
The Relationship Between Board of Directors' Characteristics and Bank Risk-Taking: Evidence from Egyptian Banking Sector

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Abstract: There is argument that the main reason behind the corporate failure is the engagement of banks in excessive risk taking. However, the existence literature provides conflicting evidence in this concern. The main objectives of this study is to investigate the influence of board characteristics on bank risk taking, by using Pooled Ordinary Least Squares regression techniques to test a sample of 27 Egyptian banks covering the period from 2006 to 2011. Measures of bank risk employed are the insolvency risk, credit risk and liquidity risk. The explanatory variables of board characteristics are board size, non-executive directors, CEO duality, female presence and, board qualifications. The control variables are bank size, debt ratio, and crisis. The results show that Board size is positively significant with the three measures of risks. Non-executive directors are negatively significant correlated with both insolvency and liquidity risk. CEO's duality is found positively significant with credit risk. Board female is negatively significant with insolvency and liquidity risk, while it is positively significant with credit risk. Board qualifications have no effect on the three measures of risks. The findings support the idea that board of director's characteristics is a determinant factor for bank risk taking.

Keywords: Board Characteristics, Bank Risk Taking, Insolvency Risk, Credit Risk, Liquidity Risk, and Egypt

1. Introduction

The banking system stability is very important to the proper performing of the financial system and subsequently enhances the economic growth [14]. Therefore, Governments intervene and implement reforms and take corrective actions that bring the efficiency and stability to the financial system. This led regulators to conduct new cautious standards, in order to create healthier and stronger bank governance [10].

However, recently a lot of effort exerted by academic and regulatory bodies to alleviate the bank risky behavior, especially after the 2008 financial crisis that affected most countries all over the world. Excessive bank risk-taking would damage not only the solidity of individual institutions, but also the stability of the financial system as a whole [42]. The internal mechanisms of governance contribute effectively in improving bank governance and accordingly, affect the bank risk [39].

Egypt as an emerging country has launched in 2004 a lot of reform programs, which intended to bring banks in conformity with the Basel Committee requirements. These reforms aimed to privatize and consolidate the banking sector, restructure state-owned banks financially and managerially, address default loans and strengthen the supervisory role of the Central Bank of Egypt [17]. However, these reforms have obliged some small banks, who can't keep track with the requirement of raising their capital adequacy to merge with other banks and accordingly the number of banks decreased from 57 in 2004 to 39 banks in 2008. The second phase of reforms started 2009 "This stage aims to increase the efficiency and soundness of the Egyptian banking sector, and enhancing its competitiveness and ability for risk management so that it can perform its role in financial intermediation in a way that serves the national economy, and achieve the targeted development" [18]. This has been followed by the issuance of specific rules for banking

governance by the Central Bank of Egypt (CBE) on March 2011.

Reviewing the literature the researchers found that most studies focused on the effect of corporate governance on the bank's performance [4, 32, 41, 48]. Despite these literatures, less consideration has been given to the influence of board characteristics on bank risk-taking. Besides, most of these studies conducted in the developed countries. Therefore, the research object is to fill this gap.

The aim of this research is to examine the nature of the relationship between the board of directors characteristics as one of the main internal governance techniques, and management of banking risks in an emerging market such as Egypt, and raise the awareness of how corporate governance affects the risk taking by banks, and accordingly the stability of the banking system. As only few researches has addressed this relationship.

This research contributes to the existing literature of banking governance from the perspective of internal mechanisms to explaining bank risk, and also to show how different board characteristics, namely, Board size, Non-Executive directors, CEO duality, Female presence, and Board skills are a significant determinant of risk-taking by banks. The findings of our research should benefit several parties, such as bank regulators, policy makers, and others.

The rest of this research is organized as follows: Section 2 includes the literature review. Section 3 describes the research data and methodology. Section 4 contains the empirical analysis and discussion of the results. Section 5 The conclusion of the research.

2. Literature Review

Reviewing the existing literature, there is no consensus what corporate governance is? As every definition represents a different perspective view. According to [38], corporate governance is the approach by means the shareholders can protect their investment from management, opportunistic behavior and assure to get return for it. [21], prolong the definition to include the resolution of problems among different types of investors for the aim of alleviating the conflicts of interest between them.

Researchers frequently view corporate governance mechanisms into two groups: the first group is internal to firms, while the second group is external to firms. The basic internal governance system comprises of management, and the board of directors. Management is acting as agent of the owners in deciding the kind of assets to invest in and the way to finance it, while the board of directors as the top of internal control systems, is responsible for providing advises to the management and providing monitoring and controlling of management as well [7]. The Board plays an essential role in the internal governance of corporate in monitoring and controlling function, accordingly it is considered the heart of corporate governance.

[24], demonstrate the roles of the board in alleviating agency problems by providing advises to the CEO and

executive managers, and to play an important role in extending the company's relation to the external environment.

Therefore, the board characteristic is considered as an essential part of the function of board directors, as it is responsible for controlling of management on the best interest of shareholders. It is also supposed that board performance is affected by the board's effectiveness, which in turn is affected by different features such as, board formation and quality, size of the board, the duality of chairman and CEO and Board gender [12].

2.1. Board Size and Bank Risk-Taking

In the literature we can find two different approaches regarding board size, the first perspective argues that the absolute number of board directors is considered as an essential determinant of effective corporate governance as large board size promotes the company's capability to better understand and respond to various stakeholders, as larger boards can provide more diversity that help companies to secure resources and to reduce the associated uncertainties. Furthermore, board assignments are affected by board size as large boards' means more directors and can constitute more committees to task different assignments and facilitate of work division over a greater number of members. [3, 36]. The other perspective, argue that board size is inversely associated with the board's ability to give advices and engage in strategic planning due to the difficulties associated with organizing and coordinating large groups of director's. [43, 51]. [27], examine the relation between board characteristics and corporate risk taking to detect an inverse relation between board size and the level of risk-taking, suggesting that large board faces communication, and coordination problems which affects its flexibility in decision-making. This is consistent with [19], finding that board size is statistically negative significant on risk taking measured by the standard deviation of earnings. [35], find that companies with more board members exhibit lower bankruptcy, but the relation is not significant.

Studies related the board of director's size and banking risks have conflicting results. [39], examine 11 Tunisian banks for ten years to find a negative correlation between board size and insolvency risk, but it is insignificant with both credit and global risks. [40], find that large bank board is associated with less (1/Z- score). [40], tests the relation between bank board structure in the US and bank risk-taking over the period from 1997 to 2004. He used different bank risk, such as the total risk, idiosyncratic risk and systematic risk to find an inverse relation between board size and all measures of risk suggesting that larger boards reduce the banks' risk. [33], investigate a sample of bank holding companies from year 2003-2008. They record a negative correlation between board size and total risk.

On the contrary [23], find a significant positive correlation between board size and risk taking variables, arguing that the large board size achieves higher insolvency risk. On the same line, [44], find that board size positively affects the bank risk-

taking explaining that small board size aligns the interests between shareholders and managers resulting in a reduction of bank risk. Accordingly, our hypothesis is constructed as follows;

H1: Board size has a negative effect on a bank's risk-taking.

2.2. Non-executive Directors and Bank Risk-Taking

There are two different kinds of members of the board the insider and the outsider. Insiders (Executive) are the members of the top management team, but, they are the employees of the company as well. Outside or External directors (Non-Executive) on the contrary have no such association, but considered either affiliated or non-affiliated (independent). Affiliated outsiders or externals are not members of the management team or employees of the firm, but have attachments in some ways with the firm. Non-affiliated outsiders or the independent directors are enrolled mainly for their expertise and skills [36]. There is a visible assumption that boards with high portion of external directors may perform and take better decisions than boards controlled by insiders [28].

[19], examines this relation to find a positive relation between independent directors and risk taking. While another study conducted by [34], record those firms with a higher percentage of independent directors have a lower idiosyncratic risk.

In the same line, the empirical studies concerning non-executive directors and bank risk taking are also mixed; For example [39], examine the relation between the proportion of independent directors and banks risk taking in Tunisia to find a significant positive relation with global risk, but at the same time has insignificant effect on both insolvency and credit risks. On the contrary [43], finds a negative significant relationship with banks risk taking which mean that more independent directors decrease the bank holding companies' risk taking. In the same line [26], analyze this relation in the borrowers' bank holding companies. To record that increasing the board's independence will decrease the bank's risk. [23], finds a significant negative correlation between the proportion of the independent directors and insolvency risk. Other studies such as, [40], who examine the presence of independent directors and how can they affect the banks risk taking to find no significant effect on the risk-taking as measured by (1/Z-score). Accordingly, our hypothesis is constructed as follows;

H2: Non-Executive directors have a negative relation on a bank's risk-taking.

2.3. CEO Duality and Bank Risk-Taking

Duality means that one person holds the two powerful positions on the board of directors, namely the CEO and the chairman. [24], argue that a firm's planning function which is the CEO responsibility should be separated from control function which is the chairman's responsibility. Agency theories predict when the CEO holds the two powerful positions of CEO and Chairman, the interests of the

shareholders will be channeled in favor of management to a certain degree, and accordingly managerial opportunism and agency loss will exist. On the contrary stewardship theory predicts that the CEO duality concentrate power and authority in one hand of the same person. So they expect that the leadership style will be clearer for both subordinate managers and board members. Accordingly the corporation will enjoy the traditional benefits of unity of command and control [22]

[31], in a sample of 74 firms half of them are subprime lending companies, explain that concentrating the power and authority in one hand, increase the CEO power and give him motivates to take risks that others would avoid.

However, the studies investigated the relationship between CEO duality and bank risk- taking finding mixed results: [39], find a positive significant relation between the CEO duality and insolvency risk. [44], record a significant positive association between CEO duality and bank risk taking, arguing that when CEO is the Chairman the rule of supervision and control function is weak resulting in reducing the effectiveness of this function and increase the bank risk - taking. On the same line, [23], used a panel data of 120 observations from Tunisian banks find a significant positive association between duality and insolvency risk. On the contrary [43], found that CEO duality decreases the bank holding companies risk.

Accordingly, our hypothesis is constructed as follow;

H3: CEO duality has a positive relation on a bank's risk-taking.

2.4. Board Female and Bank Risk-Taking

The presence of women on boards of directors has become a very interested issue in recent years. [3], document that female directors exert more effort to monitor the executive directors. Some researchers examine the effect of board gender on firm performance, such as [37, 45, 46]. Other types of researches study the effect of a woman's presence on firm value [13, 16]. Others investigate the effect of board gender diversity on the financing choice of the firms [1, 5].

Some other studies investigate the presence of females on the firm board and its effect on firm risk-taking. For example, [2], find a positive relationship while, [25], find an inverse relation between gender diversity and risk-taking predicting that board females are risk averse. However, the studies concerning the relationship between board female and bank risk-taking are mixed, for example, [9], record a positive relationship, suggesting that female directors in banks have the tendency to take more risk than male directors and having females on the board not necessarily lead to more risk-averse decision-making. On the contrary, some other studies such as [11, 47], find a negative correlation between gender diversity and risk-taking predicting that board females are risk averse. [47], find that the presences of female directors on the board decrease the company's bankruptcy probability. In the same line, [29], investigate board female and their effect on bank risk- taking to find an inverse correlation between the presence of board females and all measures of risk-taking.

(Ratio of loan loss provisions and Z-score) Accordingly, our hypothesis is constructed as follow;

H4: Board female has a negative effect on a bank's risk-taking.

2.5. Board Qualifications and Bank Risk-Taking

Board of directors is pool of social capital that comprise of a mix of competencies and qualifications that add value in performing the board's governance function [15]. Therefore, qualifications of individual board members are important in the decision making. If the board members are qualified and experienced, monitoring and controlling roles can be effectively implemented. [20], found that higher education increases participation in stock market investments and accordingly increases the bank risk - taking. On the contrary [9], in his research to investigate the relation between executive directors holding PhD degrees find that better educated members in the board of directors' decreases portfolio risk, arguing that they apply better risk management techniques.

Accordingly, our hypothesis is constructed as follows;

H5: Board member with a PhD qualification has positive effect a bank's risk-taking.

3. Data and Methodology

This study aims to investigate the relation between bank governance attributes, namely the board of directors characteristics as one of the internal governance and the top supervisory body in banking institutions and bank risk-taking. We use OLS regression techniques to test for a relation by using cross sectional, time-series regression analyses design. In this section, we present the sample and data sources of the study, the models and variables definition.

3.1. Sample and Data Sources

The sample consists of 27 banks operating in Egypt with data covering the period of six years from 2006–2011. Table 1 describes the sample selection criteria. The study considers all banks operating in Egypt and having the required data in *KOMPASS EGYPT*, whether they are national banks, Arab banks, or foreign banks. The banks selected in the sample and subjected to the analysis met the following criteria:

- 1) The bank should be subject to the Central Bank of Egypt supervision.
- 2) Financial and governance data of a bank are available for at least three consecutive years during the period 2006–2011.

Table 1. Sample Selection Criteria.

Criterion	Number of banks	Percent
The total number of banks available from <i>Kompass Egypt</i> during 2006–2011	30	100
Less: banks with less than 3 consecutive years of data on <i>Kompass Egypt</i>	3	10
The number of banks in the sample	27	90

Governance and financial data were obtained from

KOMPASS EGYPT, and bank financial statements. The data available for six years is pooled to obtain 126 observations. However, the number of observations is further reduced due to some missing data.

3.2. The Model and Variable Definition

In this study, we followed the model used by Pathan (2009) with some modifications as follow.:

$$\begin{aligned} \text{Ln Z-score}_{i,t} = & \beta_0 + \beta_1 (\text{BSIZE})_{i,t} + \beta_2 (\text{N-EXEC})_{i,t} + \beta_3 (\text{DUAL})_{i,t} \\ & + \beta_4 (\text{BFEMALE})_{i,t} + \beta_5 (\text{BQUALIF})_{i,t} + \beta_6 \text{Ln} (\text{T-ASSETS})_{i,t} + \\ & \beta_7 (\text{DR}) + \beta_8 (\text{Crisis}) + e \end{aligned} \quad (1)$$

$$\begin{aligned} \text{CR}_{i,t} = & \beta_0 + \beta_1 (\text{BSIZE})_{i,t} + \beta_2 (\text{N-EXEC})_{i,t} + \beta_3 (\text{DUAL})_{i,t} \\ & + \beta_4 (\text{BFEMALE})_{i,t} + \beta_5 (\text{BQUALIF})_{i,t} + \beta_6 \text{Ln} (\text{T-ASSETS})_{i,t} + \\ & \beta_7 (\text{DR}) + \beta_8 (\text{Crisis}) + e \end{aligned} \quad (2)$$

$$\begin{aligned} \text{LR}_{i,t} = & \beta_0 + \beta_1 (\text{BSIZE})_{i,t} + \beta_2 (\text{N-EXEC})_{i,t} + \beta_3 (\text{DUAL})_{i,t} \\ & + \beta_4 (\text{BFEMALE})_{i,t} + \beta_5 (\text{BQUALIF})_{i,t} + \beta_6 \text{Ln} (\text{T-ASSETS})_{i,t} + \\ & \beta_7 (\text{DR})_{i,t} + \beta_8 (\text{Crisis}) + e \end{aligned} \quad (3)$$

- Where subscripts i denotes individual banks ($i = 1, 2, \dots, 27$), t the time period ($t = 2006, 2007, \dots, 2011$), Ln is the natural logarithm, β are the parameters to be estimated and e is the error term.
- Risk: Various different measures of bank risk-taking have been employed in empirical studies. However, in this study, we measure bank risk - taking using three different measures, the Z-score, the credit risk and the liquidity risk of each bank. Z-score as a measure of a bank's distance from insolvency equals the average return on assets plus the capital asset ratio divided by the standard deviation of asset returns. Taking into consideration that in calculating Z - scores, annual values of ROA and CAR are used and σ (ROA) which is the standard deviation of annual ROA calculated at least over the preceding three annual observations of ROA. A high Z-score means less insolvency risk, indicating that the bank is more stable and accordingly banks' risk- taking and vice versa. Since the Z-score is highly skewed, we followed [30, 50], by using the natural logarithm, which is normally distributed. We also calculate capital adequacy ratio CAP as total assets minus total liabilities, divided by total assets. The credit risk (CR) is measured as the ratio of customer net loans to customer deposits. Liquidity risk (LR) is measured as the ratio of core deposits to total assets.
- Board size. (BSIZE): is the total number of directors on the bank board at the end of each fiscal year.
- The Duality of the CEO (DUAL): is a dummy variable that equals one if the CEO is also the chairman of the board and zero for otherwise.
- Non-Executive directors (N-EXEC): is the number of Non-Executive directors, as a percentage of the total number of board directors, as information about the

independent directors are not available and is not disclosed by any means.

- Board Female (BFEMALE): is the number of women as a percentage of the total number of board directors.
- Board Qualifications (BQUALIF): is the number of board directors that have a PhD degree.
- The natural logarithm of bank size (T-ASSETS): Ln of Total Assets at the end of each fiscal year.
- Debt Ratio (DR): is the total debt divided on the total assets.
- Crisis is a dummy variable stands for 1 if the year is 2008 and 0 for otherwise.

4. Data Analysis and Results

4.1. Results of Descriptive Statistics

The analysis will start with descriptive statistics of the research variables

Table 2. Descriptive statistics of explanatory variables.

	Obs	Minimum	Maximum	Mean	Std. Deviation
Ln_Zscore	126	.00	5.56	2.8676	.88471
ROA	126	-2.15	4.02	1.2248	1.11130
CAP	126	3.26	22.58	9.4691	3.68295
σ (ROA)	126	.00	1.75	.6294	.39412
C_RISK	126	17.98	120.24	53.1186	18.54241
L_RISK	126	45.18	91.96	78.4656	9.70599
BSIZE	126	5.00	16.00	9.7381	2.63872
N_EXEC	126	.57	93.75	80.6000	14.34944
DUAL	126	.00	1.00	.4683	.50098
FEMALE	126	.00	30.00	6.4279	7.86730
BQUALIF	126	.00	40.00	8.0565	10.25701
Ln_ASSETS	126	14.64	19.54	16.8050	1.01309
DEBT_RATIO	126	9.56	96.72	89.0476	10.64739

Table 2 presents summary statistics of the variables used in our study. Concerning bank risk taking variables we noticed that the Z- score has a mean of 2.86 and a standard deviation

4.2. Results of Correlation and Regression Analysis

Table 3. Person's Correlations Matrix between the Dependent and Independent Variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. LN_ZSCORE	1													
2. ROA	.044	1												
3. CAP	.351**	.279**	1											
4. σ (ROA)	-.731**	.250**	.291**	1										
5. CREDIT RISK	.170*	.168*	.018	-.084	1									
6. LIQUIDITY RISK	-.127	-.150	-.123	.033	-.331**	1								
7. BSIZE	-.050	-.021	-.240**	-.105	.438**	.046	1							
8. NON_EXEC	.191*	-.081	.019	-.294**	.260**	-.143	.446**	1						
9. DUALITY	.039	.163*	-.091	-.008	.264**	-.161*	.040	.074	1					
	.335	.037	.160	.467	.002	.040	.334	.210						

of 0.88. This fairly high standard deviation and the wide range in Z-scores from 0 to 5.56 suggest the presence of cross-sectional variation in the level of bank risk. Credit risk mean is 53.11 ranging from 17.98 to 120.24, liquidity risk mean is 78.46 ranging from 45.18 to 91.96, which indicates again the wide variation of bank risk level among the banks sample. However the level of risks indicates that the Egyptian banking system is stable.

Concerning the components of Z-score, we noticed that ROA mean is 1.22 percent, ranging from -2.15 to 4.02 with a standard deviation of 1.11. CAP mean is 9.47 percent, which is slightly lower than the percentage determined by The Central Bank of Egypt (CBE), which is 10 percent as a minimum capital ratio. Ranging from 3.26 to 22.58 percent, this indicates that some banks still in a breach of the CBE regulations. The σ (ROA) shows a mean of 0.63, and a standard deviation of 0.39.

Concerning bank's board of directors' characteristics, we found that the board size average is 9 directors ranging from 5 to 16 directors. Non-executive directors' average is 80 percent, ranging from 57 percent to 93 percent of the board, accordingly the mean of the executive directors is 20 percent. However, this indicates that non-executive directors are the majority of banks boards, which is in compliance with the Central Bank of Egypt Banking Governance Recommendations issued on August 2011 stating that non-executive members should be the majority in the board formation (Rule 5.2.2). CEO duality records a mean of 46 percent indicating that 46 percent of the sample has CEO duality, which is against the Egyptian code of governance requesting banks to split these two powerful positions (Rule 3.2.2). The proportion of females sitting on the board has a mean of 6 percent of the total number of directors, ranging from 0 to 30 percent. The percentage of the board members that has a PhD degree is 8 percent, ranging from 0 to 40 percent indicating the wide variation of bank's qualified members with PhD degree.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. BFEMALE	.222**	.381**	.033	-.091	.278**	-.279**	.050	.092	.324**	1				
11. BQUALIF	.130	-.039	.129	-.110	.029	.051	-.132	.129	.010	.059	1			
12. LN_ASSETS	-.167*	.219**	-.418**	-.077	-.162*	.181*	-.091	-.096	.253**	.081	-.051	1		
13. DEBT_RATIO	-.112	-.099	-.154*	.029	-.050	.220**	-.081	-.087	.028	-.030	.068	.281**	1	
14. CRISIS	.096	.066	.026	-.066	.141	.012	.019	.185*	.012	.086	-.034	.017	.0461	1
	.149	.237	.391	.238	.062	.450	.416	.021	.447	.174	.354	.425	.309	

*. Correlation is significant at the 0.05 level (1-tailed)

**. Correlation is significant at the 0.01 level (1-tailed)

The correlations coefficients are used to test clarify the existence of Multicollinearity among independent variables: table (3) presents the correlation matrix. The maximum correlation is-. 731 (less than. 80), which indicates the absence of Multicollinearity. This has been further confirmed by calculating the tolerance level and The variance inflation factor (VIF). VIF (tolerance) ranges from 1.06 (0.72) to 1.39 (0.94) for all regression models. As shown in table (2), Z-score is positively significant with CAP, credit risk, non-executive directors, and board female at the 0.01,0.05,0.05

and 0.01 levels, respectively, while it is negative significant with both the standard deviation of the return on assets and bank size (total assets) at the 0.01 and 0.05 respectively levels. Credit risk is positively significant with board size, non-executive, duality, and board female at the 0.01 level, while it is negative significant with liquidity risk and bank size at the 0.01and 0.05 levels respectively. Liquidity risk is positive significant with both bank size and debt ratio at 0.05 and 0.01 while, it is negative significant with both duality and board female at the 0.05 and 0.01 respectively.

Table 4. Results of regression analysis.

Details	Ln Zscore	Credit Risk	Liquidity Risk
(Constant)	4.134566 0.0000 ***	72.76625 0.0044 ***	38.67648 0.0201 **
BOARD SIZE	-0.037173 0.0946 *	2.743173 0.0000 ***	0.768953 0.0491 **
NON-EXECUTIVE DIRECTORS	0.008269 0.0330 **	-0.006151 0.9532	-0.131318 0.0576 *
CEO DUALITY	0.001192 0.9910	7.933968 0.0056 ***	-2.537866 0.1701
BOARD FEMALE	0.014895 0.0215 **	0.385370 0.0262 **	-0.313799 0.0060 ***
BOARD QUALIFICATIONS	0.003327 0.4916 -0.088220	0.099942 0.4402 -3.476244	0.114231 0.1792 1.957111
LN ASSETS	0.0968 *	0.0149 **	0.0356 **
DEBT RATIO	-0.003003 0.5203	0.046833 0.7074	0.135968 0.0980 *
CRISIS	-.112 .363	5.132012 0.1330	1.543700 0.4884
R	.377	.5860	.45
R ²	0.142	0.343621	0.202543
Adjusted R ²	0.085959	0.296314	0.145069
Standard Error	.52534	13.9660	9.1465
F Value	2.299	7.263697	3.524065
Prob (F-statistics)	0.015	0.000	0.001
Obs	120	120	120

In order to meet the OLS assumption, we have carried out many tests such as, histograms and scatter plots to assess normality, linearity and homoscedasticity assumptions.

Furthermore, we use the Durbin-Watson statistics to detect for the independence of errors, which suggest no presence of autocorrelation in the residuals. Accordingly, all OLS

assumptions are met.

The regression results point out the following:-

Consistent with the first hypothesis: "*Board size has a negative effect on a bank's risk-taking*". The results revealed a negative and significant relationship between board size and z-score at the 0.10 level, which indicate that small board size will increase z-score and accordingly decrease risk and enhance the stability of the bank. Board size is also positively significant with both credit risk and liquidity risk at the 0.01, 0.05 levels, respectively, accordingly the first hypothesis is not supported. This result supports the argument that board size is negatively correlated with the board's ability to give advices and involved in long-term strategic planning due to the difficulties associated with organizing and coordinating large groups of director's. [7, 8, 49]. This result is in the same line with [23]. [44], suggested that large board size achieves higher insolvency risk and small board size aligns the interests between shareholders and managers resulting in a reduction of bank risk.

As for hypothesis two which states that: "*Non-Executive directors have a negative relation on a bank's risk-taking*", the proportion of non- executive was found positively correlated at 0.05 level with Z-score, which indicate that more existence of non-executive board members will lead to increase the Z-score and, accordingly reduce the bank risk and enhance bank stability and vice versa. The non-executive directors are also negatively significant correlated with liquidity risk at the level of 0.10 but this relation is negatively insignificant correlated with credit risk. This indicates that the proportion of outside directors has a negative significant impact on bank risk taking and accordingly this hypothesis is supported. These results are consistent with [23, 26, 43].

As for hypothesis three which stated that: "*CEO duality has a positive relation on a bank's risk-taking*", the CEO's duality is found positive significantly with only credit risk at 0.01 levels, while it is positive insignificant with Z-score and negative insignificant with liquidity risk accordingly, hypothesis 3 is partially supported. This result indicates that when the CEO is the chairman this increase the CEO power and give him motivates to take more risks These findings are consistent with [31, 39, 44].

Concerning hypothesis No. Four which stated that: "*Board female has a negative effect on a bank's risk-taking*", the study found that the proportion of board female is positively significant related to Z-score at the level 0.05, indicating that more board female reduce bank insolvency risk. It is found also significant positive with credit risk at the level 0.05, while it is negative significant with liquidity risk at the 0.10 level, accordingly, more female members will decrease both insolvency risk, liquidity risk and increase credit risk, therefore hypothesis 4 is partially accepted. The findings are consistent with the results of [11, 47] who find a negative relation between gender diversity and risk-taking predicting that board females are risk averse. One explanation of having a positive correlation with credit risk is that the presence of women on boards doesn't hinder them from providing loans to their customers as loans is the core of bank business, beside the poor percentage of women

existence in the board (on average 6.50%).

As for hypothesis No. Five which stated that: "*Board member with a PhD qualification has a positive effect a bank's risk-taking*", the study found that Board member with a PhD has a positive insignificant relation with the three measures of risks, accordingly, the results don't support hypothesis 5. However, This is in contrast with the finding of [9], who find that better educated members in the board of directors decreases portfolio risk, suggesting that they apply better risk management techniques, and with [20], who show that higher education increase the bank risk taking. It seems that it is not the qualification only that affect the bank risk taking but also the way the members leverage their knowledge and skills with their educational qualifications in enhancing the bank efficiency.

Furthermore the total assets are found positively significant with insolvency and liquidity risk at the level 0.10, 0.05 respectively, while it is a negatively significant with credit risk at the level 0.05, indicating that larger bank size are associated with higher bank insolvency risk and liquidity risk, which is in the same line with [6], who suggested that larger banks are risk taking, as they intend to benefit from a too-big-to-fail status. Debt ratio is found positively related to risk, but only significant with liquidity risk at the level 0.10. The Crisis is found insignificantly related to the three risk measures which indicate that Egyptian bank's risk is not affected significantly by the financial crisis during 2008.

4.3. Decomposing of the Z-score

Decomposing the Z-score measure, with otherwise unchanged, we know that, higher Z-scores can be attributed to higher levels of ROA and or higher level of CAP, while a higher standard deviation of ROA will result into lower Z-scores. So, when we find, for example that larger board size translate into lower Z-scores this may be a result of lower ROA, lower CAP, and/or a higher standard deviation. Therefore, larger board size may not necessarily increase the risk of bank assets, but rather the drop in Z-score may instead be attributed to a decrease in the bank capital ratio. To investigate how the various components of the Z-score act in response to different board characteristics, we run a regression analysis using each of Z-score components as a separate independent variable as in table (5).

We notice that board size is negatively significant to the CAP, while it is negative insignificant with both ROA and the standard deviation of ROA. The results suggest that the lower Z-score is not attributed to the decrease in ROA or the increase of the standard deviation of ROA rather than the decrease in bank capital. One potential explanation is that large board size banks tend to rely on deposit-based financing

Non-executive directors are only negatively significant with the standard deviation of the ROA, while it is negatively insignificant with ROA, and positively insignificant with CAP. This result justifies the positive sign with the Z-score and suggest that the higher Z-score may be attributed to the pressure of the non-executive directors to invest in less risky

assets, and that the result is primarily driven by the reduction in ROA standard deviation.

Table 5. Results of regression analysis between Z-score components and independent variables.

Details	ROA	CAP	σ (ROA)
	-.774	39.529	1.947
(Constant)	0.664	0.000 ***	0.001 ***
	0.009	-.475	-0.003
BOARD SIZE	0.831	0.000 ***	0.805
	-0.009	0.026	-0.006
NON-EXECUTIVE DIRECTORS	0.205	0.283	0.010 *
	0.004	.003	.081
CEO DUALITY	0.983	0.997	0.198
	0.049	0.031	-0.004
BOARD FEMALE	0.000 ***	0.434	0.315
	-0.002	0.018	-0.003
BOARD QUALIFICATIONS	0.842	0.544	0.255
	-0.243	-1.561	-.054
TOTAL ASSETS	0.017 **	0.000 ***	0.090 *
	-0.016	-0.018	0.003
DEBT RATIO	0.070 *	0.526	0.360
	.169	.176	-.016
CRISIS	.486	0.822	0.831
R	.467	.525	.372
R ²	0.218	0.276	0.138
Adjusted R ²	0.162	0.223	0.073
Standard Error	.99262	3.20458	.30421
F Value	3.866	5.278	2.105
Prob (F-statistics)	0.000	0.000	0.042
	120	120	114

CEO Duality is found positively insignificant with the three measurements, accordingly it is no related to the insolvency risk.

Board female is found positively significant correlated with ROA, positively insignificant with CAP and negatively insignificant with ROA standard deviation. The results suggest that the higher Z-score is mainly resulting from the increase in ROA. One explanation of this finding, is that women as a risk averse tends to reduce bank insolvency risk by increasing the return on assets through investing in less risky and better-performing assets.

Board qualifications are found not related to any of the three measures.

Total assets are negatively significantly related to the three measures. However the inverse relation with ROA and CAP reduce the Z - score and accordingly increase the risk taking, while decreasing the ROA standard deviation may increase the Z - score and decrease the bank stability. Overall, it follows that the large bank size decreases the quality of assets and leads to higher bank risk. Debt ratio is negatively significant only with ROA, and Crisis is insignificant with the three risk measures.

5. Research Limitations

There are several limitations in this research that should be taken into consideration in future research. First, the research sample is small and limited to 27 large Egyptian banks, which may limit the generalizability of the results.

Secondly, the researchers have suffered a lot to obtain the governance data that is only available in one source which is *KOMPASS EGYPT* and therefore, the sample was only limited to those banks that are exist in it.

Thirdly, as only a few banks are traded in the Egyptian Stock of Exchange (EGX). This prevented the researchers from using market risk measures such as market beta, idiosyncratic risk and the standard deviation of stock returns, which may be considered in next researches whenever data is available.

6. Conclusion

The purpose of this study is to test the association between board of directors' characteristics and bank risk-taking in a sample consisting of 27 banks operating in Egypt during the period from year 2006 – 2011. The researchers use three accounting based proxies for bank risk-taking, including insolvency risk, credit risk, and liquidity risk. To the researchers' knowledge, this is the first study to investigate the relation between the board of directors and bank risk in Egypt. Accordingly, this study's findings should be useful not only to the Egyptian policy makers, but also for their counterpart in other emerging countries. The empirical results show evidence that board size is positively significant with bank risk. This is consistent with studies found that large board size achieves higher insolvency risk and small board size aligns the interests between shareholders and managers resulting in a reduction of bank risks [23, 44]. The proportion of the non-executive directors is also negatively significant correlated with both insolvency risk and liquidity risk, which is consistent with studies of [23, 26, 43]. CEO's duality is found positive significantly with only credit risk, which is consistent with the studies suggesting that CEO duality increases the CEO power and give him motivates to take more risks [31, 39, 44]. Board female is positively significant related to Z-score indicating that more board female reduces bank insolvency risk. It is also found a positive significant relation with credit risk, while it is negative significant with liquidity risk, accordingly, more female members will decrease both insolvency risk, liquidity risk and increase credit risk. The findings are consistent with the studies that found a negative relation between gender diversity and risk-taking predicting that board females are risk averse [11, 47]. Board members with a PhD degree has positive insignificant relation with the three measures of risks which is a contrast to the finding of [9], who find that better educated board members decrease portfolio risk, and with [20], who found higher education increase the bank risk-taking.

The results of Z-score components analysis yield that board size is negatively significant to the CAP, suggest that the negative significant relation between board size and the Z-score is due to a low capital ratio and low standard

deviations of returns therefore, a considerable attention must be given to the banks that their capital ratio is less than the minimum capital required by the CBE. Non-executive directors are found negatively significant with the standard deviation of returns. This result justifies the positive sign with the Z-score, and suggests that, the higher Z-score is mainly driven by the reduction in returns standard deviation. Board female is found positively significantly correlated with ROA. The results suggest that the higher Z-score is mainly resulting from the increase in ROA. One explanation of this finding, is that women as a risk averse tends to reduce bank insolvency risk by increasing the return on assets through investing in less risky and better-performing assets.

Furthermore the bank size is found positively significant with insolvency and liquidity risk, while it is a significant negative with credit risk. Debt ratio is positively related to liquidity risk. The Crisis is found insignificantly related to the three risk measures which indicate that Egyptian bank's risk is not affected significantly by the financial crisis during 2008.

Finally, the empirical evidence suggests that board characteristics, including board size, non-executive directors, CEO duality, and board female are significant determinants of bank risk-taking.

The findings suggest that capital ratio is the main determinant of bank insolvency risk, accordingly increasing capital ratio will enhance the stability of banks

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