International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. VIII, Issue 3, March 2020

http://ijecm.co.uk/

EFFECT OF EXCHANGE RATE VOLATILITY ON MANUFACTURING SECTOR PERFORMANCE IN NIGERIA

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Abstract

The performance of the manufacturing sector of the Nigerian economy has remained visibly unimpressive over the years. Efforts directed by various stakeholders and the government to revive the sector have proved abortive. Empirical evidences suggest that the volatile nature of the country's exchange rate has been the major challenge impeding the performance of the sector. It is against this backdrop that this study investigated the impact of exchange

rate volatility on the Nigerian manufacturing sector from 1981 to 2018. The study employed the vector autoregressive (VAR) model in analyzing the annual time series data. The GARCH (1, 1) model was used to ascertain the prevalence of exchange rate volatility persistency and to extract exchange rate volatility series. The VAR model was used to estimate the impact of exchange rate volatility on the manufacturing sector. The GARCH (1, 1) estimates obtained showed that there is persistent of volatility associated with exchange rate. Manufacturing output was further disaggregated into oil-related manufacturing output and non-oil related manufacturing output. The empirical results obtained from the VAR estimation show that exchange rate volatility has significant negative effect on aggregate manufacturing output in Nigeria. The study therefore recommended that firms should identify the types and measurement of exchange rate risk exposed to them so as to develop particular exchange rate risk exposure management strategies to cushion its negative effects.

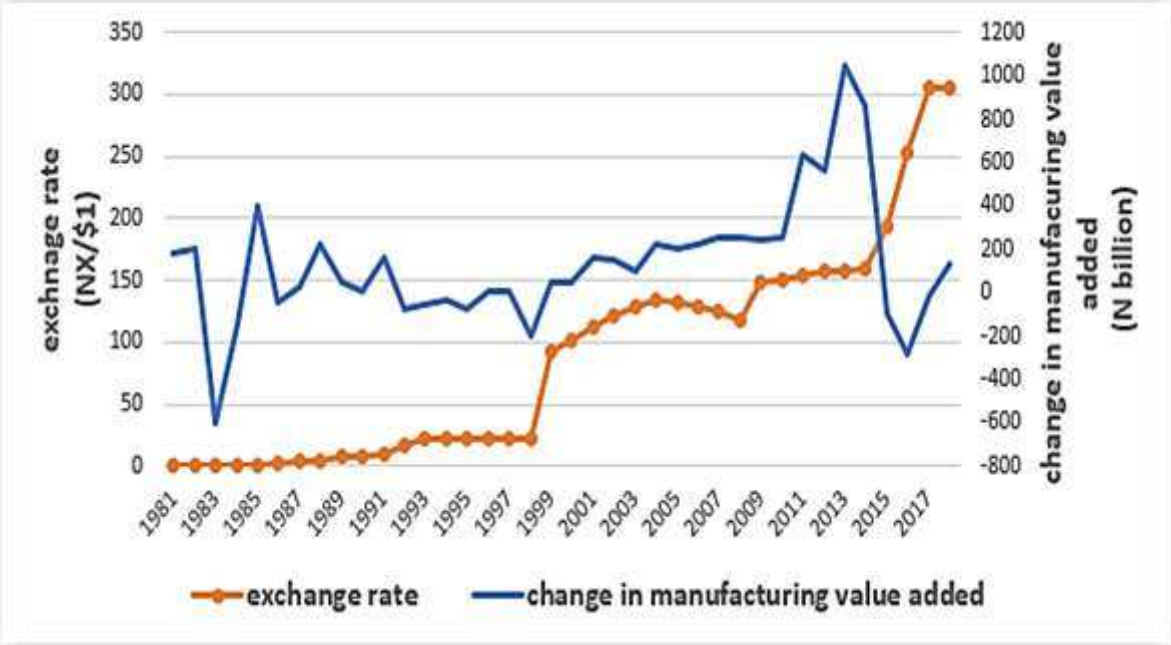
Keywords: Exchange Rate, Volatility, Manufacturing sector, Performance, Nigeria

INTRODUCTION

Manufacturing sector over the years has proven to be a major driver of growth and development of an economy. According to Dijkstra (2000), the manufacturing sector has not only provided stable and well-paying jobs for emerging economies, it has also helped to build the necessary infrastructure that complements growth. The sector has also created forward and backward linkages with other critical sectors of the economy, thereby making it critical for transition from a developing to a developed economy (Tregenna, 2009). The level and pace of growth of the sector depends on the prevailing macroeconomic environment and the dynamic and complementary nature of economic policies targeted at shifting resources from low productivity to high-productivity sectors as well as the stability of the exchange rate (Dijkstra, 2000). The stability of exchange rate is critical for manufacturing activities because the value of exchange rate determines the profitability of manufacturing exports. Furthermore, investors are discouraged from investing in the manufacturing sector if the nation's exchange rate remains volatile (Uniamikogbo, 1995).

In Nigeria, available data suggests that the performance of the manufacturing sector output has not been impressive. This may not be unconnected to the volatile nature of the country's exchange rate. This assertion is further justified by the figure 1.

Figure 1. Trend of exchange rate and change in manufacturing value added



Source: CBN (2018)

While manufacturing value-added as percentage of GDP averaged 10.6% between 1980 and 1986, it declined to an average of 8.1% during the period of 1987-1993. The growth rate of value added however rose to 8.5% during between 2000 and 2010. However, this rise continued till 2014 as growth in value added rose to 13.5% in 2012 and 14.7% in 2014. Growth in value added of the manufacturing sector declined sharply in the subsequent years as it recorded -1.5%, -4.3% and -0.21 in 2015, 2016 and 2017 respectively. In 2018, the manufacturing value added witnessed marginal growth of about 2.09% (CBN, 2018).

Similarly, exchange rate depreciated between 1980 and 1984 to 0.68 and 3.90 within 1985 - 1989. It depreciated further to 16.59 between 1990 and 1994, averaging 22.71 between 1995 and 1999. Exchange rate depreciation was more dramatic since 2000. For example, the exchange rate depreciated from 113.45 in 2001 to 137.00 in 2003. However, the period between 2004 and 2007 witnessed appreciation of the naira exchange rate. The rate appreciated from 137.00 in 2003 to 132.85, 129.00, 128.27 and 117.97 in 2004, 2005, 2006 and 2007 respectively (CBN, 2016). Since the exchange rate resumed depreciation in 2008, it has never appreciated. It depreciated from 117.97 in 2007 to 150.66, 197.00 and 305.00 in 2010, 2015 and 2016 (CBN, 2010, 2016). According to Manuelli and Peck (1990), exchange rate volatility is of great concern because it increases risk in both domestic and international transactions. Manufacturing firms operate in both domestic and international markets. In the

international market, firms export their goods, import raw materials and also receive net capital investment. When the exchange rate is volatile, it increases risk and uncertainty, thereby leading to decline in investment and profit.

Nigerian government has taken several steps to boost and reinvigorate the manufacturing sector for development. Such policies include the Structural Adjustment Program (SAP), Import Substitution Strategy (ISS), Small and Medium Enterprises (SME) loan scheme and more recently, the federal government ban on importation and the closure of land borders.

Despite all these efforts of government, the manufacturing sector contribution to GDP has continued to decline. While acknowledging the efforts of previous researchers in providing answers to this quagmire, it seems no reasonable breakthrough has been made. A close observation of these research outcomes suggest that the nuances may have emanated from either measurement of variables or estimation methods. As an improvement to the preexisting methods, this study captured exchange rate volatility using generalized autoregressive heterosckedasticity (GARCH) model which is reputed to be appropriate in estimating volatility in time series. Therefore, this study sets out to ascertain whether exchange rate has effect on aggregate manufacturing output in Nigeria.

LITERATURE REVIEW

Theoretical Literature Review

a. Exchange Rate

Mordi (2006) defined exchange rate as the price of one currency in relation to another currency. He went further to assert that exchange rate links the domestic and foreign prices of goods and services. According to Ngerebo and Ibe (2013), exchange rate is the ratio between a unit of one currency and the amount of another currency for which that unit can be exchanged at a particular time. Although both real and nominal exchange rate are critical for the economy, real exchange is most employed in the evaluation of international competitiveness of an economy while nominal exchange rate is usually applied in domestic economic evaluation (Sloman, 2006). Since this study focuses on understanding how domestic manufacturing sector output is affected by exchange rate volatility, the nominal concept of exchange rate is the focus of this study in this regard, Ngerebo and Ibe (2013) definition was adopted in this study.

b. Exchange Rate Volatility

Engle (2003) defined volatility as the measure of the amount of randomness in an asset return at any particular time. According to Nyahokwe and Ncwadi (2013), exchange rate volatility refers to the amount of uncertainty or risk involved with size of changes in a currency exchange rate. There is volatility when the values of a given series change rapidly from period to period in

an unpredictable manner (Greene, 2003; Engle, 2003). Olufayo and Fagite (2014) viewed exchange rate volatility as a swing or fluctuation in the value of a currency over a period of time. There has been excessive volatility of the naira against major currencies in Nigeria since the adoption of flexible exchange rate regimes in 1986. Consequently, sustained exchange rate volatility has been viewed to have led to currency crisis, distortion of production patterns including manufacturing production as well as sharp fluctuations in external reserve.

c. Manufacturing Sector

Soludo and Adenikinju (1996) defined manufacturing sector as the sector that takes raw materials and converts them into finished products. According to Tybout (2000), manufacturing sector is the sector that engages in the production of merchandise for use or sale using labour and machines, tools, chemical and biological processing, or formulation. The term may refer to a range of human activity, from handicraft to high tech, but is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale.

Review of Basic Theories

a. Harrod-Domar Growth Theory

Harrod-Domar growth theory was proposed by Harrod (1943) and Domar (1943) cited in Easterly; et al, (2003). The theory views capital factor as the crucial factor of economic growth. It concentrates on the possibility of steady growth through adjustment of supply of demand for capital. It assumes that substitution between capital, labour and a neutral technical progress in the sense that technical progress is neither saving nor absorbing of labour or capital. Both factors are used in the same proportion even when neutral technical progress takes place. The Harrod-Domar model, points out that output depends on the investment rate and the productivity of that investment. According to this model, in order to maintain full employment equilibrium level of income from year to year, it is essential that both real income and output should be expanded at the same rate at which the productive capacity of the capital stock is increasing. In other words, any divergence between these two will lead to excess or idle capacity, forcing the entrepreneurs to cut back their investments. It will adversely affect the economy by lowering incomes and employment in the subsequent periods and will move the economy away from the equilibrium path of steady growth state.

b. Mundell-Fleming Model (MFM)

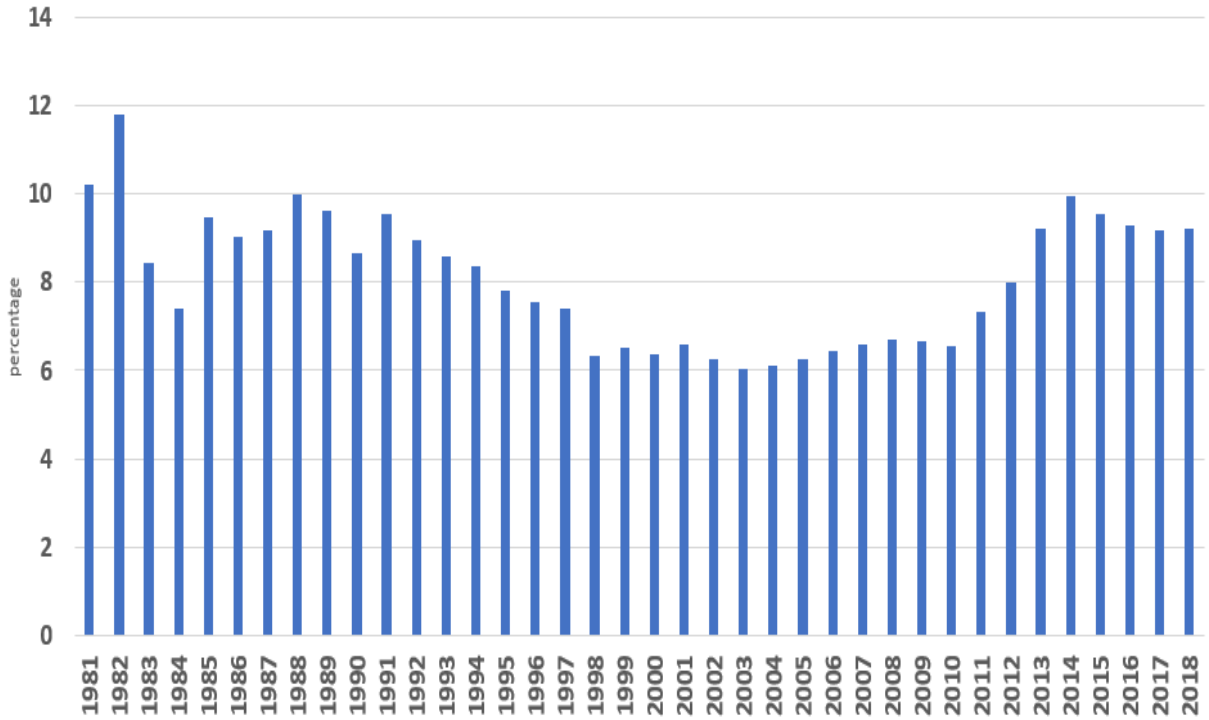
The Mundell–Fleming model (MFM) was independently proposed by Mundel (1968) and Fleming (1969). MFM describes the workings of a small economy open to international trade in goods and financial assets and provides a framework to analyze the effect of exchange rate

fluctuation on economic activities in a small open economy. The MFM postulates that the effect of exchange rate depends on the particular exchange rate regime that the country operates. In a system of flexible exchange rates, central banks allow the exchange rate to be determined by market forces alone. An increase in money supply shifts the Liquidity of Money (LM) curve to the right. This directly reduces the local interest rate relative to the global interest rate. This leads to increase capital outflow which will lead to an increase in the real exchange rate, ultimately leading to increase in exports, decrease in imports and overall increase in income. Under the fixed exchange rate system, the central bank operates in the foreign exchange market to maintain a specific exchange rate.

Review of the Performance of the Nigerian Manufacturing Sector

The manufacturing sector was performing with satisfactory growth levels from 1970 to 1980. Figure 2 also shows that this early statisfactory performance extended to 1981 and 1982 when manufacturing output recorded about 10% and 12% of the GDP respectively.

Figure 2. Performance of the Nigeria Manufacturing Sector from 1981-2018.



Source: Estimated by the Researcher using EVIEW 10.1

However, after that phase there was a sharp decline in the growth and profitability of the Nigerian manufacturing sector. Manufacturing output slumped to 8% and 7% of the RGDP in

1983 and 1984 respectively. After 1983, the negative effects of the oil price collapse in the international oil market can be clearly seen on the sector's performance. Due to that global oil crisis, the revenues of the Nigerian government sharply declined which resulted in reduction in foreign exchange earnings. This in turn forced the government to take several initiatives with the intention of strictly controlling its trade. There were several import duties enacted in the form of import licenses and tariffs, and some quantitative restrictions were also imposed on the importation of certain items. One of the goals of such restriction was to boost manufacturing output. However, manufacturing output continued to decline getting to its all-time low of 6% of RGDP in 2004. Since then, the output has been struggling to increase significantly.

Empirical Literature Review

Opaluwa, Umeh and Ameh (2010) examined the impact of exchange rate fluctuations on the Nigerian manufacturing sector during a twenty (20) year period (1986 – 2005). The argument is that fluctuations in exchange rate adversely affect output of the manufacturing sector. In the OLS model that was used, manufacturing output was used as the dependent variable while exchange rate, employment rate and foreign private investment were used as the explanatory variables. The result of the regression analysis shows that exchange rate has adverse effect on manufacturing activities in Nigeria.

Ehinomen and Oladipo (2012) examined the impact of exchange rate management on the growth of the manufacturing sector in Nigeria. Ordinary Least Square (OLS) multiple regression analysis was employed. The study covered the periods of 1986-2010 with the use of time-series data. The empirical result of this study shows that depreciation has no significant relationship with the manufacturing's sector productivity. It was found that in Nigeria, exchange rate appreciation has a significant relationship with domestic output. And that exchange rate appreciation will promote growth in the manufacturing sector.

Enekwe, Ordu and Nwoha (2013) sought to ascertain the effects of exchange rate fluctuations on manufacturing sector in Nigeria over a period of 25 years (1985 – 2010). The study employed four (4) variables such as manufacturing gross domestic product, manufacturing foreign private investment, manufacturing employment rate and exchange rate. Manufacturing gross domestic product stands as dependent variable while, manufacturing foreign private investment, manufacturing employment rate and exchange rate as independent variables. The time series data were analysed using OLS technique. The results of the analysis showed that, manufacturing foreign private investment, manufacturing employment rate and exchange rate have significant and positive relationship with manufacturing gross domestic product.

Tams-Alasia, Olokoyo, Okoye and Ejemeyovwi (2018) examined the impact of exchange rate deregulation on manufacturing output performance in Nigeria over the period 1980 to 2016. The normalized cointegration technique was used to test for long-run relationship between exchange rate and manufacturing output while the granger causality test was used to ascertain the direction of causality between them. Also, the error correction mechanism (ECM) was used to calculate the speed of adjustment of the model to short-run disequilibrium condition. The empirical findings revealed that exchange rate has non-significant positive long-run effect on manufacturing industry output. However, unidirectional causal impact of exchange rate on manufacturing output was established using the pairwise granger causality test.

Justification for the Study

The reviewed literature on exchange rate volatility and manufacturing industries nexus utilized either the real exchange rate or nominal exchange rate as a measure of exchange rate volatility. But as contended by Eze and Igbanugo (2017) and Engel (2003), exchange rate volatility is not the same as exchange rate. Volatility is the measure of the amount of randomness in an asset return at any particular time. Thus, results obtained from such proxies could be interpreted for exchange rate and not exchange rate volatility. To circumvent this flaw, we used GARCH framework to extract volatility series for onward estimations. According to Greene (2003), the GARCH model would not only generate unbiased and efficient estimates in the face of heteroscedasticity, but also predict the persistency of the observed volatility.

METHODOLOGY

Mundell-Fleming Model (MFM) was adopted as the theoretical framework for this study. This was adopted for several reasons. As argued by Opaluwa et al (2010), MFM has been a workhorse macroeconomic analytical framework for studying the interaction between exchange rate and economic outcomes. The MFM framework is also preferred because of its flexibility. It integrates both the open economy and domestic economic outcome.

Model Specification

Following Boug and Fagereng (2010), Nazlioglu (2013) and Pino, Tas and Sharma (2016), a multivariate vector autoregressive model is specified as follows:

$$V_t = \omega_i + \sum_{i=1}^{k} A_i V_{t-1} + \varepsilon_t \quad 3.1$$

Where; V_t represents vector of predicted variables such that V= aggregate manufacturing (AMO), oil-related manufacturing output (OMO), non-oil related manufacturing output (NOMO), exchange rate volatility (ERV), exchange rate (ER), domestic investment (DI), price level (PRIL),

oil price (OILP) and interest rate (INT). ω_i *and* A_i are vectors of parameter estimates; ε_t is the vector of usual stochastic error term.

From equation 3.1, the specific equation in VAR specification was estimated:

$AMO_t = \omega_1 + \alpha_1 AMO_{t-1} + \alpha_2 OMO_{t-1} + \alpha_3 NOMO_{t-1} + \alpha_4 ERV_{t-1} + \alpha_5 ER_{t-1} + \alpha_6 DI_{t-1} + \alpha_7 INT_{t-1} + \alpha_8 PRIL_{t-1} + \alpha_9 OILP_{t-1} + \varepsilon_{1t}$ 3.2

Where*; α, β and π are slope parameter estimates,* $\omega_1 \omega_2$ *and* ω_3 *are intercept parameters.*

The estimation techniques used in this study are VAR and GARCH. Procedurally, the unit root properties of the series were first investigated, followed by the co-integration and the error correction model.

Description of Data

The data for this study is a quarterly time series data ranging from 1986 to 2018. The choice of this period is based on the fact that the period is characterised by significant movement in naira exchange rate and significant changes in the performance of manufacturing sector in Nigeria.

ANALYSIS AND RESULTS

Unit Root Test Analysis

The test of stationarity was conducted using Augmented Dicker Fuller (ADF) unit root test procedure and Phillips Perron test (PP).

Table 1. Results of ADF and Philip-Perron unit root test

	ADF Test		**Philip-Perron Test**	
Variable	ADF statistics	Order of Integration	PP statistics	Order of Integration
AMO	-6.7518***	I(1)	-6.0568***	I(1)
OMO	-7.2584**	I(0)	-7.3313***	I(0)
NOMO	-3.9458**	I(1)	-3.9403***	I(1)
ER	-6.7484***	I(1)	-6.8938***	I(1)
OILP	-4.9018***	I(1)	-4.0369***	I(1)
DI	-5.4332**	I(1)	-5.8190***	I(1)
INT	-4.4871***	I(1)	-5.7526***	I(1)
PRIL	-7.2205**	I(1)	-7.0209***	I(1)
Critical	1% level	-3.632900		
values	5% level	-2.948404		
	10% level	-2.612874		

*,** and *** indicate 10%, 5% and 1% significance level.

Source: Estimated by the Researchers using EVIEW 10.1

The table above indicates that aggregate manufacturing output growth (AMO), non-oil related manufacturing output growth (NOMO), exchange rage (ER), oil price (OILP), domestic investment (DI), interest rate (INT) and price level (PRIL) were integrated of order one I (1). Oil-related manufacturing output growth (OMO) was stationary at level. The result corroborates Gujarati (2004) assertion that time series are realization of stochastic processes.

The Bound Test Analysis

Given that the series were not integrated of the same order, Johansen maximum likelihood procedure and Engel Granger Residual-based cointegration may not generate efficient outcome (Kim & Schmidt, 1993). Consequently, ARDL procedure was employed.

Table 2. Bounds test result (with intercept and trend)

F-statistic	5% Critical Value		1% Critical Value	
	I(0)	I(1)	I(0)	I(1)
8.056522	4.94	5.73	6.84	7.84

Source: Estimated by the Researchers using EVIEW 10.1

The result of the ARDL bound test is shown in Table 2 above. The f-statistic of 8.06 is above the upper bound (5.73) at 5% significant level. This suggests that the time series are cointegrated. That is, there is long run relationship between manufacturing sector GDP growth and components of international trade.

Error Correction Model

The error correction model was estimated to ascertain how the variables adjust to long run equilibrium through short run dynamics.

Table 3. Summary of result of Error Correction

Error Correction:	Aggregate manufacturing output growth (AMO)	Oil-related manufacturing output growth (OMO)	Non-oil related manufacturing output growth
Error correction term	- 0.365830	-0.540206	-0.099904
t-stat	-2.16585	-4.18835	-3.37059
Remark	Negative and Significant	Negative and Significant	Negative and Significant

Source: Estimated by the Researchers using EVIEW 10.1

The result of vector error correction procedure showed that deviations in the short run among the cointegrated processes are correlated in the long run to attain a stable equilibrium. The error correction terms (ECTs) are - 0.365830, -0.540206 and -0.099904 for aggregate manufacturing output, oil-related manufacturing output and non-oil related manufacturing output respectively. The statistical significance of the negatively signed error correction term (ECT) further lends credence to the co-integration among the variables under investigation. The magnitude of the ECTs also suggest that 36%, 54% and 10% of the disequilibria in aggregate manufacturing output, oil-related manufacturing output and non-oil related manufacturing output respectively are correlated in the current period. This further indicates that the speed of adjustment for oil-related manufacturing output is moderate.

A GARCH model of exchange rate volatility

To obtain the volatility series, we estimated the following mean and variance equation of nominal exchange rate within the framework of GARCH (1.1):

Mean Equation: $\mathrm{ER_t} = \alpha_0 + ER_{t-1} + u_t$ 3.3

Conditional Variance Equation: $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$ 3.4

The result of equation 3.3 and 3.4 estimated using GARCH (1.1) is presented in Table below.

Table 4. GARCH model of nominal exchange rate volatility

Variable	Coefficient	Std. error	z-statistics	Prob
ER(-1)	0.9882	0.0158	65.523	0.0000
C	0.0995	0.0116	8.61	0.0000
		Conditional Variance		
arch (1)	1.0310	0.1298	7.94	0.0000
garch (1)	0.0206	0.0053	3.85	0.0000
C	0.0004	0.00007	5.38	0.0000

Source: Estimated by the Researchers using EVIEW 10.1

Thus, a combination of AR (1) and GARCH (1, 1) model yields the equation below:

$ER_t = 0.099 + 0.988ER_{t-1}$

$\delta_t^2 = 0.0004 + 1.031\varepsilon_{t-1}^2 + 0.0206\delta_{t-1}^2$

From the Table above, it can be noted that the GARCH (1) parameter (0.0206) is about zero while the ARCH (1) parameter (1.03102) is about one and the sum of the two parameters (1.0516) is greater than one. Moreover, the table also shows that the sum of the two estimated ARCH and GARCH coefficients is larger than one, suggesting that the conditional variance is an

explosive process. The test results show that volatility in the exchange rate was not only significant but also persistent in Nigeria over the study period. We therefore use predicted values of variance from the GARCH model as our measure of exchange rate volatility.

Impact of Exchange Rate Volatility on Aggregate Manufacturing Output

Table 5 below shows that exchange rate volatility entered the model with negative coefficient. The coefficient of exchange rate volatility is -0.136. This indicates that one unit increase in volatility leads to 0.14 unit decline in manufacturing output growth.

Table 5. Summary of VAR output for impact of exchange rate volatility on aggregate manufacturing output

Dependent Variable: Aggregate manufacturing output growth			
Variables	Coefficients	Standard Error	t-statistic
Oil related manufacturing output growth	-0.868427	0.51085	-1.69996
Non-oil related manufacturing output growth	0.603025	0.54802	1.10037
Exchange rate	-0.704783	0.74459	-0.94654
Exchange rate volatility	-0.135767	0.03934	-3.45062
Price level	-0.023078	0.01888	-1.22245
Domestic investment	0.063509	0.23621	0.26887
Interest rate	0.090043	0.09556	0.94226
Oil price	3.509756	1.52038	2.30848
Constant	-482.9125	198.799	-2.42915
R-squared	0.931076		
Adj. R-squared	0.906264		
S.E. equation	0.003689		
F-statistic	37.52445		

Source: Estimated by the Researchers using EVIEW 10.1

Similarly, one unit increase (or depreciation) in naira exchange rate leads to 0.70 units decline in manufacturing output growth. Also, while investment, interest rate and oil price are positively related with manufacturing output, general price level is negatively related with manufacturing output growth.

Statistical and Econometric Evaluation

Statistical criterion evaluates the robustness of the regression parameters using $R^2$and F-statistics. A model is said to have a good fit if the $R^2 \geq 0.50$. The values of R^2 shows that the

explanatory variables explained 93%, 97% and 98% of the variation in aggregate manufacturing output growth, oil-related manufacturing output growth and non-oil related manufacturing output growth respectively. Furthermore, the f-reported for aggregate manufacturing output growth, oil-related manufacturing output growth and non-oil related manufacturing output growth are 37.52, 83.04 and 110.63 respectively. This implies that all the equations of our model are statistically significant and robust.

VAR stability test

Since VAR estimates are adjudged invalid if the VAR model is not stable, the study implemented VAR stability test using the inverse roots of the characteristic AR polynomial of the VAR processes. The estimated VAR was stable since all roots have modulus less than one and lie inside the unit circle.

Table 6. Residual diagnostic test

S/N	Tests	F-Statistics	Prob.
1	Breusch-Godfrey Serial Correlation LM Test	0.295117	0.7470
2.	Heteroscedasticity Test	0.019256	0.8905
3.	VAR Normality: Jaque-bera statistic	0.629262	0.2036

Source: Estimated by the Researchers using EVIEW 10.1

Diagnostic tests were conducted to examine the plausibility of the model.. The result of Breusch-Godfrey Serial Correlation LM test shows that there is no serial correlation in the estimated model since the probability of the F-statistic (0.7470) is greater than the 5% significance level. The heteroscedasticity test using the Heteroscedasticity ARCH test approach shows that there is no heteroscedasticity in the estimated model since the probability value of the F-statistic (0.8905) is greater than 5% significance level. Finally, given the joint Jaque-bera statistics of 0.629 with probability of 0.2036, the null hypothesis cannot be rejected. Thus, we conclude that the residual is normally distributed.

CONCLUSION AND RECOMMENDATIONS

The main objective of this study was to ascertain the impact of exchange rate volatility on manufacturing output in Nigeria. The GARCH (1.1) model was employed to ascertain the prevalence of volatility clustering and to extract volatility series. The estimates obtained showed that there is volatility clustering associated with exchange rate. Based on Mundell-Fleming framework, we estimated a VAR model to ascertain the effect of exchange rate volatility on

manufacturing output between 1981 and 2016. The results obtained from the VAR estimation showed that exchange rate volatility has significant negative impact on manufacturing output. Volatility engenders uncertainty which can cause investment paucity thereby slowing production. Therefore, exchange rate volatility can complicate the situations in the forex market and engender price effects which that could affect demand for manufacturing output.

Given that the key finding of this study shows that exchange rate volatility or shock has significant negative effect on firms' output. In view of possible currency volatility management decisions, firms with significant exchange rate exposure need to mitigate the risk associated with such exposure. To this effect, the study recommends for firms to identify the types of exchange rate risk that it is exposed to and measurement of such associated risk exposure. There is also need for firms to develop exchange rate volatility risk management strategy in order to hedge against volatility. Finally, the central bank is expected to improve in its regulatory and management role of the economy to ensure the achievement of macroeconomic goal of exchange rate stability.

Given that firms are severely affected by exchange rate volatility, this research recommended that appropriate exchange risk management strategy such as hedging should be adopted. However, evaluation of optimal risk management strategy and measurement of risk exposure was outside the scope of this study. Therefore, further studies are recommended to be carried out on exchange rate risk measurement and management.

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