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Macroeconomic Implications of Exchange Rate Fluctuations on the Manufacturing Sector Performance in Nigeria

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Abstract

This study focuses on the macroeconomic implications of exchange rate fluctuation on manufacturing sector performance in Nigeria between 1981 and 2016. Variables such as manufacturing capacity utilisation, manufacturing value added, and manufacturing output are used to proxy manufacturing sector performance while exchange rate was used as the explanatory variable. Data were analyzed using the vector autoregression estimation technique while the GARCH was used to determine exchange rate volatility. The unit root results confirm that all the variables were stationary at first difference, while the Johansen cointegration test confirms that long run relationship exists between the variables employed in the study. Empirical results confirm that exchange rate depreciation has a positive impact on manufacturing output and manufacturing value added while it enhances manufacturing capacity utilisation. It indicates that exchange rate fluctuation restricts the performance of the manufacturing sector in Nigeria and hence has a strong macroeconomic implication on the sector. Efforts should be targeted at stimulating manufacturing output whenever there is depreciation of the domestic currency to stabilize the sector's performance.

JEL classification numbers: F31, L16, F62.
Keywords: Capacity Utilisation, Exchange Rate; Macroeconomic, Manufacturing, Utilisation; Nigeria.

1. Introduction

The degree of uncertainty and volatility of exchange rate fluctuation in the global economy since 1973 which marks the beginning of the generalized floating have led researchers and policy makers to investigate the extent and nature of the effect of such movements on the manufacturing sector especially in developing countries (Bordo & Flandreau, 2001). The frequent exchange rate fluctuations are viewed widely as an important driving force in business cycles (Mendoza, 1995; Crucini, Kose, Otrok, 2011). While many industrial and economic activities are affected by sharp exchange rate movements, its impact on manufacturing sector in Nigeria cannot be over emphases.

In modern economy, manufacturing sector through it operations and activities play catalytic role and the sector has many dynamic benefits that are very crucial for economic

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transformation and growth. In many developed countries, the manufacturing sector plays a leading role among other sectors of the economy; by providing avenues for increased productivity in relation to export expansion and import substitution, increasing employment, creating foreign exchange earning capacity, promoting investment growth, as well as acting as a promoting an efficient and wider linkage among other sectors of the economy (Fakiyesi, 2005). Meanwhile, the manufacturing sector in Nigeria is under-industrialized and has a very low capacity utilization even though the sector since 1973 has appears to be a fastest growing sector (Obadan, 1994). The sector has been dependent on the external sector for the import of its non-labour input (Okigbo, 1993). Therefore, inability to import may impact negatively on manufacturing production and activities.

In its annual reports, the Central Bank of Nigeria (CBN) highlighted that the manufacturing activities during the period of 160s and early 1970s were positively accelerated while value added per worker was recorded to be at par with other African countries like Kenya, Ghana and Botswana. The share of manufacturing in GDP during this period almost doubled, from 5% to nearly 8% increase and this increase was misunderstood by many and it was believed that Nigeria was on a path to industrialisation and growth (Ehinomen and Oladipo, 2012). However, Manufacturing industries in Nigeria experiences relative stagnation as from 1980 as the sectors contribution to GDP dropped and lagged many comparator African countries (Sandbrook, 1986). A survey carried out by Manufacturers Association of Nigeria (MAN) in 2010 shows that 839 out of 2780 registered members representing 30.2% closed their factory in 2009 due to their inability to cope with the challenges posed by the harsh operating business environment in the country which is caused mainly by infrastructural inadequacies and exchange rate management issues.

Manufacturing Association of Nigeria (MAN) in its annual report of 2006, claimed that the job loss in the manufacturing sector between 1983 and early 2006 was estimated at 4.2 million. In addition, in its Newsletter edition for March 2010, MAN also reported that one million jobs were lost in the sector between 2006 and 2010. Ubok-Udom (1999) established that development strategy was import dependent; therefore, leading to foreign exchange problems. Thus, the inability of the monetary authority to effectively manage exchange rate fluctuation has contributed negatively to the low capacity utilization in the manufacturing sector in Nigeria.

The relationship between exchange rate movements and manufacturing sector performance constitutes share of literature in financial management. Empirical analysis using both multi-country panel regression and econometric models applied to different countries have been conducted into how exchange rate fluctuation affect the manufacturing sector performance in Nigeria. Despite the plethora of the empirical and theoretical research into how exchange rate fluctuation affects manufacturing sector performance of developing and developed countries, there exists considerable agreement concerning the relationship between these economic variables. This study improves on previously related studies in that it employs the GARCH modelling procedure combined with the Vector Auto-regression (VAR) Technique to examine the macroeconomic implications of exchange rate fluctuations on manufacturing sector performance in Nigeria. This will enable us to determine both the exchange rate volatility and its effect on the macroeconomic indicators in Nigeria. Furthermore, these techniques (GARCH and VAR) are used because they provide unbiased estimates of the model as well as help to eliminate endogeneity problem. The study covered the periods between of 1986-2016 and time-series data are used.

2. Literature Review

2.1 Review of Exchange Rate Policies in Nigeria

The exchange rate management has witnessed series of changes since its enactment in 1962 (exchange control act of 1962). Fixed exchange rate was established before 1986 while flexible exchange rate which has been in used since 1986 has witness various changes and modifications. Before 1907, the Nigeria currency was pegged at par with pound sterling, however, when the British pounds was devalued in 1907, Nigeria government pegged the domestic currency (Naira) to a dollar at an overvalued rate to make importation cheaper for the domestic industries whose raw materials are import based. Between 1971-1985, Nigeria witnessed increase in foreign exchange earnings and revenue from crude-oils, naira appreciated and this triggered several problems in the country especially in the external sector, the sudden rapid increase of the country's external reserve was a shock as adequate measures were not put in place to manage the sudden growth neither was there any structure in place to cater for such unexpected growth. The inability of the exchange control system to evolve an appropriate mechanism for foreign exchange allocation in consonance with the goal of internal balance led to the introduction of the Second-tier Foreign Exchange Market (SFEM) in September 1986. During this exchange rate regime, the allocation of foreign exchange and the determination of exchange rate were based on market forces of demand and supply. To ensure efficient allocation of scare resources after the introduction of SEFM, naira was depreciated. In 1987, SFEM was merged into a unified foreign exchange market (FEMI) while the exchange rate was determined by market forces of demand and supply.

Autonomous foreign exchange market which was established in 1988 was destabilized and subsequently merged with FEMI due to its speculative tendencies and Dutch Auction System (DAS) was introduced in 1990. Although Nigeria went through various foreign exchange rate reforms within 1986-991in Nigeria continued to rise in-spite of all the various foreign exchange reforms and in 1992, the adoption of completely regulated exchange rate regime in Nigeria led to the depreciation of naira and CBN was unable to meet the high demand for foreign exchange by the authorized dealers. In 1994 Central Bank of Nigeria reverted to fixed exchange rate regime and naira was pegged at N21.9960:51. The fixed exchange rate regime worsened the exchange rate situation as naira depreciated sharply while demand for foreign exchange continuous to rise. In 1995, the monetary authority returned to the dual exchange rate regime which comprises of a combination of official market and autonomous foreign exchange transaction until 1999 when it was replaced with a new interbank foreign exchange market (FEM). The Dutch Auction System (DAS) was re-introduced by the government in 2002 for the purpose of narrowing the gap between the official market and parallel market rates and to converse the foreign exchange reserves. The foreign exchange market became a little restricted in 2002 as interbank transactions were abolished and transaction were made through DAS. Dutch Auction System was then regarded as a better alternative due to its contribution in solving certain noted foreign exchange challenges that the government was experiencing.

2.2 Theoretical Review

Several attempts have been made by researchers and economists to provide theoretical analysis of the impact of exchange rate fluctuation on manufacturing sector. The following are various related theories that support the relationship between exchange rate movement and manufacturing sector.

2.2.1 International Monetary Model.

The International Monetary Model established that exchange rate are greatly influenced by the asset holder's preference for money. The model opposed concentrating merely on the importance of current account flows in the short or long term as approved by other models or approaches. Its argument centres majorly on the fact of adjusted by capital transaction through a change in the exchange rate. It explained that fluctuation of exchange rates are brought about by stock disequilibrium, which is the willingness to hold the outstanding stock of money by individuals. This model defined exchange rate as the price of foreign money in terms of domestic money rather than the flow of receipts and payments arising from this perspective. Being a relative price of two assets (money), the equilibrium exchange rate is attained when the existing stocks of the two moneys are willingly held. The monetary model is based on the following three assumptions; (a) that prices are determined by the world price level and the exchange rate through purchasing power parity (PPP), and (b) the demand for money balances is a stable function of real income and interest rates, (c) that with wage flexibility, the domestic economy is at full employment level.

2.2.2 Portfolio Balance Approach (PBA.).

Portfolio Balance Approach expressed the role of asset market adjustment with the assumption of perfect capital mobility. The model assumed that substitutability of domestic and foreign interest- bearing assets due to the perceived existence of exchange, political and default risks against the monetary model. The model argues that the exchange rate reflects the demand for and the supply of a whole range of different currency denominated assets.

2.2.3 Purchasing Power Parity (PPP) Theory.

This model states that a unit of any given currency should be able to buy the same quantity of goods in all countries. Most economists believe that the purchasing power parity theory describes the forces that determine exchange rates in the long run. It established that the nominal exchange rate between the currencies of two countries must reflect the different prices level in those countries. The PPP forms a strong building block of the theory of exchange rate determination assumes the existence of a proportional relationship between the exchange rate of the currencies of two countries and their relative inflation rates. This theory is based on the law of one price, and it explains that, in the absence of transportation costs and trade barriers, spatial commodity arbitrage ensures that price of any commodity in one country is equal to prices of similar commodities across different other countries. The theory can be formulated in both absolute and relative forms. In the relative form argues that changes in exchange rate measured from a base period reflect changes in relative price levels while the absolute forms on the other hand, states that the equilibrium exchange rate equalizes the general purchasing power of a given income in terms of relative price levels. As such, it relates to the level of exchange rate to relative prices levels.

2.2.4 Uncovered Interest Parity (UIP).

This model is the capital account equivalent of the purchasing power parity and it forms the central assumption for the Capital Account Monetary Model of exchange rate determination. It maintains that exchange rate moves in such a way that the expected rates of return are equalized across countries. This means that the spot rate and expected value of future exchange rate in asset market equilibrium is in such a way that investors are indifferent between the currencies in which they hold their assets given the relevant interest rates (r_d rand r_d). The uncovered Interest Parity model assumes capital mobility across countries which states that there is absence of transaction costs, investors are risk neutral and that there is no exchange controls. The implication of this is that assets denominated in different currencies are regarded by investors as perfect substitutes. Thus, the law of one price will hold for asset returns rather than prices of tradable goods. This means that if the expected changes in the nominal spot exchange rates reflect that expected inflation rate differential in two countries which ensure that real exchange rate remains constant. The UIP theory assumed that real interest rates will always be the same in two different countries.

2.2.5 Balance of Payment (BOP) Model.

The Balance of Payment (BOP) model suggests that exchange rate is determined by the capital flow arising from international trade in services, goods as well as financial assets in such a way that the balance of payment equality is continuously maintained at all times. It uses the balance of payment equality as a condition of equilibrium in the foreign exchange market. The BOP argument is based on the fact that the current account is influenced by the exchange rate to the extent that it alters relative prices. This implies that the degree of competitiveness and the Capital Account is also affected so long as the expectation variables play a significant role from an initial position of balance of payment equilibrium, given foreign income and interest rates and prices. To bring the balance of payment back to its initial equilibrium, a need for higher interest rate that will generate an offsetting rate of Capital outflow is required. As a result, exchange rate is represented in the analysis to depend more on interest rate, income and relative prices of goods and services. It therefore means that a rise in income, due to possible autonomous increase in spending, will certainly require an offsetting depreciation. While Increases in both domestic interest rate and foreign prices will lead to an offsetting appreciation. From the above explanation, two significant arguments are discovered of the BOP model, and this contradict the monetary model.

2.3 Empirical Review

In the empirical literature, studies have beamed searchlight on the link between exchange rate and the macro economy. For instance, Ehinohem and Oladipo (2012) researched into the relationship between exchange rate and manufacturing performance in Nigeria between 1986 and 2010. The study employed the ordinary least square (OLS) technique and found that exchange rate depreciation has no significant impact on manufacturing output in Nigeria. It was found that in Nigeria, exchange rate appreciation has a significant relationship with domestic output. Also, it was found that appreciation of exchange rate has significant impact on manufacturing output. It also observed that inflation has positive effect on manufacturing output. It therefore suggested that the Nigerian government should focus on giving subsidy to the manufacturing sector to cushion the negative effect of exchange rate movement on manufacturing.

Furthermore, Opaluwa, Umeh and Ameh, (2014) established that exchange rate fluctuations adversely affect output of the manufacturing sector in Nigeria between 1986 and 2005. The reason given for this in the study is that manufacturing sector is highly import dependent. Also, the high demand for foreign exchange caused adverse fluctuation of exchange rate and this affected the manufacturing sector activities whose dependency on external sources for its productive input is very high. The analysis showed that coefficients of the variables had both positive and negative signs. It is therefore suggested that the Nigerian government should strengthen the link between manufacturing sector and agriculture by encouraging local sourcing of raw material in order to reduce the reliance of manufacturing sector on imported inputs. Similarly, Umubanmwen (1995) established the adverse consequence of exchange rate movement on manufacturing companies' ability to import raw materials. Moreover, (Ojo, 1990) posited that devaluation of naira which aggravates the situation has not positively impacted on the economic performance in Nigeria especially in respect to manufacturing sector.

3. Theoretical Framework and Research Methodology

3.1 Theoretical Framework

The study adopted the Solow swan model of growth which is adapted by Guerrini (2006) to model macroeconomic performance. Solow's model takes the rate of saving, population growth and technical progress as exogenous. There are two inputs capital and labour which are paid their marginal products (Solow, 1956). Assuming a Cobb -Douglas production functions the production function at time t is given by:

$$y(t) = k(t)^{\propto} A(t)L(t)^{1-\propto} \qquad 0 < \propto < 1 \qquad (1)$$

Where: Y is output, K is capital, L is labor and A is the level of technology.
The initial levels of capital, labor and level of technology are taken as given. Labor and level of technology grow at constant rates:

$$\dot{(t)} = n\mathrm{L}(t) \qquad (2)$$

$$\dot{(}t) = gA(t) \qquad (3)$$

Where n and g are exogenous parameters and where a dot over a variable denotes a derivative with respect to time.
Applying the result that a variables growth rate equals the rate of change of its log to equation (2) and (3) tells us that the rates of change of the logs of L and A are constant and that they equal n and g respectively. Thus,

$$\ln L(t) = \{\ln L(0)\} + nt \qquad (4)$$

$$\ln A\,(t) = \{\ln A(0)\} + gt \qquad (5)$$

Where $L(0)$ and $A(0)$ are the values of L and A at time 0. Exponentiating both sides of these equations gives us:

$$L(t) = L(0)\, e^{nt} \qquad (6)$$

$$A(t) = A(0)e^{nt} \qquad (7)$$

The number of effective units of labour, A (t) L (t), grows at rate n+g.
The model assumes that a constant fraction of output s is invested. Defining k as the stock of capital per effective unit of labour, k = *K/AL*, and y as the level of output per effective unit of labour, y=*Y/AL*, the evolution of k is governed by

$$k(t) = sY(t) - (n + g - \partial)k(t) = sK(t)^{\alpha} - (n + g + \partial)k(t) \qquad (8)$$

Where ∂ is the depreciation rate.
Equation 8 implies that K converges to a steady state value which is defined by

$$sK^{\propto} = (n + g + \partial)K \qquad or$$

$$K = \left[\left(\frac{s}{n} + g + \partial\right)\right] 1/(1 - \alpha \qquad (9)$$

The steady state capital labour ratio is related positively to the rate of saving and negatively to the rate of population growth. The central prediction of the Solow model concerns the impact of saving and population growth on real income. Substituting 9 into the production function (1) and taking logs we find the steady state income per capita is:

$$\ln[\frac{y(t)}{L(t)}] = \ln A\,(0) + g(t) + \propto/1{-}\propto\ \ln(s) - \propto/1{-}\propto\ \ln(n + g + \partial) \qquad (10)$$

Because the model assumes factors of marginal products, it then predicts not only the signs but also the magnitudes of the coefficients on saving and population growth.

3.2 Methodology

The vector auto-regression/vector error correction (VAR)/VECM model is the most suitable for this work. This is because the study focuses on how the lags of exchange rate affect the three indicators of manufacturing sector in Nigeria. Also, the VAR/VECM model makes it possible for each equation to be estimated with the usual OLS method separately and forecasts obtained from the VAR/VECM models are in most cases better than those obtained from the far more complex simultaneous equation models (Mahmoud, 1984; McNees, 1986). Moreover, the VAR/VECM model is employed in this study to be able to test for the direction of causality among the variables and to enable us to determine the macroeconomic implications of exchange rate fluctuation on manufacturing sector performance in Nigeria.

3.2.1 Model Specification

In order to carry out this research with a robust analysis, this present study has decided to modify the Solow growth model by replacing the output per effective labour with manufacturing output, manufacturing value added and manufacturing capacity utilisation, while capital per effective labour is replaced with exchange rate in order to align with the objectives of the study. In the specified model in equations 11 to 14, the semi-log is employed. The reason is because it enables us to reduce the large values associated with each of the variables and also makes the coefficients of the regressed parameters to be smaller and reflect real life situations. However, exchange rate is not logged since it is already in rate form and its value is already small. The VAR/VECM model to be estimated is stated as follows:

$$LMVD = \alpha + \beta_1 (EXR)_{t-1} + \beta_2 (LMQ)_{t-1} + \beta_3 (LMCU)_{t-1} + \beta_4 (LMVD)_{t-1} + \varepsilon_1 \quad (11)$$
$$LMQ = \alpha + \beta_1 (EXR)_{t-1} + \beta_2 (LMQ)_{t-1} + \beta_3 (LMCU)_{t-1} + \beta_4 (LMVD)_{t-1} + \varepsilon_2 \quad (12)$$
$$LMCU = \alpha + \beta_1 (EXR)_{t-1} + \beta_2 (LMQ)_{t-1} + \beta_3 (LMCU)_{t-1} + \beta_4 (LMVD)_{t-1} + \varepsilon_2 \quad (13)$$
$$EXR = \alpha + \beta_1 (EXR)_{t-1} + \beta_2 (LMQ)_{t-1} + \beta_3 (LMCU)_{t-1} + \beta_4 (LMVD)_{t-1} + \varepsilon_2 \quad (14)$$

Where LMVD = Log of manufacturing value added;
LMCU = Log of manufacturing capacity utilisation;
LMQ = Log of manufacturing output; and
EXR = Exchange rate;
α represents the intercept term;
β_1, β_2, β_3 and β_2 are the slope parameters; while
ε is the error term.

3.2.2 Sources and Measurement of Data

The focus for the study is on the Nigerian economy. Only secondary data are employed in this study, which span across a period of thirty-one years i.e. 1981 to 2016. In doing this, data are sourced from the World Bank's World Development Indicators (WDI, 2017) and Central Bank of Nigeria Statistical Bulletins (CBN, 2017). The data include manufacturing value added, manufacturing output, manufacturing capacity utilisation and exchange rate.

4. Results and Discussion

In this section, the result of the analysis for the study on macroeconomic implications of exchange rate fluctuations on manufacturing performance in Nigeria is presented. The section begins with unit root test to find out if the variables employed in the study are stationary. Then, followed by the Johansen cointegration test for long run relationship. The section is rounded off with the presentation of the VAR/VECM result.

4.1 Stationarity Test

Table 1: Unit Root Tests Results

Variables	ADF Test	Critical Value at 1%	Critical Value at 5%	Stationarity
EXC	-4.294032	-2.932772	-2.642947	I(1)
MCU	-4.912340	-2.889241	-2.432460	I(1)
MQ	-5.640382	-3.622342	-2.812908	I(1)
MVD	-4.210045	-2.648375	-2.432043	I(1)

Authors' Computation (2017)

The unit root test result in table 1 suggests that the time series variable, exchange rate (EXC), manufacturing capacity utilisation (MCU), manufacturing output (MQ), and manufacturing value added (MVD) are stationary at first difference. The implication for this is that there is no unit root in the series at first difference. This means that all the variables are stationary at first difference. We can then estimate the vector error correction.

4.2 Cointegration Test

Table 2: Johansen Cointegration Test

Hypothesized No. of CE (s)	Trace Statistic	Prob. **	Hypothesized No. of CE (s)	Max-Eigen Statistic	Prob.**
None*	47.74028	0.0413	None*	29.95151	0.0244
At most 1	17.78877	0.5817	At most 1	10.75735	0.6715
At most 2	7.031420	0.5740	At most 2	5.895959	0.6266
At most 3	1.135461	0.2866	At most 3	1.135461	0.2866

Authors' Computation (2017)

In Table 2, both the Trace and the Maximum-Eigen statistics confirmed that there is one co-integrating vector respectively at 5% significance level. This implies that there is long-run relationship among the series employed in the study. Specifically, manufacturing value added, manufacturing output, manufacturing capacity utilisation, and the exchange rate have long-run relationship among them.

5.3 Empirical Results

Table 3: Vector Error Correction Estimates

Independent variables	Dependent variables			
	Manufacturing Value Added	Manufacturing Output	Manufacturing Capacity Utilisation	Exchange Rate (Garch)
	I	II	III	IV
Ecm_{-1}	-0.0186** (-0.4711)	-0.0155** (-0.2400)	-0.4065*** (-6.7899)	0.2123 (0.5996)
MVD_{-1}	-0.3657 (-1.2930)	-0.8659** (-1.8676)	0.7680* (1.7929)	5.0429** (1.9902)
MVD_{-2}	-0.9132*** (-3.4481)	-1.3125*** (-3.0229)	-0.0813 (-0.2028)	4.7187** (1.9889)
MQ_{-1}	0.0067 (0.0341)	0.3805 (1.1809)	0.2077 (0.6977)	-0.6509 (-0.3697)

MQ_{-2}	0.4666**	0.5027*	0.3574	-3.0702**
	(2.6784)	(1.7601)	(1.3544)	(-1.9669)
MCU_{-1}	0.0583	0.1664	-0.1697*	-0.8208
	(0.8051)	(1.4028)	(-1.5488)	(-1.2662)
MCU_{-2}	-0.0837	-0.0658	-0.3047**	0.5984**
	(-1.1823)	(-0.5670)	(-2.8408)	(1.9432)
$Garch01_{-1}$	-0.0234	-0.0095	0.0745**	-0.4197**
	(-1.1719)	(-0.2887)	(2.4593)	(-2.3435)
$Garch01_{-2}$	-0.0276***	-0.0146	0.0576***	0.3799
	(-1.6189)	(-0.5218)	(4.1378)	(0.4884)
Intercept	-0.0377**	-0.0137	-0.0578**	0.4554**
	(-2.0179)	(-0.4477)	(-2.0482)	(2.7213)

*Note: t-statistics in ( ), *, **, ***, significant at 10%, 5%, 1% respectively.*
Source: Author's Computation (2018)

Using optimal lag structure of two, the result of the estimated vector error correction model is as shown in table 3. This study is more interested in models 1, 2 and 3 which enable us to determine the effect of exchange rate fluctuation on the three indicators of manufacturing sector performance. In the result presented, for the three models, the coefficients of the error correction terms show that there is convergence to the long run path after short run deviations. This is informed by the fact that the coefficient of the error correction terms are negative and are significant while the adjustment speed is 1.5%, 1.8%, and 40% respectively. In model 1, the volatility of the exchange rate of both first and second lags, as captured by the Garch has a negative but significant impact on the manufacturing value added. This means that a depreciation in the exchange rate reduces the manufacturing value added in Nigeria. In the same vein, the volatility of the exchange rate of both first and second lags, as captured by the Garch has a negative and insignificant impact on the manufacturing output. The result is not surprising as the manufacturing sector in Nigeria is heavily dependent on imports. Hence, any external shocks that affect the nominal exchange rate negatively impacts both the output and manufacturing value addition in the country as manufacturing production cost increases. This makes several firms close their operations or even lay off their workers, thereby, negatively impacting on manufacturing productivity. However, in model 3, exchange rate fluctuations of both first and second lags have positive impacts on the manufacturing capacity utilisation. This means that capacity utilisation in the manufacturing sector expands with exchange rate depreciation in Nigeria. Since manufacturing capacity utilisation is a measure of productive efficiency, it means that the manufacturing sector becomes more productively efficient whenever production cost increases due to nominal exchange rate increases.

5. Conclusion

This study has beamed searchlight on the macroeconomic implications of exchange rate fluctuation on manufacturing sector performance in Nigeria between the period of 1981 to 2016. In the study, variables such as manufacturing capacity utilisation, manufacturing value added, and manufacturing output are used to proxy manufacturing sector performance while exchange rate was used as the explanatory variable. In conducting this scientific enquiry, the vector autoregression framework was used as the estimation technique while the GARCH was used to extract exchange rate volatility. In the study, it was observed that all variables were stationary at first difference, which necessitated the use of the vector error correction technique. Also, the Johansen cointegration test conducted confirmed that long run relationship exists between the variables employed in the study. In terms of the VECM result, it was found that exchange rate depreciation has a positive impact on manufacturing output and manufacturing value added while it enhances manufacturing capacity utilisation. To this end, we conclude that exchange rate fluctuation restricts the performance of the manufacturing sector in Nigeria and hence has a strong macroeconomic implication on the sector. Therefore, efforts should be targeted at stimulating manufacturing output whenever there is depreciation of the domestic currency to stabilize the sector's performance. More so, the manufacturing sector can be encouraged to look inwards and source their inputs more from within the country. This can provide the needed impetus to galvanise the sector's performance and stabilize the performance of the overall economy in the long-term.

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APENDIX

Table 4: Garch model result

Dependent Variable: EXR
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 03/01/18 Time: 15:18
Sample: 1981 2016
Included observations: 36
Convergence achieved after 31 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(1) + C(2)*RESID(-1)^2 + C(3)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
		Variance Equation		
C	2738.207	1901.155	1.440286	0.1498
RESID(-1)^2	2.160811	0.535476	4.035309	0.0001
GARCH(-1)	-0.988951	0.009175	-107.7896	0.0000

R-squared	-1.075108	Mean dependent var	74.63805
Adjusted R-squared	-1.017466	S.D. dependent var	73.00481
S.E. of regression	103.6942	Akaike info criterion	10.85727
Sum squared resid	387089.8	Schwarz criterion	10.98923
Log likelihood	-192.4309	Hannan-Quinn criter.	10.90333
Durbin-Watson stat	0.023452		

Table 5: vector error correction estimates result

Date: 03/01/18 Time: 15:27
Sample (adjusted): 1984 2016
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LMVD(-1)	1.000000
LMQ(-1)	-0.508786
	(0.12967)
	[-3.92355]
LMCU(-1)	-1.398641
	(0.17760)
	[-7.87505]
GARCH01(-1)	0.313855
	(0.03248)
	[9.66389]
C	5.038704

Error Correction:	D(LMVD)	D(LMQ)	D(LMCU)	D(GARCH01)
CointEq1	-0.018621	-0.015552	0.406493	0.212327
	(0.03953)	(0.06480)	(0.05987)	(0.35410)
	[-0.47110]	[-0.24001]	[6.78999]	[0.59962]
D(LMVD(-1))	-0.365703	-0.865977	0.768028	5.042860

	(0.28283)	(0.46368)	(0.42838)	(2.53383)
	[-1.29301]	[-1.86763]	[1.79286]	[1.99021]
D(LMVD(-2))	-0.913172	-1.312451	-0.081361	4.718781
	(0.26483)	(0.43417)	(0.40112)	(2.37257)
	[-3.44813]	[-3.02291]	[-0.20283]	[1.98889]
D(LMQ(-1))	0.006707	0.380464	0.207659	-0.650923
	(0.19651)	(0.32216)	(0.29763)	(1.76048)
	[0.03413]	[1.18099]	[0.69770]	[-0.36974]
D(LMQ(-2))	0.466661	0.502743	0.357422	-3.070233
	(0.17423)	(0.28564)	(0.26389)	(1.56091)
	[2.67839]	[1.76007]	[1.35441]	[-1.96695]
D(LMCU(-1))	0.058258	0.166414	-0.169740	-0.820843
	(0.07236)	(0.11863)	(0.10960)	(0.64825)
	[0.80513]	[1.40285]	[-1.54878]	[-1.26625]
D(LMCU(-2))	-0.083732	-0.065834	-0.304716	0.598447
	(0.07082)	(0.11610)	(0.10727)	(0.63446)
	[-1.18232]	[-0.56702]	[-2.84076]	[0.94323]
D(GARCH01(-1))	-0.023425	-0.009460	0.074458	-0.419663
	(0.01999)	(0.03277)	(0.03028)	(0.17908)
	[-1.17189]	[-0.28869]	[2.45935]	[-2.34350]
D(GARCH01(-2))	-0.027585	-0.014576	0.106785	0.379855
	(0.01704)	(0.02793)	(0.02581)	(0.15265)
	[-1.61896]	[-0.52180]	[4.13775]	[2.48842]
C	-0.037696	-0.013711	-0.057952	0.455436
	(0.01868)	(0.03063)	(0.02829)	(0.16736)
	[-2.01790]	[-0.44768]	[-2.04816]	[2.72130]
R-squared	0.599130	0.578341	0.761521	0.955404
Adj. R-squared	0.442268	0.413344	0.668204	0.937953
Sum sq. resids	0.075179	0.202059	0.172467	6.033928
S.E. equation	0.057172	0.093729	0.086594	0.512196
F-statistic	3.819472	3.505165	8.160521	54.74859
Log likelihood	53.56739	37.25413	39.86695	-18.78967
Akaike AIC	-2.640448	-1.651766	-1.810118	1.744828
Schwarz SC	-2.186961	-1.198279	-1.356631	2.198316
Mean dependent	-0.016053	0.039908	-0.005185	0.091687
S.D. dependent	0.076555	0.122372	0.150333	2.056248

Determinant resid covariance (dof adj.)	1.07E-08
Determinant resid covariance	2.52E-09
Log likelihood	139.3825
Akaike information criterion	-5.780760
Schwarz criterion	-3.785417

Table 6: johansen cointegration result

Date: 03/01/18 Time: 17:23
Sample (adjusted): 1983 2016
Included observations: 34 after adjustments
Trend assumption: Linear deterministic trend
Series: GARCH01 LMQ LMCU LMVD
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.585601	47.74028	47.85613	0.0413
At most 1	0.271227	17.78877	29.79707	0.5817
At most 2	0.159208	7.031420	15.49471	0.5740
At most 3	0.032844	1.135461	3.841466	0.2866

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.585601	29.95151	27.58434	0.0244
At most 1	0.271227	10.75735	21.13162	0.6715
At most 2	0.159208	5.895959	14.26460	0.6266
At most 3	0.032844	1.135461	3.841466	0.2866

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

GARCH01	LMQ	LMCU	LMVD
1.721427	-2.495595	-3.016940	9.062199
-1.664361	3.557756	-2.958240	-13.64520
-0.540525	2.170076	-3.102427	2.396976
0.176889	2.664821	-0.317173	2.836359

Unrestricted Adjustment Coefficients (alpha):

D(GARCH01)	-0.165875	0.019179	0.061850	-0.089721
D(LMQ)	0.001392	0.025416	-0.038275	0.003559
D(LMCU)	0.077306	0.043855	-0.001135	-0.011344
D(LMVD)	-0.008166	0.027258	-0.017045	0.006126

1 Cointegrating Equation(s):		Log likelihood	99.92644
Normalized cointegrating coefficients (standard error in parentheses)			
GARCH01	LMQ	LMCU	LMVD
1.000000	-1.449725	-1.752581	5.264353
	(0.30646)	(0.48233)	(0.65123)
Adjustment coefficients (standard error in parentheses)			
D(GARCH01)	-0.285541		
	(0.17517)		
D(LMQ)	0.002396		
	(0.03559)		
D(LMCU)	0.133076		
	(0.04017)		
D(LMVD)	-0.014058		
	(0.02468)		

2 Cointegrating Equation(s):		Log likelihood	105.3051
Normalized cointegrating coefficients (standard error in parentheses)			
GARCH01	LMQ	LMCU	LMVD
1.000000	0.000000	-9.192049	-0.919298
		(2.24120)	(3.14938)
0.000000	1.000000	-5.131641	-4.265396
		(1.39283)	(1.95723)
Adjustment coefficients (standard error in parentheses)			
D(GARCH01)	-0.317462	0.482190	
	(0.24351)	(0.44194)	
D(LMQ)	-0.039905	0.086950	
	(0.04815)	(0.08740)	
D(LMCU)	0.060086	-0.036899	
	(0.05223)	(0.09480)	
D(LMVD)	-0.059425	0.117357	
	(0.03203)	(0.05814)	

3 Cointegrating Equation(s):		Log likelihood	108.2531
Normalized cointegrating coefficients (standard error in parentheses)			
GARCH01	LMQ	LMCU	LMVD
1.000000	0.000000	0.000000	32.53785
			(9.66155)
0.000000	1.000000	0.000000	14.41271
			(5.25592)
0.000000	0.000000	1.000000	3.639792
			(1.24002)
Adjustment coefficients (standard error in parentheses)			
D(GARCH01)	-0.350893	0.616409	0.251813
	(0.24798)	(0.49071)	(0.52955)
D(LMQ)	-0.019216	0.003889	0.039362
	(0.04606)	(0.09115)	(0.09837)
D(LMCU)	0.060700	-0.039363	-0.359438
	(0.05354)	(0.10595)	(0.11434)
D(LMVD)	-0.050212	0.080369	-0.003119
	(0.03187)	(0.06307)	(0.06806)