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Board Gender Diversity and Firm Performance: Recent Evidence from Japan

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Abstract: Gender diversity is increasingly recognized as a critical element in corporate management. However, existing research on its impact on firm performance demonstrates inconsistency in a global context. This study employs 1990 publicly listed Japanese companies from 2006 to 2023 and examines the effect of board gender diversity on firm performance in Japan. Findings from the fixed-effects regression model revealed a significant negative impact of board gender diversity on firm performance. This adverse correlation is more pronounced in smaller firms, those with greater leverage and reduced institutional ownership, and regulated and consumer-focused industries, particularly pre-COVID-19. The detrimental impact of board gender diversity on firm performance is transmitted via corporate social responsibility and firm innovation instead of board independence or CEO duality. Notably, the two-stage least squares estimation addresses potential endogeneity, employing an equal opportunity policy as an instrumental variable. Moreover, the robustness of our results is affirmed via the substitution of return on equity for return on assets as an indicator of firm performance. Lastly, our analysis does not reveal a U-shaped nonlinear relationship between board gender diversity and corporate performance. As Japan progressively promotes women's participation in corporate governance, this research bears significant implications for corporate leaders, investors, and policymakers in Japan.

Keywords: gender diversity; firm performance; corporate governance; fixed-effects regression; two-stage least squares; instrumental variable; Chow's test; Japan

JEL Classification: G30; J16; M14

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1. Introduction

Board attributes have consistently garnered extensive research interest as a pivotal intrinsic element of corporate governance. Recently, the gender diversity of corporate boards has elicited heightened academic focus. Credit Suisse's (2021) Gender 3000 report reveals that the global proportion of female directors on corporate boards escalated from 15.1% in 2015 to 24.0% in 2021, denoting a 59% augmentation. Specifically, this metric surged from 3.6% to 11.5% in Japan, a 219% increase. In comparison, it rose from 23.5% to 34.4% in Europe, while in North America, it advanced from 17.5% to 28.6% (Credit Suisse 2021). Consequently, Japan emerges as the leader in accelerating gender diversity. Its influence may diverge from that in Europe and North America. Thus, comprehending the implications of board gender diversity in Japan is imperative.

In the present study, we delineate four motivations underpinning the investigation. Firstly, Japan has witnessed an extraordinary surge in the ratio of female directors on corporate boards over a notably condensed timeframe. Such accelerated evolution affords a singular lens to examine the repercussions of this rapid alteration in board structure.

EgonZehnder (2022) delineates that the presence of at least one female director on Japanese boards has augmented by 21.4% relative to 2020, starkly contrasting to the global median escalation of merely 4.7%, highlighting Japan's significant progress in the recent two years. Secondly, Japan's corporate culture has traditionally been male-dominated, and patriarchal norms often characterize its society. Therefore, the increasing presence of female directors in such an environment could have different implications than in other countries with different cultural and corporate dynamics. Thirdly, the Japanese administration has overtly endeavored to bolster female participation in leadership roles. As per a draft plan by the Gender Equality Bureau (Reynolds 2023), Japan aspires for women to constitute at least 30% of corporate directorships by 2030. This governmental pledge and its ensuing influence on corporate stewardship and efficacy present a fertile terrain for exploration. Fourthly, Japan is one of the world's largest economies. Understanding how gender diversity impacts corporate performance in such a significant economy can offer valuable insights for economic policies and corporate strategies within and outside Japan.

Numerous investigations have examined the influence of female directors on firm performance, yet their conclusions vary, which are attributable to disparate societal norms, attitudes toward women, and supportive policies across nations. A wealth of empirical research indicates that board gender diversity positively correlates with firm performance. Notably, Carter et al.'s (2003) analysis of 1000 Fortune-selected firms in 1997, Terjesen et al.'s (2016) examination of 3876 publicly traded entities across 47 nations, and Liu et al.'s (2014) study of over 2000 listed companies in China from 1999 to 2011 all affirm this beneficial effect of female directorship on firm performance. Conversely, other studies present differing views, suggesting female board members' detrimental or negligible impact on firm performance. For instance, Carter et al. (2010) identified no significant link between female directors and the financial performance of major U.S. corporations. Adams and Ferreira (2009) found a negative association and posited that increased gender diversity on boards might lead to excessive governance in these firms.

While there is a considerable corpus of literature on board gender diversity, its specific examination in Japan, especially concerning the influence of female directors on corporate performance, remains underexplored. Japan has recently shown a commitment to enhancing female representation in boardrooms. Prime Minister Shinzo Abe, in his address at the Global Leaders Meeting on Gender Equality and Women's Empowerment on 27 September 2015, stated an objective to have women fill about 30% of leadership roles in Japanese society by 2020. Nevertheless, this target was not attained by the designated year. Morgan Stanley Capital International's (2020) report suggests that maintaining the current trajectory, achieving a 30% female representation on corporate boards might be realized by 2029, with a potential to reach 50% by 2045. Nonetheless, Japan's patriarchal societal structure continues to present significant barriers to women's professional ascension.

This study utilizes a sample of 1990 listed Japanese companies from 2006 to 2023 to explore the nexus between board gender diversity and corporate performance, offering novel insights into Japanese corporate governance. Our empirical findings, derived from the fixed-effects regression model, indicate that board gender diversity adversely affects corporate performance in Japan. This diversity is quantified by the proportion of female directors and a binary variable denoting their presence on the board. To address potential endogeneity, we apply a two-stage least squares (2SLS) regression model, which corroborates the negative impact of board gender diversity on firm performance. This outcome persists even when altering corporate performance metrics from return on assets (ROA) to return on equity (ROE). In addition, our analysis does not reveal a nonlinear quadratic relationship between board gender diversity and corporate performance. The detrimental impact of board gender diversity on firm performance is more marked in smaller companies compared to larger ones, in firms with higher leverage as opposed to those with lower leverage, in firms with diminished institutional ownership relative to those with augmented ownership, in regulated and consumer-oriented industries in contrast to innovation-driven industries and was notably more pronounced pre-COVID-19

than during the COVID-19 period. The mediating effects are more pronounced via environmental, social, and governance (ESG) factors and weakly via research and development (R&D) rather than board independence and CEO duality.

Our study contributes to the literature on corporate governance in Japan. Despite numerous global studies exploring the correlation between board gender diversity and corporate performance, the results remain inconsistent. Moreover, given Japan's leading pace in augmenting gender diversity, comprehending its gender-specific effects is vital. However, this aspect has scarcely been the focus of academic scrutiny in Japan. Therefore, our study addresses this gap in the literature concerning the influence of board gender diversity on Japanese corporate performance. Additionally, how firm size, leverage, institutional ownership, and sector classification moderate the impact of gender diversity on firm performance in Japan remains unexplored. Furthermore, the COVID-19 pandemic, an unprecedented global health emergency, necessitates additional exploration of its implications for gender diversity and firm performance in Japan.

The subsequent sections of this paper are structured as follows: Section 2 presents a background of corporate governance and board gender diversity in Japan. Section 3 examines the theoretical framework regarding the impact of board gender diversity on firm performance. Section 4 delves into a review of the extant literature and formulates our hypotheses. Section 5 delineates the data and regression models employed in our analysis. Section 6 presents and discusses the regression results. Finally, Section 7 concludes our research, synthesizing our findings and implications.

2. Background

Japanese corporate governance has traditionally emphasized long-term relationships and consensual decision-making, epitomized by the "keiretsu" system (Aman et al. 2021). Historically, Japan has adhered to a stakeholder-centric governance model, privileging the needs of a broad array of stakeholders over shareholder primacy. Japanese firms have been intricately connected with their primary banks, suppliers, and clients, fostering robust, long-standing alliances. This interdependence between companies and stakeholders has distinctly influenced Japan's corporate governance, setting it apart from Western countries. Nevertheless, Japan's corporate governance landscape has witnessed substantial transformations in response to evolving global contexts. Efforts have been made to align Japanese corporate governance norms with global standards. The 2021 revision of Japan's Corporate Governance Code marked a significant step in this direction, enhancing board independence, fostering diversity, and emphasizing sustainability and ESG considerations (Sawaji 2021).

Augmenting board diversity can be attained by enhancing gender diversity. The Japanese government has set a target of achieving 30% female representation on the boards of companies listed on the prime market by 2030 (Reynolds 2023). The Global Gender Gap Report 2023 indicates that Japan's progress in gender equality lags behind its G7 counterparts (World Economic Forum 2023). In 2023, Japan scored 0.65 in the gender gap, positioning it 125th among 146 countries assessed in the report. This figure is markedly below the G7 average of 0.76. The gender inequality in Japan predominantly arises from women's limited participation in the workforce and scarce representation in political spheres. Per World Bank's (2023) data, the proportion of female to male labor force participation escalated from 64% in 2000 to 76% in 2022. The Gender Equality Bureau's (2022) analysis of gender diversity reveals substantial progress: the proportion of Tokyo Exchange-listed companies lacking female board members has markedly reduced, dropping from 84% in 2013 to 18.7% in 2022. However, women occupied 21.3% of managerial roles and a mere 6.2% of board positions in 2021 (Sawaji 2021). Furthermore, while the gender gap in school enrollment is minimal, a significant gap persists in higher education, particularly at the postgraduate level, where Japan reports the lowest proportion of female master's graduates among OECD countries (OECD 2023).

While Japan has exerted efforts to enhance corporate governance and advance gender diversity, considerable progress is yet to be realized. Despite these initiatives, entrenched gender norms and societal expectations remain impediments to enhancing gender diversity (Binder et al. 2019). Cultural and infrastructural transformations are gradual processes, necessitating persistent endeavors to guarantee enduring advancements in these domains. The Japanese government might encounter obstacles in fulfilling the 30% female directorship objective by 2030, which is attributable to a limited pool of qualified female candidates.

3. Theoretical Framework

3.1. Resource Dependence Theory

Numerous theories address the influence of board gender diversity on corporate performance. The resource dependence theory, a sociological and organizational concept, argues that organizations require external resources for success and sustainability (Pfeffer and Salancik 1978). Consequently, companies strive to appoint directors capable of providing these essential resources. Prior research indicates that boards with diverse membership amalgamate individuals with varied backgrounds, skills, experiences, expertise, and viewpoints, creating a more extensive resource base. This diversity facilitates more effective decision-making and improves corporate outcomes (Chan and Li 2008; Berger et al. 2014; Delis et al. 2017; Kim and Starks 2016). As women increasingly contribute to societal roles, female directors offer new resources, enabling firms to adapt to contemporary challenges. For instance, Brahma et al. (2021) analyzed FTSE 100 companies in the UK and observed a positive correlation between board gender diversity and firm performance. From a legitimacy standpoint, a gender-diverse board potentially enhances a firm's interactions with stakeholders, including customers, employees, and communities. With the growing prominence of female consumers, gender diversity on boards can help maintain relationships with female clientele or comprehend female consumer purchasing patterns (Süssmuth-Dyckerhoff et al. 2012).

3.2. Agency Theory

Agency theory, as proposed by Jensen and Meckling (1976), delves into potential conflicts of interest arising from the division of ownership and control between principals (shareholders) and agents (management). A critical function of directors is to alleviate these agency issues via managerial monitoring. Within gender diversity, agency theory facilitates an exploration into whether female directors enhance managerial monitoring efficiency. One segment of literature posits that boardroom gender diversity positively influences corporate performance due to increased vigilance from women directors, the introduction of novel viewpoints, and the avoidance of entrenched "old boys' networks" (Adams and Ferreira 2009; Lara et al. 2017; Gul et al. 2011). Conversely, another body of literature contends that board gender diversity adversely affects companies, attributed either to a scarcity of suitably qualified female directors (Ahern and Dittmar 2012; Bøhren and Staubo 2014) or to potential over-monitoring by women directors (Adams and Ferreira 2009).

3.3. Behavioral Theory

The behavioral theory of the firm, as articulated by Cyert and March (1963), proposes that firm decision-makers are constrained by their capabilities. Research on group diversity suggests that member heterogeneity can stimulate information processing and enhance problem-solving (Hoffman and Maier 1961; Van Knippenberg and Schippers 2007), leading to heightened innovation efficiency and improved performance (Chen et al. 2018; Alesina and La Ferrara 2005). However, counterarguments exist, contending that diversity may escalate communication expenses and even foster conflicts, thereby deteriorating performance (Wagner et al. 1984; Zenger and Lawrence 1989; Alesina and La Ferrara 2005).

3.4. Critical Mass Theory

Critical mass theory emphasizes the need to attain minimum female representation in the boardroom. This threshold, commonly termed critical mass, is deemed crucial for an organization to reap the benefits of gender diversity (Kanter 1977). Absent from this critical mass, including one or two women on a board might be perceived as tokenistic or symbolic merely to satisfy regulatory requirements. As a result, the effectiveness and influence of female directors can be diminished and marginalized in a predominantly male boardroom (Schwartz-Ziv 2017; Konrad et al. 2008). Conversely, appointing three or more women to a board yields more significant contributions and notable positive impacts (Owen and Temesvary 2018). Recent research has pivoted toward identifying this threshold and examining the veracity of the critical mass theory. The threshold is frequently defined as at least three or 30% female directors, equating to roughly one-third of most boards (Torchia et al. 2011; Joecks et al. 2013). In light of these findings, several countries are adopting affirmative measures by implementing gender quotas of 30–40% in boardrooms (Terjesen and Sealy 2016). Nonetheless, critics of these policies argue that companies remain dubious about the efficacy of such regulations, their alignment with corporate structures, and the variability in social, cultural, and legal nuances across different nations (Carter et al. 2010).

In summary, theoretical models forecast both advantageous and detrimental effects of board gender diversity on corporate performance, with empirical studies yielding mixed outcomes.

4. Literature Review and Hypotheses Development

The correlation between board gender diversity and corporate performance constitutes a significant and debated topic. The subsequent sections comprehensively review pertinent empirical research in this domain.

4.1. Positive Impact of Board Gender Diversity on Firm Performance

Numerous country-specific analyses substantiate the beneficial impact of board gender diversity on corporate performance, with evidence from Mauritius (Mahadeo et al. 2012), China (Liu et al. 2014), France (Sabatier 2015), the UK (Brahma et al. 2021), Russia (Garanina and Muravyev 2021), and India (Sanan 2016; Sarkar and Selarka 2021). These empirical investigations employ accounting performance measures such as ROA and ROE, market performance metric Tobin's Q (Tobin 1969), or a blend of these indicators to assess corporate performance. They consistently illustrate a positive correlation between enhanced corporate performance and an increased proportion of female directors on boards.

Findings from several multi-country investigations also indicate that gender diversity on boards enhances corporate performance. Low et al. (2015) conducted an extensive analysis of board diversification and corporate performance in East Asia, assessing firms in Hong Kong, South Korea, Malaysia, and Singapore. Their study reveals a positive influence of female directors on ROE, particularly in nations where cultural norms limit women's economic involvement. Belaounia et al. (2020), examining listed companies across 24 countries, ascertain that firms with a higher fraction of female directors exhibit superior overall performance, with the addition of a female board member boosting ROA and Tobin's Q. Terjesen et al.'s (2016) research on companies from 47 countries demonstrates that gender-diverse boards significantly enhance corporate performance, with increases in the percentage of female directors correlating with improvements in Tobin's Q and ROA. Pucheta-Martínez and Gallego-Álvarez (2020) analyzed firms from 34 countries and confirmed that the presence of women on boards is associated with better firm performance. In light of the literature reviewed, we propose our first hypothesis.

Hypothesis 1. *Board gender diversity has a positive impact on firm performance.*

4.2. Negative Impact of Board Gender Diversity on Firm Performance

Various empirical studies across different national contexts support the notion that board gender diversity negatively impacts corporate performance. Shehata et al. (2017) examine UK-listed companies using four gender diversity measures, all indicating a significant negative correlation with corporate performance. Mirza et al. (2012) analyze a sample of Pakistani companies, discovering negative correlations between female directorship and performance indicators such as ROE and ROA, attributing this to potential information deficits, risk aversion, and societal barriers women face. Similarly, Akram et al. (2020) observe that female directors in Pakistani firms lead to reduced corporate value. In Malaysia, Ahmad et al. (2020) report that an increased proportion of female directors correlates with a decline in ROA. Likewise, Lim et al. (2019) find a negative impact of female directors on Tobin's Q, and Abdullah (2014) identifies a significant negative relationship between board gender diversity and ROA and Tobin's Q. Based on the literature discussed above, we propose our second hypothesis.

Hypothesis 2. *Board gender diversity has a negative impact on firm performance.*

4.3. Neutral Impact of Board Gender Diversity on Firm Performance

Country-specific investigations suggest a neutral link between board gender diversity and corporate performance. Kagzi and Guha (2018), assessing listed Indian companies, observe no significant influence of board gender diversity on company performance before and after implementing the 2013 Companies Act, which mandated certain levels of board gender diversity. This finding aligns with earlier studies. Marinova et al. (2016), examining firms in the Netherlands and Denmark, indicate that board gender diversity bears no correlation with corporate performance. Yasser (2012), in an analysis of Pakistani listed companies, detects no association between board gender diversity and corporate performance. Likewise, research in other nations corroborates this absence of correlation. In the United States, Carter et al. (2010) find no empirical evidence supporting a positive or negative causal link between board gender diversity and corporate performance. Ararat and Yurtoglu (2021) investigated Turkish-listed companies. They ascertained no effect of female board presence on Tobin's Q. Similarly, Unite et al. (2019), studying Philippine companies, conclude that board gender diversity does not significantly affect ROA, ROE, or Tobin's Q. These observations underpin our third hypothesis.

Hypothesis 3. *Board gender diversity has a neutral impact on firm performance.*

While the scholarly community remains engaged with the effects of board gender diversity on corporate performance, the vast array of empirical studies yields divergent outcomes without a clear consensus. The existing research on the interplay between corporate gender diversity and firm performance in Japan is notably scarce. For instance, Nakagawa and Schreiber (2014), utilizing data from Toyo Keizai and Nikkei NEEDS on 745 Japanese-listed companies, identify a significant positive correlation between firm performance and the ratio of female managers and gender diversity. However, their dataset is dated and no longer reflective of Japan's current gender diversity landscape. Another investigation by Tanaka (2019) suggests that outside female directors enhance firm performance, yet this study focuses primarily on the factors leading to female directorship rather than their impact. Additionally, Tanaka's research, covering the period from 2006 to 2015, does not represent more recent trends. Our study, examining Japanese firms in the recent timeframe of 2006–2023, presents contrasting findings to the two studies above by demonstrating a negative effect of board gender diversity on corporate performance in Japan.

5. Research Design

5.1. Data Sample

The board composition and financial metrics of Japanese publicly traded firms were extracted from Bloomberg Terminals. Table 1 summarizes the definitions of these variables. The dataset obtained from Bloomberg includes ROA, ROE, market capitalization, total assets, total debts, fixed assets, the total number of directors, the number of female directors, the number of independent directors, the director age, the dual role of the CEO as board chairman, the firm's explicit commitment to non-discrimination practices, the cash holding, the institutional ownership, R&D, and ESG scores. The final sample includes 25,363 firm-year observations, spanning 2006 to 2023, representing 1990 Japanese entities listed on the Tokyo Stock Exchange.

Table 1. Variable definitions.

Variable	Definition
ROA	The net income divided by the total assets.
ROE	The net income divided by the shareholder's equity.
MktCapChg	The annual percentage change in the market capitalization.
FemaleFrac	The number of female directors divided by the total number of directors
FemaleDum	The dummy variable equals one in the presence of at least one female director and zero in its absence.
FirmSize	The natural logarithm of the total assets.
FirmLev	The total debts divided by the total assets.
Tangibility	The fixed assets divided by the total assets.
BoardSize	The total number of directors.
BoardInd	The number of independent directors divided by the total number of directors.
DirAge	The average director's age.
Duality	The dummy variable is set to one if the company's CEO also serves as the board chair; alternatively, it takes a value of zero.
EqOpp	The dummy variable is assigned a value of one if the firm explicitly commits to non-discrimination against any group of people; in other cases, it is set to zero.
CashHold	The cash and cash equivalents divided by the total assets.
InstiOwn	Institutional ownership measures the percentage of a company's outstanding shares that institutional investors hold.
RD	The research and development expenditure divided by the net sales.
ESG	A metric that evaluates a company's performance in three key areas: environmental, social, and governance.

The table summarizes the definitions of the variables, where the variable names are italicized.

5.2. Fixed-Effects Model

In our analysis, we employed the fixed-effects model, Chow's (1960) test, and the 2SLS model to examine the effect of board gender diversity on corporate performance. Each firm possesses distinct attributes, such as management style, corporate culture, or brand reputation, which may not be directly quantifiable or observable. As shown below, the firm fixed-effects model accommodates these unseen characteristics, presuming their constancy over time.

$$Perf_{i,t} = \beta_0 + \beta_1 Female_{i,t} + \beta_2 FirmSize_{i,t} + \beta_3 FirmLev_{i,t} + \beta_4 Tangibility_{i,t} + \beta_5 BoardSize_{i,t} + \beta_6 BoardInd_{i,t} + \beta_7 DirAge_{i,t} + \beta_8 Duality_{i,t} + FirmFE + \varepsilon_{i,t} \quad (1)$$

where the subscript i represents firm i, and the subscript t represents year t. *Perf* denotes firm performance proxied by ROA or ROE. *Female* denotes the board gender diversity, proxied by *FemaleFrac* or *FemaleDum*. *FirmFE* denotes the firm-fixed-effects. The definitions for all other control variables in Equation (1) are provided in Table 1.

5.2.1. Dependent Variable

Per empirical research, ROA is widely utilized as a metric for corporate performance (Adams and Ferreira 2009; Sanan 2016; Terjesen et al. 2016; Brahma et al. 2021; Sarkar and Selarka 2021). Aligning with these studies, ROA is employed in our analysis to gauge firm performance. As an accounting-based metric, ROA represents a company's net income proportion to its total assets. Barber and Lyon (1996) highlighted ROA's merits in evaluating corporate performance. They reveal that ROA facilitates comparative analysis of one company's performance against others. Furthermore, García-Meca et al. (2015) contended that the application of ROA enables the examination of potential market irregularities that might impede the complete, accurate reflection of information in stock prices.

Additionally, we utilize ROE for robustness assessments in measuring corporate performance. ROE, another accounting-based metric, is the ratio of net income to shareholder's equity. This application of ROE aligns with preceding studies on firm performance (Low et al. 2015; Sabatier 2015; Garanina and Muravyev 2021).

5.2.2. Explanatory Variables

Board gender diversity is measured via two approaches: (1) the proportion of female directors on the board, calculated by dividing the number of female directors by the total number of directors, and (2) the dummy variable, set to one in the presence of at least one female director, and zero in its absence.

5.2.3. Control Variables

In our analysis, control variables are bifurcated into two classifications: firm characteristics and board characteristics. The control variables about firm characteristics encompass firm size, financial leverage, and asset tangibility. Those relating to board characteristics include board size, board independence, average director age, and the dual role of the CEO as board chairman.

The initial category of control variables pertains to firm characteristics. This research quantifies firm size using the natural logarithm of total assets. Doğan (2013) demonstrated a positive correlation between firm size and performance. Financial leverage, the debt ratio, is calculated as total debts over total assets. Das et al. (2022) identified a negative influence of firm leverage on performance. Asset tangibility is derived by dividing fixed assets by total assets. Lee (2010) presented findings indicating a negative effect of fixed asset capital intensity on firm performance.

The second set of control variables relates to board characteristics. Existing empirical research demonstrates that board size adversely affects corporate performance. Conyon and Peck (1998) showed that the correlation between board size and company performance is typically negative. Guest (2009) similarly reported a significant negative effect of board size on firm performance. The influence of independent directors on company performance has been thoroughly investigated in corporate governance literature, yielding mixed outcomes (Aluchna et al. 2020; Reguera-Alvarado and Bravo 2017; Zeng 2018).

5.3. Chow's Test

Chow's (1960) test is a statistical test used to determine whether there are significant differences in the intercepts and slopes of two linear regressions across different subgroups. For example, in contrasting regression coefficients between small and large firm subgroups, we designate the *FSD* as one for firms surpassing the median size in a given year and zero for those below. Subsequently, we undertake the prescribed Chow's test by integrating a sequence of interactions with *FSD*.

$$\begin{aligned} Perf_{i,t} = {} & \beta_0 + \beta_1 Female_{i,t} + \beta_2 FirmSize_{i,t} + \beta_3 FirmLev_{i,t} + \beta_4 Tangibility_{i,t} \\ & + \beta_5 BoardSize_{i,t} + \beta_6 BoardInd_{i,t} + \beta_7 DirAge_{i,t} + \beta_8 Duality_{i,t} \\ & + \theta_0 FSD_{i,t} + \theta_1 (FSD_{i,t} \times Female_{i,t}) + \theta_2 (FSD_{i,t} \times FirmSize_{i,t}) + \theta_3 (FSD_{i,t} \times FirmLev_{i,t}) \\ & + \theta_4 (FSD_{i,t} \times Tangibility_{i,t}) + \theta_5 (FSD_{i,t} \times BoardSize_{i,t}) + \theta_6 (FSD_{i,t} \times BoardInd_{i,t}) \\ & + \theta_7 (FSD_{i,t} \times DirAge_{i,t}) + \theta_8 (FSD_{i,t} \times Duality_{i,t}) + FirmFE + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Rather than evaluating the joint hypothesis that all θ values are null, we focus on discerning the differential influence of gender diversity. Hence, we examine the null hypothesis asserting θ_1 equals zero and subsequently disclose corresponding *F*-values and *p*-values. A comparable methodology is employed for other subgroup comparisons.

5.4. Instrumental Variables and 2SLS Model

An endogeneity issue may exist between board gender diversity and corporate performance, suggesting a bidirectional causality: board gender diversity might influence corporate performance, and conversely, corporate performance could impact board gender diversity (Hermalin and Weisbach 2003; Adams and Ferreira 2009). In line with Carter et al. (2003), we employed a 2SLS regression to tackle this endogeneity concern. The regression equations are delineated as follows:

$$\begin{aligned} Female_{i,t} = {} & \beta_0 + \beta_1 EqOpp_{i,t} + \beta_2 FirmSize_{i,t} + \beta_3 FirmLev_{i,t} + \beta_4 Tangibility_{i,t} \\ & + \beta_5 BoardSize_{i,t} + \beta_6 BoardInd_{i,t} + \beta_7 DirAge_{i,t} + \beta_8 Duality_{i,t} + FirmFE + \varepsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned} Perf_{i,t} = {} & \beta_0 + \beta_1 \hat{Female}_{i,t} + \beta_2 FirmSize_{i,t} + \beta_3 FirmLev_{i,t} + \beta_4 Tangibility_{i,t} \\ & + \beta_5 BoardSize_{i,t} + \beta_6 BoardInd_{i,t} + \beta_7 DirAge_{i,t} + \beta_8 Duality_{i,t} + FirmFE + \varepsilon_{i,t} \end{aligned} \quad (4)$$

where all variables remain identical to those in Equation (1), except *EqOpp* represents a dummy variable assigned one if the firm explicitly pledges non-discrimination toward any group and zero otherwise. In the first stage, Equation (3) employs regression to estimate board gender diversity, utilizing the equal opportunity policy as the instrumental variable. The second stage employs the predicted gender diversity from the first stage, $\hat{Female}$, to forecast firm performance in Equation (4). As Adams and Ferreira (2009) noted, identifying an instrumental variable is challenging, given that other governance features pertinent to endogenous issues are already incorporated in the performance regression. Our research selects the equal opportunity policy as an instrumental variable. We posit that firms actively pursuing non-discrimination policies are more inclined to appoint female directors, reflecting a corporate culture less prone to gender bias and discrimination. Additionally, the equal opportunity policy does not directly influence corporate performance.

5.5. Nonlinear Quadratic Model

Joecks et al.'s (2013) empirical investigation into the critical mass theory posited that the link between board gender diversity and corporate performance is not linear, potentially following a U-shaped pattern. This theory contends that the unique abilities and skills women contribute to a group become significantly impactful only once their representation reaches a certain critical threshold. Consequently, we explore the potential for a U-shaped correlation between board gender diversity and corporate performance, as delineated below.

$$Perf_{i,t} = \beta_0 + \beta_1 FemaleFrac_{i,t} + \beta_2 FemaleFrac^2_{i,t} + \beta_3 FirmSize_{i,t} + \beta_4 FirmLev_{i,t} + \beta_5 Tangibility_{i,t} + \beta_6 BoardSize_{i,t} + \beta_7 BoardInd_{i,t} + \beta_8 DirAge_{i,t} + \beta_9 Duality_{i,t} + FirmFE + \varepsilon_{i,t} \quad (5)$$

where all variables remain identical to those in Equation (1), except $FemaleFrac^2$ denotes the squared term of *FemaleFrac*.

6. Empirical Results and Discussion

6.1. Descriptive Statistics

Table 2 presents the descriptive statistics for the variables under study. The mean ROA is recorded at 3.81%, lower than its standard deviation of 4.69%. A meager 5.00% of board directors are female, yet 35.0% of firms have at least one woman on their board. The average financial leverage ratio is calculated to be 18.44%. Asset tangibility is noted at 25.86%. Boards typically comprise about nine directors, with 23.12% classified as independent. The average age of directors is approximately 59.57 years. About 52% of corporations have adopted an equal opportunity policy. Lastly, the variance inflation factor test confirms no multicollinearity concerns in this research, as indicated by all variance inflation factors remaining under five.

Table 2. Descriptive statistics of variables.

Variable	Obs.	Mean	Std. Dev.	Min	P25	Median	P75	Max
ROA	25,363	3.813	4.693	−12.572	1.379	3.324	5.820	20.213
ROE	25,363	7.446	9.822	−37.329	3.659	7.114	11.439	37.418
MktCapChg	21,901	0.112	0.391	−0.548	−0.123	0.038	0.252	1.793
FemaleFrac	25,363	5.002	7.832	0.000	0.000	0.000	10.000	96.000
FemaleDum	25,363	0.350	0.477	0.000	0.000	0.000	1.000	1.000
FirmSize	25,363	11.588	1.832	7.925	10.346	11.346	12.615	16.635
FirmLev	25,363	18.443	17.044	0.000	3.615	14.309	28.722	68.934
Tangibility	25,363	25.859	18.254	0.324	11.463	24.256	37.059	76.667
BoardSize	25,363	8.972	2.879	4.000	7.000	9.000	11.000	18.000
BoardInd	25,363	23.122	16.838	0.000	10.000	22.222	33.333	66.667
DirAge	25,363	59.574	4.716	43.690	57.380	60.333	62.667	69.000
Duality	25,363	0.779	0.415	0.000	1.000	1.000	1.000	1.000
EqOpp	22,274	0.517	0.500	0.000	0.000	1.000	1.000	1.000
CashHold	25,363	18.706	14.211	1.402	8.423	14.919	24.751	70.160
InstiOwn	22,263	35.797	18.661	2.341	21.491	33.938	48.938	83.894
RD	23,450	1.707	2.749	0.000	0.000	0.509	2.391	15.640
ESG	5696	2.237	1.044	0.750	1.365	1.995	2.910	5.150

The table reports descriptive statistics of the variables, where the variable names are italicized.

Figure 1 illustrates the temporal progression of *FemaleFrac* from 2006 to 2023 among Tokyo Exchange-listed firms. *FemaleFrac* is the ratio of female directors to the overall director count. Accompanying standard error bars are also depicted. *FemaleFrac* remained subdued until 2012 and escalated exponentially in the recent decade. Despite this rapid growth, the overall level remains below 14% by 2023.

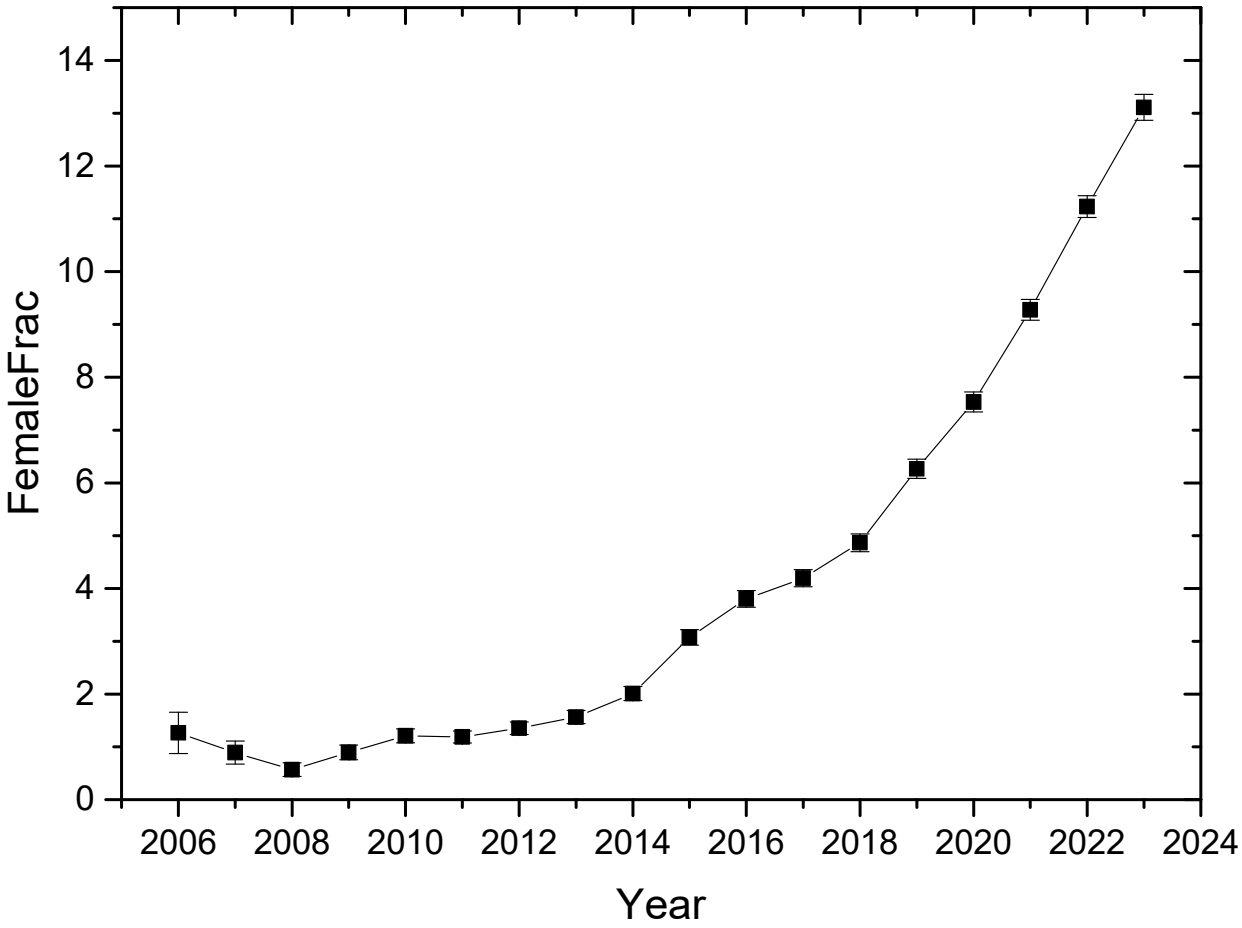

Figure 1. Time evolution of the fraction of female board directors in Japan.

6.2. Fixed-Effects Regressions

Table 3 presents the regression outcomes from the firm fixed-effects model, following Equation (1). Irrespective of being quantified by the proportion of female directors or via a dummy variable, the findings indicate a negative association between board gender diversity and corporate performance, with the gender diversity coefficient being statistically significant at the 1% or 5% level. In terms of economic importance, a one standard deviation shift in *FemaleFrac*, amounting to 7.832%, correlates with a 0.10% decrease (=7.832% $\times$ 0.013) in ROA, representing approximately 2.7% of the average ROA (3.813%). Similarly, a transition of *FemaleDum* from zero to one corresponds to a 0.156% reduction in ROA, equating to roughly 4.1% of the mean ROA. In summary, the negative impact of board gender diversity on corporate performance is statistically substantial and bears mediocre economic implications.

The reasons for the negative relationship between board gender diversity and firm performance are manifold. Firstly, the presence of female directors may introduce enhanced supervision and excessive oversight, potentially undermining organizational efficacy. Adams and Ferreira (2007) posited that increased oversight could disrupt the flow of communication between directors and management during decision-making processes, adversely impacting firm performance. Moreover, over-monitoring could erode shareholder value (Almazan and Suarez 2003). Secondly, the social identity theory elucidates the dynamics and implications of social identity, including categorizing personal and others' characteristics, such as gender, skin tone, or ethnicity (Abrams and Hogg 2010). Within the context of Japanese culture, women typically occupy comparatively lower status tiers than men, potentially complicating communication and management of this demographic. Female professionals often confront entrenched stereotypes and biases, prompting public

skepticism regarding their leadership capabilities (Thomas 2018). Thirdly, Smith et al. (2006) contended that a gender-diverse board is prone to conflicts, resulting in delayed decision-making processes, whereas the market necessitates prompt reactions. Similarly, Williams Phillips and O'Reilly (1998) argued that gender-diverse groups are more likely to encounter affective conflicts, yielding detrimental effects on team dynamics.

Table 3. Fixed-effects regression results.

	(1) *ROA*	(2) *ROA*
FemaleFrac	−0.013 ***	
	(0.004)	
FemaleDum		−0.156 **
		(0.065)
FirmSize	1.494 ***	1.478 ***
	(0.088)	(0.088)
FirmLev	−0.181 ***	−0.181 ***
	(0.003)	(0.003)
Tangibility	−0.063 ***	−0.063 ***
	(0.005)	(0.005)
BoardSize	0.034 ***	0.037 ***
	(0.012)	(0.012)
BoardInd	0.003	0.002
	(0.002)	(0.002)
DirAge	−0.078 ***	−0.076 ***
	(0.010)	(0.010)
Duality	0.018	0.022
	(0.075)	(0.075)
Constant	−4.191 ***	−4.141 ***
	(1.044)	(1.045)
Firm FE	Yes	Yes
Observations	25,363	25,363
R-squared	0.146	0.145

The table shows the fixed-effects regression results. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.3. Small vs. Large Firms

Table 4 bifurcates our dataset into two subsets based on firm sizes. The smaller firm subsample includes companies whose size falls below the yearly median, while the larger firm subsample comprises those exceeding the median. Subsequently, we apply the fixed-effects regression in line with Equation (1) to these subsamples. The findings indicate that board gender diversity, quantified by the fraction of female directors or as a dummy variable, negatively influences corporate performance, but this effect is predominantly observed in smaller firms. Within this context, the gender diversity coefficient is statistically significant at 1%. Economically, a one standard deviation shift in *FemaleFrac* for smaller firms correlates with a 0.22% reduction in ROA, which is 5.8% of the mean ROA. Altering *FemaleDum* from zero to one in these firms associates with a 0.38% decrease in ROA, amounting to 10.0% of the mean ROA. Chow's test for the divergence between these two coefficients is also significant at the 1% and 10% thresholds. Collectively, the results in Table 4 suggest that the negative relationship between board gender diversity and corporate performance is more pronounced in smaller-sized firms.

Table 4. Small vs. large firms.

	(1) Small Firms *ROA*	(2) Large Firms *ROA*	(3) Small Firms *ROA*	(4) Large Firms *ROA*
FemaleFrac	−0.028 ***	0.000		
	(0.006)	(0.005)		
FemaleDum			−0.383 ***	−0.103
			(0.111)	(0.075)
FirmSize	1.815 ***	1.405 ***	1.791 ***	1.438 ***
	(0.141)	(0.125)	(0.141)	(0.124)
FirmLev	−0.203 ***	−0.163 ***	−0.204 ***	−0.163 ***
	(0.005)	(0.004)	(0.005)	(0.004)
Tangibility	−0.058 ***	−0.067 ***	−0.058 ***	−0.067 ***
	(0.007)	(0.006)	(0.007)	(0.006)
BoardSize	0.087 ***	0.022 *	0.098 ***	0.023 *
	(0.023)	(0.013)	(0.024)	(0.013)
BoardInd	−0.003	0.001	−0.004	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
DirAge	−0.114 ***	−0.022 *	−0.112 ***	−0.024 *
	(0.015)	(0.013)	(0.015)	(0.013)
Duality	0.109	0.055	0.118	0.051
	(0.151)	(0.077)	(0.151)	(0.077)
Constant	−3.381 **	−8.724 ***	−3.345 **	−9.012 ***
	(1.493)	(1.643)	(1.495)	(1.645)
Firm FE	Yes	Yes	Yes	Yes
Observations	12,676	12,687	12,676	12,687
R-squared	0.149	0.158	0.148	0.158
Chow F-value	10.835 ***		3.739 *	

The table shows the fixed-effects regression results for two subsamples based on the median firm size. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. *Chow F-value*, extracted from Chow's test, assesses the null hypothesis of equal regression coefficients for the key explanatory variable across two subgroups. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.4. Low vs. High Leverages

Table 5 divides our sample into two groups based on firm leverage, with firms annually categorized by leverage levels. The lower leverage subset includes companies with leverage below the median, and the higher leverage subset comprises those above the median. We conducted the fixed-effects regression following Equation (1) for both subsets. The coefficient for *FemaleDum* is insignificant for low-leverage firms but markedly negative at the 1% threshold for high-leverage firms. Correspondingly, the coefficient for *FemaleFrac* is more significant and more prominent in magnitude for high-leverage firms than those with lower leverage. Chow's test for the disparity between these two coefficients is significant at 1%. Overall, the findings in Table 5 indicate that the negative impact of board gender diversity on corporate performance is more pronounced in high-leverage firms.

Table 5. Low- vs. high-leverage firms.

	(1) Low Leverage *ROA*	(2) High Leverage *ROA*	(3) Low Leverage *ROA*	(4) High Leverage *ROA*
FemaleFrac	−0.012 **	−0.021 ***		
	(0.006)	(0.006)		
FemaleDum			−0.091	−0.315 ***
			(0.093)	(0.092)
FirmSize	2.050 ***	1.304 ***	2.020 ***	1.300 ***
	(0.135)	(0.126)	(0.134)	(0.126)
FirmLev	−0.156 ***	−0.198 ***	−0.156 ***	−0.199 ***
	(0.011)	(0.005)	(0.011)	(0.005)
Tangibility	−0.087 ***	−0.063 ***	−0.087 ***	−0.063 ***
	(0.008)	(0.006)	(0.008)	(0.006)
BoardSize	0.030	0.021	0.033 *	0.027
	(0.018)	(0.017)	(0.018)	(0.017)

Table 5. *Cont.*

	(1) Low Leverage *ROA*	(2) High Leverage *ROA*	(3) Low Leverage *ROA*	(4) High Leverage *ROA*
BoardInd	0.007 **	−0.006 **	0.005 *	−0.007 **
	(0.003)	(0.003)	(0.003)	(0.003)
DirAge	−0.140 ***	−0.036 **	−0.137 ***	−0.034 **
	(0.014)	(0.014)	(0.014)	(0.014)
Duality	0.043	0.052	0.051	0.052
	(0.108)	(0.106)	(0.108)	(0.106)
Constant	−7.843 ***	−2.282	−7.677 ***	−2.366
	(1.581)	(1.511)	(1.579)	(1.514)
Firm FE	Yes	Yes	Yes	Yes
Observations	12,676	12,687	12,676	12,687
R-squared	0.067	0.168	0.067	0.168
Chow F-value	6.790 ***		7.416 ***	

The table shows the fixed-effects regression results for two subsamples based on the median firm leverage. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. *Chow F-value*, extracted from Chow's test, assesses the null hypothesis of equal regression coefficients for the key explanatory variable across two subgroups. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.5. Low vs. High Cash Holding

Table 6 divides our sample into two groups based on the median cash holding in a given year. We executed the fixed-effects regression per Equation (1) for each subgroup. The results disclose a consistently negative coefficient for *FemaleFrac*, significant at the 1% level for both low and high cash holdings. Nevertheless, Chow's test for the disparity between the two coefficients is insignificant. In contrast, the coefficient for *FemaleDum* is significantly negative at the 1% level for low cash holding but proves insignificant for high cash holding. Nevertheless, Chow's test fails to exhibit a substantial divergence between the two coefficients. Overall, cash holding does not appear to influence the negative effect of gender diversity on corporate performance.

Table 6. Low vs. high cash holding.

	(1) Low *CashHold* *ROA*	(2) High *CashHold* *ROA*	(3) Low *CashHold* *ROA*	(4) High *CashHold* *ROA*
FemaleFrac	−0.019 ***	−0.018 ***		
	(0.005)	(0.007)		
FemaleDum			−0.312 ***	−0.144
			(0.073)	(0.112)
FirmSize	1.449 ***	1.682 ***	1.455 ***	1.644 ***
	(0.120)	(0.135)	(0.120)	(0.135)
FirmLev	−0.155 ***	−0.208 ***	−0.155 ***	−0.208 ***
	(0.004)	(0.006)	(0.004)	(0.006)
Tangibility	−0.057 ***	−0.067 ***	−0.057 ***	−0.067 ***
	(0.006)	(0.008)	(0.006)	(0.008)
BoardSize	0.042 ***	0.051 **	0.047 ***	0.054 **
	(0.013)	(0.023)	(0.013)	(0.023)
BoardInd	0.003	0.002	0.004	0.000
	(0.003)	(0.003)	(0.003)	(0.003)
DirAge	−0.009	−0.137 ***	−0.008	−0.133 ***
	(0.012)	(0.015)	(0.012)	(0.015)
Duality	−0.023	0.116	−0.027	0.128
	(0.079)	(0.141)	(0.079)	(0.141)
Constant	−9.494 ***	−1.745	−9.644 ***	−1.602
	(1.523)	(1.511)	(1.525)	(1.512)
Firm FE	Yes	Yes	Yes	Yes
Observations	12676	12687	12676	12687
R-squared	0.165	0.138	0.165	0.138
Chow F-value	0.493		1.467	

The table shows the fixed-effects regression results for two subsamples based on the median cash holding. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. *Chow F-value*, extracted from Chow's test, assesses the null hypothesis of equal regression coefficients for the key explanatory variable across two subgroups. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.6. Low vs. High Institutional Ownership

Table 7 bifurcates our dataset into two cohorts based on the median institutional ownership in a specific year. We conducted a fixed-effects regression analysis in alignment with Equation (1) for each subgroup. The findings indicate that the coefficients of *FemaleFrac* and *FemaleDum* are markedly negative at the 1% significance level within the low institutional ownership subset, yet they are not statistically significant for the high institutional ownership group. Chow's test for the divergence between these two coefficients is also significant at the 1% threshold. It suggests that elevated institutional ownership might engender intensified scrutiny by institutions, thereby eclipsing the governance impact attributable to female directors.

Table 7. Low vs. high institutional ownership.

	(1) **Low *InstiOwn*** ***ROA***	**(2)** **High *InstiOwn*** ***ROA***	**(3)** **Low *InstiOwn*** ***ROA***	**(4)** **High *InstiOwn*** ***ROA***
FemaleFrac	−0.035 ***	−0.000		
	(0.007)	(0.006)		
FemaleDum			−0.347 ***	0.011
			(0.113)	(0.086)
FirmSize	1.820 ***	1.586 ***	1.782 ***	1.583 ***
	(0.154)	(0.133)	(0.154)	(0.132)
FirmLev	−0.188 ***	−0.170 ***	−0.189 ***	−0.170 ***
	(0.005)	(0.005)	(0.005)	(0.005)
Tangibility	−0.045 ***	−0.081 ***	−0.045 ***	−0.081 ***
	(0.008)	(0.007)	(0.008)	(0.007)
BoardSize	0.054 **	−0.011	0.064 ***	−0.011
	(0.022)	(0.017)	(0.022)	(0.017)
BoardInd	0.002	−0.008 ***	−0.001	−0.008 ***
	(0.003)	(0.003)	(0.003)	(0.003)
DirAge	−0.107 ***	−0.060 ***	−0.102 ***	−0.060 ***
	(0.016)	(0.015)	(0.016)	(0.015)
Duality	0.048	0.162 *	0.057	0.162 *
	(0.144)	(0.095)	(0.144)	(0.095)
Constant	−5.522 ***	−6.383 ***	−5.522 ***	−6.355 ***
	(1.701)	(1.648)	(1.704)	(1.647)
Firm FE	Yes	Yes	Yes	Yes
Observations	11,129	11,134	11,129	11,134
R-squared	0.132	0.138	0.131	0.138
Chow F-value	14.007 ***		7.879 ***	

The table shows the fixed-effects regression results for two subsamples based on the median institutional ownership. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. *Chow F-value*, extracted from Chow's test, assesses the null hypothesis of equal regression coefficients for the key explanatory variable across two subgroups. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.7. The Impact of COVID-19

Table 8 delineates the influence of the COVID-19 pandemic by dividing the sample into pre-COVID-19 (2006–2019) and during-COVID-19 (2020–2023) subsets. We executed the fixed-effects regression for both subsets according to Equation (1). The findings reveal that before COVID-19, *FemaleFrac* had a significantly negative effect on firm performance at the 1% level. During COVID-19, this negative relationship lost its significance. Chow's test for the divergence between these two coefficients is also significant at the 5% threshold. *FemaleDum* is negatively significant at the 10% level pre-COVID-19 and becomes insignificant during the COVID-19 period. This modest difference is further evidenced by the insignificant outcome in Chow's test. In summary, the detrimental impact of board gender diversity on corporate performance was weakly more pronounced pre-COVID-19 than during the pandemic.

Table 8. Before vs. during COVID-19.

	(1) Before COVID-19 *ROA*	(2) During COVID-19 *ROA*	(3) Before COVID-19 *ROA*	(4) During COVID-19 *ROA*
FemaleFrac	−0.023 ***	−0.005		
	(0.006)	(0.008)		
FemaleDum			−0.157 *	−0.152
			(0.083)	(0.147)
FirmSize	1.580 ***	5.511 ***	1.555 ***	5.531 ***
	(0.109)	(0.334)	(0.109)	(0.333)
FirmLev	−0.175 ***	−0.270 ***	−0.175 ***	−0.271 ***
	(0.004)	(0.010)	(0.004)	(0.010)
Tangibility	−0.079 ***	−0.156 ***	−0.079 ***	−0.156 ***
	(0.006)	(0.016)	(0.006)	(0.015)
BoardSize	0.047 ***	0.103 ***	0.050 ***	0.108 ***
	(0.015)	(0.036)	(0.015)	(0.036)
BoardInd	0.010 ***	−0.007	0.009 ***	−0.006
	(0.003)	(0.007)	(0.003)	(0.007)
DirAge	−0.060 ***	−0.046 *	−0.056 ***	−0.048 *
	(0.012)	(0.025)	(0.012)	(0.025)
Duality	0.063	−0.117	0.066	−0.117
	(0.089)	(0.185)	(0.089)	(0.185)
Constant	−6.233 ***	−49.453 ***	−6.168 ***	−49.624 ***
	(1.315)	(4.047)	(1.316)	(4.043)
Firm FE	Yes	Yes	Yes	Yes
Observations	18,153	7210	18,153	7210
R-squared	0.153	0.205	0.152	0.205
Chow F-value	3.879 **		1.993	

The table shows the fixed-effects regression results before and during the COVID-19 pandemic: 2006–2019 and 2020–2023. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. *Chow F-value*, extracted from Chow's test, assesses the null hypothesis of equal regression coefficients for the key explanatory variable across two subgroups. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.8. Different Industries

Table 9 exhibits the fixed-effects regression outcomes according to Equation (1) across eleven disparate industries. The analysis reveals a substantial adverse effect of board gender diversity on firm performance in the energy, materials, consumer discretionary, consumer staples, and utilities sectors. Conversely, this impact is insignificant in the industrials, health care, financials, information technology, communication services, and real estate sectors. The former cluster of industries constitutes regulated and consumer-centric sectors. These fields operate in regulated environments and are closely tied to consumer behaviors and preferences. Diverse perspectives and governance practices can significantly influence their performance, making them sensitive to board composition. In contrast, the latter group of industries is characterized by their innovation-driven nature. Their performance might be more influenced by technological innovation, market adaptability, and industry-specific challenges rather than solely by board composition.

Table 9. Different industries.

	(1) Energy	(2) Materials	(3) Industrials	(4) Consumer Discretionary	(5) Consumer Staples	(6) Health Care	(7) Financials	(8) Information Technology	(9) Communication Services	(10) Utilities	(11) Real Estate
	ROA	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*
FemaleFrac	−0.075 *	−0.032 ***	−0.006	−0.020 **	−0.022 **	−0.019	−0.006	−0.015	0.041	−0.064 **	−0.020
	(0.042)	(0.012)	(0.008)	(0.009)	(0.009)	(0.020)	(0.009)	(0.012)	(0.031)	(0.026)	(0.031)
FirmSize	3.721 ***	2.421 ***	1.545 ***	1.606 ***	0.802 ***	2.562 ***	−0.149	2.497 ***	1.004 *	−0.301	0.457
	(1.240)	(0.295)	(0.171)	(0.218)	(0.230)	(0.404)	(0.170)	(0.260)	(0.523)	(0.657)	(0.468)
FirmLev	−0.096 ***	−0.180 ***	−0.161 ***	−0.217 ***	−0.162 ***	−0.168 ***	−0.080 ***	−0.190 ***	−0.256 ***	−0.106 ***	−0.107 ***
	(0.036)	(0.009)	(0.006)	(0.007)	(0.009)	(0.014)	(0.009)	(0.010)	(0.024)	(0.021)	(0.021)
Tangibility	−0.064 *	−0.118 ***	−0.084 ***	−0.025 **	−0.056 ***	0.012	−0.030 **	−0.132 ***	0.052	0.002	−0.083 ***
	(0.034)	(0.013)	(0.008)	(0.011)	(0.011)	(0.026)	(0.015)	(0.015)	(0.045)	(0.016)	(0.022)
BoardSize	−0.147	0.021	0.048 **	−0.058 **	0.027	−0.027	0.011	0.123 ***	0.426 ***	0.016	0.200 **
	(0.109)	(0.031)	(0.020)	(0.029)	(0.032)	(0.061)	(0.029)	(0.038)	(0.126)	(0.073)	(0.098)
BoardInd	0.041 **	−0.005	0.006 *	−0.024 ***	0.004	−0.010	0.028 ***	0.029 ***	−0.054 ***	0.030 **	0.004
	(0.019)	(0.006)	(0.004)	(0.005)	(0.005)	(0.010)	(0.005)	(0.006)	(0.018)	(0.015)	(0.017)
DirAge	−0.165	−0.019	−0.035 **	−0.107 ***	−0.013	−0.157 ***	−0.079 ***	−0.052 *	−0.306 ***	0.013	−0.067
	(0.107)	(0.028)	(0.017)	(0.023)	(0.023)	(0.051)	(0.028)	(0.028)	(0.071)	(0.062)	(0.073)
Duality	−0.250	−0.006	−0.044	−0.295	0.269	−0.082	−0.473 ***	0.227	2.142 **	0.401	0.989
	(0.646)	(0.173)	(0.121)	(0.192)	(0.190)	(0.386)	(0.165)	(0.230)	(0.888)	(0.575)	(0.621)
Constant	−28.022 *	−16.348 ***	−7.173 ***	−1.696	−0.125	−11.606 ***	9.011 ***	−16.421 ***	10.241 *	9.267	7.055
	(16.100)	(3.579)	(1.941)	(2.491)	(2.797)	(4.458)	(2.493)	(2.984)	(6.132)	(10.274)	(5.416)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	239	2586	7175	4734	2287	1181	1686	3444	1157	323	551
R-squared	0.150	0.244	0.164	0.186	0.175	0.134	0.070	0.211	0.161	0.134	0.119

The table shows the fixed-effects regression results for different industries. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.9. Mediating Effects

Table 10 investigates the mediating effects employing a two-step regression methodology. Concerning *BoardInd* in Columns 1 and 2, the manifested indirect effect stands at 0.004 (=1.268 × 0.003), juxtaposed with a direct effect of −0.013. The absence of a mediating effect by board independence is inferred from their contrasting signs. Regarding CEO duality in Columns 3 and 4, the indirect effect registers at −0.000054 (=−0.003 × 0.018), while the direct effect maintains at −0.013. It suggests a negligible mediating impact of CEO duality. Columns 5 and 7 indicate that board gender diversity exerts a notably positive influence on firm innovation (*RD*) and corporate social responsibility (*ESG*). About *RD* in Columns 5 and 6, the indirect effect is −0.0022 (=0.003 × −0.742), against a direct effect of −0.012, implying a mediating effect of *RD* at 15% (=0.0022/(0.0022 + 0.012)). For *ESG* in Columns 7 and 8, the indirect effect is calculated at −0.011 (=0.051 × −0.215), while the direct effect is −0.005, indicating a mediating effect of ESG at 69% (=0.011/(0.011 + 0.005)). The findings indicate a modest mediating role via *RD* and a more pronounced one through *ESG*, yet no significant mediation is observed for *BoardInd* and *Duality*.

Table 10. Mediating effects.

	(1) *BoardInd*	(2) *ROA*	(3) *Duality*	(4) *ROA*	(5) *RD*	(6) *ROA*	(7) *ESG*	(8) *ROA*
FemaleFrac	1.268 ***	−0.013 ***	−0.003 ***	−0.013 ***	0.003 ***	−0.012 ***	0.051 ***	−0.005
	(0.013)	(0.004)	(0.000)	(0.004)	(0.001)	(0.004)	(0.001)	(0.010)
BoardInd		0.003		0.003		0.002		−0.010
		(0.002)		(0.002)		(0.002)		(0.007)
Duality		0.018		0.018		0.031		−0.017
		(0.075)		(0.075)		(0.080)		(0.173)
RD						−0.742 ***		
						(0.033)		
ESG								−0.215 **
								(0.105)
FirmSize		1.494 ***		1.494 ***		1.486 ***		2.822 ***
		(0.088)		(0.088)		(0.092)		(0.312)
FirmLev		−0.181 ***		−0.181 ***		−0.184 ***		−0.236 ***
		(0.003)		(0.003)		(0.003)		(0.010)
Tangibility		−0.063 ***		−0.063 ***		−0.061 ***		−0.120 ***
		(0.005)		(0.005)		(0.005)		(0.016)
BoardSize		0.034 ***		0.034 ***		0.033 ***		−0.040
		(0.012)		(0.012)		(0.013)		(0.033)
DirAge		−0.078 ***		−0.078 ***		−0.078 ***		−0.024
		(0.010)		(0.010)		(0.010)		(0.027)
Constant	16.780 ***	−4.191 ***	0.794 ***	−4.191 ***	1.694 ***	−2.304 **	1.800 ***	−20.635 ***
	(0.098)	(1.044)	(0.002)	(1.044)	(0.006)	(1.082)	(0.013)	(3.980)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,363	25,363	25,363	25,363	23,450	23,450	5696	5696
R-squared	0.300	0.146	0.004	0.146	0.001	0.170	0.261	0.159

The table shows the fixed-effects regression results for the mediating effects of *BoardInd*, *Duality*, *RD*, and *ESG*. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

6.10. 2SLS Regressions

Table 11 explores the endogeneity issue concerning board gender diversity within the fixed-effects regression framework. There exists the potential for higher firm performance to affect board gender diversity inversely. Conversely, a third variable might simultaneously elevate board gender diversity and diminish firm performance, creating a perceived negative correlation where none inherently exists. To reassess this dynamic, we introduce an instrumental variable. Initially, we conducted a test for the endogeneity of regression variables. The Hausman *F* test refutes the hypothesis of exogeneity at the 10% level, underscoring the need to address endogeneity and suggesting the 2SLS model's superiority over

ordinary least squares regression. Subsequently, we assess the strength of the instrumental variable, the equal opportunity policy. According to Equation (3), Columns 1 and 3 of Table 11 exhibit the instrumental variable's significant effect on *FemaleFrac* and *FemaleDum*, achieving statistical significance at the 1% level. The second-stage results, following Equation (4) and displayed in Columns 2 and 4 of Table 11, indicate that predicted board gender diversity adversely affects corporate performance, reaching a 1% level of statistical significance, irrespective of whether it is measured by the percentage of female directors or as a dummy variable.

Table 11. Two-stage least squares (2SLS) regression results.

	(1) 1st Stage *FemaleFrac*	(2) 2nd Stage *ROA*	(3) 1st Stage *FemaleDum*	(4) 2nd Stage *ROA*
EqOpp	1.427 ***		0.100 ***	
	(0.110)		(0.006)	
Predicted FemaleFrac		−0.246 ***		
		(0.051)		
Predicted FemaleDum				−3.187 ***
				(0.649)
FirmSize	4.129 ***	2.718 ***	0.024 ***	2.458 ***
	(0.163)	(0.255)	(0.002)	(0.203)
FirmLev	−0.002	−0.188 ***	−0.001 ***	−0.191 ***
	(0.006)	(0.004)	(0.000)	(0.004)
Tangibility	−0.015 *	−0.066 ***	0.001 ***	−0.067 ***
	(0.008)	(0.006)	(0.000)	(0.006)
BoardSize	−0.081 ***	0.024 *	0.023 ***	0.096 ***
	(0.021)	(0.015)	(0.001)	(0.018)
BoardInd	0.222 ***	0.059 ***	0.014 ***	0.049 ***
	(0.004)	(0.012)	(0.000)	(0.010)
DirAge	−0.390 ***	−0.176 ***	−0.015 ***	−0.147 ***
	(0.017)	(0.023)	(0.001)	(0.017)
Duality	−0.809 ***	−0.192 **	−0.014 *	−0.156 *
	(0.127)	(0.094)	(0.007)	(0.089)
Constant	−24.024 ***	−12.424 ***	0.373 ***	−11.562 ***
	(1.980)	(1.964)	(0.041)	(1.795)
Firm FE	Yes	Yes	Yes	Yes
Observations	22,274	22,274	22,274	22,274
R-squared	0.348	0.146	0.269	0.146

The table shows the 2SLS regression results using the equal opportunity policy as the instrumental variable. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

The 2SLS findings mitigate endogeneity concerns. Various factors could underlie the negative impact of board gender diversity on firm performance. One plausible rationale is that female directors might enact stricter supervision, potentially hampering company performance, as posited by Adams and Ferreira (2009). Another hypothesis suggests that gender-mixed groups may encounter more conflicts during decision-making processes, consuming additional time and energy, thereby diminishing the competitive edge of firms with gender-diverse boards (Lim et al. 2019). Additionally, the influence of gender stereotypes, particularly in patriarchal societies like Japan, cannot be overlooked. Culturally, women have historically been consigned to subordinate roles, facing barriers to accessing educational resources. Moreover, prevalent stereotypes often paint women as uninformed, aggressive, and overly emotional. Consequently, the presence of female directors on a board might lead to negative investor perceptions and a loss of confidence in the firm, ultimately adversely affecting corporate performance.

6.11. Alternative Performance Measures

Columns 1 and 2 of Table 12 replace ROA with ROE in our analysis to examine robustness, in line with Equation (1). These findings are in harmony with the previous application of ROA for assessing corporate performance, as illustrated in Table 3. The results demonstrate a negative association between board gender diversity and corporate performance, statistically significant at the 1% level. The regression coefficients in Table 12 exhibit magnitudes surpassing those in Table 3, indicating enhanced economic significance. Hence, we affirm that the negative relationship between board gender diversity and corporate performance is robust with an alternative performance measure.

Table 12. Alternative performance measures.

	(1) *ROE*	(2) *ROE*	(3) *MktCapChg*	(4) *MktCapChg*
FemaleFrac	−0.038 ***		−0.000	
	(0.010)		(0.001)	
FemaleDum		−0.585 ***		−0.001
		(0.162)		(0.009)
FirmSize	2.769 ***	2.750 ***	−0.336 ***	−0.336 ***
	(0.219)	(0.218)	(0.012)	(0.012)
FirmLev	−0.323 ***	−0.323 ***	0.006 ***	0.006 ***
	(0.008)	(0.008)	(0.000)	(0.000)
Tangibility	−0.133 ***	−0.133 ***	0.001 *	0.001 *
	(0.012)	(0.012)	(0.001)	(0.001)
BoardSize	0.086 ***	0.099 ***	−0.006 ***	−0.006 ***
	(0.031)	(0.031)	(0.002)	(0.002)
BoardInd	−0.010 *	−0.010 *	−0.000	−0.000
	(0.005)	(0.005)	(0.000)	(0.000)
DirAge	−0.158 ***	−0.156 ***	0.002 *	0.002 *
	(0.025)	(0.025)	(0.001)	(0.001)
Duality	−0.057	−0.053	0.018 *	0.018 *
	(0.188)	(0.188)	(0.010)	(0.010)
Constant	−6.117 **	−6.154 **	3.757 ***	3.758 ***
	(2.604)	(2.606)	(0.147)	(0.147)
Firm FE	Yes	Yes	Yes	Yes
Observations	25,363	25,363	21,901	21,901
R-squared	0.081	0.081	0.061	0.061

The table shows the fixed-effects regression results with alternative performance measures: ROE and *MktCapChg*. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

Table 12 also incorporates the percentage change in market capitalization as the dependent variable. Nonetheless, the coefficients associated with *FemaleFrac* and *FemaleDum* are insignificant. It likely reflects the distinction between accounting-based performance measures (ROA and ROE) and market-based performance measures (market capitalization variation). While ROA focuses on internal operational performance per accounting records, market capitalization change is swayed by external market forces and expectations. Gender diversity might have a more direct or observable impact on internal management practices and policies (affecting ROA), but its influence on external market valuation (market capitalization change) could be less direct or be overshadowed by other factors. Alternatively, accounting measures like ROA reflect current or short-term operational performance, while market valuations often incorporate long-term expectations and growth potential.

6.12. Nonlinear Quadratic Regression

Zhang et al. (2023) employed nonlinear quadratic regression to demonstrate a convex correlation between a CEO's educational background and corporate risk-taking. Alfar et al. (2023) uncover a nonlinear effect of gender diversity on firm performance in the Palestine Exchange. Consequently, the association between board gender diversity and

corporate performance in Japan may similarly be nonlinear. Table 13 presents the results of nonlinear quadratic regression analyses following Equation (5). These findings indicate that regardless of whether ROA or ROE is utilized to assess corporate performance, the purported quadratic relationship between board gender diversity and corporate performance is not statistically significant. Consequently, we deduce that within our sample, there is no evidence of a nonlinear quadratic relationship between board gender diversity and corporate performance. Thus, the critical mass theory does not appear to be substantiated by our study.

Table 13. Nonlinear quadratic regression results.

	(1) ***ROA***	**(2)** ***ROE***
FemaleFrac	−0.014 *	−0.058 ***
	(0.007)	(0.017)
$FemaleFrac^2$	0.000	0.001
	(0.000)	(0.001)
FirmSize	1.494 ***	2.784 ***
	(0.088)	(0.219)
FirmLev	−0.181 ***	−0.323 ***
	(0.003)	(0.008)
Tangibility	−0.063 ***	−0.133 ***
	(0.005)	(0.012)
BoardSize	0.034 ***	0.088 ***
	(0.012)	(0.031)
BoardInd	0.003	−0.009
	(0.002)	(0.005)
DirAge	−0.078 ***	−0.160 ***
	(0.010)	(0.025)
Duality	0.018	−0.060
	(0.075)	(0.188)
Constant	−4.193 ***	−6.205 **
	(1.045)	(2.604)
Firm FE	Yes	Yes
Observations	25,363	25,363
R-squared	0.146	0.081

The table shows the nonlinear quadratic regression results by adding the squared term of *FemaleFrac*. The variable names are italicized. The standard errors are reported below the estimated coefficients in parentheses. ***, **, and * denotes statistical significance level of 1%, 5%, and 10%, respectively.

According to the critical mass theory, the commonly accepted threshold is a minimum of three or 30% female directors. Nevertheless, as illustrated in Figure 1, the average proportion of female directors in Japanese firms significantly lags behind this 30% benchmark. In data not presented, the frequency count of female directors reveals a mere 396 firm-year observations out of 25,363 (1.6%) that meet or exceed the threshold of three female directors in Japan. We conducted a robustness analysis for further validation by regressing ROA against the number of female directors and its squared value. This analysis did not reveal a nonlinear quadratic association. Therefore, the critical mass theory may not apply to Japanese companies due to their low female directorship ratio.

6.13. Comparison with Other Countries

Examining the interplay between board gender diversity and corporate performance in Japan versus other countries is imperative. A substantial portion of research reveals a positive impact in Japan (Nakagawa and Schreiber 2014; Tanaka 2019), Mauritius (Mahadeo et al. 2012), China (Liu et al. 2014), France (Sabatier 2015), the UK (Brahma et al. 2021), Russia (Garanina and Muravyev 2021), India (Sanan 2016; Sarkar and Selarka 2021), East Asian territories including Hong Kong, South Korea, Malaysia, and Singapore (Low et al. 2015), across 24 countries (Belaounia et al. 2020), 47 countries (Terjesen et al. 2016), and

34 countries (Pucheta-Martínez and Gallego-Álvarez 2020). Conversely, a minority of studies indicate a detrimental impact in the UK (Shehata et al. 2017), Pakistan (Mirza et al. 2012; Akram et al. 2020), and Malaysia (Ahmad et al. 2020; Abdullah 2014; Lim et al. 2019). Additionally, limited investigations report a neutral influence in India (Kagzi and Guha 2018), the Netherlands and Denmark (Marinova et al. 2016), Pakistan (Yasser 2012), the United States (Carter et al. 2010), Turkey (Ararat and Yurtoglu 2021), and the Philippines (Unite et al. 2019). Notably, disparities exist even within the same nation, as evidenced in the UK, the United States, and Malaysia. Our findings also diverge from established outcomes for Japan based on earlier data (Nakagawa and Schreiber 2014; Tanaka 2019). It is significant to acknowledge Japan's distinctive context, characterized by a historically low ratio of female directors and a remarkable increase in this ratio over the past decade within a predominantly male-centric culture. Hence, a focused study on Japan can yield insights beneficial for other nations with low female director representation and male-dominated environments.

This research also offers pertinent implications for nations exhibiting similar limited female labor force participation patterns and lower gender gap indices. Firstly, the outcomes afford valuable perspectives for such countries. Secondly, despite the distinctive nature of Japanese corporate governance compared to Western standards, its robustness is acknowledged. In this context of stringent corporate governance, enhanced gender diversity may inadvertently foster excessive oversight, potentially detracting from organizational performance. Our observations regarding the adverse effects of board gender diversity on Japanese corporate performance align with prior analyses in jurisdictions characterized by vigorous corporate governance regimes (Ahern and Dittmar 2012; Adams and Ferreira 2009). In contrast, inquiries in locales with lax corporate governance structures have documented beneficial impacts (Liu et al. 2014; Herdhayinta et al. 2021). Consequently, adopting board gender diversity mandates a tailored approach by governments and corporations, reflecting their unique circumstances. It is crucial to recognize the absence of a universally applicable strategy.

Amid global institutional shifts, a reevaluation of corporate governance dynamics is underway. Future research should focus on a dual approach: a macro-level multi-country analysis and a micro-level study of Japanese corporate governance. Variations in the impact of gender diversity on firm performance across nations are influenced by unique national contexts (Terjesen and Singh 2008), with studies highlighting the varying effects of gender diversity quotas on market and accounting performance (Atinc et al. 2021). Further exploration is needed to understand the implementation of these global standards within different social, cultural, and political frameworks (Ansari et al. 2010). Japan's distinctive labor market characteristics and the potential influence of women's educational level and board independence on firm performance warrant deeper investigation (Gull et al. 2018). This nuanced approach will enhance understanding of gender diversity's complex role in corporate governance.

7. Conclusions

Board gender diversity and corporate governance structure have increasingly garnered scholarly interest. While a substantial body of existing literature has investigated the connection between female directors and corporate performance, findings indicate that the influence of female directors on corporate performance varies across diverse national contexts and environments. This paper aimed to contribute novel insights into the relationship between board gender diversity and corporate performance within the Japanese context, a realm hitherto unexplored in prior research.

We employed a sample of 1990 publicly traded Japanese firms from 2006 to 2023 and revealed that female directors significantly and negatively influence corporate performance in Japan. This implies that companies with a higher proportion of female directors underperform relative to those with fewer or no female directors or that firms with at least one female board member fare worse than those with exclusively male boards. This relationship

is more pronounced in smaller firms with higher leverage or lower institutional ownership, within regulated and consumer-oriented industries, and in the pre-COVID-19 period. To address potential endogeneity between board gender diversity and firm performance, we employed the 2SLS methodology. Our findings confirm the robustness of this result, suggesting a causal direction from board gender diversity to firm performance rather than vice versa. We also used ROE as an alternative performance metric. Our fundamental conclusion remains robust. Our study did not identify a U-shaped relationship between board gender diversity and firm performance.

The results of this study are relevant to corporate leaders, investors, and policymakers in Japan. For Japanese policymakers, enacting the 2023 policies that require a 30% female board membership by 2030 poses a significant challenge. There may be a necessity for these policymakers to reassess or modify current regulations to alleviate potential adverse effects on organizational performance. Consequently, it is recommended that policymakers promote cooperative endeavors involving government, private sector entities, and non-profit organizations to formulate an all-encompassing strategy that capitalizes on varied viewpoints and resources. Corporate leaders are faced with the challenge of effectively addressing the international standard of gender quotas. Merely meeting these quota requirements does not automatically lead to the benefits associated with gender diversity. In fact, it could potentially harm corporate performance (Adams and Ferreira 2009). The push to comply with these policy mandates has increased the demand for experienced female directors, surpassing the available pool (Carter et al. 2010). Consequently, this has led to the appointment of less experienced second and third female directors, who may not fully capitalize on the positive impacts on corporate performance (Claessens et al. 2000). Thus, corporate leaders must focus on aligning women's resources, expertise, and viewpoints within the corporate governance framework, accentuating the substantial inclusion of women's contributions beyond their mere presence on the board. For investors, our results indicate the necessity of meticulously considering the changing dynamics in gender diversity regulations and policies. The 30% female board member target by 2030 may affect investment choices, as companies adhering to these requirements could be perceived as more socially responsible and aligned with global expectations. Nonetheless, financial performance may not exhibit uniform progress; thus, investors should engage in more informed investment strategies that align with their ethical standards and risk appetite.

Three potential reasons might explain the observed negative correlation between board gender diversity and corporate performance: female directors could contribute to excessive monitoring, boards with gender diversity might experience more conflicts during decision-making and prevailing social stereotypes about women. Consequently, firms should not anticipate an enhancement in performance merely by appointing female directors. Nevertheless, our research has certain limitations. Firstly, the instrumental variable employed, the equal opportunity policy, may not be the best choice. Future research should consider more potent instrumental variables. Secondly, due to constraints in data availability, our analysis included only a limited set of control variables. Future investigations could benefit from using panel data encompassing a more extensive array of control variables. Finally, this study focused on the nexus between board gender diversity and performance within the Japanese cultural environment. The effects of gender diversity on corporate performance may vary across policy and cultural environments. Hence, cross-country comparisons are warranted in subsequent research endeavors.

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