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Article

The moderating influence of firm size in the relation between gender balance in board rooms and capital structure

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Abstract: Using company size as a moderator, this article examines the MENA region's gender balance on boards and how it influences capital structure. The study uses the Generalized Method of Moments (GMM) estimate technique to analyze data from a sample of 556 non-financial organizations across 10 MENA countries from 2010 to 2023. The results show that a lower debt ratio is connected with a higher percentage of female board members. Further steps towards debt reduction include increasing the number of independent female board members and decreasing the board's overall size. The opposite is true for larger enterprises, more profitability, more expansion opportunities, and macroeconomic variables like inflation and GDP growth, which tend to raise the debt ratio. Capital structure decisions in the MENA area are influenced by gender diversity on boards and business characteristics. Therefore, Companies in the MENA area would do well to support initiatives that increase the representation of women on corporate boards. One way to achieve this goal is to establish gender diversity targets or launch programs to increase the number of women serving on boards of directors, particularly in positions of power.

Keywords: capital structure; gender diversity; firm size; GMM; MENA region; agency theory
JEL Classification: G30; G32; G34

1. Introduction

Board diversity is essential for the promotion of sustainable business growth, the improvement of decision-making, and the promotion of effective corporate governance. A diverse board, which is comprised of individuals with a variety of backgrounds, perspectives, and expertise, enhances risk management, reduces groupthink, and promotes innovation. Subsequently encourages stakeholder trust by illustrating a dedication to ethical leadership (Abinzano et al., 2023). Gender diversity has gathered substantial attention due to its influence on corporate financial decisions, such as capital structure, across the diverse dimensions of board diversity. Research indicates that gender-diverse boards are more likely to implement financial policies that are more conservative, which results in increased firm stability and reduced financial risk (Adusei et al., 2019). Female directors frequently contribute to prudent decision-making by reducing excessive reliance on debt and advocating for balanced financing strategies. Additionally, companies that have a higher degree of gender diversity on their boards tend to have more positive relationships with investors and creditors, which can result in enhanced access to financing at favorable terms. This ultimately affects a company's capital structure by optimizing the balance between debt and equity, thereby guaranteeing long-term financial sustainability (Awad et al., 2023).

Gender Diversity has garnered significant interest across the decades for the involvement of women on board of corporation as a way of strengthening business leadership and administration (Nguyen et al., 2020). Board of directors performs a significant function in managing the company's capital structure, that is important both regular company operations and investing initiatives. Financial leverage denotes the utilization of borrowed capital to fund a company's operations and investments, aiming to augment returns for shareholders. It is essential in corporate finance as it allows organizations to broaden their operations, capitalize on growth possibilities, and optimize profitability (Ayagre et al., 2024). Effectively administered financial leverage can result in elevated earnings per share and enhanced returns on equity. Excessive dependence on debt can increase financial risk, rendering companies more vulnerable to economic recessions and interest rate variations. To achieve long-term sustainability, organizations must equilibrate debt and equity financing, guaranteeing the fulfilment of financial obligations while preserving operational flexibility (Abu Khalaf and Awad, 2024). An effectively organized financial leverage plan enhances business resilience, bolsters investor confidence, and aids in a company's overall financial stability and market competitiveness. Company factors such as assets tangibility, firm size, growth and profitability help members to acquire the required finances. The current body of research on the association among capital structure and gender diversity has been concentrated on developed markets (Gong et al., 2023). This has resulted in a notable lack of knowledge on the functioning of these dynamics in rising regions such as the MENA countries (Dwaikat et al., 2021). In addition, although numerous investigations have examined the immediate impact of board gender diversity on a company's profitability, there is a scarcity of study addressing the interplay between gender diversity and other factors, such as firm characteristics (company size, profitability), Board characteristics (Board size and independent directors) and macroeconomic conditions, in shaping a company's capital structure (Benkraiem et al., 2018). The current study objectives to fill such gaps by examining how the size of a company influences the linking between the diversity of its board members in terms of gender and its capital structure in the MENA region. This research provides fresh perspectives on the distinct economic and cultural environments of these markets.

The size of a company significantly moderates the association between gender diversity on corporate boards and decisions regarding capital structure. More substantial corporations typically possess intricate financial frameworks, enhanced access to capital markets, and more stringent governance mandates, which can intensify the impact of gender-diverse boards on funding decisions (Gharios et al., 2024). Agency theory posits that larger enterprises experience heightened agency conflicts, whereas gender-diverse boards may improve oversight and decision-making, potentially resulting in more favorable capital structures. Resource dependency theory posits that larger organizations get advantages from board diversity by utilizing varied perspectives and networks to secure a broader array of financing alternatives, therefore enhancing capital allocation. Moreover, institutional theory asserts that larger corporations face heightened legal and stakeholder demands to implement inclusive governance practices, hence rendering gender diversity a more critical element in financial decision-making (Elzahar et al., 2022). Conversely, smaller enterprises

typically exhibit concentrated ownership, limited financing alternatives, and diminished external oversight, thereby lessening the direct influence of board diversity on capital structure. Consequently, company size impacts the relationship between gender diversity and financial leverage, with the consequences being more significant in larger organizations due to enhanced governance mechanisms and external constraints (Ghosh, 2022).

The purpose of this research is to investigate the relationship between board gender diversity and capital structure in non-financial organizations in the MENA area, with a specific emphasis on how business size influences this relationship. The study's goal is to provide insights into how gender diversity on corporate boards effects firm debt ratios, as well as how this effect is affected by firm size. Based on the previous discussion the research question that this paper is trying to answer is: How does board gender diversity affect the capital structure of non-financial organizations in the MENA area, and how does business size impact this relationship? Therefore, this empirical investigation hypothesizes that there is a negative relation between board gender diversity and capital structure.

The present research investigates the impact of gender diversity among directors on the financial practices of publicly traded non-financial corporations in the MENA region, utilizing these theoretical frameworks. The MENA area has achieved incremental advancements in promoting board diversity, especially in woman representation; yet, substantial hurdles persist (Khalaf et al., 2023). Regulatory authorities and governmental initiatives in nations such as the UAE, Saudi Arabia, and Egypt have established mandates and rules to enhance the representation of women and varied expertise on company boards. The UAE Securities and Commodities Authority has established quotas for female representation, whereas Saudi Arabia's Vision 2030 prioritizes gender inclusion in senior positions (Nam and Ryu, 2024). Nonetheless, cultural and institutional impediments persistently hinder the speed of diversity, as several corporations maintain homogeneous boards predominantly composed of male directors. Although institutional investors and international organizations promote enhanced diversity, its implementation differs among countries, industries, and corporate governance frameworks. In industries characterized by substantial foreign investment or multinational involvement, board diversification is more pronounced, while family-owned and state-controlled firms demonstrate slower advancement (Shahzad et al., 2022). Although the MENA area is progressing in promoting board diversity, the level of encouragement is variable, with legal reforms and corporate governance standards significantly influencing future developments.

The findings indicate that the higher the gender diversity contribute to a reduction in banking debt. The results presented here confirm the resource-based perspective, demonstrating that female directors, due to their unique psychological characteristics, act as significant assets in mitigating financial and bankruptcy risks while enhancing access to alternative financing resources, such as trade credit, for corporate operations. The study indicates that female directors influence capital structure, resulting in a constant reduction in long-term and financial debt in smaller enterprises. Mitigating financial and insolvency risks underscores the importance of gender diversity on boards in preventing agency conflicts and costs. The paper addresses deficiencies in the examination of board gender diversity's impact on corporate capital structures, a

relatively underexplored area. To enhance understanding of the relationship between gender diversity and capital structure. Moreover, it provides additional evidence that independent female directors assist corporations in alleviating their long-term and financial liabilities. Empirical studies indicate that female executive directors significantly influence the determination of financial debt levels. It illustrates how gender diversity in boardrooms can affect debt structure and substitute bank dependency with trade debt.

The structure of this paper is as follows; Section two provides a selected literature review and hypotheses development. Section Three highlights the sample used, and the estimation technique applied. While section four provides the findings and analysis of results. Section five states the closing remarks and conclusion.

2. Literature review

2.1. Theoretical background

The literature on organizational capital structures offers several insights to assist the board of directors in selecting the optimal capital structure to enhance shareholder value. The optimal capital structure is determined by balancing bankruptcy costs with the interest tax shield, as posited by the trade-off theory (Ben Saad et al., 2022). The Agency theory existence informs prospective financiers about dynamics between directors and shareholder, as well as between stockholders, debtors and how these dynamics affects organization ability to take on debt (Tripathi, 2019). According to the financial pecking order theory, business should if feasible use their own resources to cover deficits. When internal resources are insufficient, businesses to take external debt (Frank et al., 2020). Businesses may try to manipulate market movements by providing debt when stock prices are less and equity whenever share price rise, reflecting the preferences of the market for debt and equity in various circumstances (Kontuš et al., 2023). Numerous academics have concentrated on characteristics such as earnings volatility, asset tangibility, growth, business non-debt tax shield, size, profitability, and prospective growth in their analysis of the determinants of a corporation's capital structure (Geyer-Klingeberg et al., 2018). Research also considers institutional and nation-specific elements, including macroeconomic indicators, legal frameworks, taxation policies, and company governance (Poletti-Hughes et al., 2022). Moreover, examining how it affects organizations' financial practices has placed a lot of emphasis on corporate governance (Elzahar et al., 2022). Based on the previous discussion gender diversity frequently contribute to more careful financial strategies, less dependence on excessive debt, and enhanced financial stability. Research indicates that companies exhibiting greater gender diversity typically maintain lower leverage ratios, since women are generally more risk-averse in financial decision-making, hence fostering sustainable long-term growth (Zhang et al., 2024). Considering the influence of board size; larger boards may result in more diversified viewpoint involving less risky financing options. Also, board independence is essential since it can result in improve choices regarding capital structure and enhanced oversights procedure.

2.2. Previous studies and hypothesis development

The relationship between board gender diversity and a firm's debt

Diéguez-Soto et al. (2018) and Granado-Peiró et al. (2017) revealed a link between a firm's debt level and the gender diversity of the board. In a similar manner López-Delgado and Diéguez-Soto (2020) showed that adding female directors to boards results in lower debt levels. Emphasizing the importance of board gender diversity in lowering a firm's debt. Similarly, Rossi et al. (2018) lends credibility to this conclusion. However, the effect of female directors on debt maturity might differ, for example, Briozzo et al. (2019) studied the debt maturity structures of Spanish and Argentinean SMEs and concluded that while women's representation on boards did not affect the short-term debt of Argentinean companies, it does help to reduce it in Spanish companies. This implies that the impact of female directors on debt maturity depends on the situation. According to their empirical findings, female directors may persuade companies to select longer debt maturities which would be consistent with an emphasis on sustainable growth and financial stability (Sun et al., 2022). Several researchers indicates that companies that have a greater percentage of female directors typically choose longer loan maturities indicating a strategic move towards ensuring long term financial securities (Adusei et al., 2019; Li et al., 2019). Moreover, García et al. (2021) found that the debt of European Union companies is reduced when women are the directors. The examination of the capital structure of microfinance organizations, there is sensitivity to econometric models and no clear-cut association between board gender diversity and debt levels. Based on the previous discussion, the following hypothesis has been developed.

H1: There is a negative relationship between female directors and debt ratio.

The above **Table 1** provides the expected impact of the independent and moderating variables on capital structure based on the agency theory and signaling theories.

Table 1. Expected impact of variables and linked theory.

Variables	Expected Impact	Linked Theory
Independent Variable		
Board Gender Diversity	Negative	Agency Theory
Moderating Variable		
Firm Size	Positive	Signaling Theory
Authors Analysis		

3. Methodology

This research empirically investigates the impact of gender diversity on capital structure for nonfinancial companies in the MENA region. The Dependent variable is Leverage while the independent variable is Gender Diversity and Controlling for Independent Female Directors, Firm Size, Board Size, Firm Growth, Profitability, GDP and Inflation.

All variables have been collected from Refinitiv Eikon Platform from LSEG and world bank database. Any missing data were looked at from the annual reports or the relevant stock market exchange website. Furthermore, the above **Table 2** provides the procedure followed to select the final sample during the period of 2010–2023. Seven

countries were included from the Middle East region (Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi-Arab and UAE) and three countries from the North Africa region (Egypt, Morocco, and Tunisia). The final sample included 556 companies out of a total of 972 nonfinancial companies. Thus, four hundred and sixteen nonfinancial companies haven excluded due to missing data for more than five years of the total period of study under investigation.

Table 2. Sampling procedure.

Sampling Procedure	**Description**			**Total population**	**Sample Size**
1-	All listed non-financial Companies in MENA region			972	-
2-	Data Availability Consideration			-	556
3-	Selection of companies with data			-	556
4-	Period covered			-	2010–2023
Country	Population	Final Sample	Country	Population	Final Sample
Panel A: Middle East			Panel C: Full Sample		
Bahrain	20	11	Bahrain	20	11
Jordan	122	72	Egypt	172	108
Kuwait	93	59	Jordan	122	72
Oman	77	47	Kuwait	93	59
Qatar	33	18	Morocco	58	34
Saudi Arabia	270	126	Oman	77	47
UAE	75	43	Qatar	33	18
Panel B: North Africa			Saudi Arabia	270	126
Egypt	172	108	Tunisia	52	38
Morocco	58	34	UAE	75	43
Tunisia	52	38	Total	972	556
Authors Collection and Analysis					

3.1. Economic model

The following model has been used to investigate the impact of board gender diversity on the capital structure of nonfinancial firms in the MENA region.

Baseline Model

$$LEV_{i,t} = \beta_0 + \beta_1\, GenDiv_{i,t} + \beta_2\, INFD_{i,t} + \beta_3\, FSize_{i,t} + \beta_4\, BSize_{i,t} + \beta_5\, Growth_{i,t} + \beta_6\, Prof_{i,t} + \beta_7\, GDP_{t} + \beta_8\, Inf_{t} + \varepsilon_{i,t}$$

Interaction Model

$$LEV_{i,t} = \beta_0 + \beta_1\, GenDiv_{i,t} + \beta_2\, INFD_{i,t} + \beta_3\, FSize_{i,t} + \beta_4\, BSize_{i,t} + \beta_5\, Growth_{i,t} + \beta_6\, Prof_{i,t} + \beta_7\, GDP_{t} + \beta_8\, Inf_{t} + \beta_9\, GenDiv_{i,t} * FSize_{i,t} + \varepsilon_{i,t}$$

where:

- LEV is leverage which is measured by the debt ratio.
- GenDiv is Gender Diversity which is measured by the number of females on board divided by the total number of board members.
- INFD is independent female directors which is measured by the percentage of independent female directors to the total number of board members.

- FSize is firm size and measured by the natural logarithm of Total Assets.
- BSize is board size and measured by the number of directors on board.
- Growth is growth opportunities and measured by the price-to-book value per share.
- Prof is profitability and measured by the return on assets ratio.
- GDPG is the Growth in the Gross Domestic Product provided by the World Bank.
- Inf is inflation as measured by the World Bank.
- ε is the error term.

3.2. Variable measurement

The following **Table 3** provides the measurement of each variable included in our model, the main reference used to adopt the selected measurement and the source of data collected.

Table 3. Description of variables.

Variable	Measurement	Citation	Sources
Dependent Variable			
Leverage (LEV)	Debt Ratio which is debt to total assets.	(Abu Khalaf, 2024; Supyati et al., 2024)	Refinitiv Eikon Platform
Independent Variable			
Gender Diversity (GenDiv)	The number of female board members to the total number of board members	(Alshaiba and Abu Khalaf, 2024; Muien et al., 2024)	Refinitiv Eikon Platform
Moderating Variable			
Firm Size (FSize)	Natural Logarithm of Total Assets	(Ayagre et al., 2024; Gharios and Abu Khalaf, 2024)	Refinitiv Eikon Platform
Control Variables: Board Characteristics			
Independent Female Directors (INFD)	The percentage of independent female directors to the total board members	(Awad et al., 2024; Gharios et al., 2024)	Refinitiv Eikon Platform
Board Size (BSize)	The number of members on board	(Abu Khalaf and Awad, 2024; Awad et al., 2023)	Refinitiv Eikon Platform
Control Variables: Firm Characteristics			
Growth opportunities (Growth)	Price to book ratio	(Abu Khalaf et al., 2024; Ayalew and McMillan, 2021)	Refinitiv Eikon Platform
Profitability (Prof)	Return on Assets (ROA)	(Priharta et al., 2024; Wassie, 2020)	Refinitiv Eikon Platform
Control Variables: Macroeconomic Variables			
Gross Domestic Product (GDP)	GDP as an annual percentage	(Abu Khalaf and Awad, 2024; Ahmed et al., 2023)	World Bank Data
Inflation (Inf)	The annual percentage of consumer prices index.	(Akter et al. 2024; Khalaf et al., 2023)	World Bank Data

4. Data analysis

4.1. Descriptive statistic

The following **Table 4** provides several interesting descriptive statistics. Firstly, in the MENA region few of the companies had no women on board and this comes close to few researches that reported a minimum of one women on their board of directors and the medium percentage of women on the board of directors is not high, approximately 8 percent Dwaikat et al. (2021).

Table 4. Descriptive statistics.

Variables	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.
Panel A	Middle East				Panel B	North Africa		
LEV	0.15	0.86	0.34	0.241	0.12	0.90	0.46	0.421
GenDiv	0.00	0.45	0.12	0.152	0.00	0.42	0.21	0.325
INFD	0.25	0.50	0.40	0.952	0.20	0.50	0.30	0.826
BSize	6	18	10.0	0.595	7	17	12.7	0.513
FSize	9.28	24.25	15.73	2.628	8.62	22.72	14.28	3.296
Growth	0.54	2.04	1.19	0.479	0.45	2.56	1.05	0.432
ROA	0.04	0.81	0.14	0.076	0.01	0.79	0.58	0.068
GDPG	−0.08	0.09	0.05	0.845	−0.29	0.32	0.12	1.025
INF	−0.02	0.05	0.01	0.058	0.03	0.29	0.05	0.098
Panel C	Full Sample				Observations			
LEV	0.12	0.90	0.38	0.352	7784			
GenDiv	0.00	0.45	0.19	0.256	7784			
INFD	0.20	0.50	0.40	0.946	7784			
BSize	6	18	12.87	1.845	7784			
FSize	8.62	24.25	15.14	3.935	7784			
Growth	0.45	2.56	1.25	0.524	7784			
ROA	0.01	0.81	0.127	0.092	7784			
GDPG	−0.29	0.32	0.14	1.125	7784			
INF	−0.02	0.29	0.06	0.125	7784			

Secondly, the mean leverage for the MENA nonfinancial companies is 38 percent which is an acceptable level of debt compared to published empirical evidences such as Ben Hamouda et al. (2023); Komarev et al. (2019) and Latridis and Zaghmour (2013). Thirdly, the mean value for gender deviation is 19 percent which means that in case of 18 members on board then 4 female members are expected to serve on the MENA boards. Fourthly, the highest standard deviation of 3.935 for firm size which indicates high variability in firm size in the MENA region and this comes in live with results reported in Abu Khalaf and Awad (2024).

4.2. Correlation matrix

Table 5 states that there is a negative correlation between gender diversity, independent female directors and leverage ratio, this suggests that the more females on board and independent the lower the expected leverage in the MENA region (Zhang, 2014).

Table 5. Correlation matrix.

Variables	LEV	GenDiv	INFD	BSize	FSize	Growth	ROA	GDPG	Inf
LEV	1								
GenDiv	−0.053**	1							
INFD	−0.048*	0.123	1						

BSize	0.196*	0.263	−0.036	1					
FSize	0.203**	0.069	0.243**	0.326**	1				
Growth	0.461***	0.048	0.268**	0.063	−0.103**	1			
ROA	−0.151**	0962	−0.082	0.018*	0.042	0.072**	1		
GDPG	0.056	0.032	0.084	0.032	0.021	0.085**	0.038**	1	
Inf	0.018	0.254	0.067	0.041	0.016	0.054	0.053**	0.062*	1

Authors Analysis and note that: ***, **, * are significant at 10 percent, 5 percent and 1 percent respectively.

In addition, there is a positive correlation between board size, firm size, growth, GDPG and inflation with the leverage ratio. This suggests that the more members on board helps companies to get more external funds through connections and good relations with influential impact on decisions. Moreover, the larger the company the higher the possibility to secure more funds since the company might use its total assets as collaterals. Also, According to Ben Hamouda et al. (2023) and Naceur et al. (2017), the higher the growth opportunities available to firms then the more funds needed to support such growth.

4.3. Cross-sectional dependence and panel unit root results

According to Pesaran (2015), uncontrolled cross-sectional dependence between states has the potential to introduce bias into estimates. In addition, he stated that the cross-sectional dependence test evaluates the alternative hypothesis of substantial dependence against the null hypothesis of weak cross-sectional dependence for both balanced and unbalanced data. To prevent inaccurate conclusions regarding cross-sectional dependence, unit root tests of the second generation are conducted. For example, as suggested by Pesaran (2007) the following tests have been applied; Levin-Lin-Chu Test, Pesaran CIPS and Im-Pesaran- Shin test.

Table 6. Cross-sectional dependence and panel unit root results.

Variables	**Pesaran Cross-Sectional Dependency Test**	**Levin-Lin-Chu Test**		**Pesaran CIPS**		**Im-Pesaran-Shin**	
		At Levels	First Difference	At Levels	First Difference	At Levels	First Difference
LEV	1.859***	−1.265***	−5.258***	−2.235***	−4.225***	−1.296***	−6.340***
GenDiv	5.628***	−4.254**	−6.352***	−2.112***	−4.188***	−1.960	−6.287***
INFD	14.598***	−8.357***	−7.322***	−1.969***	−4.391***	1.863**	−6.369***
BSize	25.365***	−4.362***	−9.366***	−1.567***	−4.025***	−1.327	−6.030***
FSize	6.281***	−1.258	−7.325***	−1.361***	−4.352***	−1.747**	−6.574***
Growth	5.362***	−2.365*	-8.314	−1.252***	−4.639***	1.892**	−6.691***
ROA	4.968***	−2.845***	−9.335***	−1.486***	−4.770***	−1.378	−6.873***
GDPG	18.924***	−1.358**	−8.272***	−1.885***	−3.960***	1.630***	−6.118***
Inf	19.365***	−1.399**	−8.858***	−2.111***	−3.865***	1.878***	−6.273***

Authors Analysis and note that: ***, **, * are significant at 10 percent, 5 percent and 1 percent respectively.

As evident in **Table 6**, the Cross-sectional Dependence statistics are significant at the 1% level, it can be concluded that there is substantial evidence of cross-sectional dependence for all variables at their respective levels, beginning with the CD test. This

indicates that estimation techniques that account for cross-sectional dependence are necessary. In addition, as determined by at least two of the panel unit root tests, the majority of series are nonstationary at the majority of levels. However, following initial differencing to account for unit roots, the LLC, CIPS, and IPS tests all indicate that all series attain stationarity. This verifies that all model variables are integrated in the first order, denoted as I (1). In brief, the initial results suggest that the variables exhibit cross-sectional dependence and unit roots at various levels. Consequently, the findings indicate that the data is highly suitable for sophisticated panel data analysis and utilizing panel estimation techniques, such as the GMM method, that account for endogeneity and cross-sectional dependence is a must.

4.4. Panel cointegration test

The continuing link between variables in panel data as the link between gender diversity and leverage ratio is examined using panel cointegration test It evaluates if there is consistent relationship between these factors across time. This approach is important because it clarifies whether gender diversity affects leverage ratio over time (Amadi et al., 2023). Researcher first assess the findings static qualities before examining their panel cointegration features (Ghosh, 2022). **Table 7** define the how the panel cointegration test finds the results.

Table 7. Panel cointegration test.

Westerlund Test for Cointegration	
H0: No Cointegration	Number of panels 556
H1: All Panels are Cointegrated	Number of periods 14
Panel Specific with Statistic	*p*-value
Without panel-specific time trends (4.3685) *	0.000
With panel-specific time trends (1.6829) *	0.010

Notes: * Shows 1%, significance level. Source: Researchers Analysis.

Table 7 shows that Westlund (2005) test was taken for 556 panels and 14 number of periods and two test results analysis without panel and with the panel. The results are significant at 1 percent and confirms that there is cointegration and there is long-term equilibrium relationship among the variables in the model. Thus, they are endogenous, as they deny the null hypothesis of non-causality. Aware that endogeneity could introduce bias into our findings, we estimated using the generalized method of moments (GMM). Specifically engineered to generate reliable estimates even when endogenous regressors are present, GMM is the method to be applied.

4.5. Diagnostic tests

The objective of these tests analysis is to ascertain whether there is noteworthy Heteroskedasticity, omitted variables, multicollinearity and normality tests among the gender diversity of board members and the financial choices made regarding debt financing (PeiZhi et al., 2020).

Table 8. Diagnostic tests.

Tests	Chi 2 (*P*-Value)	Results
Heteroskedasticity (Breusch-Pagan)	1.985 (0.093)	No Heteroskedasticity
Omitted variable Test (Ramsey Reset)	1.79 (0.048)	No omitted variables
Multicollinearity Test (VIF)	1.72	No Multicollinearity
Normality Test (Shapiro wilk)	0.152 (0.215)	No normality problem

The above **Table 8** shows the results of diagnostic tests, firstly, no Heteroskedasticity problem since the coefficients' *p*-values of the Breusch-Pagan is higher than the specified threshold, which is typically set at 0.05. In a similar result and based on the Ramsey reset test, the omitted variable test analysis shows that there is no indication of omitted variables. In other words, there is no significant variables omitted from the model under investigation. Subsequently since all the computed various inflation factors are much blow the critical threshold of 10 then the VIF test indicate the three is no multicollinearity. Then, the Shapiro-Wilk normality test does not identify any evidence to refute the residuals' normality. All these considered different tests show that this model is fit to investigate the relationship between gender diversity and leverage.

4.6. Granger non-causality test results

Prior to employing GMM for model estimation, it is critical to ascertain whether there is an evidence of endogeneity among the dependent and independent variables (Di et al., 2022). The below **Table 9** shows the result of the granger causality test.

Table 9. Granger non-causality test results.

Variables	Using Granger non-causality Test
L. GenDiv	0.075**
L. INFD	−0.034***
L. BSize	0.015***
L. FSize	0.029 **
L. Growth	0.041**
L. ROA	−0.073***
L. GDPG	0.039
L. Inf	0.071**
Number of nonfinancial companies	556

Note: *** and ** indicate the significance levels of 1% and 5%, respectively.

Table 9 shows that Granger Non-causality results investigate whether the lags of the independent variables can be utilized to predict the forthcoming leverage values. According to the p-values, the majority of covariates indicate to induce Granger-cause leverage. Significantly, Granger-caused leverage is consistently induced by delays in gender diversity, independent female directors, firm size, bank size, growth opportunities, GDP growth, and inflation, with a significance level of 5% or 1%.

4.7. Decision results between system GMM and difference GMM

Initially based on the results reported in **Table 10**, it is worth mentioning that the coefficient derived from the fixed effects model (0.412) is comparatively smaller than that of the aggregated OLS (0.526), which indicates the existence of unobserved heterogeneity (Aslam et al., 2019). In accordance with the recommendations put forth by Bond et al. (2001), this result suggests that Difference GMM would be a more appropriate approach in comparison to System GMM.

Table 10. Decision Results Between System GMM and Difference GMM.

Estimators	**Coefficients**
Pooled OLS	0.526
Fixed Effect	0.412
One-Step Difference GMM	0.135
Two-Step Difference GMM	0.162
One-Step System GMM	0.234
Two-Step System GMM	0.295

Source: Researchers Analysis.

In comparison to the System GMM estimators, the Difference GMM coefficients are less substantial (Sheikh et al., 2018). This further validates the assertion that Difference GMM is more suitable for this particular application, given its ability to account for endogeneity and unobserved heterogeneity without resorting to excessively stringent constraints (Okoyeuzu et al., 2021).

4.8. Difference GMM estimation results

The below **Table 11** shows the effect of gender diversity on the capital structure while controlling for firm specific characteristics and macroeconomic variables. Upon initial examination of gender diversity (GenDiv), both models establish that it is negatively statistically impacting capital structure. This is consistent with previous research indicating that greater female representation correlates with lower debt utilization, thereby supporting the first Hypothesis. This is consistent with the findings of Berhe (2023) and supports the agency theory view that representation reduces debt utilization through enhanced monitoring (Agrawal and Knoeber, 1996). In addition, according to Ben Saad et al. (2022), gender diversity may result in modification to the capital structure for a number of reasons, including enhanced making decisions increased knowledge accountability and varying opinions risk. More specifically, depending on the specifics of the organization and circumstances, the type and strength of the connection may differ (João et al., 2023).

Table 11. Effect of gender diversity on the capital structure while controlling for other variables.

	One-Step Difference GMM		**Two-Step Difference GMM**	
Variables	Baseline	Interaction	Baseline	Interaction
L. Lev	0.132^{*}	0.145^{*}	0.109^{**}	0.096^{***}
GenDiv	-0.096^{***}	-0.082^{**}	-0.063^{***}	-0.074^{***}
GenDiv* FSize		-0.035^{***}		-0.052^{***}

INFD	−0.083**	−0.052**	−0.098**	−0.068***
BSize	−0.059**	−0.082**	−0.037**	−0.077***
FSize	0.047***	0.063**	0.072***	0.096**
Growth	0.085**	0.039**	0.055**	0.062***
ROA	0.094**	0.078**	0.081**	0.059***
GDPG	0.036 *	0.052**	0.046*	0.073***
Inf	0.045 *	0.066**	0.012*	0.032***
Observations	7784	7784	7784	7784
Prob > *F*	0.000	0.000	0.000	0.000
Number of Companies	556	556	556	556
AR (1)	0.125	0.162	0.150	0.185
AR (2)	0.526	0.559	0.426	0.496
Hansen Test	0.265	0.326	0.165	0.185

Note: *** and ** and * indicate the significance levels of 1% and 5% and 10% respectively.

In addition, Kang et al. (2007) recommended that independent female directors exhibit a notable degree of independence due to their detachment from the "old boys club." This characteristic renders them more effective as corporate monitors. According to Hillman (2015), the inclusion of independent female directors facilitates the execution of appropriate strategic alternatives that align with the expectations of stakeholders. Corporate innovation, adaptation, and competitiveness are all expedited by the social capital and additional knowledge of female directors (Chen et al., 2021; Gordini and Rancati, 2017; Nguyen et al., 2015). Moreover, considering their inherent gender composition, women exhibit reduced levels of dominance and self-centeredness (Mather et al., 2021). It is reasonable to assume that women are risk averse; as a result, they are more likely to advocate for increased board attentiveness in order to protect the reputation of the company (Sattar et al., 2022). Furthermore, **Table 11** stated that the higher the number of board member the lower is the debt ratio. Specifically, the size of the board significantly and negatively affects debt financing. This result aligns with the conclusions drawn by Yermack (1996), which suggest that a growth in the total number of directors leads to less effective management oversight due to the increased complexity of cooperation and decisions being made. Alves et al. (2015) and Heng et al. (2012), who discovered that a firm with a greater number of directors decreases its debt ratio and increases its exposure to hazardous assets in order to improve its performance, concur with these findings. This is due to the fact that larger boards may affect the effectiveness of monitoring activities. These responsibilities—coordination, communication, and decision making—could burden larger executive committees and consequently diminish their effectiveness.

Also, there is a significant positive impact between firm size and capital structure. This result is consistent with the tradeoff theory proposed by Modigliani and Miller (1963), which states that a larger company is more likely to be stable under a variety of conditions and to be less likely to declare insolvency. This result aligns with the research conducted by Hanousek and Shamsur (2011) as well as Matemilola et al. (2018), providing further support for tradeoff theory. This theory posits that long-term assets can serve as a guarantee when suggesting debt financing options. For the period

2010–2023, the regression results indicate that growth opportunity positively influences capital structure in the MENA region. These results demonstrate that a business with a rapid rate of growth will attempt to enhance its total assets in order to improve its future funding requirements, while nonetheless attempting to preserve the margin of profit. Consequently, in order to sustain its debt ratio, the organization will likely incur additional liabilities while retained earnings increase (Pathak and Chandani, 2021). In order to finance its operational activities, a distributor company has a tendency to increase its reliance on debt financing as the level of growth opportunity it possesses increases (Rani et al., 2020). In accordance with the trade-off theory, which theorizes that developing companies frequently need substantial funds for business expansion, this decision is made in order to avoid the ridiculous expense associated with issuing shares. Moreover, the utilization of debt can serve as a catalyst for the company's progress (Yunita and Aji, 2018). This finding is consistent with the results reported in prior studies conducted by Haron et al. (2021) and Pathak and Chandani (2021).

The findings indicate that leverage is significantly and positively impacted by profitability in both models. This finding supports the view that firms with higher profitability levels employ comparatively greater amounts of debt within their capital structures. The agency rationale of profit allowing capability for debt is confirmed by the profitability leverage relationship across models (Jo and Lee, 1996). According to Al-Kayed et al. (2014), this association also corresponds with results on performance facilitating borrowing, as higher profitable companies have easier access to market and can raise more debt easier than low profitable companies (Khalaf et al., 2023). Finally, the positive impact of macroeconomic variables (GDPG and Inflation) indicates that when economy is stronger, nonfinancial companies in the MENA region tend to borrow more (Kim, 2023). Companies tend to face more investment opportunities that empower companies to get more funds to be able to invest in positive net present value projects. This result comes in line with the results reported by Cam and Ozer (2022) and Khemiri and Noubbigh (2018), were they claimed that companies tend to borrow more when facing prosperous economy since more requirements arise for funds to invest and seize the opportunity of growth in the market.

4.9. Implications for investors, policy makers and management practices

The results of this study have important implications for the management of companies, government officials, and individuals who invest in businesses. The study emphasizes the significance of enhancing gender diversity on boards as an element of corporate governance. Specifically, it highlights the presence of independent female directors, which is linked to more cautious capital structures and reduced debt ratios. These findings indicate that having boards with a diverse range of genders may lead to the adoption of more stable financial practices. Policymakers in the MENA region can utilize these insights to facilitate policies that foster female representation on boards, not only to achieve social equity but also to bolster financial stability. Investors must comprehend the connection between the composition of a company's board and its financial decisions. This is particularly important for identifying organizations that implement cautious financial strategies as a result of having a higher level of gender

diversity. Moreover, this research sets the stage for future investigations into the influence of board gender diversity in various geographical areas, industries, or during different economic periods. These studies might provide significant knowledge on the lasting consequences on financial performance and risk control.

4.10. Robustness of results

The following **Table 12** shows the linear dynamic panel data regression results in order to check the robustness of results. As evident by the results reported below the results hold and confirm that our results for investigating the impact of gender diversity on the capital structure of MENA nonfinancial companies during the period 2010–2023 holds.

Table 12. Linear dynamic panel regression results.

Variables	One-Step Dynamic Panel	
	Baseline	**Interaction**
GenDiv	−0.048***	−0.052***
INFD	−0.059**	−0.082***
BSize	−0.035**	−0.044***
FSize	0.072***	0.060***
Growth	0.049**	0.052***
ROA	0.038**	0.041***
GDPG	0.067*	0.056**
Inf	0.071*	0.035*
Constant	0.254***	0.316***
Wald Chi 2 (8)	0.526	0.496
Number of Nonfinancial Companies	556	556

Note: *** and ** and * indicate the significance levels of 1% and 5% and 10%, respectively.

5. Conclusion

MENA nations have a notable impact on global trade and possess unique geographical location connecting Europe to Assia and Africa. Acquiring insights into the financial decisions made by corporations is critical for stimulating economic growth and potentially offering alternative frameworks for capital structure optimization. Therefore, this empirical investigation examined the impact of board gender diversity on the capital structure of non-financial companies listed in the MENA region. The data has been collected through Refinitiv Eikon Platform (LSEG) during the period of 2010–2023. The final sample included 556 nonfinancial firms listed on the MENA region. Several Econometric techniques have been applied to investigate the relationship such as the different GMM and system GMM, controlling for independent female directors, board size, firm size, profitability, growth opportunities, growth in gross domestic product and inflation. The results suggested that the presence of females on board of directors can lead to reduced debt ratio. The females on board of directors' help in achieving the risk awareness, making better decision making, making long term strategic plans with the help of financial results and help organization to achieve goals. In addition, the higher the percentage of

independent females on boards the lower is the debt ratio, this shows the impact of including their experience and high protection of companies' reputation that females try to implement by decreasing the risk associated by debt. Also, the more members on boards the lower is the debt ratio which can be explained by the possibility of the contradicting views that can lead to lower debt. On the other hand, the firm size was found positively impacting the capital structure, in other words, the larger the company the more debt that can be raised due to the likelihood of using their assets as collaterals. Similarly, the higher the growth opportunities and the more profitability the companies enjoy then the higher the debt, this due to the fact that companies need more funds to finance their growth and investments in positive net present value projects and also high profitable firms tend to borrow more to signal healthy future expectations of cash flows. Finally, the macroeconomic variables suggested positive impact on debt levels; when the market is facing favorable conditions then companies request more funds to gain advantage and invest more to achieve their aim of maximizing shareholders wealth. Finally, similar to previous studies, this study has certain limitations. This empirical investigation utilized data from publicly traded companies; consequently, future research may investigate data from unlisted companies to determine whether comparable results exist. In addition, this investigation checked the impact of companies listed on the MENA region and the results stand for this specific region, therefore, future research might look at other regions and compare the findings.

Conflict of interest: The authors declare no conflict of interest.

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