



EFFECTS OF EXCHANGE AND INFLATION RATE ON MANUFACTURING OUTPUT GROWTH IN NIGERIA: A BOUND TESTING APPROACH TO COINTEGRATION

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Abstract

The study investigated the performance of Nigeria's manufacturing sector from 1981 to 2022 in relation to currency depreciation. In order to ascertain this, the Central Bank of Nigeria (CBN) statistical bulletin's various issues provided the annual time series data for the dependent variables, which are the growth rate of manufacturing output, and the independent variables, which are the exchange rate, inflation rate, interest rate, and trade openness. The unit root was tested using the Augmented Dickey Fuller (ADF) method, and the long-term connection between the series was ascertained using the bound test technique to cointegration, also referred to as the Auto regressive distributed lag approach. The estimate's conclusions showed that there was a substantial adverse association between manufacturing performance and changes in interest rates, inflation, and exchange rates. Additionally, trade openness and manufacturing performance exhibited a negative link, nevertheless it was not very strong. The outcome demonstrated that any disturbance or out-of-equilibrium state in the system will be brought back to equilibrium at a rate of about 15.7% adjustment speed. It was suggested that in order to boost Nigerian industrial production, monetary authorities should work to keep the exchange rate generally stable and refrain from devaluing the currency.

Keyword: Exchange rate, Inflation Rate, Manufacturing Sector

Introduction

The attainment of macroeconomic objectives is often considered paramount goals to be achieved of political leaders and policy makers in every given nation. In order to secure stability, material prosperity, peace and social progress, every economy – Nigeria inclusive strives to attain these macroeconomic objectives among which include: rapid economic growth, high employment and full maximum productivity or output in all industrial sectors of the economy. To ensure high delivers on the resource and potentials of a nation, the role of manufacturing industries in the production of finished and intermediate goods for industrialization of an economy cannot be undermined (Okaro, 2017). Mbelede (2012) submitted that the manufacturing sector contributes to the process of enhancing raw materials' value by converting them into finished goods. As a result, the manufacturing sector drives the

transformation of raw materials into completed items and is the primary economic factor. The 18th and 19th centuries saw significant technical and social changes in Western nations, which gave rise to the manufacturing industries. This time frame was dubbed the "industrial revolution" by many. It all started in Britain, when fuel-based mechanisation took the role of labor-intensive textile manufacture. Engineering, construction, electronics, chemical, energy, textile, food and beverage, metalworking, plastic, transportation, and communications sectors are the several subsectors that make up the manufacturing sector (Central Bank of Nigeria, 2011). Charles (2012) noted that manufacturing industries are largely considered an asset to any given nation because they help to create employment for boosts in the agricultural sector, facilitate the diversification of the economy.

Before the 1980s, Nigeria's manufacturing sector was recognised for making a respectable contribution to the GDP of the country. For example, in the 1980s, the manufacturing sector's share of GDP averaged 18% (i.e. between 1981 and 1989). This suggests that the manufacturing sector's contribution to GDP has not been very noteworthy. Unfortunately, the manufacturing sector's share of Nigeria's GDP was greater than 20 percent in 1994, but during the following years, it has decreased. In January 2010, as part of its membership operational audit, the Manufacturers Association of Nigeria (MAN) conducted a survey and found that out of the 2780 registered members, 840 (30.21%) of the manufacturing enterprises shuttered their plants. This may be due to their inability to cope with the challenges posted by the harsh operating environment in Nigeria; which include the exchange rate management problems and infrastructural decay. In the annual report of MAN for 2006, it was also claimed that the job loss in the sector between 1983 and January 2006 was estimated at 4.2million.

Furthermore, it was claimed in the Association's March 2016 Newsletter that the industry lost almost one million three hundred thousand (1.3 million) employment between 2006 and 2015. Particularly since 2002, the manufacturing sector's share of the GDP has been less than 10%; between 2013 and 2015, it barely averaged 9% (Premuimtimes, 2017). In the first two quarters of 2016, before the economic downturn, a number of Nigerian industrial enterprises faced various types of business failures. Before the economic downturn, a few businesses, namely Michelin and Dunlop Nigeria Plc (the two remaining Nigerian tyre manufacturers), closed their operations, fired hundreds of employees, and moved their headquarters to Ghana. Aside, these firms, several others involved in the production of completed and intermediate goods also shut down their plants temporarily because of high production cost incurred and other exogenous factors. The lack of proper electrical supply, the smuggling of foreign goods into the nation, trade liberalisation, the enormous importation of completed and intermediate goods, and the inadequate government backing for emerging businesses might all be contributing factors to this action. To support this argument, Okafor (2012) said that high interest rate on lending, high levels of difficulties in assessing raw materials, high exchange rate (or naira depreciation) and poor government budget execution may lead Nigeria's manufacturing sector to keep declining.

The government policy, the external sector, and macroeconomic performance are the elements Asinya and Nelson (2014) highlighted as having significant effects on the devaluation of the Nigerian currency. They went on to say that the following are some of the

ways that the dropping value of the naira affects the increase of production in industries such as manufacturing and the economy overall. First, as Nigeria's economy is highly dependent on imports and the country's inclination to import is strong, the depreciation of the naira would discourage importers due to the resulting increase in prices. As a result, imports are price inelastic. Second, depreciation typically lowers the price of export goods or at least makes them competitive in the global market, increasing demand. Two crucial elements were overlooked in this argument: the price structure and the elasticity of demand for the export. However, the reality that has surfaced indicates that the export goods from Nigeria are largely inelastic, with pricing set by the global market and not positively connected with fluctuations in the value of the naira.

Additional negative consequences of devaluation include poor per capita income, rising external debt, unemployment, and a lack of direct private investments abroad. In light of this, the main objective of this study was to examine how Nigeria's manufacturing sector is affected by currency rates and inflation. To achieve this, the following hypotheses were formulated and tested in the study:

1. Ho: Inflation rate has no significant effect on manufacturing output in Nigeria.
2. Ho: Exchange rate has no significant effect on manufacturing output in Nigeria.

Literature Review

Numerous studies have been conducted to investigate the relationship between macroeconomic variables and the performance of the manufacturing sector in Nigeria, as well as the factors that influence that performance both domestically and internationally. Lawal (2018) looked analysed the impact of changes in exchange rates on the production of Nigeria's manufacturing sector during a 28-year period, from 1986 to 2014. To investigate the impact of exchange rate fluctuations on the manufacturing sector, data on manufacturing output, the Consumer Price Index (CPI), government capital expenditure (GCE), and the real effective exchange rate (EXC) were sourced from the Central Bank of Nigeria (CBN) statistical bulletin and the World Development Indicators (WDI). The data were analysed using Autoregressive Distribution Lag (ARDL). Exchange rate variations were found to have an impact on the manufacturing sector's production in both the short and long term, using ARDL. The findings indicated a slight but favourable correlation between the exchange rate and manufacturing sector production. Nonetheless, the empirical research revealed a favourable relationship between the manufacturing sector's production and the exchange rate.

Over a twenty-year period (1986–2005), Opaluwa, Umeh, and Abu (2017) investigated the effects of currency depreciation on the Nigerian manufacturing sector. Empirical technique was used for the investigation. The explanatory variables in the model were the manufacturing output employment rate and foreign private investment. The regression analysis's outcome reveals that each variable's coefficient included both positive and negative indications. In the end, the study's findings are statistically significant and demonstrate a negative impact.

Abubakar and Bambale (2017) investigated the relationship between company performance in Nigeria's northwest geopolitical zone and currency devaluation and depreciation. This study design is descriptive. High-level executives of organisations located in the six states that make up Nigeria's Northwestern geopolitical zone are the study's target demographic for the survey portion. The findings indicated that, in light of the Marshall-Lerner condition, there appears to be a theoretical conflict between the use of devaluation and Nigeria's current international trade situation.

Ehinomen and Oladipo (2017) looked at how currency depreciation affected Nigeria's industrial sector's expansion. E-view was used to do an Ordinary Least Square (OLS) multiple regression analysis. The study used time-series data to span the years 1986–2010. It was shown that there is a substantial correlation between domestic output and exchange rate appreciation in Nigeria. Additionally, the manufacturing sector will develop as a result of the appreciation of the currency rate. Additionally, it was determined from the computed regression line that devaluation and the manufacturing output are positively correlated.

In keeping with the goals of this study, secondary data were gathered from the central bank of Nigeria statistics bulletin, which covered the years 1970 to 2010, for Owolabi and Adegbite's (2017) investigation of the influence of monetary policy on industrial growth in the Nigerian economy. Using multiple regressions to examine data on variables like manufacturing output, Treasury Bills, deposit & leading, and rediscount rate for Nigeria from 1970 to 2010, the study concluded that all of these variables had a significant impact on the country's industrial growth, with an adjusted R² of 0.8156 (81.56%). The study's findings lead to the conclusion that while Treasury Bills have a negative influence on industrial output, Rediscount Rate and Deposit have a considerable favourable impact.

The effect of devaluation on Nigeria's economic development was examined by Momodu and Akani (2017). For the error correction mechanism (ECM), the autoregressive distributed lags (ARDL) method was

used in conjunction with the Johansen Co-integration technique using multivariate estimates. The (ARDL) and (ECM) results indicate when growth fluctuations are brief enough to be explained by the model's other components and devaluation. The conclusion was that devaluation makes local commodities more affordable on the global market, with a considerable relationship between interest rates and exchange rates. A rise in exports leads to higher levels of investment and output, which in turn raises exchange rates.

The effect of currency depreciation on the increase of industrial production in Nigeria between 1980 and 2014 was studied by Adekoya and Fagbohun (2016). For the stationarity test, it uses an augmented Dickey Fuller; for the long-run connection, it uses Engel-Granger cointegration; for the long-run estimate, it uses ordinary least square; and for the causal links, it uses the Granger causality test. The results show that while every variable is stationary at initial difference, there is a long-term link between them. Accordingly, the analysis came to the conclusion that Nigeria's exchange rate and monetary policies did not contribute to the country's manufacturing sector's predicted development. The depreciation of the exchange rate and government actions in Nigeria were studied by Oisaozoje and Opusunju (2016). They used time series secondary data spanning from 198 to 2011 in conjunction with an Ordinary Least Squares (OLS) regression analysis approach. First, the Philips-Perron (PP) and Augmented Dickey Fuller (ADF) tests were used to look for unit roots in the data. Next, a co-integration regression was performed to look at the variables' long-term association. The rate of adjustment to equilibrium was also evaluated using the short-run Vector Error Correction (VEC) model. Empirical evidence has demonstrated a noteworthy correlation between government monetary and fiscal policies and the depreciation of exchange rates.

Obialor (2017) investigated the impact of depreciation of the Nigerian Naira. Using sample data from 1986 to 2008, the study employed a structural vector autoregression (SVAR) method to track the impact of monetary policy shocks on production and prices in Nigeria. Three different policy tools were used in the study to perform the experiment: wide money (M₂), the minimum rediscount rate (MRR), and the effective exchange rate at the real level. Depending on the chosen policy variable, the study discovered evidence that devaluation has both nominal and real effects on economic parameters.

A 30-year empirical analysis of the Nigerian manufacturing sector's productivity by Oisaozoje and Opusunju (2016) revealed that the country's manufacturing production performed satisfactorily from 1970 to 1980. However, both GDP growth and profitability have clearly been trending downward

since 1980. The manufacturing sector's performance has also been adversely impacted by the 1983 oil price drop in the global oil market. This specific issue has led to a drop in government income, which has decreased foreign exchange earnings.

King-George (2013) looked at how changes in exchange rates affected the Nigerian manufacturing sector in an effort to determine the impact of currency rates on this sector. From 1986 to 2010, annual time series data were gathered on the manufacturing GDP, which serves as a proxy for economic growth, exchange rate, private foreign investment, and manufacturing employment rate. Using Ordinary Least Square (OLS) methods, multiple linear regressions were used. The study produced some intriguing findings. The findings showed that Nigeria's economic development is not much impacted by the exchange rate. Additionally, the manufacturing employment rate, private foreign investment, and exchange rate can all affect the dependent variable (the manufacturing gross domestic product).

Separating the Nigerian export industries into oil and non-oil sectors, Olufayo and Fagile (2014) looked at how exchange rate volatility affected the performance of these sectors. They used GARCH (generalised autoregressive conditional heteroskedasticity) and the econometrics approach of Seemingly Unrelated Regression (SUR) to test the exchange rate's volatility. They also looked at how the floating exchange rate policy affected the nominal exchange rate's volatility. The study used time series data from 1980 to 2011 and the GARCH model to establish a negative relationship—though one that is statistically not significant—between the volatility of the exchange rate and the export performance of the oil and non-oil sectors. They also found that the regime of floating exchange rates in Nigeria had a significant impact.

Numerous studies have also made an effort to look at the other factors that influence the rise of industrial output and how that production affects Nigeria's economic expansion. Adebisi (2013) looked at how Nigeria's manufacturing sector production was affected by fiscal policy. This study was conducted using an ex-post facto design, which is a type of quantitative research approach. Based on the size and degree of significance of the coefficient and p-value, the study's findings show that government spending has a considerable impact on manufacturing sector production. Additionally, there is a long-term correlation between fiscal regulation and manufacturing sector output. In the age of globalisation, Akinmulegun and Oluwole (2013) evaluated the manufacturing sector's contribution to Nigeria's economic growth. On time series data of pertinent variables of manufacturing output, trade openness, and current account balance, the Ordinary Least Square

(OLS) econometric approach was applied. Although the Nigerian manufacturing sector profited from the process of globalisation, the study concluded that the industry's degree of development was extremely little, indicating that the manufacturing sector of the economy is not much impacted by globalisation in terms of economic growth.

Nigeria's industrial production was examined by Kairo, Mang, Okeke, and Aondo (2017) in relation to bank lending and economic development. Utilising cointegration and vector error correction model (VECM) approaches, time series data spanning a 36-year period (1973-2009) were applied and tested. The study's conclusions demonstrate that bank lending rates and manufacturing capacity utilisation have a major impact on Nigeria's industrial output. However, it was not possible to determine a connection in the nation between industrial production and economic growth. Using a Vector Auto Regressive Model (VAR), Oladeji (2015) assessed the factors influencing the Nigerian manufacturing sector's capacity to profit from the Nigerian oil and gas industry content development bill. The author employed a SWOT analysis and literature review to ascertain the key factors influencing the Nigerian manufacturing sector's potential to benefit from the Local Content Development Bill. The VAR was then utilised to determine the most influential factors. According to the findings, interest rates (IR), capital goods imports (IM), and electricity generation (ELEC) have the greatest influence.

Currency depreciation and increase in industrial production in Nigeria have been the subject of several research (Adekoya & Fagbohun, 2016; Ehinomen & Oladipo, 2017; Abubakar & Bambale, 2017; Opaluwa, Umeh & Abu, 2017; Lawal, 2018). Exchange rate fluctuations have both a long-term and short-term relationship with manufacturing sector output, according to Lawal's (2018) analysis of the impact of these fluctuations on Nigeria's manufacturing sector output over the 28-year period from 1986 to 2014. Lawal did this analysis using the Autoregressive Distribution Lag (ARDL). Ehinomen and Oladipo (2017) investigated the effect of currency depreciation on the expansion of the Nigerian manufacturing sector using the Ordinary Least Square (OLS) multiple regression analysis and discovered that an appreciation in exchange rates encouraged the expansion of the manufacturing sector. Similarly, Adekoya and Fagbohun (2016) investigated how currency depreciation affected the increase of manufacturing production in Nigeria between 1980 and 2014 and discovered a one-way causal relationship between manufacturing output and the private sector, imports, and exchange rates. Consequently, the study came to the conclusion that Nigeria's exchange rate and

monetary policies had not been effective in fostering the country's manufacturing sector's projected growth. As a result of the aforementioned, the majority of recent research on the relationship between currency depreciation and industrial production in Nigeria has focused on export, import, bank credit, and exchange rates as ways to quantify the economy's external sector. In the use of foreign exchange rate as proxy for currency devaluation, all the studies simply examined the effect of average annual fluctuations of exchange rate on manufacturing output as against measuring the depth of the devalued currency by differencing the exchange rate between current period (at time t) from previous period (at time t-1). Consequently, the researcher seeks to investigate whether taking the differenced currency value would improve the outcome from previous studies. Furthermore, the recent studies on this area of interest shows that all to the best of the researcher's knowledge used annual time series which did not cover year 2016 and beyond where the value of the Nigerian naira was largely depreciated and fell against the US dollar and other international currencies like the Euro and British Pounds. Considering the highly volatile nature of the exchange rate within this period (year 2016 and beyond), it is pertinent to focus on year 2016 and beyond in the current investigations for better policy formations and regulations for economic stability. In addition to this, taking the average annual foreign exchange of ₦1 to US\$1 as a proxy for currency devaluation may not suffice in capturing the dynamics and fluctuations in the Nigerian naira in the international market. Hence, the researcher further seeks to employ differenced monthly average exchange rate in other to capture the effect of the devalued naira on domestic firms in the manufacturing industry of Nigeria.

The researcher is unaware of any study that has examined trade openness in addition to inflation and currency fluctuations, despite the knowledge on exchange rate, inflation rate, and manufacturing output growth in Nigeria from all of the prior review studies. Hence, this study seeks to fill this gap by investigating the effects of inflation and exchange rate on manufacturing output growth in Nigeria from 1981 to 2022. This period of about 39years is considered large enough to determine the effect of inflation and exchange rate on manufacturing output in Nigeria.

Research Methods

Sources of Data

Secondary data were used in this investigation. Over a 42-year span, the study used yearly monthly time series data. The precise time frame covered is from 1981 to 2022. Various editions of the Central Bank of Nigeria (CBN) Statistical Bulletin provided the secondary data required for the investigation. The remaining statistics,

with the exception of the average monthly foreign exchange rate (₦1 to US\$1), were obtained from different CBN Statistical Bulletin issues.

Theoretical Framework

This study's theoretical foundation is the Mundell-Fleming theory, sometimes referred to as the "Mundell-Fleming model" or "M-F model." The Mundell-Fleming model analyses the traditional response to currency devaluations, and the outcome is a favourable impact on the current account. Since exports rise faster than imports, depreciation is thus expansionary in terms of GDP. Robert Mundell and Marcus Fleming proposed the Mundell-Fleming model, sometimes referred to as the IS-LM-BoP model, as an expansion of the IS-LM Model. The Mundell-Fleming model depicts a tiny open economy, while the conventional IS-LM model deals with economies operating under autarky. According to Mundell's research, the model may be used in Zurich, Brussels, and other places (Fleming, 1962; Mundell, 1963).

Whereas the closed-economy IS-LM model solely considers the link between the interest rate and output, the Mundell-Fleming model illustrates the short-run relationship between an economy's nominal exchange rate, interest rate, and output. The Mundell-Fleming model provides a solution to the claim that an economy cannot sustain a stable exchange rate, unrestricted capital mobility, higher output growth, and an independent monetary policy at the same time. Various names for this idea include the "impossible trinity," "unholy trinity," "irreconcilable trinity," "inconsistent trinity," or "Mundell-Fleming trilemma" (Fleming, 1962). The following variables are used in the M-F model: GDP is represented by Y, consumption by C, real money demand (actual money demand) by L, nominal money supply (M), price level by P, nominal interest rate by I, physical investment by I, government expenditure (an exogenous variable) by G, taxes by T, and net exports by NX. The following equations form the foundation of the Mundell-Fleming model:

The IS curve: $Y = Y_0 + \alpha(r - r_0)$

[1] The LM curve, $r = r_0 + \beta(L - L_0)$.

[2] Lower GDP levels or higher interest rates cause the money demand to decline. The Balance of Payments, or BoP, Curve is shown as: $KA = CA + NX$

[3] Where KA is the capital account surplus, BoP is the balance of payments surplus, and CA is the current account surplus. The Mundell-Fleming model can be naturally expanded to take into account a wide range of other significant factors that influence how the current account reacts. These factors include: (i) the price elasticity of the world's (or country's) demand for tradable goods, or how exports and imports fluctuate in

response to changes in the real exchange rate; and (ii) the existence of supply shocks caused by the presence of intermediate supplies and raw materials, like oil, which may lead to increases in prices (Saibene & Sicouri, 2012).

Increases in exchange rates or currency depreciation, according to the Mundell–Fleming model, decrease the balance of payment deficit, albeit this may not always be the case. The Marshall-Lerner condition, which states that currency devaluation strengthens exports and reduces imports when the total price elasticity of market demand for the imports of a pair of nations trading the products between them is higher than unity, determines the effectiveness of devaluation (Dwivedi, 2001). Further, Mundell (1963) said that devaluation lowers the BOP deficit when the total, absolute value of the price elasticity of A's demand for imports and B's demand for A's exportables is larger than unity. When a country's total price responsiveness of demand for both imports and exports is less than unity, it also results in a greater imbalance in the balance of payments.

Furthermore, devaluation has no effect on the balance of payments (BOP) when the total elasticity of prices of demand for a nation's exportable goods and its importable goods equals one (Fleming, 1962). This is because the trade balance remains unaltered. According to empirical data, devaluation short-term depresses real output in the real sector and worsens the BOP (Abdullahil, Abdul-Hamid, Chowdhury, & Shahanara, 2013; Asinya, & Nelson, 2014). This is because, in the short aftermath of a devaluation, import prices have a propensity to increase more quickly on the domestic market than export prices, even in the absence of variations in the quantities imported and exported. This results in a J-shaped curve that economists refer to as the devaluation's "J-curve effect." The real, monetary, and external sectors of the economy are represented by equations [1, 2, and 3]. The way the three equations interact demonstrates how monetary and external sector activity may have an impact on the actual output of the economy's manufacturing sector.

Model Specification

In their paper, "Currency devaluation and manufacturing output growth in Nigeria," Adekoya and Fagbohun (2016) combined equations [3] and [4] as follows:

$$\text{OUTPUT} = \beta_0 + \beta_1 \text{EXCH}_t + \beta_2 \text{INF}_t + \beta_3 \text{INTR}_t + \beta_5 \text{NIMPO}_t + \beta_6 \text{NEXPO}_t + \varepsilon_t$$

U = Disturbance term

t = time (yearly trend)

Method of the Study

This study employed ARDL bound testing technique to cointegration and time series analysis utilising

[4] The output of the non-oil manufacturing sector is measured by OUTPUT in equation [4], the market exchange rate between the US dollar and the Nigerian naira, expressed in naira, is measured by exchange rate (EXR), and inflation (INF) is determined by the consumer price index in millions of Naira. Measured in millions of Naira, credit to the private sector (CPS) is the total amount of domestic credit extended to the private sector of the economy. The interest rate on a time deposit maturing in a year is used by commercial banks to calculate interest rates (INT). The total annual export of non-oil manufactured items is measured by export (NEXPO), while the total annual import of semi-finished and completed goods is measured by import (NIMPO). As a result, the variables in equation [4]'s right side correspond to the external market indicators as well as the extent of exchange rate restrictions and devaluation.

We will modify the Adekoya and Fagbohun (2016) model by swapping out a few variables. First, the dependent variable, OUTPUT, was substituted with the growth rate of industrial output. Second, trade openness—which is calculated as the ratio of the total of export and import to GDP—will take the role of export and import (NEXPO and NIMPO, respectively). Third, since interest rates are kept in the model to account for financial institution activity as a control variable, credit to the private sector will be eliminated. In the modified form of equation [4], the new equation is functionally expressed as follow:

$$\text{GRMOU} = f(\text{EXCH}, \text{INF}, \text{INT}, \text{TRAO})$$

[5] Assuming linearity among the variables, the econometric forms of the functional expression are given below thus:

$$\text{GRMOU} = \alpha_0 + \alpha_1 \text{EXCH}_t + \alpha_2 \text{INF}_t + \alpha_3 \text{INTR}_t + \alpha_4 \text{TRAO}_t + \varepsilon_t \quad [6]$$

$$\alpha_0 > 0, \quad \alpha_1 > 0, \quad \alpha_2 > 0, \quad \alpha_3 > 0 \quad \alpha_4 > 0$$

Where:

GRMOU = Growth rate of manufacturing output (%)

EXCH = Exchange rate (percentage difference between exchange rate in current and previous period of time t and time t-1 respectively)

INF = Inflation rate (%)

INTR = Interest rate (%)

TRAO = Trade openness [ratio of the sum of export (X) and import (M) to gross domestic product (GDP) i.e X+M/GDP]

α_0 , = Constant of the model

$\alpha_1 - \alpha_4$ are all coefficients of the estimates

Augmented Dickey Fuller (ADF) unit-root test as econometric methodologies.

Results

The degree of stationarity and integration order of the variables was evaluated using the Augmented Dickey Fuller Unit root test. The Dickey Fuller (AD) test is not as good as the ADF as it does not compensate for the serial relationship in the variable. In the test, the alternative hypothesis of stationarity was pitted against the null hypothesis of non-stationarity of the variables. Therefore, an order of integration test was performed for all variables using Augmented Dickey-Fuller (ADF) prior to the testing of the ARDL bound test. The Unit Root Test may persuade us to employ the ARDL model even if the ARDL framework does not include pre-testing of variables. This is to ensure that the variables are not 1(2) stationary so as to avoid spurious results. The results of the ADF unit root test are presented in Table 4.1.

Table 4.1: Results of Augmented Dickey Fuller (ADF) Unit Root Test

(INTR), and degree of trade openness (TRAO) are all stationary at level 1(0). The calculated ADF is greater

Test statistic	Computed F-statistic	Lag	Significance level	Bound Critical values	
				Lower Bounds	Upper Bounds
				I(0)	I(1)
F-statistic	69.0935	4	5%	2.27	3.28

than the McKinnon 5% critical values.

Lag Length Criteria

Consequently, the next step is to figure out the proper latency. To ascertain the proper lag length of models one, two, and three, lag-length selection criteria such as sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hanna-Quinn information criterion (HQ) were utilised. Table 4.2 presents the test results for the various lag selection techniques.

Table 4.2: Lag Order Selection Criteria (model)

Variable	ADF Calculated Value In Level	ADF Calculated Value At 1st Difference	McKinnon 5% Critical Value	Order Of Integration
GRMO			-2.9390	1(0)
U	-5.9821*	-		
EXCH	-5.0153*	-	-2.9390	1(0)
INF	-2.9508*	-	-2.9390	1(0)
INFR	-3.659*	-	-2.9390	1(0)
TRAO	-2.4131	8.2597*	-2.9411	1(1)

Source: Regression Output using Eviews 12

*Significant at 5 per cent

The results of the unit root test in Table 4.1 demonstrate that the exchange rate depreciation (EXCH), growth rate of manufacturing sector output (GRMOU), inflation rate (INF), interest rate

Lag	LoqL	LR	FPE	AIC	SC	HQ
0	-627.0133	NA	4675856.	35.22296	35.53087	35.33043
1	-404.0634	346.8110	313.1632	25.55908	28.02233	26.41882
2	-349.5868	63.55609	319.7279	25.25482	29.87342	26.86683
3	-259.0366	70.42788	87.83720	22.94648	29.72042	25.31077
4	-7.691181	97.74546*	0.021526*	11.70507*	20.63435*	14.82163*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

After analysing the various lag lengths in Table 4.2 by estimating the VAR at each lag length and determining the whiteness of the resultant residuals, four lag lengths were chosen for the model, per the recommendation of the Akaike Information Criteria (AIC) statistic.

Bounds Test for Co-Integration

Applying the bound F-test to ascertain whether or not there is a long-run connection between the variables came next, after the determination of the variables' order of integration and lag length.

Table 4.3: Summary of ARDL Bound Test Results

Source: Regression Output using Eviews 12 (2022)

Table 4.3 displays the bound test for co-integration summary result for the model along with crucial values. 69.0935 is the computed F-statistic for the model derived from the bound test. These numbers are higher than the model's upper bound critical value of 3.28 at the 5% significance level. This suggests that the null hypothesis of no co-integration is rejected and that the alternative hypothesis of a unique co-integration (long run) relationship between the explanatory variables of exchange rate, inflation rate, other control variables, and manufacturing sector output is permitted.

Long Run Regression Results of Manufacturing Sector Output

Table 4 displays the findings of the ARDL method estimates of the long run coefficients for the model. AIC chose the model number four below.

Table: 4.4. Summary of the Long Run ARDL Regression Results

The values in parenthesis are t-statistic

Note: * is significant at 5% level of significance.

Source: Regression output using Eviews 12

The coefficient of exchange rate depreciation (EXCH) and the growth rate of Nigeria's manufacturing sector have a substantial inverse association, according to the regression result of the model estimation in Table 4.4. The growth rate of Nigeria's manufacturing sector decreases by 0.0032 percent for every percent increase in exchange rate depreciation. This is not in line with what one would anticipate apriori. This finding implies that, in the long run, currency devaluation has not aided in the expansion of Nigeria's manufacturing sector. Additionally, the inverse nature and significance of this variable is that, contrary to Adekoya and Fagbohun (2015) and Lawal (2016), who found that exchange rate appreciation has a positive relationship with the industry's manufacturing output, the use of depreciation as a mechanism to promote the growth of the Nigerian manufacturing sector has not enhanced sector productivity. In order to recover the value of the naira, it is necessary to examine the existing exchange rate policy in favour of appreciation and implement monetary discipline.

The growth of Nigeria's manufacturing sector is directly and significantly correlated with the inflation rate; a one percent increase in INF is accompanied by a 0.061 percent decline in sector growth. This variable's direct and important characteristics go counter to the apriori assumption. The outcome also shows that the expansion of Nigeria's manufacturing sector is directly and significantly impacted by interest rates (INTR). The growth of Nigeria's manufacturing sector increases by approximately 0.0536 percent for every one percent increase in INTR. This is not in line with what one would anticipate apriori. The importance of this finding lends credence to the idea that a properly controlled interest rate might eventually encourage the expansion of the manufacturing sector. This is consistent with research by Nwabuisi, Oke-Bello, Oyewole, Toriola, Folami, and Afolabi (2020), which found a statistically significant relationship between interest rates and the expansion of Nigeria's manufacturing sector.

The transparency of commerce According to model two's assessment, TRAO has a large but negative impact on the expansion of Nigeria's manufacturing sector. Specifically, a one percent rise in TRAO causes

a 0.0082 percent drop in the sector's growth. This doesn't match what was anticipated apriori. Table 4.4 below displays the outcome of the error correction representation of the chosen lag model according to the selection criteria.

Short Run Parsimonious Estimation of Manufacturing Sector Output

Table 4.5 presents a dynamic parsimonious error correction estimate to account for any short run

Independent Variable	Dependent Variable GRMOU
Constant	1.6740* (19.3933)
EXCH	-0.0032* (-8.0980)
INF	0.0061* (4.0071)
INTR	0.0536* (9.3135)
TRAO	-0.0082 (-4.8864)

variations in the long run co-integration equation estimation.

Table 4.5: Summary of Short Run Parsimonious Estimations

Independent Variable	Dependent Variable D(GRMOU)
D(GRMOU(-1))	-1.2105* (-32.9056)
D(GRMOU(-2))	-0.4759* (-16.3761)
D(GRMOU(-3))	-0.65039* (-23.5657)
D(EXCH)	-0.0120* (-41.4004)
D(EXCH(-1))	0.0003 (-1.9626)
D(EXCH(-2))	0.0018* (11.2108)
D(EXCH(-3))	-0.003*1 (-17.7589)
D(INF)	0.0047* (16.9770)
D(INF(-1))	-0.0029* (-10.5231)
D(INF(-2))	-0.0009* (-2.9394)
D(INF(-3))	-0.0007* (-2.9771)
D(INTR)	0.0100* (9.5449)
D(INTR(-1))	-0.0786* (-39.3302)
D(INTR(-2))	-0.0829* (-32.0162)
D(INTR(-3))	-0.0397* (-29.5163)
D(TRAO)	-0.0029* (-10.5231)
D(TRAO(-1))	0.0038* (6.1692)
D(TRAO(-2))	0.0193* (37.1367)
D(TRAO(-3))	-

ECM(-1)	-0.6909* (-42.9243)
R ²	0.7993
R ⁻²	0.7702
D.W Statistic	2.2397

The values in parenthesis are t-statistic

Note: * is significant at 5% level of significance.

Source: Regression Output using Eviews 12

The manufacturing sector's past growth rate at lags one, two, and three had an inverse and substantial influence on the sector's growth, in accordance with Table 4.5's ECM calculation. Based on the factors that plague the industry and impair its performance, this research suggests that the sector's growth rate over time has not been promising. The current year's model coefficients of the difference in naira exchange, or D(EXCH), have a substantial and inverse effect on the pace of growth of the Nigerian manufacturing sector. This is not in line with what one would anticipate a priori. This suggested that the short-term growth rate of the manufacturing sector has not been influenced by the naira exchange. However, there is a clear and substantial correlation between the two-year and one-year lags in the naira exchange rate, D(EXCH(-1)) and D(EXCH(-2)), and the growth rate of Nigeria's manufacturing sector. This demonstrates that sustained exchange rate depreciation increased the manufacturing sector's growth rate in the short term, but only at a three-month lag in the naira currency exchange rate D(EXCH(-3)). In other words, short-term currency depreciation has a substantial but opposite effect on the manufacturing sector's growth rate.

Moreover, the model's estimation findings demonstrate that, in the near term, the difference in the present inflation rate D(INF) has a direct and substantial effect on the growth rate of Nigeria's manufacturing sector. This suggests that the rate of expansion of Nigeria's manufacturing sector is stimulated by increases in the prices of goods and services. On the other hand, the growth rate of Nigeria's manufacturing sector is significantly and inversely affected at lags one, two, and three of the disparity in the rate of inflation, or D(INF(-1)), D(INF(-2)), and D(INF(-3)). This aligns with the a priori prediction. Contrary to the a priori expectation, the short-term expansion rate of the manufacturing sector is significantly and directly affected by the difference in interest rates, or D(INTR). This suggests that, in the short term, a well-managed rate of interest accelerates the growth rate of Nigeria's manufacturing industry.

The findings shown that the short-term growth rate of the manufacturing sector is directly and significantly impacted by the difference in the present trade openness D(TRAO), as well as at lag one D(TRAO(-1)), lag two D(TRAO(-2)), and lag three D(TRAO(-3)).

This suggests that in the short term, the export of products and services may accelerate the growth rate of Nigeria's manufacturing sector. This finding indicated that the nation's manufacturing sector grows at a faster pace when finished goods and services are continuously exported.

At the 5% level, the model's coefficient of ECM(-1) is determined to be statistically significant. This demonstrates that the variables have a long-term connection. -0.6909 is the coefficient of the ECM term. This suggests that in the current year, approximately 69% of the imbalances in the manufacturing sector's growth rate from the previous year have been corrected. The relevance of the ECM is a validation of the presence of a long term link between the development rate of Nigeria manufacturing sector and the explanatory factors.

The coefficient of determinations R² of estimation of model is 0.7993 which indicates that about 79.9 per cent of the total variations in the growth rate of Nigeria manufacturing sector are explained by the variations in the explanatory variables. Finally, The Durbin Watson statistic value is 2.2397. This test value shows the absence of positive serial autocorrelation among the independent variables since the DW statistics is approximately equal to 2.

The result from the models showed that currency development (EXCH) and trade openness had inverse impact on growth rate of manufacturing output. By implication, the outcome of this study shows that exchange rate changes in the form of devaluation of the Nigerian naira against foreign currencies like the US dollar and trade openness has adverse effect on industries in the manufacturing sector. This could be due to the fact many manufacturing firms depend largely on the external sources to obtain their intermediate and semi-finished products for processing and reprocessing. Hence, border openness, poor import restrictions, low import duties and other favourable imports regulations could adversely affect industries. It could also bring about a downward shift in the demand for "made in Nigerian goods" simply because many infant manufacturing firms may be unable to stay competitive with the quality of goods and services imported into the Nigerian consumer market.

Inflation and interest rate also had inverse relationship with manufacturing performance. This result implies that increase in inflation and interest rate will bring about decrease in manufacturing output growth. This invariably shows that any monetary or credit policy that will bring about increase in the cost of borrowing (interest rate) could reduce investment demand in the manufacturing sector and thereby affect manufacturing performance. Hence, specialized banks such as bank of industries (BOI) need to be mindful of their interest

rate targeting and its implications on investment demand in the manufacturing sector.

Conclusion and Recommendations

The importance of the manufacturing sector in the real sector of the Nigerian economy cannot be overemphasized. Based on findings it is concluded that naira devaluation, inflation rate and trade openness adversely affect manufacturing performance while credit to private sector and supply of foreign currency promotes manufacturing performance. To this end, the following recommendations are made:

- 1) Monetary authorities should endeavour to maintain a relatively stability exchange rate and avoid currency devaluation in other to increase manufacturing output in Nigeria.
- 2) Deposit money banks and specialized banks such as Bank of Industries (BOIs) should review their loan policy by giving preference to would-be investors who seek for low interest loans to establish and develop their manufacturing firms. By increasing credit disbursed to the private sector and reducing the cost of borrowing, it is expected that investment demand in the manufacturing sector will rise and so also with manufacturing sector performance.
- 3) Import restrictions should be instituted in other to avoid naira fall against other hard currencies like United State dollar and British pounds. This is to avoid excessive trade openness and dumping activities that could adversely affect manufacturing sector.

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