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**CRITICAL MASS AND BANK RISK:  
EXAMINING THE THRESHOLD  
EFFECT OF WOMEN ON BOARDS  
IN THE MENA REGION**

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# **CRITICAL MASS AND BANK RISK: EXAMINING THE THRESHOLD EFFECT OF WOMEN ON BOARDS IN THE MENA REGION<sup>2</sup>**

## **Purpose**

This study investigates the impact of women on boards on bank risk-taking in the MENA context and whether a critical mass of women on boards affects bank risk.

## **Design/methodology/approach**

The influence of woman directors on bank risk is studied using a sample of 126 commercial banks for the period 2007–2020. A dynamic panel threshold method is adopted in order to investigate the critical mass of woman on boards and its impact on risk.

## **Findings**

The findings suggest a nonlinear association between women on boards and bank risk-taking confirming the critical mass hypotheses. The results show that the percentage of women on the board matters in shaping risk decisions. More precisely, we find that there is a negative and significant impact only when the proportion of women exceeds a certain threshold. A set of robustness checks confirms our findings.

## **Research limitations/implications**

The findings highlight the importance of achieving a critical mass of women on boards to influence corporate governance and risk management. Therefore, policies should aim to surpass the empirically determined threshold to achieve a meaningful reduction in risk-taking.

## **Originality/value**

While most studies on this topic either assume a specific critical percentage or treat the relationship as linear, this research uses a threshold regression model to empirically determine the threshold that goes beyond simply assuming a critical percentage.

**Keywords:** Women on Boards, Bank Risk-Taking, Critical Mass, Panel Threshold Regression, MENA region

**Paper type:** Research paper

**JEL classification:** Z

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## 1. Introduction

The board of directors is a key element of corporate governance, playing a vital role in bridging the gap between the business and its external environment (Carter *et al.*, 2010). The directors are tasked with prioritizing business ethics and corporate responsibility, fostering a positive corporate culture, and overseeing the organization's strategic objectives (Villanueva-Villar *et al.*, 2016; Mohammadi *et al.*, 2021). In banks, the composition of the board is essential for guiding strategic decisions. Gender diversity is increasingly recognized as a key driver for improving the efficiency of banks, ultimately contributing to their success and resilience in the face of changing market conditions (Issa *et al.*, 2024). However, the impact of board gender diversity on banking stability remains under-explored in the MENA region.

The literature on the relationship between board diversity and banking efficiency presents mixed picture. Some studies indicate a positive relationship, suggesting that diverse boards reduce agency costs and boost firm performance and value (Abou-El-Sood, 2021; Arvanitis *et al.*, 2022). In contrast, other research points out that banks featuring more diverse boards are less likely to seek public bailouts and, when they do, tend to obtain smaller amounts of support, which can lead to diminished performance (Cardillo *et al.*, 2021; Issa *et al.*, 2021).

In recent years, there has been a noticeable surge in interest regarding gender diversity, particularly in relation to its impact on corporate performance and governance. Numerous studies have explored how the presence of women in leadership roles influences these outcomes (Burgess and Tharenou, 2002; Carter *et al.*, 2003; Adams and Ferreira, 2009; Farrell and Hersch, 2005; Bhat *et al.*, 2019; Ullah *et al.*, 2019; Adeabah, 2019). The connection between [gender diversity](#)[1] and firm performance, as well as risk exposure, has drawn the attention of economists and researchers for some time. A compelling question arises: can an increase in the number of women on boards (WoB) of directors help to mitigate excessive risk in the banking sector?

Although the current discussions argue that having women on the board of directors may serve as an effective mechanism leading to improve financial performance and reduce risk-taking behaviors in management, an important question remains: ***Is there a threshold proportion of women on boards which influences board decisions?***

Some empirical studies (Menicucci and Paolucci, 2022; Rossi *et al.*, 2017; Menicucci and Paolucci, 2024) have addressed this question relying on critical mass theory, which states that the influence of WoB becomes noticeable once they reach a specific threshold. Konrad and Kramer (2006) and Konrad *et al.* (2008) suggest that having at least three could lead to a decrease in bank risk-taking.

While some studies on gender diversity utilize critical mass theory, positing a specific numerical threshold beyond which a significant change in outcomes occurs, this approach suffers from

limitations. The selection of the threshold often appears arbitrary, lacking a rigorous statistical basis. In this work, we propose a threshold regression methodology to verify the critical mass of WoB in banks in the MENA context. The threshold regression model offers a robust and data-driven approach; the optimal threshold itself becomes an estimated parameter, determined statistically rather than imposed *a priori*. This method provides a more nuanced [2] understanding of the relationship between gender diversity and bank risk-taking, identifying the precise point at which the impact of WoB shifts significantly. This avoids the potential biases inherent in pre-selecting an arbitrary number.

We use a sample of 126 MENA banks for the period 2007–2020. The results confirm a nonlinear [3] relationship between WoB and bank risk-taking. More precisely, while women board members do not affect risk-taking below the threshold value, they have a significant negative impact above the threshold.

This study seeks to deepen our understanding of the factors influencing bank risk-taking in the MENA region, particularly focusing on how WoB affects the bank risk-taking. Relying on different theories, this paper contributes to the literature by investigating the contributions of woman directors to board decision-making using a threshold regression. It provides evidence supporting critical mass theory concerning a certain WoB threshold and its effect on bank risk-taking in the MENA region using a nonlinear methodology.

By emphasizing the importance of WoB, the research highlights how board diversity can improve decision-making, risk management, and overall bank risk-taking. Given the unique socio-economic, cultural, and regulatory landscape of the MENA region, this study provides a specialized investigation into the governance dynamics which differ from other regions. The findings suggest a negative relationship between WoB and bank risk-taking.

The rest of this paper is structured as follows.

First, we discuss the context. Section 2 provides a theoretical and empirical discussion of the relationship between WoB and bank risk-taking. Section 3 gives the data and the methodology. Section 4 presents and analyzes the results. Section 5 concludes with the contributions and implications of the paper.

## **2. Contextual framework**

The MENA region serves as a unique context for a number of reasons. First, most economies in the MENA region share similar social, cultural, and economic traits. Arabic is predominantly spoken, and Islamic customs and traditions are integral to daily life. These elements can shape economic features, influence business practices, affect shareholding structures, and modify the information landscape (Sarhan and Ntim, 2018; Issa and Fang, 2019). Both formal and informal

norms play pivotal roles in determining corporate behaviors, with informal traditions often having a considerable impact on managerial choices. This can ultimately influence corporate governance practices (Elamer *et al.*, 2020).

Second, many firms in the MENA region are either family or state owned, leading to ownership structures that are more concentrated than those typically found in developed economies, where firms often turn to stock markets for external financing (Khanchel *et al.*, 2023). The legal frameworks in the MENA region tend to offer less protection for minority shareholders when compared to those in more developed markets (Sarhan and Ntim, 2018).

Third, financial systems in MENA countries tend to be bank-oriented, which results in less dynamic capital markets and weaker enforcement of capital market regulations (Issa *et al.*, 2021; Sarhan and Ntim, 2018).

Finally, despite the MENA banking sector being generally well-capitalized, ongoing economic and political issues have negatively impacted banks' asset quality, leading to an increase in non-performing loans (NPLs), especially in non-Gulf Cooperation Council (GCC [4]) countries. Consequently, the average NPL rate in MENA stands at 6.2%, which is higher than the global average of 3.6%. Non-GCC countries are particularly affected, with their NPLs reaching an even more concerning average of 8.2% (Gray *et al.*, 2014).

### **3. Literature review and hypotheses development**

#### ***3.1. Theoretical and empirical studies regarding Women on Boards***

##### *3.1.1. Agency Theory*

According to agency theory, tensions can arise between owners and managers in corporations (Fama and Jensen, 1983). Introducing members from various national backgrounds into a board can create a rich mix of perspectives, which helps to reduce the likelihood of groupthink and leads to more rounded decision-making (Adams and Baker, 2021; Harjoto *et al.*, 2015). This diversity can strengthen oversight and governance within banks, ultimately driving efficiency and reducing agency costs. The theory argues that women are considered more committed, more democratic, less self-oriented than men, and having higher levels of accountability and transparency about sustainability issues.

Previous studies have explored the connection between gender diversity and agency theory and have found that WoB wield significant influence over agency theory. Jurkus *et al.* (2011) show that the presence of a higher number of WoB could help reduce agency costs. Mustafa *et al.* (2017) demonstrate that the more diversified a board, the more effective its the control it, leading to positive effects on firms.

Several empirical studies have emphasized the economic benefits and transformed dynamics brought about by gender diversity on boards. WoB often offer different viewpoints, contributing to discussions that involve complex decisions (Terjesen *et al.*, 2009; Ye *et al.*, 2019). This diversity of perspectives is seen as a valuable asset which can enhance decision-making and overall performance within organizations. The research highlights the importance of gender diversity in promoting effective governance and advancing corporate performance.

### *3.1.2. Resource Dependence and Human Capital Theories*

Pfeffer and Salancik (1978) argue that the inclusion of women on a board of directors provides an additional and valuable perspective that enriches group dynamics and decision-making, particularly in the context of dividend distribution within the complex environments where banking institutions operate.

Extensive research has shown that WoB can significantly enhance overall governance effectiveness (Adams and Ferreira, 2009). Carter *et al.* (2003) highlight that gender diversity on boards fosters increased independence and proactive engagement, leading to procedural fairness by ensuring direct representation of both shareholder interests and those of other stakeholders in decision-making. This blend of perspectives not only enriches discussions but also ensures a more inclusive and comprehensive approach to governance within organizations.

### *3.1.3. Critical Mass Theory*

According to critical mass theory, the dynamics within a minority group improve once it reaches a certain threshold; specifically, having at least three members (Kanter, 1977). In our investigation, we aim to explore the nonlinear relationship between gender diversity and NPLs stemming from this theory. We posit that board gender diversity reduces the level of NPLs only above a certain threshold. Supporting this idea, some studies on gender diversity are based on critical mass theory. Post *et al.* (2011) suggest that a critical mass of woman directors fosters improved Corporate Social Responsibility (CSR) outcomes. Cabeza-Garzía *et al.* (2017) show that having a minimum of three woman directors boosts CSR disclosure. Yarram and Adapa (2021) highlight a significant positive relationship between the presence of a critical mass of women on Australian boards and firm performance.

We examining the impact of WoB on risk-taking using the foundational aspects of critical mass theory as proposed by Kanter (1977). Our review of the literature highlighted a noteworthy gap: the lack of empirical studies examining the link between WoB and banking stability in the MENA region, using critical mass theory (Kanter, 1977; Pareek *et al.*, 2023; Saggarr *et al.*, 2021).

### ***3.2. Studies regarding the presence of women on boards and risk-taking***

Empirical works have consistently shown a solid connection between the presence of women directors and various outcomes for banks. Studies indicate that banks with women in leadership positions experience lower levels of risk, improved profitability, and heightened cost efficiency (Dong *et al.*, 2017), decreased fluctuations in stock returns (Adams and Ferreira, 2009), and a reduction in corporate default risk (Abinzano *et al.*, 2023).

Examining the influence of board diversity on the financial stability and performance of European banks, Farag and Mallin (2017) illustrate that including more women on boards could reduce the chances of a financial crisis. Abou-El-Sood (2021) finds that diverse boards helped mitigate risk-taking in US commercial banks. Kinatader *et al.* (2021) demonstrate that WoB participation lowers bank-specific credit risk across 20 countries. In Ghana, Fiador (2023) establishes a significant link between corporate governance, board gender diversity, and bank risk-taking behaviors. The authors find that gender diversity decreases risk-taking. Elnahass *et al.* (2023) explore how board diversity correlates with bank stability, revealing strong evidence from a unique dataset covering 14 countries. Their findings highlight a positive relationship between the presence of woman directors on a bank's board and its overall stability.

Adams (2016) shows that the appointment of women to the board of directors reduces the possibility of excessive risk-taking, suggesting women are more risk averse in financial decisions which leads to less risky business results. Andries *et al.* (2017) examine the impact of WoB on bank performance and risk by analyzing a dataset of 156 banks from Central and Eastern Europe, covering the period from 2005 to 2012. Their findings indicate that institutions with a chairwoman and a significant number of woman board members achieved higher profitability and experienced lower credit losses. Mateos de Cabo *et al.* (2012) utilize a sample of 612 European banks to explore how the gender composition of bank boards affects risk-taking behavior. Their study concludes that a higher ratio of women on boards is associated with reduced risk-taking. Furthermore, Birindelli *et al.* (2020) investigate a sample of 215 listed banks across 40 countries from 2008 to 2016 and find that woman directors play a crucial role in minimizing risk, especially when banks are financially stable. These findings reinforce the notion that increased WoB correlates with lower risk-taking behavior.

Although the literature on board gender diversity and risk-taking in the context of banks is limited, our research expectations are in line with the view of most empirical findings. We assume that WoB have a significant negative effect on risk-taking. However, this effect depends on their proportion. Hence, we formulate our hypothesis:

***H1: There exists a nonlinear negative relationship between women on boards and bank risk-taking depending on their proportion.***

## 4. Data and Methods

### 4.1. *Data collection and variables definitions*

#### 4.1.1. *Data collection*

This study utilizes data from MENA countries and banks spanning 14 years (2007–2020). The data were collected using the Orbis Bank Focus database and economic indicators from the World Bank and International Financial Statistics. The initial sample is consisted of 160 banks. To maintain relevance and consistency, we excluded Islamic banks, due to their specific regulatory framework, and banks with missing data. Consequently, the final sample comprises 126 MENA banks for 19 MENA nations.

#### 4.1.2. *Variables definitions*

##### 4.1.2.1. *The dependent variable: risk-taking*

We adopt the NPLs as a measure of bank risk-taking. According to the IMF, a loan is classified as an NPL if it fails to generate interest and the principal amount remains unpaid for at least 90 days. Alton and Hazen (2001) further explain that loans become NPLs when both the principal and interest payments are not made by the due date and there is no expectation for recovery in the future. In this study, we assess NPLs by calculating the ratio of NPLs to the total amount of loans.

##### 4.1.2.2. *The independent variable: women on boards*

WoB refers to the number of women on the board of directors. Following Martínez and Rambaud (2019), the proportion of WoB is obtained from the percentage board members who are women.

##### 4.1.2.3. *Control variables*

We incorporate a variety of bank-level and country-level control factors in our regression analysis that could influence risk-taking.

*Bank-level control variables include:*

*Bank size (SIZE)* is calculated as the logarithm of bank assets. *The deposits ratio (DEP)* represents the proportion of total deposits to total assets. *Bank profitability (ROA)* is defined as the ratio of net income to total assets. *Capital (CAP)* measures the ratio of equity to total assets. *Growth opportunity (GROWTH)* represents the annual change in assets.

*Country-level control variables include:*

two economic indicators: *GDP growth (GDP)* and *inflation rate (INFL)*.

We also control for *financial crisis and Covid-19* (a dummy variable equal to one in the period 2007–2009 and 2020, and zero otherwise).



Table 1 illustrates the calculation methods.

**Table 1: Variable definition**

Variables	Definition	Measure
Dependent variable		
NPLs	Loan quality	The ratio of NPLs to the total amount of loans
Independent variable		
WoB	Women on boards	The percentage of woman on the board of directors
Control variables		
SIZE	Bank size	The logarithm of bank assets
ROA	Bank profitability	The ratio of net income to total assets
DEP	Deposits	The proportion of total deposits to total assets
CAP	Capitalization	The ratio of equity to total assets
GROWTH	Growth opportunity	Annual change in assets
GDP	GDP growth	Annual GDP growth rate
INFL	Inflation	Consumer Price Index
CRISES	Financial crises and Covid-19	Dummy variable equal to one in the period 2007–2009 and 2020, zero otherwise

*Source(s): Table created by author(s)*

## 5. Empirical results

### 5.1. Descriptive statistics and correlation matrix

#### 5.1.1. Descriptive statistics

Table 2 shows that the average value of the NPLs for the sample MENA banks is 8.32%, which is above the average value (7.57%) found by Mdaghri (2022) in the same context during the period 2010–2017. This might be the result of the two financial events we included in our sample. The highest values are reported in 2010 and 2020. This result could be justified by the political and economic disturbances affecting the MENA region during the financial crises and the pandemic.

Women are underrepresented on the boards of MENA banks, with an average board's gender ratio of 9%, which is low compared with European banks—27.42% (Menicucci and Paolucci, 2024)). The minimum value of 0 shows that some boards have no women.

**Table 2: Summary statistics**

	<i>OBS</i>	<i>SD</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>
<b>Panel A: the dependent variable</b>					
NPLs	1764	0.04	0.08	0	0.67
<b>Panel B: the independent variable</b>					
WoB	1764	0.14	0.09	0	0.46
<b>Panel C: the control variables</b>					
SIZE	1764	1.76	9.81	4.89	15.07
ROA	1764	1.90	0.02	-0.15	0.42
DEP	1764	0.16	0.59	0.02	0.82
CAP	1764	0.23	0.55	0.12	4.46
GROWTH	1764	0.12	0.16	-0.21	1.10
GDP	1764	0.09	0.03	-0.51	0.87
INFL	1764	0.08	0.61	-0.04	0.90

*Source(s):* Table created by author(s)

#### 5.1.2. Correlation matrix and variation inflation factor

Table 3 gives information on the correlation matrix for the variables used in this study. The correlations between all independent variables are below 80%, indicating no multicollinearity issue in our specification. Furthermore, we find the average VIF equal to 1.21, confirming the absence of multicollinearity.

**Table 3: Correlation Matrix**

	<b>NPLs</b>	<b>WoB</b>	<b>SIZE</b>	<b>ROA</b>	<b>DEP</b>	<b>CAP</b>	<b>GDP</b>	<b>INFL</b>	<b>GROWTH</b>
<b>NPLs</b>	1.000								
<b>WoB</b>	-0.025*	1.000							
<b>SIZE</b>	-0.051*	0.011	1.000						
<b>ROA</b>	-0.077*	0.024*	0.045*	1.000					
<b>DEP</b>	0.002*	0.031*	-0.043*	0.109	1.000				
<b>CAP</b>	-0.031	0.013	-0.063	0.071	0.162*	1.000			
<b>GDP</b>	0.017	0.002	-0.025	0.092*	0.014	0.017	1.000		
<b>INFL</b>	0.002*	0.002	-0.022	0.021	0.081*	-0.042*	-0.211*	1.000	
<b>GROWTH</b>	-0.021*	0.030	0.142*	-0.132*	0.090	0.019*	0.133*	-0.031	1.000

Note: This table presents the correlation coefficients between the variables used in this study. \* indicates statistical significance at the level of 5%

**Source(s):** Table created by author(s)

## 5.2. Regression analysis

To investigate how the proportion of women on the board could affect bank risk-taking, we adopt a panel threshold model proposed by Hansen (1999).

$$NPLs_{it} = \alpha_i + \mu_t + WoB_{it}I(WoB_{it} \leq \delta_1)\beta_1 + WoB_{it}I(\delta_1 < WoB_{it} \leq \delta_2)\beta_2 + \dots + WoB_{it}I(\delta_n \leq WoB_{it})\beta_{n+1} + \beta \sum Control_{i,t} + YearEffect + BankEffect + \varepsilon_{it}$$

Where, *NPLs* is the dependent variable that represents loan quality. *WoB* is the independent and the threshold variable that represents the percentage on women on the board of directors. *Control* is a set of control variables (*SIZE* is bank size. *ROA* is bank profitability. *DEP* is deposits. *CAP* is bank capitalization. *GROWTH* represents bank growth opportunity. *GDP* is the gross domestic product. *INFL* represents the inflation. *CRISES* is dummy variable equal to one in the period 2007–2009 and 2020, zero otherwise).  $\alpha_i$  are individual fixed effects.  $\mu_t$  are time fixed effects.  $\varepsilon_{it}$  is the random standard error.  $\delta_1, \delta_2 \dots \delta_n$  are thresholds that divide the equation into  $n+1$  regimes with coefficients  $\beta_1, \beta_2 \dots \beta_{n+1}$ . *I*(.) refers to the indicator function taking the value 1 if the *WoB* belongs to the indicated interval and 0 otherwise.

We first test for a threshold effect. Results, reported in Table 4, confirm a threshold effect for *WoB* and risk-taking.

**Table 4: Testing for a threshold effect (Bootstrap results)**

SupWStar	Observed Coef.	Bootstrap Std. Err.	Z	P>z	Normal-based [95% Conf. Interval]	
WoB	2.276	1.247	1.82	0.000	1.167	3.926

*Source(s): Table created by author(s)*

Table 5 reports the results of the threshold regression for the relationship between *WoB* and *NPLs*. The threshold value is 19%. This threshold value splits the sample into two regimes, banks with a woman directors less or equal to threshold value in regime 1 and banks with woman directors greater than the threshold value in regime 2. This supports our hypothesis. We confirm that there is a nonlinear relationship between *WoB* and bank risk-taking depending on the proportion of women on the board.

Results show that below the threshold value there is no effect of *WoB* on *NPLs*. It means, when women represent less than 19% of the total directors, they do not have any effect on *NPLs* [regime 1]. The lack of a significant impact suggests that having a relatively small proportion of women on the board does not significantly affect *NPLs*. This could be because the presence of a few women is not enough to influence decision-making related to credit risk management.

Above the threshold, the relationship becomes negative and significant with a coefficient of -0.094 meaning that when women are more than 19% of the directors on the boards, they reduce NPLs [regime 2]. The negative impact above the threshold indicates that once this critical mass of women is reached, there is a statistically significant reduction in NPLs. This suggests that a higher proportion of women on the board is associated with improved credit risk management and potentially better financial performance.

This finding supports our hypothesis from both views. First, we confirm the existence of a nonlinear relationship between WoB and NPLs. This is in line with critical mass theory. While previous studies rely on the critical mass theory by adopting a specific percentage of women on the board necessary to trigger a significant shift in risk-taking behavior (Rossi *et al.*, 2017; Menicucci and Paolucci, 2024), using threshold model analysis objectively identifies the optimal threshold value, eliminating the need for arbitrary selection of a critical percentage.

Second, we confirm the connection between WoB and risk-taking. We show that above the threshold, the presence of women on boards reduces NPLs. Therefore, the presence of women in boardrooms has a negative effect on bank risk-taking, supporting the view that women are more risk averse than men in decision-making. This finding is in line with previous studies (Krishnan and Parsons, 2008; Barua *et al.*, 2010; Huang and Kisgen, 2013; Faccio *et al.*, 2016). The outcome of these studies is that women on boards are more conservative in decision-making than men.

Overall, the results show that generally WoB influence the risk-taking behavior of the analyzed banks, but the results depend on the percentage of women. If more than 19% of the board are women, this negatively influence bank risk-taking. The findings provide a more nuanced and potentially more accurate understanding of the relationship between WoB and risk-taking measured as the level of NPLs.

Regarding the control variables, we find that good profitability decreases NPLs. Bank size increases NPLs. In addition, market concentration is found to be negatively linked to bank default risk. Our findings indicate that while large firms with high levels of deposits tend to have higher NPLs, well capitalized banks with better performance, tend to have lower NPLs.

**Table 5: The impact of women on board (WoB) on Bank risk-taking (NPLs)**

Dependent variable:	Dynamic PT with endogenous regressors
NPLs	
NPLs L1.	0.127 (0.001)***
<i>Panel A : Estimation of threshold effect</i>	
Threshold value:	0.19
<i>Panel B : Impact of WoB on NPLs</i>	
Below	<b>0.016 (0.142)</b>
Above	<b>-0.094 (0.001)***</b>
<i>Panel C : Impact of control variables on NPLs</i>	
SIZE	0.074 (0.000)***
ROA	-0.035 (0.001)***
DEP	0.088 (0.000)***
CAP	-0.108 (0.000)***
GROWTH	0.073 (0.221)
GDP	-0.039 (0.001)***
INFL	0.081 (0.000)***
CRISES	0.127 (0.000)***
Constant_	0.169 (0.000)***
<i>Time effects</i>	YES
<i>Bank effects</i>	YES
<i>Wald Chi2</i>	20.13***

Notes: This table reports results for the dynamic panel threshold estimation using all available lags of the instrument variables. The robust standard errors are reported. \*\*\* indicate significance at 1% level.

**Source(s):** Table created by author(s)

### 5.3. Robustness check

#### 5.3.1. Additional control variables

We control for the impact of the institutional context in the MENA region. We re-estimate our main equation adding two institutional indicators: political stability (PS) and control of corruption (COC). The findings in table 6 corroborate the main findings. The nonlinear relationship between WoB and NPLs holds and the impact of women on the board is found to be significantly negative above the threshold value.

Both indicators, jointly and separately, have negative impact on NPLs. More precisely, the higher the level of political stability and the lower the corruption, the fewer NPLs are observed.

**Table 6: The impact of WoB on NPLs (additional control variables)**

Dependent variable:	Dynamic PT with endogenous regressors		
NPLs			
NPLs	0.154 (0.000)***	0.167 (0.000)***	0.175 (0.000)***
L1.			
Independent variable:	The Threshold value: 0.19	The Threshold value: 0.19	The Threshold value: 0.19
WoB			
Below	<b>0.051 (0.114)</b>	<b>0.073 (0.145)</b>	<b>0.066 (0.127)</b>
Above	<b>-0.081 (0.000)***</b>	<b>-0.093 (0.000)***</b>	<b>-0.098 (0.000)***</b>
SIZE	0.061 (0.000)***	0.059 (0.001)***	0.086 (0.001)***
ROA	-0.088 (0.000)***	-0.061 (0.000)***	-0.041 (0.000)***
DEP	0.028 (0.000)***	0.011 (0.025)**	0.024 (0.009)***
CAP	-0.070 (0.003)***	-0.067 (0.000)***	-0.070 (0.000)***
GROWTH	0.128 (0.108)	0.096 (0.159)	0.101 (0.231)
GDP	0.091 (0.000)***	0.089 (0.001)***	0.078 (0.000)***
INFL	0.178 (0.000)***	0.129 (0.001)***	0.146 (0.000)***
PS	-0.057 (0.021)**		-0.084 (0.001)***
COC		-0.127 (0.000)***	-0.085 (0.0001)***
CRISES	0.120 (0.000)***	0.126 (0.000)***	0.107 (0.001)***
Constant_	0.949 (0.000)***	-0.200 (0.000)***	0.258 (0.000)***
<i>Time effects</i>	YES	YES	YES
<i>Bank effects</i>	YES	YES	YES
<i>Wald Chi2</i>	18.74***	18.10***	18.62***

Notes: This table reports results for the dynamic panel threshold estimation using all available lags of the instrument variables. The robust standard errors are reported. \*\*/\*\* indicate significance at the 5% and 1% level respectively.

**Source(s):** Table created by author(s)

### 5.3.2. Alternative measure of risk

We use the Z-score as an alternative measure of bank risk-taking. The index is measured as:

$$Z\text{-score} = [\text{ROA} + \text{E/A}] / \text{std.ROA}$$

Where, ROA is return on assets ratio, E/A is the equity capital to assets ratio, and Std.ROA is the standard deviation of ROA.

*Note: A high Z-score indicates that the bank is more stable and thus is less likely to make risky decisions.*

The results in Table 7 confirm our main findings using the NPLs as a risk measure. Using Z-score, while there is no effect below the threshold value, WoB have positive impact on Z-score and thus a negative impact on risk-taking above the threshold value.

**Table 7: The impact of women on board (WoB) on Bank risk-taking (Z-score)**

Dependent variable: Z-score	Dynamic PT with endogenous regressors
Z-score L1.	0.140 (0.001)***
<i>Panel A : Estimation of threshold effect</i>	
Threshold value:	0.21
<i>Panel B : Impact of WoB on Z-score</i>	
Independent variable: WoB	
<u>Below</u>	0.062 (0.121)
<u>Above</u>	0.105 (0.001)***
<i>Panel C : Impact of control variables on Z-score</i>	
SIZE	-0.071 (0.000)***
ROA	0.084 (0.001)***
DEP	-0.241 (0.142)
CAP	0.112 (0.001)***
GROWTH	0.166 (0.106)
GDP	0.143 (0.000)***
INFL	-0.149 (0.000)***
CRISES	-0.163 (0.000)***
Constant_	1.607 (0.000)***
<i>Time effects</i>	YES
<i>Bank effects</i>	YES
<i>Wald Chi2</i>	16.53***

Notes: This table reports results for the dynamic panel threshold estimation using all available lags of the instrument variables. The robust standard errors are reported. \*\*\* indicate significance at 1% level.

**Source(s):** Table created by author(s)

## 6. Conclusions

This paper examines the impact of women on boards and bank risk-taking using a threshold methodology over 14 years of MENA region panel data. We apply a threshold model for 126 banks during the period 2007–2020, illustrating the existence of a threshold effect dividing our sample in two regimes. Below the threshold value (19%) there is no impact of WoB on bank risk-taking, while impact is negative above the threshold. After controlling for intuitional quality



variables our results remain robust. Using Z-score as an alternative measure for risk-taking, our results hold.

This research has many theoretical and practical values. This study fills a gap in the literature by adding new insights and providing new empirical findings concerning the influence of WoB on bank risk-taking in developing markets such as MENA region. Our results support the critical mass hypothesis, suggesting that a sufficient proportion of women on the board is necessary to effectively influence decision-making related to risk. Below the threshold, their voices might be marginalized or insufficient to impact risk-taking. While previous studies that posit a fixed critical mass for WoB (often cited as three members), this study employs a threshold regression model to empirically determine the optimal threshold at which the impact of WoB becomes statistically significant, eliminating the need for arbitrary assumptions about the number of women on the board required to influence bank risk-taking. Therefore, the threshold might reflect a change in board dynamics. Above the threshold, the presence of women might lead to more robust discussions, challenging risky proposals, and a more balanced approach to risk management.

The findings support policies promoting greater gender diversity on corporate boards, particularly aiming for levels exceeding the identified threshold. This could involve quotas, incentives, or other measures to increase representation of women. Regulators might consider setting minimum thresholds for the representation of women on boards to encourage better risk management practices. Knowing there is a threshold suggests that simply having some women on the board is not enough; a critical mass is needed to influence risk-taking behavior.

Finally, it is important to acknowledge the limitations of our study, as they could guide future research endeavors. Further research is needed to explore the mechanisms through which women on boards influence risk-taking behavior. Qualitative studies could provide valuable insights into the dynamics of boardroom discussions and decision-making processes. Our study was conducted within the context of emerging economies, and it may not be directly applicable to developed countries. Investigating whether the threshold varies across different countries or regulatory environments could provide further insights into the factors influencing the relationship between gender diversity and bank risk. Therefore, this study could pave the way for further exploration of the WoB–risk-taking nexus in the context of developed countries, using panel threshold methods to validate our findings.

## References

- Abinzano, I., Garcés-Galdeano, L. and Martinez, B. (2023), “Female CEOs and default risk in listed family firms”, *Gender in Management: An International Journal*, Ahead-of-Print, Vol. 38 No. 8, doi: 10.1108/GM-01-2022-0030.
- Abou-El-Sood, H. (2021), “Board gender diversity, power, and bank risk taking”, *International Review of Financial Analysis*, Vol. 75, 101733, doi: 10.1016/j.irfa.2021.101733.
- Adams, M. and Baker, P.L. (2021), “Does boardroom nationality affect the performance of UK insurers?”, *The British Accounting Review*, Vol. 53 No. 5, 100923, doi: 10.1016/j.bar.2020.100923.
- Adams, R.B. (2016), “Women on boards: the superheroes of tomorrow?”, *The Leadership Quarterly*, Vol. 27 No. 3, pp. 371-386, doi: 10.1016/j.leaqua.2015.11.001.
- Adams, R.B. and Ferreira, D. (2009), “Women in the boardroom and their impact on governance and performance”, *Journal of Financial Economics*, Vol. 94 No. 2, pp. 291-309.
- Adeabah, D., Gyeke-Dako, A. and Andoh, C. (2019), “Board gender diversity, corporate governance and bank efficiency in Ghana: a two stage data envelope analysis (DEA) approach”, *Corporate Governance: The International Journal of Business in Society*, Vol. 19 No. 2, pp. 299-320.
- Alton, R.G. and Hazen, J.H. (2001), “As economy flounders, do we see a rise in problem loans”, *Federal Reserve Bank of St. Louis*, Vol. 11 No. 4, pp. 45–65.
- Andries, A.M., Seyed M.M., and Ovidiu, S. (2017), “The Impact of Board Gender on Bank Performance and Risk in Emerging Markets”, <http://dx.doi.org/10.2139/ssrn.3041484>.
- Arvanitis, S.E., Varouchas, E.G. and Agiomirgianakis, G.M. (2022), “Does board gender diversity really improve firm performance? Evidence from Greek listed firms”, *Journal of Risk and Financial Management*, Vol. 15 No. 7, p. 306, doi: 10.3390/jrfm15070306.
- Barua, A., Davidson, L.F., Rama, D.V. and Thiruvadi, S. (2010), “CEO gender and accruals quality”, *Accounting Horizons*, Vol. 24 No. 1, pp. 25-39.
- Bhat, K.U., Chen, Y., Jebran, K. and Memon, Z.A. (2019), “Board diversity and corporate risk: evidence from China”, *Corporate Governance: The International Journal of Business in Society*, Vol. 20 No. 2, pp. 280-293.
- Birindelli, G., Chiappini, H. and Savioli, M. (2020), “When do women on board of directors reduce bank risk?”, *Corporate Governance: The International Journal of Business in Society*, Vol. 20 No. 7, pp. 1307-1327, doi: 10.1108/CG-03-2020-0089.

- Burgess, Z. and Tharenou, P. (2002), "Women board directors: characteristics of the few", *Journal of Business Ethics*, Vol. 37 No. 1, pp. 39-49.
- Cabeza-Garzi'a, L., Fernandez-Gago, R. and Nieto, M. (2017), "Do board gender diversity and director typology impact CSR reporting?", *European Management Review*, Vol. 15 No. 4, pp. 559-575.
- Cardillo, G., Onali, E. and Torluccio, G. (2021), "Does gender diversity on banks' boards matter? Evidence from public bailouts", *Journal of Corporate Finance*, Vol. 71, p. 101560.
- Carter, D.A., D'Souza, F., Simkins, B.J. and Simpson, W.G. (2010), "The gender and ethnic diversity of US boards and board committees and firm financial performance", *Corporate Governance: An International Review*, Vol. 18 No. 5, pp. 396-414, doi: 10.1111/j.1467-8683.2010.00809.x.
- Carter, D.A., Simkins, B.J. and Simpson, W.G. (2003), "Corporate governance, board diversity, and firm value", *The Financial Review*, Vol. 38 No. 1, pp. 33-53.
- Dong, Y., Liang, C. and Wanyin, Z. (2023), "Board diversity and firm performance: impact of ESG activities in China", *Economic Research-Ekonomiska istrazivanja*, Vol. 36 No. 1, pp. 1592-1609, doi: 10.1080/1331677x.2022.2090406.
- Elamer, A.A., Ntim, C.G., Abdou, H.A. and Pyke, C. (2020), "Sharia supervisory boards, governance structures and operational risk disclosures: evidence from Islamic banks in MENA countries", *Global Finance Journal*, Vol. 46, 100488, doi: 10.1016/j.gfj.2019.100488.
- Elnahass, M., Alharbi, R., Mohamed, T.S. and McLaren, J. (2023), "The nexus among board diversity and bank stability: implications from gender, nationality and education", *Emerging Markets Review*, Vol. 57, p. 101071.
- Faccio, M., Marchica, M.T. and Mura, R. (2016), "CEO gender, corporate risk-taking, and the efficiency of Capital allocation", *Journal of Corporate Finance*, Vol. 39, pp. 193-209.
- Fama, E.F. and Jensen, M.C. (1983), "Agency problems and residual claims", *The Journal of Law and Economics*, Vol. 26 No. 2, pp. 327-349, doi: 10.1086/467038.
- Farag, H. and Mallin, C. (2017), "Board diversity and financial fragility: evidence from european banks", *International Review of Financial Analysis*, Vol. 49, pp. 98-112.
- Farrell, K. and Hersch, P. (2005), "Additions to corporate boards: the effect of gender", *Journal of Corporate Finance*, Vol. 11 Nos 1/2, pp. 85-10.

- Fiador, V. (2023), "Corporate governance, gender diversity and risk-taking behaviour of banks in an emerging economy – some empirical evidence from Ghana", *Gender in Management*, Vol. 38 No. 1, pp. 57-75. <https://doi.org/10.1108/GM-03-2021-0083>.
- Gray, S., Karam, P. and Turk, R. (2014), "Are Banks Really Lazy? Evidence from Middle East and North Africa", International Monetary Fund, Washington, DC.
- Harjoto, M., Laksmana, I. and Lee, R. (2015), "Board diversity and corporate social responsibility", *Journal of Business Ethics*, Vol. 132 No. 4, pp. 641-660, doi: 10.1007/s10551-014-2343-0.
- Huang, J. and Kisgen, D.J. (2013), "Gender and corporate finance: are male executives overconfident relative to female executives?", *Journal of Financial Economics*, Vol. 108 No. 3, pp. 822-839.
- Issa, A. and Fang, H.-X. (2019), "The impact of board gender diversity on corporate social responsibility in the Arab Gulf states", *Gender in Management*, Vol. 34 No. 7, pp. 577-605, doi: 10.1108/GM-07-2018-0087.
- Issa, A. and Zaid, M.A.A. (2021), "Boardroom gender diversity and corporate environmental performance: a multi-theoretical perspective in the MENA region", *International Journal of Accounting and Information Management*, Vol. 29 No. 4, pp. 603-630, doi: 10.1108/IJAIM-05-2021-0101.
- Issa, A., Sahyouni, A. and Mateev, M. (2024), "A path to success: educational board diversity and its influence on MENA banks' efficiency and stability", *Corporate Governance: The International Journal of Business in Society*, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/CG-08-2023-0339.
- Issa, A., Yousef, H., Bakry, A., Hanaysha, J.R. and Sahyouni, A. (2021), "Does the board diversity impact bank performance in the MENA countries? A multilevel study", *Corporate Governance: The International Journal of Business in Society*, Vol. 21 No. 5, pp. 865-891, doi: 10.1108/CG-06-2020-0222.
- Issa, A. and Zaid, M.A.A. (2021), "Boardroom gender diversity and corporate environmental performance: a multi-theoretical perspective in the MENA region", *International Journal of Accounting and Information Management*, Vol. 29 No. 4, pp. 603-630, doi: 10.1108/IJAIM-05-2021-0101.
- Jurkus, A.F., Park, J.C. and Woodard, L.S. (2011), "Women in top management and agency costs", *Journal of Business Research*, Vol. 64 No. 2, pp. 180-186, doi: 10.1016/j.jbusres.2009.12.01.

- Kanter, R.M. (1977), "Some effects of proportions on group life: skewed sex ratios and responses to token women", *American Journal of Sociology*, Vol. 82 No. 5, pp. 965-990.
- Khanchel, I., Lassoued, N. and Ferchichi, O. (2023), "Are political connections a curse for banks of the MENA region? The moderating effect of ownership structure", *International Journal of Emerging Markets*, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/IJOEM-03-2022-0480.
- Kinateder, H., Choudhury, T., Zaman, R., Scagnelli, S.D. and Sohel, N. (2021), "Does boardroom gender diversity decrease credit risk in the financial sector? Worldwide evidence", *Journal of International Financial Markets, Institutions and Money*, Vol. 73, p. 101347.
- Konrad, A.M. and Kramer, V. (2006), "How many women do boards need?", *Harvard Business Review*, Vol. 84 No. 12, p. 22. Konrad, A.M., Kramer, V. and Erkut, S. (2008), "Critical mass: the impact of three or more women on corporate boards", *Organizational Dynamics*, Vol. 37 No. 2, pp. 145-164.
- Krishnan, G.V. and Parsons, L.M. (2008), "Getting to the bottom line: an exploration of gender and earnings quality", *Journal of Business Ethics*, Vol. 78 Nos 1/2, pp. 65-76.
- Martínez, M.C.V. and Rambaud, S.C. (2019), "Women on corporate boards and firm's financial performance", *Women's Studies International Forum*, Vol. 76, p. 102251, doi: 10.1016/j.wsif.2019.102251.
- Mateos de Cabo, R., Gimeno, R. and Nieto, M.J. (2012), "Gender diversity on European banks' boards of directors", *Journal of Business Ethics*, Vol. 109 No. 2, pp. 145-162.
- Mdaghri, A. (2022), "How does bank liquidity creation affect non-performing loans in the MENA region?", *International Journal of Emerging Markets*, Vol. 17, No. 7, pp.1635-1658.
- Menicucci, E. and Paolucci, G. (2022), "Gender diversity and bank risk-taking: an empirical investigation in Italy", *Corporate Governance: The International Journal of Business in Society*, Vol. 22 No. 2, pp. 317-339.
- Menicucci, E. and Paolucci, G. (2024), "Board gender equality and ESG performance. Evidence from European banking sector", *Corporate Governance*, Vol. 24 No. 8, pp. 147-174. <https://doi.org/10.1108/CG-04-2023-0146>.
- Mohammadi, S., Saeidi, H. and Naghshbandi, N. (2021), "The impact of board and audit committee characteristics on corporate social responsibility: evidence from the Iranian stock exchange", *International Journal of Productivity and Performance Management*, Vol. 70 No. 8, pp. 2207-2236.

- Mustafa, A.S., Che-Ahmad, A. and Chandren, S. (2017), "Board diversity and audit quality: evidence from Turkey", *Journal of Advanced Research in Business and Management Studies*, Vol. 6 No. 1, pp. 50-60.
- Pareek, R., Sahu, T.N. and Gupta, A. (2023), "Gender diversity and corporate sustainability performance: empirical evidence from India", *Vilakshan - XIMB Journal of Management*, Vol. 20 No. 1, pp. 140-153
- Pfeffer, J. and Salancik, G.R. (1978), "The External Control of Organizations: A Resource Dependence Perspective", Harper & Row, New York.
- Post, C., Rahman, N. and Rubow, E. (2011), "Green governance: boards of directors' composition and environmental corporate social responsibility", *Business & Society*, Vol. 50 No. 1, pp. 189-223.
- Ullah, I., Fang, H. and Jebran, K. (2019), "Do gender diversity and CEO gender enhance firm's value? Evidence from an emerging economy", *Corporate Governance: The International Journal of Business in Society*, Vol. 20 No. 1, pp. 44-66.
- Rossi, F., Chengru, H. and Maggie, F. (2017), "Women in the boardroom and corporate decisions of Italian listed companies: does the 'critical mass' matter?", *Management Decision*, Vol. 55 No. 7, pp. 1578-1595.
- Saggar, R., Arore, N. and Singh, B. (2021), "Gender diversity in corporate boardrooms and risk disclosure: Indian evidence", *Gender in Management: An International Journal*, Vol. 37 No. 2, pp. 182-201.
- Sarhan, A.A. and Ntim, C.G. (2018), "Firm- and country-level antecedents of corporate governance compliance and disclosure in MENA countries", *Managerial Auditing Journal*, Vol. 33 Nos 6-7, pp. 558-585, doi: 10.1108/MAJ-10-2017-1688.
- Terjesen, S., Sealy, R. and Singh, V. (2009), "Women directors on corporate boards: a review and research agenda", *Corporate Governance: An International Review*, Vol. 17 No. 3, pp. 320-337, doi: 10.1111/j.1467-8683.2009.00742.
- Villanueva-Villar, M., Rivo-Lopez, E. and Lago-Penas, S. (2016), "On the relationship between corporate governance and value creation in an economic crisis: empirical evidence for the Spanish case", *BRQ Business Research Quarterly*, Vol. 19 No. 4, pp. 233-245.
- Yarram, S.R. and Adapa, S. (2021), "Board gender diversity and corporate social responsibility: is there a case for critical mass?", *Journal of Cleaner Production*, Vol. 278, p. 123319.

Ye, D., Deng, J., Liu, Y., Szewczyk, S.-H. and Chen, X. (2019), “Does board gender diversity increase dividend payouts? Analysis of global evidence”, *Journal of Corporate Finance*, Vol. 58, pp. 1-26, doi: 10.1016/j.jcorpfin.2019.04.002.

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