Exchange Rate and the Performance of Manufacturing Firms in Nigeria

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Abstract
Propelled by the current disturbing depreciation of the Nigerian domestic currency, this research examined the effect of exchange rate movement and exchange rate volatility on the performance of manufacturing firms in Nigeria from 1985 to 2019. Data on exchange rate, Nigerian manufacturing output, bank loans and advances and interest rate were sourced from the central bank of Nigerian statistical bulletin for the study while Augmented Dickey Fuller (ADF) unit root test was used to ascertain the stationarity and order of integration of the variables. It utilizes ordinary least square log - log model, and Generalized Autoregressive Conditional Heteroscedastic (GARCH) model to capture the research objectives. The results show that appreciation of Nigerian domestic currency has significant positive effect on Nigerian manufacturing performance while exchange rate volatility has significant negative effect on Nigerian manufacturing output. It was recommended among other things that Nigeria, through the monetary authority, should embark on monetary policies that will make exchange rate less volatile so as to reduce its negative effect on manufacturing output in Nigeria. Nigerian government should also encourage manufacturing activities especially the manufacturing of export, so as to encourage appreciation of value of Naira against foreign currencies especially the US dollar.
Keywords: Exchange Rate, Manufacturing, Volatility, Stationarity

Introduction
Exchange rate is a prominent determinant of Nigerian manufacturing activities and world trade, receiving much attention in the context of national and global imbalances. It is obvious fact that the Nigerian manufacturing sector highly import dependent for input factors and as such, must be mindful of the exchange rate system that governs import and export activities. The subject of exchange rate movement and volatility came to be burning issues in Nigeria because of the interest of every economy to have a stable rate of exchange with its trading partners. Exchange rate is the price of one currency in terms of another currency (Fagbemi, 2006) and it is exceptional price which government is interested in. Choosing the right exchange rate or maintaining relative stability in exchange rate is essential for both internal and external balances and economic growth in the long run. Insufficient management of the exchange rate causes distortions in the patterns of consumption and manufacturing (Mordi, 2006). Similarly, excessive fluctuation in exchange rate creates uncertainty and risks for manufacturing agents with destabilizing effect on the macro-economy. Private sector operators in manufacturing activities are concerned with exchange rate fluctuation and the volatility because of its impacts on their portfolios which may result in capital losses (Mordi, 2006).

There are some factors affecting optimal response of manufacturing industry investment policy to exchange rate changes. It includes the reliance on imported inputs and the share of foreign sales in total sales. If a manufacturing firm is more dependent on imported inputs, there will be more variable costs and less marginal value of capital. So a depreciation of exchange rate causes a reduction in the level of industrial investment. By contrast, there will be increase in price competitiveness of a firm following an exchange rate appreciation. This likely leads to an increase in the expected value of capital and its level of investment. Those sectors, in which output price is determined in the world markets, are likely to be more sensitive to exchange rate movement. The manufacturing firms that rely on export and imported input, the effect of currency valuation changes could be either positive or negative.

The erratic fluctuations in exchange rates, also referred to as exchange rate volatility, could be described as periods of sharp domestic currency appreciation or depreciation. The exchange rate is therefore an important relative prices as it has influence on the external competitiveness of domestic manufactured goods, especially in countries like Nigeria that is import dependent for manufacturing input. The subject of exchange rate fluctuation became a tropical issue in the Structural Adjustment Programme (SAP) in Nigeria, as a result of fluctuations of naira exchange rate in 1986. This is because it is the goal of other economies of the world to have stable exchange rate in Nigeria. This goal was not realized despite the currency devaluation embarked on in Nigeria to promote export and stabilize exchange rate (King, 2019). The failure to realize this goal subjected the Nigerian manufacturing sector to the challenge of a constantly fluctuating exchange rate. This was not necessitated by the devaluation of the Naira but by the weak and narrow productive base of the manufacturing sector and the rising import bills. In order to stem this development and ensure a stable exchange rate, the Nigerian monetary authority put in place a number of exchange rate policies aimed at stabilizing the economy.

This study is justified by notable volatility of exchange rate and depreciation of domestic currency in Nigeria which has perceived high negative effect on Nigerian manufacturing activities. For instance, Nigeria experienced upsurge in demand for dollar especially in the first quarter of 2017, where the exchange rate rose from about N330 per dollar on February 2017 to about N520 per dollar in March 2017. As a result of this the government, through CBN intervened about 6 times in the exchange rate market within a short period by pumping in dollars into the banking system as follows; Tuesday February 21, $417 Million, Thursday February 23, $231 Million, Monday February 27, $180 Million, Friday March 31, $350 Million, Monday March 6, $367 Million Tuesday March 7, $100 Million all in 2017. As at this period, the Acting Director, Corporate Communications Department of CBN stated that the intervention by the CBN was to fund the commercial banks with enough foreign exchange to carter for the request of customers especially manufacturers to meet their business demand and insure continuous appreciation of the Naira. Most of the manufacturing firms in Nigeria such as Innoson in Enugu had earlier lamented that they were producing at a lower capacity as low as 50% due to inadequate exchange rate to purchase their input as well as high exchange rate depreciation in the recent times which negatively affects business and manufacturing expectation (Babajide, 2017).

However, in spite of these different methods of determining exchange rate, a realistic exchange rate has not been found for naira because the existing exchange rate system had continued to widen the gap between the official and the parallel markets and failed to prevent disequilibrium in the foreign exchange market. It has also failed to ensure stability of the exchange rate and maintain a favourable external reserve positions and consequently ensure external balances. In addition, the various exchange rate systems in use in Nigeria had also failed to eliminate or reduce the incidence of capital flight and the power to correct the sky rocketing Naira exchange rate has been missing.

The manufacturing sector plays a catalytic role in a modern economy and has many dynamic benefits that are crucial for economic transformation. In an advanced country, the manufacturing sector is a leading sector in many respects. It is a quest for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment, promoting the growth of investments at a faster rate than any other sector of the economy, as well as wider and more efficient linkage among different sectors (Fakiyesi, 2013). However the Nigerian economy is under-industrialized and its capacity utilization is also low. This is in spite of the fact that manufacturing is the fastest growing sector since 1973/74 (Obadan, 2012). The sector has become increasingly dependent on the external sector for import of non-labour input which is highly determined by exchange rate conditions. (Okigbo, 2010).

The effect of exchange rate on manufacturing output is still an issue for research and debate and had not receives adequate attention. This paper seeks to contribute to the debate and attention to the issue. Hence the broad

objective of this study is to investigate the effect of exchange rate and exchange rate volatility on the Nigeria manufacturing output.

Literature Review

For several years, the Nigerian manufacturing sector has concentrated basically on the import of raw materials. This seems to be attributed to the overcrowding of the important sector of the Nigerian economy by multinational corporations. As a result, this sector has been devised by high interest rates, rising inflation, naira depreciation, foreign shortages and consumers strong resistance to local productions. Akinlo, & Lawan, (2015) expressed that the naira exchange rate given its macro-economic impact specially in Nigeria is perhaps one of the most widely discussed topic today. The effect of exchange rate changes on the Nigeria manufacturing sector has long been a major concern for producers and even policy makers. According to Eme, (2011), the exchange rate should be left to the vagaries of the market forces of demand and supply. He further emphasized that in practice, no Government will really hands off completely the determination of the exchange rate at some levels, which is often different from the competitive market rate.

This policy which is often different from domestic political pressure led to persistent excess demand for relatively cheap import. Hence, Fakiyesi, (2013) argued that exchange rate devaluation by an economy conceptually relates both substitution effect and income effect. Devaluation of the domestic currency deduces the international price of domestic goods, this induces increased demand by foreigners for the product of the country (substitution effect). Eme (2011) included that the heavy debt burden being born by African countries has a depressive impact on the economy. This has not only stifled the rates but has also created mountain of debts acquire by African countries (Nigeria inclusive).

This study agrees with the Kaldor's manufacturing output growth determinants theory which explains that the growth of aggregate output of an economy depends on the growth rate of manufacturing output. Kaldor's first law states that there is a close correlation between the growth of manufacturing output and the growth of GDP. This law summed up in the expression "manufacturing is the engine of growth" was first estimated by Kaldor in a cross section of developed countries over the period 1952-1954 and 1963 – 1964 (Kaldor 1966).

King George (2019), examined the effect of exchange rate fluctuations on the Nigerian manufacturing Sector. A multiple linear regressions were adopted employing Ordinary Least Square (OLS) techniques. From the results it was observed that exchange rate has no significant effect on manufacturing output growth in Nigeria. Opaluwa, Umeh and Abu (2010) examined the impact of exchange rate fluctuations on the Nigerian manufacturing sector during a twenty (20) year period (1986 2005). The ordinary least square econometric tool of regression was used for the analysis. The finding of this study is that fluctuations in the rate of exchange are not favourable to economic activities in the manufacturing sector. It was discovered that the performance of the manufacturing sector was affected by factors such as high cost of foreign exchange for procuring raw materials and machineries required for production, availability of financial capital, technological underdevelopment, inadequate socioeconomic infrastructure, shortage of technical manpower and foreign domination.

Enekwe (2013) showed that exchange rate fluctuations have a positive effect on manufacturing sector in Nigeria. However, exchange rate fluctuations have no significant effect on the quantity and quality of goods manufactured by Nigeria firms. Exchange rate appears not to be an important variable for manufacturing Gross Domestic product.

Abdallah (2018) examined the effect of exchange rate variability on manufacturing sector performance in Ghana. Using time series data and employing the autoregressive distributed lag (ARDL) approach. The empirical result shows that there exist both a short as well as long run relationship between exchange rate and manufacturing sector performance/output. Thus in Ghana as exchange rate appreciates the manufacturing sector performance

improves and as it depreciates, the manufacturing sector is adversely affected. Ilechukwu, and Nwokoye, (2015) investigated the long-run impact of exchange rate on Nigerian's industrial output. They employed the ordinary least square technique using annual time series data from 1980-2013. The result of the study showed that the domestic capital, foreign direct investment, population growth rate and real exchange rate were significant determinant of industrial output. The changes in external balance and inflation were of little or no consequences to industrial output.

Anubha (2013) explored the impact of real exchange rate changes on the performance of Indian manufacturing firm over the period 2000-2012 using ordinary least square technique of regression and analysis. The empirical analysis shows that real exchange rate movement has a significant impact on Indian manufacturing firms' performance through the import cost channel but not the export competitiveness channel. Ehinomen and Oladipo (2012) examined the impact of exchange rate management on the growth of manufacturing sector in Nigeria, employing the ordinary least square multiple regression technique. The empirical result of the study shows that depreciation which forms part of the structural adjustment policy (SAP) 1986, and which dominated the period under review has no significant relationship with the Nigerian manufacturing sector productivity. It was found that the Nigerian exchange rate appreciation has a significance relationship with domestic output and that exchange rate appreciation will promote growth in manufacturing sector of Nigeria.

Mohammad, Maliheh and Maryam (2013) examined the relationship between changes in exchange rate and the investment of manufacturing sector in Iran using the panel data approach. The result showed that exchange rate movement has a negative and statistically significant impact on manufacturing investment in Iran. The empirical study of Akinlo and Lawal (2015), on impact of exchange rate on industrial production in Nigeria over the period 1986-2010. The study employed vector error correction model (VECM) and the result confirm the existence of long run relationship between industrial production index, exchange rate, money supply and inflation rate. According to the study exchange rate depreciation had no perceptible impact on industrial production in the short-run but had positive impact in the long-run.

Considering that the topic is not entirely new, the direction and focus of discuss would be slightly different from the previous studies in the sense that it will build on their observed shortfalls. The previous work done related to the research did not look at how exchange rate volatility affects the Nigerian manufacturing output. Also, the data used are not updated to the recent past as the most current of the data used ended in 2015. But data for this study was updated to 2019 for more current effects.

Methodology
This study captured two objectives. First, it determined the effect of exchange rate movement on manufacturing output of NN. Second, it ascertained the effect of exchange rate volatility on Nigerian manufacturing output. Following the stated general objective above, we can specify the functional form of the model of this research as:

NMO = f (EXR, BLA, INTR, VOLEXCHR) - (3.1)
Where NMO =Nigerian manufacturing output, EXR = Exchange rate of Nigeria against the United States Dollars, INTR = Nigeria Interest rate, BLA = Bank loan advances in Nigeria, VOLRXCHR = Exchange Rate Volatility (Generated from GARCH model)

To determine the effect of exchange rate movement on Nigerian manufacturing, we utilized the ordinary least square (OLS) estimation technique. The log - log model can be specified as follows:
$$LogNMO_t = \alpha_0 + \alpha_1 EXR_t + \alpha_2 LogBLA_t + \alpha_3 INTR_t + \mu_t - - - - - - - - - (3.2)$$

Financial time series such as exchange rate, stock prices, inflation rate etc. Often exhibit the phenomenon of volatility clustering. That is period in which their prices show wide swings for an extended time period followed

by periods in which there is relative calm. Volatility in exchange rate may result in huge losses for importers and exporters. For instance, importers of manufacturing inputs mostly encounter difficulty in their financial planning due to exchange rate volatility. The characteristics of financial time series that exhibits volatility clustering is that in their level form, they are random work. That is, they are not stationary in their level form. But in their first differencing form they are generally stationary.

Before we determined the effect of exchange rate volatility on manufacturing output, we tested for volatility clustering using the Auto-Regressive Conditional Hetroscedastic (ARCH) model. We observed ARCH (1) process, where (1) means the use of one Auto-Regressive term, given as

$$\hat{U}^2_{t = c + \propto \hat{U}^2_{t-1}} + \mu -(3.3)$$

where, $\hat{U}^2_t$ = The residual generated from regressing the differenced exchange rate on a constant and its lagged value. We concluded that there is ARCH effect as $\propto$ is statistically significant at 5% level of significance. The generated residual becomes a proxy for our exchange rate volatility (VOLEXCHR).

To determine the effect of exchange rate volatility on manufacturing output in Nigeria, we used the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model. The GARCH model can be specified as follows:

$$\boldsymbol{NMO_t = \beta_0 + \beta_1 \sum EXR_{t-1} + \beta_2 \sum BLA_{t-1} + \beta_3 \sum INTR_{t-1} + \beta_4 VOLEXCHR_{t-1} + \mu_t - (3.4)}$$

Where;
B$_0$, α$_0$ = Model intercepts which show the value of dependent variable without the influence of independent variable.

β_1, β_2, β_3 , α_1, α_2 , α_3 , α_4 = Slope parameters of the model, which indicates the change in dependent variable as a result of a unit change in the independent variables respectively.

U_t = Error term representing among other things, unobserved explanatory variables.

Results of Model Estimations and Interpretation
All the research variables used for this research work were subjected to Augmented Dickey Fuller (ADF) unit root test for stationarity. This is based on the econometric rule, that all the data used for the regression must be stationary to avoid spurious regression. This test is also important to determine the order of integration of the variables. The test result conducted on the variables as contained in the appendix section are summarized in table 1 below:

TABLE 4.1 Unit Root Test Result

Variables	Level Stationarity		First Differencing Stationarity		Order of Integration
	ADF	5%	ADF	5%	
NMO	-4.109763	-2.9527	_	_	1(0)
EXR	-0.491758	-2.9527	-3.615571	-2.9558	1(1)
BLA	0.414371	-2.9527	-6.594966	-2.9558	1(1)
INTR	-2.759034	-2.9527	-7.394300	-2.9558	1(1)

SOURCE: E-Views Result and Author's Tabulation

From the table above, it is observed that Manufacturing output (NMO) is stationary at level form, thus it is integrated of order zero. Exchange rate (EXR), Bank loan and advances (BLA) and Interest rate (INTR) became stationary at first differencing and they are integrated of order one.

The summary of OLS and GARCH estimates to determine the influence of Exchange rate (EXR), Bank loan and advances (BLA), Interest rate (INTR) and Exchange Rate volatility (VOLEXCHR) on Nigerian manufacturing sector (NMO) are tabulated thus:

Table 4.2: OLS Estimate and Impact Analysis

Models		OLS				GARCH	
Dependent variable		LOG(NMO)				LOG(NMO)	
Intercept parameters		11.86332				9.877756	
Independent variable		**Coefficient**	**t-statistic**	**Prob.**	**Coefficients**	**t-statistic**	**Prob.**
1	LOG(D(EXR)	0.448994	6.084988	0.0000	_	_	_
2	D(BLA)	8.5507	1.543545	0.1401	_	_	_
3	D(INTR)	-0.008302	-0.549507	0.5894	_	_	_
4	D(EXR)(-1)	_	_	_	0.004817	0.660606	0.5147
5	LOG(D(BLA)(-1)	_	_	_	0.292944	7.719194	0.0000
6	D(INTR)(-1)	_	_	_	0.003734	0.346108	0.7320
7	VOLEXR(-1)	_	_	_	-0.143214	-6.37810	0.0012

SOURCE: E-Views Result and Authors Tabulation

Group Statistics

Model	OLS	GARCH
R-squared	0.673948	0.858644
Adjusted R-squared	0.619606	0.836897
F-statistic	12.40199	39.48332
Prob.(F-statistic)	0.000123	0.000000
Durbin-Watson stat	1.817684	2.132705

Source: E-Views Result

Model One Analysis
The estimated OLS equation for our research objective one from table 4.2 can be stated as:
NMO =11.86332 + 0.448994EXR + 8.5507BLA - 0.008302INTR

Economic Criterion
The intercept parameter for model one, which is 11.86332 indicating that without the influence of Exchange rate (EXR), Bank loan and advances (BLA) and Interest rate (INTR), the Nigerian Manufacturing output (NMO) value will be 11.86332. Slope parameter of Exchange rate (EXR) is 0.448994 which indicates that there is a positive relationship between Nigeria Manufacturing Output (NMO) and Exchange Rate (EXR) which conforms to a priori expectation. Since Nigerian Manufacturing output (NMO) and Exchange rate (EXR) was logged, it means that 1% appreciation in Nigerian Exchange rate (EXR) will result in 44.8994% increase in Nigerian Manufacturing output (NMO).

Statistical Criterion

The multiple coefficient of determination R^2 as 0.673948. This simply shows that the explanatory variables in the model, Exchange rate (EXR), Bank loan and advances (BLA) and Interest rate (INTR) jointly explain about 67.3% of the variations in Nigerian Manufacturing output (NMO).

For statistical significant in model, since t-statistic of Exchange rate (EXR), 6.084988 is greater than t-tabulated **2.021** and its probability of **0.0000** multiply by 100 is less than 5, we therefore conclude that Exchange rate (EXR) has statistical significant effect on Nigerian Manufacturing output (NMO) at 5% level of statistical significance. F statistics from the regression output is12.40199 which is greater than the critical F value at 5% level of statistical significance 2.71.The probability F-statistic 0.000123 multiplied by 100 is less than 5 meaning that it is significance at 5% level of significance. We therefore, conclude that Exchange rate (EXR) has a jointly statistical significant effect on Nigerian Manufacturing output (NMO) at 5% level of significance.

Econometric Criterion

We used Durbin-Watson statistics to check if auto correlations exist in the model. The Durbin-Watson as well as Durbin-Watson upper and lower table values is as tabulated in the table 4.3 below

Table 4.3: Durbin- Watson Value

Durbin Watson lower value	Durbin Watson statistics	Durbin Watson upper value
1.222	1.817684	1.726

Source: E-Views result and Durbin-Watson Statistics Table

From the regression output Durbin-Watson statistics d is 1.817684. From statistical table Durbin Watson lower value d_l= 1.222 while Durbin Watson upper value d_u= 1.726 and $4 - d_u = 4 - 1.726 = 2.274$. Hence $d_u< d< 4- d_u$. That is, $1.726 < 1.817684 < 2.274$. This falls in the acceptance zone. Therefore, we accept the null hypothesis H_o and conclude that there is no auto correlation in the model.

Model Two Analysis

We stated in chapter 3 to use ARCH (1) model to determine whether there is volatility clustering in Exchange Rate (EXCHR) or ARCH effect. The regression result of the ARCH (1) model is in the appendix section, but the summary of the result is as tabulated in the table below.

DEPENDENT	Variable	SQVOLEXR	
Variables	Coefficient	t-statistics	Probability
SQVOLEXR$_{t-1}$	0.622543	5.093969	0.0001

The table above show that the t-statistic and probability value of the slope parameter of lagged volatility in exchange rate is statistically significant at both 1%, 5% and 10% level of significance. Hence we conclude that there is ARCH effect, indicating volatility clustering.

The estimated GARCH equation for our research objective two from Table4.2 can be stated as:

NMO = 9.877756 + 0.00481EXR$_{t-1}$ + 0.29294BLA$_{t-1}$ + 0.003734INTR$_{t-1}$ − 0.143214VOLEXCHR$_{t-1}$

The intercept parameter for model two, which is 9.877756, indicates that without the influence of Exchange rate volatility (VOLEXCHR), the value of Nigerian Manufacturing output (NMO) will be 9.877756. Slope parameter of VOLEXCHR which is -0.143214, indicates that there is a negative relationship between Exchange rate volatility (VOLEXCHR) and Nigerian Manufacturing output (NMO) which conforms to a priori expectation.

Since Nigerian Manufacturing output (NMO) is logged, it means that a unit increase in VOLEXCHR will cause 0.143214% decreases in Nigerian Manufacturing output (NMO). For statistical significance in model, since t-statistic of Exchange rate volatility (VOLEXCHR), -6.37810 is greater than t-tabulated 2.021, we conclude that Exchange rate volatility (VOLEXCHR) has statistical significant effect on Nigerian Manufacturing output (NMO) at 5% level of statistical significance.

Discussion of Findings

The outcome of this research has indicated that exchange rate movement and exchange rate volatility explains reasonable proportion of variation in Nigerian Manufacturing output. It has also shown that appreciation in exchange rate in Nigeria has a positive effect on Nigerian Manufacturing output. This highly conforms to a priori expectation, in the sense that if exchange rate appreciates, Nigerian Manufacturers will use less naira to obtain a dollar in foreign exchange rate market, which will enable them to import more input factors and consequently produce higher output as well as employ more labour to reduce Nigerian unemployment rate.

On the other hand our outcome indicates that volatility in exchange rate impact negatively on Nigerian Manufacturing output. It can be noted that volatility in exchange rate creates uncertainty in manufacturing business decisions, which has negative implication on manufacturing activities in any economy. Hence the Nigerian monetary authority should always monitor exchange rate and ensure its stability, so as to avoid uncertainty in manufacturing investment decision.

Conclusion

Exchange rate system has been a problem in Nigerian economy especially as it affects the manufacturing activities due to the fact that the Nigerian manufacturing sector is import dependent for input factors. The exchange system and exchange rate volatility is still a subject for debate in Nigerian economy. Hence more effort should be made by monetary authority to avoid unstable exchange rate which creates uncertainty in business decision of the manufacturers, which consequently affect manufacturing output negatively. Nigerian Government should encourage manufacturing activities especially the manufacturing of quality exports, to encourage appreciation of Nigerian domestic currency.

Recommendations and Policy Suggestions

Following our research findings as well as the critical effect of Exchange rate movement and Volatility of exchange on Nigerian manufacturing output, we make the following recommendations and policy suggestions:

1) Nigerian monetary authority or CBN should make the monitoring of exchange rate system a priority since it explains high proportion of variation in Nigerian manufacturing output.

2) Nigerian government should encourage or fund manufacturing activities especially the manufacturing of export, so as to encourage appreciation of value of Naira domestic currency against foreign currencies especially the US dollar. Nigerian government should grant subsidies and tax holiday to manufacturers to enhance their expansion and quality delivery. This is vital because manufacturing of quality goods for export will result in higher demand for domestic currency, which will result in appreciation of Naira and consequently result in higher accessibility of dollar by manufacturers to import more input factors, since Nigeria is import dependent for manufacturing inputs.

3) Nigeria through the monetary authority should embark on monetary policies that will make exchange rate less volatile so as to reduce its negative effect on manufacturing output in Nigeria. We can recall from the study that volatility in exchange rate in Nigeria resulted in intervention of the federal government through pumping of millions dollars into the banking system to reduce the high volatility of naira exchange rate which depreciated N330 per dollar on February 2017 to as far as N520 per dollar in March 2017.

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