The effect of board of directors diversity on firm performance

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Abstract

This research explores the connection between the diversity of boards of directors and the performance of firms within the realm of publicly traded companies in Egypt. As the practices of corporate governance continue to evolve, particularly in developing markets, the composition and diversity of boards have gained significance in influencing organizational results. A varied board composition, encompassing factors such as gender, culture, and educational background, can affect decision-making processes, strategic supervision, and ultimately, the performance of the firm. In this study, firm performance is assessed through three commonly recognized financial metrics: Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). The objective of this research is to empirically investigate the hypothesis that board composition diversity significantly impacts firm performance. By shedding light on how governance frameworks influence financial results, this study adds to the broader discourse on corporate responsibility and sustainable value creation, as well as providing practical implications for policymakers, regulators, and corporate stakeholders in comparable economic contexts.

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Introduction

In recent years, the academic conversation surrounding board diversity has made significant progress, with an increasing number of scholarly articles highlighting its complex importance, especially in areas such as gender, educational attainment, and cultural backgrounds. Researchers contend that board diversity serves as a vital compound for innovation, creativity, and the recognition of strategic opportunities within organizations (Şener & Karaye, 2014). This shifting viewpoint has powered a global initiative towards more diverse board structures, based on the view that varied boards improve decision-making quality and ultimately lead to greater shareholder value (Huang, 2013). This research adds to the existing body of knowledge by examining the effect of board diversity on firm performance, concentrating particularly on companies listed in the EGX100 index. By incorporating modern insights and framing the results within a fluid business landscape, the study seeks to enrich the understanding of how diversity influences organizational outcomes. In this process, it emphasizes the strategic importance of board diversity in enhancing firms' adaptability and competitiveness in increasingly diverse markets (Mirza, Andleeb, & Ramzan, 2012).

The primary aim of this study is to examine how board diversity affects firm performance, providing empirical evidence to support governance practices and policy development in emerging markets.

Theoretical foundation and hypothesis development:

Board of directors' diversity characteristics and Firm Performance

The available research examining the relationship between board diversity and corporate performance has yielded inconsistent results. Some investigations have identified a positive correlation between board diversity and company performance, while others indicate a negative or negligible effect (Carter, Simkins, & Simpson, 2003; Huang & Kisgen, 2013). Additionally, the influence of board diversity on organizational performance seems to vary across developing nations, with unique outcomes observed in each scenario (Post & Byron, 2015). Differences in the approaches used to assess board diversity and its features have played a role in these varied results (Erhardt, Werbel, & Shrader, 2003). Moreover, studies indicate that board diversity, including factors such as gender, educational background, and cultural representation, can have a substantial effect on firm performance. These diverse traits of the board may therefore be essential in influencing the organization's performance, as they affect both governance processes and strategic choices that foster value creation.

Board of directors' gender diversity and Firm Performance

The connection between board diversity and firm performance has received growing attention from scholars in recent years. Numerous studies have investigated how different types of diversity, such as gender, cultural representation, and educational background, effect organizational outcomes. Researchers have investigated the effects of female board representation on corporate governance and performance in U.S. businesses. Their results indicated that women on boards typically demonstrated higher attendance and more engagement in monitoring committees. However, they also noted a negative effect of board gender diversity on firm performance, especially in organizations with weak governance structures, as evidenced by inadequate takeover defenses. Likewise, research has indicated that both gender and ethnic diversity can influence the performance of U.S. corporations, with some studies finding no significant correlation between board diversity and firm performance. This stands in contrast to findings from developing countries, where the effects of board diversity may vary according to cultural and economic contexts (Adams & Ferreira, 2009). Other studies focusing on Indonesian companies revealed that gender diversity adversely affected firm performance (Darmadi, 2011). Conversely, (Shukeri 2012) examined Malaysian firms and discovered that ethnic diversity positively influenced firm performance, while gender diversity had no significant effect.

In summary, these studies demonstrate that the effect of board diversity on firm performance is intricate and influenced by context; factors such as gender, education, and cultural diversity assume different levels of importance depending on governance structures, economic conditions, and organizational contexts, suggesting that this relationship is shaped by a variety of internal and external factors.

Board of directors' cultural diversity and Firm Performance

Recent studies have increasingly emphasized the effect of culture on the performance of firms. A significant portion of the current research in corporate finance has focused on how national culture influences strategic decisions and financial outcomes at the firm level (Bryan et al., 2015; El Ghoul & Zheng, 2016; Zheng et al., 2012). Other research has looked at how larger cultural differences affect financial results on both macro and micro scales, highlighting the role of shared values and norms in shaping decision-making processes (Ahern et al., 2015; Beugelsdijk & Frijns, 2010; Karolyi, 2016). Nonetheless, most cultural studies in finance have typically centered on differences between groups, investigating how distinctions in culture between national or regional categories influence financial performance. In contrast, a more recent area of study has begun to investigate cultural diversity within

groups, particularly within organizational frameworks like corporate boards. This new perspective views cultural diversity not merely as a distinguishing national feature but also as an internal organizational element that might impact governance and strategic implementation.

Board of directors' educational diversity and Firm Performance.

Board diversity includes not only gender and cultural representation but also the involvement of individuals with different educational backgrounds, which is crucial for forming a balanced and proficient board capable of enhancing company performance. A well-structured board that comprises directors with various academic qualifications can improve the strategic direction of an organization, especially when traditional promises made by authorities fail to materialize. Thus, competency emerges as a significant factor in choosing board members, as it is closely associated with the board's ability to elevate organizational outcomes. While there is a scarcity of empirical studies specifically examining the effect of educational diversity on firm performance, the available evidence remains ambiguous. Some research indicates that having highly educated individuals on boards positively influences performance results. This perspective is based on the idea that higher education provides individuals with essential leadership abilities and decision-making skills. Regardless of these differing opinions, the current research expects a strong and positive correlation between educational diversity among board members and the performance of firms in Nigeria. This expectation stems from the belief that diverse educational experiences can improve decision-making by incorporating various perspectives and areas of expertise (Shariff Kabara et al., 2022).

Accordingly, the following hypotheses were developed:

H_1: There is a significant effect of the board of directors' characteristics diversity on firms' performance.

H_{1a}: There is a significant effect of the board of directors' gender diversity on firms' performance.

H_{1b}: There is a significant effect of the board of directors' cultural diversity on firms' performance.

H_{1c}: There is a significant effect of the board of directors' educational diversity on firms' performance.

Research Objectives

This research aims to:

1. To examine the overall effect of the board of directors' characteristics diversity on firms' performance.

1.1 To analyze the impact of gender diversity among board members on firms' performance.

1.2 To investigate the influence of cultural diversity within the board of directors on firms' performance.

1.3 To assess the effect of educational diversity among board members on the performance of firms**.**

Research Model

The research model is developed in accordance with the previously stated hypotheses.

Board of directors' characteristics diversity

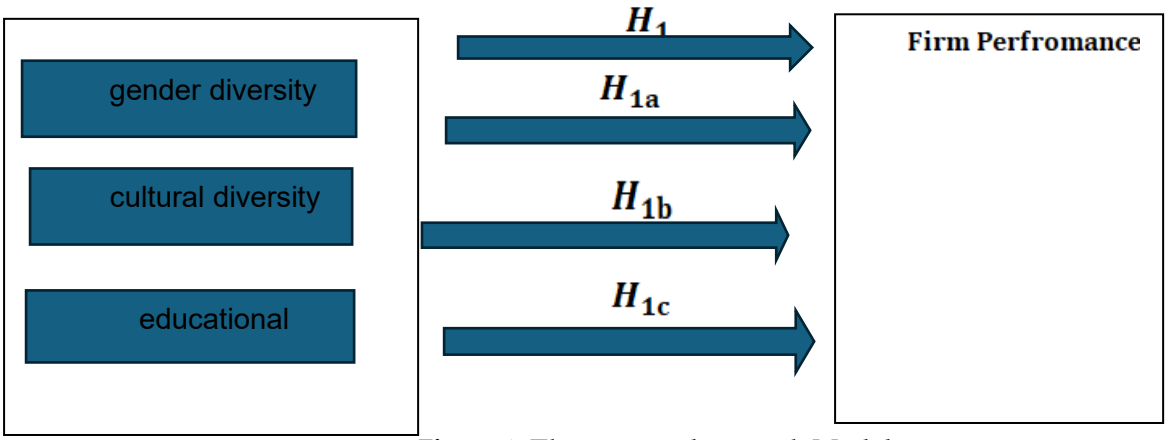

Figure 1: The proposed research Model

Research Context and Data Gathering

The researcher collected secondary annual data spanning a period of six years, from 2017 to 2022, to ensure the comprehensiveness and reliability of the analysis. The data were obtained from a sample of 45 companies listed on the EGX 100 Index of the Egyptian Stock Exchange (EGX), representing a diverse cross-section of sectors and industries within the Egyptian capital market. Each company in the sample provided a continuous time series of annual data for the full six-year period, thereby ensuring consistency and completeness across all units of observation. This resulted in a total of 270 firm-year observations (45 companies × 6 years), which form the empirical basis of the study. The selection of the EGX 100 was guided by its representativeness and the availability of reliable financial and non-financial data, making it an appropriate context for examining the effect of board of directors' diversity on firm performance. The data collection process focused on obtaining accurate and comparable figures from publicly available financial statements, annual reports, and official databases to support the study's analytical framework.

Measurement Scales

In this study, several measurement scales were employed to assess the variables under investigation, particularly to evaluate the relationship between board diversity and firm performance. Board diversity was measured through three key dimensions: gender diversity, cultural diversity, and educational diversity.

Gender diversity was measured using a nominal scale, represented by a dummy variable indicating the presence or absence of female directors on the board (1 = presence of at least one female director, 0 = otherwise). In addition, the proportion of female board members to total board size was also considered, which reflects a ratio scale measurement for robustness.

Similarly, cultural diversity was assessed using the same approach as gender diversity. It was measured on a nominal scale through a dummy variable indicating whether at least one non-national (or foreign) director was present on the board (1 = presence of culturally diverse director(s), 0 = otherwise). The proportion of non-national board members was also recorded, applying a ratio scale for additional depth in analysis.

Educational diversity was measured using an index-based approach on a ratio scale, considering the heterogeneity of academic backgrounds among board members. The Blau Index was applied to capture

the distribution of directors' educational fields, thereby quantifying the diversity of knowledge and expertise on the board. Higher index values indicate greater educational diversity.

As for the dependent variable, firm performance was measured using both accounting-based and market-based indicators. Accounting-based performance was captured through Return on Assets (ROA) and Return on Equity (ROE), and Earnings per Share (EPS) all measured on a ratio scale.

Data Analysis and results

This chapter examines the impact of diversity in board of directors' characteristics on firm performance.

Sample Size and Descriptive analysis

The researcher gathered annual data over a six-year period (2017–2022) from 45 companies listed under the EGX 100 index. Each company contributes a time series of six years, resulting in a total of 270 observations for the final study sample.

The main variables of the study will be examined to identify central tendency indicators—namely the mean, maximum, and minimum values—as well as dispersion measures, such as the standard deviation and the coefficient of variation for each variable.

Table (7.1): Variables descriptive analysis

Variable	N	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Gender diversity	270	0.00	0.50	0.14	0.12	0.87
Education diversity	270	0.00	0.70	0.25	0.18	0.71
Culture diversity	270	2.00	4.00	3.45	0.39	0.11
ROA	270	-0.33	0.86	0.08	0.11	1.44
ROE	270	-1.00	13.61	0.28	1.24	4.48
EPS	270	4.63	15.00	0.81	1.86	2.30
Firm size	270	14.15	25.82	21.35	1.98	0.09
Leverage	270	0.00	4.05	0.47	0.34	0.72

Source: prepared by the researcher from E-views software output.

From table (7.1) it is concluded that:

- All variables included in the study comprise 270 observations, indicating the absence of any missing data.
- The independent sub-variable **Gender Diversity** shows values ranging from 0.00 to 0.50, with a mean of 0.14. The standard deviation is calculated at 0.12, and the coefficient of variation (CV) stands at 87%, reflecting a moderate degree of variability around the mean.
- **Education Diversity**, one of the independent sub-variables, ranges from a minimum of 0.00 to a maximum of 0.70. It has an average value of 0.25, with a standard deviation of 0.18 and a coefficient of variation of 71%, indicating a moderate degree of variability around the mean.

- For the independent sub-variable **Cultural Diversity**, the values range from 2.00 to 4.00, with an average of 3.45. The standard deviation is 0.39, and the coefficient of variation is relatively low at 11%, indicating limited variation around the mean.
- Regarding the dependent variables:
- **Return on Assets (ROA)** has values spanning from -0.33 to 0.86, with a mean of 0.08. The standard deviation is 0.11, and the coefficient of variation is 144%, which denotes a high level of variability relative to the mean.
- **Return on Equity (ROE)** ranges between -1.00 and 13.61, with an average value of 0.28. It exhibits a standard deviation of 1.24 and a coefficient of variation of 448%, suggesting a very high degree of dispersion.
- **Earnings per Share (EPS)** records values from 4.63 to 15.00, with a mean of 0.81. The standard deviation is 1.86, and the coefficient of variation reaches 230%, indicating substantial variability around the mean.
- In terms of control variables:
- **Firm Size** varies from 14.15 to 25.82, with a mean of 21.35. Its standard deviation is 1.98, and the coefficient of variation is relatively low at 9%, suggesting minimal dispersion.
- **Leverage** has a minimum value of 0.00 and a maximum of 4.05, with a mean of 0.47. The standard deviation is 0.34, and the coefficient of variation is 72%, reflecting a moderate level of variation.

Overall, the coefficients of variation range from low to high, which can be attributed to the heterogeneity of the sample. The dataset includes companies from various sectors within the EGX 100 index, ensuring broad representation and minimizing sectoral bias in the study.

Test of normality

The researcher employed the Shapiro-Wilk test to evaluate whether the main variables in the study conform to a normal distribution. This test, grounded in the Chi-squared framework, examines data normality using two hypotheses: the null hypothesis assumes the variables are not normally distributed when the p-value is less than or equal to 0.05, while the alternative hypothesis indicates normal distribution when the p-value is greater than 0.05.

Table (7.2): Shapiro-Wilk test of normality

Variable	Statistic	*df*	*P-value*
Gender diversity	0.914	270	*0.000*
Education diversity	0.934	270	*0.000*
Culture diversity	0.903	270	*0.000*
ROA	0.843	270	*0.000*
ROE	0.207	270	*0.000*
EPS	0.539	270	*0.000*
Firm size	0.905	270	*0.000*
Leverage	0.741	270	*0.000*

Source: prepared by the researcher from E-views software output.

Based on the results presented in Table (7.2), it can be concluded that all independent sub-variables, the moderator variable, and the dependent sub-variables do not follow a normal distribution, as the p-values associated with the Chi-square statistic are below 0.05. Therefore, the alternative hypothesis is accepted, indicating that the variables are not normally distributed.

Testing the means differences between the independent Sub-Variables

In order to test that is there a significant difference between the independent variable "Board characteristics diversity" sub-variables and the dependent variable "Firms' performance" sub-variables means are equal or not, the researcher will use Kruskial-Wallis test to test the mean differences between three or more sub-variables, by which the test null hypothesis states that: there is no significance difference between sub-variables means and will be accepted if the test p-value more than or equal 0.05, while the test alternative hypothesis states that: there is a significance difference between sub-variables means and will be accepted if the test p-value less than 0.05.

Table 7.3 below displays the results of the Kruskal-Wallis test, which was conducted to examine the differences in means among the sub-variables of the independent variable "Board Characteristics Diversification," namely Gender Diversity, Education Diversity, and Cultural Diversity.

Table (7.3): Kruskial-Wallis test of Board characteristics diversity

Method	DF	Chi-Squared	*P-value*	Reject H_0 at (α=0.05)
Not Corrected for Ties	2	549.7593	*0.000*	**Yes**
Corrected for Ties	2	551.5086	*0.000*	**Yes**

Source: prepared by the researcher from SPSS output

From table (7.3) it is concluded that: there is a significance difference between Board characteristics diversity sub-variables means which are: (Gender diversity, Education diversity, and Culture diversity.

The following table (7.4) presents Kruskial-Wallis test to test the means difference dependent variable "Firms' Performance" sub-variables which are: (Return on Assets, Return on Equity, and Earnings per share).

Table (7.4): Kruskial-Wallis test of Firms' Performance

Method	DF	Chi-Squared	*P-value*	Reject H_0 at (α=0.05)
Not Corrected for Ties	2	160.9796	*0.000*	**Yes**
Corrected for Ties	2	160.9800	*0.000*	**Yes**

Source: prepared by the researcher from SPSS output

From table (7.4) it is concluded that: there is a significance difference between Firms' Performance sub-variables means which are: (Return on Assets, Return on Equity, and Earnings per share)

Correlation Matrix

After conducting normality tests on the independent and dependent sub-variables, it was determined that the study variables do not follow a normal distribution. Consequently, the Spearman correlation coefficient is deemed the most suitable method for assessing the strength and direction of the relationships between pairs of variables. To evaluate the significance of the correlation, a t-test is applied, where the null hypothesis suggests that no correlation exists if the p-value exceeds 0.05.

Table (7.5): Spearman correlation matrix

Variable	BGD	Culture	Education	Firm size	Leverage	ROA	ROE	EPS
BGD	**1.000**							
P-value	**-**							
Culture	-0.170**	**1.000**						

P-value	*0.005*	-						
Education	-0.109	0.083	**1.000**					
P-value	*0.073*	*0.171*	-					
Firm size	-0.079	-0.019	0.112	**1.000**				
P-value	*0.197*	*0.753*	*0.067*	-				
Leverage	-0.050	0.234**	-0.186**	0.167**	**1.000**			
P-value	*0.417*	*0.000*	*0.002*	*0.006*	-			
ROA	0.236*	-0.321**	0.211*	0.273*	-0.283**	**1.000**		
P-value	*0.048*	*0.000*	*0.048*	*0.031*	*0.000*	-		
ROE	-0.025	-0.335**	-0.015	0.166**	-0.052	0.861**	**1.000**	
P-value	*0.686*	*0.000*	*0.800*	*0.006*	*0.399*	*0.000*	-	
EPS	-0.013	-0.152*	0.054	0.165**	-0.158**	0.662**	0.608**	**1.000**
P-value	*0.827*	*0.013*	*0.378*	*0.007*	*0.010*	*0.000*	*0.000*	-

Source: prepared by the researcher from E-views software output.

From Matrix (7.5) it is concluded that:

- A statistically significant, positive, and weak correlation exists between Return on Assets (ROA) and board gender diversity, with a correlation coefficient of 0.236 and a p-value of 0.048.
- ROA shows a significant, negative, and weak relationship with cultural diversity, evidenced by a correlation coefficient of -0.321 and a p-value of 0.000.
- A weak, positive, and statistically significant relationship is found between ROA and educational diversity, with a correlation coefficient of 0.211 and a p-value of 0.048.
- There is a significant, direct, and weak correlation between ROA and firm size, with a coefficient of 0.273 and a p-value of 0.031.
- ROA is significantly and negatively associated with leverage, showing a weak correlation of -0.283 and a p-value of 0.000.
- The relationship between Return on Equity (ROE) and board gender diversity is weak, negative, and statistically insignificant, with a correlation coefficient of -0.025 and a p-value of 0.686.
- ROE has a significant, inverse, and weak association with cultural diversity, indicated by a correlation coefficient of -0.335 and a p-value of 0.000.
- A weak, negative, and statistically insignificant relationship exists between ROE and educational diversity, with a coefficient of -0.015 and a p-value of 0.800.
- There is a significant, positive, and weak correlation between ROE and firm size, with a coefficient of 0.166 and a p-value of 0.006.
- ROE shows a weak, negative, and statistically insignificant relationship with leverage, with a correlation of -0.052 and a p-value of 0.399.
- The association between Earnings per Share (EPS) and board gender diversity is weak, negative, and not statistically significant, with a correlation coefficient of -0.013 and a p-value of 0.827.

- EPS has a significant, negative, and weak correlation with cultural diversity, with a coefficient of -0.152 and a p-value of 0.013.
- A weak, positive, and statistically insignificant relationship is observed between EPS and educational diversity, with a coefficient of 0.054 and a p-value of 0.378.
- EPS is significantly and weakly positively correlated with firm size, with a coefficient of 0.165 and a p-value of 0.031.
- Lastly, EPS shows a significant, negative, and weak correlation with leverage, with a coefficient of -0.158 and a p-value of 0.010.

Linear Panel Regression model specification

The Panel Regression Model:

The study's hypotheses propose that board characteristics and ownership structure influence financial distress, with firm size acting as a moderating factor. Generally, the dataset consists of cross-sectional observations from various companies, collected and re-sampled over a specific time period. So, a Panel data regression will be most applicable to represent such a linear relationship and the following is the model equation:

$$\hat{y}_{it} = \beta\hat{o} + \beta\hat{1}x_{it} + \cdots + \beta\hat{n}x_{it} + \epsilon_{it}$$

Where:

- $\beta\hat{o}$: The estimated constant term.
- $\beta\hat{n}$: The estimated independent Parameter coefficient.
- y: The dependent variable.
- x: The independent variable.
- i: The Firm Number.
- t: Referring to the year.
- $\in$: Model white noise error.

7.5.2 Steps of Constructing a Panel Regression Model:

- Set the time series variable and the cross-section variable to identify the panel regression model.
- Run a pooled Panel Regression and show the model significance result.
- Apply F-test to determine which more significant pooled or fixed model is.
- Apply Breusch-Pagan test to determine which is more significant Pooled or Random model is.
- Apply Hausman test to determine which is more significant Fixed or Random model is.

"In the three tests: F-test, Breusch-Pagan test, and Hausman test if the *p-value* < 0.05, accept the alternative hypothesis".

Apply Robustness check test by performing:

a) F-test for overall significance of regressors: The regressors are considered jointly significant in the panel model when the p-value of the F-test is below 0.05.

b) Welch test for intercept equality across groups (cross-sections or time): If the p-value of the Welch test exceeds 0.05, it indicates that the groups share a common intercept. Conversely, if the p-value is below 0.05, the groups have different intercepts.

Pooled OLS is the most basic estimation method used for panel data. While it is generally insufficient for capturing the complexities of such data, it serves as a useful benchmark for evaluating the performance of more advanced estimation techniques.

Fixed Effects are constant across firms', and random effects vary according time. a model with random intercepts ***ai*** and fixed slope ***b*** corresponds to parallel lines for different individuals, or the model $y_{it} = a_i + b_t y_{it} = a_i + b_t$. Kreft and De Leeuw (1998) thus distinguish between fixed and random coefficients.

Performing the model diagnostics tests:

a) Ramsey RESET Test for Model Specification: This test is applied to assess whether the model is correctly specified, ensuring it includes all relevant variables and omits any irrelevant ones so that the estimated coefficients remain unbiased. The Ramsey RESET test is used for this purpose, and the decision rule is to accept the null hypothesis—indicating that the model is properly specified—if the p-value exceeds 0.05.

b) White Stability test for random error variation: The regression models and the OLS technique rely on several key assumptions, one of which is homoscedasticity—meaning that the variance of the error terms remains constant and the mean of the errors is zero. When heteroscedasticity is present, it can violate this assumption, and methods like the White test are employed to detect and address the issue. In this test, the null hypothesis assumes the presence of heteroscedasticity, and if the p-value is greater than 0.05, it indicates a problem of inconsistent error variance in the model.

c) Variance Inflation Factors: Minimum possible value equal 1.0 and the values greater than 10.0 may indicate a collinearity problem.

Testing the Hypothesis 1a

For testing the impact of board of directors' characteristics diversity on firms' performance (ROA), the researcher will apply the panel diagnostics tests in order to determine the most appropriate linear panel regression to test that hypothesis.

Table (7.6): The pooled panel model diagnostics for the first hypothesis H_{1a}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test	Comparing between Pooled panel and Fixed Effect Panel	F = 4.25994	4.02129e-013	Fixed effect
Breusch-Pagan test	Comparing between Pooled panel and Random Effect Panel	LM = 76.1452	2.63559e-018	Random effect
Hausman test	Comparing between Fixed Effect panel and Random Effect Panel	H = 4.47364	0.483418	Random effect

Source: Prepared by the researcher depending on E-views software output.

After comparing the three panel effects (pooled, fixed, and random) the researcher found that random linear panel regression is the most fitted model for forecasting Return on Assets (ROA).

Also will apply and robustness check test to verify this model to be applied for any other sample from the study population.

Table (7.6): The robustness check test panel model diagnostics for the first hypothesis H_{1a}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test for joint regressors' significance	The regressors' are jointly significant with the panel model	F = 10.632	<0.0001	Verified
Welch test for intercepts of different groups	Cross sections and time have a common intercept or one of them performed by different intercepts	F = 69.362	<0.0001	Cross sections or time have different intercepts

Source: Prepared by the researcher depending on E-views software output.

From the robustness check test it was found that:

- The F-test for joint significance of the regresses showed that the independent variables, along with the constant term, significantly influence the dependent variable, as indicated by a p-value less than 0.05.
- The Welch test, which assesses differences in intercepts across various groups, demonstrated that both cross-sectional units and time periods have distinct intercepts. This finding supports the use of the random effects panel model as the most appropriate linear regression method for analyzing this relationship.

Table (7.7): The random effect panel model of the first hypothesis H_{1a}

Model	*Random effect Panel*	Dependent variable		ROA	VIF Test
Independent variables	***Coefficient***	***t-ratio***	***p-value***	**Significance**	
Constant	0.135315	2.111	0.0357	**Significant**	
Gender diversity	−0.101432	−2.496	0.0132	**Significant**	1.045
Culture diversity	−0.0910354	−4.145	<0.0001	**Significant**	1.075
Education diversity	0.0415095	3.199	0.0015	**Significant**	1.069
Firm size	0.00850385	3.320	0.0010	**Significant**	1.061
Leverage	−0.121317	−5.786	<0.0001	**Significant**	1.065
F-test	16.52436	***p-value***		<0.0001	
Ramsey Reset test	0.44535	***p-value***		0.716265	
Heterosckadicity test	0.9982	***p-value***		0.852337	
Adjusted R-squared			22.3938%		

Source: Prepared by the researcher depending on E-views software output.

From table (7.7) it is concluded that:

- The overall random effects panel model is statistically significant, with an F-test value of 16.52436 and a p-value less than 0.0001, indicating strong significance. The adjusted R-squared is 22.39%, suggesting that the independent sub-variables account for 22.39% of the variation in Return on Assets (ROA).
- The constant term has a significant effect on ROA.

- Gender diversity has a significant negative impact on ROA.
- Cultural diversity also shows a significant negative effect on ROA.
- Education diversity has a significant positive influence on ROA.
- Firm size exhibits a significant positive effect on ROA.
- Leverage has a significant negative impact on ROA.
- There is no evidence of multicollinearity among the independent variables, as the Variance Inflation Factor (VIF) for each variable is equal to one.
- The Ramsey RESET test yielded a p-value of 0.716265, exceeding the 0.05 threshold, indicating that the model includes all relevant independent variables.
- Both heteroscedasticity tests produced p-values of 0.852337, suggesting that the residuals maintain constant variance over time and that the model does not suffer from heteroscedasticity.
- The overall equation for forecasting the ROA is:

$$\widehat{ROA_{it}} = 0.135315 - 0.101432\text{BGD}_{\text{it}} - 0.0910354\text{Culture}_{\text{it}} + 0.0415095\text{Education}_{\text{it}} + 0.00850385\ \text{Size}_{\text{it}} - 0.121317\ \text{Leverage}_{\text{it}}$$

Therefore, the researcher will accept the first hypothesis which means that there is significant impact from board of directors' characteristics diversity on firms' performance (ROA).

Testing the Hypothesis 1b

For testing the impact of board of directors' characteristics diversity on firms' performance (ROE), the researcher will apply the panel diagnostics tests in order to determine the most appropriate linear panel regression to test that hypothesis.

Table (7.8): The pooled panel model diagnostics for the second hypothesis H_{1b}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test	Comparing between Pooled panel and Fixed Effect Panel	F = 8.59774	1.24047e-028	Fixed effect
Breusch-Pagan test	Comparing between Pooled panel and Random Effect Panel	LM = 204.01	2.78508e-046	Random effect
Hausman test	Comparing between Fixed Effect panel and Random Effect Panel	H = 2.47249	0.780632	Random effect

Source: Prepared by the researcher depending on E-views software output.

After comparing the three panel effects (pooled, fixed, and random) the researcher found that random linear panel regression is the most fitted model for forecasting Return on Equity (ROE).

A robustness check test will also be conducted to confirm that the model is suitable for application to other samples within the study population.

Table (7.8): The robustness check test panel model diagnostics for the second hypothesis H_{1b}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test for joint regressors' significance	The regressors' are jointly significant with the panel model	F = 10.485	<0.0001	Verified
Welch test for intercepts of different groups	Cross sections and time have a common intercept or one of them performed by different intercepts	F = 72.533	<0.0001	Cross sections or time have different intercepts

Source: Prepared by the researcher depending on E-views software output.

From the robustness check test it was found that:

- The F-test for joint significance of the regressors demonstrated that the independent variables and the constant significantly affect the dependent variable, as indicated by a p-value below 0.05.
- The Welch test for intercepts across different groups revealed that the cross-sections and time periods have distinct intercepts, confirming that the random effects panel model is the most suitable linear regression model for this analysis.

Table (7.9): The random effect panel model of the second hypothesis H_{1b}

Model	*Random effect Panel*	**Dependent variable**		ROE	**VIF Test**
Independent variables	***Coefficient***	***t-ratio***	***p-value***	**Significance**	
Constant	0.154201	0.8085	0.4195	**Insignificant**	
Gender diversity	−0.0186833	−0.1125	0.9105	**Insignificant**	1.045
Culture diversity	−0.352813	−2.456	0.0147	**Significant**	1.075
Education diversity	0.104807	16.63	<0.001	**Significant**	1.069
Firm size	0.0221492	2.863	0.0045	**Significant**	1.061
Leverage	−0.0497590	−0.7377	0.4614	**Insignificant**	1.065
F-test	2.713939	***p-value***		0.020664	
Ramsey Reset test	1.77299	***p-value***		0.2242418	
Heterosckadicity test	0.03300	***p-value***		0.693207	
Adjusted R-squared			13.0874%		

Source: Prepared by the researcher depending on E-views software output.

From table (7.9) it is concluded that:

- The overall random effects panel model is significant, with an F-test value of 2.713939 and a p-value of 0.020664, which is below the 0.05 threshold. The adjusted R-squared of 13.09% indicates that the independent sub-variables explain 13.09% of the variation in Return on Equity (ROE).
- The constant term has an insignificant effect on ROE and was therefore excluded from the model.
- Gender diversity shows a negative but insignificant impact on ROE and was removed from the equation.
- Cultural diversity has a significant negative effect on ROE.
- Education diversity demonstrates a significant positive impact on ROE.
- Firm size has a significant positive influence on ROE.
- Leverage exhibits a negative but insignificant effect on ROE and was dropped from the model.
- Multicollinearity is not a concern, as the Variance Inflation Factor (VIF) for the independent variables is equal to one.

- The Ramsey RESET test yielded a p-value of 0.2242418, exceeding 0.05, suggesting that the model includes all relevant independent variables.
- Both heteroscedasticity tests returned p-values of 0.693207, indicating that the residuals maintain constant variance over time, and the model does not suffer from heteroscedasticity.
- The overall equation for forecasting the ROE is:

$$\widehat{ROE}_{it} = -0.352813\ \text{Culture}_{it} + 0.104807\ \text{Education}_{it} + 0.0221492\ \text{Size}_{it}$$

Therefore, the researcher will accept the second hypothesis which means that there is significant impact from board of directors' characteristics diversity on firms' performance (ROE).

Testing the Hypothesis 1c

For testing the impact of board of directors' characteristics diversity on firms' performance (EPS), the researcher will apply the panel diagnostics tests in order to determine the most appropriate linear panel regression to test that hypothesis.

Table (7.10): The pooled panel model diagnostics for the third hypothesis H_{1c}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test	Comparing between Pooled panel and Fixed Effect Panel	F = 4.36683	1.56308e-013	Fixed effect
Breusch-Pagan test	Comparing between Pooled panel and Random Effect Panel	LM = 76.0627	2.74796e-018	Random effect
Hausman test	Comparing between Fixed Effect panel and Random Effect Panel	H = 6.32152	0.276179	Random effect

Source: Prepared by the researcher depending on E-views software output.

After comparing the three panel effects (pooled, fixed, and random) the researcher found that random linear panel regression is the most fitted model for forecasting Earnings per share (EPS).

Also will apply and robustness check test to verify this model to be applied for any other sample from the study population.

Table (7.10): The robustness check test panel model diagnostics for the third hypothesis H_{1c}

Test	Purpose	Test-statistic result	*P-value*	Fitted panel model
F-test for joint regressors' significance	The regressors' are jointly significant with the panel model	F = 11.596	<0.0001	Verified
Welch test for intercepts of different groups	Cross sections and time have a common intercept or one of them performed by different intercepts	F = 83.661	<0.0001	Cross sections or time have different intercepts

Source: Prepared by the researcher depending on E-views software output.

From the robustness check test it was found that:

- The F-test for joint significance of the regressors indicated that both the independent variables and the constant significantly influence the dependent variable, as the p-value is below 0.05.
- The Welch test for intercepts across different groups revealed that the cross-sectional units and time periods have distinct intercepts, confirming that the random effects panel model is the most suitable linear regression approach for this relationship.

Table (7.11): The random effect panel model of the third hypothesis H_{1c}

Model	*Random effect Panel*	**Dependent variable**		EPS
Independent variables	***Coefficient***	***t-ratio***	***p-value***	**Significance**
Constant	−6.75350	−0.6253	0.5324	**Insignificant**
Gender diversity	−0.628035	−0.3602	0.7190	**Insignificant**
Culture diversity	1.07310	1.024	0.3070	**Insignificant**
Education diversity	0.293748	0.1040	0.9172	**Insignificant**
Firm size	0.291841	1.297	0.1959	**Insignificant**
Leverage	0.291577	0.8081	0.4199	**Insignificant**
F-test	1.501843	***p-value***		0.189524

Source: Prepared by the researcher depending on E-views software output.

From table (7.11) it is concluded that:

- The overall random panel model is insignificant as the overall F-test for significance has a value of 1.501843 and *p-value* 0.189524 which is more than 0.05, which means that the independent sub-variables don't explain the change in the Earnings per share (EPS).
- Constant has insignificant impact on EPS. (dropped from equation)
- Gender diversity has insignificant impact on EPS. (dropped from equation)
- Culture diversity has insignificant impact on EPS. (dropped from equation)
- Education diversity has insignificant impact on EPS. (dropped from equation)
- Firm size has insignificant impact on EPS. (dropped from equation)
- Leverage has insignificant impact on EPS. (dropped from equation)

Therefore, the researcher will reject the third hypothesis which means that there is no significant impact from board of directors' characteristics diversity on firms' performance (EPS).

Discussion and Conclusion

This research set out to examine the relationship between board of directors' diversity and firm performance among publicly traded companies in Egypt. The findings offer important insights into the evolving role of corporate governance in emerging markets, particularly the impact of board composition on financial outcomes.

The results revealed a **significant positive relationship** between board diversity and two key performance indicators: **Return on Assets (ROA)** and **Return on Equity (ROE)**. Specifically, the first hypothesis, which evaluated the impact of board diversity on ROA, showed a **significant random effect of 22.3938%**, suggesting that firms with more diverse boards tend to utilize their assets more efficiently to generate profit. The second hypothesis, testing the influence on ROE, demonstrated a **significant effect of 13.0874%**, reinforcing the argument that a more heterogeneous board can enhance the firm's ability to generate returns on shareholders' equity.

These findings support the view that diversity in the boardroom—whether in terms of gender, educational background, or cultural perspectives—can enhance strategic oversight and broaden the range of viewpoints in decision-making. Such diversity likely promotes more balanced risk assessment and encourages innovative strategies, both of which contribute to improved financial performance. This is consistent with agency theory and resource dependence theory, which suggest that diverse boards bring broader knowledge and reduce information asymmetries, thereby improving governance effectiveness.

However, the **hypothesis 1c**, which examined the effect of board diversity on **Earnings Per Share (EPS)**, yielded **insignificant results**. This suggests that while board diversity influences the firm's overall operational and equity performance, its impact on per-share earnings may be mediated by other factors such as market sentiment, dividend policy, or earnings management practices. It also implies that short-term shareholder-oriented metrics like EPS might not fully capture the strategic benefits derived from board diversity, especially in contexts where capital markets are less mature or investor expectations are less sensitive to governance-related variables.

The empirical evidence from this study underscores the significance of board diversity in enhancing firm performance in Egypt's publicly traded companies. The positive and significant effects on ROA and ROE confirm that diverse boards can drive stronger financial outcomes by improving governance quality, fostering innovation, and enabling more effective strategic oversight.

Nonetheless, the lack of a significant impact on EPS highlights the nuanced nature of this relationship and suggests the need for a more comprehensive understanding of how market-based indicators respond to internal governance changes. These findings have several practical implications:

- **For policymakers and regulators**, the results advocate for continued support of board diversity initiatives, including gender quotas and guidelines on board composition.
- **For corporate leaders**, the findings emphasize the value of intentionally cultivating diverse boards as part of broader governance and performance strategies.
- **For investors and stakeholders**, this research provides empirical support for incorporating governance-related criteria into investment decisions, particularly in emerging markets like Egypt.

In conclusion, board diversity emerges not only as a matter of corporate social responsibility but also as a tangible driver of organizational performance. Future research may benefit from exploring longitudinal impacts, sector-specific dynamics, or the interplay between diversity dimensions and other governance mechanisms.

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