



“EFFECT OF BOARD GENDER DIVERSITY ON PRODUCTIVITY IN THE NIGERIAN CONSUMER GOODS INDUSTRY”

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ABSTRACT

Many corporate failures have been attributed to lack of good administration, with far-reaching effects not only on investors but on return on investment and productivity performance metrics. This study sought to establish the effect of board gender diversity on productivity in the Nigerian consumer goods industry. The objective is to determine, given the existence of corporate governance mechanism, if significant relationship exist between the board gender diversity and Total Factor productivity (TFP) variables. The secondary data were collected through published financial statements of the consumer goods companies listed in the Nigerian Exchange Group (NGX) from 2015 to 2024. The Panel data regression analysis using Random effects model were employed for testing of our hypothesis following the result of the diagnostic tests: Levin, Lin Chu (LLC) Unit root Test, Breusch-Pagan Lagrange Multiplier (LM) and Hausman tests which showed that the random effect is the best estimator. The random effects and fixed effects models were all estimated, and disclose that the fixed effects coefficient was not significant. The findings from the study revealed that, board gender diversity has a positive significant effect on productivity of the Nigerian consumer goods industry. The implication of this finding is that encouraging gender diversity on boards can be beneficial at the macro level, as it correlates with higher productivity across firms. Therefore, consumer goods industry in Nigeria can thrive better in terms of productivity performance by diversifying leadership and a balanced board gender diversity structure. The study contributes to knowledge by providing evidence of the effect of board gender diversity on productivity.

1. INTRODUCTION

The formation of equitable board of directors have been the frontline of the decision makers in organizations especially the connection between the board gender diversity and corporate productivity performance metrics. The need for corporate governance is to help in building an environment of trust, transparency and accountability necessary for nurturing long-term investment so as to influence organizational productivity growth and more inclusive societies (Organization for economic Cooperation and Development -OECD, 2015). The structure of the Board is said to be a vital element of corporate governance and it helps to curtail the possible conflicts of interest amongst the stakeholders (Garcia-Sanchez & Garcia-Meca, 2018).

Therefore, a sound corporate governance could be seen as mechanism that supports organisations to operate more capably and reduce risk against mismanagement and ensure smooth access to capital that will support productivity growth of the corporate institutions. While the absence of organized governance system resulted to mismanagement of organizations saddled with corporate frauds and many numerous corporate scandals (J. Zuva & Tranos, 2018).

Previous studies have shown that corporate governance is related to the process of productivity growth. On measures of companies performance, some researchers have become interested at the productivity of a company and employees of the total factor productivity (TFP) as a measure of the value of a company (Schoar, 2002; Adegoke, 2013). The links between corporate board diversity and productivity have been largely unexplored. Most existing in-country studies of corporate governance in Nigeria pay attention only to the firm Management structure and internal processes, but not on its impact on productivity and quality. Yet at the core of corporate governance board diversity are asymmetric information issues that can draw attention to agency costs and their consequences on firm productivity. The identification of informational differences is vital in determining what a firm's environment structure (including balanced board structure in a particular firm) plays in disciplining and monitoring its management, that is, the impact governance board diversity patterns can have on firm attribute and quality of outcomes.

The advocates of diversity on corporate boards contend that greater diversity can enhance oversight, mitigate risks, enhance decision-making, and improve the overall corporate governance (Harjoto et al., 2014). Thus organizations must take the time to analyse the full impacts of the type of board of directors because the makeup of the board of directors has a huge impact on a firm's performance. However, the persistent and wide spread of corporate failures of many financial and non-financial firms in Nigeria in recent time such as the Shoprite Nigeria, Mr Bigg's and the strong allegation of financial scandals with Cadbury Plc Nigeria as well as other corporate failures resulted from inadequate implementation of corporate governance policies has called for concerns. McKinsey and Company (2021) on this premised also notes that Nigerian firms perform well below global best practices and other Sub-Saharan African countries, indicating ongoing governance weaknesses that hinder the efficiency and managerial effectiveness.

The objective of this research is to determine, given the existence of corporate board diversity mechanism, if significant relationship exist between corporate board diversity and productivity variables of the Nigerian consumer goods industry. This research is crucial and timely as it will support the government policies on corporate governance and productivity improvement in Nigeria and therefore contribute to the sustainable development and performance improvement in the corporate world. This research is divided into Seven major sections; the introduction, literature review and hypothesis development, methodology, method of data analysis, the results and discussion, conclusion and recommendations as well as limitations of the study.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Concept of Board Gender Diversity and Productivity

The concept of Board Diversity has emerged as a cornerstone of progressive leadership in a modern day corporate world. It encompasses a strategic approach towards integrating individuals from varied backgrounds, experiences, and perspectives into the decision-making body of an organization. Board Diversity refers to the composition of a company's board of directors, encompassing a mix of individuals with different attributes such as gender, race, ethnicity, age, cultural background, professional expertise,

and cognitive styles. It aims to foster inclusivity, equitable representation, and a broad spectrum of viewpoints within the highest echelon of corporate governance (Ferreira, 2010; García-Meca, García-Sánchez, & Martínez-Ferrero, 2015).

The prior literatures such as Owen and Temesvary (2018) has discussed and used different methods to measured gender diversity; studies have adopted the percentage of female directors on board as a measurement of the variable (Owen & Temesvary 2018; Naghavi, Sharif,& Hussain, 2021), while others used the number of female board directors or a dummy variable on the basis of the premise that a critical mass is required prior to the emergence of the influence of female board directors . Recently, the issue of board diversity has emphasized more on gender diversity in corporate boards which involves ascertaining the ratio of women to men on boards of companies. As a wake-up call to encourage women and enhance women's emancipation in general, board diversity in favour of increasing the ratio of women to men in boards of companies has gained much attention (Sathyamoorthi, Baliyan, Dzimiri & Wally-Dima, 2019). Following this premise too, the Nigerian Code of corporate governance (NCCG) states the effective discharge of the responsibilities of the Board and its committees is assured by an appropriate balance of skills and diversity (NCCG,2018:2).

There are deferent definitions of the word productivity by different authors and organizations. However, productivity is commonly described as a ratio between the volume of output and the volume of inputs. In other words, it measures how production inputs capital, labour and materials are efficiently used in an economy to yield particular output. Productivity serves as key foundation of economic revamp and development and, therefore, internationally comparable indicators of productivity are central for assessing economic performance. (OECD, 2021). According to Okwoli(2001), productivity is the net output from a known inputs from factors of production (such as land, labour, capital and entrepreneurship) within a period. Obviously, productivity is commonly measured in terms of output per worker or per capital units depending on the availability of data and other required information. However, the measures of productivity solely on labour or capital as partial productivity have some deficiencies. For example, partial productivity can produce misleading information because of substitution between factors of production (Afzal, 2017). As a result of this deficiency in partial productivity, researchers prefer productivity measured in terms of all inputs which is also called multifactor productivity or total factor productivity (TFP) which is the focus of this study.

Overall, the subject of productivity has been variously investigated by different authorities and different views that been asserted towards the factors that promotes more and better productivity performance. However Findings on the influence of female managers on firm and financial performance have been inconsistent. A positive correlation was found in the studies of Garneroe et al. (2014), Sabatier (2015), Terjesen et al. (2016), Vieira (2018), Kılıç and Kuzey (2016) and Ahmadi et al. (2018). While, a negative association was found by Marimuthu and Kolandaisamy (2009); Ahern and Dittmar (2012) ; Gaitan, Herrera and Pablo (2018).However, several other investigations still failed to find any correlation (Chapple &Humphrey 2014; Bennouri et al. 2018; Ararat Claessens & Yurtoglu, 2021). Although some of these studies indicate that board diversity has a strategic influence on productivity performance, but the literature on the effect of board diversity on productivity efficiency is yet to be settle and still open for further inquiry.

Obviously, the assertions mentioned above and evidence from empirical work support the fact that both corporate board diversity and productivity are related to each other in somehow. However, the relationship is country specific and even those related to our nation are time bound. As such one should not extrapolate one country's experience to another. Based on these assertions and gaps, the researchers therefore,

examined the causal relationship that exists between the board gender diversity and productivity of Nigerian firms. We directly test whether board gender diversity has significant effects on productivity of the Nigerian firms. We state this prediction formally as our first hypothesis:

Ho: Board Gender Diversity has no significant effect on productivity of the Nigerian consumer goods industry.

The Agency Theory

The principal-agent theory encapsulates a tradition of rational choice modeling, in which some actor(s) (the principal(s) uses whatever actions are available, to provide incentives for some other actor(s)) the agent(s) to make decisions that the principal most prefers. This study is anchored on agency theory. The key idea regarding this theory is that policy makers and public managers do not have the same interests as citizens and that they must be held accountable for their actions in order to demonstrate that they have acted according to their responsibilities (Jensen & Meckling, 1976; Fama, 1980). Here the proponents of this theory describe shareholders as principals while the managers are seen as agents. The theory argues that the value of a company cannot be maximized if appropriate incentives or adequate monitoring are not effective enough to restrain firm managers from using their own discretion to maximize their own benefits. The new skills that female directors bring to the board of directors provide new perspectives and values that enable top managers to offer advice, lead to better decision-making in problem-solving, increase effectiveness and innovation, increase access to information (Bennouri, Chtioui, Nagati, & Nekhili, 2018). Therefore, an effective board structures, accountability, and alignment of management decisions with shareholders’ interests is pivotal to improving organizational productivity performance.

III. METHODOLOGY

The study adopts an ex post facto research methods in an attempt to determine the effectiveness of board gender diversity on productivity in the Nigerian consumer goods companies. The study used secondary data generated from the financial statements of the studied companies listed in the Nigerian Exchange Group (NGX) from 2015 to 2024. The population of this study is comprised of all the 20 consumer goods companies listed at the Nigerian Exchange Group (XGN) during the years 2015 to 2024 periods. Table 1 displays the chart for the population of the study. This study employs convenient sampling method to select 15 consumer goods companies listed in the Nigerian Exchange Group (NGX Group) formally known as the Nigerian Stock Exchange (NSE) as at December 2024. This is because of the unavailability of required updated data from other companies under study.

IV. METHOD OF DATA ANALYSIS

This study adopted panel data analysis using Random Effect Model (REM). The random effect method (REM) was adopted because the result of the Hausman test showed that the random effect is the best estimator in this study. Thus following Gujarati and Porter (2009); Marashdeh (2014); Zelalem, Abebe, & Bezabih (2022) the Panel Regression-REM estimator can be obtained as;

(i) formula:

The formula for the Panel regression REM is:

$$Y_{it} = X_{it} + a + U_i + \epsilon_{it}$$

Where:

Y_{it} = Dependent variable of firm, i in time, t (firm productivity indicators);

X_{it} = Explanatory or independent or predicting or regressing variable in the estimation model of firm, i in time, t ;

β = Regression coefficient or slope or gradient of the explanatory variable (corporate governance characteristics);

a = Overall intercept;

U_i = the cross-section or individual-specific random error term (unobserved heterogeneity);

ε_{it} = the idiosyncratic error term or residual random element of firm, i in time, t (assumed to have zero (0) mean and independent over time period).

(ii) Decision Criterion

The decision rule for the test is that, If $p\text{-value}(s) < \alpha$, reject H_0 , But if $p\text{-value}(s) > \alpha$, we fail to reject H_0 .

Model: Effect of Board Gender Diversity on Productivity in Nigerian firms

In addition, to express the general prediction equation in the variables under consideration, we have:

Productivity (TFP) = f (Board Gender Diversity) ... (1)

In order to ensure robustness of the model and to reduce specification bias, the prediction model also includes control variables, making the general formula to be further represented as:

$TFP_{it} = \beta_0 + \beta_n [(Corporate\ Governance + Control\ variable) + \varepsilon_{it} \dots (2)$

By specifying the board gender diversity under study: board gender diversity (BGD) control variable included in the study: firm size (FSZ), we have:

$TFP_{it} = \alpha + \beta_1 BGD_{it} + \beta_2 FSZ_{it} + \varepsilon_{it} \dots (3)$

Where:

TFP_{it} = Total Factor Productivity of firm i in time t .

BGD_{it} = Board gender diversity of firm i in time t .

FSZ_{it} = a vector of control variables of firm, i in time, t .

U_{it} = Component error term

α_0 = constant intercept

α_1 = the coefficient of Board gender diversity.

The test for the hypotheses in this model are conducted at 5% critical level through the p -value.

Variables measurement/ Operationalisation

(a). Productivity Measure: Our main measure of firm productivity is total factor productivity (TFP) as the dependent variable. Total factor productivity (TFP), also called multi-factor productivity, is usually

measured as the ratio of aggregate output to aggregate inputs (Sickles & Zelenyuk, 2019). For the purpose of this study, total factor productivity is calculated as the ratios of total output (total sales or Operating revenue) to total inputs (labour, capital and material input using cost of materials) in a given year as in Kendrick and Creamer (1965); Summanth (1979); Tian and Twite(2011) with modification. Thus Total Factor Productivity (TFP) of a firm in this study is defined as the output per unit of total input, where total input is the sum of the individual inputs. The TFP of firm i , at time t is

$$Y_{i,t} = \frac{Y_{i,t}}{f(L_{i,t}, K_{i,t}, M_{i,t})}$$

Where y_{it} denotes the TFP, Y represents output, $f(\cdot)$ represents the production function, L , represents labor input; K represents the capital input and M , represent material input. We adopt net sales as the measure for the output. Following Schoar (2002), the summation of employees cost is employed for the labour input. The real net stock of property, plant and equipment (PPE) is adopted as the capital input measure. Thus our TFP was measured as:

$$\text{Total Factor Productivity} = \frac{\text{total output}}{\text{total inputs}} \quad \text{with transformed data displayed in the appendix.}$$

(b). The Board Gender Diversity: Corporate board gender diversity as the independent measure the proportion of female directors on the board Measuring in terms of proportion of women directors in the board. We therefore measure Board Gender as;

$$\text{BGD} = \frac{\text{total number of female directors}}{\text{total number of Directors}}$$

This is consistent with the prior studies such as Mensah and Bein (2023); and Ndudi, Uzozie, Ogundare, & Alordiah (2024) who measured board gender as proportionate female directors on the board in a financial year.

(c). Control Variable: The control variables used in the study is Firm Size (FSZ) which is measured as log transformation of total assets following the work of Appah and Tebepah (2021).

V. RESULTS AND DISCUSSION

To ensure the data to be used in testing the hypothesis are validated and reliable for analysis, preliminary diagnostic tests are conducted. They are Panel Unit root test, the Breusch-Pagan Lagrange Multiplier (LM) test and Hausman Specification test for choice of model. One important pre-analysis test in this study is the unit root test; apart from validating the data for analysis and accounting for inflation, it is a navigating tool which points to the direction or the method of analysis to be used.

The Panel Unit Root Test: The Unit root test adopted for this study is the Levin Lin and Chu unit root tests.

Levin Lin and Chu (LLC) unit root test Formula;

$$\Delta y_{it} = \alpha y_{it-1} + \sum \beta_{ij} \Delta y_{it-j} + X_{it} \delta + v_{it}$$

Where

y_{it} refers to the pooled variable,

Δ = difference factor

y_{it-1} = lag dependent variable

δ = coefficient of independent variable

Σ = sum

β_{ij} = coefficient of lag dependent variable at lag j_{th}

α = coefficient of lag dependent variable

X_{it} ' represents exogenous variables in the model such as company fixed effects and individual time trends, and

V_{it} refers to the error terms which are assumed to be mutually independent disturbances.

Decision criterion

If the order of integration are $I(0)$ for all the variables, i.e. stationary at level, the pooled, fixed or random effect are applied. If the order of integration are $I(1)$ for all the variables are stationary at first difference, the Fully Modified Ordinary Least Squares are applied. However, if there is a mixture of order of integration i.e. $I(0)$ and $I(1)$, the Panel Autoregressive Distributed Lagged (ARDL) is applied.

Computation: The data for this computation are attached as Appendix B2

Table 1

Levin, Lin Chu (LLC) Unit root Tests

Variable	LLC@ Level	LLC @ First difference	Order of co-integration
TFP	-5.32506**	-17.3556**	$I(0)$
BZE	-6.19382**	-9.24507**	$I(0)$
BGD	-3.49033**	-8.08409**	$I(0)$
FSZ	-3.80796**	-14.6694**	$I(0)$

Source: STATA 17

Interpretation: Table 1 displayed the result of the unit root test for the variables under study, using the Levin, Lin Chu (LLC) method. The result shows that Total Factor Productivity (TFP), Board size (BZE), and board gender (BGD), and firm size (FSZ) were stationary at level which have integration order of I (0). Hence, the random effect method of analysis is applied.

The Breusch-Pagan Lagrange Multiplier (LM) test:

This method is employed to know whether a model with random effects is more appropriate than a simple pooled OLS model. To choose between the Random Effects (RE) regression and the pooled OLS regression, the Breusch-Pagan Lagrange Multiplier (LM) test is usually conducted.

The Breusch-Pagan Lagrange Multiplier (LM) is defined as:

$$LM = nR^2,$$

Where “n” is the number of observations and

R^2 is the coefficient of determination from an auxiliary regression.

Decision Rule: Where the p-values are less than 0.05, we reject the null while alternate is accepted (the random effect is appropriate).

Computation: The data for this computation are attached in Appendix B2

Table 2

Breusch-Pagan LM Test for Random Effects

Variable	Chibar2(01)	Prob > F	Null (H0)
TFP	25.18	0.0000	Reject

Source: STATA 17 output

Interpretation:

Table 2 displayed the computed value Breusch-Pagan LM Test produced a chibar2 value of 25.18 and a p-value of 0.0000 which is less than 0.05. we reject the null while the random effect is significance. Therefore the use of random effects model is more appropriate than pooled OLS techniques to analyse the data set.

Choice between Fixed and Random Effects

In choosing the most appropriate method between fixed effect and random in this research work, the researcher adopted Hausman Chi-square test to select between the Fixed or Random effects.

Test Statistic: Hausman Specification Test

$$\text{Formula: } \chi^2 = (\hat{\beta}_c - \hat{\beta}_e) [\text{var}(\hat{\beta}_c) - \text{var}(\hat{\beta}_e)^{-1}] (\hat{\beta}_c - \hat{\beta}_e)$$

Where: $\hat{\beta}_c$ is the Instrumental Variable estimate and $\hat{\beta}_e$ is the Ordinary Least Square estimate.

Decision

The random effect method (REM) was adopted because the result of the Hausman test showed that the random effect is the best estimator. The REM is applied when there is no individual effects and correlation among regressors.

Raw Data: The data for the estimation of the stated model is attached as appendix A1

Result: The result of the Hausman test is presented in Table 3.

Table 3
Hausman Test Result

Hausman Test	
Chi-Square	7.46
P-value	0.2804
Remark	Random Effect better than Fixed Effect

Source: Stata 17

The table 3 shows the result of the Hausman specification test. The Hausman test indicated that the chi-square value of 7.46 with a p-value of 0.2804 which is greater than the 5% significance level. This means that the Random effect model is consistent method compared to the fixed Effect method.

Testing of Hypothesis:

In presenting our results, the hypothesis is restated as follows:

H0: Board gender diversity has no significant effect on the productivity of consumer goods industry in Nigeria

H1: Board gender diversity has a significant effect on the productivity of consumer goods industry in Nigeria

Data: The data for computation are attached in Appendix.

Table 4
Result of Board Gender Diversity and Total Factor Productivity

	Random Effect		Fixed Effect	
	Coeff	P-value	Coeff	P-value
<i>BGD_{it}</i>	0.737	(0.016)**	0.324	(0.474)
CONST	2.087	(0.003)**	2.939	(0.023)**

Dependent Variable: TFP

Source:: STATA 17

Interpretation

The effect of Board gender diversity on Total Factor Productivity is 0.737 and the p-value is 0.016; Board gender diversity is associated with higher TFP. This means that a 1% increase in BGDit raises TFP by about 73.7%, holding other factors constant. This indicates that there is a positive effect of Board gender diversity on Total Factor Productivity of firms under study for the period of 2015 to 2024.

Discussion of the finding

Following the result of the analysis, the p-value of Board gender diversity under the random effect is 0.016, we therefore, reject the null hypothesis and accept the alternate hypothesis which states that Board gender diversity has a significant effect on productivity of the Nigerian consumer goods industry. This means that firms with more gender diverse boards tend to have higher productivity than those without. Therefore an increase in board gender diversity is positively associated with higher productivity of the consumer goods industry in Nigeria.

This finding is consistent with the findings of Mensah and Bein (2023); Ndudi, Uzozie, Ogundare and Alordiah (2024) who found a positive statistical significant effect between gender diversity of leadership with organizational performance. The finding is also consistent with Alemu and Worku (2025) who found that corporate governance larger board size and gender composition has improved the financial performance of private commercial banks in Ethiopia. Also with Bruder Badie Kurdova, Strivastava and Tyll (2025) who found out that female executives constitute a minority in firms despite the observed positive correlation between the share of women and firm profitability in the Czech Republic. However, the study is not consistent with Gaitán, Herrera and Pablo (2018) who found that a higher proportion of female directors relates negatively to productivity in Latin America

This finding supports the agency assumption that a gender diverse boards may strengthen monitoring and reduce managerial deviousness. Therefore, diversity can strengthen monitoring and reduce managerial opportunism, leading to efficiency gains to which productivity can be enhanced. The implication of this finding is that encouraging gender diversity on boards can be beneficial at the macro level, as it correlates with higher productivity across firms. Therefore consumer goods industry in Nigeria can thrive better in terms of productivity performance by diversifying leadership and a balanced board gender diversity structure.

V. CONCLUSION

The study examines the effect of board gender diversity on productivity in the Nigerian Consumer goods industry. Using a panel setting with random effect model and diagnostic analyses. we document a positive relationship between our measure of board gender diversity, measured by the number of women directors, and productivity as measured by the total factor productivity (TFP). In the final analysis, the random effects and fixed effects models were all estimated, and disclose that the fixed effects coefficient was not significant. The study finds that; Board gender diversity has a positive significant effect on productivity of the Nigerian consumer goods industry. Therefore, board gender diversity- productivity hypothesis is a valid hypothesis for Nigerian consumer goods industry. The study set out to recommend measures that will enhance productivity.

Recommendations

This study provides an understanding of the effectiveness and efficiency of Board gender diversity as a mechanism to enhance productivity growth in the Nigerian Consumer goods Industry. Consequently, the following recommendations are proffered by the researchers:

- (1) Efforts should be made to strengthen the Financial Reporting Council of Nigeria (FRC) and other custodians of the Nigerian Corporate Governance code.
- (2) There should be Value re-orientation and awareness creation through training, workshops, and conferences in relation to morality, ethics and appropriateness of compliance with government policies or applicable laws.

VII. LIMITATIONS OF THE STUDY

(i). This present study was limited due a single digit or variable (gender diversity) of corporate board used. The study therefore suggests an expanded study to include other variables of corporate governance as measure to ensure more robustness.

(ii) Also gender is simply one aspect of board diversity. Hence, future studies need to examine the impact of other characteristics of board diversity, such as age, education, experience and culture, on firm productivity performance.

(iii). Another limitation of this study is that it considers only listed consumer goods industry, so further research should be conducted in this area with emphasis on other sector of the economy such as manufacturing, oil and gas, deposit money banks among others.

REFERENCES

- Adegoke, J.F. (2013). "Corporate Governance and Productivity in Nigerian Manufacturing Industries". *Electronic Journal of Business Ethics and Organization Studies*. 18, (2), 38-46
- Afzal, M.(2017). National Innovative Capacity, Technological Advancement and Total Factor Productivity Growth. Ph.D. Thesis of the University of the Punjab Lahore, Pakistan. Retrieved from <https://pr.hec.gov.pk/jspui/bitstream/123456789/15581/1/Muhammad%20afzal%20economics%202020%20pu%20lhr.pdf> on 21-o0-2023
- Ahmadi, A., Nakaa, N., & Bouri, A.(2018). "Chief Executive Officer attributes, board structures, gender diversity and firm performance among French CAC 40 listed firms," *Research in International Business and Finance, Elsevier*, 44(C), 218-226,
- Alemu. F.M. & Worku, M. D. (2025). "Impacts of corporate governance mechanisms on dynamics of banks financial performance: empirical evidences from private commercial banks of Ethiopia" *Cogent Business & Management*, 12,(1)

- Ararat, M., Claessens, S. & Burcin Yurtoglu, B.B.(2021). Corporate governance in emerging markets: A selective review and an agenda for future research. *Emerging Markets Review*, 48,(September 2021), 10076
- Baig, A. (2002). “Your Productivity is National Prosperity. Productivity”.*Journal, National Productivity Organization Pakistan, Islamabad*, 8-9
- Bennouri, M., Chtioui, T. , Nagati, H., & Nekhili, M.,(2018). "Female board directorship and firm performance: What really matters?," *Journal of Banking & Finance, Elsevier*, 88(C), 267-291
- Black, K. (2019).”Business statistics: for contemporary decision making”.Houston: John Wiley & Sons.
- Breusch, T. S. & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica*, 47, 1287- 1294.
- Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier test and its applications to model specification in Econometrics. *Review of Economic Studies*, 47(1):239-253.
- Bruder Badie, N., Kurdova, Y., Srivastava, M., & Tyll, L. (2025). Gender Diversity in the Boardroom and Firm Performance: Evidence from the Czech Republic. *Journal of East-West Business*, 1–34. <https://doi.org/10.1080/10669868.2025.2489653>
- Chapple, L. & Humphrey,J.(2014). "Does Board Gender Diversity Have a Financial Impact? Evidence Using Stock Portfolio Performance," *Journal of Business Ethics, Springer*, 122(4),709-723
- Fama, E. F. (1980). ‘Agency Problems and the Theory of the firm’. *Journal of Political Economy*. 88(2),288-307
- Ferreira, D. (2010). Board diversity. Corporate governance: A synthesis of theory, research, and practice, 225-242 <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118258439#page=227>
- García-Meca, E., García-Sánchez, I. M., & Martínez-Ferrero, J. (2015). Board diversity and its effects on bank performance: An international analysis. *Journal of banking & Finance*, 53, 202-214. <https://www.sciencedirect.com/science/article/abs/pii/S0378426614003811>
- Gaitán,S.C., Herrera,H., & Pablo,E.(2018).”Corporate Governance and its Effect on Productivity under Different Business Environments: Evidence from Latin America”, *Global Finance Journal*,37,173-185
- García-Sánchez, IM and García-Meca, E. (2018). 'Do talented managers invest more efficiently? The moderating role of corporate governance mechanisms', *Corporate Governance: International Review*, 26 (4), 238-254.
- Garnero, A., Raitano, M. and Sanchez, R. (2014) ‘Diversity and firm performance: Evidence from European firms’, *IZA Journal of European Labor Studies*, 3(1), 1-22
- Gujarati, D. N. & Porter, D. C. (2009). *Basic Econometrics* (5th ed), New York McGraw-Hill
- Harjoto, M. A., Laksmana, I., & Lee, R. (2014). Board diversity and corporate social responsibility. *Journal of Business Ethics*, 132(4), 641–660. <https://doi.org/10.1007/s10551-014-2343-0>
- Jensen, M. C. & Meckling, W. H.(1976).Theory of the firm: Managerial behavior, Agency costs and ownership structure’. *Journal of Financial Economics*, 3(4), 303-360

- Jiang, Y., Mubarik,M.S., Zaman,S.I., Alam , S.H.,& Arif ,M.(2023).“Corporate governance, cash holding, and firm performance in an emerging market”. *International journal of Finance & Economics* <https://doi.org/10.1002/ijfe.2804>
- Kendrick, J.W. and Creamer, D.(1965). Measuring Company Productivity: Handbook with Case Studies. (Studies in Business Economics, Vol. 89.) National Industrial Conference Board, New York, NY
- Kılıç, M. & Kuzey , C. (2016)."The effect of board gender diversity on firm performance: evidence from Turkey", *Gender in Management: An International Journal*, 31 (7). 434 – 455 .
- Marashdeh, Z.M.S.(2014). “The Effect of Corporate Governance on Firm Performance in Jordan. University of Central Lancashire”, Retrieved on 18th June 2021 from [https://clouk.uclan.ac.uk/11163/1/Marashdeh%20Zyad%20Final%20e-Thesis%20\(Master%20Copy\).pdf](https://clouk.uclan.ac.uk/11163/1/Marashdeh%20Zyad%20Final%20e-Thesis%20(Master%20Copy).pdf)
- Marimuthu,M. & KolandaisamyI.(2009). Demographic Diversity in Top Level Management and Its Implications on Firm Financial Performance: An Empirical Discussion. *International Journal of Business and Management*, 4(6), 176-188.
- McKinsey & Company. (2021).*Reimagining productivity in Africa: The role of effective governance*. McKinsey & Company Report.
- Mensah, L., and Bein, M.A.(2023). “Sound Corporate Governance and Financial Performance: Is There a Link? Evidence from Manufacturing Companies in South Africa, Nigeria, and Ghana”. *Sustainability*, 15(12), 9263; <https://doi.org/10.3390/su15129263>
- Momade, M. H., Shahid, S., Hainin, M. R., Nashwan, M. S., & Tahir, U. A. (2020). Modelling labour productivity using SVM and RF: A comparative study on classifiers performance. *International Journal of Construction Management*, 1– 11. <https://doi.org/10.1080/15623599.2020.1744799>
- Naghavi, N., Pahlevan Sharif, S., & Iqbal Hussain, H. B. (2021). The role of national culture in the impact of board gender diversity on firm performance: evidence from a multi-country study. *Equality, Diversity and Inclusion*, 40(5), 631-650. <https://doi.org/10.1108/EDI-04-2020-0092>
- Nigerian Code of Corporate Governance 2018. Retrieved from <https://www.ecgi.global/publications/codes/nigerian-code-of-corporate-governance-2018>
- Ndudi , E.F., Uzozie, H. C., Ogundare J., & Alordiah, C.O.(2024). “Effect of Gender Diversity On Organizational Performance In Nigerian Business Context: A Study Of Selected Businesses In Asaba, Delta State, Nigeria”. *Bayero journal of African Entrepreneur Studies*, 6,(2),pp.34-49
- OECD (2021).OECD Compendium of Productivity. Retrieved on 5th August 2023 from https://www.oecdilibrary.org/sites/f25cdb25en/1/3/2/index.html?itemId=/content/publication/f25cdb25-en&_ga=2.154889592.1943347353.1626085949-1
- OECD. (2015). G20/ OECD Principles of Corporate Governance, OECD publishing, Paris. <http://dx.doi.org/10.1787/9789264236882-en.Access 2022/09/26>
- Okwoli, A.A.(2001), Performance Appraisal for Improved Productivity. The Nigerian Academic Forum, .4(1), 141-146.

- Owen, A. L., and Temesvary, J.(2018). The performance effects of gender diversity on bank boards. *Journal of Banking & Finance* 90(C), P. 50–63.
- Sabatier, M. (2015) ‘A women’s boom in the boardroom: Effects on employment stability and firm performance’, *Corporate Governance: An International Review*, 23(5), 436–449
- Sathyamoorthi, C.R., Baliyan,P. S., Dzimiri, M. &Wall y-Dima,L. (2019).”Capital Structure and Its Effect on Firm Performance: An Empirical Study On The Listed Consumer Services Sector Organizations In Botswana”. *European Journal of Economic and Financial Research*,3 (5)
- Schoar, A. (2002) “Effects of Corporate Diversification on Productivity., *Journal of Finance*, 57, 2379–2403
- Shan, Y. G., & McIver, R. P. (2011). Corporate governance mechanisms and financial performance in china: Panel data evidence on listed non-financial companies. *Asia Pacific Business Review*, 17(3), 301.
- Shiru, M. S., Chung, E. S., Shahid, S., & Alias, N. (2020). GCM selection and temperature projection of Nigeria under different RCPs of the CMIP5 GCMs. *Theoretical and Applied Climatology*, 141(3), 1611–1627
- Sickles, R. C., & Zelenyuk, V. (2019). *Measurement of Productivity and Efficiency: Theory and Practice*. Cambridge University Press. <https://doi.org/10.1017/9781139565981>
- Sumanth, D.J.(1979). *Productivity Engineering and Management*.McGraw-Hill, Inc., New York, NY.
- Tian, G. Y. and Twite, G.(2011). "Corporate governance, external market discipline and firm productivity," *Journal of Corporate Finance*, 17(3), 403-417
- Tugcu, Can Tansel & Tiwari, Aviral Kumar, 2016. "Does renewable and/or non-renewable energy consumption matter for total factor productivity (TFP) growth? Evidence from the BRICS," *Renewable and Sustainable Energy Reviews*, 65(C), 610-616.
- Vijayamohanam, P. N. (2016). Panel data analysis with STATA part 1-fixed effects and random effects models. Munich Personal RePEc Archive MPRA Paper (No.76869). Retrieved from <https://mpra.ub.uni-muenchen.de/76869/>
- Zelalem ,B.A., Abebe,A.A.,& Bezabih, S.W. (2022) .“Corporate governance and financial performance in the emerging economy: The case of Ethiopian insurance companies”. *Cogent Economics and Finance*, .10(1). DOI: 10.1080/23322039.2022.2117117
- Zuva,J.,& Zuva,T.(2018). Corporate Governance and Organizational Performance.*International Journal of Business And Management Studies* 10, (1), 16-29

APPENDIX A:

COMPANIES RAW DATA

COMPANIES	YEARS	ID	BS Z	BG D	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
CADBURY	2016	1	7	3	2828,392,951	29,979,410	5,700,394	14,187,437	12,123,964
CADBURY	2017	1	7	2	28,423,122	33,079,446	5,037,721	13,882,124	14,336,229
CADBURY	2018	1	7	2	27,528,040	35,973,479	5,325,577	13,291,154	15,482,005
CADBURY	2019	1	7	2	28,801,938	39,326,807	5,434,484	13,483,386	17,125,811
CADBURY	2020	1	8	4	33,210,684	35,407,323	5,819,960	12,579,383	18,206,960
CADBURY	2021	1	7	4	43,688,291	42,372,034	3,752,354	13,018,307	27,054,456
CADBURY	2022	1	6	4	59,713,684	55,212,617	5,800,382	14,070,993	36,722,836
CADBURY	2023	1	6	3	63,431,020	80,378,955	6,601,628	14,564,239	50,583,290
CADBURY	2024	1	8	4	72,443,944	129,165,095	7,446,966	16,706,145	89,210,366
CHAMPION	2015	2	9	1	10,329,160	3,501,845	794,984	6,917,604	367,753
CHAMPION	2016	2	11	1	9,961,240	3,864,943	871,123	6,766,215	637,599
CHAMPION	2017	2	11	1	10,088,861	4,777,313	1,023,401	6,981,724	990,049
CHAMPION	2018	2	12	2	10,487,010	4,763,757	999,787	7,533,632	1,161,290
CHAMPION	2019	2	11	2	10,981,383	6,927,177	875,968	7,742,400	1,697,674
CHAMPION	2020	2	11	2	11,368,517	7,051,806	1,047,506	8,798,638	1,886,654
CHAMPION	2021	2	10	1	13,486,815	9,559,079	1,143,071	8,894,854	3,397,569
CHAMPION	2022	2	9	1	15,453,585	12,288,893	1,452,314	10,298,837	4,397,133
CHAMPION	2023	2	9	1	20,553,079	12,704,274	1,540,724	15,117,284	4,016,780
CHAMPION	2024	2	9	1	21,345,197	20,890,735	1,901,608	13,826,723	7,058,988
DANGSUGAR	2015	3	9	2	106,671,333	100,092,221	3,091,315	30,070,710	63,716,356
DANGSUGAR	2016	3	9	2	175,936,048	167,409,161	3,647,512	29,591,825	124,665,981
DANGSUGAR	2017	3	9	2	196,064,664	198,120,639	4,020,176	35,594,866	120,237,622
DANGSUGAR	2018	3	8	2	178,523,711	146,549,176	4,824,408	29,963,120	77,710,948
DANGSUGAR	2019	3	9	2	196,125,122	158,104,577	4,869,282	32,706,935	89,937,589
DANGSUGAR	2020	3	9	2	259,280,544	206,360,656	6,370,368	76,698,057	117,087,019
DANGSUGAR	2021	3	9	2	349,382,869	276,054,781	8,943,974	83,829,184	183,373,949
DANGSUGAR	2022	3	8	2	490,969,836	403,245,988	10,737,667	93,696,015	256,326,637
DANGSUGAR	2023	3	10	4	601,040,524	441,452,953	12,649,536	101,177,858	296,027,663
DANGSUGAR	2024	3	11	4	1,018,344,271	665,689,763	6,227,621	511,552,200	546,050,652

COMPANIES	YEARS	ID	BS Z	BG D	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
GUINNESS	2015	4	9	1	122,246,632	118,495,882	12,728,213	87,754,074	39,879,504
GUINNESS	2016	4	12	3	136,992,444	101,973,030	12,320,601	87,232,984	37,371,923
GUINNESS	2017	4	12	2	146,038,216	125,919,817	11,557,163	87,324,546	53,439,891
GUINNESS	2018	4	12	2	153,254,968	142,975,792	12,047,558	97,602,019	71,639,030
GUINNESS	2019	4	14	4	160,792,627	131,498,373	100,801,064	4	62,893,478
GUINNESS	2020	4	13	4	144,145,581	104,376,015	8,183,211	88,919,044	43,947,164
GUINNESS	2021	4	12	4	169,406,525	160,416,257	13,490,498	94,236,887	84,230,651
GUINNESS	2022	4	11	5	215,660,208	206,822,127	13,792,197	97,685,577	97,102,834
GUINNESS	2023	4	13	6	241,748,144	229,440,861	16,571,391	99,177,647	106,569,228
GUINNESS	2024	4	2	6	226,130,077	299,489,774	18,031,165	101,321,397	149,019,423
HONYFLOUR	2015	5	9	0	67,943,444	49,057,511	1,609,803	49,282,429	7,374,822
HONYFLOUR	2016	5	15	2	76,046,576	50,883,780	1,505,152	53,757,796	5,351,144
HONYFLOUR	2017	5	15	2	113,151,714	53,227,891	100,118,393	103,210,06	3,590,840
HONYFLOUR	2018	5	13	2	124,835,013	71,476,319	1,662,538	2	6,865,934
HONYFLOUR	2019	5	10	2	137,505,112	74,409,113	1,777,384	106,622,428	2,871,793
HONYFLOUR	2020	5	10	2	142,261,292	80,450,397	2,845,394	8	4,627,292
HONYFLOUR	2021	5	9	1	147,394,656	109,594,730	4,103,269	105,326,91	6,568,926
HONYFLOUR	2022	5	9	1	148,696,031	136,427,507	4,594,596	9	111,438,506
HONYFLOUR	2023	5	8	2	164,999,977	147,350,739	4,899,981	97,061,562	123,994,336
HONYFLOUR	2024	5	8	1	148,965,948	188,311,035	6,513,997	84,959,560	140,601,683
INTBREW	2015	6	9	1	30,171,590	20,649,295	3,267,815	22,679,843	9,128,658
INTBREW	2016	6	9	1	33,482,106	23,269,362	780,616	25,216,244	9,838,591
INTBREW	2017	6	8	1	44,962,735	36,527,807	823,855	31,575,208	19,034,878
INTBREW	2018	6	13	3	310,308,494	120,610,825	554,774	243,373,657	66,746,370
INTBREW	2019	6	14	4	365,146,533	132,351,500	4,588,953	271,160,046	84,157,999
INTBREW	2020	6	12	3	372,646,406	136,790,573	4,381,150	253,684,588	79,900,379

COMPANIES	YEARS	ID	BS Z	BG D	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
INTBREW	2021	6	11	3	469,953,215	182,298,045	5,172,675	25,664,863 252,071,52	108,275,486
INTBREW	2022	6	11	1	484,251,740	218,650,267	5,524,727	3 253,320,30	104,769,895
INTBREW	2023	6	11	2	724,497,461	260,598,228	5,586,416	8 287,581,28	136,804,587
INTBREW	2024	6	11	2	727,872,297	488,955,682	4,239,125	6	305,589,858
MCNICHOLS	2015	7	6	1	420,149,791	1,009,806,76 3	22,691,53 1	266,505,59 2	51,640,152
MCNICHOLS	2016	7	6	1	475,140,932	1,093,805,28 8	33,756,48 1	318,804,87 6	75,436,383
MCNICHOLS	2017	7	4	1	539,237,536	967,193,655	38,362,07 0	384,041,62 5	41,356,842
MCNICHOLS	2018	7	4	1	825,689,552	786,912,331	37,319,19 5	379,042,73 8	514,769,024
MCNICHOLS	2019	7	5	1	722,521,934	643,380,590	30,294,03 2	336,506,69 7	437,646,616
MCNICHOLS	2020	7	5	2	711,959,366	732,091,283	30,825,61 0	350,541,93 5	53,664,894
MCNICHOLS	2021	7	7	2	692,513,156	773,559,018	33,413,69 7	323,929,62 4	585,808,520
MCNICHOLS	2022	7	7	2	653,717,275	834,017,661	31,791,27 4	281,003,10 2	624,721,932
MCNICHOLS	2023	7	6	2	1,068,653,14 9	1,594,612,86 6	46,365,27 0	320,151,37 2	1,287,746,91 5
MCNICHOLS	2024	7	6	2	1,314,444,40 9	5,801,919,27 2	60,025,83 6	390,713,69 9	5,120,867,05 3
NNFM	2015	8	12	0	4,934,766	10,529,075	163,187	728,107	8,481,046
NNFM	2016	8	14	0	1,739,766	979,038	185,086	816,633	808,278
NNFM	2017	8	12	0	4,337,444	940,521	176,645	2,008,933	684,584
NNFM	2018	8	12	0	5,917,639	2,861,752	231,421	2,109,691	1,668,841
NNFM	2019	8	11	0	4,992,912	4,149,917	261,267	2,094,232	2,869,104
NNFM	2020	8	14	1	8,491,986	8,841,135	339,530	3,732,892	6,969,562
NNFM	2021	8	10	0	7,365,270	8,667,751	348,646	3,572,311	7,183,220
NNFM	2022	8	12	0	13,315,128	15,232,820	493,623	3,847,899	13,017,831
NNFM	2023	8	11	0	17,827,833	16,161,840	565,678	7,566,959	13,436,335
NNFM	2024	8	10	0	17,924,446	25,951,365	288,603	7,460,386	20,949,695
NASCON	2015	9	10	4	16,294,826	16,178,197	1,423,170	6,759,039	7,588,592
NASCON	2016	9	10	4	24,603,267	18,291,792	1,253,773	6,346,688	7,231,144
NASCON	2017	9	10	4	30,123,247	27,064,325	1,558,098	9,419,203 11,	10,148,410
NASCON	2018	9	10	4	30,270,429	25,769,352	1,745,687	705,283	10,660,806
NASCON	2019	9	10	4	38,668,792	27,487,788	1,855,820	15,174,724	13,921,257
NASCON	2020	9	10	4	44,308,991	28,010,059	2,068,563	16,698,217	13,467,658

COMPANIES	YEARS	ID	BS Z	BG D	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
NASCON	2021	9	10	4	40,521,398	33,279,688	2,263,997	14,063,444	18,014,086
NASCON	2022	9	10	4	55,530,771	58,786,251	2,381,334	12,468,851	30,451,330
NASCON	2023	9	10	4	83,591,991	80,828,373	3,764,945	12,097,461	31,372,245
NASCON	2024	9	10	4	78,602,487	120,387,151	1,896,481	12,340,012	55,886,619
NESTLE	2015	10	8	2	119,215,053	151,271,526	18,800,312	69,148,171	57,419,630
NESTLE	2016	10	9	1	169,585,932	181,910,977	20,817,867	70,171,526	75,447,982
NESTLE	2017	10	8	1	146,804,128	244,151,411	22,758,609	72,377,943	97,524,898
NESTLE	2018	10	8	1	162,334,422	266,274,621	23,506,644	73,365,523	104,147,275
NESTLE	2019	10	8	2	193,374,314	284,035,255	25,937,349	79,393,681	110,714,113
NESTLE	2020	10	7	1	246,184,996	287,084,087	26,575,687	87,265,836	124,779,955
NESTLE	2021	10	9	2	310,238,504	351,822,329	30,030,634	98,964,157	163,737,856
NESTLE	2022	10	10	2	415,044,031	446,819,260	34,787,521	116,739,370	223,681,354
NESTLE	2023	10	12	3	581,774,407	547,118,754	40,816,181	165,383,791	284,156,447
NESTLE	2024	10	10	4	858,698,352	958,814,739	56,162,029	421,154,868	357,547,161
ENAMELWA	2015	11	7	0	5,022,344	2,608,286	111,283	1,056.03	1,271,128
ENAMELWA	2016	11	6	0	4,539,683	2,795,190	109,457	1,009,589	1,691.20
ENAMELWA	2017	11	6	0	5,826,562	2,528,319	42,176	998,134	1,034,173
ENAMELWA	2018	11	6	0	4,576,107	1,650,999	27,095	949,855	579,384
ENAMELWA	2019	11	6	0	4,382,630	740,232	16,144	901,576	170,572
ENAMELWA	2020	11	6	0	1,708,231	497,933		918,792	289,268
ENAMELWA	2021	11	6	0	1,507,040	297,666	26,202	867,102	244,271
ENAMELWA	2022	11	8	0	4,408,807	345,804	23,715	815,443	210,303
ENAMELWA	2023	11	7	0	5,501,642	227,301	23,014	356,552	52,250
ENAMELWA	2024	11	7	0	2,502,735	718,353	23,705	315,622	252,910
NBREW	2015	12	15	0	356,707,123	293,905,792	11,903,504	197,108,847	28,409,703
NBREW	2016	12	15	2	367,639,915	313,743,147	10,101,065	190,996,700	31,244,703

COMPANIES	YEARS	ID	BS Z	BG D	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
NBREW	2017	12	13	2	382,726,540	344,562,517	41,640,292	195,050,394	128,857,254
NBREW	2018	12	11	3	388,766,316	350,226,472	42,400,343	203,317,850	127,772,129
NBREW	2019	12	10	3	382,503,815	323,002,120	39,838,447	201,362,280	122,549,191
NBREW	2020	12	10	3	444,437,374	337,006,267	40,983,265	212,369,121	143,390,789
NBREW	2021	12	11	4	482,639,565	437,195,534	49,605,575	255,630,534	197,821,763
NBREW	2022	12	12	4	621,318,254	550,477,627	51,083,811	357,922,963	246,722,480
NBREW	2023	12	10	4	797,326,993	599,508,761	55,372,648	440,787,687	286,061,312
NBREW	2024	12	10	5	1,126,267,553	1,074,881,526	68,043,844	527,012,459	609,028,019
PZ	2015	13	10	3	48,106,661	73,126,070	4,864,352	19,239,673	8,053,017
PZ	2016	13	11	3	55,251,100	69,527,537	6,153,877	25,339,722	9,192,746
PZ	2017	13	11	3	73,039,610	79,630,111	5,098,917	27,060,502	13,776,341
PZ	2018	13	10	2	74,576,119	58,483,029	7,493,100	26,882,195	12,237,853
PZ	2019	13	10	2	64,315,676	47,200,919	6,122,806	25,858,961	9,027,018
PZ	2020	13	10	2	79,936,740	38,939,223	5,894,044	24,638,865	5,656,281
PZ	2021	13	7	3	69,368,708	47,832,559	5,151,711	23,126,484	7,251,136
PZ	2022	13	7	3	79,875,535	58,264,660	5,884,694	15,137,428	8,148,863
PZ	2023	13	7	3	110,826,600	67,413,111	6,130,708	14,031,271	9,420,094
PZ	2024	13	6	3	118,112,517	90,810,486	6,766,616	13,472,073	15,666,709
UNILEVER	2015	14	11	2	50,172,484	59,221,748	6,961,370	27,368,919	28,635,437
UNILEVER	2016	14	10	2	72,491,309	69,777,061	6,748,272	29,272,186	35,676,236
UNILEVER	2017	14	10	2	121,084,365	85,193,369	7,373,428	29,880,704	42,824,285
UNILEVER	2018	14	10	2	131,843,373	92,899,969	9,739,754	29,677,539	50,127,989
UNILEVER	2019	14	10	2	103,677,519	60,486,835	10,637,234	31,957,420	41,276,161
UNILEVER	2020	14	10	2	91,517,538	61,959,678	9,914,451	27,370,607	36,549,099
UNILEVER	2021	14	10	2	108,288,535	70,523,695	9,222,695	22,376,287	37,972,099
UNILEVER	2022	14	10	3	125,389,892	68,637,363	8,771,608	21,490,568	30,413,653
UNILEVER	2023	14	13	4	116,302,344	103,879,730	10,067,042	18,770,920	49,616,577
UNILEVER	2024	14	14	6	141,646,696	149,522,596	12,419,072	22,376,767	81,672,151
VITAFOAM	2015	15	8	2	12,079,656	15,487,801	1,160,113	2,666,278	10,639,121
VITAFOAM	2016	15	8	2	13,098,732	12,189,558	1,138,392	2,443,814	7,965,764
VITAFOAM	2017	15	10	2	12,974,483	15,921,022	1,118,683	2,286,109	11,567,817
VITAFOAM	2018	15	10	2	15,156,727	17,612,291	1,031,290	2,160,974	12,568,754

COMPANIES	YEARS	ID	BSZ	BGD	FIRM SIZE	OUTPUT(SALES)	LABOUR	CAPITAL	MATERIALS
CADBURY	2015	1	7	2	,417,005	27,825,194	5,481,288	15,365,655	8,169,615
VITAFOAM	2019	15	10	2	12,358,342	20,330,040	1,375,261	2,201,089	12,683,164
VITAFOAM	2020	15	10	2	19,802,249	21,521,097	1,457,532	3,844,335	12,059,200
VITAFOAM	2021	15	10	2	29,693,840	32,007,979	1,872,822	2,859,214	20,343,989
VITAFOAM	2022	15	9	2	36,913,111	42,128,595	1,977,275	3,004,961	28,734,559
VITAFOAM	2023	15	12	2	46,673,301	47,723,375	2,451,486	3,200,289	9,034,091
VITAFOAM	2024	15	12	2	45,907,461	73,492,246	3,044,762	11,766,459	12,989,162

APPENDIX B1

COMPANIES TRANSFORMED DATA

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
CADBURY	2015	1	0.958941926	7	0.29	7.462645894
CADBURY	2016	1	0.93651137	7	0.43	7.505310027
CADBURY	2017	1	0.99468885	7	0.29	7.521870978
CADBURY	2018	1	1.054979839	7	0.29	7.532738281
CADBURY	2019	1	1.091087423	7	0.29	7.556829137
CADBURY	2020	1	0.967246624	8	0.50	7.56355587
CADBURY	2021	1	0.966843602	7	0.57	7.641723084
CADBURY	2022	1	0.975587715	6	0.67	7.75277201
CADBURY	2023	1	1.120277343	6	0.50	7.855816803
CADBURY	2024	1	1.139388967	8	0.50	8.054473158
CHAMPION	2015	2	0.433378369	9	0.11	6.907429689
CHAMPION	2016	2	0.467066154	11	0.09	6.917764696
CHAMPION	2017	2	0.531097342	11	0.09	6.954009569
CHAMPION	2018	2	0.491376997	12	0.17	6.986534778
CHAMPION	2019	2	0.671495618	11	0.18	7.013513102
CHAMPION	2020	2	0.601033615	11	0.18	7.069401594
CHAMPION	2021	2	0.711479533	10	0.10	7.128253639
CHAMPION	2022	2	0.761003027	9	0.11	7.208126379

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
CHAMPION	2023	2	0.614481464	9	0.11	7.315441065
CHAMPION	2024	2	0.9167702	9	0.11	7.357693232
DANGSUGAR	2015	3	1.033173965	9	0.22	7.986226872
DANGSUGAR	2016	3	1.060186972	9	0.22	8.198396757
DANGSUGAR	2017	3	1.239395291	9	0.22	8.203719878
DANGSUGAR	2018	3	1.302676989	8	0.25	8.051146639
DANGSUGAR	2019	3	1.239901639	9	0.22	8.105557209
DANGSUGAR	2020	3	1.031001965	9	0.22	8.301367407
DANGSUGAR	2021	3	0.999665664	9	0.22	8.441140498
DANGSUGAR	2022	3	1.117767024	8	0.25	8.557218762
DANGSUGAR	2023	3	1.077095294	10	0.40	8.612630298
DANGSUGAR	2024	3	0.625747974	11	0.36	9.026872426
GUINNESS	2015	4	0.844217512	9	0.11	8.147248901
GUINNESS	2016	4	0.744733626	12	0.25	8.136484361
GUINNESS	2017	4	0.826670787	12	0.17	8.182761493
GUINNESS	2018	4	0.788663967	12	0.17	8.258370512
GUINNESS	2019	4	0.762468785	14	0.29	8.236698311
GUINNESS	2020	4	0.739996065	13	0.31	8.149371302
GUINNESS	2021	4	0.835683988	12	0.33	8.283206298
GUINNESS	2022	4	0.991569298	11	0.45	8.319273929
GUINNESS	2023	4	1.032037831	13	0.46	8.346975146
GUINNESS	2024	4	1.115950214	12	0.50	8.428737178
HONYFLOUR	2015	5	0.841942532	9	0.00	7.765423061
HONYFLOUR	2016	5	0.839471125	15	0.13	7.782573604
HONYFLOUR	2017	5	0.505143745	15	0.13	8.022724279
HONYFLOUR	2018	5	0.639017963	13	0.15	8.048649112
HONYFLOUR	2019	5	0.662358626	10	0.20	8.050532931
HONYFLOUR	2020	5	0.705349642	10	0.20	8.057123742
HONYFLOUR	2021	5	0.974308135	9	0.11	8.051093342
HONYFLOUR	2022	5	0.63930401	9	0.11	8.329194515
HONYFLOUR	2023	5	0.683864018	8	0.25	8.333382565

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
HONYFLOUR	2024	5	0.837362145	8	0.13	8.351962447
INTBREW	2015	6	0.633625483	9	0.11	7.513072593
INTBREW	2016	6	0.648556622	9	0.11	7.554836578
INTBREW	2017	6	0.713923716	8	0.13	7.70897179
INTBREW	2018	6	0.383245578	13	0.23	8.497909135
INTBREW	2019	6	0.367950504	14	0.29	8.555939466
INTBREW	2020	6	0.405575178	12	0.25	8.527984801
INTBREW	2021	6	1.310431186	11	0.27	8.143367791
INTBREW	2022	6	0.603395957	11	0.09	8.559147616
INTBREW	2023	6	0.658556429	11	0.18	8.597378464
INTBREW	2024	6	0.818458783	11	0.18	8.776272684
MCNICHOLS	2015	7	2.962723966	6	0.17	8.532547084
MCNICHOLS	2016	7	2.555633326	6	0.17	8.631441476
MCNICHOLS	2017	7	2.085545401	4	0.25	8.66629379
MCNICHOLS	2018	7	0.845114562	4	0.25	8.969010766
MCNICHOLS	2019	7	0.799779618	5	0.20	8.905497623
MCNICHOLS	2020	7	1.682842973	5	0.40	8.638521642
MCNICHOLS	2021	7	0.820185027	7	0.29	8.974581617
MCNICHOLS	2022	7	0.889603364	7	0.29	8.971978831
MCNICHOLS	2023	7	0.963941241	6	0.29	9.218604702
MCNICHOLS	2024	7	1.041336853	6	0.29	9.745980443
NNFM	2015	8	1.123420085	12	0.00	6.971848035
NNFM	2016	8	0.540905869	14	0.00	6.257677855
NNFM	2017	8	0.327689169	12	0.00	6.45790641
NNFM	2018	8	0.71366223	12	0.00	6.603139282
NNFM	2019	8	0.79430284	11	0.00	6.718053295
NNFM	2020	8	0.800683555	14	0.07	7.043047114
NNFM	2021	8	0.78058473	10	0.00	7.045486376
NNFM	2022	8	0.877499294	12	0.00	7.239533535
NNFM	2023	8	0.749309703	11	0.00	7.333829447
NNFM	2024	8	0.90427021	10	0.00	7.457861982

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
NASCON	2015	9	1.025832296	10	0.40	7.197853752
NASCON	2016	9	1.233298217	10	0.40	7.171188151
NASCON	2017	9	1.281108361	10	0.40	7.324811334
NASCON	2018	9		10	0.40	
NASCON	2019	9	0.888083637	10	0.40	7.490685924
NASCON	2020	9	0.868948266	10	0.40	7.508320103
NASCON	2021	9	0.96908003	10	0.40	7.535819602
NASCON	2022	9	1.297666336	10	0.40	7.656112726
NASCON	2023	9	1.711209277	10	0.40	7.674260711
NASCON	2024	9	1.716797038	10	0.40	7.845861181
NESTLE	2015	10	1.040610096	8	0.25	8.162469153
NESTLE	2016	10	1.092969515	9	0.11	8.221250858
NESTLE	2017	10	1.267256169	8	0.13	8.284794825
NESTLE	2018	10	1.324621232	8	0.125	8.303238063
NESTLE	2019	10	1.314703266	8	0.25	8.334544507
NESTLE	2020	10	1.203094078	7	0.1428	8.377709531
NESTLE	2021	10	1.201855456	9	0.22	8.46647116
NESTLE	2022	10	1.19085672	10	0.2	8.574272373
NESTLE	2023	10	1.1157573	12	0.25	8.690511865
NESTLE	2024	10	1.148468101	10	0.4	8.921615765
ENAMELWA	2015	11	1.885325743	7	0	6.140968813
ENAMELWA	2016	11	2.494063727	6	0	6.049503788
ENAMELWA	2017	11	1.218770653	6	0	6.31690988
ENAMELWA	2018	11	1.060825633	6	0	6.192102805
ENAMELWA	2019	11	0.680177746	6	0	6.036745437
ENAMELWA	2020	11	0.403425691	6	0	6.091407358
ENAMELWA	2021	11	0.262240461	6	0	6.055029532
ENAMELWA	2022	11	0.329726534	8	0	6.020676115
ENAMELWA	2023	11	0.525542939	7	0	5.635993141
ENAMELWA	2024	11	1.233789565	7	0	5.765096817
NBREW	2015	12	1.237904344	15	0	8.375521058

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
NBREW	2016	12	1.350347828	15	0.133	8.366128598
NBREW	2017	12	0.942591872	13	0.1538	8.562944341
NBREW	2018	12	0.937712308	11	0.2727	8.572279353
NBREW	2019	12	0.887978537	10	0.3	8.560802904
NBREW	2020	12	0.849431794	10	0.3	8.598509465
NBREW	2021	12	0.869076022	11	0.3636	8.701617949
NBREW	2022	12	0.8394892	12	0.333	8.816724559
NBREW	2023	12	0.766418014	10	0.4	8.89332983
NBREW	2024	12	0.892696223	10	0.5	9.080656902
PZ	2015	13	2.274029744	10	0.3	7.507276093
PZ	2016	13	1.708866623	11	0.2727	7.609448677
PZ	2017	13	1.733510254	11	0.2727	7.662150906
PZ	2018	13	1.254646629	10	0.2	7.668508434
PZ	2019	13	1.150995305	10	0.2	7.612876902
PZ	2020	13	1.075990455	10	0.2	7.558578863
PZ	2021	13	1.346283694	7	0.4286	7.55058703
PZ	2022	13	1.997349764	7	0.4286	7.464951094
PZ	2023	13	2.278850133	7	0.4286	7.471028604
PZ	2024	13	2.52915971	6	0.5	7.555159745
UNILEVER	2015	14	0.940539429	11	0.1818	7.799104215
UNILEVER	2016	14	0.973225641	10	0.2	7.85549913
UNILEVER	2017	14	1.06387429	10	0.2	7.903515479
UNILEVER	2018	14	1.037463582	10	0.2	7.952042708
UNILEVER	2019	14	0.7211905	10	0.2	7.923610863
UNILEVER	2020	14	0.839173636	10	0.2	7.868257321
UNILEVER	2021	14	1.013692672	10	0.2	7.842428752
UNILEVER	2022	14	1.13121426	10	0.3	7.783015719
UNILEVER	2023	14	1.324075462	13	0.308	7.894618075
UNILEVER	2024	14	1.283808504	14	0.4286	8.06620658
VITAFOAM	2015	15	1.070670779	8	0.25	7.16033381
VITAFOAM	2016	15	1.055558509	8	0.25	7.062505647

COMPANIES	YEARS	ID	TFP	BSZ	BGD	Log(FMZ)
VITAFOAM	2017	15	1.06	10	0.2	7.175297483
VITAFOAM	2018	15	1.117458974	10	0.2	7.197584265
VITAFOAM	2019	15	1.250347335	10	0.2	7.21110756
VITAFOAM	2020	15	1.239618337	10	0.2	7.239576413
VITAFOAM	2021	15	1.276437514	10	0.2	7.399258694
VITAFOAM	2022	15	1.249483974	9	0.2222	7.527846285
VITAFOAM	2023	15	3.249612587	12	0.1667	7.166899561
VITAFOAM	2024	15	2.643569551	12	0.1667	7.444050779

APPENDIX B2

Panel data Regression and Diagnostics Analyses Results

	Random Effect		Fixed Effect	
	Coeff	P-value	Coeff	P-value
BGD_{it}	0.737	(0.016)**	0.324	(0.474)
CONST	2.087	(0.003)**	2.939	(0.023)**
Observations	150			
No. of groups	15			
R ²	0.737			
P>z	0.050			
Wald chi2	62.20			
Prob>chi2	0.000			

Notes:.

***, **, represent significant at 5%.

STATA 17 Output

Breusch and Pagan Lagrangian multiplier (Lm test) test for random effects

Test: $\text{Var}(u) = 0$

$\text{chibar2}(01) = 25.18$

$\text{Prob} > \text{chibar2} = 0.0000$

$\text{productivty}[\text{id},t] = Xb + u[\text{id}] + e[\text{id},t]$

Estimated results:

	Var	SD = sqrt(Var)
product~y	.2466172	.4966056
e	.1600403	.4000504
u	.0749965	.2738548

hausman test

---- Coefficients ----

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	Std. err.
bgd	-.0254155	.0034973	-.0289129	.0228308
bcp	.1384377	-.2361804	.3746181	.2213774
lfirmsize	.1100057	.0511439	.0588618	.05525

b = Consistent under H_0 and H_a ; obtained from xtreg.

B = Inconsistent under H_a , efficient under H_0 ; obtained from xtreg.

Breusch and Pagan Lagrangian multiplier (Lm test) test for random effects

Test: $\text{Var}(u) = 0$

$\text{chibar2}(01) = 25.18$

$\text{Prob} > \text{chibar2} = 0.0000$

$$\text{productivty}[id,t] = Xb + u[id] + e[id,t]$$

Estimated results:

```

      |      Var      SD = sqrt(Var)
-----+-----
product~y | .2466172      .4966056
      e | .1600403      .4000504
      u | .0749965      .2738548

```

Table 1

Levin, Lin Chu (LLC) Unit root Tests

Variable	LLC@ Level	LLC @ First difference	Order of co-integration
TFP	-5.32506**	-17.3556**	I(0)
BZE	-6.19382**	-9.24507**	I(0)
BGD	-3.49033**	-8.08409**	I(0)
FSZ	-3.80796**	-14.6694**	I(0)

Source: STATA 17

Co-integration Test

Pedroni Residual Cointegration Test

Series: BGD, BSZ LOG_FSZ_ TFP

Date: 12/22/25 Time: 21:29

Sample: 2015 2024

Included observations: 150

Cross-sections included: 5 (10 dropped) in non-parametric (PP) test; 0

(15 dropped) parametric (ADF) test

Pedroni Residual Cointegration Test

Series: BGD, BSZ LOG_FSZ_ TFP

Date: 12/22/25 Time: 21:29

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coeffs. (within-dimension)

	<u>Statistic</u>	<u>Prob.</u>	Weighted	
			<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-2.064954	0.9805	-3.617183	0.9999
Panel rho-Statistic	2.726541	0.9968	2.033137	0.9790
Panel PP-Statistic	-2.219577	0.0132	-4.367593	0.0000
Panel ADF-Statistic	NA	NA	NA	NA

Alternative hypothesis: individual AR coeffs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	3.513836	0.9998
Group PP-Statistic	-8.140294	0.0000
Group ADF-Statistic	NA	NA

STATA 17 OUTPUT