

## Board Gender Diversity and Investment Efficiency: The Mediating Role of Corporate Financialization in Pakistan

Amina Malik<sup>1</sup>  | Bilal Latif<sup>2\*</sup>  | Adnan Jamil<sup>3</sup> 

<sup>1</sup>National Defence University, Islamabad, Postal code 44000, Pakistan

<sup>2</sup>National Defence University, Islamabad, Postal code 44000, Pakistan

<sup>3</sup>National Defence University, Islamabad, Postal code 44000, Pakistan

\*Correspondence to: Bilal Latif, National Defence University, Islamabad, Postal code 44000, Pakistan.

E-mail: bilallatif@ndu.edu.pk

**Abstract:** This research explores whether board gender diversity has an effect on investment efficiency and through which mediation channel of seamless financial models, besides contemporary production avenue, is used for profitability and survival in non-financial firms by using data from the Pakistani market from 2014 to 2023. Existing studies provide limited evidence on the direct effect of board gender diversity on investment inefficiency and indirectly through the mechanism of corporate financialization. The study employed panel regression analysis. The study findings reveal that board gender diversity significantly improves investment efficiency, as it fosters better strategic decision-making, ultimately enhancing firm value by curtailing inefficient investments. Further, our mechanism analysis reveals that corporate financialization partially mediates the relationship by transcending traditional investment strategies and promoting corporate financialization. The findings remain robust after mitigating endogeneity concerns by deploying multiple robustness checks, analyses, and by utilizing the female quota as an instrumental variable. The stimulatory effect of corporate financialization, i.e., short-termism, is more evident in non-SOEs in heterogeneity analysis. Our findings have implications for policymakers, stakeholders, and practitioners, as this study provides insights into the role of board gender diversity in making investment choices and the need to align corporate financialization activities with production investment.

**Keywords:** Board gender diversity, corporate financialization, investment efficiency, board size, chairman CEO duality, outside directors

**Article info:** Received 1 June 2026 | revised 6 July 2026 | accepted 10 July 2026 | published 14 July 2026

**Recommended citation:** Malik, A., Latif, B., & Jamil, A. (2026). Board Gender Diversity and Investment Efficiency: The Mediating Role of Corporate Financialization in Pakistan. *Indonesian Journal of Sustainability Accounting and Management*, 10(2), 33–54. <https://doi.org/10.20448/ijSAM.v10i2.8983>

## INTRODUCTION

The investment decision propositions are based on perfect market assumptions, where firms face moral hazards and adverse selection problems while also focusing on the maximization of shareholder wealth (Modigliani & Miller, 1958). Contrary to the theoretical models, the real-world market remains imperfect, with various factors establishing a linkage between firm investment choices and sources (Abuhommous, 2025). The empirical finance research highlights that agency costs and information asymmetries are critical drivers of investment inefficiency, often leading to over- or under-investment (Kraus & Litzenberger, 1973; Leland & Pyle, 1977). Informed managers make financial strategies and investment decisions (Myers & Majluf, 1984), but



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information asymmetry may lead to poor investment choices (Jensen, 1986; Myers & Majluf, 1984; Shleifer & Vishny, 1989). Hence, a firm's operating performance may be adversely affected by suboptimal investment decisions (Fu, 2010; Peng, Han, & Li, 2018), leading to investment inefficiency. In such a scenario, earlier literature revealed that board gender diversity plays a monitoring role, reduces agency problems, and improves allocation of resources, which improves investment efficiency (Mirza, Majeed, & Ahsan, 2020). As increased agency problems may compromise fund allocation efficiency due to managers' prioritization of private objectives rather than the maximization of firm value (Wulf, 2009), this raises an important question as to whether board gender diversity affects investment efficiency directly and through corporate financialization, especially in non-financial firms. Board oversight aligns managerial behavior with shareholder value maximization, as they are responsible for making judicious investment choices (Hermalin & Weisbach, 1998). Emerging research points to board gender diversity as an important driver in shaping corporate decisions, safeguarding shareholders' interests, and demonstrating stronger oversight than their counterparts, which affects financial performance (Adams & Ferreira, 2009; Francis, Hasan, Park, & Wu, 2015). As inefficient investment decisions stem from information asymmetry and agency conflicts (Blanchard, Lopez-de-Silanes, & Shleifer, 1994; Lang, Stulz, & Walkling, 1991; Ullah, Majeed, Fang, & Khan, 2020). We posit that gender-diverse boards exhibit a different approach relative to male counterparts, as they limit managerial opportunism, information asymmetry, and agency conflicts, which strengthen governance mechanisms by having better strategic control and oversight, leading to improved investment choices (Frye & Pham, 2018; Loukil, Yousfi, & Yerbanga, 2020; Nielsen & Huse, 2010; Ullah, Zeb, Khan, & Xiao, 2020). Further, gender-diverse boards show greater risk aversion relative to male boards (Levi, Li, & Zhang, 2014), hold more cash than their counterparts, which thus affects the quality of their decision making, and also avoid overinvestment, thereby reducing the chances of suboptimal investment decisions (Zeng & Wang, 2015). Hence, we argue that board gender diversity may affect corporate investment decisions, which have an impact on investment efficiency.

Further, prior literature provides limited and mixed evidence on the role of board gender diversity in investment efficiency. Earlier empirical evidence provides mixed findings, with some studies that have shown beneficial effects (Baik, Chen, & Godsell, 2024; Mirza et al., 2020; Ullah, Zeb, et al., 2020). On the contrary, other studies document that board gender diversity may not reduce underinvestment (Mirza et al., 2020), shows an insignificant effect (Kakabadse et al., 2015) and even exerts a negative effect (Keisse & Jaafar, 2025) on the performance of the board. Thus, existing empirical evidence on the impact of board gender diversity on investment efficiency is still inconclusive. Optimization of allocation of internal resources is one of the critical driving factors of improved investment efficiency, which is overseen by the board (Stulz, 1990). Further, recent studies have also highlighted that non-financial firms are opting for corporate financialization to mitigate the challenge of ameliorating operational performance in traditional industries (Demir, 2009; Peng et al., 2018; Tang & Zhang, 2019) as it reserve liquidity, mitigate risks, and brings higher returns for the firms (Davis, 2016, 2017). In this context, existing empirical evidence has shown that corporate financialization positively influences investment efficiency (Gong, Gong, & Jiang, 2023) and the role of the board in the optimization of the allocation of internal resources (Hermalin & Weisbach, 1998; Kang, Xu, Tong, & Li, 2025; Lin & Long, 2025).

Most of the time, board gender diversity is usually associated with risk-averse decision-making, but in certain contexts, gender-diverse boards may instead use corporate financialization as a strategic response to organizational challenges and constraints. In such situations, they may align with prevailing high-risk, profit-oriented managerial norms, rather than displaying their usual risk-averse tendencies. In this context, Zuojun and Jingjing (2024) documented that female executives influence financial investment preferences by showing a positive association with corporate financialization. Further, the unique skills, perspectives, and approaches of female directors contribute to enhancing problem-solving through effective leadership and global connectivity (Egbunike, Igbinovia, Oranefo, & Iyoha, 2023; Guizani, 2025). Accordingly, corporate financialization may serve as a channel for gender-diverse boards to optimize the allocation of internal resources, keeping in view the challenges faced by non-financial firms. Further, emerging-country studies paid limited attention to contextual factors that may contribute to understanding the effectiveness of board gender diversity in improving investment efficiency, especially mediated through corporate financialization in environments plagued with information asymmetry, to explore whether board gender diversity promotes

improved investment efficiency through the mediation of corporate financialization. Building on upper echelon theory, organizational outcomes are shaped by the cognitive frames of board members (Hambrick & Mason, 1984). In this context, board gender diversity introduces varied experiences and values that influence strategic financial decisions. Consequently, corporate financialization may serve as a mechanism through which board gender diversity affects firms' investment efficiency. Building on upper echelons theory, corporate investment behaviors are shaped by the cognitive frames, particularly experiences, values, and personal traits of board members (Hambrick & Mason, 1984). Thus, strategic decisions are not entirely dependent on rational calculations but are largely shaped by the socio-psychological characteristics and behavioral preferences of board members. Thus, within this theoretical framework, board gender diversity impacts corporate decisions (Zhang, Zheng, Lam, Fu, & Li, 2022). This study enriches and revisits earlier empirical evidence in various significant aspects. First, existing evidence on board gender diversity has mostly emphasized various aspects of performance (Bogdan, Popa, & Beleneși, 2022; Brahma, Nwafor, & Boateng, 2021; Casey, Skibnes, & Pringle, 2011; Li & Chen, 2018; Vafaei, Ahmed, & Mather, 2015). Unlike these studies, which largely focus on governance mechanisms and performance outcomes, the present study shifts attention to underlying corporate investment decisions, which affect investment efficiency (Wu, Wang, & Chen, 2017). This research explores the direct relationship between board gender diversity and investment efficiency, as it acknowledges the pivotal role of board gender diversity in investment efficiency in non-financial firms in an emerging-country context. Second, declining industrial performance reflected in the lowering of profits is a critical driving factor of corporate financialization, as it serves as a precautionary measure that acts as a reservoir and improves the company's position in the wake of challenges (Demir, 2009; Peng et al., 2018; Tang & Zhang, 2019; Xu & Xuan, 2021). We contribute to this academic debate by arguing that multiple inclusive features of board gender diversity may act as a central instrument in improving investment efficiency, with a focus on Pakistan, which is a clear example of a weak institutional context with agency conflicts and weak corporate governance practices that may affect operational performance (Latif, Voordeckers, Lambrechts, & Hendriks, 2020). Since financialization practices have been seen in emerging economies (Feng, Yao, Wang, Liao, & Cheng, 2022; Gong et al., 2023; Wei, Luo, & Lu, 2025; Wu, Lee, Lee, & Peng, 2022), this study focuses on the direct relationship and exploration of corporate financialization as a potential mediator between board gender diversity and investment efficiency. The findings highlight critical policy implications for financial practice and policy, where weak governance practices and institutions prevail. Therefore, regulators may consider measures to restrain over-financialization, which undermines the efficiency of financial systems (Wu et al., 2017).

The study outcomes revealed that board gender diversity directly improves investment efficiency, with corporate financialization acting as an intermediary channel in a sample of non-financial firms listed on the Pakistan Stock Exchange (PSX) spanning from the year 2014 to 2023. Further, our mechanism analysis reveals that corporate financialization partially mediates the relationship by transcending traditional investment strategies and making investments in financial assets. The relationship still holds even after addressing endogeneity by deploying instrumental variables, utilizing system GMM regressions, and using alternative measures along with control variables. Further, the stimulatory mediation effect of corporate financialization is more apparent in non-SOEs as per the heterogeneity analysis. The rest of the paper is organized as follows: Section 2 synthesizes the literature and proposes the hypothesis. Section 3 introduces the sample, data, and model used in the study. Section 4 discusses the main empirical findings, robustness tests and provides additional analysis. Section 5 provides the conclusion and discusses implications.

## LITERATURE REVIEW AND RESEARCH HYPOTHESIS

### Board Gender Diversity and Investment Efficiency

Investment efficiency has become a central concern, particularly in emerging markets where corporate governance mechanisms are in the refinement stage. Biddle, Hilary, and Verdi (2009) define it as the ability of a firm to allocate resources toward value-maximizing projects while also avoiding over- or underinvestment. This efficiency is closely shaped by governance mechanisms, including board structure, independence, and diversity (Ali, Wang, Jebran, & Ali, 2021; Rajkovic, 2020; Ullah, Zeb, et al., 2020). Earlier empirical evidence

highlighted that board diversity improves the monitoring and strategic oversight that enforces accountability, sound investment choices, leading to improvement in investment efficiency. Further, Forbes and Milliken (1999) also argued that internal board dynamics, knowledge, skills, effort norms, and cognitive abilities also shape board oversight to make better investment decisions. The cognitive frame refers to how they seek, process, and evaluate information rooted in their unique experience and knowledge (Hambrick, Werder, & Zajac, 2008). Since the cognitive frames shape decision-making and influence outcomes, board gender diversity emerges as a key determinant (Mason, 2002). Existing literature has identified two motivations for why board gender diversity improves investment efficiency. The first point of view is the agency hypothesis, which builds on the idea that it contributes to the mitigation of information asymmetry and agency issues (Abad, Lucas-Pérez, Minguez-Vera, & Yagüe, 2017). This means that board gender diversity acts as the core mechanism of the internal control responsible for aligning corporate decisions with shareholder interests (Jensen & Meckling, 1976). As board gender diversity enriches the board with a wide range of skills, knowledge, and complementary experiences, thereby positively influencing management control and supervision, which is a function of board oversight (Hillman & Dalziel, 2003), as well as agency conflicts mitigation (Adams & Ferreira, 2009; Terjesen, Sealy, & Singh, 2009). Farooq, Gan, and Nadeem (2023) argue that board diversity curbs agency problems. Hence, proponents of this view argue that board gender diversity fosters a deeper perspective and strengthens oversight functions, which improve strategic decision making, having an impact on investment efficiency (Adams & Ferreira, 2009; Carter, Simkins, & Simpson, 2003; Terjesen & Sealy, 2016). The second perspective is the resource-based view argument, which builds on the idea that gender diverse boards have distinct cognitive frames and perform comprehensive deliberation, through which they can provide better advice in investment decisions, which may lead to better investment decisions. We contend that gender diverse boards have distinct cognitive frames that influence information evaluation and investment choices (Hambrick et al., 2008). Consistent with the argument, Loyd, Wang, Phillips, and Lount (2013) also found that diverse groups engage in comprehensive deliberation, discussion, and thorough integration of information and knowledge, which outperform homogeneous groups. Bart and McQueen (2013) also highlighted that female directors exhibit an inclusive decision-making style which emphasizes fairness, especially when conflicting interests prevail, as compared to the male directors who normally adhere to conventional rule-based approaches. The relationship between board gender diversity and firm performance is theoretically grounded in upper echelon theory. The theory posits that the characteristics of management teams, including experiences, values, and personal traits, have an influence on the corporate investment behavior and decisions. This theory argues that personal experiences of executives shape their cognitive frameworks, which impact their strategic choices. Thus, strategic decisions are not merely based on rational calculations but are also shaped by the executives' socio-psychological characteristics and behavioral preferences (Hambrick & Mason, 1984; Hambrick et al., 2008). Within this, gender diverse boards also have heterogeneous cognitive frameworks that impact strategic choices and investment behavior. More precisely, board gender diversity brings better strategic oversight, comprehensive deliberation, knowledge, skills, and cognitive abilities that may help in making better investment decisions, which may improve investment efficiency. Arguably, a gender diverse board may be perceived as one of the important avenues through which the board protects shareholders' interests.

As firms strive to make optimal investment decisions, board gender diversity is one of the key factors that influence strategic investment behavior. Although board gender diversity is widely advocated in global governance codes for enhancing transparency, accountability, and long-term decision-making, the empirical evidence regarding its effect on firm investment behavior remains divided. Earlier literature finds that board gender diversity brings diverse perspectives, cognitive frames, and a cautious decision-making approach, which improves strategic oversight, which is a key driver of investment efficiency. Specifically, Adams and Ferreira (2009) highlighted that women have a participatory leadership style and diverse perspective that enhances monitoring and aligns managerial actions with shareholder interests. The cognitive abilities of female directors enhance financial disclosure and overall firm performance (Hussain, Ahmad, Fazal, & Menegaki, 2024; Post & Byron, 2015; Zalata, Ntim, Choudhry, Hassanein, & Elzahar, 2019). Srinidhi, Gul, and Tsui (2011) further indicate that board gender diversity improves transparency and strategic oversight. Charness and Gneezy (2012) and Mohd Saleh and Sun (2022) further indicate that female directors have a cautious approach, which encourages

disciplined investment behaviours that minimize inefficient investment outcomes. Thus, female directors' cognitive frameworks improve strategic decision-making, which strengthens governance, as both are key drivers of efficient investment (Latif et al., 2020; Zhao, 2021). In contrast, evidence suggests that board gender diversity may not consistently yield favorable outcomes (Alexander, Nuchols, Bloom, & Lee, 1995; Carter et al., 2003; Richard, Barnett, Dwyer, & Chadwick, 2004), particularly when female presence is minimal and tokenistic (Kakabadse et al., 2015; Rixom, Jackson, & Rixom, 2023), and female chairpersons also reduce investment efficiency due to increased over-investment tendencies (Gonçalves, Barros, Gaio, & Almeida, 2026). These inconsistencies motivate our examination of the link with investment efficiency. We argue that multiple inclusive features of gender-diverse boards have positioned them as a crucial mechanism in improving investment decision-making. This study contributes to this academic debate by exploring the impact of board gender diversity on investment efficiency in Pakistan, an example of a weak institutional context plagued with agency conflicts and weak corporate governance practices (Latif et al., 2020). As weak corporate governance often exacerbates agency conflicts, gender-diverse boards' cognitive frames may act as an effective mechanism to strengthen monitoring and governance, decision making, and mechanisms of investment efficiency (Adams & Ferreira, 2009; Amin, Ur Rehman, Ali, & Ntim, 2022). Besides the above, Mirza et al. (2020) revealed that female directors mitigate agency issues, improve monitoring and efficient allocation of resources, curb the overinvestment problem, but they do not play a significant role in reducing the underinvestment problem. Therefore, in light of these contrasting views and the limited evidence, we explore whether board gender diversity influences firm-level investment efficiency. Accordingly, we posit the following hypothesis.

*Hypothesis 1: Board gender diversity is positively associated with investment efficiency, ceteris paribus.*

The above discussion highlights divergent results and frames the discussion on the benefits and detriments of board gender diversity. However, the board gender diversity benefit or negative effect is dependent on the situation (Shin, Chang, Jeon, & Kim, 2020). Indeed, firms are situation-dependent, as a strategic response is required to mitigate issues like declining industry profitability (Demir, 2009), weak operational performance (Peng et al., 2018), and economic policy uncertainties (Zhao & Su, 2022). Hence, corporate governance challenges are situation-dependent. Earlier research carried out in an emerging context has also encountered challenges, which include corruption and weak institutional frameworks that fail to protect property, shareholders, and creditors (Latif et al., 2020; Shin et al., 2020). In Pakistan, for instance, the industrial and manufacturing sectors, which account for approximately 13% of GDP, continued to struggle despite modest growth. This was primarily due to rising production costs and fragile market sentiment, resulting in shrinking profit margins and reduced efficiency (Ministry of Finance Government of Pakistan, 2025).

Although female board members have a cautious and risk-averse approach, we still argue that they may support corporate financialization as a strategic response to highlighted challenges. We extend this critical debate by investigating whether board gender diversity affects investment efficiency in Pakistan, which is characterized by a weak institutional context plagued with challenges. It offers a compelling research setting as an emerging economy where governance challenges are more pronounced than in developed countries (Latif et al., 2020; Young, Peng, Ahlstrom, Bruton, & Jiang, 2008). Moreover, prior research on board dynamics and firm performance highlights the need for a deeper inquiry into mediating mechanisms (McIntyre, Murphy, & Mitchell, 2007). Among these mechanisms, corporate financialization has emerged as a pertinent mediator, particularly in contexts where firms increasingly divert capital from tangible assets to financial investments amid declining profits, weak operations, and economic policy uncertainty (Demir, 2009; Peng et al., 2018; Zhao & Su, 2022). These pressures prompt a shift of capital expansions towards finance, termed corporate financialization, especially in emerging economies (Waldkirch, 2020; Zheng, Lei, Wang, & Li, 2024).

In such challenging environments, financialization refers to a gradual shift towards investment in financial assets instead of reliance on production and trading activities for profits (Krippner, 2005). When firms face operational distress or survival threats, managers are often incentivized to pursue high-risk financial investments as a way to offset deteriorating core performance and to signal financial stability (Peng et al., 2018). Thus, board gender diversity may support such financial strategies, not recklessly, but as a deliberate, risk-balanced response to ensure firm sustainability under adverse conditions. Nevertheless, the effectiveness

and desirability of corporate financialization remain highly contested within the literature. While some studies view it in terms of enhancing investment efficiency by improving liquidity, reducing financial distress, and easing financing constraints (Denis & Sibilkov, 2010; Stulz, 2008). It results in a favorable influence on investment efficiency (Gong et al., 2023). Financial assets, liquidity, and short payback help firms respond to external shocks and fund productive activities when capital is scarce. This view sees financialization as a buffer or reservoir (Krippner, 2005; Orhangazi, 2006) enabling firms to strengthen their financial resilience, support ongoing operations, and invest more efficiently when faced with capital constraints or unpredictable operating environments. This argument draws support from reservoir theory and investment substitution theory. As proponents of the reservoir theory suggest, financial assets help in maintaining liquidity, easing funding constraints, as highly liquid assets can be liquidated (Chang, Gan, & Mohsin, 2022). Similarly, advocates contend that corporate financialization also mitigates distress and operational constraints while bolstering profitability through investment substitution (Arrighi, 1994; Krippner, 2005; Titman & Wessels, 1988).

Conversely, the crowding-out argument contends that holding financial assets can significantly impede the actual production activities of enterprises by diverting resources to financial instruments. Excessive financialization may crowd out real economic activities by shifting capital away from core operations to short-term financial gains (Jin, Mai, & Cheung, 2022; Orhangazi, 2008). This shift, driven by shareholder value maximization, can undermine long-term growth by reducing R&D, innovation, and infrastructure investment (Davis & Kim, 2015; Stockhammer, 2004).

Further, financialization may affect a firm's competitive edge by cutting R&D and operational investments, leading to strategic drift and greater exposure to market risks. While it may yield short-term gains, the transition from retain and reinvest to downsize and distribute model (Lazonick & O'Sullivan, 2000). This shift may also weaken the firm's competitive advantage by reducing spending on R&D and production-related activities.

These opposing views raise an important question: Does board gender diversity promote or inhibit corporate financialization, especially under conditions of declining profitability, policy uncertainty, and operational inefficiencies? While traditionally associated with risk aversion and prudence, gender-diverse boards may adopt a strategically adaptive approach, endorsing limited or well-governed financialization to sustain firm performance during economic stress. In emerging economies like Pakistan, where rising input costs, weak industrial competitiveness, and regulatory fragility reduce the returns on real investments, carefully calibrated financial investments can serve as a rational hedge against operational volatility. Thus, the relationship between board gender diversity and investment efficiency may not follow a linear graph. Instead, it may be mediated by corporate financialization, particularly when such financial strategies are deployed not to speculate but to stabilize cash flows, enhance firm resilience, and complement long-term goals. This perspective aligns with recent arguments suggesting that financialization, when managed judiciously under diverse board leadership, can improve resource allocation and mitigate inefficiencies caused by uncertainty in declining industrial profits (Demir, 2009; Peng et al., 2018; Zhao & Su, 2022).

A few studies contend that board gender diversity promotes corporate financialization (Huang & Li, 2024; Zuojun & Jingjing, 2024). This indicates a potential indirect channel through which gender-diverse boards may shape firms' financial investment decisions that affect investment efficiency. As previously discussed, gender-diverse boards contribute to mitigating investment inefficiencies by utilizing their cognitive framework, exercising prudent judgment, and adopting a cautious and risk-averse approach. More specifically, corporate financialization may help in mitigating financial constraints by providing stable cash flow support, leading to an improvement in investment efficiency. Therefore, exploring board gender diversity's influence on investment efficiency via corporate financialization offers a nuanced understanding of governance dynamics in financially constrained, volatile markets. Accordingly, we posit the second hypothesis.

*Hypothesis 2: Board gender diversity increases investment efficiency mediated through corporate financialization, ceteris paribus.*

## DATA AND METHODOLOGY

### Data and Sample

To explore whether board gender diversity affects investment efficiency by testing the aforementioned hypothesis, we have used non-financial firms' unbalanced data listed on the Pakistan Stock Exchange. The study period spans from the period 2014 to 2023 to assess how board gender diversity affects investment efficiency, with corporate financialization as a mediating factor. Major amendments to codes of corporate governance, especially pertaining to strengthening the board, were incorporated in 2012, followed by the mandatory inclusion of female directors on boards in 2017. Further, the independent director criteria were also enhanced in 2019. Overall, these amendments influence investment efficiency. Board diversity and investment efficiency data have been retrieved from annual reports. Whereas corporate financialization data has been retrieved from the financial statement analysis report, published on an annual basis by the State Bank of Pakistan. The final sample consists of 401 non-financial companies with 1,687 firm-year observations, after a cleaning procedure that included dropping observations with missing values in STATA. In order to minimize the influence of extreme values on the results, data have been winsorized at the 1% and 99% quantiles for all the continuous variables.

### Model and Variables

#### Dependent Variable

Investment Efficiency is the dependent variable used in the study. By drawing from established frameworks of Feng et al. (2022); Richardson (2006); Wu et al. (2022); and Zhang, An, and Zhong (2019), we have constructed the following model to estimate investment inefficiency, which is the absolute residual value that measures the deviation between a firm's actual investment and its predicted level. A higher absolute residual indicates increased deviation between actual and forecasted investment, thereby signaling higher investment inefficiency and lower efficiency. The proposed investment efficiency model is articulated as follows:

$$Inveff_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t} + \alpha_2 Cash_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 Age_{i,t} + \alpha_6 Ret_{i,t} + \alpha_7 Inv_{i,t} + \sum Year Dummy + \sum Industry Dummy + \varepsilon_{it} \quad (1)$$

Where  $Inv_{i,t}$  represents the capital investment of firm  $i$  in year  $t$ , measured as the net cash expenditure on acquiring fixed, intangible, and other long-term assets, less the cash receipts from the sale of fixed assets, intangible, and other long-term assets, scaled by the total firm assets. Specifically, firm characteristics include  $Growth_{i,t}$  (Operating revenue growth rate),  $Cash_{i,t}$  (Cash and bank balance to total assets),  $Lev_{i,t}$  (Firm leverage to total assets),  $Size_{i,t}$  (Log of total assets),  $Age_{i,t}$  (Log of one plus the time difference between the observation year and listing year) which is represented by the formula  $\ln(\text{current year} - \text{listing year} + 1)$  and  $Ret_{i,t}$  (ROA of net income standardized by total assets). Further, *Year* and *Industry Dummy* effects in the model have also been included to mitigate time- and industry-specific heterogeneity. The variable definitions and symbols of the key variables are shown in Appendix A.

#### Independent Variable

Board gender diversity is the independent variable used in this study, which is measured by the following (Farooq, Su, Boubaker, & Gull, 2022). Its proxy is  $bgd_{i,t}$ , which equals one when the proxy of board gender diversity, i.e., female board members, is present, and takes the value of zero otherwise. The same has been taken as an indicator variable.

#### Mediator

Corporate financialization is a mediator in this study, which has been calculated by following (Davis, 2018). It has been taken as the sum of financial assets, including cash and short-term investments, trade debts, short-term loans and advances, and other current assets.

### Control Variables

By following the study of Farooq et al. (2022), board-related control variables have also been incorporated, which include Board\_size<sub>i,t</sub> (number of directors on the board), Outside\_dir<sub>i,t</sub> (percentage of non-executive and independent directors standardized by the total directors), CEO\_duality<sub>i,t</sub> (dummy variable coded as 1 when the CEO is also the chairperson and 0 otherwise).

### Model Specification

By following Feng et al. (2022), we have employed panel regression to examine the impact of board gender diversity on investment efficiency. The econometric model employed in this study is as follows:

$$Inveff_{i,t} = b_0 + b_1 Bgd_{i,t} + \sum b_n Controls_{i,t} + \Sigma YearDummy + \Sigma IndustryDummy + \varepsilon_{it} \quad (2)$$

Where *i* and *t* represent the firm and year, respectively. Inveff<sub>i,t</sub> serves as a proxy of investment inefficiency, and Bgd<sub>i,t</sub> board gender diversity is represented by the presence of females on the board. The greater the Inveff, the lower the investment efficiency. Controls<sub>i,t</sub> indicates a group of controls that includes Growth<sub>i,t</sub>, Cash<sub>i,t</sub>, Lev<sub>i,t</sub>, Size<sub>i,t</sub>, Age<sub>i,t</sub>, Ret<sub>i,t</sub>, Board\_size<sub>i,t</sub>, Outside\_dir<sub>i,t</sub>, and CEO\_duality<sub>i,t</sub>. We have controlled for variations across industries and years by including industry and year effects. Further, to limit outlier bias, continuous variables were winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles.

## EMPIRICAL RESULTS AND ANALYSIS

### Descriptive Statistics and Correlations

Table 1 and Table 2 display the descriptive statistics and correlations of the variables used in the study. Inveff, the mean value is (13.241), and the standard deviation is (1.603), showing moderate variability. Inveff minimum and maximum values are (5.41) and (18.772), respectively, which indicate a substantial spread in inefficiency across firms. The corporate financialization average is (13.824), with a relatively larger standard deviation (2.204), showing significant heterogeneity in corporate financialization levels of the firms, with a minimum value of (2.565) to a maximum of (20.262), suggesting that some firms are heavily engaged in corporate financialization as compared to others. We further analyzed Pearson correlation coefficients among the variables used in the study. F\_quota exhibits a positive correlation with corporate financialization, growth, cash, firm size, and board gender diversity, indicating that quota-implementing firms are more financially active and gender-diverse. In addition, Table 3 presents VIF statistics that are well below 5, with a mean VIF of 1.727, suggesting no serious multicollinearity among independent variables, thereby supporting robust regression results.

**Table 1: Descriptive Statistics**

| Var.                        | Obs. | Mean   | Std. Dev. | Min.   | Max.   |
|-----------------------------|------|--------|-----------|--------|--------|
| Inveff <sub>t</sub>         | 1687 | 13.241 | 1.603     | 5.41   | 18.772 |
| cf <sub>t</sub>             | 1687 | 13.824 | 2.204     | 2.565  | 20.262 |
| Growth <sub>t</sub>         | 1297 | 13.215 | 2.126     | 5.587  | 18.934 |
| Cash <sub>t</sub>           | 1687 | 10.849 | 2.538     | 2.398  | 17.503 |
| Lev <sub>t</sub>            | 1532 | .88    | 0.619     | -0.117 | 6.944  |
| Size <sub>t</sub>           | 1687 | 15.433 | 1.842     | 4.394  | 20.748 |
| Age <sub>t</sub>            | 1687 | 1.291  | 0.125     | 0.327  | 2.03   |
| Ret <sub>t</sub>            | 1147 | 1.489  | 1.274     | -4.605 | 5.656  |
| Bgd <sub>t</sub>            | 1687 | 1.058  | 0.985     | 0      | 6      |
| Board_size <sub>t</sub>     | 1687 | 7.866  | 1.449     | 4      | 18     |
| Outside_dir <sub>t</sub>    | 1687 | 76.069 | 10.031    | 14.286 | 100    |
| Dual_Chair_CEO <sub>t</sub> | 1687 | 0.01   | 0.1       | 0      | 1      |

Table 1 represents descriptive statistics of the variables of the study, having 1,687 observations, covering the period 2014 to 2023.

Table 2: Correlation coefficients

| Variables                        | (1)                 | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                | (8)                 | (9)                  | (10)                | (11)                | (12)                 | (13)  |
|----------------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|---------------------|----------------------|---------------------|---------------------|----------------------|-------|
| (1) Inveff <sub>t</sub>          | 1.000               |                      |                      |                      |                      |                      |                    |                     |                      |                     |                     |                      |       |
| (2) cf <sub>t</sub>              | 0.470***<br>(0.000) | 1.000                |                      |                      |                      |                      |                    |                     |                      |                     |                     |                      |       |
| (3) Growth <sub>t</sub>          | 0.490***<br>(0.000) | 0.872***<br>(0.000)  | 1.000                |                      |                      |                      |                    |                     |                      |                     |                     |                      |       |
| (4) Cash <sub>t</sub>            | 0.402***<br>(0.000) | 0.823***<br>(0.000)  | 0.722***<br>(0.000)  | 1.000                |                      |                      |                    |                     |                      |                     |                     |                      |       |
| (5) Lev <sub>t</sub>             | -0.002<br>(0.924)   | -0.040<br>(0.115)    | 0.011<br>(0.691)     | -0.136***<br>(0.000) | 1.000                |                      |                    |                     |                      |                     |                     |                      |       |
| (6) Size <sub>t</sub>            | 0.515***<br>(0.000) | 0.918***<br>(0.000)  | 0.867***<br>(0.000)  | 0.761***<br>(0.000)  | 0.006<br>(0.821)     | 1.000                |                    |                     |                      |                     |                     |                      |       |
| (7) Age <sub>t</sub>             | -0.021<br>(0.386)   | -0.066***<br>(0.007) | -0.076***<br>(0.006) | -0.007<br>(0.788)    | -0.085***<br>(0.001) | -0.068***<br>(0.005) | 1.000              |                     |                      |                     |                     |                      |       |
| (8) Ret <sub>t</sub>             | 0.146***<br>(0.000) | 0.284***<br>(0.000)  | 0.469***<br>(0.000)  | 0.345***<br>(0.000)  | -0.133***<br>(0.000) | 0.179***<br>(0.000)  | -0.043<br>(0.145)  | 1.000               |                      |                     |                     |                      |       |
| (9) Bgd <sub>t</sub>             | -0.026<br>(0.279)   | -0.055**<br>(0.024)  | -0.049*<br>(0.078)   | -0.051**<br>(0.036)  | -0.051**<br>(0.046)  | -0.052**<br>(0.034)  | -0.007<br>(0.785)  | -0.026<br>(0.378)   | 1.000                |                     |                     |                      |       |
| (10) Board_size <sub>t</sub>     | 0.227***<br>(0.000) | 0.385***<br>(0.000)  | 0.334***<br>(0.000)  | 0.345***<br>(0.000)  | -0.010<br>(0.703)    | 0.395***<br>(0.000)  | 0.040*<br>(0.102)  | 0.135***<br>(0.000) | -0.029<br>(0.240)    | 1.000               |                     |                      |       |
| (11) Outside_dir <sub>t</sub>    | 0.134***<br>(0.000) | 0.126***<br>(0.000)  | 0.125***<br>(0.000)  | 0.087***<br>(0.000)  | 0.005<br>(0.858)     | 0.134***<br>(0.000)  | -0.021<br>(0.383)  | 0.062**<br>(0.036)  | -0.070***<br>(0.004) | 0.137***<br>(0.000) | 1.000               |                      |       |
| (12) Dual_Chair_CEO <sub>t</sub> | -0.040*<br>(0.102)  | -0.036<br>(0.136)    | -0.017<br>(0.538)    | -0.069***<br>(0.005) | 0.027<br>(0.297)     | -0.042*<br>(0.081)   | 0.007<br>(0.781)   | -0.042<br>(0.153)   | -0.036<br>(0.139)    | -0.023<br>(0.336)   | -0.020<br>(0.405)   | 1.000                |       |
| (13) F_quota <sub>t</sub>        | -0.009<br>(0.718)   | 0.054**<br>(0.027)   | 0.062**<br>(0.025)   | 0.053**<br>(0.030)   | -0.008<br>(0.744)    | 0.069***<br>(0.004)  | 0.061**<br>(0.013) | -0.013<br>(0.648)   | 0.129***<br>(0.000)  | 0.019<br>(0.436)    | 0.134***<br>(0.000) | -0.075***<br>(0.002) | 1.000 |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 3: Multiple covariance test**

| Variables        | VIF   | 1/VIF |
|------------------|-------|-------|
| Outside dir      | 3.429 | 0.292 |
| Board_size       | 3.303 | 0.303 |
| Size             | 2.492 | 0.401 |
| Growth           | 2.328 | 0.430 |
| Cash             | 1.311 | 0.763 |
| F_quota          | 1.047 | 0.955 |
| Bgd <sub>t</sub> | 1.027 | 0.973 |
| ROA              | 1.023 | 0.977 |
| Lev              | 1.021 | 0.979 |
| Age              | 1.01  | 0.990 |
| Dual_Chair_CEO   | 1.008 | 0.992 |
| Mean VIF         | 1.727 |       |

### Baseline Results

In order to calculate baseline results, panel data regression has been employed to explore the relationship between board gender diversity and investment efficiency after controlling for firm and board factors. Regression results across five model specifications are presented in Table 4, which confirms that board gender diversity improves investment efficiency. The coefficients of Bgd<sub>t</sub> are negative and statistically significant across the Columns (1 to 5). Further, control variables and fixed effects played a substantial role in improving explanatory power by raising R<sup>2</sup>. More precisely, firm size showed a significant contribution to explaining variation in investment efficiency, while CEO duality also has a strong explanatory role. The overall result indicates that gender-diverse boards experience lower investment inefficiency, supporting the argument that board gender diversity positively affects investment efficiency, which supports H1a. The significant coefficient of board gender diversity on investment efficiency corroborates the notion that board gender diversity enhances investment efficiency in emerging economies by improving governance and reducing inefficiencies (Ullah, Majeed, et al., 2020).

**Table 4: Baseline results: The effect of board gender diversity on investment efficiency**

| Var.                    | Dependent variable = Inveff <sub>t</sub> |                                   |                                                    |                                                        |                                                 |
|-------------------------|------------------------------------------|-----------------------------------|----------------------------------------------------|--------------------------------------------------------|-------------------------------------------------|
|                         | (1)<br>Model 1<br>(Without<br>Controls)  | (2)<br>Model 2 (With<br>Controls) | (3)<br>Model 3 (With<br>Controls + Year<br>effect) | (4)<br>Model 4 (With<br>Controls + Industry<br>effect) | (5)<br>Model 5<br>(Year and<br>Industry effect) |
| Bgd <sub>t</sub>        | -0.233***<br>(0.0869)                    | -0.159**<br>(0.0691)              | -0.163**<br>(0.0644)                               | -0.134**<br>(0.0668)                                   | -0.143**<br>(0.0628)                            |
| Growth <sub>t</sub>     |                                          | -0.000959<br>(0.0481)             | -0.00790<br>(0.0478)                               | -0.00431<br>(0.0516)                                   | -0.0355<br>(0.0401)                             |
| Cash <sub>t</sub>       |                                          | 0.0253<br>(0.0694)                | 0.0240<br>(0.0684)                                 | -0.0548<br>(0.0803)                                    | -0.0457<br>(0.0674)                             |
| Lev <sub>t</sub>        |                                          | 0.00303<br>(0.0210)               | 0.00536<br>(0.0210)                                | -0.00106<br>(0.0210)                                   | 0.00370<br>(0.0194)                             |
| Size <sub>t</sub>       |                                          | 0.0419***<br>(0.00620)            | 0.0420***<br>(0.00609)                             | 0.0372***<br>(0.00777)                                 | 0.0382***<br>(0.00628)                          |
| Age <sub>t</sub>        |                                          | 0.289<br>(0.247)                  | 0.214<br>(0.242)                                   | 0.331<br>(0.241)                                       | 0.137<br>(0.230)                                |
| Ret <sub>t</sub>        |                                          | -0.000126<br>(0.00141)            | 0.00119<br>(0.00143)                               | -0.000817<br>(0.00137)                                 | -0.000416<br>(0.00153)                          |
| Board_size <sub>t</sub> |                                          | -0.126<br>(0.130)                 | -0.129<br>(0.129)                                  | 0.0611<br>(0.147)                                      | 0.196*<br>(0.106)                               |

| Var.                        | Dependent variable = Inveff <sub>t</sub> |                                   |                                                    |                                                        |                                                 |
|-----------------------------|------------------------------------------|-----------------------------------|----------------------------------------------------|--------------------------------------------------------|-------------------------------------------------|
|                             | (1)<br>Model 1<br>(Without<br>Controls)  | (2)<br>Model 2 (With<br>Controls) | (3)<br>Model 3 (With<br>Controls + Year<br>effect) | (4)<br>Model 4 (With<br>Controls + Industry<br>effect) | (5)<br>Model 5<br>(Year and<br>Industry effect) |
| Outside_dir <sub>t</sub>    |                                          | 0.0985<br>(0.148)                 | 0.123<br>(0.145)                                   | -0.0586<br>(0.155)                                     | -0.149<br>(0.100)                               |
| Dual_Chair_CEO <sub>t</sub> |                                          | -0.734***<br>(0.160)              | -0.734***<br>(0.182)                               | -0.623***<br>(0.167)                                   | -0.534**<br>(0.214)                             |
| Constant                    | 2.115***<br>(0.159)                      | 0.374<br>(0.994)                  | 0.863<br>(1.122)                                   | -0.365<br>(0.986)                                      | 0.0880<br>(1.241)                               |
| Year FE                     | Yes                                      | Yes                               | Yes                                                | Yes                                                    | Yes                                             |
| Industry FE                 | Yes                                      | Yes                               | Yes                                                | Yes                                                    | Yes                                             |
| Observations                | 1,687                                    | 1,687                             | 1,687                                              | 1,687                                                  | 1,687                                           |
| R <sup>2</sup>              | 0.003                                    | 0.423                             | 0.439                                              | 0.485                                                  | 0.582                                           |

**Note:** This table shows the results between board gender diversity and investment inefficiency with the model without controls, with controls, with controls and year effects, controls with industry effects, and year and industry effects. Parentheses report robust standard errors. The symbols and significance are indicated at the 1%, 5%, and 10% levels by \*\*\*, \*\*, and \*, respectively.

### Robustness Checks

We have performed several checks to mitigate endogeneity issues, which include incorporation of dependent variable lag into the model, which accounts for the dynamic effect of investment efficiency over time to capture persistence, alternative independent variable and applied instrumental variable approach under generalized method of moments (GMM) to reduce bias resulting from reverse causality, bias due to omitted variables, and unobserved heterogeneity, thereby strengthening the reliability of our empirical results (Gul, Srinidhi, & Ng, 2011; Ullah, Majeed, & Fang, 2021). The results of the robustness checks are reported in Table 5.

**Lagged dependent variable.** We incorporated the lagged dependent variable value into the model, which accounts for the dynamic effect of investment efficiency over time to capture persistence. Nevertheless, the results remain consistent as the board gender diversity remains negative and significant at the 5% level, which implies that our baseline findings are not driven by the omission of historical firm dynamics, which align with prior work by Chen, Hope, Li, and Wang (2011). Consistency improves investment efficiency by utilizing the lagged value of the dependent variable.

**Alternative board gender diversity measure.** There is no universally accepted standard for capturing board gender diversity on corporate boards; these varying measures may affect research conclusions. To verify the robustness of our findings, board gender diversity has been measured through two alternative measures, including the number of female directors (*Fdir\_num<sub>t</sub>*), which is the count of female directors on the board of directors. While the proportion of female directors in board size (*Fdir\_prop<sub>t</sub>*) captures their relative decision-making influence on the board. The proxy is consistent with earlier studies (Adams & Ferreira, 2009; Chen, Tong, Zhang, & Zhou, 2021; Gul et al., 2011; Mohd Saleh & Sun, 2022).

The regression results show that the *Fdir\_num<sub>t</sub>* coefficient remains negative at the 1% significance level, which demonstrates that the findings remain consistent even when alternate measures of board gender diversity are used.

Further, findings also reinforce the conclusion that greater board gender diversity is associated with improved investment efficiency. Further, the alternate measure (*Fdir\_prop<sub>t</sub>*) shows a significant negative coefficient, which further supports the argument that board gender diversity improves investment efficiency, as the negative sign indicates a reduction in investment inefficiency.

**Table 5: Robustness checks**

| Dependent variable = Inveff <sub>t</sub> | L Inveff               | Fdir_num               | Fdir_prop              |
|------------------------------------------|------------------------|------------------------|------------------------|
| bgd <sub>t</sub>                         | -0.166**<br>(0.0655)   |                        |                        |
| Board_size <sub>t</sub>                  | 0.314***<br>(0.120)    | 0.313***<br>(0.120)    | 0.293**<br>(0.117)     |
| Outside_dir <sub>t</sub>                 | -0.194*<br>(0.110)     | -0.193*<br>(0.110)     | -0.190*<br>(0.109)     |
| Dual_Chair_CEO <sub>t</sub>              | -0.530**<br>(0.221)    | -0.533**<br>(0.222)    | -0.533**<br>(0.222)    |
| F_quota <sub>t</sub>                     | 0.106<br>(0.429)       | 0.110<br>(0.429)       | 0.0892<br>(0.431)      |
| Growth <sub>t</sub>                      | -0.0514<br>(0.0524)    | -0.0514<br>(0.0523)    | -0.0514<br>(0.0524)    |
| Cash <sub>t</sub>                        | -0.138*<br>(0.0707)    | -0.138*<br>(0.0706)    | -0.137*<br>(0.0707)    |
| Lev <sub>t</sub>                         | 0.00551<br>(0.0182)    | 0.00526<br>(0.0182)    | 0.00562<br>(0.0182)    |
| Size <sub>t</sub>                        | 0.0386***<br>(0.00854) | 0.0386***<br>(0.00853) | 0.0386***<br>(0.00854) |
| Age <sub>t</sub>                         | 0.0149<br>(0.262)      | 0.0128<br>(0.262)      | 0.0171<br>(0.262)      |
| Ret <sub>t</sub>                         | -0.000280<br>(0.00133) | -0.000288<br>(0.00133) | -0.000259<br>(0.00133) |
| Fdir_num <sub>t</sub>                    |                        | -0.177***<br>(0.0657)  |                        |
| Fdir_prop <sub>t</sub>                   |                        |                        | -0.0113**<br>(0.00466) |
| Constant                                 | -0.290<br>(1.250)      | -0.264<br>(1.251)      | -0.163<br>(1.278)      |
| Observations                             | 1,382                  | 1,382                  | 1,382                  |
| R <sup>2</sup>                           | 0.440                  | 0.441                  | 0.440                  |

**Note:** The results of Equation 2 are shown in the table by using an alternate measure of investment inefficiency (L.Inveff), and board gender diversity (Fdir\_num and Fdir\_prop). L.Inveff is a lag of investment inefficiency. Whereas Fdir\_num represents the number of female directors on the board, fdir\_prop represents the percentage of female directors in the board size. Robust standard errors are shown in parentheses. Parentheses report robust standard errors. The symbols and significance are indicated at the 1%, 5%, and 10% levels by \*\*\*, \*\*, and \*, respectively.

## Endogeneity Concerns

### Instrumental Variable (IV) Method

Despite mitigating potential endogeneities through robustness tests, our findings may be subject to reverse causality (Wu et al., 2022; Zhang et al., 2019). Specifically, firms exhibiting a higher level of investment efficiency may attract or appoint more female directors, which may potentially bias the estimates. To further mitigate this issue, we have employed the instrumental variable method within a GMM framework by employing three alternative measures of board gender diversity to assess its impact on investment efficiency. First, we estimate the GMM equation by using female quota ( $F\_quota_t$ ) as an instrumental variable, the presence of board gender diversity through the number of female directors on the board ( $Fdir\_num_t$ ), and the proportion of female directors in board size ( $Fdir\_prop_t$ ) to capture the effect of board gender diversity on investment efficiency. The GMM findings reported in Table 6 show that the coefficients of both the main and alternative measures of board gender diversity remain significantly negative, which supports the argument that board gender diversity contributes to improvement in investment efficiency.

Table 6: Endogeneity concern: Instrumental variable (IV) method

| Model                       | (1) bgd <sub>t</sub>  | (2) Fdir_prop <sub>t</sub> | (3) Fdir_num <sub>t</sub> |
|-----------------------------|-----------------------|----------------------------|---------------------------|
| Inveff <sub>t</sub>         | -0.0223<br>(0.0730)   | 0.0107<br>(0.0810)         | -0.0384<br>(0.0803)       |
| bgd <sub>t</sub>            | -7.176*<br>(3.690)    |                            |                           |
| Growth <sub>t</sub>         | 0.0253<br>(0.106)     | 0.000870<br>(0.0905)       | 0.00385<br>(0.0974)       |
| Cash <sub>t</sub>           | 0.0700<br>(0.171)     | 0.0707<br>(0.163)          | 0.0734<br>(0.169)         |
| Lev <sub>t</sub>            | -0.0664<br>(0.0965)   | -0.0388<br>(0.0827)        | -0.0553<br>(0.0976)       |
| Size <sub>t</sub>           | 0.0282*<br>(0.0158)   | 0.0322**<br>(0.0142)       | 0.0333**<br>(0.0156)      |
| Age <sub>t</sub>            | -0.485<br>(1.750)     | -0.787<br>(1.570)          | -0.826<br>(1.875)         |
| Ret <sub>t</sub>            | -0.00536<br>(0.00783) | -0.00420<br>(0.00723)      | -0.00581<br>(0.00799)     |
| Board_size <sub>t</sub>     | 0.396<br>(0.633)      | -0.505<br>(0.757)          | 0.223<br>(0.598)          |
| Outside_dir <sub>t</sub>    | -0.106*<br>(0.0643)   | -0.0851<br>(0.0604)        | -0.0959<br>(0.0641)       |
| Dual_Chair_CEO <sub>t</sub> | -1.734<br>(2.918)     | -1.643<br>(2.607)          | -1.825<br>(2.986)         |
| F_quota <sub>t</sub>        | 4.323**<br>(2.107)    | 4.019**<br>(1.965)         | 4.781**<br>(2.101)        |
| Fdir_prop <sub>t</sub>      |                       | -0.505**<br>(0.247)        |                           |
| Fdir_num <sub>t</sub>       |                       |                            | -8.125**<br>(3.481)       |
| Constant                    | 14.35<br>(11.88)      | 20.57<br>(13.22)           | 17.21<br>(12.02)          |
| Observations                | 1,382                 | 1,382                      | 1,382                     |
| Number of Firm_id           | 240                   | 240                        | 240                       |

**Note:** This table presents GMM results when using the instrumental variable of board gender diversity (F\_quota) by using three alternate independent variables: bgd, Fdir\_prop, and Fdir\_num. Parentheses report robust standard errors. The symbols and significance are indicated at the 5% and 10% levels by \*\*and \*, respectively.

### 2SLS Regression

To control for potential reverse causality, i.e., instrumental variable two-stage least squares regression has been used. We employed a female quota dummy as the instrumental variable. Specifically, the quota dummy has been coded as 1 for years  $\geq 2017$  (the year when mandatory gender quota regulations were implemented) and 0 otherwise, to capture the exogenous variation. The first step estimation results (Column 1 of Table 7) show that the instrumental variable coefficient is significantly positive, which satisfies the condition for instrumental variable estimation. Further, this variable serves as a valid instrument because it influences firm decisions in the appointment of female, but is unlikely to directly affect investment efficiency except through female board representation (Farooq et al., 2022).

The second-step estimates shown in (Column 2 of Table 7) indicate that board gender diversity positively influences investment efficiency, which provides strong evidence that board gender diversity promotes more efficient investment decisions within firms by reducing inefficient investment behavior. The results are even more robust after controlling for board size, outside directors, duality, firm growth, cash holdings, leverage, firm size, profitability, as well as year and industry effects. Overall, these findings show that not only does board

gender diversity enhance investment efficiency, but the observed relationship is not merely an artifact of reverse causality.

**Table 7: Endogeneity concern: 2SLS Results**

| Model                 | (1) $bgd_t$         | (2) $Inveff_t$      |
|-----------------------|---------------------|---------------------|
| $F\_quota_t$          | 0.569***<br>(0.107) |                     |
| $bgd_t$               |                     | -1.339**<br>(0.616) |
| $Board\_size_t$       | 0.0585*<br>(0.0335) | -0.0721<br>(0.107)  |
| $Outside\_dir_t$      | -0.078**<br>(0.031) | 0.0127<br>(0.112)   |
| $Dual\_Chair\_CEO_t$  | -0.244<br>(0.234)   | -1.165<br>(0.859)   |
| $Growth_t$            | 0.001<br>(0.005)    | 0.003<br>(0.020)    |
| $Cash_t$              | 0.010<br>(0.014)    | 0.029<br>(0.048)    |
| $Lev_t$               | -0.007<br>(0.004)   | -0.007<br>(0.016)   |
| $Size_t$              | -0.000<br>(0.001)   | 0.041***<br>(0.002) |
| $Age_t$               | -0.077<br>(0.056)   | 0.248<br>(0.196)    |
| $Ret_t$               | -0.001<br>(0.001)   | -0.001<br>(0.003)   |
| Constant              | 1.142***<br>(0.254) | 1.892<br>(1.153)    |
| F-test                | 5.27***             | 108.74***           |
| F-test(p-value)       | 0.0000              | 0.0000              |
| Cragg–Donald Wald F = | -                   | 32.069              |
| Observations          | 1,687               | 1,687               |
| R <sup>2</sup>        | 0.087               | 0.347               |

**Note:** This table provides 2SLS instrumental variable analysis results. The findings of the first step analysis show the impact of the IV ( $f\_quota$ ) on board gender diversity, and the second step analysis shows the results of board gender diversity impact on investment efficiency. The symbols and significance are indicated at the 1%, 5%, and 10% levels by \*\*\*, \*\*, and \*, respectively.

### Channel Test

We have also investigated the potential channel behind the main findings. As outlined in the hypothesis section, board gender diversity may yield beneficial outcomes via some mediating channel. As board gender diversity may shape investment preferences and encourage prudent risk-taking by influencing capital allocation decisions to offset production challenges and operational constraints by promoting corporate financialization, which may improve investment efficiency. Thus, we posit that corporate financialization may act as a potential channel in the relationship between board gender diversity and investment efficiency. By following Feng et al. (2022) two step panel regression approach to study the channel is as follows:

$$Channel\ var_{i,t} = b_0 + b_1 bgd_{i,t} + \sum b_n Controls_{i,t} + \varepsilon_{it} \quad \text{Step (1)}$$

$$Inveff_{i,t} = b_0 + b_1 Channel\ variable_{i,t} + \sum b_n Controls_{i,t} + \varepsilon_{it} \quad \text{Step (2)}$$

In the first stage, we examine the relationship between board gender diversity and the channel variable, i.e., corporate financialization (cf). In the second stage, we investigate whether cf influences investment efficiency. The findings of both steps are summarized in Table 8. Column (1) shows board gender diversity

coefficient is significantly positive. Column (2) regression results show that the cf coefficient is significantly negative, which shows that corporate financialization significantly reduces investment inefficiencies. More precisely, the coefficient of bgd decreases from  $-0.143$  in the baseline specification to  $-0.117$  after introducing corporate financialization, which shows that part of the impact of board gender diversity operates through financialization. As expected, Al Hosani, Nobanee, and Ellili (2025) find that board gender diversity helps mitigate operational inefficiencies, losses, and production-related challenges by fostering corporate financialization. Hence, findings reveal that board gender diversity facilitates corporate financialization, which subsequently enhances investment efficiency, potentially by offsetting production-related challenges and operational constraints through short-term financial gain.

**Table 8: Channel test: Corporate financialization**

| Model                   | (1) cf                    | (2) Inveff                 |
|-------------------------|---------------------------|----------------------------|
| Channel variable $cf_t$ |                           | $-0.0484^{**}$<br>(0.0188) |
| $bgd_t$                 | $0.593^{***}$<br>(0.136)  | $-0.117^*$<br>(0.0619)     |
| $Board\_size_t$         | $-0.391$<br>(0.322)       | $0.0554$<br>(0.144)        |
| $Outside\_dir_t$        | $0.770^{***}$<br>(0.233)  | $-0.0127$<br>(0.152)       |
| $Dual\_Chair\_CEO_t$    | $0.756^*$<br>(0.459)      | $-0.528^{***}$<br>(0.185)  |
| $F\_quota_t$            | $-1.943^{**}$<br>(0.858)  | $1.087^{**}$<br>(0.425)    |
| $Growth_t$              | $-0.149$<br>(0.152)       | $-0.0195$<br>(0.0508)      |
| $Cash_t$                | $-0.391$<br>(0.324)       | $-0.0792$<br>(0.0793)      |
| $Lev_t$                 | $-0.0480$<br>(0.0373)     | $-0.00148$<br>(0.0206)     |
| $Size_t$                | $0.442^{***}$<br>(0.0273) | $0.0587^{***}$<br>(0.0103) |
| $Age_t$                 | $1.151^{**}$<br>(0.497)   | $0.284$<br>(0.237)         |
| $Ret_t$                 | $0.00610$<br>(0.00644)    | $0.000819$<br>(0.00132)    |
| Constant                | $-6.712^{***}$<br>(2.454) | $-0.341$<br>(1.084)        |
| Observations            | 1,687                     | 1,687                      |
| $R^2$                   | 0.930                     | 0.510                      |

**Note:** Table 8 shows the estimation of the underlying channel, i.e., corporate financialization (cf), linking board gender diversity and investment efficiency. Parentheses report robust standard errors. The symbols and significance are indicated at the 1%, 5%, and 10% levels by \*\*\*, \*\*, and \*, respectively. Robust standard errors are shown in parentheses. Significance level is shown at \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ , respectively.

### Heterogeneity Analysis in SOEs/non-SOEs

Enterprise ownership differs in resource endowments, which shape the allocation of financial assets, having an impact on investment efficiency (Gong et al., 2023; Peng, Lee, & Xiong, 2021). Notably, Guo, Wang, and Wu (2025) highlighted that both state-owned enterprises (SOEs) and non-SOEs increase their allocation to financial assets when facing adverse external demand shocks, with the effect being more pronounced among non-SOEs. Yao and Chen (2025) highlighted that government subsidies curb corporate financialization, with the effect

strengthened under higher policy uncertainty. Moreover, specifically, Kang et al. (2025) highlighted that board characteristics have a stronger impact on corporate financialization in non-state-owned enterprises.

In order to test this heterogeneity, the sample has been categorized into SOEs and non-SOEs listed on the Pakistan Stock Exchange, and the findings are presented in Table 9. Columns (1) and (2) indicate the effect of board gender diversity on corporate financialization, which differs markedly, indicating that board gender diversity mitigates investment inefficiencies by improving investment efficiency. However, in SOEs, the coefficient of board gender diversity is positive but not statistically significant, indicating no discernible effect.

**Table 9: Heterogeneity analysis. SOEs and non-SOEs**

| Model                | (1) SOEs             | (2) Non-SOEs           |
|----------------------|----------------------|------------------------|
| $bgd_t$              | 0.787<br>(5.256)     | -0.111*<br>(0.0577)    |
| $Board\_size_t$      | -0.450<br>(2.829)    | 0.226**<br>(0.0985)    |
| $Outside\_dir_t$     | 3.188***<br>(1.019)  | -0.196**<br>(0.0920)   |
| $Dual\_Chair\_CEO_t$ |                      | -0.373**<br>(0.170)    |
| $F\_quota_t$         | 11.24<br>(15.01)     | 1.034***<br>(0.386)    |
| $Growth_t$           | 0.242<br>(0.209)     | -0.117***<br>(0.0408)  |
| $Cash_t$             | 0.362<br>(0.860)     | -0.115*<br>(0.0702)    |
| $Lev_t$              | -0.726***<br>(0.234) | 0.000558<br>(0.0183)   |
| $Size_t$             | -0.0537<br>(0.0619)  | 0.0551***<br>(0.00633) |
| $Age_t$              | -21.87<br>(14.88)    | 0.140<br>(0.227)       |
| $Ret_t$              | 0.520<br>(0.426)     | 0.00162<br>(0.00121)   |
| Constant             | 59.23<br>(49.13)     | -0.120<br>(1.074)      |
| Observations         | 34                   | 1,653                  |
| $R^2$                | 0.787                | 0.427                  |

**Note:** The table shows the heterogeneity analysis of SOEs and non-SOEs. Parentheses report robust standard errors. The symbols and significance are indicated at the 1%, 5%, and 10% levels by \*\*\*, \*\*, and \*, respectively.

## CONCLUSION

Existing literature has shown equivocal evidence regarding the impact of board gender diversity on investment efficiency, which needs further exploration of the emerging channel of corporate financialization. Thus, we explore the relationship between board gender diversity and investment efficiency mediated through corporate financialization in non-financial firms, which has emerged as a means of business survival, especially in emerging economies, amidst challenges. Governance controls (outside directors, dual chair-CEO, board size) and financial controls (firm growth, cash holdings, leverage, size, age, and ROA) have also been incorporated. The study utilized a panel dataset of 402 non-financial firms listed on the Pakistan Stock Exchange (PSX) spanning from the year 2014 to 2023.

The findings of the study indicate that board gender diversity is significantly associated with the mitigation of investment inefficiencies, which means it has resulted in an improvement in investment efficiency. Further, the findings of the study also reveal that the relationship between board gender diversity and firm performance is theoretically grounded in upper echelon theory, which argues that gender-diverse boards also have heterogeneous cognitive frameworks that impact strategic choices and investment behavior.

The results remained robust after conducting multiple years, industry effects, without & with controls, channel analyses, robustness checks, and heterogeneity analysis. Our mechanism analysis shows that board gender diversity partially influences investment efficiency through corporate financialization, which acts as a potential mediator. In particular, corporate financialization can mitigate the financial constraints by providing stable and cash-flow support, leading to an improvement in investment efficiency.

The findings may have several important policy implications. Firstly, board gender diversity improves investment efficiency, as it is a more precise measure of firm performance than traditional indicators such as ROA or other corporate outcomes. Secondly, while earlier studies primarily examined the effects of board gender diversity on investment efficiency, our study goes further by exploring the mediating role of corporate financialization in the association between board gender diversity and investment efficiency. This improvement occurs through corporate financialization, serving as a potential mediator to mitigate challenges by easing financing constraints and promoting more effective resource allocation. This method provides a deep insight into how board gender diversity not only directly influences investment efficiency but also, through an indirect pathway, shapes financial strategies and investment decisions, and provides meaningful insights for both regulatory policy and corporate governance practices. The limitations of this study, along with future research directions, are as follows: First, although this study analyzed the relationship between board gender diversity and investment efficiency through corporate financialization in a unique context of an emerging country by utilizing data of Pakistani non-financial firms from 2014 to 2023, it may limit generalizability in other countries having varied governance structures and institutional environments. Future studies may extend this research by using cross-country samples in developed and developing countries.

Secondly, corporate financialization can be explored from the precautionary financial holdings (e.g., maintaining liquidity buffers to manage uncertainty) and speculative financial activities (e.g., pursuing short-term financial returns) motives, as they have different implications on investment efficiency and may generate opposing effects. Thus, future research may distinguish between these motives to have a more nuanced understanding of corporate financialization. Thirdly, although the study has included various firm and board-related controls, the possibility of omitted-variable bias cannot be completely ruled out. Thus, other factors like managerial risk preferences, CEO characteristics, strategic orientation, or internal governance practices may also influence both board gender diversity and investment decisions. Hence, future studies may incorporate additional qualitative as well as managerial characteristics and apply alternative identification strategies to further address endogeneity concerns. Lastly, the impact of different roles of female executives, like chief executive officer and chief financial officer, on investment efficiency may also be explored to examine their independent effects. Future studies could further examine whether the financial background of female board members also impacts investment efficiency.

This study highlights that policymakers and practitioners must recognize the role of gender-diverse boards in shaping firms' financial investment decisions, but at the same time encourage effective gender-based representation on corporate boards. Corporate boards can leverage diverse perspectives to improve financial decision-making and ensure balanced corporate financialization activities that support investment efficiency.

**FUNDING:** This study received no specific financial support.

**INSTITUTIONAL REVIEW BOARD STATEMENT:** Not applicable.

**TRANSPARENCY:** The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

**COMPETING INTERESTS:** The authors declare that they have no competing interests.

**AUTHORS' CONTRIBUTIONS:** All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

**DISCLOSURE OF AI USE:** During the preparation of this manuscript, the authors used OpenAI's ChatGPT (GPT-3.5) to refine the wording of the language and improve the overall clarity of the text.

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**Appendix A: Variable definition**

| <b>Variables</b>                        |                             | <b>Symbol</b>  | <b>Definition</b>                                                                                                                                                                               |
|-----------------------------------------|-----------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Explanatory variable                    | Investment                  | Inveff         | Absolute difference from the optimal level of investment.                                                                                                                                       |
|                                         | Efficiency                  |                |                                                                                                                                                                                                 |
|                                         | Investment                  | Inv            | Capital investment amount for the firm i in year t, which consists of cash expenditure less cash income of fixed, intangible, and other long-term assets standardized by the total firm assets. |
|                                         | Growth                      | Growth         | Operating revenue growth rate.                                                                                                                                                                  |
|                                         | Cash                        | Cash           | Fraction of cash and bank balance to total assets                                                                                                                                               |
|                                         | Leverage                    | Lev            | Financial leverage of the firm to total assets                                                                                                                                                  |
|                                         | Size                        | Size           | Logarithm of total assets                                                                                                                                                                       |
|                                         | Age                         | Age            | Ln (current year less listing year add 1)                                                                                                                                                       |
| Mediating variable                      | Return                      | Ret            | ROA of net income divided by total assets                                                                                                                                                       |
|                                         | Corporate Financialization  | Cf             | Cash and short term investments + Trade debts + Short-term loans and advances + Short-term investment + other current assets                                                                    |
| Explanatory variable                    | Female board members        | Bgd            | Female equals 1 if present, 0 otherwise                                                                                                                                                         |
| Alternate Proxy of explanatory variable | No of female directors      | Fdir_num       | Total number of female directors on the board                                                                                                                                                   |
|                                         | Female directors proportion | Fdir_prop      | The percentage of female directors in the board size                                                                                                                                            |
| Control variable                        | Board size                  | Board_size     | The number of directors on the board                                                                                                                                                            |
|                                         | Chairman CEO duality        | Dual_Chair_CEO | Chairman and CEO holding both positions is 1, otherwise 0                                                                                                                                       |
|                                         | Outside directors           | Outside_dir    | Percentage of non-executive and independent directors out of the total directors                                                                                                                |