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Determinants of Manufacturing Firms' Performance in Nigeria: A Sub-sectoral Comparative Analysis

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ABSTRACT

A sub-sectoral comparative analysis of the manufacturing sector provides more valuable insights into individual firm peculiarities regarding what determines their performance. This has informed the need to embark on this study to investigate if the effect of the determinants of athletic performance varies across manufacturing sub-sectors in Nigeria. Five sub-sectors out of the ten manufacturing sub-sectors quoted in the Nigeria Stock Exchange market from 1999 to 2020 were analyzed using the panel autoregressive distributed lag (P-ARDL) estimating technique. It was found that the determinants that accounted for firms' performance varied among the five manufacturing sub-sectors. The study, therefore, recommends that the government should consider the peculiarity of the different sub-sectors when formulating industrial policies because it will impact them differently. The follow-up and support should be specific to each sub-sector for the overall achievement of improved performance.

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1. Introduction

The growth of the manufacturing sector has been universally acknowledged as one of the significant instruments employed to achieve sustainable growth and development of nations. The manufacturing sector plays critical roles in the production and distribution of goods and services. It has enormous employment generation potential, especially for low-skilled labour, as well as positive linkages to other sectors of the economy. It is also the fastest sector in creating investment capital (UNIDO, 2020). Furthermore, the manufacturing sector promotes technological development and aids in reducing the nation's poverty (Kenny, 2019; Sokunle et al., 2018). Some nations, such as the United States of America and Japan, that have experienced recessions in the past enhanced the productivity of their manufacturing sector as a measure to overcome the challenge. Söderbom & Teal (2002) remarked that the growth of manufacturing exports was the most prominent characteristic of the rapid productivity and economic development of the Asian tigers.

Given the significance of this sector, policymakers in Nigeria have intervened through various policies and programmesprograms to improve the manufacturing sector's performance. Such measures include the Import Substitution Strategy (ISS), export promotion policy, incentives for local industries, and the National Economic Empowerment and Development Strategy (Adelowokan et al.; NPC, 2004). Notwithstanding these interventions, the performance of the manufacturing sector is unimpressive. It recorded a negative growth rate of -1.5%, -4.3%, -0.2% and -2.8% in 2015, 2016, 2017 and 2020 respectively. Also, in the 1990s and 2000s, the contribution of manufacturing value added to GDP averaged 20.5% and 10.59%, respectively. In 2013, 2018, and 2020, it was 8.9%, 9.6%, and 12.7%, respectively (World Bank, 2021).

To reverse this trend, researchers have asserted that there is a need to improve the manufacturing sector's performance. This can be achieved by investigating the determinants of the performance of the manufacturing firms. Previous studies have considered the impact of many factors (which are classified under firm characteristics, internal, external, and macroeconomic) that affect firms' performance (Aregbeyen, 2012; Tousek et al., 2021). This study argues that specific determinants may be responsible for firms' growth in one industry but deters it in another. However, there are little or no studies on sub-sectoral comparative analysis in the previous empirical studies on the determinants of manufacturing firms' performance in Nigeria. A sub-sectoral comparative analysis of the manufacturing sector will provide more valuable insights into individual firm peculiarities regarding what determines their performance. It will also show how each industry fares amid varying determinants of their performances. This will serve as essential guidelines for of formulating and implementing appropriate industrial policies by the government. Moreover, the results of this study will help the owners/managers of manufacturing firms to make proper decisions and adequately plan for the expansion of their firms. In light of the above, this study conducts a sub-sectoral comparative analysis to investigate the effect of the various determinants of firm performance across manufacturing sub-sectors in Nigeria.

The subsequent sections of this research paper are organized as follows: section two contains the review of literature, data, and methodology presented in section three. This is followed by the result and discussion, found in section four. Finally, section five offers the conclusion and policy recommendation.

2. Review of Literature

2.1. Conceptual framework

Firm performance can be measured in various ways, which include the use of sales/turnover, assets, value-added, number of employees, and profit (Selvam et al., 2016). Nevertheless, value-added was used in the study because it explains the internal process of the manufacturing firm. According to the literature, several factors have been acknowledged to positively or negatively affect firm performance. These factors are classified under immutable characteristics, internal factors, external factors, and macroeconomic factors (Aregbeyen, 2012; Tousek et al., 2021). It is argued that the great differences in firm performance over time depend on the interactions among these different determinants of athletic performance. These determinants' definitions were based on previous theories and empirical studies.

According to the optimum firm size theory, firm size is a significant determinant of athletic performance. Fit size is the by-product of strong growth in a given period. The optimum firm size theory postulates a negative relationship between firm size and performance. It assumes that large firms operate close to the optimum level, the minimum efficient scale (MES) of production, growing at a very low rate. Conversely, small firms operate far below the optimum size and, therefore, need faster growth to reach the optimum level (Geroski, 1999).

Firm age is another crucial factor that determines the performance of firms. The negative relationship between healthy age and growth is based on the theory of strong learning (Jovanovic, 1982). The theory postulates decreasing returns to learning over time and the reduction in efficiency gain when the firm's age increases as the cause for the negative relationship (Aregbeyen, 2012).

Capital intensity is the measure of the firms' efficiency in the use of assets. Theoretically, researchers assume a positive relationship between capital intensity and firm performance. This implies that firms with a higher level of capital intensity are likely to have high asset specificity and are also more variable in capital utilization and therefore grow more (Tousek et al., 2021).

The impact of access to financial resources on firm survival and growth is based on the financing constraints theory, which assumes a positive relationship between access to finance and athletic performance. Firms with enough resources are more disposed to experiment with new ideas, which increases their innovation potential and enables them to exploit new growth opportunities (Esuh & Mohd, 2012). Vertical integration gives firms a competitive advantage over smaller firms concerning sourcing raw materials and channels of distribution. Thus, vertical integration enhances firm performance (Sangosanya (2011).

Firms with high managerial capability perform better than the ones with less efficient management teams. Penrose theory of firm growth lends theoretical support to this proposition. According to Penrose (1959), a healthy growth rate is constrained and enabled by managerial capability. The growth rate of firms is determined by managers' experience, which depends on their expertise and skill contributions.

External factors (such as corporate income tax) that are beyond the direct control of the firms are also considered by researchers to determine the performance of firms. Macroeconomic factors such as GDP growth rate and inflation rate influence firms' business opportunities and thus considerably assess their performance (Tousek et. al., 2021). GDP growth rate impacts manufacturing firms' performance positively whereas the inflation rate is proven to have a negative impact (Loto, 2012).

Due to the heavy dependence of Nigeria's economy on the oil sector for her revenue and foreign exchange earnings, the study, therefore, controls the oil price in the analysis of the determinants of manufacturing firm performance across sub-sectors in Nigeria.

2.2. Empirical review

Many studies have investigated the determinants of manufacturing firms' performance in Nigeria and nationwide. Some of these empirical studies are reviewed below.

Tousek et al. (2021) examined the determining factors of profitability performance of selected 447 firms in the Czech Republic from 2008 to 2018. The analysis findings revealed that long-term financing, working capital, age, labor cost, lagged profitability, and GDP growth rate had a significant impact on the performance of the firms.

Using data from 1990 to 2017, Sankaran et al. (2020) identified the effects of dynamic macroeconomic variables on manufacturing performance in India. The study found that manufacturing output was driven by agricultural production, export, and population. Adelowokan et al. (2020) also studied the macroeconomic determinants of performance in Nigeria's manufacturing sector from 1981 to 2018. The Non-Linear Autoregressive Distributed Lag (NARDL) result revealed that in the short run, manufacturing value added and exchange rate lags significantly impacted manufacturing sector performance. But in the long run, all the determinants except for GDP per capita significantly affect the sector's performance.

Kenny (2019) investigated the determinants of manufacturing sector performance in Nigeria from 1981 to 2015 and adopted the Johansen Cointegration and the Vector Error Correction Model in the analysis. The study indicated a long-run relationship among the variables under review. Furthermore, gross fixed capital formation, . Still, thelabor force, and the exchange rate had a positive and

significant effect on manufacturing value added, but the effect of government expenditure, lending rate, and capacity utilization was found to be negative and significant. Investigating the dynamics of macroeconomic variables and manufacturing sector growth in Nigeria, Onakoya (2018) also adopted the vector error correction model to ascertain the short-run relationship among the variables. The finding of the analysis showed a negative relationship between manufacturing output and exchange rate, interest rate, inflation, and broad money supply, respectively. Also, a positive and significant relationship exists between manufacturing output and unemployment and one year lag of GDP respectively.

Kamaku & Waari (2016) examined firm-level determinants of manufacturing firms' growth in Kenya using 30 manufacturing firms. The study concluded that capital stock positively and significantly impacts manufacturing firms' growth. But leverage, electricity costs, wage bills, and fuel costs have a negative effect on firm growth. Yeboah (2015) examined the entrepreneurial factors and immutable characteristics as determinants of SME growth in Ghana. The result of the study showed that for entrepreneurial traits, the level of education is the most important determinant of strong growth, followed by gender. For immutable characteristics, fit size is the most significant determinant of healthy growth and is followed by the firm firm's legal status. The study concluded that acquiring formal education, seminars, and workshops of the owners/managers is the key to SME growth in Ghana.

Aggarwal (2015) examined the determinants of firm growth in India using 250 selected companies from 2004 - 2014. Employing multiple regression fitindustry techniques, the analysis revealed that firm size, age, advertising intensity, profitability, solvency, efficiency, leverage, research and development intensity, nature of the industry, and diversification were significant determinants of India's firms' growth. Pantea et al. (2014) investigated the relationship between microeconomic factors and the financial performance of 55 Romanian industrial companies listed on the Bucharest Stock Exchange. The result of the study revealed a strong and positive relation between capital intensity, firm size, human resources, and economic performance of the firms.

Harabi (2003) empirically analyzed the factors that affect the growth of 370 private firms in Morocco. Using the complete information maximum likelihood (FIML) method and a multinomial logit regression for estimation, the result of the study revealed that location in large urban centres, market share expansion, product diversification, legal status as a limited liability company, presence in markets with high demand, the presence of price competition and some government policies such as labor laws, tax policy, anti-trust and environmental policy were the major factors promoting firm growth in Morocco.

Esch & Mohd (2012) researched the effect of external factors, individual determinants, and firm characteristics on the performance of SMEs in Nigeria. The study concluded that individual determinants, external factors and immutable characteristics significantly impact athletic performance in Nigeria.

Prompted by the rate of firm closure in the Nigerian manufacturing sector, Sangosanya (2011) analyzed the dynamics of manufacturing firms' growth in Nigeria using 45 manufacturing firms quoted under the Nigeria Stock Exchange market. The estimated dynamic panel model revealed that firm size, capital reserve, manufacturing firm's finance mix, utilization of assets to generate more sales, the abundance of funds reserve, government intervention, operating efficiency, and government policies have a significant impact in determining manufacturing firms' growth and therefore explained firms' dynamics in Nigeria.

In a similar study, Aregbeyen (2012) investigated the determining factors in the growth rate of Nigerian manufacturing firms. The result of the survey showed that firm age, size, managerial efficiency, capital intensity, inflation, and vertical integration were significant determinants of the firms' growth when proxy by sales growth. But for value-added as a proxy of firm growth, management efficiency, financial constraints, capital intensity, and vertical integration were found to be significant.

From the preceding empirical studies, there is a shortage of research on the sub-sectoral analysis of the determinants of manufacturing firms' performance both in Nigeria and across the country. Hence, this study would serve as a major contribution to the existing literature on determinants of manufacturing firms' performance.

3. Data and Methodology

3.1. Data Source and Scope

The study used panel data from fifty-five manufacturing firms quoted in the Nigerian Stock Exchange (NSE) from 1999 to 2020. These firms have a private dominant ownership structure, have existed for at least ten financial years, and the necessary variables of interest are available. The period was chosen because it coincides with the present democratic government in Nigeria, which has various policy measures geared towards improving the performance of the manufacturing sector. The data were sourced from the various issues of the Central Bank of Nigeria Statistical Bulletin and the annual reports and statements of accounts of these firms.

3.2. Theoretical Framework

The study adopted the optimum firm size model as applicable in Geroski (1999) and Harabi (2003). The optimum firm size model specifies a steady state firm size (S*), and deviations from that equilibrium are subsequently assessed as firm growth. S* is thus employed as a benchmark, and all observed changes in fit size are interpreted either as white noise or as part of a transitional process of convergence to S*. Following Harabi (2003), the optimum firm size model is stated as;

$$\Delta S_{(t)} = S^* + \beta S_{(t-1)} + \mu_{(t)} \quad (1)$$

where $\Delta S_{(t)}$= firm growth over time t, S^* = long-run steady-state size of the firm, $S_{(t-1)}$ = last period firm size, $\mu_{(t)}$ = normally distributed white noise error process. To improve the model, other important exogenous variables aside lag of firm size were added. Assume X_t = vector of other exogenous variables and including a constant (A) to the model yields

$$\Delta S_{(t)} = A + S^* + \beta S_{(t-1)} + \propto X_t + \mu_{(t)} \quad (2)$$

But S^* is unobservable. Nevertheless, the solution of S^* can be obtained under the scenario that the firm is in a steady state. In this state,

$$S^* = S_{(t)} = S_{(t-1)} \quad (3)$$

Substituting equation 3 into equation 2 and evaluating, we have

$$S^* = C - \left(\frac{\propto X_t + \mu_{(t)}}{(1+\beta)} \right) \quad (4)$$

Substituting equation 4 into equation 2 and solving for $\Delta S_{(t)}$, gives

$$\Delta S_{(t)} = D + \beta S_{t-1} + \alpha X_t + \epsilon_t \quad (5)$$

where

$$\alpha = \frac{\propto \beta}{1+\beta} \text{ and } \epsilon_t = \left(\frac{\beta}{1+\beta} \right) \mu_{(t)}$$

A panel data of 55 quoted manufacturing firms in Nigeria from 1999 to 2020 was used to test equation 5, therefore it becomes

$$\Delta S_{i(t)} = D + \beta S_{i(t-1)} + \alpha X_{it} + \varepsilon_{it} \quad (6)$$

where

Equation 6 can be expressed as firm growth (performance) over time t depends on firm size and other determinants. The choice of these other determinants is based on previous literature as shown in Table 1. The optimum firm size model is chosen because it offers the most practical approach to the study and is considered robust with very strong flexibility that affords researchers to test for many determinants of firm performance apart from its firm size as long as they can be supported by the literature.

3.3. Model Specification

Given the above, the empirical model to investigate the determinants of manufacturing firms' performance across sub-sectors is represented in equation 7 which is an extension of equation 6.

$$\Delta VAGR_{it} = \beta_0 + \beta_1 VAGR_{it-1} + \beta_2 FCF_{it} + \beta_3 INTF_{it} + \beta_4 EXTF_{it} + \beta_5 MAF_{it} + \beta_6 OILP_{it} + \Delta\mu_{it} \quad (7)$$

where FCF = firm characteristics factors, INTF = internal factors, EXTF = external factors, MAF = macroeconomic factors, OIL = oil price. Other variables remain as earlier explained.
Where FCF = f(AG, CI)
INTF = f(VI, ME, LFC)
EXTF = f(GRP)
MAF = f(GRGDP, INF)

Equation 7 is further expanded to become equation 8 thus:

$$\Delta VAGR_{it} = \beta_0 + \beta_1 VAGR_{i(t-1)} + \beta_2 AG_{it} + \beta_3 CI_{it} + \beta_4 VI_{it} + \beta_5 ME_{it} + \beta_6 LFC_{it} + \beta_7 GRP_{it} + \beta_8 GRGDP_t + \beta_9 INF_t + \beta_{10} OILP_t + \Delta\mu_{it} \quad (8)$$

Table 1. Definitions and Measurements of Variables

Variable	Definition	Measurement	Literature
Dependent: Firm performance: VAGR	Growth rate of the firms' value added	$\frac{VA_{it} - VA_{it-1}}{VA_{it-1}} \times 100$	Aregbeyen, 2012; Geroski; 1999; Harabi, 2003
Independent: Firm characteristics: $VAGR_{it-1}$	Last period firm size (value added) i. e. value added growth rate lagged one period.	$VAGR_{it-1}$	Adelowokan et. al., 2020; Sangosanya, 2011
AG	Age of the firm	The number of years the firm has existed from the date of incorporation.	Aggarwal, 2015; Sankaran et al. (2020)
CI	Capital Intensity	Capital-Output ratio i.e. ratio of total assets to total sales	Aregbeyen, 2012; Pantea et al., 2014; Yeboah, 2015
Internal factors: VI	Vertical Integration	Value added as a percentage of sales	Aregbeyen, 2012; Sangosanya, 2011
ME	Management Efficiency	Net profit after taxes as a percentage of sales	Aggarwal, 2015; Hossain, 2020.
LFC	Log of Financial Constraint	Log of Retained profit plus log of depreciation	Esuh & Mohd, 2012; Tousek et. al. (2021)
External factor: GRP	Government Regulations and Policies	Company Income tax as a percentage of gross profit	Harabi, 2003; Sangosanya, 2011
Macroeconomic factors: GRGDP	Growth rate of GDP	$\frac{GDP_{it} - GDP_{it-1}}{GDP_{it-1}} \times 100$	Aregbeyen, 2012; Onakoya, 2018
INF	Inflation rate	Consumer price index	Loto, 2012; Adebiyi & Babatope-Obasa (2004)
OILP	Oil Price	International oil price	Agu & Nyatanga, 2020

Source: Author's compilation (2022)

3.4. Estimation Technique

To examine if the determinants of manufacturing firms' performance in Nigeria vary across different sub-sectors, the study classified the fifty-five quoted manufacturing firms into ten sub-sectors with varying numbers of firms (see appendix A) (NBS, 2019). However, only five sub-sectors were analysed because the estimate for the other five sub-sectors with fewer firms could not reach convergence. The panel unit root test was first employed to test the stationarity properties of the variables used. The study employed the use of a panel autoregressive distributed lag (PARDL) estimation technique. Three estimators (pooled mean group, mean group and the dynamic fixed effect) were estimated for the various sub-sectors under consideration and then used the Hausman selection test to ascertain the most appropriate estimator for the study. The use of the PARDL estimation technique is considered appropriate because the variables are integrated of both order 1 and 0. Also, the cross-sectional unit in each of the sub-sector (which ranges between two and fifteen) is less than the time unit (twenty-two years). The ARDL model is specified thus:

$$\begin{aligned}\Delta VAGR_{it} = {} & \beta_0 + \sum_{j=1}^{n}\beta_{1j}\Delta VAGR_{i(t-1)} + \sum_{j=1}^{n}\beta_{2j}\Delta AG_{it} + \sum_{j=1}^{n}\beta_{3j}\Delta CI_{it} + \sum_{j=1}^{n}\beta_{4j}\Delta VI_{it} \\ & + \sum_{j=1}^{n}\beta_{5j}\Delta ME_{it} + \sum_{j=1}^{n}\beta_{6j}\Delta LFC_{it} + \sum_{j=1}^{n}\beta_{7j}\Delta GRP_{it} + \sum_{j=1}^{n}\beta_{8j}\Delta GRGDP_{t} \\ & + \sum_{j=1}^{n}\beta_{9j}\Delta INF_{t} + \sum_{j=1}^{n}\beta_{10j}\Delta OILP_{t} + \sigma_1 VAGR_{i(t-1)} + \sigma_2 AG_{i(t-1)} \\ & + \sigma_3 CL_{i(t-1)} + \sigma_4 VI_{i(t-1)} + \sigma_5 ME_{i(t-1)} + \sigma_6 LFC_{i(t-1)} + \sigma_7 GRP_{i(t-1)} \\ & + \sigma_8 GRGDP_{i(t-1)} + \sigma_9 INF_{i(t-1)} + \sigma_{10} OILP_{i(t-1)} + \varepsilon_{it}\end{aligned} \tag{9}$$

Where j = number of lags, n = optimal lag length, Δ = first difference operator, β_0= constant term, β_{1j},..., β_{10j} = short run coefficients for the independent variables, σ_1,..., σ_{10} = elasticity coefficients used to proxy the long-run relationship, ε_{it} = the stochastic error term. All other variables remain the same as in table 1.

4. Results and Discussion

4.1. Panel Unit Root Test

The unit root test result which comprises of the Im-Pesaran-Shin and the Augmented Dickey Fuller tests is presented in Table 2. The choice of these two tests is because they accommodate the use of unbalanced panel as applicable in this study. Table 2 shows that L_VAGR, AG, CI, VI, ME, LFC, GRP, GRGDP and the dependent variable VAGR are integrated of order zero I(0) while INF and OILP are integrated of order one I(1) at 1% level of significance. This result is consistent with both the Im-Pesaran-Shin and the Augmented Dickey Fuller tests.

Table 2. Panel Unit Root Results

Variables	Im Pesaran & Shin		ADF- Fisher Chi- square	
	P-value	Order of Integration	P-value	Order of Integration
VAGR	0.0000***	I(0)	0.0000***	I(0)
L_VAGR	0.0000***	I(0)	0.0000***	I(0)
AG	0.0000***	I(0)	0.0000***	I(0)
CI	0.0003***	I(0)	0.0000***	I(0)
VI	0.0000***	I(0)	0.0000***	I(0)
ME	0.0000***	I(0)	0.0000***	I(0)
LFC	0.0002***	I(0)	0.0020***	I(0)
GRP	0.0000***	I(0)	0.0000***	I(0)
GRGDP	0.0000***	I(0)	0.0000***	I(0)
INF	0.0000***	I(1)	0.0000***	I(1)
OILP	0.0091***	I(1)	0.0000***	I(1)

Source: Author's Compilation (2022)
Note: *** represents 1% significance level

4.2. PARDL short run and long run results

The Hausman test result suggests the use of a pooled mean group (PMG) as the most appropriate estimator for this study. The PARDL (PMG estimator) short-run and long-run results of the five sub-sectors analyzed are presented in Table 3.

Chemical and Pharmaceutical Sub-sector (15 firms)

Results from the chemical and pharmaceutical sub-sector reveal that a 1% rise in firm size (L_VAGR) results in a -1.93% decrease in the performance of the sub-sector in the long run at a 1% significance level. This corroborates the optimum firm size theory, which suggests a negative relationship between firm size and firm growth. Also, a 1% increase in firms' capital intensity is associated with a 4.32% increase and a -44.20% decrease in the industry's performance during the long run and short run, respectively, both at a 1% significance level. Again, a 1% increase in firms' age and inflation rate are negatively associated with -0.73% and -1.17% in firms' performance, respectively, during the long run at a 5% significance level. The inflation indicator follows prior expectations and is consistent with the

study of Loto (2012). The negative relationship of firms' age with their performance corroborates the studies of Aggarwal (2015) and Yasuda (2005). This could be attributed to the decrease in productivity as the firms grow older because of higher levels of inflexibility, which limits the ability of the firm to innovate or exploit favourable opportunities that would induce performance.

A 1% increase in government regulation and policy (GRP) is associated with a 0.65% increase in their performance during the long run at a 1% significance level. This indicates that government intervention and control measures on the activities of chemical and pharmaceutical firms in Nigeria benefit their continual existence in the long run. This finding corresponds to Harabi's (2003) and Sangosanya (2011) studies. Also, only the log of financial constraint (LFC) significantly impacts the industry's performance at a 10% significance level in the short run. Therefore, with no long-run relationship between firms' performance and LFC, we conclude that most firms in this industry will exit since their profitability could not contribute significantly to their performance in the long run.

Finally, the result reveals that short-run disequilibrium can be corrected in the long run at 92.6% adjustment speed. This means it will take only one year and about one month for the system to revert to equilibrium whenever contemporaneous short-run shocks threaten the system.

Food, Beverages and Tobacco Sub-sector (15 Firms)

The results of this sub-sector reveal that firm size (L_VAGR) and capital intensity negatively impact firms' performance during the long run. This result aligns with the optimum firm size theory and the study of Oh et al. (2014), respectively. The capital intensity result means that the average production per capital detracts from the industry's performance rather than adds to it.

Management efficiency, inflation, and oil price shock also have a significant negativenegatively impact firms' performance in this industry. Specifically, a 1% increase in management efficiency is associated with a 126.46% decrease in the industry's performance in Nigeria. This result is ambiguous and makes for an immediate call for policy issues to be put in placemainly, especially in the area of management efficiency, to forestall its negative impact.

A positive relationship was reported between firms' vertical integration, log of financial constraint, government regulatory policies, and the industry's performance. That is, a 1% rise in vertical integration, log of financial constraint, and government regulation and policy are associated with 0.59%, 3.43%, and 0.72% increases, respectively, in the performance of firms under the industry during the long run. This is very much interrelated as firms' vertical integration rises with their market share, their financial constraint improves through higher profit, and their active network is strengthened through favorable government policies and regulations. Therefore, their positive nexus with performance indicates that as long as these firms control a reasonable part of the total market share (vertical integration), they will continue to make a profit, thereby raising their advantage on financial constraints. With good standing in their financial constraint, they will always quickly meet their obligations to the government in terms of tax payment and other regulations.

Moreover, the negative impact of inflation both during the short run and long run, as well as oil price shocks in the long run, is a clear indication that firms in this industry are very vulnerable to macroeconomic instability/shocks. This explains why food prices in Nigeria always respond to oil price movements and inflation rate. However, the analysis further reveals that irrespective of possible macroeconomic shocks capable of threatening the entire industry, disequilibrium in the short run can be corrected during the long run at an adjustment speed of 76.8% per annum at a 1% significance level. This implies that it will take the industry approximately one year and a quarter for short-run disequilibrium to be corrected.

Paper Product Sub-sector (5 Firms)

Unlike the first two industries presented above, this sub-sector has a limited number of firms, and as such, competition will be low, and there is a high tendency for the firms to act as monopolists. The findings show a consistent result with the food, beverages, and tobacco industries. A negative significant impact of firm size (L_VAGR), capital intensity, and firms' age on firms' performance was recorded, but unlike the previous industries, a negative significant impact of government regulation and policy was also reported for paper production firms. This could be attributed to the reason above

that the firms operate as monopolists; therefore, government intervention is always seen as counter-productive.

Table 3. PARDL short run and long run results

	CHEM & PHAR	FOOD & BEVAGE	PAPER PROD.	CEMENT	NON METAL
LONG-RUN VARIABLES	**ΔVAGR**	**ΔVAGR**	**ΔVAGR**	**ΔVAGR**	**ΔVAGR**
Constant	31.684	22.890	348.397	-15.519	38.173
	(2.34)**	(2.16)**	(1.03)	(0.34)	(1.48)
First Lag of VAGR ($VAGR_{it-1}$)	-1.934	-1.555	-4.556	-4.611	-1.140
	(6.13)***	(4.94)***	(5.12)***	(0.71)	(2.26)**
First Lag of Capital Intensity (CI_{it-1})	4.321	-29.392	-18.346	0.124	36.883
	(3.21)***	(14.22)***	(3.43)***	(0.09)	(2.54)**
First Lag of AGE	-0.728	-0.704	-2.391	-4.224	-2.599
	(2.33)**	(3.49)***	(3.85)***	(7.81)***	(2.55)**
First Lag of Vertical Integration (VI_{it-1})	-0.053	0.586	0.946	0.050	-2.829
	(0.53)	(14.18)***	(5.45)***	(1.23)	(3.27)***
First Lag of Log of Fin. Constraint (LFC_{it-1})	-0.287	3.429	8.767	10.748	6.433
	(0.73)	(2.71)***	(6.27)***	(5.80)***	(1.33)
First Lag of Mgt Efficiency (ME)	0.853	-126.457	-40.174	11.244	-51.407
	(0.20)	(11.29)***	(0.91)	(1.28)	(0.57)
First Lag of Govt. Reg & Policies (GRP_{it-1})	0.645	0.720	-0.679	0.015	0.887
	(3.68)***	(20.57)***	(2.59)***	(0.18)	(1.66)*
First Lag of Inflation (INF_{it-1})	-1.173	-0.873	-0.325	0.229	-5.473
	(4.02)***	(5.63)***	(0.59)	(0.80)	(1.15)
First Lag of Growth of GDP ($GRGDP_{it-1}$)	0.304	-0.226	-1.075	-1.239	1.065
	(0.79)	(1.57)	(1.26)	(3.40)***	(0.25)
First Lag of Oil Price ($OILP_{it-1}$)	-0.001	-0.232	-0.001	0.151	-0.004
	(0.02)	(12.72)***	(0.02)	(3.47)***	(0.01)
Error Correction Term (ECT_{it-1})	-0.926	-0.768	-0.710	-1.070	-0.952
	(20.06)**	(8.45)***	(3.67)***	(21.34)***	(10.02)***
SHORT-RUN VARIABLES					
First Difference of VAGR (ΔVAGR)	-0.327	-1.509	2.187	-1.418	2.714
	(0.27)	(0.91)	(1.23)	(2.99)	(0.05)**
First Difference of Capital Intensity (ΔCI)	-44.198	156.115	54.380	-38.732	-34.813
	(20.06)***	(1.00)	(0.58)	(1.79)*	(2.72)***
First Difference of AGE (ΔAGE)	0.000	0.000	-3.668	0.000	0.000
	(.)	(.)	(0.59)	(.)	(.)
First Difference of Vertical Integration (ΔVI)	0.727	6.288	15.593	5.221	3.589
	(0.21)	(4.73)***	(1.05)	(1.86)*	(6.25)***
First Difference Log of Fin. Constraint (ΔLFC)	30.133	34.534	23.601	54.192	6.138
	(1.73)*	(1.52)	(1.77)*	(1.36)	(2.46)**
First Difference of Mgt Efficiency (ΔME)	-290.131	-275.622	176.501	23.603	-75.779
	(1.49)	(1.80)	(0.46)	(0.48)	(4.26)***
First Difference Govt. Reg and Policies (ΔGRP)	-4.023	-0.958	0.099	0.222	0.206
	(1.13)	(0.58)	(0.24)	(1.29)	(0.19)
First Difference of Inflation (ΔINF)	-1.837	-2.143	-33.666	-2.790	-6.908
	(0.39)	(2.41)**	(0.98)	(1.06)	(0.83)
First Difference of Growth of GDP (ΔGRGDP)	1.498	17.457	21.886	-1.001	1.248
	(0.64)	(0.86)	(1.11)	(0.66)	(0.27)
First Difference of Oil Price (ΔOILP)	0.148	-0.361	-14.913	-0.207	0.106
	(0.20)	(0.63)	(0.97)	(0.81)	(0.19)
Hausman Test: H_0:PMG is the most appropriate	0.1576	0.1955	1.0000	0.9119	1.0000
No of Obs/Groups	300/15	286/15	100/5	80/4	80/4

*** significant at 1%; ** significant at 5%; * significant at 10%; Absolute values of z statistics in parentheses
Source: Author's Estimation (2022)

Another main finding from this industry is that a 1% increase in vertical integration and financial constraint is, on average, associated with 0.95% and 8.77% increase in the performance of these five firms during the long run. This suggests that there is an increased mix of their performance-to-total sales ratio as well as their profit-to-performance level over time.

Furthermore, the result shows that macroeconomic indicators could not account for changes in firms' performance levels both during the short-run and long-run. This is because all the macroeconomic indicators, such as the inflation rate, the growth rate of GDP, and oil price, were not significant. The major determinants of this sub-sector's performance are their internal and firm characteristics factors. This strengthens the assertion that they take advantage of their small size to collude and operate as a monopolist, thereby having firm control over prices and even their output level to an extent.

The speed of adjustment to a long-run steady state is 71% per annum at a 1% significance level. Therefore, short-run disturbances can be corrected in the space of one year and five months, all things being equal.

Cement Sub-sector (4 Firms)

This analysis reveals that firm age and financial constraint are strong indicators of cement firms' performance at a 1% significance level. The result also shows that the cement industry is more responsive to macroeconomic determinants of firms' performances than other indicators. This is because both the GDP growth rate and oil price significantly account for variations in firms' performance. More specifically, a 1% variation in the growth rate of GDP and oil price is associated with 1.24% decrease and 0.15% increase in firms' performance respectively during the long run, at 1% significance level. Although the negative nexus between cement firms' performance and economic growth does not follow theoretical apriori expectations, however, the result conforms to the studies of Enu & Havi (2014) and Hossain (2020) which found a negative relationship between the growth rate of GDP and firm performance. This ambiguous result could be justified because the business cycle is in recession at the period of this study; hence, there will be a threshold effect beyond which a positive relationship will be found. On the other hand, the positive impact of oil price prices. This explains the current simultaneous increases in oil price and outputs of cement firms over the years in Nigeria. Furthermore, only vertical integration and capital intensity accounted for changes in the firms' performance at 10% significance levels during the short run. Whereas the latter indicator reveals a positive relationship with the dependent variable, the former had a negative impact.

The speed of adjustment to long-run steady-state equilibrium is -1.07 (-107%) per annum at 1% significance level. The implication is that short-run disequilibrium can be corrected in the long run at an average speed of -107%. As a result, we see that the firms revert to equilibrium in less than one year whenever contemporaneous shocks threaten the system.

Non-Metallic Sub-sector (4 Firms)

The results reveal that the non-metallic industry's performance is more responsive to firms' specific, internal, and external factors than to macroeconomic factors. Firm size, capital intensity, firms' age, vertical integration, log of financial constraint, firms' managerial competency and government regulation and control were the main variables that determine firms' performance both during the short-run and the long-run. Furthermore, we can assert that the system can revert to an equilibrium/steady state when contemporaneous shocks affect the firms' activities at an adjustment speed of 95.2% per annum. This means that it will take approximately one year and one month to reach convergence to steady state growth after short-run disequilibrium.

Summarily, the analyses of results show that for the chemical and pharmaceutical industry, firms' specific factors of capital intensity and age of the firm were its significant determinants. Among the food, beverages, and tobacco industries, all the indicators significantly affected firms' performance. Looking at the paper production industry, firms' specific, internal, and external variables were the major players. For the cement industry, macroeconomic indicators of economic growth rate and oil price were its significant drivers, whereas, for the non-metallic industries, firms' specific, internal and external variables played a significant role.

4.3. Result of the serial correlation test

To test for the robustness of the research outcome, the study examines the presence of serial correlation for the five sub-sectors; the result is presented in Table 4.

Table 4. Breusch-Godfrey Serial Correlation LM Test

CHEM & PHAR	F-Statistic	0.546	Prob. F(2, 312)	0.547
	Obs* R-Squared	0.779	Prob. Chi-Square (2)	0.541
FOOD & BEVAGE	F-Statistic	0.381	Prob. F(2, 312)	0.531
	Obs* R-Squared	0.599	Prob. Chi-Square (2)	0.342
PAPER PROD	F-Statistic	0.393	Prob. F(2, 101)	0.784
	Obs* R-Squared	0.460	Prob. Chi-Square (2)	0.783
CEMENT	F-Statistic	0.217	Prob. F(2, 80)	0.806
	Obs* R-Squared	0.648	Prob. Chi-Square (2)	0.723
NON METAL	F-Statistic	1.379	Prob. F(2, 80)	0.266
	Obs* R-Squared	3.432	Prob. Chi-Square (2)	0.179

Source: Author's Estimation (2022)

Table 4 shows that all the P-values of the F-statistics for the five sub-sectors are more significant than 5%. This means that the null hypothesis of no serial correlation is therefore accepted. This implies that there is no serial correlation affecting firm performance and the factors that determine it in the Nigerian manufacturing sub-sectors under investigation.

5. Conclusions

A sub-sectoral comparative analysis of the manufacturing sector provides more valuable insights into individual firm peculiarities regarding what determines their performance. This study, therefore, investigated if the effect of the determinants of athletic performance varies across manufacturing sub-sectors in Nigeria. Fifty-five manufacturing firms quoted in the Nigeria Stock Exchange spanning 1999 to 2020 were examined. The Nigerian manufacturing sector is disaggregated into ten sub-sectors. However, five sub-sectors were considered out of the ten sub-sectors examined. This is because the estimate for five sub-sectors (with less than four firms) could not converge. The study employed the Panel autoregressive distributive lags (P-ARDL) for short- and long-run regression as the most appropriate estimation technique.

From the analyses of the P-ARDL results, the general finding across these sub-sectors is that the variables/factors that accounted for firms' performance vary among the five sub-sectors examined. However, firm size, capital intensity, and financial constraint had a dominating impact across the five sub-sectors that were discussed. Therefore, each industry has its peculiarities regarding what determines its performance. In addition, with good standing in their financial constraint, expansion of firm size, and good capital base, the performance of Nigeria manufacturing firms would be improved.

In light of the above, the study recommends that when formulating industrial policies, the government should consider the peculiarity of the different sub-sectors as that will impact them differently. The follow-up and support should be specific to each sub-sector for the overall achievement of improved performance. Given the dominant impact of firm size, capital intensity, and log of financial constraint on athletic performance, banks should increase access to financial resources by providing adequate loans and advances to manufacturing firms at a minimal cost. This will also help to enhance the assets base and the size of the manufacturing firms in Nigeria.

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