IMPACT OF EXCHANGE RATE VOLATILITY ON MANUFACTURING SECTOR DEVELOPMENT IN NIGERIA

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ABSTRACT

Exchange rate volatility has a substantial impact on the development of Nigeria's manufacturing sector. As a result, various research has been done to investigate this subject, with a variety of conclusions. Hence, this study examines the impact of exchange rate volatility on manufacturing sector development in Nigeria, collecting data that span from 1999 to 2023. Statistical analysis using Multiple Regression Method was employed, and from the result, exchange rate has positive but insignificant impact on manufacturing output. Access to electricity in a similar vein, has positive but insignificant impact on manufacturing output. Conversely, inflation and total reserves have negative impact on manufacturing output. This reveals that exchange rate helps to stimulate the growth of the manufacturing sector, despite the volatility of the rate. As a result of these findings, the study recommends that government should formulate policy such as fixing the rate of exchange, as this will stabilize the rate of exchange so as to help manufacturing sector's growth because the sector rely on importation of raw materials for production.

Keywords: Manufacturing sector development, Exchange rate volatility, Economic growth, Nigeria.

JEL Classification Codes: F31, L6, O14.

1. INTRODUCTION

In the context of today's global economy, fluctuations in exchange rates are a vital factor affecting economic activities worldwide. This is particularly pertinent for developing countries such as Nigeria, where the manufacturing sector serves as a cornerstone for driving economic

growth and job creation. According to Mahmoud and Ali (2011), a fluctuating exchange rate structure might have serious consequences for the macroeconomic outcome by encouraging uncertainty and high risk in potential investment opportunities. Consequently, it is essential to understand the impacts of exchange rate volatility. Recognized as a catalyst for industrialization and diversification away from oil revenues, the Nigerian manufacturing sector operates within an economic landscape characterized by fluctuating exchange rates, influenced by a mix of domestic and external factors.

Exchange rate volatility indicates the extent to which a currency's value changes compared to another currency within a specific timeframe. When a significant number of short-term variations are recorded over time, the rate is said to be volatile (Ugochukwu, 2015). In Nigeria, the Naira's volatility against major global currencies like the US dollar, Euro, and British Pound has been consistently observed. Several factors affect this volatility, such as capital flows, global commodity prices, fiscal policies, and rates of inflation in the country. These fluctuations significantly affect the manufacturing sector, impacting aspects such as production, trade, investment choices, and overall economic performance.

Germany serves as a compelling illustration of how exchange rate dynamics profoundly influence manufacturing sector growth, especially in vital industries like automotive and machinery. Changes in the value of the euro have strengthened the nation's manufacturing capabilities and increased its export competitiveness internationally. During periods of euro depreciation, German exports gain greater appeal, leading to heightened demand for German-manufactured goods. For instance, in 2020, Germany's exports surged to €1.34 trillion, with machinery, motor vehicles, and chemicals emerging as the top export categories, as reported by the Federal Statistical Office of Germany (2020).

Similarly, South Africa underscores the impact of exchange rate volatility on manufacturing sector advancement within the African landscape. Despite grappling with challenges linked to currency fluctuations, South Africa has made significant strides in its manufacturing domain. Foreign Direct Investment (FDI) assumes a pivotal role in this progress, drawn by the fluctuating exchange rates that fortify production and export competitiveness. Noteworthy is South Africa's success in attracting substantial FDI investments, notably in sectors like automotive and mining. UNCTAD (United Nations Conference on Trade and Development) (2019) reports that FDI inflows to South Africa reached a total of $4.6 billion in 2019, making a noteworthy contribution to the manufacturing sector's expansion.

According to Abolo (2017), poor and deteriorating infrastructural services is one of the challenges of the manufacturing sector. The manufacturing industry in Nigeria grapples with

several hurdles, including inadequate infrastructure, policy inconsistencies, regulatory barriers, and restricted access to funding. Amidst these challenges, exchange rate fluctuations pose an additional layer of complexity for manufacturing firms. Alterations in exchange rates can affect expenses related to imported materials, disrupt supply chains, alter competitiveness against foreign competitors, and introduce uncertainty into future cash flows, investment plans, and profitability.

Despite acknowledging the significance of exchange rate volatility, research on its specific impact on the Nigerian manufacturing sector remains sparse and fragmented. Existing studies often focus on broader macroeconomic indicators or rely on anecdotal evidence, leaving gaps in understanding the nuanced relationships between exchange rate dynamics and manufacturing performance. This lack of comprehensive analysis hampers policymakers and industry stakeholders from making informed decisions to address the adverse effects of exchange rate fluctuations on the manufacturing sector. Thus, there is a pressing need for more robust empirical research to delve into the specific mechanisms through which exchange rate volatility affects manufacturing activities in Nigeria. Bridging this knowledge gap can offer valuable insights for developing effective strategies to increase the manufacturing sector's resilience and competitiveness in Nigeria against variations in exchange rates.

This study aims to enrich academic literature and inform policy discussions by providing empirical evidence and practical insights into the complex interplay between exchange rate dynamics and the Nigerian manufacturing sector. By gaining a deeper understanding of these dynamics, stakeholders can more effectively address the challenges presented by exchange rate volatility and promote sustainable industrial growth and economic development in Nigeria.

2. LITERATURE REVIEW

2.1. Theoretical Framework

The International Fisher Effect Theory

The International Fisher Effect (IFE) is a theory pioneered by American economist Irving Fisher. It posits that the disparity between the nominal interest rates of two nations corresponds directly to fluctuations in their currency exchange rates at any given moment. This theory relies on both present and anticipated nominal interest rates and serves as a tool for forecasting currency movements, distinguishing itself from approaches that solely rely on inflation for such predictions. The conceptualization of IFE theory is rooted in the belief that interest rates operate independently of other monetary factors and offer significant insights into a country's currency

performance. Fisher argued that inflation changes do not affect real interest rates, as the latter is essentially the nominal rate adjusted for inflation.

According to the theory, nations with lower interest rates also have lower rates of inflation, which increases the real value of their currencies in comparison to other nations. On the other hand, higher interest rates result in more inflation, which lowers the value of the nation's currency. The Nigerian manufacturing sector and exchange rate volatility are affected by the IFE theory. Exchange rate volatility refers to currency value fluctuations, affecting various sectors like manufacturing. In Nigeria, manufacturing is crucial, and exchange rate volatility has mixed effects. Based on the theory, differences in nominal interest rates between Nigeria and its trading partners influence exchange rates. Higher Nigerian rates suggest higher inflation, possibly causing currency depreciation, while lower rates relative to partners could lead to currency appreciation.

2.2. Empirical Literature

Handoyo *et al.* (2023) examined how fluctuations in exchange rates affected the manufacturing commodity exports from the ASEAN-5 countries (Indonesia, Singapore, Thailand, Malaysia, and the Philippines). The research employed the ARCH/GARCH, ARDL, and Nonlinear ARDL techniques to determine the short- and long-term symmetrical and asymmetrical effects of exchange rate fluctuation on industrial exports. The top five commodities exported by each of the ASEAN-5 countries were looked at using data from January 2007 to March 2019. According to the ARDL analysis, volatility has a significant short-term impact on 13 commodity exports. However, according to the Nonlinear ARDL result, 19 commodity exports were impacted by volatility. Furthermore, the nonlinear model demonstrates how volatility affects nearly all commodity exports unevenly over a long period of time. Because of this, authorities must maintain the currency rate's stability by using sufficient foreign reserves and increasing investment levels.

Chiagoziem *et al.* (2021) conducted a similar study on the effect of exchange rate movement and volatility on the performance of Nigerian manufacturing enterprises between 1985 and 2019. The study used the ordinary least square log - log model and the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model to capture the research aims. The findings reveal that appreciation of the Nigerian domestic currency has a large beneficial influence on Nigerian manufacturing performance, whereas exchange rate volatility has a significant negative impact.

Using ARDL and the ARCH/GARCH model specifically, Onwuka (2021) performed an econometric analysis of the effects of exchange rate volatility on the manufacturing sector's performance in Nigeria between 1981 and 2020. The significant positive coefficients of the

ARCH/GARCH model at the 1% level suggest that there is a high degree of exchange rate volatility. According to the research, the manufacturing sector's long-term performance is negatively impacted by interest rates, inflation, and currency rate volatility; however, imports and gross capital formation have a positive impact.

Iwedi (2021) examined the impact of foreign exchange crises on the manufacturing sector performance in Nigeria between 1985 and 2019. It measured the performance of the manufacturing sector using GDP, and it used measures including trade openness, foreign direct investment, and the exchange rate between the United States and Nigeria to proxy foreign exchange crises. The OLS regression technique was employed and the results indicate that foreign exchange rates negatively and significantly affect Nigeria's manufacturing sector GDP, while trade openness and foreign direct investment positively and significantly influence manufacturing sector performance.

From 1981 to 2018, Onwuka *et al.* (2020) studied how exchange rate volatility affected Nigeria's manufacturing industry. The annual time series data were analysed using the vector autoregressive (VAR) model. To determine the frequency of exchange rate volatility persistency and to extract exchange rate volatility series, the GARCH (1, 1) model was employed. The GARCH (1, 1) estimates that were obtained demonstrated that the exchange rate is consistently volatile. The empirical findings derived from the VAR estimation demonstrate that the overall manufacturing output in Nigeria is significantly but negatively impacted by exchange rate volatility.

Ojeyinka (2019) examined how Nigeria's manufacturing industry performed from 1981 to 2016 in relation to changes in exchange rates. Based on the results of the unit root test, an ARDL estimate method was applied. The Bounds Test for Cointegration results showed that there is a long-term link between the variables. Additionally, studies show that the exchange rate has a negative and significant short-term impact on manufacturing sector output, but a positive but negligible long-term impact. The performance of the manufacturing sector is also adversely and significantly impacted by imports.

Adebanjo *et al.* (2019) assessed the impact of exchange rate on the manufacturing sector in Nigeria over a 25-year period (1990-2014) Granger causality, and Error Correction Model were employed to analyze the impact. Findings indicated that Naira devaluation negatively impacts the manufacturing sector, with exchange rates showing a negative, significant, and causal relationship. Inflation rates and capacity utilization positively influence sector performance, while exchange rates, imports, and manufacturing FDI have negative but significant effects.

Orji *et al.* (2018) looked into how changes in exchange rates affected Nigeria's manufacturing sector between 1981 and 2016. This was accomplished by using the OLS estimator. The results showed that EXCH changes have a major effect on how well Nigeria's manufacturing sector performs. In particular, the findings showed that while credit to the private sector showed a negative correlation, EXCH, government capital expenditure (GCEXP), imports, and FDI all showed positive relationships with Manufacturing GDP.

Lawal and Omotola (2016) investigated the impact of exchange rate fluctuations on the growth of Nigeria's manufacturing sector between 1986 and 2014 using ARDL. The findings demonstrated that exchange rate volatility and manufacturing sector output are correlated both in the short and long run. Although there was a positive correlation, it was not statistically significant. However, empirical research showed that the output of the manufacturing sector and the exchange rate were positively correlated.

Enekwe *et al.* (2013) studied the effect of exchange rate fluctuations on manufacturing Sector in Nigeria from 1985 to 2010. Descriptive statistics and multiple regressions were applied to investigate the effects and the results indicated that manufacturing foreign private investment (MFPI) and exchange rate (ER) significantly and positively influence manufacturing gross domestic product (MGDP), with an R-squared value of 80%. David *et al.* (2010) examined the effect of exchange rate fluctuations on the Nigerian manufacturing sector from 1986 to 2005. Regression analysis was employed as the econometric tool for this examination. The regression analysis revealed that the coefficients of these variables displayed both positive and negative signs. The study unveiled significant adverse effects on the manufacturing sector, as indicated by the statistical significance of the findings.

3. DATA AND METHOD

3.1. Model Specification

This study investigates the impact of exchange rate on manufacturing sector in Nigeria from 1999 to 2023. The multiple regression method, which is more suitable to ceteris paribus since it allows for explicit control of numerous additional factors that influence the dependent variable at the same time, was utilised in this investigation. The study adapts Lawal and Omotola's (2016) model, which is stated as follows:

$$MAN = f(CPI, GCE, EXC) \qquad (1)$$

Where, MAN is manufacturing output; CPI = consumer price index; GCE = government capital expenditure; EXC = real effective exchange rate.

The variables such as exchange rate, import, inflation, total reserves, and access to electricity are introduced as the explanatory variables while manufacturing output is the dependent variable. The model for this study is thus specified in its functional and econometrical forms as in equations 2 and 3 respectively;

$$MANO = f(EXR, IMP, INF, TOR, ACE) \tag{2}$$

$$MANO_t = \beta_0 + \beta_1 EXR_t + \beta_2 IMP_t + \beta_3 INF_t + \beta_4 TOR_t + \beta_5 ACE_t + \varepsilon_t \tag{3}$$

Where, MANO is manufacturing output; EXR = exchange rate; IMP = import; INF = inflation; TOR = total reserves; ACE = access to electricity.

3.2. Estimation Procedures

After the unit root test, which employs the Augmented Dickey-Fuller test to confirm stationarity, comes the cointegration test. The cointegration test, or long-run test, is conducted using the Johansen cointegration test. Once the long-term relationship has been established, the multiple regression approach is applied. The validity and reliability of the study's model are then demonstrated by diagnostic tests such the heteroscedasticity and normality tests.

3.3. Nature and Sources of Data

This study gathers data from the National Bureau of Statistics and the Central Bank of Nigeria Statistical Bulletin based on annual time series.

4. DATA ANALYSIS AND INTERPRETATION OF RESULTS

This section contains the results of the tests conducted to determine the study's objectives, as well as an interpretation of the results for clarity.

Stationarity Test

Table 1: Summary of the Augmented Dickey Fuller Unit Root Test

Variables	ADF Stats	Critical Value @5%	Order of Integration	Remarks
MANO	-3.4254	-2.9981	I(1)	Stationary
EXR	-3.0756	-2.9981	I(1)	Stationary
IMP	-4.1100	-3.0049	I(1)	Stationary
INF	-5.0006	-3.0049	I(1)	Stationary
TOR	-3.3904	-2.9981	I(1)	Stationary
ACE	-4.8303	-3.0124	I(1)	Stationary

Source: E-views 10 Output.

The ADF test revealed that all the variables (MANO, EXR, IMP, INF, TOR, ACE) are stationary at first difference. It is therefore concluded that the variables are stationary.

Cointegration Test

Table 2: Summary of Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.910468	150.0049	95.75366	0.0000
At most 1 *	0.857383	94.50218	69.81889	0.0002
At most 2 *	0.665143	49.70754	47.85613	0.0331
At most 3	0.472847	24.54438	29.79707	0.1784
At most 4	0.312934	9.818276	15.49471	0.2950
At most 5	0.050250	1.185804	3.841466	0.2762

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.910468	55.50270	40.07757	0.0005
At most 1 *	0.857383	44.79464	33.87687	0.0017
At most 2	0.665143	25.16316	27.58434	0.0989
At most 3	0.472847	14.72610	21.13162	0.3086
At most 4	0.312934	8.632472	14.26460	0.3180
At most 5	0.050250	1.185804	3.841466	0.2762

Source: E-views 10 Output.

From this result in Table 2, while the trace statistic has three cointegrating equations, the max-eigen statistic has two cointegrating equations. This suggests long run relationship among the variables.

Parameters Estimation Test Result

Table 3: Summary of Multiple Regression Model

Dependent Variable: MANO

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.532157	0.759870	2.016342	0.0581
EXR	0.272393	0.135512	2.010108	0.0588
IMP	0.202916	0.096202	2.109272	0.0484
INF	-0.199660	0.095307	-2.094912	0.0498
TOR	-0.144618	0.073968	-1.955148	0.0654
ACE	0.691093	0.555612	1.243840	0.2287

R-squared	0.869729	Mean dependent var	3.654671
Adjusted R-squared	0.835448	S.D. dependent var	0.146875
S.E. of regression	0.059580	Akaike info criterion	-2.597433
Sum squared resid	0.067446	Schwarz criterion	-2.304903
Log likelihood	38.46791	Hannan-Quinn criter.	-2.516297
F-statistic	25.37006	Durbin-Watson stat	1.903545
Prob(F-statistic)	0.000000		

Source: E-views 10 Output.

This result shows that exchange rate has positive but insignificant impact on manufacturing output. The coefficient value shows that 1 percent increase in exchange rate will increase manufacturing output by 0.27%. In the case of Nigeria, this does not conform to a priori expectation because Nigeria is an import dependent nation, and owing to the fact the rate of exchange is high and volatile, and that larger proportion of raw materials are imported. The impact of import on manufacturing output is also positive and statistically significant. This suggests that 1 percent increase in import will increase manufacturing output by 0.20%. Importing raw materials for production will stimulate manufacturing output because Nigeria cannot produce all the raw materials needed to make production.

Access to electricity in a similar vein, has positive but insignificant impact on manufacturing output. The coefficient value is 0.691 which indicates that on average 1 percent increase in access to electricity will increase manufacturing output by 0.69%. This conforms to the a priori expectation because increased access to electricity determines the growth and development of the manufacturing sector. This is because production in the sector needs energy.

Conversely, inflation and total reserves have negative coefficients with manufacturing output and it implies that 1 percent increase in inflation and total reserves on average will decrease manufacturing output by 0.199% and 0.144% respectively. The negative impact means that inflation would cause prices of raw materials to increase, thereby, forcing the producers to cut down production. Similarly, because prices of finished goods increased, people could not but the quantity of goods they usually buy. This also will cause the producers to cut down production since the demand for goods has declined. The negative implication of total reserves indicates that manufacturers cannot access foreign currency directly from the apex bank. This in turn has negative implication on their output because most of them need to access foreign currencies from the black market. On the significance level, while inflation is statistically significant, total reserves is statistically insignificant.

The R^2 of 0.869 indicates that exchange rate, import, inflation, total reserves, and access to electricity in Nigeria account for 87% of fluctuations in manufacturing output. Furthermore, the F-statistic which is 25.370 shows that the variables are jointly statistically significant at 5 percent. The Durbin-Watson test shows a value of 1.90, meaning that the residuals are not correlated.

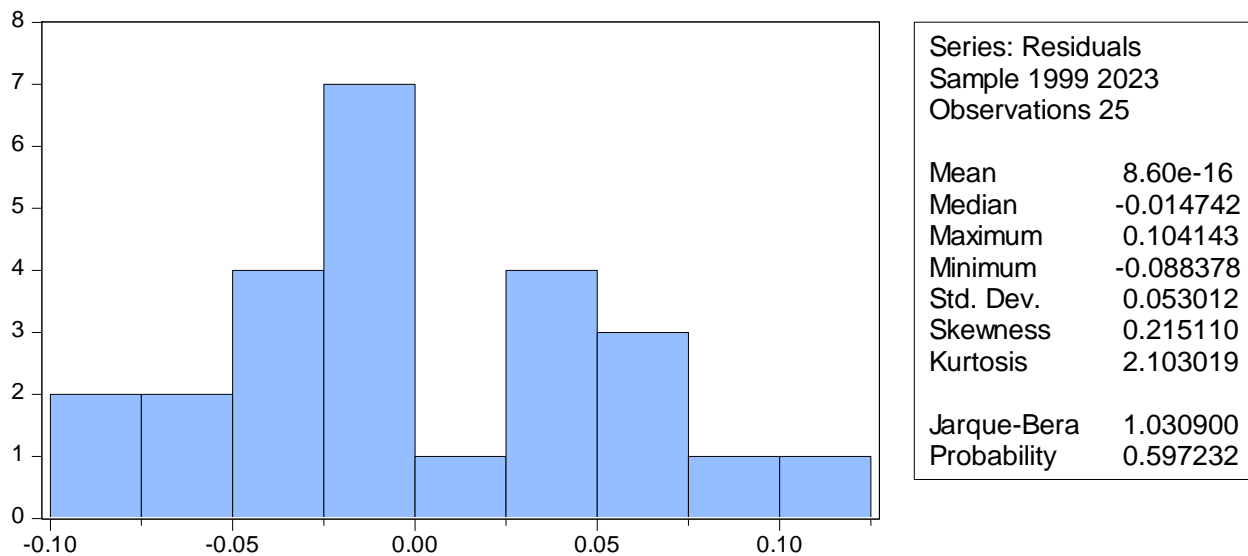**Post Estimation Diagnostic Tests**

Normality Test

Figure 1: Histogram Normality Test

Source: Eviews 10 Output.

According to Figure 1, Jarque-Bera has a probability value of 0.5972, which is higher than 0.05. As a result, the research concludes that the model is normally distributed.

Heteroscedasticity Test

Table 4: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.401681	Prob. F(5,19)	0.2683
Obs*R-squared	6.736673	Prob. Chi-Square(5)	0.2410
Scaled explained SS	2.145980	Prob. Chi-Square(5)	0.8286

Source: Eviews 10 Output.

After testing the model for mean and constant variance, the probability value of the F-statistic is 0.2683. This exceeds five percent. Therefore, the study indicates that the model does not exhibit heteroscedasticity based on the decision rule.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study's main aim is to use time series data from 1986 to 2022 to investigate how exchange rate volatility affects the development of Nigeria's manufacturing sector. The study employed multiple regression modelling, and the findings indicated a positive relationship between manufacturing output and imports, exchange rates, and access to electricity, while inflation and total reserves have negative impact. While import and inflation are statistically significant, exchange rate, total reserves and access to electricity are insignificant. The exchange rate is considered one of the most important major macroeconomic indicators when it comes to decisions about general economic policy and reform programmes. It plays a critical role in predicting the rate of growth of an economy and industry in a country since no country can live in isolation without involving in international trade. The result therefore concludes that exchange rate helps to stimulate the growth of the manufacturing sector, despite the volatility of the rate.

Policy Recommendations

As a result of the findings of this study, it is recommended that;

i. Government should formulate policy such as fixing the rate of exchange, as this will stabilize the rate of exchange so as to help manufacturing sector's growth because the sector rely on importation of raw materials for production.

ii. Government should formulate policies to tame inflation so that production as well as consumption can be increased. This can be achieved by focusing more on production economy.

iii. Government should ensure that the manufacturers have access to foreign currency directly from the apex bank.

Since access to electricity determines the growth of the manufacturing sector, government should generate more watts, make the energy affordable for optimization, and ensure stable supply of electricity.

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