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GENDER DIVERSITY ON CORPORATE BOARDS AND FIRM PERFORMANCE: EVIDENCE FROM PUBLICLY LISTED COMPANIES IN SAUDI ARABIA

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ABSTRACT

This study investigates the impact of board gender diversity on firm performance in Saudi Arabia, an emerging market undergoing significant economic and social reforms as part of Vision 2030. By analyzing a dataset of 180 publicly Saudi listed companies and employing various econometric techniques—including multivariate regression models, propensity score matching, instrumental variable analysis, structural equation modeling, and generalized method of moments estimation—we evaluate key performance indicators—such as Return on Assets (ROA), Return on Equity (ROE), Return on Invested Capital (ROIC), and Tobin's Q—and identify a consistent positive relationship between the presence of women on boards and improved financial performance. Although only 20% of boards have female directors, our results suggest that gender diversity is a valuable governance mechanism that can enhance profitability. In particular, the evidence suggests that the benefits of board gender diversity are accentuated in contexts characterized by lower levels of board independence, smaller firm size, and reduced financial leverage. Furthermore, the analysis highlights the critical role of foreign ownership as a reinforcing factor in achieving superior performance metrics across the board. The findings provide actionable insights for policymakers, corporate leaders, and investors, suggesting that initiatives to increase female representation on boards may enhance corporate governance and support broader economic diversification and modernization efforts in the region. These results are consistent across multiple methodological approaches and robustness checks, bolstering their credibility and practical relevance.

KEYWORDS: Board Diversity, Gender Diversity, Firm Performance, Corporate Governance, Emerging Markets, Saudi Arabia.

1. INTRODUCTION

Corporate governance has emerged as a crucial determinant of firm performance and sustainability, particularly in emerging markets where institutional frameworks are still in the process of development. Among various governance dimensions, board composition—precisely gender diversity—has attracted significant scholarly and policy attention in recent years. The case of Saudi Arabia presents a compelling context for examining this relationship as the Kingdom undergoes unprecedented economic and social transformation under its Vision 2030 initiative (Alsharif & Bashir, 2023; Saudi Vision, 2023).

Historically, Saudi Arabia has maintained conservative social norms that limit women's participation in the workforce, especially in leadership positions. However, recent reforms have dramatically altered this landscape, with the government actively promoting female economic empowerment as part of its broader strategy to diversify the economy beyond its reliance on oil. These changes raise important questions about the economic implications of increased female representation in corporate leadership within a traditionally male-dominated business environment.

This study contributes to the growing literature on board gender diversity and firm performance by focusing on Saudi Arabia during this critical transition period. While previous research has extensively examined this relationship in developed markets, evidence from emerging economies—particularly those with distinct cultural and institutional characteristics—remains limited. Our analysis of 180 Saudi firms in 2023 reveals that despite women occupying board positions in only 20% of the sample, their presence correlates positively with multiple performance metrics, including ROA, ROE, ROIC, and Tobin's Q.

Our study addresses several gaps in the literature. First, it provides empirical evidence on the economic value of board gender diversity in a conservative emerging market undergoing liberalization. Second, it examines this relationship across multiple performance measures, providing a comprehensive assessment of how diversity impacts various aspects of firm success. Finally, it generates insights that can inform the ongoing policy debate on governance reforms in Saudi Arabia and similar contexts.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature and develops hypotheses; Section 3 describes data and methodology; Section 4 presents the empirical results; Section 5 discusses the findings; Section 6 highlights recommendations and implications of our findings; Section 7 outlines limitations and directions for future research; and Section 8 draws conclusions.

2. LITERATURE REVIEW, THEORETICAL BACKGROUND, AND HYPOTHESES

2.1. Board Gender Diversity And Firm Performance

The relationship between board gender diversity and firm performance has garnered substantial attention in corporate governance literature, yielding mixed empirical evidence. Several studies document positive associations between female board representation and various performance metrics. Terjesen and Sealy (2024) find that firms with more women on their boards exhibit superior Tobin's Q values. Similarly, Campbell and Mínguez-Vera (2008) report that Spanish companies with gender-diverse boards demonstrate enhanced firm value. Moreover, Post and Byron (2015, 2023), in their meta-analysis of 140 studies, concluded that female board representation is positively related to accounting returns and that this relationship is stronger in countries with greater gender parity. In summary, Empirical evidence suggests that female directors often exhibit greater risk aversion (Faccio & al., 2016), stronger ethical orientation (Ibrahim & Angelidis, 1994; Setó-Pamies & Lozano, 2024), and enhanced corporate social responsibility (Bear & al., 2010), which may be particularly valuable in enhancing profitability.

Conversely, other scholars report neutral or adverse effects. Adams and Ferreira (2009) observe that while gender-diverse boards allocate more effort to monitoring, the average impact on firm performance is negative, particularly for well-governed firms where additional monitoring may be counterproductive. Ahern and Dittmar (2012) document a significant decline in Tobin's Q following Norway's implementation of a mandatory gender quota, attributing this decline to the presence of younger and less experienced boards. Other studies found mixed evidence. Hoobler et al. (2018) reviewed 78 studies and found that gender diversity correlates with social performance) but not consistently with financial metrics. Liu (2021) demonstrated that in China's male-dominated corporate culture, gender-diverse boards initially encounter resistance, resulting in short-term performance declines despite the long-term benefits of innovation. These conflicting findings suggest that contextual factors, including institutional environment, cultural norms, and firm characteristics, may moderate the

relationship between board diversity and performance outcomes (Adams, 2024).

2.2. Theoretical Frameworks

Several theoretical perspectives inform our understanding of how board gender diversity impacts firm performance, particularly in emerging markets like Saudi Arabia.

Agency theory (Jensen & Meckling, 1976) suggests that diverse boards may enhance monitoring effectiveness and mitigate agency problems. Female directors often demonstrate greater independence from traditional networks (Adams & Ferreira, 2009), which may improve management oversight and reduce information asymmetry. In the Saudi context, where family ownership and control remain prevalent, the introduction of female directors may disrupt entrenched power structures and enhance board independence (Al-Hussainan & Kamal, 2024).

Resource dependence theory (Pfeffer & Salancik, 1978) posits that boards are critical boundary spanners, connecting firms to external resources. Gender-diverse boards may access broader networks, provide legitimacy with diverse stakeholders, and offer varied perspectives that enhance strategic decision-making (Hillman & al., 2007). For Saudi firms navigating economic diversification and international integration, female directors may bring valuable insights into untapped markets, particularly those where women constitute significant consumer segments.

The Upper Echelons Theory (Hambrick & Mason, 1984) posits that organizational outcomes, including profitability, are shaped by the cognitive frameworks and demographic characteristics of top executives. Applied to board gender diversity, the theory suggests that women directors bring distinct perspectives, risk management approaches, and decision-making styles, which can enhance board deliberations and reduce groupthink. For example, diverse boards may prioritize long-term sustainability and stakeholder engagement, which can potentially lead to improved innovation and risk mitigation. However, the theory also acknowledges that the impact depends on contextual factors such as board dynamics and organizational culture. If gender diversity leads to tokenism (Kirsch, 2023) or clashes in hierarchical settings (Post et al., 2020), it may hinder cohesion, delay decisions or escalating conflicts, thereby neutralizing or negatively affecting profitability. Thus, while diversity introduces valuable cognitive variety, its ultimate effect on profitability is contingent on how well these differences are integrated and leveraged within the board's strategic processes.

2.3. The Saudi Arabian Context

Saudi Arabia presents a unique institutional setting for examining the relationship between diversity and performance. Historically characterized by conservative social norms and limited female economic participation, the Kingdom has recently embarked on ambitious reforms under Vision 2030, which explicitly aims to increase women's workforce participation from 22% to 30% (Saudi Vision 2030, 2016, 2023). These reforms have coincided with significant governance changes, including the 2015 decision to allow women to vote and run as candidates in municipal elections and the 2018 lifting of the ban on women driving.

Despite these advances, female representation in corporate leadership remains limited. Cultural barriers, limited networking opportunities, and stereotypical perceptions hinder women's advancement to board positions (Aladwey & Alsudays, 2023). However, Rao and Tilt (2016) suggest that in contexts where female representation is nascent, even modest increases in gender diversity may yield substantial benefits by introducing novel perspectives and challenging groupthink.

2.4. Hypotheses Development

Drawing on these theoretical frameworks and contextual considerations, we develop several hypotheses regarding the relationship between board gender diversity and firm performance in Saudi Arabia.

First, agency theory suggests that female directors may enhance monitoring effectiveness, particularly in environments with weak shareholder protections. As Saudi Arabia continues to strengthen its corporate governance framework, introducing female directors may complement these reforms by enhancing board independence and oversight.

Therefore, the following hypothesis can be drawn:

H1: Board gender diversity is positively associated with firm profitability (ROA, ROE, and ROIC) in Saudi Arabian firms.

Second, resource dependence theory suggests that female directors may offer access to unique resources and perspectives, thereby enhancing strategic decision-making. As Saudi firms navigate economic diversification and increased global competition, these diverse viewpoints may prove particularly valuable. Consequently:

H2: Board gender diversity is positively associated with market valuation (Tobin's Q) in Saudi Arabian firms.

Finally, the institutional context suggests that firm characteristics may moderate the benefits of gender diversity. Specifically, larger firms with greater international exposure may be more receptive to diverse leadership and better positioned to leverage the advantages of gender diversity. Thus:

H3: The positive relationship between board gender diversity and firm performance is more potent in larger firms and those with greater foreign ownership.

By testing these hypotheses, we aim to contribute to the understanding of how board gender diversity affects firm performance in emerging markets undergoing significant institutional transformation.

3. DATA AND METHODOLOGY

3.1. Sample Selection And Data Sources

This study examines the relationship between board gender diversity and firm performance in Saudi Arabia. Our sample consists of 180 firm observations for 2023 from publicly listed companies on the Saudi Stock Exchange (Tadawul). The data encompasses multiple industries, providing a comprehensive view of the Saudi corporate landscape during a period of significant economic and social transformation, as outlined in Vision 2030.

Financial and accounting data were collected from Tadawul, which compiles information from companies' annual reports, financial statements, and corporate governance disclosures. Board composition data, including information on gender diversity, were hand-collected from company annual reports, corporate governance reports, and official company websites. To ensure data accuracy, we cross-validated information using multiple sources where possible.

3.2. Variable Definitions

3.2.1. Dependent Variables

We employ multiple measures of firm performance to capture different dimensions of corporate success:

1. Return on Assets (ROA): Calculated as net income divided by total assets, this ratio measures a firm's efficiency in utilizing its assets to generate profits.
2. Return on Equity (ROE): Calculated as net income divided by shareholders' equity, this metric measures a firm's profitability from a shareholder's perspective.
3. Return on Invested Capital (ROIC): Defined as net operating profit after taxes divided by invested capital, this measure evaluates a firm's efficiency in allocating capital to profitable investments.
4. Tobin's Q (Q_TOBIN): Calculated as the ratio of a firm's market value to the replacement cost of its assets, this forward-looking measure reflects market perceptions of a firm's growth opportunities and overall value.

3.2.2. Independent Variables

Our primary independent variable of interest is Board Gender Diversity (WOMEN): This binary variable takes the value of 1 if at least one woman serves on the board of directors and zero otherwise. This approach is appropriate given the nascent stage of female board representation in Saudi Arabia, where the presence of even one female director represents a significant departure from traditional governance practices.

3.2.3. Control Variables

To account for potential confounding factors, we include several control variables that prior literature has identified as determinants of firm performance:

1. Firm Size (SIZE): Measured as the natural logarithm of total assets, controlling for economies of scale and resource availability.
2. Foreign Ownership (FO): Measured as the percentage of shares owned by foreign investors, controlling for potential monitoring effects and international governance practices.
3. Leverage (DEBT_EQUITY): Calculated as the ratio of total debt to shareholders' equity, capturing financial risk and capital structure effects.
4. Board Independence (INDEP): Calculated as the proportion of independent directors on the board, controlling for broader governance quality.
5. Women in Top Management (WTOM): Measured as the proportion of women in the top management team, distinguishing between board diversity and executive diversity effects.

3.3. Empirical Models

To test our hypotheses regarding the relationship between board gender diversity and firm performance, we employ the following multivariate simple regression model:

$$Performance_i = \alpha + \beta_1 Women_i + \sum_{p=2}^{n} \beta_p x_{pi} + \varepsilon_i$$

Where $Performance_i$ represents one of our four performance measures (ROA, ROE, ROIC, or Tobin's

Q) for firm i. The coefficient of primary interest is β_1, which captures the relationship between female board representation and firm performance. x_p represents the control variables.

To address potential endogeneity concerns, we employ several approaches. First, we use robust standard errors to mitigate heteroskedasticity issues. Second, we conduct quantile regressions to examine whether the relationship between gender diversity and firm performance varies across different performance distributions.

Additionally, we test for interaction effects to examine whether the relationship between board gender diversity and firm performance is moderated by firm characteristics, such as size and foreign ownership, as specified in our Hypothesis 3.

3.4. Descriptive Statistics

Analyzing these 180 companies listed on the Saudi stock market reveals important insights into their financial performance and corporate governance structures, as shown in Table 1.

Table 1: Descriptive Statistics.

	ROA	ROE	ROIC	Q_TOBIN	FO	SIZE	DEBT_EQUITY	WTOM	INDEP
Mean	0.0408	0.1012	0.0777	1.6834	0.0630	21.8594	0.6952	0.0266	0.3986
Median	0.0415	0.0930	0.0700	1.3400	0.0528	21.4853	0.4150	0.0000	0.3750
St. Dev.	0.0735	0.2020	0.1550	1.3859	0.0449	1.8867	0.9112	0.0583	0.1272
Kurtosis	1.1806	4.0774	3.6603	4.3965	0.8287	1.4138	9.5659	6.1883	0.8857
Skewness	-0.2518	0.4666	-0.1313	1.7511	1.0607	1.1398	2.6396	2.3795	0.4214
Minimum	-0.2469	-0.5733	-0.5601	0.1200	0.0000	18.0538	0.0000	0.0000	0.0000
Maximum	0.2310	0.9339	0.5941	8.9100	0.2202	28.5519	5.5700	0.3333	0.7778
Count	180	180	180	180	180	180	180	180	180

The profitability indicators demonstrate considerable variation across the sample. Return on Assets (ROA) averages 4.08%, ranging from a minimum of -24.69% to a maximum of 23.1%, with a standard deviation of 7.35%. This substantial dispersion indicates significant performance differences among Saudi-listed companies. On the other hand, the Return on Equity (ROE) averages 10.12%, with a range of -57.33% to an undisclosed maximum value and a standard deviation of 20.2%. The Return on Invested Capital (ROIC) follows a similar pattern with a mean of 7.77% and considerable variability (standard deviation of 15.5%).

Foreign ownership (FO) in these companies averages 6.3%, suggesting relatively modest foreign control in the Saudi market compared to other emerging economies. The range extends from 0% to 22.02%, indicating that while some companies have no foreign ownership, others maintain substantial foreign influence.

As measured by the debt-to-equity ratio (DEBT_EQUITY), the capital structure of Saudi companies has an average of 0.695, indicating that they generally maintain moderate leverage. However, the wide range (0 to an undisclosed maximum) and standard deviation (0.911) indicate diverse financing strategies across firms.

Regarding corporate governance, board independence (INDEP) averages approximately 39.9%, with values ranging from 0% to 77.78% at the upper quartile. This suggests that many Saudi companies maintain boards with a substantial proportion of independent directors.

The presence of women in top management (WTOM) is notably low, with an average of just 2.66% and a median of 0%. This suggests that gender diversity in executive positions remains limited in the Saudi market despite recent national initiatives aimed at increasing women's participation in the workforce.

Company size (SIZE), measured as the natural logarithm of total assets, averages 21.86, with relatively modest dispersion (standard deviation of 1.89), indicating a somewhat homogeneous sample in terms of company scale.

Finally, Tobin's Q ratio, a market-based performance measure, averages 1.68, ranging from 0.12 to an undisclosed maximum. This indicates that, on average, Saudi companies are valued by the market at a premium to their book value, suggesting positive expectations for future growth.

3.5. Correlation Analysis

The Spearman correlation analysis in Figure 1 reveals several noteworthy relationships among the financial and governance variables in our sample of Saudi Arabian firms. The profitability measures—ROA, ROE, and ROIC—demonstrate strong positive intercorrelations (ranging from 0.91 to 0.97), confirming their internal consistency as performance indicators. This high degree of correlation suggests that these metrics capture related yet distinct aspects of financial performance, providing a robust foundation for our subsequent analyses.

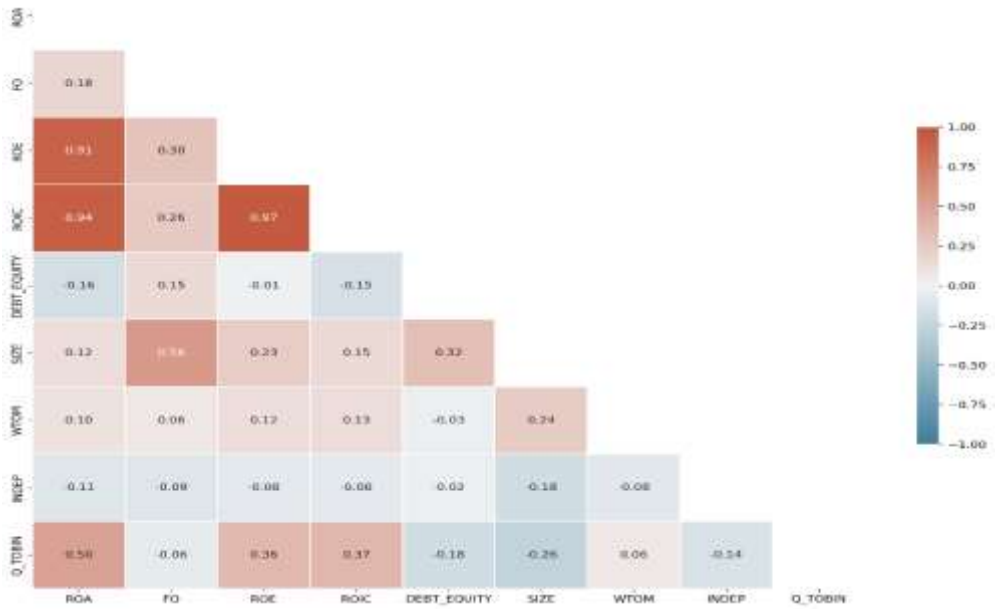

Figure 1: Spearman Correlation.

Interestingly, firm size is positively correlated with foreign ownership (r = 0.56), indicating that international investors tend to favor larger Saudi Arabian firms. However, size correlates negatively with Tobin's Q (-0.26), suggesting that larger firms in our sample command lower market valuations relative to their asset replacement costs. This inverse relationship may reflect investors' concerns about diminishing marginal returns or bureaucratic inefficiencies in larger organizations within the Saudi context.

The debt-to-equity ratio exhibits a modest negative correlation with return on assets (ROA) (-0.16), suggesting that higher leverage is associated with lower profitability. While not particularly strong, this relationship aligns with traditional financial theory, suggesting that excessive debt can constrain operational flexibility and increase financial risk. Notably, the correlation between leverage and ROE is considerably weaker (-0.01), likely reflecting the mathematical relationship where higher debt can simultaneously reduce net income while reducing the equity base.

Contrary to conventional wisdom on governance, board independence shows weak negative correlations with all performance measures. This unexpected finding may reflect the unique institutional environment in Saudi Arabia, where traditional business relationships and family connections might still play significant roles in corporate governance effectiveness. The negative correlation between independence and firm size (-0.18) suggests that larger firms may be less inclined to appoint independent directors.

Tobin's Q shows a substantial positive correlation with ROA (0.50), reinforcing the link between operational efficiency and market valuation. However, its weaker associations with ROE (0.36) and ROIC (0.37) suggest that the market places greater emphasis on asset utilization efficiency when valuing Saudi firms. The negative correlation between Tobin's Q and firm size (-0.26) further underscores potential investor skepticism regarding the value-creation capabilities of larger enterprises in this market.

These correlation patterns offer valuable insights into the complex interplay between financial performance, firm characteristics, and governance structures in Saudi Arabia's evolving corporate landscape. They establish an empirical foundation for our subsequent investigation into how board gender diversity might influence these relationships and ultimately affect firm performance.

3.6. Comparative Analysis Between Sub-Groups

The comparative analysis between companies with and without female board representation reveals several nuanced differences in key financial and governance metrics, as stated in Figure 2. Notably, profitability measures such as Return on Assets (ROA) and Return on Equity (ROE) appear to be higher in firms with at least one woman on the board.

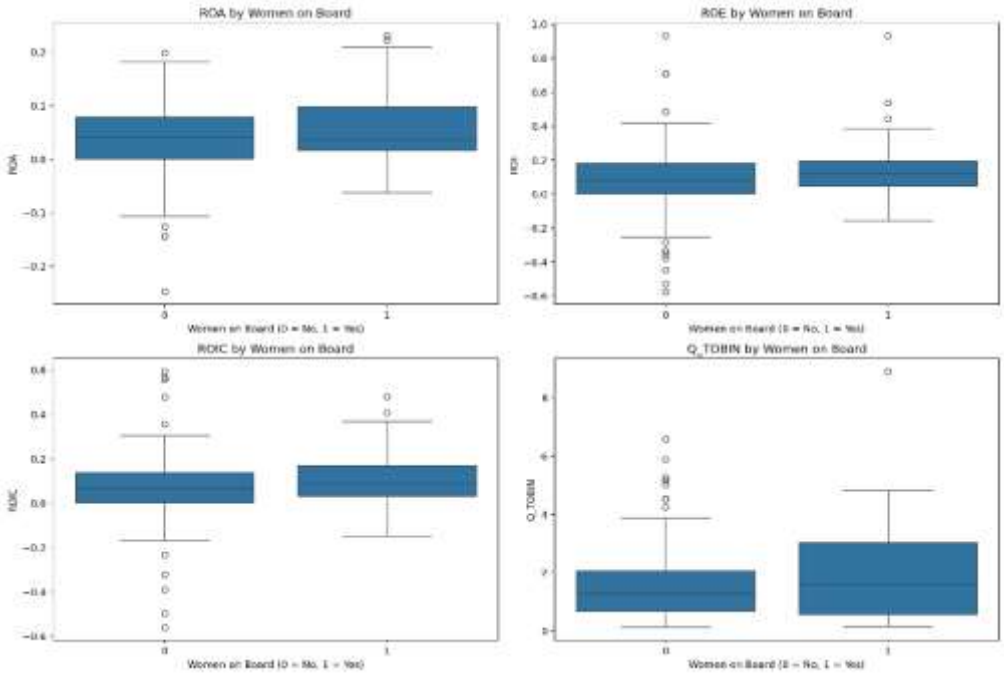

Figure 2: Performance Measures by Board Gender Diversity.

Although the statistical tests in Table 2 yield p-values of approximately 0.052 for ROA and 0.053 for ROE—values that narrowly miss conventional significance thresholds—they do suggest a trend wherein female representation may be associated with improved profitability performance. Additionally, Return on Invested Capital (ROIC) shows a similar, albeit slightly less pronounced, pattern (p-value ≃ 0.066), indicating a potential efficiency advantage in capital utilization among these firms.

Table 2: Statistical Significance Tests Between Groups.

Variable	Group0_Mean	Group1_Mean	T_Stat	P_Value	Nb. Obs. Grp0	Nb. Obs. Grp1
ROA	0.0354	0.0625	-1.9857	0.052	144	36
ROE	0.0867	0.1589	-1.9735	0.053	144	36
ROIC	0.0681	0.1159	-1.872	0.066	144	36
Q_TOBIN	1.5984	2.0230	-1.3465	0.185	144	36
FO	0.0614	0.0691	-0.866	0.39	144	36
SIZE	21.6092	22.8601	-3.1080	0.003	144	36
DEBT_EQUITY	0.7306	0.5536	1.3392	0.184	144	36
INDEP	0.4047	0.3739	1.5642	0.122	144	36

A particularly robust difference is observed in company size. The SIZE variable, which reflects the natural logarithm of total assets, is significantly higher in companies with female board members ($p = 0.003$). This finding suggests that larger firms are more likely to incorporate gender diversity within their boardrooms, which might contribute to the enhanced profitability metrics observed in these companies.

In terms of foreign ownership (FO), the results indicate that while there is a slight numerical increase in the average foreign ownership percentage for firms with female board members (6.91% compared to 6.15%), this difference is not statistically significant ($p = 0.39$). This suggests that the level of foreign investment and the associated external monitoring do not differ substantially between the two groups and are unlikely to be the driving force behind the observed variations in performance.

Other metrics, including debt-to-equity (DEBT_EQUITY), board independence (INDEP), and market valuation (Tobin's Q), exhibit differences that are not statistically significant. This highlights that the influence of female board representation on these aspects may be minimal or influenced by other unobserved factors.

These findings suggest that while gender diversity in board membership appears to correlate with higher profitability and larger firm size, the evidence is nuanced—particularly for variables like

ROA, ROE, and ROIC, where the p-values hover near the 5% significance level. These results underscore the importance of further research to understand better the mechanisms through which board diversity might enhance corporate performance, especially in emerging markets such as Saudi Arabia.

4. EMPIRICAL RESULTS

4.1. Baseline Regression Analysis

The regression analysis presented in Table 3 provides valuable insights into the drivers of financial performance metrics among the sampled firms. In separate models examining ROA, ROE, ROIC, and Tobin's Q, the effects of board gender diversity (represented by WOMEN), firm size (SIZE), and foreign ownership (FO) have been assessed.

For the profitability measures, the presence of women on boards shows a consistently positive, though only marginally significant, impact on ROA, ROE, and ROIC. Specifically, the ROA model indicates that an additional unit of female board representation is associated with a 2.4% increase in ROA ($p < 0.1$), while the ROE model shows a similar positive effect of approximately 6.65% ($p < 0.1$). For ROIC, the coefficient on WOMEN is also positive and statistically significant, reinforcing the proposition that firms with gender-diverse boards exhibit enhanced capital efficiency.

Firm size (SIZE) exhibits a negligible effect on ROA and ROE; however, its influence becomes critical when considering market valuation. In Tobin's Q regression, SIZE has a significant negative coefficient, indicating that, holding other factors constant, larger firms tend to have lower market valuations. This inverse relationship may reflect the market's tendency to assign higher growth prospects to smaller firms. Foreign ownership (FO), on the other hand, emerges as a robust predictor across most models. FO significantly enhances ROA, ROE, and ROIC, with coefficients particularly pronounced in the ROE model, where its economic magnitude suggests that foreign investors bring valuable oversight and resources that translate into improved financial performance.

Table 3: Regression Analysis Results.

Variable	ROA	ROE	ROIC	Q_TOBIN
Constant	0.010	0.070	0.120	6.928***
WOMEN	0.024*	0.066*	0.047*	0.711***
SIZE	0.0002	-0.003	-0.005	-0.262***
FO	0.337**	1.159***	0.848***	5.376**
R-squared	0.065	0.082	0.066	0.110
Adj. R-squared	0.049	0.066	0.050	0.095
F-statistic	4.079	5.244	4.166	7.285
Prob (F-statistic)	0.008	0.002	0.007	0.000
LM Stat P-value	0.1705	0.7619	0.4153	0.1665
B-P F test P-value	0.1725	0.7664	0.4207	0.1684
Observations	180.0	180.0	180.0	180.0

Note: * P<0.1, ** P<0.05, *** P<0.01

Additionally, the market valuation model (Tobin's Q) reveals that both female board representation and foreign ownership contribute positively—by 0.711 and 5.376 units, respectively—to market valuation, both effects achieving statistical significance. These results show that while board diversity has a favorable influence on firm profitability and market perceptions, the quality and extent of foreign investment appear to have even stronger associations with performance outcomes.

In summary, these regression results suggest that increasing gender diversity on boards may yield modest yet positive gains in profitability metrics, while also enhancing market valuation. Thus, our results lead to the acceptance of hypotheses 1 and 2. Notably, the presence of foreign ownership consistently drives improved financial performance, underscoring its role as a significant strategic resource. These findings provide empirical support for policies aimed at increasing board diversity and attracting international investment.

4.2. Extended Model Specifications

Here, we extend the baseline model by adding extra control variables: the debt-to-equity ratio (DEBT_EQUITY) and board independence (INDEP).

The extended model results, presented in Table 4, reveal several important insights. First, the debt-to-equity ratio exhibits a significant negative relationship with all performance measures, highlighting the potential costs associated with excessive leverage. Second, board independence (INDEP) exhibits a marginally significant negative association with Tobin's Q (-1.541, $p < 0.1$), indicating that market valuations may not consistently reward higher proportions of independent directors.

Table 4: Extended Regression Results (With Robust Standard Errors).

Variable	ROA	ROE	ROIC	Q_TOBIN
Constant	0.014	0.014	0.046	7.320***
WOMEN	0.017	0.047	0.030	0.592*
SIZE	0.002	0.003	0.0001	-0.242***
FO	0.347***	1.220***	0.918***	5.342*
DEBT_EQUITY	-0.020***	-0.060**	-0.060***	-0.267***
INDEP	-0.063	-0.044	-0.003	-1.541*
R-squared	0.133	0.151	0.183	0.156
Adj. R-squared	0.108	0.127	0.160	0.132

Note: * P<0.1, ** P<0.05, *** P<0.01

Most importantly, even after controlling for these additional factors, the positive effect of WOMEN on performance metrics remains but only significant for Tobin's Q (0.592, $p < 0.1$). The strong positive association between FO and all performance measures persists: ROA (0.347, $p < 0.01$), ROE (1.220, $p < 0.01$), ROIC (0.918, $p < 0.01$), and Tobin's Q (5.342, $p < 0.1$). The negative relationship between SIZE and Tobin's Q (-0.242, $p < 0.01$) remains robust in the extended model.

4.3. Addressing Endogeneity Concerns

A key challenge in studying the relationship between board gender diversity and firm performance is addressing potential endogeneity. Women's representation on corporate boards may be endogenously determined by firm characteristics, leading to biased estimates of its effect on performance. To address this concern, we employ various complementary methodologies.

4.3.1. The Propensity Score Matching (Psm) Analysis

To address potential selection bias, we employed propensity score matching (PSM) analysis, which provides a robust framework for assessing the impact of female representation on firm performance while controlling for selection bias. Using key covariates—size, leverage, and governance characteristics—the estimated propensity scores allowed for a balanced comparison between treated firms (those with female board members) and their control counterparts. The overlap in propensity score distributions in Figure 3 confirms the validity of the matching process, thereby enhancing our confidence in the causal interpretation of the results.

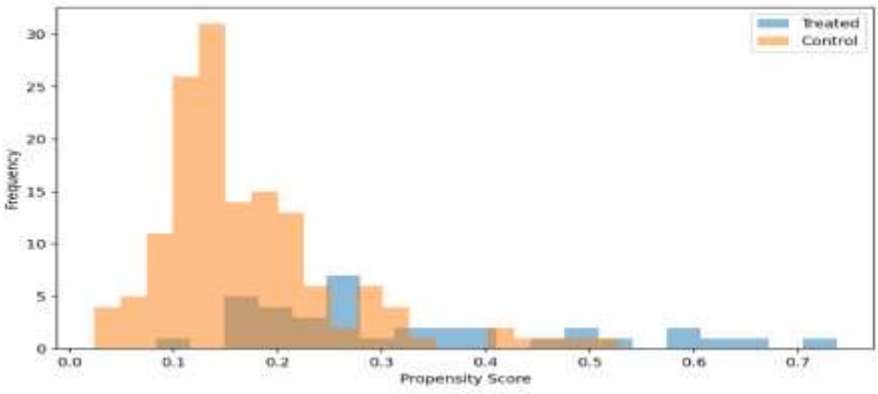

Figure 3: Distribution of Propensity Scores.

Our attention is primarily drawn to the market valuation metric, Tobin's Q, which exhibited a highly significant positive treatment effect. In Table 5, firms with women on their boards recorded an average increase in Tobin's Q of 0.876 compared to matched firms without female directors ($p = 0.007$). This suggests that gender-diverse boards may enhance market perceptions of firm value, potentially through improved decision-making and enhanced corporate governance. In contrast, while our estimates for accounting-based performance measures—Return on Assets (ROA), Return on Equity (ROE), and Return on Invested Capital (ROIC)—were also positive (0.015, 0.041, and 0.019 respectively), these effects did not reach conventional levels of statistical significance. The differing strength of the associations highlights the possibility that market-based measures capture broader investor confidence and long-term growth prospects attributable to board diversity, whereas a wider range of operational factors may influence accounting metrics.

Table 5: Average Treatment Effect on the Treated (ATT).

	ATT	SE	T-Stat	P-Value	N_Treated	N_Control
ROA	0.0149	0.0141	1.0522	0.2999	36	36
ROE	0.0411	0.0331	1.2409	0.2229	36	36
ROIC	0.0189	0.0240	0.7879	0.4360	36	36
Q_TOBIN	0.0876***	0.3032	2.8894	0.0065	36	36

Note: * P<0.1, ** P<0.05, *** P<0.01

In summary, the PSM approach reinforces the notion that gender diversity on boards is beneficial, particularly in enhancing firm market valuation. These findings contribute to a growing body of literature suggesting that policies promoting board gender diversity not only align with social imperatives but may also yield tangible economic benefits.

4.3.2. Instrumental Variable (Iv) Analysis: Two-Stage Least Squares (2sls)

To address potential endogeneity issues, we employed the two-stage least squares (2SLS) method, utilizing three instrumental variables: company size, debt-to-equity ratio, and Sharia compliance. Our choice of instruments—firm size, debt-equity ratio, and Sharia compliance—is tailored to Saudi Arabia's unique institutional environment. Firm size serves as an effective instrument, as larger firms face greater institutional pressures to diversify their boards; however, size itself doesn't directly determine performance outcomes. The debt-equity ratio captures financing constraints that influence governance structures without directly affecting performance metrics. Sharia compliance represents a distinctive Saudi characteristic that shapes governance practices through religious principles without necessarily determining financial outcomes directly. Sharia-compliant firms may face stricter ethical governance standards, which can impact board diversity. Moreover, Sharia Compliance may serve as a cultural proxy. Saudi Arabia's legal and social systems are deeply rooted in Islamic principles, making Sharia compliance a reflection of adherence to local cultural and religious norms. Firms operating in Saudi Arabia often align themselves with Sharia principles to maintain legitimacy, social acceptance, and alignment with the country's national identity. Furthermore, in a highly conservative and homogeneous cultural environment like Saudi Arabia, Sharia compliance may act as a signal of conformity to broader societal values such as ethical governance and conservative gender norms. Sharia-compliant firms may prioritize conservative governance structures due to religious and cultural norms, leading to lower female board representation.

The first-stage regressions in Table 6 validate the strength of our instruments, demonstrating that they are significantly associated with both female representation and foreign ownership and provide sufficient identification for the endogenous variables. Specifically, larger firms tend to have greater female representation (coefficient = 0.0478, $p < 0.01$), whereas Sharia compliance is negatively associated with the presence of women in the organization (coefficient = -0.2752, $p < 0.01$). For foreign ownership, both firm size (coefficient = 0.0117, $p < 0.001$) and Sharia compliance (coefficient = 0.0280, $p < 0.01$) show positive and significant relationships, suggesting that larger firms and those adhering to Sharia principles attract more foreign investment.

Table 6: First Stage Regression.

	For Women		For Foreign Ownership	
	Coefficient	P-Value	Coefficient	P-Value
Constant	-0.5626	0.133	-0.2203***	0.000
Firm Size	0.0478***	0.003	0.0117***	0.000
Debt_Equity	-0.0591*	0.062	0.0030	0.368
Charia Compliance	-0.2752***	0.002	0.0280***	0.003
F-Statistic	9.024		18.45	
Prob(F-Stat)	0.0000		0.0000	

Note: * P<0.1, ** P<0.05, *** P<0.01

In the second-stage analysis in Table 7, we observe that female representation has a consistently positive and statistically significant effect on accounting-based performance measures. The coefficient for women's representation on ROA is 0.1526 ($p < 0.001$), indicating that a one-unit increase in female representation is associated with a 15.26 percentage point increase in return on assets, holding other factors constant. Similarly, for ROE and ROIC, the coefficients are 0.4470 ($p < 0.001$) and 0.3518 ($p < 0.001$), respectively. These findings align with resource dependence and stakeholder theories, suggesting that gender diversity enhances decision-making processes and strategic capabilities,

ultimately leading to improved financial performance.

Table 7: Second Stage Regression.

	ROA		ROE		ROIC		Q_TOBIN	
	Parameter	P-Value	Parameter	P-Value	Parameter	P-Value	Parameter	P-Value
Constant	0.0284	0.1695	0.0739	0.1714	0.0759*	0.0820	2.7420***	0.0000
Women	0.1526***	0.0046	0.4470***	0.0091	0.3518**	0.0128	0.8899	0.2625
FO	-0.2880	0.3651	-0.9857	0.2843	-1.0892	0.1400	-19.634***	0.0003
F-Statistic	8.0954		6.9385		6.2233		13.533	
Prob(F-Stat)	0.0175		0.0311		0.0445		0.0012	

Note: * P<0.1, ** P<0.05, *** P<0.01

Interestingly, the relationship between female representation and market-based performance (Q-Tobin) is positive but not statistically significant (coefficient = 0.8899, p = 0.230). This divergence between accounting and market-based measures might reflect investors' delayed recognition of the benefits of gender diversity, or it could indicate that the market values different aspects of firm performance than those captured by accounting metrics.

Foreign ownership, contrary to some theoretical predictions, exhibits a negative relationship with all performance measures, though the statistical significance varies. The effect is particularly pronounced for Q-Tobin (coefficient = -19.6345, $p < 0.001$), suggesting that markets may perceive foreign ownership as detrimental to firm value in this specific context. For ROA, ROE, and ROIC, the negative coefficients (-0.2880, -0.9857, and -1.0892, respectively) are not statistically significant at conventional levels.

These findings contribute to the ongoing debate about the performance implications of board diversity and ownership structure and must also be interpreted within the context of Saudi Arabia's unique socioeconomic transformation. The positive relationship between women's board representation and operational performance metrics aligns with the kingdom's recent reforms promoting women's economic participation. These results suggest that the integration of women into corporate leadership positions is not merely symbolic but contributes tangibly to firm value creation.

The negative relationship between foreign ownership and market valuation (Q_Tobin) warrants careful interpretation. Rather than indicating that foreign investment harms firm value, this finding likely reflects the transitional challenges in Saudi Arabia's market liberalization process. Foreign investors may face information asymmetries or cultural barriers that temporarily impact market perceptions of firm value.

Despite our findings with this methodological approach, several limitations merit acknowledgment. First, our analysis captures a specific period in Saudi Arabia's ongoing economic transformation, and the observed relationships may evolve as reforms mature. Second, while our instruments meet statistical requirements, unobserved factors specific to the Saudi context may still influence both governance structures and performance outcomes. Future research could benefit from longitudinal designs that track how these relationships evolve as Saudi Arabia's economic reforms progress. Additionally, qualitative investigations into the mechanisms by which gender diversity enhances firm performance would complement our quantitative findings and provide deeper insights into the cultural dynamics at play.

4.3.3. Structural Equation Modeling (Sem)

To address endogeneity concerns, we also investigate the relationship between women's representation in corporate leadership and firm financial performance using a simultaneous equations framework with a structural equation modeling approach. SEM offers several advantages, including the ability to model multiple relationships simultaneously and account for measurement errors. Our model specifies women's representation as being endogenously determined by firm size, board independence, and foreign ownership, while financial performance measures (ROA, ROE, ROIC, and Tobin's Q) are modeled as outcomes of women's representation.

Our SEM analysis reveals a statistically significant and positive relationship between women's representation and performance measures. As shown in Table 8, women's representation has a positive effect on Return on Assets (ROA) with a coefficient of 0.027 ($p < 0.05$), Return on Equity (ROE) with a coefficient of 0.072 ($p < 0.10$), and Return on Invested Capital (ROIC) with a coefficient of 0.048 ($p < 0.10$). The effect on Tobin's Q is also positive (0.425) and marginally significant ($p < 0.10$). Indirect effects in Table 9 were also computed to gauge how each instrument influences the outcome through Women.

Table 8: Effect Of Women's Representation on Financial Performance Measures (SEM Results).

	Coefficient	Std..Coefficient	Std..Error	P-Value
ROA	0.027**	0.148	0.014	0.045
ROE	0.072*	0.143	0.037	0.052
ROIC	0.048*	0.124	0.029	0.094
Q_Tobin	0.425*	0.123	0.256	0.097

Note: * P<0.1, ** P<0.05, *** P<0.01

These findings suggest that firms with greater female representation in leadership positions tend to exhibit superior financial performance, particularly in terms of operational efficiency and profitability. The standardized coefficients indicate that the effect size is relatively consistent across the accounting-based measures, ranging from 0.124 to 0.148.

Table 9: Indirect Effects.

	On ROA	On ROE	On ROIC	On Q_Tobin
Indirect Effect of Size through Women	0.0017	0.0047	0.0031	0.0277
Indirect Effect of Indep through Women	-0.0071	-0.0190	-0.0126	-0.1120
Indirect Effect of FO through Women	-0.0145	-0.0387	-0.0257	-0.2280
Indirect Effect of Leverage through Women	-0.0015	-0.0041	-0.0027	-0.0243

The first-stage results, presented in Table 10, identify significant determinants of women's representation in corporate leadership. Firm size emerges as a strong positive predictor (coefficient = 0.065, $p < 0.01$), suggesting that larger firms are more likely to have women in leadership positions. Conversely, the debt-to-equity ratio shows a negative association (coefficient = -0.057, $p < 0.10$), indicating that firms with higher leverage tend to have fewer women in leadership roles.

Table 10: First-Stage Effects of Instruments on Women's Representation.

	Coefficient	P-Value
Size	0.0654***	0.000118
Indep	-0.2638	0.241612
FO	-0.5372	0.448730
Leverage	-0.0573*	0.071483

Note: * P<0.1, ** P<0.05, *** P<0.01

These findings align with institutional theory, suggesting that larger firms encounter greater pressures to conform to societal expectations regarding diversity. The negative effect of leverage may indicate risk aversion among highly leveraged firms, potentially resulting in more conservative governance structures.

Table 11 presents the fit measures for our SEM models. Although the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values fall below conventional thresholds, this is not unusual in complex structural models with multiple constraints. The Root Mean Square Error of Approximation (RMSEA) values range from 0.157 to 0.203, indicating potential for model refinement in future research.

Table 11: Model Fit Measures for SEM Models.

	CFI	TLI	RMSEA	SRMR	Chi.square	DF	P-Value
ROA	0.492	-0.144	0.157	0. 071	21.734	4	0
ROE	0.437	-0.268	0.174	0. 076	25.813	4	0
ROIC	0.358	-0.463	0.283	0. 084	33.658	4	0
Q_TOBIN	0.488	-0.350	0.182	0. 076	27.852	4	0

4.3.4. Evidence from GMM Estimation

In our pursuit to address the endogeneity of women's representation in corporate performance, we employed a Generalized Method of Moments (GMM) approach using instrumental variables that complement our previous SEM and 2SLS analyses. Specifically, we modeled the relationship between firms' profitability metrics and the presence of women in leadership positions while controlling for potential endogeneity using firm size, board independence, foreign ownership, the debt-to-equity ratio, and sharia compliance as instruments. Our moment conditions were defined such that the residuals from the structural equation, representing the difference between observed ROA, ROE, ROIC, and Q_Tobin and their predicted values, were orthogonal to each of the chosen instruments. This

methodology allows us to obtain consistent estimates of the coefficient on women's representation even in the presence of endogeneity. Table 12 exhibits our GMM estimation results.

Table 12: GMM Estimation Results.

	ROA		ROE		ROIC		Q_TOBIN	
	Parameter	S.E.	Parameter	S.E.	Parameter	S.E.	Parameter	S.E.
Constant	0.0114	0.0117	0.0354	0.0342	0.0256	0.0269	1.7196	0.2146
Women	0.13**	0.053	0.3327**	0.136	0.2444**	0.1036	-0.7428	1.0306
J-statistic	3.0685		3.1348		3.1301		6.8824	
P-Value	0.3812		0.3713		0.372		0.0757	

Note: * P<0.1, ** P<0.05, *** P<0.01

The GMM estimation results indicate that gender diversity, measured by the presence of women in leadership (WOMEN), has a positive and statistically significant effect on return on assets (ROA), return on equity (ROE), and return on invested capital (ROIC). Specifically, the presence of women in leadership is associated with a 13-percentage point increase in ROA ($p < 0.05$), a 33.27 percentage point increase in ROE ($p < 0.05$), and a 24.44 percentage point increase in ROIC ($p < 0.05$). These findings are economically substantial and statistically robust, indicating that gender-diverse leadership teams make a meaningful contribution to firm profitability.

Interestingly, we find no statistically significant relationship between gender diversity and Tobin's Q, our market-based measure of performance. The coefficient for WOMEN on Q_tobin is negative (-0.7428) but not statistically significant ($p > 0.10$). This divergence between accounting-based and market-based performance measures suggests that while gender diversity improves operational efficiency and profitability, these improvements may not be immediately reflected in market valuations. This could indicate either market inefficiency in recognizing the value of gender diversity or that investors incorporate additional factors beyond current profitability in their valuation decisions.

Hansen's J-test confirms the validity of our instrumental variables approach for overidentifying restrictions. The test fails to reject the null hypothesis of valid instruments for all performance measures (p-values ranging from 0.3713 to 0.3812 for ROA, ROE, and ROIC), indicating that our instrument set (firm size, board independence, foreign ownership, and debt-to-equity ratio) satisfies the exclusion restriction. For Tobin's Q, the J-test p-value (0.0757) is marginally acceptable at the 5% significance level, suggesting some caution in interpreting this particular result.

For that reason, it is important to acknowledge several potential limitations of the analysis. Weak instruments can lead to biased estimates, and further tests or alternative instrument choices should be considered to reinforce the findings. Another limitation is related to model specification. The GMM framework assumes that the underlying model is correctly specified and that the moment conditions capture the true relationship between the explanatory variables and performance outcomes. Any misspecification—whether in the functional form or due to omitted variables—can potentially bias the results. The exclusion of variables that might be relevant to both leadership diversity and firm performance could also affect the reliability and generalizability of the results.

Additionally, the study is based on cross-sectional data, which limits the ability to generalize the results to different contexts, industries, or time periods. Endogeneity, while addressed through the GMM approach and instrumental variables, may still persist if unobserved factors concurrently influence both gender diversity and performance metrics.

In conclusion, while the GMM calculations appear robust for most of the performance measures under consideration, careful attention to these limitations is essential. Future research could benefit from exploring alternative instruments, incorporating a broader set of control variables, and utilizing panel data to capture dynamic effects and further validate the results.

4.3.5. Interaction Effect Analysis

To determine whether the relationship between the proportion of women on the board and corporate performance outcomes is moderated by variables such as board independence, firm size, or debt-to-equity, we performed an interaction regression analysis.

For each performance measure (ROA, ROE, ROIC, Tobin's Q), we estimated the following model:

$$Outcome = \beta_0 + \beta_1.Women + \beta_2.Moderator + \beta_3.(Women \times Moderator) + \varepsilon$$

To further examine the role of the moderator, we divided the sample into two groups using binary indicators: high (1) and low (0). For each subsample, we estimated the effect of WOMEN on performance. The differences in coefficients between the subsamples indicate how the moderator may change the strength or direction of the relationship.

By doing so, we test moderation effects both parametrically (through the inclusion of interaction terms) and non-parametrically (through subsample splits), allowing for a robust analysis of how board composition may interact with key corporate and financial characteristics.

Our results in Table 13 reveal nuanced relationships between board gender diversity and firm performance, with several key moderating factors playing significant roles. The findings suggest that the impact of women's representation on corporate boards is contingent upon specific organizational characteristics.

The interaction regression analysis identified a statistically significant interaction between board gender diversity and board independence in relation to Tobin's Q. This negative interaction coefficient suggests that the positive effect of women on boards diminishes as board independence increases. This finding challenges the conventional wisdom that combining gender diversity with strong governance mechanisms would yield synergistic benefits. Instead, it seems that women directors may contribute most significantly to firm value when operating in environments with fewer independent directors, perhaps by providing alternative monitoring mechanisms or offering unique perspectives to boards that might otherwise lack diverse viewpoints.

Figure 4 also shows the varying impact of female board representation on firm performance across different levels of the key moderating factors. For each performance metric, the graph compares firms with no women on the board to those with women while simultaneously stratifying the moderator variables into three quantile levels: low (10th percentile), medium (50th percentile), and high (90th percentile).

For ROA, the presence of women on boards generally contributes to higher returns, particularly at the 10th percentile of board independence and debt-to-equity levels. This suggests an enhanced performance benefit when formal governance mechanisms (e.g., board independence) or financial risk elements (such as leverage) are relatively low. A similar pattern is observed for Return on Equity (ROE), where firms with greater female representation show substantial increases in profitability—most notably in smaller firms and under lower debt conditions. These findings imply that in environments with lower financial risk or when board structures are less independent, the influence of gender diversity is more pronounced.

Table 13: Interaction Regression Analysis.

Outcome	Moderator	Interaction Coefficient	Interaction P-Value
ROA	Board Independence	-0.13247	0.32216
ROA	Firm Size	-0.00193	0.76848
ROA	Leverage	0.00179	0.92971
ROE	Board Independence	-0.46343	0.21002
ROE	Firm Size	0.00071	0.96860
ROE	Leverage	0.07957	0.15077
ROIC	Board Independence	-0.41877	0.14096
ROIC	Firm Size	0.00353	0.79917
ROIC	Leverage	0.04157	0.31776
Q_TOBIN	Board Independence	-5.09372**	0.04303
Q_TOBIN	Firm Size	0.09703	0.41741
Q_TOBIN	Leverage	-0.12520	0.74437

Note: * P<0.1, ** P<0.05, *** P<0.01

For the Return on Invested Capital (ROIC), the graph reveals a consistent positive effect of women on boards, with the strongest gains at the lower quantiles of the moderating variables. This trend suggests that female directors may be particularly effective in enhancing capital efficiency in contexts where firms are less burdened by high leverage or where board independence is relatively limited. Lastly, the market valuation measure, as captured by Tobin's Q, demonstrates a robust association with female board representation, especially in smaller firms and under lower debt conditions. This not only reflects potential operational benefits but also suggests that the market recognizes the value of diversity within the governance structures of firms with lower risk profiles.

Overall, this result supports the hypothesis that female board representation is positively related to firm performance, with the magnitude of these effects varying significantly according to firm-specific moderators. The results underscore the importance of incorporating a nuanced, context-dependent perspective when evaluating the efficacy of gender diversity in corporate governance. These insights invite further empirical investigations into how board composition interacts with corporate structures and financial policies to influence operational outcomes and market perceptions.

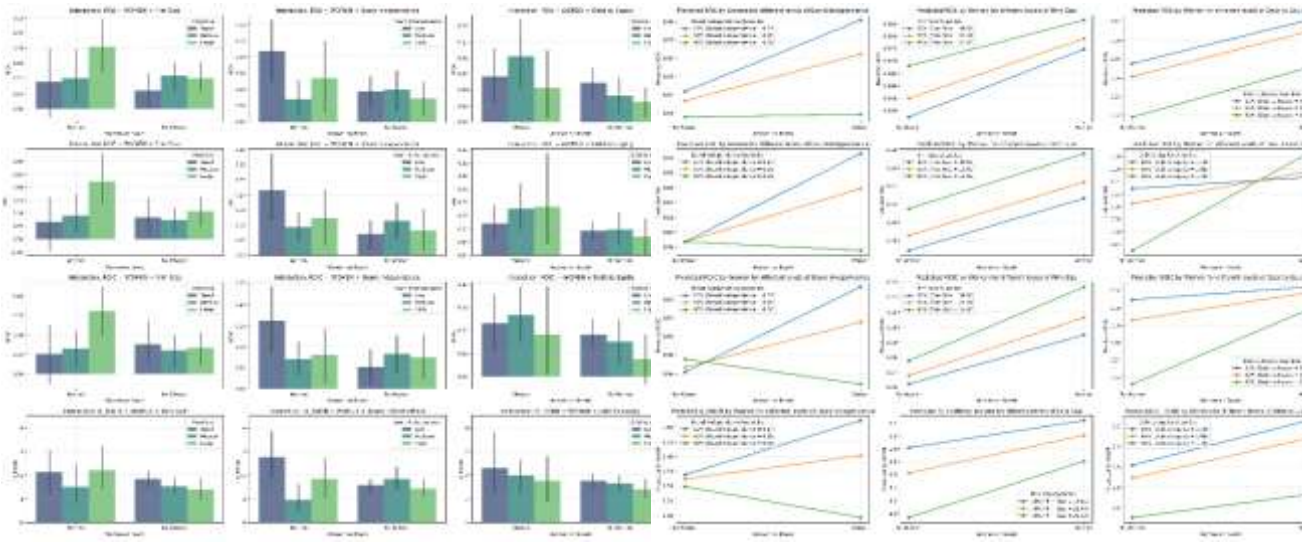

Figure 4: Interaction Effects.

The subsample analysis in Table 14 further corroborates this interpretation. In firms with low board independence, women's representation is associated with a substantial positive effect on Tobin's Q (β = 0.695, p = 0.062), while no significant relationship exists in firms with high board independence (β = 0.022, p = 0.950). This stark contrast suggests that women directors may serve as substitutes for formal independence mechanisms, particularly in enhancing market valuation.

Firm size emerges as another critical moderator, particularly for accounting-based performance measures. The effect of women directors on ROE is positive and significant in larger firms (β = 0.093, p = 0.037) but negligible in smaller firms (β = 0.004, p = 0.958). Similarly, for ROIC, women's representation shows a positive association in larger firms (β = 0.072, p = 0.029) but not in smaller ones (β = -0.006, p = 0.920). These findings align with resource dependence theory, suggesting that larger firms may provide women directors with the necessary resources and platforms to effectively leverage their expertise and networks, thereby enhancing financial performance.

Table 14: Subsample Analysis Summary.

	Moderator	High_WOMEN coefficient	High_WOMEN P-Value	Low_WOMEN coefficient	Low_WOMEN P-Value	Coefficient Difference
ROA	Board Independence	0.0215	0.3010	0.0294	0.1046	-0.0079
ROA	Firm Size	0.0260*	0.0855	0.0131	0.6127	0.0128
ROA	Leverage	0.0217	0.2133	0.0342	0.1063	-0.0125
ROE	Board Independence	0.0367	0.5273	0.0967*	0.0522	-0.0600
ROE	Firm Size	0.0925**	0.0367	0.0036	0.9577	0.0889
ROE	Leverage	0.0746	0.2327	0.0700*	0.0930	0.0046
ROIC	Board Independence	0.0118	0.7889	0.0739*	0.0567	-0.0622
ROIC	Firm Size	0.0719**	0.0290	-0.0055	0.9198	0.0774
ROIC	Leverage	0.0400	0.3641	0.0592	0.1104	-0.0191
Q_TOBIN	Board Independence	0.0216	0.9504	0.6946*	0.0618	-0.6730
Q_TOBIN	Firm Size	0.5884	0.1031	0.2606	0.5125	0.3279
Q_TOBIN	Leverage	0.3028	0.3726	0.5892	0.1282	-0.2865

Note: * P<0.1, ** P<0.05, *** P<0.01

Interestingly, the relationship between women directors and ROA shows a marginally significant positive effect in larger firms (β = 0.026, p = 0.086), indicating that the asset utilization efficiency may also benefit from gender diversity under certain conditions. The leverage moderator shows a less pronounced pattern, with only a marginally significant effect of women directors on ROE in firms with low leverage (β = 0.070, p = 0.093).

These findings contribute to the ongoing debate about the business case for board gender diversity by highlighting the importance of contextual factors. Rather than assuming a universal relationship between women's representation and firm performance, our results suggest that organizational characteristics create boundary conditions that determine when and how gender diversity translates into financial benefits. The substitution effect between women directors and board independence regarding firm valuation is particularly noteworthy, as it suggests that the market recognizes the

monitoring value that women bring to less independent boards.

From a practical perspective, these results suggest that firms should consider their specific governance structures and organizational characteristics when determining the composition of their boards. The benefits of gender diversity may be most pronounced in certain contexts, such as larger firms or those with less independent boards. This contextual approach to board gender diversity moves beyond simplistic prescriptions and recognizes the complex interplay between director characteristics and organizational factors in shaping firm outcomes.

4.4. Robustness Check

To validate the reliability of our findings, we conducted two distinct robustness checks using alternative methodological approaches: quantile regression and winsorized variables. These complementary analyses provide a more comprehensive understanding of the relationships between board gender diversity, firm size, foreign ownership, and financial performance.

4.4.1. Quantile Regression

Our quantile regression analysis, presented in Figure 5 and Table 16, reveals nuanced patterns in the relationship between board gender diversity and firm performance that would be obscured in traditional mean-based regression approaches. The results demonstrate that the impact of female board representation varies substantially across different segments of the performance distribution, indicating significant heterogeneity in how gender diversity affects corporate outcomes.

For accounting-based performance measures, the presence of women on corporate boards exhibits a particularly pronounced effect among high-performing firms. Specifically, at the 90th percentile of the performance distribution, female board representation is associated with significant increases in ROA (coefficient = 0.0477, $p < 0.05$), ROE (coefficient = 0.1733, $p < 0.01$), and ROIC (coefficient = 0.1122, $p < 0.01$). This pattern suggests that gender diversity may serve as a catalyst that enhances the effectiveness of already well-functioning governance systems, potentially by introducing complementary perspectives and monitoring approaches that refine strategic decision-making in these high-performing contexts.

Interestingly, the market-based performance measure, Tobin's Q, displays a somewhat different pattern. Here, the positive effect of gender diversity is evident at the median (coefficient = 0.4686, $p < 0.05$) and becomes substantially stronger at the upper tail of the distribution (coefficient = 1.6346, $p < 0.01$). This finding suggests that investors may recognize the value-enhancing potential of gender-diverse boards, even for firms with moderate performance levels, with the effect becoming particularly pronounced for firms with premium market valuations.

The absence of significant associations at lower quantiles across all performance measures warrants careful interpretation. Rather than suggesting that gender diversity is inconsequential for underperforming firms, this pattern may reflect the presence of more fundamental governance or operational challenges in these firms that potentially overshadow the benefits of board diversity. Alternatively, it may suggest that the positive effects of gender diversity require a certain level of organizational effectiveness to fully materialize.

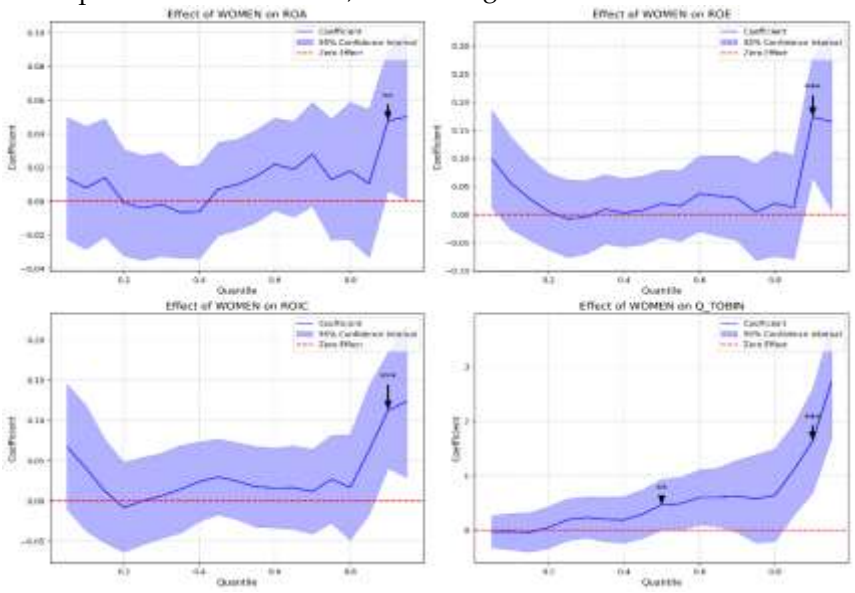

Figure 5: Quantile Regression.

Table 16: Quantile Regression.

	ROA	ROE	ROIC	Q_TOBIN
Quantile	Coefficient	Coefficient	Coefficient	Coefficient
0.1	0.0079	0.0558	0.0405	-0.0284
0.25	-0.0041	-0.0074	-0.0002	0.1880
0.5	0.0098	0.0193	0.0246	0.4686**
0.75	0.0128	0.0044	0.0271	0.5748
0.9	0.0477**	0.1733***	0.1122***	1.6346***

Note: * P<0.1, ** P<0.05, *** P<0.01

4.4.2. Winsorized Variables

The second robustness check employs winsorization, which mitigates the influence of extreme values by capping them at the 5th and 95th percentiles. This approach is particularly valuable for financial data that may contain outliers. The results with winsorized dependent variables in Table 17 largely corroborate our main findings.

The coefficient on WOMEN is statistically significant for ROIC (0.034, $p < 0.1$) and remains significant for Tobin's Q (0.596, $p < 0.05$), suggesting that extreme observations do not drive the positive effect of gender diversity on capital efficiency and market valuation.

Foreign ownership continues to demonstrate a strong positive association with all performance measures: ROA (0.304, $p < 0.01$), ROE (0.978, $p < 0.01$), ROIC (0.730, $p < 0.01$), and Tobin's Q (4.340, $p < 0.1$). The negative relationship between SIZE and Tobin's Q (-0.237, $p < 0.01$) also persists after winsorization, further validating this finding.

Table 17: Winsorized Regression Results (With Robust Standard Errors).

Variable	ROA (win)	ROE (win)	ROIC (win)	Q_TOBIN (win)
Constant	0.044	-0.023	0.078	6.417***
WOMEN	0.016	0.039	0.034*	0.596**
SIZE	-0.001	0.002	-0.002	-0.237***
FO	0.304***	0.978***	0.730***	4.340*
R-squared	0.053	0.114	0.088	0.116
Adj. R-squared	0.037	0.099	0.072	0.101

Note: * P<0.1, ** P<0.05, *** P<0.01

4.4.3. Synthesis Of Robustness Findings

Collectively, these robustness checks provide strong validation for our main findings. Across different methodological approaches —quantile regression and winsorization— several consistent patterns emerge:

1. The positive association between female board representation and market valuation (Tobin's Q) remains robust across all specifications, indicating that the market values gender diversity on boards, regardless of the estimation method or control variables included.
2. Foreign ownership consistently demonstrates a strong positive relationship with all performance measures across all robustness checks, reinforcing its role as a key driver of financial performance.
3. The negative relationship between firm size and Tobin's Q is consistently significant across all specifications, indicating that smaller firms tend to have higher market-to-book ratios, which may reflect more significant growth opportunities.

These robustness checks not only strengthen the credibility of our original findings but also provide a more nuanced understanding of the complex relationships between board characteristics, ownership structure, and firm performance. The consistency of results across different methodological approaches underscores the reliability of our conclusions regarding the positive effects of board gender diversity on financial performance.

5. DISCUSSION

The empirical results presented in this study provide several important insights into the role of board gender diversity in shaping firm performance in Saudi Arabia, a market undergoing significant socio-economic reform. Our findings suggest that even modest increases in female representation on corporate boards are associated with improvements in both accounting-based profitability measures and market valuations.

One of the key contributions of our research is its demonstration of a consistent, positive relationship between board diversity and firm performance, albeit with varying degrees of statistical significance across different model specifications. The robustness of these results reinforces the notion that gender diversity is not merely a symbolic inclusion but a

strategic asset for firms. In a country where only 20% of boards currently feature women, our evidence underscores the substantial opportunity for enhancing corporate governance frameworks through greater female representation. From an agency theory perspective, our findings support the notion that female directors can enhance board effectiveness by improving oversight and mitigating agency conflicts.

One of the novel contributions of this research is the identification of contextual drivers that shape the impact of board gender diversity. Specifically, our extended analyses revealed that the benefits of having female directors are contingent upon corporate characteristics, including board independence, firm size, and leverage. For example, the substitution effect observed between board independence and gender diversity suggests that, in firms where board oversight mechanisms may be less rigorous, the inclusion of women on the board complements traditional governance structures by providing additional screening and monitoring capabilities. Furthermore, the amplified positive effect on Tobin's Q in smaller firms and under lower debt conditions underscores that market participants perceive female board representation as particularly valuable in environments where organizational agility and prudent financial management are critical.

At the same time, our study adds nuance to the resource dependence argument, illustrating that diverse boards can bring unique external linkages and a broader range of perspectives that enrich strategic deliberations. The positive association between diversity and Tobin's Q in some estimations implies that the market recognizes these qualitative benefits, translating them into higher valuations. This aligns with the view that gender diversity, by introducing fresh insights and fostering innovation, enables firms to adapt more successfully to dynamic market conditions.

The role of foreign ownership emerged as another significant determinant of firm performance. The strong positive association between foreign investment and all performance measures reflects a dual dynamic: not only does it signal confidence in the firm's governance practices and strategic orientation, but it also suggests that international stakeholders may appreciate the enhanced decision-making quality that comes with a diverse board composition. Such findings support the view that globalization and the adoption of international norms in corporate governance can serve as catalysts for improved firm outcomes.

In addition to these substantive findings, the study makes methodological contributions by addressing potential endogeneity concerns through the use of advanced econometric techniques, including instrumental variable analysis, propensity score matching, structural equation modeling, and generalized method of moments estimation. The robustness checks—particularly the quantile regression and the analysis using winsorized variables—further bolster the credibility of the observed relationships, revealing that the positive impact of female board representation is most pronounced among high-performing firms.

Despite these positive findings, our study also highlights the challenges inherent in transforming traditional business environments. Cultural and institutional inertia may pose significant hurdles to the rapid adoption of diversity-enhancing practices. However, the strong performance associations observed in this study provide a compelling economic rationale for overcoming these barriers. As Saudi Arabia continues to move forward under Vision 2030, the case for advancing gender diversity on boards becomes increasingly persuasive—not only as a matter of social equity but also as a catalyst for corporate success.

In conclusion, our discussion reinforces the strategic value of board gender diversity in enhancing firm performance. It invites further exploration into the mechanisms behind these effects and suggests that both private and public sector stakeholders have a role to play in promoting governance practices that fully harness the benefits of diverse leadership. Future research could extend our findings by exploring industry-specific impacts, longitudinal trends, and the integration of other diversity dimensions, ultimately contributing to a richer understanding of how corporate governance reforms can drive sustainable economic growth in emerging markets.

6. IMPLICATIONS AND RECOMMENDATIONS

Our findings contribute to the literature on corporate governance in several ways. First, they provide empirical support for resource dependence and agency theories within a unique institutional context, suggesting that diverse boards can enhance firm performance by improving resource acquisition and monitoring. Second, they highlight the importance of considering multiple performance measures when examining the effects of governance mechanisms, as different aspects of firm performance may be differently affected. Third, they emphasize the need for robust methodological approaches and

extensive robustness checks in corporate governance research. Finally, they advocate for a nuanced approach to board composition—one that considers both the qualitative contributions of board members and the structural characteristics of the firm. Such an approach not only enhances corporate transparency and decision-making but also contributes to the broader agenda of fostering inclusive growth.

Our findings suggest that increasing gender diversity on boards may enhance firm performance, particularly in terms of market valuation, for corporate leaders and board members in Saudi Arabia. Companies should view board diversity not merely as a compliance issue or social responsibility initiative but as a potential source of competitive advantage. Nominating committees should actively seek qualified female candidates for board positions and create inclusive board cultures that value diverse perspectives.

For investors, our results indicate that board gender diversity and foreign ownership may serve as signals of good governance and potential future performance. Investors may want to consider incorporating these factors into their investment decision-making processes, especially when investing in emerging markets where information asymmetries are more pronounced.

For policymakers, our findings provide empirical evidence in support of initiatives promoting greater female representation in corporate leadership. The Saudi government's efforts to increase women's economic participation under Vision 2030 align with value-creating governance practices. Policymakers might consider additional incentives or requirements to accelerate the integration of women into corporate boards, given the positive performance implications.

The Saudi Arabian context presents unique challenges and opportunities for board gender diversity. The kingdom's conservative social norms have historically limited women's participation in the workforce, particularly in leadership positions. However, recent reforms, including lifting the ban on women driving and relaxing gender segregation rules, have created a more conducive environment for female advancement.

Our findings suggest that, even in this traditionally conservative context, the benefits of gender diversity are evident in improved firm performance. This suggests that the economic benefits of diverse leadership may extend beyond cultural and institutional boundaries, although the mechanisms by which diversity impacts performance may vary across different contexts.

7. LIMITATIONS AND FUTURE RESEARCH

Despite the robust nature of our findings, several limitations warrant consideration when interpreting the results. First, our analysis relies on a binary measure of gender diversity (presence or absence of at least one female director), which, while appropriate given the nascent stage of female board representation in Saudi Arabia, may not capture the nuanced effects of varying levels of gender diversity. As female representation increases over time, more sophisticated measures may reveal threshold effects or non-linear relationships.

Second, our cross-sectional approach limits our ability to establish causality definitively and restricts the ability to draw causal inferences over time. Although we employ instrumental variables and control for various firm characteristics, unobservable factors may still influence both board composition and firm performance. The potential for reverse causality—where better-performing firms are more likely to appoint female directors—cannot be entirely ruled out without longitudinal data spanning a longer period.

Third, our sample size, while representative of the Saudi market, is relatively modest compared to studies conducted in more developed markets. This limitation reflects the challenges of data collection in emerging economies but may affect the generalizability of our findings to other contexts.

Fourth, our study does not fully explore the specific mechanisms through which gender diversity influences firm performance. While we propose theoretical pathways based on agency and resource dependence theories, the precise channels—such as improved decision-making processes, enhanced stakeholder relations, or increased innovation—remain somewhat opaque and warrant further investigation.

These limitations suggest several promising avenues for future research. First, longitudinal studies tracking the evolution of board diversity and firm performance over time would provide stronger causal evidence and help identify how the relationship changes as Saudi Arabia's governance reforms mature. Such research could leverage natural experiments, such as regulatory changes or industry-specific shocks, to better isolate the effects of gender diversity.

Second, qualitative research examining the dynamics of board interactions and decision-making processes could shed light on the mechanisms by which female directors influence firm outcomes. Case studies and interview-based research might reveal how gender-diverse boards approach strategic challenges differently and how these approaches

translate into performance differentials.

Third, future studies could explore the interaction between gender diversity and other dimensions of board composition, such as educational background, professional experience, and international exposure. A more comprehensive understanding of how various diversity dimensions complement or substitute for one another would enrich our understanding of optimal board design.

Fourth, comparative analyses examining the gender diversity-performance relationship across different Gulf Cooperation Council (GCC) countries would provide insights into how varying institutional environments moderate the benefits of board diversity. Such research could help identify best practices for promoting effective governance in the region.

Finally, as Saudi Arabia continues to implement Vision 2030, researchers could investigate how changing societal attitudes toward gender roles influence the selection, retention, and effectiveness of female directors. This sociological perspective would complement the economic focus of the current study and provide a more holistic understanding of the evolving role of women in Saudi corporate leadership.

In conclusion, while our study provides compelling evidence of the positive association between board gender diversity and firm performance in Saudi Arabia, it represents only an initial step in understanding this complex relationship. As the Kingdom continues its ambitious reform agenda, the evolving landscape of corporate governance offers fertile ground for researchers seeking to understand how diversity shapes organizational outcomes in emerging markets.

8. CONCLUSION

This study provides robust evidence that board gender diversity is positively associated with firm performance in Saudi Arabia, particularly in terms of market valuation. Our findings suggest that companies with female board members tend to outperform their counterparts with all-male boards across various financial metrics, even after controlling for firm size, foreign ownership, and other factors. The positive relationship is also pronounced in smaller firms, particularly those with higher levels of foreign ownership, suggesting that the benefits of diversity may be contingent upon complementary governance structures and organizational characteristics. These results are consistent across multiple methodological approaches and robustness checks, enhancing their credibility and practical relevance.

As Saudi Arabia continues to evolve and integrate into the global economy, effective corporate governance becomes increasingly important for attracting investment and ensuring sustainable growth. Board gender diversity represents a valuable governance mechanism that may enhance firm performance while addressing broader social and ethical concerns. By promoting gender-diverse boards, companies may not only improve their financial outcomes but also contribute to more inclusive and equitable business environments.

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REFERENCES

Abd El Basset, F., Bell, R., & Al Kharusi, B. (2024). Reducing barriers to female entrepreneurship in Oman: does family matter? Journal of Enterprising Communities: People and Places in the Global Economy, 18(6),

1241-1260.
Abdullah, S. N., Ismail, K. N. I. K., & Nachum, L. (2016). Does having women on boards create value? The impact of societal perceptions and corporate governance in emerging markets. Strategic Management Journal, 37(3), 466-476.
Adams, R. B. (2024). The limits of board diversity: When does gender inclusivity fail to add value? *Corporate Governance: An International Review*, 32(2), pp. 210–230.
Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291-309.
Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. The Quarterly Journal of Economics, 127(1), 137-197.
Aladwey, L. M. A., & Alsudays, R.A. (2023). Does the Cultural Dimension Influence the Relationship between Firm Value and Board Gender Diversity in Saudi Arabia, Mediated by ESG Scoring? Journal of Risk and Financial Management 16: 512.
Al-Hussainan, S., & Kamal, Y. (2024). Gender diversity in Arab family businesses: A catalyst for governance reform? *Corporate Governance: An International Review*, 32(1), pp. 45–63.
Al-Janadi, Y., Abdul Rahman, R., & Alazzani, A. (2016). Does government ownership affect corporate governance and corporate disclosure? Evidence from Saudi Arabia. Managerial Auditing Journal, 31(8/9), 871-890.
Alshareef, M. N., & Sulimany, H.G.H. (2024). Effects of board gender and foreign directorship on the financial sustainability of Saudi listed firms: Does family ownership matter? Heliyon, Volume 10, Issue 20, e39359.
Alsharif, A. & Bashir, F. (2023). Economic transformation under Saudi Vision 2030: challenges and opportunities. *Journal of Arabian Studies*, 13(1), pp. 45–60.
Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. Journal of business ethics, 97, 207-221.
Bennouri, M., Chtioui, T., Nagati, H., & Nekhili, M. (2018). Female board directorship and firm performance: What really matters? Journal of Banking & Finance,88, 267-291.
Campbell, K., & Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. Journal of Business Ethics, 83(3), 435-451.
Carter, D.A., D'Souza, F., Simkins, B.J. & Simpson, W.G. (2010). The Gender and Ethnic Diversity of US Boards and Board Committees and Firm Financial Performance. Corporate Governance: An International Review, 18, 396-414.
Conyon, M. J., & He, L. (2017). Firm performance and boardroom gender diversity: A quantile regression approach. Journal of Business Research, 79, 198-211.
Douma, S., George, R., & Kabir, R. (2006). Foreign and domestic ownership, business groups, and firm performance: Evidence from a large emerging market. Strategic Management Journal, 27(7), 637-657.
Eulaiwi, B., Al-Hadi, A., Taylor, G., Al-Yahyaee, K. H., & Evans, J. (2016). Multiple directorships, family ownership and the board nomination committee: International evidence from the GCC. Emerging markets review, 28, 61-88.
Faccio, M., Marchica, M.T., & Mura, R. (2016). CEO gender, corporate risk-taking, and the efficiency of capital allocation. Journal of Corporate Finance, 39, 193-209.
Ferreira, M. A., & Matos, P. (2008). The colors of investors' money: The role of institutional investors around the world. Journal of Financial Economics, 88(3), 499-533.
Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. Academy of Management Review, 9(2), 193-206.
Hillman, A. J., Shropshire, C., & Cannella, A. A. Jr. (2007). Organizational predictors of women on corporate boards. Academy of management journal, 50(4), 941-952.
Hoobler, J. M., Masterson, C. R., Nkomo, S. M., & Michel, E. J. (2018). The business case for women leaders: Meta-analysis and implications. *Journal of Management*, *44*(6), 2471–2499.
Ibrahim, N. A. & Angelidis, J.P. (1994). Effect of Board Members Gender on Corporate Social Responsiveness Orientation. Journal of Applied Business Research, 10, 35.
Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. Journal of Financial Economics, 3(4), 305-360.
Khanna, T., & Palepu, K. (2000). Is group affiliation profitable in emerging markets? An analysis of diversified

Indian business groups. The Journal of Finance, 55(2), 867-891.
Kılıç, M., & Kuzey, C. (2016). The effect of board gender diversity on firm performance: evidence from Turkey. Gender in management: An international journal, 31(7), 434-455.
Kirsch, A. (2023). The paradox of diversity initiatives: When good intentions backfire. *Organization Science*, *34*(1), 1–25.
Liu, Y. (2021). Gender diversity and firm innovation in China. *Asia Pacific Journal of Management*, *38*(4), 1369–1395.
Marinova, J., Plantenga, J., & Remery, C. (2016). Gender diversity and firm performance: Evidence from Dutch and Danish boardrooms. The International Journal of Human Resource Management, 27(15), 1777-1790.
Matsa, D. A., & Miller, A. R. (2013). A female style in corporate leadership? Evidence from quotas. American Economic Journal: Applied Economics, 5(3), 136-169.
Ming, C., & Hock Eam, L. (2016). Estimating the nonlinear effects of female directors on financial performance: The case of Malaysian initial public offering companies. Gender in Management: An International Journal, 31(2), 97-113.
Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. Harper & Row.
Post, C., & Byron, K. (2015). Women on boards and financial performance: A meta-analysis. The Academy of Management Journal, 58(5), 1546–1571.
Post, C., & Byron, K. (2023). Women on boards and firm value: A meta-analysis. *Journal of Corporate Finance*, 71, p. 102345.
Post, C., Rahman, N., & Rubow, E. (2020). Board gender diversity and firm performance: The role of national culture. *Journal of Business Ethics*, *173*(2), 329–346.
Rao, K., & Tilt, C. (2016). Board composition and corporate social responsibility: The role of diversity, gender, strategy and decision making. Journal of business ethics, 138, 327-347.
Saudi Vision 2030 (2023). Saudi Vision 2030: Mid-Term Progress and Challenges
Setó-Pamies, D., & Lozano, J. M. (2024). The ethical edge: How female directors shape corporate social responsibility. *Journal of Business Ethics*, 189(3), pp. 501–520.
Shukeri, S. N., & D Alfordy, F. (2022). Female director in boardroom: Does it affect board compensation package and firm performance in Saudi Arabia? Cogent Business & Management, 9(1).
Terjesen, S., & Sealy, R. (2024). Beyond tokenism: Board gender diversity and long-term firm value. *Journal of Business Ethics*, 189(1), pp. 1–18.
Terjesen, S., Couto, E. B., & Francisco, P. M. (2016). Does the presence of independent and female directors impact firm performance? A multi-country study of board diversity. Journal of Management & Governance, 20, 447-483.