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Exchange Rate Volatility and Manufacturing Sector Performance in Nigeria: A dynamic Approach

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ABSTRACT

Exchange rate instability has been a defining feature of Nigeria's economy especially in relation to international competitiveness and domestic output. This paper examines the dynamic effects of exchange rate volatility on the performance of Nigeria's manufacturing sector, a key engine of industrialization and employment. Using annual data spanning 1970–2024 from the Central Bank of Nigeria, we employ a Vector Error Correction Model (VECM) and a Bi-variate GARCH framework to capture both short-run dynamics and long-run volatility spillovers between exchange rates, price levels, and manufacturing output. The results indicate that exchange rate volatility exerts a significant and negative impact on manufacturing performance. In the long run, a 1 percent increase in volatility reduces manufacturing output by about 8.6 percent while short-run effects are immediate and also adverse. Volatility transmission analysis reveals that exchange rate shocks spill over to both manufacturing output and aggregate prices, suggesting that currency instability undermines industrial performance partly through inflationary pressures. These findings highlight the structural vulnerabilities of Nigeria's manufacturing sector and reinforce the importance of strong exchange rate management policies along with stable macroeconomic policies as the major tools for promoting manufacturing industrial growth. Strategies that prioritise domestic input sourcing can also aid in minimizing the negative impacts of exchange rate shocks in the long run. The paper concludes that restoring exchange rate stability and reducing dependence on imported inputs are critical to positioning the sector as a driver of sustainable economic diversification.

1. INTRODUCTION

Exchange rate movements constitute one of the most important macroeconomic variables influencing economic activity especially in open economies that are deeply integrated into the global trading system. For developing countries such as Nigeria, where industrial production is heavily reliant on importation, the volatility of the exchange rate has far-reaching implications for production, costs and overall firm performance. In particular, fluctuations in the naira-dollar exchange rate directly shape the cost of imported non-labour inputs as well as investment decisions and profitability within Nigeria's manufacturing sector (Nwikina et al, 2025; Cookey & Oladosu, 2023). Since the manufacturing industry contributes significantly to employment creation and overall economic growth, understanding the implications of exchange rate volatility on its performance is critical for both policymakers and private sector stakeholders.

Exchange rate is essentially the price of one currency expressed in terms of another (European Central Bank – ECB, 2016). It establishes the link between domestic and foreign prices of goods and services, and by doing so, transmits global shocks into domestic economies. An appreciation of the domestic currency lowers the domestic cost of imports while potentially reducing export competitiveness, whereas depreciation has the opposite effect. For a country such as Nigeria, which depends extensively on imported industrial inputs, persistent depreciation or erratic fluctuations of the naira elevate the cost of production, reduce profit margins, and

often lead to higher consumer prices. Conversely, exchange rate instability also creates uncertainty, which undermines investment planning and long-term industrial strategies.

The Nigerian experience with exchange rate management is historically rooted in the introduction of the Structural Adjustment Programme (SAP) in 1986. Prior to SAP, Nigeria operated under a relatively fixed exchange rate system, sustained by oil revenue inflows and an import substitution industrialization strategy. However, mounting external imbalances, dwindling oil receipts, and fiscal crises necessitated reforms that saw the adoption of a market-determined exchange rate regime. While SAP aimed to restructure and diversify the productive base of the economy, reduce dependence on oil exports, and correct balance of payments disequilibria (Uwubanmwen & Eromosele, 2011), its most enduring outcome has been persistent depreciation and volatility of the naira. From the mid-1980s onwards, the naira has been on a downward trajectory against major foreign currencies, with volatility creating uncertainty in the business environment and exposing domestic investors to considerable risks (Ayobami, 2019). Despite repeated policy efforts, including devaluations intended to stimulate exports, the goal of exchange rate stability has remained elusive (Kurotamu-Nobaromi et al, 2020).

The consequences for the manufacturing sector have been profound. Manufacturing is widely regarded as a cornerstone of sustainable economic growth because of its ability to generate productivity gains, provide employment opportunities, strengthen inter-sectoral linkages, and enhance foreign exchange earnings through exports (Abdullah, 2016). In developed economies, manufacturing often drives industrialization through technological innovation, import substitution, and export expansion. In Nigeria, however, the sector remains under-industrialized, with low capacity utilization, high dependence on imported inputs, and vulnerability to exchange rate shocks. Exchange rate volatility not only raises the cost of production but also discourages long-term investment, constrains competitiveness, and reduces the ability of firms to scale operations. The persistent reliance on foreign inputs leaves domestic industries exposed to external currency fluctuations, thereby undermining their performance and by extension the country's economic growth trajectory.

Empirical evidence on the effect of exchange rate volatility on manufacturing performance in Nigeria remains inconclusive. Several studies, including Ugwu (2017), Nwikina et al (2025) and Cookey and Oladosu, 2023) report statistically significant positive relationships which suggest that volatility influences trade flows and firm outcomes. Conversely, other research such as Ikechukwu (2016), Lawal et al (2016), Adeniran et al (2014), and Orji and Ezeanyaeji (2022) find positive but statistically insignificant effects, raising questions about the consistency and robustness of the link between exchange rate volatility and manufacturing sector performance. These divergent findings highlight the complexity of the exchange rate–manufacturing nexus in Nigeria, where multiple structural and institutional factors—ranging from infrastructural deficiencies and power supply challenges to inflation and policy inconsistency—interact with currency volatility to shape firm outcomes.

Given Nigeria's ongoing efforts to diversify away from its oil-dependent economy, the manufacturing sector is increasingly being positioned as a driver of sustainable growth. However, for this vision to materialize, it is imperative to understand how exchange rate volatility shapes manufacturing sector performance both in the short run and the long run. The issue is particularly salient in the context of recurrent recessions, oil price shocks and global economic uncertainties. This study therefore examines the effect of exchange rate volatility on the performance of the manufacturing sector in Nigeria. The aim is to evaluate the direct and dynamic effects of exchange rate volatility on manufacturing as well as the transmission outcomes of the relationships. By addressing these objectives, the study aims to contribute to the ongoing debate on the role of exchange rate stability in promoting industrial growth and to provide evidence-based recommendations for policymakers seeking to create a stable and competitive manufacturing environment in Nigeria.

2. LITERATURE REVIEW

The empirical studies relating to the effect of exchange rate volatility on performance of the manufacturing sector in Nigeria have depicted varying outcomes. For instance, Enekwe, Ordu, and Nwoha (2013) examine the effect of exchange rate fluctuation on manufacturing sector in Nigeria using secondary data for the period of 25years (1985-2010). The results of the analysis showed that all the independent variables have significant and positive relationship with dependent variable thereby saying that exchange rate fluctuation have a positive relationship with manufacturing firms in Nigeria and statistically significant. In the same vein, Amadi, et al (2018) examine the impact of exchange rate fluctuation on manufacturing sector in Nigeria and found a significant positive impact and shows that exchange rate fluctuation weakens manufacturing in Nigeria.

Similarly, Asaolu (2011) employed secondary data of 117 quoted companies in Nigeria both financial and non-financial sector covering the period of 10 years (1998-2007) to examine the exchange rate risk exposure on Nigeria listed firms. The result reveal that Nigerian listed firms are generally exposed to adverse exchange rates risks of the three currencies under investigation, with a higher magnitude of exposure to the US dollar. The study further investigated differences in exposure by financial and non-financial sector firms. The results failed to indicate any significant differences in pattern of exposure between the financial and non-financial firms, thus providing no evidence to support the thesis that financial firms possess requisites to hedge exchange rates risks. Applying the GARCH methodology for estimating volatility, Apere and Karimo (2015) also showed that whereas exchange rate expectation has positive impact on stock returns the impact of exchange rate volatility was statistically not significant.

Ayobami (2019), also examined the impact of exchange rate on the performance of the manufacturing sector in Nigeria and indicated that the volatility has a significant negative outcome on long run manufacturing sector performance in the country. Ikechukwu (2016), empirically examined exchange rate volatility and firm's performance in Nigeria using a Dynamic Panel Regression Approach, examining cross sectional data for the most active 20 companies listed on the Nigerian Stock Exchange. It employed secondary data spanning from 2004 to 2013. The empirical investigation develops three dynamic panel models that account for heterogeneities among the companies and it extends recent research by allowing international investors and corporations to base their investment decisions on the exchange rate volatilities between the Nigerian Naira and their home country currencies. The results show that exchange rate volatility has significant negative impacts on the rate of return on assets, asset turn ratio and the portfolio activity & resilience, thus, showing the significant negative impact of exchange rate volatility on firm performance in Nigeria.

According to the study of Lawal (2016), that examined the effect of exchange rate fluctuations on manufacturing sector output in Nigeria with secondary data spanning from 1986 to 2014, a period of 28 years and it was analyzed through the multiple regression analysis using Autoregressive Distribution Lag (ARDL) to examine the effect of exchange rate fluctuations on manufacturing sector. Using ARDL it was discovered that exchange rate fluctuations have long run and short run relationship on manufacturing sector output and the overall result showed that exchange rate has a positive relationship on manufacturing sector output but not significant. That is, empirically exchange rate is positively related to manufacturing sector output in Nigeria.

In the study of Ugwu (2017) that examines foreign exchange rate dynamics and manufacturing firm's performance in Nigeria using firms' profitability as a proxy for performance within the periods 1986 to 2016 with a secondary data. The estimation technique adopted for the study was multiple regression method based on Ordinary Least Squares technique. However, in order to avoid the incidence of spurious estimates, evidence from the ADF test conducted revealed that the variables are integrated of order two. The Johansen test conducted showed evidence of long run equilibrium relationship between Exchange rate fluctuation and the profitability of manufacturing firms in Nigeria. Findings show that there is positive and a statistically significant relationship between Exchange rate fluctuations and the profitability of manufacturing firms in Nigeria.

More recent studies also revealed varied outcomes. For instance, Nwiniki (2025) examined the effect of exchange rate on the performance of manufacturing industry between 1985 and 2022 using the error correction model (ECM) approach. They found that real exchange rate has a substantial unfavourable effect on manufacturing sector GDP in Nigeria, indicating that exchange rate depreciation significantly weakens the manufacturing sector in Nigeria. In terms of volatility, Cookey and Oladosu (2023) examined the effect of exchange rate volatility on the performance of manufacturing sector in Nigeria from 1985 to 2022 and found that volatility of the naira significantly and negatively affects the manufacturing sector contribution to GDP in Nigeria. Similarly, Oseni et al employed the AR(k)-EGARCH(p,q) models for the calculation of volatility in the growth rate of nominal exchange rates and estimates the effects on industrial output in Nigeria. They found that the real exchange rate volatility determines industrial production in Nigeria.

3. METHODOLOGY

3.1 Model Specification

The pattern of investigation in this study indicates that a function that relates manufacturing sector performance to exchange rate volatility is devised. Based on the theoretical framework provided in the previous chapter, a model of this structure will include the real naira exchange rate to the dollar and the index of industrial production. This involves the application of government expenditure since we assume that the main aspects of oil price effect on the manufacturing sector also involves the pattern of government spending. The hypotheses of the study necessitate the adoption of the two methodologies in the study.

3.1.1 Volatility and Spillover Effects Model (Univariate and Bi-Variate GARCH Models)

According to the empirical literature, the information flow between an international market factor (such as exchange rate) and domestic factor (manufacturing sector performance) may not be significant and visible when correlation in the first moment are used in the analysis; however, it may have a high volatility effect (correlation in the second moment). Volatility has been considered a better proxy of information by Ross (1983). The ARCH model, which was developed and generalized by Bollerslev (1986), is one of the most popular methods for modeling the volatility of high-frequency financial time series data.

In this study, we consider the multivariate GARCH model for investigating the relationship between volatility in oil prices and industrial output. Following Mensi et al. (2013) the Bi-Variate GARCH model will be used in the estimation to allow for a focus on the interdependence of the conditional changes, conditional volatility and conditional correlations between the exchange rate volatility and manufacturing output in Nigeria. This is the method that is adopted in this study. The conditional mean equation of the Bi-Variate GARCH (1, 1) system is given by:

$$Y_t = c + \Phi T_{t-1} + \varepsilon_t \quad (1)$$

$$\varepsilon_t = h_t^{\frac{1}{2}} \eta_t \quad (2)$$

where Y_t refers to the main variables in the study including manufacturing output (*man*), real exchange rate (*exrt*), and domestic price level (*cpi*). $\varepsilon_t = \left(\varepsilon_t^{lman}, \varepsilon_t^{lcpi}, \varepsilon_t^{lexrt}\right)$, where ε_t^{lman}, ε_t^{lcpi} and ε_t^{lexrt} are the residual of the mean equations for industrial output, oil price volatility and exchange rate respectively. $\eta_t = (\eta_t^{lman}, \eta_t^{lcpi} \eta_t^{lexrt})$ refers to the innovation and is an iid distributed random vector (see Mensi, 2013). $h_t^{\frac{1}{2}}$ is a diagonal matrix containing the conditional variances of $lman_t$, $lgexp_t$ and $lexrt_t$ respectively. These variances may be respectively represented as $\left(h_t^{lman}, h_t^{lcpi}, h_t^{lexrt}\right)$. Thus, based on the multivariate GARCH analysis, the associated variance equations for the three variables are given as:

$$h_t^{lman} = C_{lman} + \alpha_{lman}(\varepsilon_{t-1}^{lman})^2 + \beta_{lman} h_{t-1}^{lman} + \alpha_{lgexp}\left(\varepsilon_{t-1}^{lcpi}\right)^2 + \beta_{lgexp} h_{t-1}^{lcpi} + \alpha_{lextr}(\varepsilon_{t-1}^{lexrt})^2 + \beta_{lexrt} h_{t-1}^{lexrt} \quad (3.3)$$

$$h_t^{lcpi} = C_{lcpi} + \alpha_{lcpi}\left(\varepsilon_{t-1}^{lcpi}\right)^2 + \beta_{lcpi} h_{t-1}^{lcpi} + \alpha_{lman}(\varepsilon_{t-1}^{lman})^2 + \beta_{lman} h_{t-1}^{lman} + \alpha_{lexrt}(\varepsilon_{t-1}^{lexrt})^2 + \beta_{lexrt} h_{t-1}^{lexrt} \quad (3.4)$$

$$h_t^{lexrt} = C_{lexrt} + \alpha_{lextr}(\varepsilon_{t-1}^{lexrt})^2 + \beta_{lexrt} h_{t-1}^{lexrt} + \alpha_{lman}(\varepsilon_{t-1}^{lman})^2 + \beta_{lman} h_{t-1}^{lman} + \alpha_{lcpi}\left(\varepsilon_{t-1}^{lcpi}\right)^2 + \beta_{lcpi} h_{t-1}^{lcpi} \quad (3)$$

Equations (3.3) to (3.5) show how volatility is transmitted over time across manufacturing output, government expenditure, and exchange rate. The cross value of the error terms $(\varepsilon_{t-1}^{lman})^2$, $\left(\varepsilon_{t-1}^{lcpi}\right)^2$ and $(\varepsilon_{t-1}^{lexrt})^2$ represent the volatility innovations in the exchange rate across the corresponding government expenditure and manufacturing output at time (*t-1*) and represents the ARCH effect of past shocks, which captures the impact of the direct effects of shock transmission. The presence of h_{t-1}^{lman}, h_{t-1}^{lcpi} and h_{t-1}^{lexrt} captures the volatility spillovers or interdependencies between real exchange rate and the domestic factors. These variables show the GARCH effects of past volatilities.

Based on the model shown above, the past shock and volatility of exchange rate are allowed to impact the future volatilities of the manufacturing sector performance (primarily via price level distortions) in addition to its own future volatility. This model will also enable us estimate the conditional covariances between exchange rate volatility and manufacturing sector performance in Nigeria.

3.1.2 The Autoregressive Model

Since the three variables included in the analysis all seem to be endogenous in the relationships, a Vector autoregressive scheme is adopted as the more appropriate means of identifying the dynamic linkages between them. Thus, we adopt the Vector Error Correction Method (VECM) for the analysis. The system of equations representing the short run relationships which is estimated in the Johansen method is a vector error correction model (VECM) derived from a standard unrestricted vector autoregressive model (VAR) of lag length *k*. The VAR system of equations can be algebraically re-arranged into a VECM, written as:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \cdots + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + \mu + \varepsilon \quad (4)$$

where z_t is the vector of variables (here *man*, *cpi* and *exrt*) and μ is a vector of constants. The first group of terms on the right-hand side of (1), up to and including z_{t-k+1}, represents the short run lagged effects of differences in the three variables in *z*, or Δz, on each variable in the system.

The next term, Πz_{t-1}, is the error correction term (ECT) that represents the long run cointegrating relationships between the levels of the variables in *z*. As all three variables are non-stationary, there should be more than one cointegrating relationships between them (Guest and Swift, 2008), with the number of cointegrating relationships given by the rank (*r)* of the matrix of long run coefficients *Π.* If at least one cointegrating relationship exists, *Π*can be factorised into *Π*= αβ' where β' is the coefficients on the individual variables in the long run or cointegrating vectors, and α is the coefficient on the ECT itself, which represent the speed of adjustment to disequilibrium (Johansen and Juselius 1990).

3.2 The Data

Data used in the study are annual time series data that covers the period 1970 to 2024. The data are all sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin. The use of a long time series is quite justified since the analysis involves dynamic implications in which long period data provide more robust outcomes.

4. EMPIRICAL ANALYSIS

4.1 Descriptive Statistics

The descriptive statistics of the variables used in the analysis are also reported in Table 1. The average exchange rate volatility over the period was 16.609 percent, which is quite high and indicative of wide variations in the naira exchange rate over short periods of time. The maximum value of 75.4 percent also confirms the extreme nature of exchange rate fluctuations in Nigeria over time. Moreover, the standard deviation is less than the mean value, which implies that the reported mean volatility value was rather well spread over the years in the study. The volatility variable also fails the significance tests in the J-B tests result, suggesting high normality of the data series. This again indicates that there were periods of smooth exchange rate movement in Nigeria since 1970

were rare. Average exchange rate value is N106.84 to the dollar, which is also a very high average value over the period. There is however a huge difference between the maximum and minimum values, with a high standard deviation, indicating that the exchange rate over time has no remained smooth.

Table 1: Descriptive Statistics

Variable	Mean	Max.	Min.	Std. Dev.	Skew	Kurt.	J-B	Prob.
EXRT	106.84	381.0	0.67	104.87	0.90	3.03	5.24	0.07
EXRV	16.609	75.4	0.684	14.636	2.106	8.218	73.066	0.000
MAN	4119.73	6684.22	2898.47	1260.50	1.01	2.50	7.11	0.03
GMAN	0.806	21.797	-29.030	11.055	-0.324	3.096	0.697	0.706
CPI	59.973	217.560	0.810	64.657	0.908	2.638	5.574	0.062

For manufacturing output, the average growth rate is 0.806 percent which is quite low. This implies that in most of the years, the manufacturing sector has grown at a lesser rate than the overall economic growth. The standard deviation also shows that there were periods of deep swings in the rate of growth of the manufacturing sector in Nigeria. Thus, given that the sector is considered a backbone for industrial development and overall economic growth over time, the manufacturing sector in Nigeria has experienced a poor performance since 1970.

4.3 Unit Root and Cointegration Analysis

Two tests of stationarity are employed in this study in order to analyze unit roots. The results are presented in levels and first difference. This enables us determine in, comparative terms, the unit root among the time series and also to obtain more robust results. Table 2 presents results of Augmented Dickey Fuller (ADF) and Philip-Perron (PP) tests in levels and first differences without taking into consideration the trend in variables. The reason for this is that an explicit test of the trending pattern of the time series has not been carried out. In all cases, the three variables in log form, *lman*, *lcpi* and *lexrt*, were non-stationary but their first differences were found to be stationary. That is, all variables (in log form) were I(1). It is therefore appropriate to use cointegration analysis to estimate the relationships between the variables, provided that the method chosen allows for the possible joint endogeneity of all three variables that as suggested by Guest and Swift (2008).

Table 2: Unit Root Test for Variables

Variable	ADF Test		Phillip-Perron Test		Order of Integration
	Levels	*First Difference*	*Levels*	*First Difference*	
Lman	-0.062	-3.69*	-0.137	-3.77*	I[1]
Lcpi	-1.203	-10.6*	-2.008	-12.7*	I[1]
Lexrt	-1.767	-8.55*	-1.981	-9.08*	I[1]

Note: indicates significance at 5 percent level

Having established that the series in the analysis are not stationary in their levels, we move on to determine if they are cointegrated. The results from the multivariate cointegration test are presented in Table 3 below. As can be seen from the table, both the λ-max and Trace test statistics indicate that the three series are cointegrated and there is one cointegrating vector.

Table 3: Multivariate Cointegration Test Results

Trace test				Max-Eigen (λ-max)			
Hypothesized No. of CE(s)	**Statistic**	**Critical Value**	**Prob**	**Hypothesized No. of CE(s)**	**Statistic**	**Critical Value**	**Prob.**
None *	35.153	29.797	0.011	None	20.747	21.132	0.057
At most 1	14.406	15.495	0.073	At most 1	9.893	14.265	0.219
At most 2 *	4.513	3.841	0.034	At most 2 *	4.513	3.841	0.034

****(**) denotes rejection of the hypothesis at 5% (1%) significance level*.**

4.4 The VECM Results

Since the variables are all cointegrated, Greene (2011) has demonstrated that the appropriate dynamic structure for the system analysis id the Vector Error Correction Mechanism (VECM). Hence, the VECM technique is used for the empirical estimation of the dynamic relationship between exchange rate volatility and manufacturing sector performance in Nigeria. "The VECM results provide information about the direction of the impact and the relative importance between variables that simultaneously influence

each other" (Adegboye, 2017). The results of the estimated error correction structure of the relationships are reported in Table 4. The results show the long run β coefficients on the individual variables in the error correction terms (ECTs) for the relationships as well as the adjustment coefficients of the individual equations. The values for the β provide information about the impact of exchange rate volatility on manufacturing sector performance in the long run in Nigeria. It should be noted that the Johansen cointegration test has confirmed that a long run relationship exists between exchange rate volatility and manufacturing sector performance.

Table 4: Long Run Coefficients of the VECM

	liip	*lopr*	*lexrtv*
coefficients of the errorcorrection term (ECT) – long run results	1.000	9.592*	-8.577**
	-	(2.438)	(-2.061)
Equations of the system:			
Dependent variable	Δ*lman*	Δ*linq*	Δ*lexrtv*
Coefficient on the ECT (α)	-0.015*	-0.005*	-0.008
	(-2.406)	(-2.149)	(-0.995)
R^2	0.244	0.594	0.101
LM test for autocorrelation of the system: p-value = 0.615			
Doornik-Hansen test for normality of the system: p-value = 0.757			

Following the usual structure of the analysis, the cointegrating vectors are all normalised on the coefficient of log of manufacturing performance (*lman*) to facilitate comparison of the relationship since this is the only variable that is shown as the basic endogenous variables. From the result in Table 4, it is seen that the coefficient of exchange rate volatility has a significant negative impact on manufacturing sector output, suggesting that over time, the volatility in exchange rates tend to reduce the output of the manufacturing sector in Nigeria. The results reveal that a 1 percent rise in exchange rate volatility tends to reduce manufacturing output by about 8.57 percent in the long run. On the other hand, a 1 percent increase in domestic causes manufacturing production to also rise by as much as 9.52 percentage points. These results therefore clearly show that long run growth in manufacturing output will be hampered by any fluctuation in exchange rates that persist for some time. Moreover, the coefficient on the ECT (α) is negative for each of the variables. Thus, each of the variables will adjust to any deviation from the long run equilibrium that may occur in the short term. The size of the ECT is however very low for each of the equations, which indicates that adjustment to long run equilibrium takes a very long term to materialized in the manufacturing sector, due to fluctuations in exchange rates and domestic price levels.

For the short run VECM results, the results are shown in Table 5 where the interactions among the variables in the long run are provided. In the first role of the Table the effects of the lags of manufacturing output and other variables on manufacturing output are presented. In the result, the second lag of manufacturing output has a significant positive effect on manufacturing output in Nigeria. Also, exchange rate volatility has a significant negative impact on manufacturing sector output both in the current and lagged coefficients. Thus, exchange rate volatility has both an immediate and delayed short run impact on manufacturing sector performance in Nigeria. Both the impacts are negative, suggesting that the first and second rounds of impact of exchange rates are effective in delaying manufacturing sector development. Thus, when the naira exchange rate fluctuates excessively, manufacturing activities appear to be hampered in the short run. Considering the results from the long run cointegrated results above, the study emphasizes that there are both short run and long run effects of exchange rate volatility on the manufacturing sector performance in Nigeria. Both of these effects are negative and debilitating.

The results in Table 5 also shows that exchange rate volatility has a significant positive impact on short run changes in price level in Nigeria with a delay of two periods. The result highlights the fact that volatility in the naira exchange rate not only intensifies manufacturing sector decline, it also leads increases in price levels in Nigeria.

Table 5: Short Run Dynamics based on the VECM

Dependent Variable	**$\Delta lman_{t-1}$**	**$\Delta lman_{t-2}$**	**$\Delta lcpi_{t-1}$**	**$\Delta lcpi_{t-2}$**	**$\Delta lexrtv_{t-1}$**	**$\Delta lexrtv_{t-2}$**
Δlman	0.029	-0.217*	-0.340	-0.226	-0.218*	-0.200*
	(0.247)	(0.031)	(0.119)	(0.611)	(0.050)	(0.049)
Δlcpi	-0.023	0.028	0.692**	-0.230*	-0.034	0.124**
	(0.910)	(0.338)	(0.000)	(0.047)	(0.427)	(0.001)
Δlexrt	-0.074	-0.164	0.016	-0.510	0.072	0.003
	(0.260)	(0.295)	(0.306)	(0.193)	(0.331)	(0.691)

Note: * and ** indicate significance at 5 percent and 1 percent respectively

The last aspect of the dynamic analysis of the effects of exchange rate volatility on manufacturing sector performance is the presentation of the Variance Decomposition results. The estimated equations of the VECM system were used to derive the Variance Decomposition shown in Table 6. "Variance Decomposition tells how much a given variable changes under the impact of its own shock and the shock of other variables". Apparently, the importance of each of the variables in the explanation of decomposition of the variances of the other variables are demonstrated through the variance decomposition. For the decomposition of manufacturing output, the results show that the determination of variances by other variables started after the first period. Exchange rate volatility had a very little effect in the explanation of variances in manufacturing output. Only the price level played significant roles in the variances that occurred in manufacturing output as demonstrated in the Table.

The decomposition of price levels show that exchange rate plays a very effective role in the explanation of price level variances over the period. Indeed, exchange rate volatility explained up to 39.6 percent of the variances in price level. This result suggests that exchange rate affects manufacturing sector output mainly through the price system in Nigeria. The decomposition of exchange rate shows that its own pattern of movement has a very strong role to play in its determination. On the other hand, manufacturing output played a relatively weak role in its determination.

Table 6: Variance Decomposition Results

Period	LMAN	LCPI	LEXRTV
Variance Decomposition of LMAN:			
1	100.000	0.000	0.000
4	85.548	12.543	1.909
8	76.645	22.104	1.251
10	73.367	25.595	1.038
Variance Decomposition of LCPI:			
1	0.703	99.297	0.000
4	2.374	83.834	13.792
8	5.501	58.699	35.800
10	6.285	54.082	39.633
Variance Decomposition of LEXRT:			
1	2.248	0.776	96.976
4	6.142	0.540	93.317
8	6.643	1.395	91.962
10	6.530	2.891	90.579

4.5 The Volatility Transmission Results

The results of the estimated Bi-variate GARCH model (used to show volatility transfer) using the Vector Conditional Heteroskedasticity (VECH) procedure is reported in Table 7 below. As mentioned in the previous chapter, volatility transmission from one variable to another is measured by considering the second moments of each of the variables. The VECH estimates report both the within-sample volatility and between variable volatility in the case of data in the series. As shown in the results, both persistence and cross effects relationships are reported for the variables. Only the coefficient of *exrtv* and *man* constants are significant; there no cross constant terms from the estimations provided. This indicates that manufacturing output and exchange rate volatility are more basic in the estimates. The z-values for the coefficient of the ARCH term for all the variables fail the significance test at the 5 percent level. This indicates that news from previous period do not actually affect the pattern of volatility of exchange rate as well as manufacturing output in Nigeria. The ARCH term for the cross variables are also not significant and show that news from previous periods do not tend to affect the pattern of interactions between the real exchange rate volatility and manufacturing sector performance in Nigeria.

Table 7: The Bi-Variate GARCH spillover Results

VECH Output	Coefficient	z-Statistic	Prob.
exrtv constant	0.031*	2.522	0.012
cpi constant	0.001	0.102	0.919
man constant	0.002*	2.004	0.045
exrtv ARCH term	1.011	1.698	0.089
Cross ARCH term (exrtv and cpi)	1.006	1.717	0.086
Cross ARCH term (exrtv and man)	1.045	1.801	0.072

lcpi ARCH term	1.002	1.735	0.083
Cross ARCH term (cpi and man)	1.040	1.818	0.069
lman ARCH term	1.079	1.853	0.064
Volatility persistence for man	0.238**	3.078	0.002
Volatiltiy spillover from exrtv to cpi	0.227**	3.168	0.002
Volatiltiy spillover from exrtv to man	0.128**	3.129	0.002
Volatility persistence for lcpi	0.217**	3.258	0.001
Volatiltiy spillover from cpi to man	0.122**	3.214	0.001
Volatility persistence for man	0.069**	2.959	0.003
exrtv constant	0.031*	2.522	0.012
cpi constant	0.001	0.102	0.919
man constant	0.002*	2.004	0.045

We focus on the GARCH terms which show persistence in volatility for the individual variables and transmission of volatility for the variables. The GARCH term passes the significance test for each of the variables and cross-interactions. This indicates that any volatility generated by exchange rates in Nigeria tends to persist both for manufacturing output and aggregate price levels. Apparently, these two variables have long lasting responses from the exchange rate fluctuations. The spillover terms each pass the significance test at the 1 percent level since its z-values are greater than the one percent critical value of 2.57. The results show that spill over from exchange rate volatility not only has a significant impact on both manufacturing output instability and the price level in Nigeria, it also causes volatility in these variables. Volatility in exchange rate tends to stimulate volatility in manufacturing output in Nigeria. From the result, a 1 percent increase in exchange rate volatility leads to a 0.128 percent rise in instability or the manufacturing sector in Nigeria. Thus, volatility transfer has been found to hold exchange rate-manufacturing output relationship in Nigeria. When the exchange rate market is under serious shock, the manufacturing sector performance also appears to be unstable.

5. CONCLUSION

The consequences of exchange rates on the real sector of the economy remain the major challenge for policy and other aspects of the macroeconomic management in Nigeria. In this study, the effects of exchange rate volatility on manufacturing sector performance in Nigeria is investigated. The study sought to provide empirical evidence on the dynamic nature of interactions between exchange rate volatility and manufacturing sector performance in Nigeria and also to show whether volatility transfer occurs between exchange rate and the manufacturing sector in Nigeria. Two methodologies were employed in the empirical analysis; first, the VECM technique was used to estimate the dynamic relationships among the variables, second the Bi-variate GARCH model were used to test for the relationships and to check if volatility in exchange rate are transmitted to manufacturing sector performance in Nigeria.

The study finds that exchange rate volatility has a significant short-term impact on manufacturing sector performance in Nigeria. From the results, the short run effect was shown to have both immediate and delayed negative impacts on manufacturing performance in Nigeria. It was also revealed that exchange rate volatility has a significant negative long run impact on manufacturing sector performance in Nigeria. Moreover, the result shows that the volatility in the naira exchange rates is effectively transmitted into volatility of manufacturing sector output in Nigeria. Finally, there is evidence that exchange rate volatility also has a channeled impact on manufacturing sector performance in Nigeria through the aggregate price system. The results suggested that exchange rate volatility can affect manufacturing sector performance by stimulating price levels in the country.

Given the debilitating and dynamic effects of exchange rate volatility on the manufacturing sector in Nigeria, there is need for the manufacturing sector to adopt measures to at least, limit the impact of exchange rate movements over time. Such measures would have to include exchange rate management techniques that will ensure sustainability of international financial transactions even when oil prices are down (or rising rapidly). Moreover, a good macroeconomic environment, especially in terms of stable price level should be created in aiding the stability of the manufacturing sector in Nigeria. This will also aid foreign investment into the manufacturing sector in Nigeria. Thus, consistent and stable policies are important in order to engender confidence in economic agents and assure foreign investors that government policies are credible and predictable.

In this direction, government can go into joint ventures with foreign investors in the manufacturing sector of economy. The joint ventures approach offers the foreign investors the best guarantee of the safety of his investments and the needed goodwill and the support of government. Although this joint venture agreement is rampant in the oil sector, its frequency with the other sectors like manufacturing has not been seen. Finally, in terms of the dependence on foreign sources for both government revenue and industrial input, there is need for a better industrial policy that aims at fostering domestic provision of basic raw materials for the industries. The industrial base will continue to shrink and experience losses if the main raw materials continue to be sourced from abroad.

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