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# Nexus between Board Gender Diversity and Firm Risk Volatility: Evidence from Listed Private Conventional Banks in Bangladesh

This study investigates the relationship between risk-taking behavior and the gender composition of corporate boards. The analysis is based on a sample of 21 private conventional banks in Bangladesh over the period 2013–2022. Firm risk, the dependent variable, is measured by the standard deviation (volatility) of daily stock returns. Board gender diversity serves as the primary independent variable, complemented by several control variables, including board size, leverage, bank age, capital intensity, financial performance, asset tangibility, and GDP growth rate. Using fixed-effects panel regression, the study finds a distinct and statistically significant positive association between board gender diversity and the propensity for risk-taking among scheduled private commercial banks in Bangladesh. However, results from two-step system GMM estimation indicate that both board gender diversity and board size exert a significant negative effect on risk volatility. Overall, the findings suggest that gender diversity on corporate boards plays an important role in shaping risk dynamics within Bangladesh's private conventional banking sector.

## 1. Introduction

Among the notable constituents of firm management, risk management remains one of the most crucial factors. Effective identification of risk and taking precautions have an undeviating contribution to firm performance and, in consequence, to investment values(Jane Lenard et al., 2014). Decisions that shape risk and performance in organizational operations originate from the top levels of an organization – by board of directors – where female representation is steadily increasing worldwide (Mohsni et al., 2021). Reflecting this trend, numerous studies have been conducted in recent years to discover whether board gender diversification is significantly interrelated to firm performance or firm risk.

This research momentum extends to Bangladesh, where several studies have attributed financial performance to female participation on boards of directors, noted by Fahad et al. (2022) and Munira (2020). Along with this, Saima and Arefin (2022) explored financial distress risk, and Fakir and Jusoh (2020) investigated firm risk management in the context of board-level gender diversity. However, previous studies have not encompassed the systematic risk-taking propensity of firms when board structure is gender-diverse. All of it enticed us to investigate the portion of risk volatility influenced by board gender diversity from the perspective of private conventional banks in Bangladesh. The investigation is

conducted using a 10-year panel dataset, employing a fixed effects regression model complemented by robustness checks through Panel Corrected Standard Errors (PCSE) and Generalized Methods of Moments (GMM). To perform all the statistical investigations and modeling, STATA has been used as the primary tool.

It is important to note that global empirical research reached assorted conclusions about the risk or performance influenced by female representatives in the boardroom. Despite these variations, some countries mandated the presence of female associates as board members, underscoring the importance of gender inclusion and women's representation in leadership roles. In the United States, a campaign has been organized over the past decade to increase the participation of female board members. This campaign resulted in a 2.5-fold increase in the participation of female board members in the USA, as reported by Gormley et al. (2023). Based on the research outcome, it is imperative, by law, to include female board members in several countries, such as Pakistan, Norway, India, Spain, and the UK. Bangladesh is not an exception to the trend, as the Bangladesh Securities and Exchange Commission (BSEC) has also declared that companies must appoint at least one female representative to their boardrooms (TBS Report, 2024). Currently, the number of women directors in Bangladesh fluctuates between 8% and 24% on average across different industries (Mamun & Akter, 2021).

Against the backdrop where female participation in decision-making yields either favorable or challenging outcomes in terms of risk, this paper aims to determine whether the participation of female members in boardrooms has a substantial link with firm risk in the conventional banking sector of Bangladesh. According to Z. Li et al. (2022), female leadership on boards is linked to curtailed firm risk, as evidenced by studies from 45 countries worldwide. It has been found that Bangladeshi private conventional banks follow a similar path. Findings from scholarly articles advocate that increased female participation on boards is connected to reduced risk volatility. However, this scenario is found to be quite the opposite in Bangladesh in terms of financial distress risk, as more female representation was found in financially distressed firms (Saima & Arefin, 2022).

This study further advances the discourse on corporate governance within an emerging market context by elucidating the connection between gender diversity and risk volatility. By empirically examining the efficacy of recent regulatory interventions – specifically the BSEC's mandate for the presence of female board members – our research makes a substantial contribution to both scholarly inquiry and policy deliberation. The findings additionally yield actionable insights for regulators and corporate leaders, highlighting the potential economic benefit driven by prudent risk management.

The structure of this paper is organized as follows. This paper comprises five parts, with the forthcoming section reviewing previous literature and conducting an empirical analysis of the relationship between risk and the number of female participants on the board of directors. Hypothesis development and model construction have been accumulated in the latter part, along with established theory concerning women's proclivity toward risk-taking. Section 4 details the empirical analysis and discussion. To elaborate, various statistical analyses are outlined in this section, which will be utilized later for informed decision-making. The final section provides a concise summary of the entire article and its key findings.

## 2. Literature Review and Hypothesis Development

Several theoretical frameworks suggest that corporate risk volatility can be minimized by an expanding presence of gender diversity in the pool of decision-making associates. These recommendations are backed mainly by psycho-

logical or behavioral theories in management. The theories assert women are born more suspicious and averse to risk, leading to extra caution or verification in decision-making. Along with the magnitude of feminization, various research studies have found that board size, board members' backgrounds, education levels, and firm age affect a firm's decisions. Accordingly, this section examines how various characteristics in female representatives influence their risk-taking tendencies, drawing on literary works from both Bangladeshi and International markets.

Human capital theory (Becker, 1985) posits that board participants from diverse backgrounds, talents, and interests comprise a precious, distinctive resource that is scarcely transferable. It constructs a unique risk profile through engagement with feminization and subsequently inflates profit generation. Women's decision-making on boards of directors is believed to strengthen oversight systems, enable dispute resolution within agencies, and reduce the likelihood of fatal decisions. Women enhance resource allocation, mitigate the issue of overinvestment, and facilitate business risk mitigation by reducing stock return volatility through their supervisory function (Jizi & Nehme, 2017; Mirza et al., 2020). Consequently, the risk metric is found to have a strong negative connection with gender. A female board member reduces company risk, as they are comparatively less enticed by high-gain scenarios, are less likely to take on higher risks, and are naturally risk-averse (L. H. Chen et al., 2019). On the far side, board independence and board-specific skill diversity were found to negatively impact systematic risk in the emerging market. The empirical analysis based on the Morgan Stanley Capital International (MSCI) spotlights a unique aspect of risk composition emerging from skills and knowledge profile of the experts on boards, irrespective of biological diversity. Hence, board of members must possess the requisite knowledge to manage the firm's risk because specialized skills help efficient decision-making (Schnatterly et al., 2021). However, empirical evidence also corroborates that risk is unrelated to board composition characterized by gender diversity found by Daniel-Vasconcelos et al. (2023).

Upper echelon theory affirms that managerial background and traits influence strategic decisions. Their values, knowledge and experience form the cognitive frames of board directors, and these frames influence how they gather, analyze, and act on the information they receive (Hambrick, 2007). Therefore, it is logical to predict that the traits directors possess are linked to organizational outcomes. It is evident when top management is being directly supervised and advised by the board of directors. This is further confirmed by Tajfel and Turner (1979), who suggest that the behavior of individuals changes depending on the group of people with whom they are interacting.

Overconfidence is another factor that has a direct and upward impact on firm risk (J. Li & Tang, 2010). In general, women directors incline to exhibit less overconfidence than male members when interpreting information (G. Chen et al., 2016; Levi et al., 2014, 2015). Levi et al. (2015) state that female directors seek consultation from experts when making decisions; therefore, diverse boards are expected to consult further before making major moves, such as mergers and acquisitions, long-term investments, and so on. Conversely, male board directors are more likely to participate in precarious investments, excessive debt, and discretionary spending due to their overconfidence and poor management (Jizi & Nehme, 2017; Mirza et al., 2020). According to the gender socialization theory, females develop distinct characteristics, attitudes, and interests during childhood, which makes them more likely to exhibit compassion and ethical standards (Ibrahim et al., 2009) and less predisposed to be drawn into corruption (Xia et al., 2018). Therefore, it is rational to believe that directors'

attitudes towards organizational decisions are correlated with business performance, and consequently, with firm risk as well.

Risk mitigation is directly linked to the rigorous monitoring and control enforced by leaders in evolved business contexts (Brahma et al., 2021; J. Li & Tang, 2010). The style of enforcement varies depending on the expertise of the responsible person making the decision, dictating whether mid-level managers operate in a strictly responsible environment or a more flexible corporate setting. Adams and Ferreira (2009) maintain that women participants on the management boards are strict controllers and regulators of managers. Their individualism enhances managerial accountability and the monitoring role, which in turn increases business effectiveness (Adams et al., 2011). However, the performance of firms does not show a steady dependence on the gender structure of the board, as quantified. The price-earnings ratio portrays a direct advantage derived from diverse boards but return on assets is unrelated to gender-based diversity in top management (Z. Li et al., 2022; Simionescu et al., 2021).

Despite positive findings, feminist theory (Claes, 1999), social identity theory (Tajfel & Turner, 1979), and resource dependency theory (Hillman et al., 2007) suggest that female board members' participation has an unfavorable influence on stable financial performance. Some scholars, such as Jeong & Harrison (2017), have found that women lean towards fewer strategic risks, which results in corporate performance inequalities. Several other studies have even concluded that women participants are generating higher firm risk (Adams & Funk, 2012; Berger et al., 2014; L. H. Chen et al., 2019). Chatjuthamard et al. (2021) have revealed that organizations characterized by highly gender-diverse boards exhibit a greater intensity in extending CEO risk-taking stimulants that are more influential. Others caution that board gender diversity (Triana et al., 2014) may even lead to corporate boards becoming dysfunctional, as it can cause disagreements among board members(Richard et al., 2004), which in turn impede managerial processes (Hambrick et al., 1996). To draw an example from Asian country, greater gender diversity on boards absorbs risk but does not improve financial performance in Pakistani non-financial corporations (Mumtaz et al., 2021). In Bangladesh, there are more female directors than in Indian businesses, but fewer than in other affluent nations. Interestingly, financially stable corporations have fewer female participants on their boards than financially distressed corporations, suggesting a complex relationship (Saima & Arefin, 2022). Here, a significant inverse connection between gender-diverse boards and firm risk is corroborated by numerous articles, while other investigations have shown no noteworthy correlation between the variables. For instance, Sila et al. (2014) investigated American firms from 1996 to 2010 and found no remarkable association between the discussed variables. Also, Bruna et al.(2019) found that firm risk in France is unrelated to the presence of gender-diverse boards. Although psychologically it is proven that women are more inverse towards risk than male participants on board, several other studies expressed doubt regarding whether having a large percentage of female participants augments the competence of a firm or curtails the risk associated with a firm (Elisa & Guido, 2020; Hoang et al., 2019; Shropshire et al., 2021). In the same line, Talavera et al. (2018) discovered firm risk is unrelated to the presence of female decision makers. The gender-stereotyping theory and role incongruity, however, argue that firm performance is inversely correlated to women participants on the corporate boards (Yang et al., 2019).

Contrary to prior research predictions, boards with diverse gender composition do not necessarily reduce the immediate chance of the firm being distressed. In Bangladesh, the corporate board is historically perceived as weaker due to the limited

participation of female members in the corporate boards (Saima & Arefin, 2022). Tokenism is a major contributor behind this situation, and even if a female participant is seen, it is most likely introduced to increase family influence in the board instead of promoting meritocracy in the board structure. According to González et al. (2020), nepotism and dynastic management, rather than meritocracy, are the primary factors behind the corporate board's allocation of seats to female directors who are family members, within an ineffective institutional and legal framework. Fariha et al. (2022) also express concern from a Bangladeshi perspective, stating that a large number of female directors are not recruited based on a scrutinized examination of quality, but rather on family legacy. For this reason, it is common not to see non-family women leaders on the boards of Bangladeshi corporations. Muttakin et al. (2012) also asserted that female directors in Bangladeshi family businesses are typically chosen based on a list of factors, such as majority shareholders, Chief executives, or sponsors, without considering their business qualifications. It leaves no room for female executives to brainstorm and contribute to value addition, instead becoming a token on a board dominated by male counterparts (Saima & Arefin, 2022). Therefore, in Bangladesh, where the patriarchal system is still in place, the biased recruitment of directors merely presents a positive image of female participation in upper management and ultimately has no economic impact on the companies.

However, many researchers from developed countries have found an inverse correlation between company risk and gender-diverse boards (Bernile et al., 2018; Jizi & Nehme, 2017; Khaw et al., 2016; Z. Li et al., 2022; Poletti-Hughes & Briano-Turrent, 2019).In every board of directors, decisions are made through the collective input of the directors, where the inclusion of female participants can make those decisions less risky. As a result, companies with diverse board compositions are shown to have lower stock market return variability (Jane Lenard et al., 2014). For instance, a study has demonstrated that the contribution of female affiliation cuts the company's tendency towards extreme risk-taking based on Australian 500 listed companies (Hutchinson et al., 2015). The risk aversion exhibited by female directors contributes to the amplification of risk aversion among managers, ultimately leading to a level of risk-taking that is sub-optimal. In line with this, European banks with higher female representatives on boards have historically been in the low-risk zone (Gordini & Rancati, 2017). France holds the highest percentage of female board members among corporations, ranking first in Europe. Similarly, Mateos De Cabo et al.(2009)confirm these findings, stating that European banks with stable risk profiles have a higher gender diversity on boards, while male-only boards foster risk-taking behavior, according to an analysis by Briano-Turrent and Poletti-Hughes (2019) based on four Latin American nations. A similar outcome is reported by Khaw et al. (2016) in China. In developed nations like the USA and the UK, the same phenomenon is also observed (Jizi & Nehme, 2017). Saeed et al.'s (2016) research has further revealed a reverse relationship between firm risk and gender-diverse in developed nations. It has been found that firm size, per capita GDP, and board size have a consequential inverse relation with firm risk (J. Li & Tang, 2010).

A similar phenomenon is persistent in developing and emerging economies as well. According to an investigation conducted by Mehmood et al. (2023), in the banking sector of South Asia, a larger board size cuts potential credit risk for banks. Because larger boards are expected to have more control and information, which helps the firm regulate its credit risk issues. This verdict is also verified by pinpointing inherent characteristics of

feminine attributes, which display an additional consciousness layer and a risk-averse attitude. Singhania et al.(2024)investigated the effect of gender diversity on leading Indian board committees from a dual performance perspective. The findings show accounting metrics of performance are not associated with diverse boards, while market-based performance metrics face upheaval with the absence or presence of female leaders. Additionally, businesses in India can reap benefits from a gender-diverse board only when women participate in governance procedures and significant committees, not just when they are nominated to the board as a token gesture. At the same time, Laskar et al. (2024)found that not only a diversified board but also a diversified workforce contributes to the rise in firm profit generation. Several different risk aspects have been investigated in South Africa, including health and safety risks. This study concluded that managerial-level gender diversity also has a noteworthy impact on the aforementioned risks, safeguarding insurance interests and firm goodwill (Chikosi & Mutezo, 2023).

According to various investigations worldwide, it is possible to some extent to curtail risk by enhancing participation of female directors. This can further result in increased value, enhanced corporate practices, and the creation of stability. According to the theory of resource dependency, having women on the board of directors can help businesses accumulate social capital and establish a strong connection with their external environment (Brahma et al., 2021). Additionally, promoting legitimacy and facilitating effective communication, having women on the board of directors is beneficial (Fernando et al., 2020). However, Greene et al. (2020) and Bertrand et al. (2018)note that a significant concern with gender-diverse boards is whether companies will be able to identify and recruit eligible female members as board members. According to agency theory, competent directors should exercise closer oversight of management to curb excessive risk-taking by the company (Hillman & Dalziel, 2003). The directors should be capable of analyzing and acting based on the information they have gathered. In other words, superior directors are better equipped to understand the circumstances they encounter and make well-informed decisions because they possess a thorough understanding and a broader perspective. Thus, competent female board directors should be able to generate greater advantages from gender diversity.

Based on this ground, we have developed our hypothesis as:

**$H_1$:** The participation of female board members is linked to firm risk volatility.

The findings of the many studies cited earlier, which have indicated a significant association between gender-diverse board composition and risk of entity, served as a key basis for our study. Although few studies have been conducted on Bangladeshi manufacturing firms, no significant studies have been conducted on the banking sector in Bangladesh. Therefore, we are focusing on Bangladeshi private conventional banks to determine how female participation on the board affects the risk volatility associated with the corporation.

| Title of the literature | Authors and year | Variables | Findings |
|---|---|---|---|
| Board Gender Diversity and Firm Risk: International Evidence | Z. Li et al.(2022) | Dependent: Standard Deviation of Daily Stock Returns<br>Independent: Proportion of Female Participants on Board, Firm Size, Board Size, Board Independence, Firm Age, Tangibility, R&D Expenditure Intensity, Capital Intensity, Per Capita GDP, and Gender Inequality Index | A remarkable correlation between the increase in gender diversity on boards and reduced business risk on a global scale |
| Impact of Board Gender Diversity on Firm Risk | Jane Lenard et al.(2014) | Dependent: Firm Risk<br>Independent: Percentage of Female Directors, Existence of Female Directors (Dummy), Market Valuation, Firm Performance, Leverage, Sales Growth, Capital Expenditure, Experience of Loss (Dummy), Board Size, Business Complexity (Dummy), CEO Duality (Dummy) | A downward relationship between the proportion of participation of female directors on a corporate board and the level of variability observed in corporate performance |
| Board Gender Diversity and Financial Distress Risk: Evidence from Bangladesh | Saima and Arefin (2022) | Dependent: Financial Distress Risk<br>Independent: Board Gender Diversity, Board Size, Board Independence, Return on Assets, Tobin's Q, Leverage, Firm Size | No significance of board gender diversity on the likelihood of being in financial distress |
| Board Gender Diversity, Firm Performance, and Risk-Taking: The Case of Non-Financial Firms of Pakistan | Mumtaz et al.(2021) | Dependent: Firm Performance and Firm Risk-Taking<br>Independent: Gender Diversity, Debt, Number of Board Meetings, Firm Size, Shareholdings by the Directors | An adverse effect of gender diversity on firm performance and a positive influence of board gender diversity on the propensity to take risks |
| Board Gender Diversity and Firm Performance: the UK Evidence | Brahma et al.(2021) | Dependent: Return on Assets Tobin's Q<br>Independent: Gender Diversity, Age, Multiple Directorship, Education of Female Director, Prominence of Female Director, Board Size, CEO Duality, Incentive Policy, Firm Size, Firm Age, Leverage, Financial Crisis. | A positive and significant relationship between gender diversity and firm performance |

Source: Authors' Compilation

## 3. Methodology

### *3.1 Sample and Data*

Data source for this article is concentrated in the listed private conventional banks of Bangladesh. A 10-year panel dataset (from 2013 to 2022) is constructed to analyze whether the overall firm risk is significantly associated with the percentage of female representation on the board of directors. During the data collection stage, 21 banks were included, and a few of the remaining listed banks were omitted due to information unavailability. All the required data have been accumulated from respective annual reports, the Dhaka Stock Exchange (DSE), and the World Bank Dataset. In terms of econometric tools, STATA has been utilized for comprehensive statistical data analysis, employing techniques such as the Pearson Correlation Matrix, VIF, and multiple panel regression models.

### *3.2 Econometric Model Specification and Rationale for Variable Selection*

For statistical analysis, primarily static models, i.e., Fixed Effects (FE), Random Effects (RE), and Panel-Corrected Standard Errors (PCSE), have been used. The following model is developed based on the hypothesis.

$$RISK_{it} = \beta - \beta\, GEND_{it} - \beta\, BRD\_SIZE_{it} + \beta\, LEV_{it} - \beta\, AGE_{it} + \beta\, CAP\_INTENSITY_{it} - \beta\, TOBINQ_{it} + \beta\, TAN_{it} - \beta\, GDP_{g(it)} + \varepsilon_{it} \quad \ldots\ldots(1)$$

However, to address probable endogeneity, such as reverse causality and omitted variable bias, and to capture dynamic behavior, a two-step system Generalized Method of Moments (GMM) estimator has been followed. Here, GMM estimation is used following the framework of Arellano and Bover(1995)and Blundell and Bond (1998). The model stated below is a manifestation of the hypothesis.

$$RISK_{it} = \beta - \beta\, GEND_{it} - \beta\, BRD\_SIZE_{it} + \beta\, LEV_{it} - \beta\, AGE_{it} + \beta\, CAP\_INTENSITY_{it} - \beta\, TOBINQ_{it} + \beta\, TAN_{it} - \beta\, GDP_{g(it)} + \varepsilon_{it} \quad \ldots\ldots(1)$$

In this equation, index i represents the year of observations, and t refers tobanks. RISK is dependent variable for this investigation, while GEND is independent variable along withseveral control variables. Here, corresponds to the coefficient of the respective independent variable, and is the idiosyncratic error term. The following paragraphs present the rationale for the selected control variables and provide relevant literary references.

- Firm Risk(RISK): A widely accepted proxy for firm risk, the standard deviation of daily stock returns over each fiscal year (RISK), has been chosen as an independent variable(Z. Li et al., 2022; Sila et al., 2014). This indicator denotes total risk, encompassing both firm risk and market risk. Several prior studies have used it as an indicator of a firm's overall risk, utilizing stock return volatility.
- Gender(GEND): Genderis used as a proxy of board diversity to quantify the proportion of female on boards, as suggested by Z. Li et al. (2022), Griffin et al. (2018), Liu (2018), and Levi et al. (2014). Previous studies have demonstrated that the characteristics of boards are important elements in evaluating board effectiveness, as they can impact the board's monitoring role and company outcomes related to risk (Bernile et al., 2018; Poletti-Hughes & Briano-Turrent, 2019).It is expected that existence of gender diversity is negatively correlated with firm risk volatility.

  Furthermore, following Z. Li et al. (2022), it is necessary to include control variables (Board size, leverage, age, capital intensity, TOBINQ, tangibility, and GDP) that are most likely to influence the association between women's involvement as directors and risk volatility.
- Board Size(BRD_SIZE): The size of the board of directors is included as a control variable, expecting it to have a negative link with firm risk. It is also supported by previous studies conducted by Z. Li et al. (2022), Jane Lenard et al. (2014), Saima and Arefin(2022), and

Brahma et al. (2021). A larger board is more likely to have female members, resulting in lower fluctuations in return generation (Bernile et al., 2018). Previous studies indicate that board size significantly impacts its effectiveness in protecting company assets, allocating resources efficiently, limiting managerial opportunism, and preventing insolvency and risky investments.

- Leverage(LEV): In line with Brahma et al. (2021), Saima and Arefin (2022), Jane Lenard et al. (2014), we included leverage as a control variable in the model. Leverage is a measure of a company's solvency and is typically linked to financial risk. The leverage level enables the measurement of risk associated with financial challenges and insolvency, providing information on the company's ability to meet its financial obligations (Bernile et al., 2018). Hence, it is expected that higher leverage is associated with increasing risk.
- Age(AGE): Consistent with Z. Li et al. (2022) and Brahma et al. (2021), we incorporate firm age as a control variable. Older organizations tend to be widely recognized, making it easier to hire high-quality female directors (Greene et al., 2020). Therefore, we expect more experienced firms to have lower risk volatility, and we have calculated firm age as the natural logarithm of the number of years a company has been listed.
- Capital Intensity(CAP_INTENSITY): A prior study found that capital intensity has a positive relationship with corporate risk(Z. Li et al., 2022). Our expectation is also similar in terms of risk volatility. It is argued that higher capital intensity may increase a firm's risk; therefore, our study considers capital intensity, which is evaluated as the ratio of fixed assets to employees.
- Tobin's Q(TOBINQ): Saima and Arefin (2022) used Tobin's Q as a control variable, an alternative to ROA, in their study. In most empirical research, firm performance has been measured using either ROA, Tobin's Q, or both(Adams & Ferreira, 2009; Brahma et al., 2021; Gordini & Rancati, 2017).We have employed Tobin's Q, a market-based metric, in light of these findings, and we are presuming it has an inverse relationship with risk.
- Tangibility(TAN): Since businesses with greater capital investment prospects are more likely to take on risk, we include tangibility in the list of control variables, as supported by Z. Li et al. (2022). Tangibility is determined as the proportion of non-current assets to total assets. Therefore, we predict that an increase in tangibility will lead to increased risk volatility for banks.
- GDP(GDPg): Z.Li et al. (2022) discovered that firm risk is substantially and adversely correlated with GDP per capita. At the national level, we control for GDP per capita, hypothesizing it is negatively correlated with risk.

To recapitulate, the findings of previous studies suggest that the participation of women members in the board of directors is a key determinant of board effectiveness, which, in effect, contributes to risk variation (Z. Li et al., 2022). Hence, *GEND* is taken as a control variable along with another parameter, i.e., board size *(BRD_SIZE)*. Historically, firms with additional capital investment opportunities are more likely to be risk-takers, and their risk-taking capability tends to strengthen over time as the firm gains experience and age. To control these variations, *TAN* and *AGE* are taken into consideration. This study also accounts for capital intensity *(CAP_INTENSITY)*, as prior studies have suggested that a greater reliance on capital may be associated with increased firm risk. To consider the firm's dependence on leverage and its financial performance, the study incorporates *LEV* (the level of leverage) and *TOBINQ* (a measure of financial performance). Finally, annual *GDP* growth, *GDPg,* is considered a control variable at the country level.

## 4. Empirical Analysis and Findings

This section presents the results of descriptive statistics and statistical diagnostic tests conducted on a panel dataset of 21 private commercial banks listed on the Dhaka Stock Exchange (DSE). The empirical data considered in this investigation spanfrom2013 to 2022. The outputs from various estimates will be highlighted here to assess the firm risk in Bangladesh's banking system by pinpointing board-level gender diversity and other relevant control factors, allowing management to pursue practical actions accordingly.

### *4.1 Descriptive Statistics*

With a total of 210 observations, Table 2 presents the descriptive statistics for the variables, including mean value, standard deviation, lowest value, and highest value.

**Table 2 : Descriptive Statistics**

| Variables | Observation | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| *RISK* | 210 | 0.0204 | 0.0003 | 0.0103 | 0.0563 |
| *GEND* | 210 | 0.1230 | 0.0076 | 0.0000 | 0.4286 |
| *BRD_SIZE* | 210 | 2.5430 | 0.0216 | 1.6094 | 3.0445 |
| *LEV* | 210 | 0.9225 | 0.0011 | 0.8542 | 0.9521 |
| *AGE* | 210 | 3.1696 | 0.0244 | 2.4849 | 3.9120 |
| *CAP_INTENSITY* | 210 | 14.2291 | 0.0421 | 12.5852 | 15.3798 |
| *TOBINQ* | 210 | 0.9903 | 0.0020 | 0.9421 | 1.2011 |
| *TAN* | 210 | 0.0182 | 0.0005 | 0.0022 | 0.0464 |
| *GDPg* | 210 | 0.0650 | 0.0008 | 0.0345 | 0.0788 |

Source: Authors' Compilation

The average firm risk among conventional private banks of Bangladesh is approximately 2%. The average board gender diversity of the sampled banks is approximately 12%, with a minimum value of 0%, demonstrating that some banks have no female board members. The average leverage level, measured by the debt-to-assets proportion, is approximately 0.92, with a low standard deviation. Unlike other variables, the age of the sampled banks and their capital intensity vary across the industry. The average of Tobin's Q ratio for banking industry has remained nearly 1 over the past decade. On average, the banks hold around 2% of total assets in tangible form. Lastly, Bangladesh's average GDP growth rate over the past decade has been approximately 6.5%.

### *4.2 Normality Test*

The following table exhibits the outcome of the Shapiro-Wilk test, which is measured for the investigation of normality test. Since each of the variables exhibits a p-value below 5%, we reject the null hypothesis of normality, indicating none of the preferred variables follow a normal distribution.

**Table 3 : Outcome of the Normality Test**

| Variables | Observation | W | V | z | Prob>z |
|---|---|---|---|---|---|
| *RISK* | 210 | 0.8551 | 22.559 | 7.187 | 0.0000 |
| *GEND* | 210 | 0.9627 | 5.795 | 4.053 | 0.0000 |
| *BRD_SIZE* | 210 | 0.9614 | 6.010 | 3.137 | 0.0000 |
| *LEV* | 210 | 0.9356 | 10.021 | 5.316 | 0.0000 |
| *AGE* | 210 | 0.9628 | 5.786 | 4.049 | 0.0000 |
| *CAP_INTENSITY* | 210 | 0.9836 | 2.559 | 2.559 | 0.0151 |
| *TOBINQ* | 210 | 0.7871 | 33.148 | 8.075 | 0.0000 |
| *TAN* | 210 | 0.9631 | 5.745 | 4.032 | 0.0000 |
| *GDPg* | 210 | 0.7923 | 32.331 | 8.018 | 0.0000 |

Source: Authors' Compilation

### *4.3 Multicollinearity Test*

The results of the Pearson correlation matrix, exhibited in Appendix III, demonstrate that no correlations among the variables fall within the range of -0.8 to +0.8. This suggests a multicollinearity issue does not bias the selected variables. The same outcome is further implied by the Variance Inflation Factor (VIF) shown in Appendix IV, all of which fall between 1 and 4–well below the commonly accepted threshold for multicollinearity.

### *4.4 Summary of Results from Econometric Models*

**Table 4 : Estimations from the Econometric Model**

| Variables | FE | PCSE | GMM |
|---|---|---|---|
| *L1.RISK* | | | -0.2766** (0.1083) |
| *GEND* | 0.0082** (0.0064) | -0.0047 (0.0033) | -0.0088* (0.0051) |
| *BRD_SIZE* | -0.0055*** (0.0033) | -0.0043** (0.0017) | -0.0057*** (0.0012) |
| *LEV* | -0.0702** (0.0464) | -0.0234 (0.0242) | -0.0444 (0.0337) |
| *AGE* | 0.0169** (0.0046) | 0.0009 (0.0009) | -0.0005 (0.0019) |
| *CAP_INTENSITY* | -0.0069*** (0.0024) | 0.0010 (0.0011) | 0.0004 (0.0013) |
| *TOBINQ* | 0.0340* (0.0184) | 0.0009 (0.0176) | -0.0122(0.0159) |
| *TAN* | 0.3102 (0.1560) | -0.0863 (0.1009) | -0.0428 (0.1128) |
| *GDPg* | -0.0238** (0.0299) | -0.0257 (0.0617) | N/A |
| Constant | 0.1056 (0.0458) | 0.0390 (0.0333) | |
| R Squared | 0.1025 | 0.0700 | |
| F-Statistic | 2.61*** | | |
| Wald $\chi^2$ | | 14.09* | 63683.55*** |
| Total banks | 21 | 21 | 21 |
| Total observations | 210 | 210 | 189 |
| AR (1) | | | -2.07** |
| AR (2) | | | -0.81 |
| Sargan test | | | 2.12 |
| Hansen test | | | 0.65 |
| Number of groups | | | 21 |
| Number of instruments | | | 18 |

Note: *, **, and *** denote significance level at 10%, 5%, and 1%. Figures represent coefficients of variables, while figures in parentheses represent standard error.
Source: Authors' Compilation

The outcome of the fixed effects model indicates that the predictor variables explain approximately 10.25% of the variation in firm risk. The model is an excellent fit for the analysis, as indicated by the p-value of the F-statistic being significant at the 1% level. Statistically significant predictors include the gender diversity of boards, board size, age, leverage level, capital intensity, financial performance, and GDP. Notably, the outcomes of the fixed effects model indicate that female participants in the boardroom exhibit a correlation with overall business risk, which contrasts with the findings from the global study coordinated by Z. Li et al. (2022). Additionally, the size of the board, leverage level, and capital intensity are found to have a negative association with firm risk. On the far side, age of firms, financial performance, and tangibility are also examined, and it is revealed that these variables are positively linked with the firm's risk.

The Hausman test further verifies the outcome of the fixed effects model, as the Chi-square probability is found statistically significant at the 1% level. This implies that the fixed effects outcomes are more suitable for this study compared to the random effects model. The results of the statistical investigation, both the random effects model and the Hausman test, are presented in Appendix V.

In addition to the fixed-effects model and random-effects models, the Panel Corrected Standard Error (PCSE) model is employed in this study to enhance robustness. The outcomes from the PCSE model indicate that the predictor variables may account for 7% of the variation in firm risk. Although the p-value of the Chi-square reveals that the model is marginally significant at a 10% significance level, the model does not exhibit strong goodness of fit. Among the predictors, only board size shows a significant bearing on the firm's overall risk.

To address endogeneity and omitted variable bias, two-step system GMM estimation is employed. This approach captures the dynamic nature of firm risk by incorporating lagged control variables and accounting for the potential for reverse causality. The validity of the model is verified by diagnostic tests, which show no second-order correlation and confirm the appropriateness of the instruments. Here, a significantly negative lagged risk variable indicates that mean-reverting behavior exists over time in Bangladeshi conventional private banks. Although GDP is not strongly correlated with other control variables, as specified by Pearson's correlation matrix and VIF, GMM estimation eliminated this variable to mitigate potential multicollinearity effects. Regarding control variables, the GMM results disclose a strong and statistically significant relationship between risk and board size. Additionally, board gender diversity portrays an inverse correlation with risk; this result is statistically significant at the 10% level, which aligns with the international evidence reported by Z. Li et al. (2022). Since the outcome contrasts with the positive association between gender diversity and risk volatility in the fixed effects model, it is inferred that the fixed effects model is likely to be biased by endogeneity and omitted variable bias.

## 5. Conclusion and Policy Implications

The paper asserts that the propensity for risk-taking is directly shaped by the structure of a firm's board, particularly its gender composition. Using data from private conventional banks in Bangladesh between 2013 and 2022, this study analyzes a decade of dynamic panel system data. The results indicate a significant relationship between gender-diverse boards and a greater capacity to manage risk. The empirical strategy began with fixed-effects estimation, followed by a

two-step GMM analysis to address the potential biases inherent in static models.

The GMM findings are consistent with Z. Li et al. (2022), whose cross-country study of 45 nations concluded that greater female representation on boards helps stabilize firm risk. Comparable evidence from Pakistan's non-financial sector (Mumtaz et al., 2021) shows that firms with lower risk profiles tend to have higher female representation. These findings suggest that Bangladesh's recent legal mandate for female board participation is not only socially progressive but also economically advantageous across industries. However, there is a risk that high-risk banks may adopt gender diversity primarily to meet compliance requirements, raising concerns about tokenism that could undermine the intended economic benefits (Fariha et al., 2022; Saima & Arefin, 2022).

Beyond gender diversity, the study finds that larger boards are significantly associated with lower risk volatility, aligning with prior research (Jane Lenard et al., 2014; J. Li & Tang, 2010; Z. Li et al., 2022). While firm age, financial performance, and asset tangibility are also negatively correlated with risk volatility in Bangladesh's banking sector, these relationships are not statistically significant.

Overall, the evidence suggests that gender-diverse boards, especially when paired with optimal board size, can serve as a governance mechanism for mitigating business risk in the private banking sector of Bangladesh. This research adds to the literature by empirically examining the link between board gender diversity and business risk in the country's banking industry.

Nevertheless, the study has limitations, creating scope for further investigation. These include constraints in variable selection, sample size, and data availability in the Bangladeshi context. Future research could extend the time frame, adopt cross-country comparisons, and incorporate industry-, governance-, and culture-specific variables to validate and strengthen these findings.

## Authors' Contribution Statement

1. Nuzat Tabassum Simran - Conceptualization of the study - Development of methodology - Designing experiments - Data collection and conducting analysis - Interpretation of findings from the analysis - Drafting, reviewing and editing the manuscript - Supervision of the research process.

2. Sadeka Jahan - Contributing to data collection and data analysis - Organizing and managing the dataset - Providing resources and materials - Writing the manuscript (drafting and reviewing) - Contributing to discussion and interpretation of results.

3. Soneya Akter - Data collection - Generating the literature review - Supporting methodology implementation - Reviewing and editing the manuscript - Contributing to discussion and interpretation of results - Ensuring reproducibility and accuracy of findings.

All authors read and approved the final version of the manuscript.

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## Appendices

**Table A.1: List of Selected Conventional Private Banks**

| Sample of Conventional Commercial Banks | | |
|---|---|---|
| AB Bank PLC | IFIC Bank PLC | Prime Bank PLC |
| Bank Asia PLC | Jamuna Bank PLC | Pubali Bank PLC |
| BRAC Bank PLC | Mercantile Bank PLC | Rupali Bank PLC |
| City Bank PLC | Mutual Trust Bank PLC | Southeast Bank PLC |
| Dhaka Bank PLC | National Credit and Commerce Bank PLC | United Commercial Bank PLC |
| Dutch-Bangla Bank PLC | One Bank PLC | Trust Bank PLC |
| Eastern Bank PLC | The Premier Bank PLC | Uttara Bank PLC |

**Table A.2: Definition of the Variables**

| Notation of Variables | Variables Explanation & Calculation Method | Type of Variable | Expected Outcome |
|---|---|---|---|
| *RISK* | Risk: A measure of firm risk measured as standard deviation in the daily stock return (Z. Li et al., 2022)<br>*RISK = SD of Daily Return*<br>*Daily Return = (Closing Price$_t$/ Closing Price$_{t-1}$) – 1* | Dependent | N/A |
| *GEND* | Gender: A proxy of the diverse board in terms of gender determined as the proportion of women participants in the boardroom (Z. Li et al., 2022)<br>*GEND = % of (Number of Female Board Members / Total Number of Directors)* | Independent | Negative |
| *BRD_SIZE* | Board Size: A proxy for the size of the board converted in the form of the natural logarithm (Z. Li et al., 2022)<br>*BRD_SIZE = ln (Total Board Members Number)* | Control | Negative |
| *LEV* | Level of Leverage: A measure of liability percentage in comparison with assets (Jane Lenard et al., 2014)<br>*LEV = Total Liabilities / Total Assets* | Control | Positive |
| *AGE* | Age of Bank: A proxy for the age of the bank measured as the natural logarithm of the number of years the bank has been operating (Z. Li et al., 2022)<br>*AGE = ln (Number of Years in Operation)* | Control | Negative |
| *CAP_INTENSITY* | Capital Intensity: A measure of capital intensity determined as the natural logarithm of the ratio of fixed assets to the number of employees (Z. Li et al., 2022)<br>*CAP_INTENSITY = ln (Fixed Assets / Number of Employees)* | Control | Positive |
| *TOBINQ* | TOBINQ: A proxy of financial performance measured as the sum of the market value of equity and the carrying value of liabilities divided by the carrying value of total assets (Gordini &Rancati, 2017)<br>*TOBINQ = (Total Market Value of Stock – Book Value of Debt) / Book Value of Assets* | Control | Negative |
| *TAN* | Tangible Assets: A quantifier of tangibility determined as the share of non-current assets to total assets (Z. Li et al., 2022)<br>*TAN = Fixed Assets / Total Assets* | Control | Positive |
| *GDP* | GDP$_g$: Annual growth in GDP (Z. Li et al., 2022) | Control | Negative |

**Table A.3: Pearson Correlation Matrix**

| Variables | *RISK* | *GEND* | *BRD_SIZE* | *LEV* | *AGE* | *CAP_INTENSIT* | *TOBINQ* | *TAN* | *GDPg* |
|---|---|---|---|---|---|---|---|---|---|
| *RISK* | 1.0000 | | | | | | | | |
| *GEND* | -0.0586 | 1.0000 | | | | | | | |
| *BRD_SIZE* | -0.2244 | -0.1168 | 1.0000 | | | | | | |
| *LEV* | 0.0330 | -0.2354 | -0.1193 | 1.0000 | | | | | |
| *AGE* | 0.0536 | -0.0524 | 0.0399 | 0.0350 | 1.0000 | | | | |
| *CAP_INTENSITY* | -0.0585 | 0.3063 | 0.2831 | -0.1779 | 0.0446 | 1.0000 | | | |
| *TOBINQ* | 0.0395 | 0.2077 | -0.3665 | -0.0240 | -0.1864 | -0.3030 | 1.0000 | | |
| *TAN* | -0.0944 | 0.3365 | 0.2312 | -0.5709 | 0.0104 | 0.6813 | -0.0751 | 1.0000 | |
| *GDPg* | -0.0487 | -0.0356 | 0.0041 | 0.0605 | 0.0223 | -0.0286 | 0.0476 | -0.0763 | 1.0000 |

**Table A.4: Variance Inflation Factor (VIF):**

| Variables | VIF | 1 / VIF |
|---|---|---|
| *GEND* | 1.31 | 0.7608 |
| *BRD_SIZE* | 1.25 | 0.7976 |
| *LEV* | 1.73 | 0.5780 |
| *AGE* | 1.04 | 0.9613 |
| *CAP_INTENSITY* | 2.60 | 0.3852 |
| *TOBINQ* | 1.42 | 0.7062 |
| *TAN* | 3.19 | 0.3130 |
| *GDPg* | 1.01 | 0.9867 |
| Mean VIF | 1.69 | |

**Table A.5: Outcomes from Random Effects Model and Hausman Test**

| Variables | Random Ef fects Model |
|---|---|
| *GEND* | -0.0022 (0.0045) |
| *BRD_SIZE* | -0.0039** (0.0017) |
| *LEV* | -0.0328 (0.0356) |
| *AGE* | 0.0015 (0.0014) |
| *CAP_INTENSITY* | 0.0004 (0.0012) |
| *TOBINQ* | 0.0070 (0.0158) |
| *TAN* | -0.0766 (0.0964) |
| *GDPg* | -0.0256 (0.0307) |
| Constant | 0.0463 (0.0364) |
| R Squared | 0.0261 |
| Wald $\chi^2$ | 8.94 |
| Total banks | 21 |
| Total observations | 210 |
| **$\chi^2$ from the Hausman test** | **20.76*** ** |

Note: *, **, and *** symbolize respective significance levels of 10%, 5%, and 1%. Figures represent coefficients of variables, while figures in parentheses represent standard error.