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EXCHANGE RATE VOLATILITY AND AGRICULTURAL COMMODITY PRICES I NIGERIA (2000-2018)

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ABSTRACT

Exchange rate stability is one of the main factors that promote investment, price stability and stable economic growth. However, the effect of positive and negative changes in exchange rate has been a controversial debate among academia and experts. Thus, this study seeks to examine the effect of exchange rate volatility on agricultural commodity prices in Nigeria. Additionally, the study examines whether exchange rate volatility have a symmetric or asymmetric effect on agricultural commodity prices in Nigeria. In order to account for the volatility behaviour such as nonlinearity and time varying risk, the study used the Non-linear Autoregressive Distributed Lag (NARDL) model with monthly data for real effective exchange rate, agricultural output prices, inflation rate, and RGDP between 2000 and 2018. The study found that there is a positive and significant relationship between positive changes in exchange rate and agricultural commodity prices and also between negative changes in exchange rate and agricultural commodity prices. The study found that inflation rate has negative effect on agricultural commodity prices while RGDP has a positive effect on it. Asymmetric test using Wald Statistics revealed that positive and negative changes in exchange rate of the same magnitude have equal impact on agricultural commodity prices. The study concluded that movement of the exchange rate plays a significant role in altering the prices of agricultural commodity in Nigeria and the volatility effect is symmetric on agricultural commodity prices in Nigeria.

Contribution/Originality: This study contributes to the existing literature in terms of symmetric effect of exchange rate volatility on agricultural commodity prices. It uses Non-linear Autoregressive Distributed Lag (NARDL) model. The paper's primary contribution is finding that exchange rate volatility have positive and significant effect on agricultural prices while RGDP effects is positive.

1. INTRODUCTION

The agriculture and exchange rate dynamism is one of the key areas in a developing country where signals about the interconnected behaviour of real as well as financial sector participants are better examined. The share of agriculture in the economic activities of any developing economy is largely higher than 50%. In the same vein, such economy also depends significantly on foreign trade which is determined by exchange rate. In Nigeria, average household spends about 60% of their income on food which is mainly agricultural produces (Mgbenka, Mbah, & Ezeano, 2015). This underscores the importance of agriculture and agricultural commodity in the individual and

household expenditure in the country. By implication, the whole economy can be easily distorted by fluctuation or instability in the agricultural commodity prices. Also, uncertainty in the agricultural commodity prices has proportional influence in the rising food inflation in developing countries since the agricultural commodities constitute a larger proportion of such countries' output. That is, the food security of developing countries, depend largely on the agricultural output and its prices.

Many, if not all developing countries have experienced considerable exchange rate volatility in different phases of their growth and development. This exchange rate volatility often turns into a high degree of uncertainty for the two main monetary policy objectives of price stability and economic growth. Exchange rates volatility are associated with unpredictable movements in the relative prices in the economy. Evidences emerging from existing literatures showed that asymmetric effects of prices suggest that differential price risk depending on the direction of price movement and persistence of the price change stimulates price inflation, exchange rate instability, and low investment. For instance, price instability in the agricultural commodity market is the sum of responses to different types of shocks including exchange rate volatility (Ogundipe, Ojeaga, & Ogundipe, 2013). Invariably, exchange rate stability is one of the main factors that promote total investment, price stability and stable economic growth (Al-Samara, 2009). Nonetheless, the specific effect of the different shock pattern is unknown on the agricultural output prices in a developing country like Nigeria. Therefore, a deep knowledge of exchange rate volatility dynamics on agricultural commodity prices can have both intellectual and policy implications with a view to addressing instability in the agricultural commodity market and its attendant challenges in Nigeria and other low income countries. Specifically, the two main objectives of this study are to examine the relationship between exchange rate volatility and agricultural commodity prices and check whether exchange rate volatility have a symmetric or asymmetric effect on agricultural commodity prices in Nigeria. Notably, this study describes the opinions and data-based judgments of the authors.

Following the introductory section, the remaining sections of this study is structured as follows. Section two presents an overview of exchange rate volatility and agricultural commodity prices in Nigeria. Section three reviewed existing literatures relevant to the study while section four presents the methodology and data related issues of the study. Section five presents the empirical analysis of the study and the final section concludes and gives policy implications of the study.

2. OVERVIEW OF EXCHANGE RATE VOLATILITY AND AGRICULTURAL COMMODITY PRICES

The Nigerian economy is currently struggling with her recovery from recession which started in 2016 when the GDP grew negatively at -0.67, -1.49, -2.34 and -1. 73 percent during the first, second, third and fourth quarters of that year respectively. The country was stroke with stagflation (simultaneous occurrence of rising inflation, rising unemployment and declining demand for goods and services) and started to face its worst economic crisis since her last experience of recession three decades ago when it adopted the structural adjustment programme. The country had been struggling with double-digit inflation which rose from 17.9 percent in September to 18.03 percent in October and to an all-time high of 18.55 percent by December 2016 occasioned by exchange rate depreciation as well as high and rising energy and transportation costs.

As noted earlier, the dynamics volatility in the agricultural output market is the totality of responses to different types of news including instability in exchange rate (Nwoko, Goodness, & Benjamin, 2016; Ogundipe et al., 2013). Price volatility is characterized by upward and downward spikes in price movement. Besides market endogenous factors, output prices are often influenced by the market response to government fiscal expansion and contractionary measures. Importers and traders at the local market often find periods marked with frequent changes in exchange rate as difficult periods since they are usually unable to meet their financial obligations to

creditors during the fluctuating exchange rate period. It is also a period of amplified risk in the foreign exchange (forex) market.

The period immediately after the global financial crises of 2008 witnessed limited knowledge of the food output price volatility in Nigeria but in the last one and half decades, food prices trend in similar order as exchange rate in the country. During this periods, many countries' (including Nigerian) forex market witnessed series of instability that contributed largely to general uncertainty in the average economy. There are concerns that this instability affects agricultural output, food price inflation and ultimately, the welfare of both the farmers and the consumers.

As a measure to stabilize the foreign exchange market, the forex trading activities of Bureau De Change (BDC) and the Inter-bank market (EXR) has helped to ensure stability in the forex market by ensuring a convergence between official and parallel market exchange rate. However, it is not yet uncommon to hear agricultural output producers and traders lament when exchange rate spikes frequently despite the Central Bank of Nigeria incessant deployment of various policy measures to guarantee stability in the forex market.

3. REVIEW OF EXISTING LITERATURES

Many researchers have considered the relationship between exchange rate movement and various components of agricultural trade such as prices, demand and the supply. However, there are yet lingering disagreements on the nature and magnitude of the effects.

Kiptui (2007) examined the effect of real exchange rate on Kenya export demand for major export commodities such as coffee, horticulture, tea and manufactured goods. The study used Bounds Auto-Regressive Distributed Lag (ARDL) model and the Error Correction Model (ECM) for its analysis. The study found long run relationship between real exchange rate on one hand and coffee, tea and horticulture exports on the other hand. However, the study could not establish the same long run relationship for manufactured goods exports. The study concluded that real exchange rate has positive but statistically insignificant effects on Kenya demand in the short run.

Oyinlola (2008) examined the effect of exchange rate dynamism on the disaggregated import prices in Nigeria. The study made use of Nigeria as an economy currently undergoing changes in structure and being an open economy. The study used Error Correction Model (ECM) for its analysis and found that exchange rate has positive and significant effects on the import prices of consumer as well as capital goods. Similarly, Adikibe (2008) investigated the impact of volatility in the exchange rate on selected macroeconomic variables in Nigeria. The study streamlined its exchange rate to only foreign exchange demanded for investment purposes. The study used time series multiple regression analysis with ordinary least square (OLS) technique to examine the relationship between exchange rate volatility and the selected variables. The study observed that there is a positive and significant effect of exchange rate volatility on economic growth in Nigeria. Also, Aliyu (2008) examined quantitatively the effect of exchange rate volatility on non-oil export flows in Nigeria. The study used Johansen cointegration to examine the long run relationship of the variables and used the Error Correction Model (ECM) to estimate the short run dynamism of the model. The study found that long run equilibrium relationship exist among the variables and that there is a positive relationship between exchange rate volatility and the non-oil export flows.

A number of researchers have also examined the forecasting power of exchange rate and macroeconomic variables. Cheung, Chinn, Cheung, and Pascual (2005); Engel and West (2005) in separate studies examined the predictability of exchange rate and economy's fundamentals. The two studies found that the predictive power of economic fundamentals such as commodity prices is weak in forecasting exchange rate. They further observed that exchange rate cannot be predicted by movements in economic fundamentals because they follow random walk. In the words of Engel and West (2005) "A more charitable interpretation of the dismal forecast performance of economic exchange rate models is that the underlying economic theory is fundamentally sound, but that linear forecasting models of exchange rate fail because there are important non-linearities in the data." This implies that the economic variables, that links the exchange rate to the economy, have a nonlinear adjustment.

Also, a number of studies have examined the effect of exchange rate volatility on the economy. Owolabi and Adegbite (2013) studied the effect of exchange rate volatility on the Nigerian economy using multiple regression analysis with Ordinary Least squares (OLS) econometric technique. The study established that there is a significantly positive relationship between average exchange rate volatility and major macroeconomic indicators likes import, export and consumer price index. Ugochukwu (2015) examined exchange rate volatility and commodity prices in Nigeria. The study used general autoregressive conditional heteroscedasticity (GARCH) technique and found that there is a negative relationship between the volatility in exchange rate and the commodity prices in Nigeria. Conversely, Jugu and Soepding (2015) examined the effects of exchange rate fluctuations on the economy of Nigeria. The study used ordinary least square (OLS) technique for its multiple regression and found that there is a positive and significant effect of exchange rate fluctuation on the growth of the economy. Similarly, Izilien and Okoh (2015) investigated the effect of the volatility in exchange rate on the growth of Nigerian economy using general autoregressive conditional heteroscedasticity (GARCH) technique. The study in agreement with Jugu and Soepding (2015) found a positive and significant effect of exchange rate volatility on the economic growth of Nigeria. These studies concluded that diversification of the export and productive base of the economy is the way forward to achieve stable exchange rate in the country.

Yakub, Sani, Obiezu, and Aliyu (2019) also examined the impact of exchange rate volatility on trade flows in Nigeria. It used the general autoregressive conditional heteroscedasticity (GARCH) method to generate the exchange rate volatility and examine the relationship of the specified model. The study result shows that exchange rate volatility has a negative relationship with trade flows in the short run but a positive relationship in the long run which validate the J-curve hypothesis. The study also recommended that stabilizing the exchange rate movement through monetary authority policies is the way to go.

4. DATA DESCRIPTION AND METHODOLOGY

4.1. Data Description and Sources

The study used monthly secondary data of real effective exchange rate, agricultural output prices, and inflation rate of Nigeria for the period under study to examine the asymmetric effect of exchange rate volatility on agricultural output prices. In order to comprehensively analyze the relevant quantitative data for the purpose of this study; the Nonlinear Auto-Regressive Distributed Lag (NARDL) model bound testing approach was adopted. This helped to take care of the problem of drifting series, asymmetric effects and equally enabled the determination of both the short run and the long run relationship of the model.

The data for the study was sourced from the Central Bank of Nigeria Statistical Bulletin 2018 and the National Bureau of Statistics from 2000 to 2018.

4.2. Model Specification

This study seeks to examine the effect of exchange rate volatility on agricultural commodity prices in Nigeria. Specifically, to establish the mathematical model describing the relationship between exchange rate volatility and agricultural output prices, the study will use real effective exchange rate volatility, inflation, real GDP as it explanatory variables while agricultural produce prices is the dependent variables, the functional form is presented in Equation 1 as:

$$AOP_t = f(REX_t, INF_t, RGDP_t) \quad (1)$$

Where:

AOP is Agricultural food price index used as a proxy for agricultural output prices.

REX is the real effective exchange rate.

INF is the inflation rate.

RGDP is the measure of economy output.

Given the nature of this study which necessitates the use of variable in volatility, real effective exchange rate in Equation 1 will be transformed accordingly based on the assertion of Engle (2002) who hypothesized that the residual of the autoregressive process is liable to reveal the volatility more than any other method. Thus, ARCH/GARCH variance series (VREX) will be generated and will serve as the pure volatility of the exchange rate.

To capture this volatility in the exchange rate, the ARCH/GARCH estimate exchange rate movement and measure volatility around the estimate. The ARCH models generalized as GARCH (Generalized ARCH) by Bollerslev (1986) offers a more parsimonious model thereby reducing the computational burden. ARCH stands for Autoregressive Conditional Heteroscedasticity while GARCH stands for Generalized Autoregressive Conditional Heteroscedasticity. Autoregressive refer to a feedback mechanism that incorporates past observation; Conditional means a dependence on the observation of immediate past while Heteroscedasticity implies time varying variance i.e. volatility. Therefore, ARCH/GARCH models allow the error term to have a time varying variance i.e. to be conditional on the past behaviour of the series. The ARCH (1) model estimated is presented as Equation 2:

$$\delta_{\mu t}^2 = \propto_0 + \propto_1 \mu_{t-1}^2 \quad (2)$$

The tested hypothesis is:

H_0: $\propto_1 = 0$

H_1: $\propto_1 = 0$

The GARCH (1, 1) model estimated take the form:

$$\delta_{\mu t}^2 = \propto_0 + \propto_1 \mu_{t-1}^2 + \propto_2 \beta_{t-1}^2 \quad (3)$$

Where $\propto_0$ = constant, $\propto_1$ and $\propto_2$ are coefficients of the lagged squared error and lagged conditional variance terms respectively. Equation 3 represent the GARCH (1, 1) model estimated in the study.

Also: $\delta_{\mu t}^2 = conditional\ variance\ term$

$\mu_{t-1}^2 = Lagged\ squared\ residual\ term$.

$\beta_{t-1}^2 = Lagged\ conditional\ variance\ term$.

Thus, the functional relation of Equation 1 can be re-expressed in econometric model as:

$$AOP_t = \theta_0 + \theta_1 VREX_t + \theta_2 INF_t + \theta_3 RGDP_t + \epsilon_t \quad (4)$$

Where: VREX is the volatility of the real effective exchange rate used as a proxy for the exchange rate volatility.

The general form of Equation 4 representing the asymmetric ARDL model is expanded as:

$$AOP_t = \propto_0 + \alpha_1 VREX_t^+ + \alpha_2 VREX_t^- + \alpha_3 INF_t + \alpha_4 RGDP_t + \mu_t \quad (5)$$

Where:

AOP is the agricultural food price index used as the dependent variable.

VREX is the volatility of the exchange rate as the main independent variable.
INF is inflation rate.
RGDP is real gross domestic products used as the control variables.

$\alpha = (\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4)$ is a vector of long term parameters to be estimated.

Equation 5 shows the long run relationship between the volatility of exchange rate and the agricultural output prices. This long term relationship between the positive changes in the volatility of exchange rate and agricultural output prices is captured by α_1 which is expected to be negative. Similarly, α_2 captures the long term relationship between negative changes in the volatility of exchange rate and agricultural output prices. Also, the other parameters capture the long run relationship between the agricultural output prices and their corresponding variables which are expected to be positive.

Equation 5 can be modified into the NARDL model form as:

$$\Delta AOP_t = \sigma_0 + \sigma_1 AOP_{t-1} + \sigma_2 VREX^+_{t-1} + \sigma_3 VREX^-_{t-1} + \sigma_4 INF_{t-1} + \sigma_5 RGDP_{t-1} + \sum_{i=1}^{a} p_0 AOP_{t-1} + \sum_{i=0}^{b} (\beta_i^+ \Delta VREX^+_{t-1} + \beta_i^- \Delta VREX^-_{t-1}) + \sum_{i=0}^{c} \delta_i \Delta INF_{t-1} + \sum_{i=0}^{d} \vartheta_i \Delta RGDP_{t-1} + ECT_t + \varepsilon_t \quad (6)$$

Where: a, b, c and d are the lag orders and

$\sigma_2 = \frac{-\sigma_2}{\sigma_0}$ measures the long run impact of exchange rate volatility increase.

$\sigma_3 = \frac{-\sigma_3}{\sigma_0}$ measures the long run impact of exchange rate volatility decrease.

$\sigma_4 = \frac{-\sigma_4}{\sigma_0}$ measures the long run impact of inflation rate.

$\sigma_5 = \frac{-\sigma_5}{\sigma_0}$ measures the long run impact of real GDP.

$\sum_{i=1}^{b} \beta_i^+$ measures the short run impact of the increase in the exchange rate volatilities.

$\sum_{i=1}^{b} \beta_i^-$ measures the short run impact of the decreases in the exchange rate volatilities.

$\sum_{i=1}^{b} \delta_i$ measures the short run impact of inflation rate.

$\sum_{i=1}^{b} \vartheta_i$ measures the short run impact of real GDP.

Hence, Equation 6 provides for both the asymmetric long run relation and the asymmetric short run influences of exchange rate volatility on agricultural output prices.

5. EMPIRICAL ANALYSIS AND DISCUSSION

5.1. Unit Root Test Results

The Augmented Dickey-Fuller unit root tests and Phillip Perron tests check the stationarity properties of the series. Since a spurious regression is not desirable, testing for stationarity is a prerequisite when working with time series data. The results from both tests show that none of the series is stationary at level as their test statistic are all larger than all the critical value for rejection of hypothesis of a unit root except for inflation rate. The null hypothesis of non-stationarity is consistently rejected for all the variables when they are expressed in their first differences, suggesting that they are all integrated of order one (I(1)). The results reported are for those with intercept and trend. However, the results for both none and intercept are not considerably different. The results of the tests are summarized in Table 1.

Table-1. Summary of unit root tests results.

Augmented Dickey-Fuller (ADF)			
Variable	ADF at level	ADF at first difference	Order of Integration
LOGAOP	-2.233990	-10.89029***	I(1)
VREX_P	-1.426796	-12.02233***	I(1)
VREX_N	-1.822795	-14.93839***	I(1)
INF	-18.65491***	-12.41786***	I(1)
LOGRGDP	-2.260799	-14.94080***	I(1)
Phillip Perron Unit Root Test (PP)			
Variable	PP at level	PP at first difference	Order of Integration
LOGAOP	-2.282342	-10.92666***	I(1)
VREX_P	-1.240696	-11.90784***	I(1)
VREX_N	-1.907752	-14.94431***	I(1)
INF	-18.58019***	-149.4456***	I(1)
LOGRGDP	-2.293205	-14.94078***	I(0)

Note: * , ** and *** denotes the rejection of null hypothesis of unit roots at 1%, 5% and 10% respectively for both tests at intercept and trend form. The lag order for the series was determined by the AIC and SIC.

5.2. Asymmetric Cointegration Test Results

Having established that the variables are integrated of the same order, we proceeded to test for cointegration. Cointegration analysis provides a framework to determine whether or not there exists a long run stable relationship among a set of economic variables. The Nonlinear Autoregressive Distribution Lag (NARDL) co-integration test is adopted for the study. The results of the NARDL bounds cointegration is presented in Table 5.3. The cointegration result is presented in Table 2 which shows that there is a long run relationship among the agricultural commodity prices, exchange rate volatility, inflation rate and real GDP given that the value of F-statistics (309.7) is greater than the Pesaran, Shin, and Smith (2001) case III critical upper bound value of 4.35 at the 0.050 level of significance. Hence, this implies that the variables are integrated in the long run and satisfies the requirement of assessing the non-linear effect of exchange rate volatility on agricultural commodity prices.

Table-2. NARDL bounds test for cointegration.

F-Statistics	**95% lower bound I(0)**	**95% upper bound I(1)**	**Conclusion**
309.6773	3.23	4.35	Cointegrated

5.3. Nonlinear ARDL Model Estimation

The basic diagnostic test of the NARDL model shows that the coefficient of determination (R2) shows that 93.88 percent of the variations in agricultural commodity prices (LOGAOP) is explained by the explanatory variables mainly volatility of exchange rate (VREX), inflation (INF) and real GDP which is above 50 percent and even after taking into consideration the degree of freedom, the adjusted coefficient of determination (adjusted R^2) still shows that 92.97 percent variation in agricultural commodity prices (LOGAOP) is explained by the explanatory variables. The F-statistic 103.37 (0.0000) confirmed the fitness of the coefficient of determination and

shows an overall significant level of the explanatory variables jointly in explaining variations in agricultural commodity prices (LOGAOP).

The results as presented in Table 3 shows that the short run drivers of agricultural commodity prices are lagged exchange rate volatility, inflation rate and real gross domestic product. Specifically, the short run model shows there is a negative and insignificant relationship between the negative changes in exchange rate volatility and the agricultural commodity prices in Nigeria. A percent appreciation of the local currency, naira, often favors the agricultural commodity prices in the short run. Conversely, there is a positive but also insignificant relationship between the positive changes in exchange rate volatility and the agricultural commodity prices in the short run which implies that a depreciation of the local currency in the immediate period often have an insignificant reduction effect on the agricultural output prices.

The long run parameters of the model calculated by dividing the negative coefficients of each explanatory variable in their level form by LOGAOP(-1) shows that the long run coefficients are: 0.0017 for positive changes in exchange rate volatility; 0.0011 for negative changes in exchange rate volatility; -0.03752 for inflation rate and 0.027 for log of real gross domestic product.

The findings shows that positive trend of exchange rate volatility, negative trend of exchange rate volatility, and real GDP have positive and significant relationships with agricultural commodity prices in the long run. However, it found that inflation has a negative but significant relationship with agricultural commodity prices in the long run. The findings imply that over time, a 1 percent depreciation of the local currency against the basket of major trading partners' currency, increases the agricultural commodity prices by 0.0017 percent and a 1 percent appreciation of the local current against the currency of its trading partners, also raises the agricultural commodity prices by 0.0011 percent.

The short run model implies that there is a negative relationship between negative changes in exchange rate volatility and agricultural commodity prices. That is, for every negative change in exchange rate volatility, the agricultural commodity prices moves in the opposite direction, though overtime the effect on the agricultural commodity prices changes. Conversely in the short run, there is a positive relationship between positive changes in exchange rate volatility and agricultural commodity prices and the same positive relationship is maintained between the positive changes in exchange rate volatility and agricultural commodity prices in the long run.

The effect of inflation on agricultural commodity prices is negative both in the long and short run. This implies that inflation and agricultural commodity prices move in opposite direction which is inconsistent with theoretical proposition. Conversely, the study found positive and significant relationship between agricultural commodity prices and real GDP which implies that the higher the total output in the economy, the higher the agricultural commodity prices in line with apriori expectation.

5.4. Wald Test Result

Having found that both the positive change and the negative change in exchange rate volatility have positive long run effect on agricultural commodity prices, there is need to examine the statistical difference (that is, the non-equality) of the two coefficients. The Wald test which tests this asymmetry of the coefficients is summarized in Table 4. The test shows that the t-statistics and f-statistic p-values are greater than 5 percent significance level. Hence, the null hypothesis of no asymmetries between the positive and negative changes in exchange rate volatility effect on agricultural commodity prices is not rejected. This explains that the long run effect of the positive changes and negative changes in exchange rate volatility on agricultural commodity prices are the same in Nigeria.

Table-3. Nonlinear ARDL estimation result.

Long run Estimates	
Dependent Variable	LOGAOP
C	-3.35559**(0.0179)
LOGAOP(-1)	1* (0.0000)
VREX_P(-1)	0.0017* (0.0081)
VREX_N(-1)	0.0011*** (0.0579)
INF(-1)	-0.03752** (0.0130)
LOGRGDP(-1)	0.027 (0.6789)
Short Run Estimates	
Dependent Variable	D(LOGAOP)
DLOGAOP(-1)	0.068214 (0.4618)
DVREX_P(-3)	0.005962 (0.2711)
DVREX_P(-6)	0.005138 (0.3381)
DVREX_N(-4)	-0.001959 (0.3774)
DINF(-1)	-0.029857*(0.0125)
DINF(-2)	-0.019596*** (0.0653)
DINF(-3)	-0.028430* (0.0022)
DINF(-4)	-0.021676* (0.0076)
DINF(-5)	-0.023016* (0.0003)
DINF(-6)	-0.008245** (0.0336)
R-squared	0.938847
Adjusted R-squared	0.929765
S.E. of regression	0.125699
Sum squared resid	1.595824
Log likelihood	85.22903
F-statistic	103.3731
Prob(F-statistic)	0.000000
Durbin-Watson stat	2.114366

Note: *,** and *** denote the rejection of null hypothesis at 1 %, 5 % and 10 % level of significance.
The long run coefficients are derived by dividing the negative coefficients of each explanatory variable in it level form by LOGAOP(-1).

Table-4. Wald statistic test result for asymmetry tests.

Test Statistic	Value	Df	Probability
t-statistic	1.519747	101	0.1317
F-statistic	2.309631	(1, 101)	0.1317

5.5. Diagnostic Check

The Ramsey RESET test for model specification indicates that the model do not have omitted variable problem and it is correctly specified. The Breusch-Godfrey LM test for serial correlation shows that serial correlation is not a problem in the model. Similarly, the Breusch-Pagan heteroskedasticity test proves that the error term is homoscedastic. Table 5 shows that the disturbance term is uncorrelated and has the same finite variance which implies that the residuals are well behaved.

Table-5. Diagnostic test results.

Stochastic properties	Test	F-Statistics/ Joint Test	p-value
Normality of residuals	Ramsey RESET Test	2.243042 (1, 100)	0.1374
Autocorrelation	Breusch-Godfrey Serial Correlation LM Test	2.268531 F(2, 99)	0.1088
Heteroskedasticity	Breusch-Pagan-Godfrey Heteroskedasticity Test	2.120255 F(15, 101)	0.1440

6. CONCLUSION AND POLICY IMPLICATION

The study suggested that there is significant relationship between agricultural commodity prices and exchange rate volatility in Nigeria. This implies that as exchange rate experience upward fluctuation due to depreciation of the local currency, it causes the imports to become dearer while the exports of local commodities become cheaper in the international markets. This force down the Nigeria agricultural commodity prices due to the excess demand created by the devaluation. Similarly, as exchange rate appreciates, for a given level of capacity utilization of the country, imports become cheaper while the exports of local commodities become dearer. Overtime, demand for agricultural commodity output decreases and the prices rise as excess imports commodities flood the local market. This suggests that the movement of exchange rate in any direction plays a symmetric and significant role in altering the price of agricultural commodity in Nigeria- a country where almost all prices are directly or indirectly linked to activities in the international market. Thus, for policy matters, policies that redirect the focus of Nigerian away from the excess dependency on the foreign goods should be formulated. Also, the government and its agencies should pursue policies that will ensure sustainable agricultural output which is the main source of food in the country and improve the information system in the agricultural sector so as to reduce the market speculations, price hikes, and uncertainty in the sector and the economy as a whole.

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REFERENCES

Adikibe, N. K. (2008). *Impact of exchange rate instability on selected macroeconomic indices in Nigeria: 1990-2004.* Unpublished Master's Thesis. Federal University of Technology, Owerri: Nigeria.

Al-Samara, M. (2009). The determinants of real exchange rate volatility in the Syrian economy (pp. 1 – 36): Economy Center of the Sorbonne, University Paris-1-Pantheon-Sorbonne.

Aliyu, S. U. R. (2008). Exchange rate volatility and export trade in Nigeria: An empirical investigation. MPRA_Working_Paper_13490, University Library of Munich, Germany.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics, 31*(3), 307-327.Available at: https://doi.org/10.1016/0304-4076(86)90063-1.

Chinn, M. D., Cheung, Y.-W., & Pascual, A. G. (2005). Empirical exchange rate models of the nineties: Are any fit to survive? *Journal of International Money and Finance, 24*(7), 1150-1175.Available at: https://doi.org/10.1016/j.jimonfin.2005.08.002.

Engel, C., & West, K. D. (2005). Exchange rates and fundamentals. *Journal of Political Economy, 113*(3), 485-517.

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics, 20*(3), 339-350.

Izilien, E. I., & Okoh, E. N. (2015). Exchange rate volatility and economic growth in Nigeria. *Journal of Economic and Financial Issues, 3*(1), 128-140.

Jugu, Y. G., & Soepding, B. A. (2015). The effect of fluctuating foreign exchange rate on the Nigerian Economy. *Journal of Economics and Financial Issues, 3*(1), 80-91.

Kiptui, M. (2007). *Does the exchange rate matter for Kenya's Exports?* Paper presented at the Paper Presented at the African Econometric Society Conference, Cape Town, South Africa.

Mgbenka, R. N., Mbah, E. N., & Ezeano, C. I. (2015). A review of small holder farming in Nigeria: Need for transformation. *Agricultural Engineering Research Journal, 5*(2), 19-26.

Nwoko, I. C., Goodness, C. A., & Benjamin, C. A. (2016). Effect of oil price on Nigeria's food price volatility. *Cogent Food & Agriculture, 2*(1), 46-57.

Ogundipe, A. A., Ojeaga, P., & Ogundipe, O. M. (2013). Estimating the long-run effect of exchange rate devaluation on the trade balance in Nigeria. *European Scientific Journal*, *9*(25), 233-249.

Owolabi, A. U., & Adegbite, T. A. (2013). Effect of exchange rate volatility on Nigerian economy. *International Journal of Academic Research in Economics and Management Sciences*, *2*(6), 172-186.

Oyinlola, M. A. (2008). Exchange rate and disaggregated import prices in Nigeria. *Journal of Economic and Monetary Integration*, *9*(1), 89-126.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326.Available at: https://doi.org/10.1002/jae.616.

Ugochukwu, P. U. (2015). Exchange rate volatility and economic growth in Nigeria (1980- 2012). *Research Journal of Economics*, *4*(3), 1-13.

Yakub, M., Sani, Z., Obiezu, T., & Aliyu, V. (2019). Empirical investigation on exchange rate volatility and trade flows in Nigeria. *Central Bank of Nigeria Economic and Financial Review*, *57*(1), 23-46.