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Exchange Rate Volatility and Agricultural Exports in Nigeria (1981-2016)

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Abstract

This study was carried out to examine the Exchange Rate Volatility and Agricultural Export in Nigeria between 1981 and 2016. The data on agricultural exports, real exchange rate, agricultural credits and nominal exchange rate were obtained from the Central Bank of Nigeria Statistical Bulletin spanning over 36 years (1981-2016). Augmented Dickey-Fuller (ADF) unit root test was used to test for the stationarity of the data set. The Johansen co-integration test was used to determine the long run relationship among the variables while the Granger Causality test was adopted to determine the direction of causality among the variables. The results of the Vector Error Correction Model (VECM) for the estimation of short run adjustment of the variables towards their long run relationship indicated that 68% of disturbance in the short run was corrected for every year with respect to the periods under study. It also showed that there is a significant direct relationship between agricultural exports and nominal exchange rate as well as agricultural credits. Total exports responded positively to increase in nominal exchange rate while its response to real exchange rate depends on the direction of the shock (increase or decrease). The analysis indicated that the relationship between agricultural credit and export was negative. The granger causality test revealed that causation exists from nominal exchange rate to agricultural export and from real exchange rate to nominal exchange rate. Autoregressive Conditional Heteroscedascity (ARCH) and General Autoregressive Conditional Heteroscedascity (ARCH-GARCH) was used to estimate the volatility of exchange rates which revealed that exchange rate in Nigeria is highly volatile and may positively or negatively impact on the agricultural exports of the country. The study therefore concluded that real exchange rate is significant in determining the volume of agricultural exports in Nigeria. The study recommends that the government, through the Central Bank of Nigeria, should provide more incentives to boost agricultural exports by improving on the stabilisation of exchange rate with a view to promoting agricultural exports.

Keywords: Agricultural exports, ARCH-GARCH model, Exchange Rate, VECM, Volatility,

Introduction

Exchange rate volatility is a measure of the degree of frequency by which the price of foreign exchange changes over time. The larger the magnitude of the price change, the more volatile the exchange rate is. If the price increases or falls with a wide margin over a period, it indicates that the exchange rate is unstable and the foreign exchange market is said to be experiencing volatility (Aminu *et al.,* 2013).

A country's exchange rate behaviour is an important determinant of the growth of its cross-border trading and it serves as a measure of its international competitiveness (Bah and Amusa, 2003). Exchange rate volatility was experienced by most countries around the world after the exit of Bretton Wood system of fixed exchange rate regime in the '70s. Exchange

rate changes have been a topical and highly debated issue among academicians, policy makers and concerned monetary authorities on account of the vital role an optimal and sustainable exchange rate plays in the achievement of sustainable growth and development.

Export performance is of paramount importance because it contributes to the economic development of nations by influencing the amount of foreign exchange reserves as well as the level of imports a country can afford. It enhances societal prosperity and helps national industries to develop and improve productivity and create new jobs (Lages and Montgomery, 2014).

Owing to the strong link between exchange rate and agricultural export, especially during flexible exchange rate regime, a period of decrease in agricultural export volume whereby there is an increase in earnings has been experienced. According to Essien (1990), cocoa products of 0.10458 million tonnes earned ? 239.1 million in 1985 but in 1987, cocoa products of 0.08316 million tonnes earned ? 419.5 million and since then, the receipts have continued to increase (apart from 1984) despite lower export volume. The monetary value of agricultural exports which stood at an average of ? 725.8 million from 1981 to 1989 increased to ? 802.7 million between 1990 and 1999. On the other hand, the rate of agricultural exports monetary value to total exports ratio during the same period stood at 0.038 but declined to 0.014. Although, the export baskets also expanded with non-traditional export commodities such as tubers, fruits and spices coming on board (Anyanwu *et al.,* 2010).

Different exchange rate policies have been used depending on the prevailing domestic economic circumstances and at other times, in response to the changing exchange rate policies in the rest of the world, as the Nigerian economy is grossly dependent on the global economy. Thus, Nigeria's economy has become extremely vulnerable resulting in severe domestic financial fragility. For instance, Agriculture as the most inclusive occupation is struggling in the face of high cost of import of inputs while Nigeria's growth rate has not been sustainable during economic recession in spite of the country's uncommon natural and human resources endowments. The economic, social and political considera-tions underpinning the exchange rate policy have therefore made the Buhari-led government to emphasise on the need to diversify our economy from mono-economy to other sectors in which agricultural export is inclusive

There is growing agreement in the literature that prolonged and substantial exchange rate misalignment can create severe macroeconomic disequilibria especially in the area of agricultural sector output of the economy. Research related to exchange rate volatility still remains of interest to economists, especially in developing countries, despite a relatively enormous body of literature in the area. This arises as a result of the fact that exchange rate movements and exchange rate uncertainty are important determinants of international transactions.

The sustainability of Naira exchange rate has received renewed attention in recent times because of the increased volatility of oil prices and depreciation in the value of the Naira (Shettima, 2016). Exchange rate issue has become paramount

for the new administration in Nigeria. There has been a growing consensus in various literatures that prolonged and substantial exchange rate volatility can create severe macroeconomic disequilibria and the correction of external balance will require both exchange rate devaluation and demand management policies. The main intuition behind this is that an increase in exchange rate volatility leads to uncertainty which might have a negative impact on trade flows. In practice, exchange rate in Nigeria has been highly volatile and favoured foreign currencies such as the Dollar, Euro and Pound which is detrimental to the growth of export trade as well as the growth of the economy as a whole.

The purchasing power parity (PPP) theory was developed by Gustav Cassel in 1920 to determine the exchange rate between countries on inconvertible paper currencies. The theory states that equilibrium exchange rate between two inconvertible paper currencies is determined by the equality of their purchasing power. This means that the rate of exchange between two countries is determined by the relative price levels. According to the theory, the equilibrium exchange rate between two countries is determined at a point which expresses the equality between their respective purchasing powers of the two currencies.

Numerous studies were conducted on the extent of Naira exchange rate and its volatility in Nigeria [(Soludo and Adenikinju, (1997); Obaseki (2001); CBN (2004)]. Assessment of the impact of exchange rate volatility on export has in the recent past been non-existent. Most studies on exchange rate volatility focused on developed countries and Asian economies (Akinlo and Adejuwon, 2014) and so there is only little empirical evidence on the volatility of exchange rate that exists for Nigeria with respect to agricultural exports. More so, some previous studies neglected to account for the possibility of unit roots and research has shown that estimation of regression models of series that have unit roots gives spurious regression therefore the goal of this study is to address these neglected issues.

The broad objective of this study is to examine the relationship between exchange rate volatility and agricultural exports in Nigeria (1981-2016) with particular reference to the data available.

The specific objectives are to:

1. examine the extent to which exchange rate volatility impact on agricultural exports in Nigeria and

2. determine the causality between exchange rate and agricultural exports in Nigeria with a view to determining the direction of relationship between the dependent and independent variables.

The hypotheses stated for this study are to determine if there is no significant relationship between exchange rate volatility and agricultural exports in Nigeria.

The study will serve as a future guide to policy formulators in taking efficient policy options for managing and stabilising exchange rate volatility in the country. The study will help the government to identify the strengths and weaknesses of the agricultural sector as it is the primary sector whose growth will act as a catalyst for the growth of other sectors and therefore adopt the best policy that will lead to sustained growth of output in the economy.

In a world where there are many national and regional currencies, exchange rates define the rate or ratio of which one of these currencies can be exchanged for one another at any given point in time. Exchange rate changes often; it moves from minute to minute, hour to hour and day to day under a floating exchange rate regime (CBN, 2016). The need for foreign exchange arises only within the framework of nations involved in international trade compared to a closed economy whose scope does not transcend its intra-country trade transactions. Thus this makes the economic issues pertinent in a bid to ensuring a guaranteed growth for the country. In managing Nigeria's foreign exchange, the country has moved from one regime to another.

The performance of export is seen as a catalyst for overall development and increases the earnings of the country thereby creating an avenue for growth by raising the national income of the country. One of the major macroeconomic objectives of an economy is to attain full employment and export stands as a driver to its achievement because higher demand for exports will require more production which will in turn lead to creation of more employment opportunities in the country.

Foreign exchange fluctuations, whether positive or negative, are not desirable to producers of export products as it has been found to increase risk and uncertainty in international transactions which discourages trade (Adubi and Okunmadewa, 1999).

Findings by Obadan (1994) and Osuntogun *et al.* (1993) on the effect of stable exchange on export performance showed that exchange rate affects a country's export performance. Kandilov and Smith (2003), Mustapha and Nishat (2004), Omojimite and Akpokodje (2010), Nessabian and Naghizadeh (2012), Yanikkaya *et al.* (2013) all asserted that there is a negative relationship between real exchange rate and agricultural exports from the demand side.

Akinlo and Adejumo (2014) examined the impact of exchange rate volatility on non-oil exports in Nigeria and found a statistically negative effect of exchange rate volatility on non-oil exports in the long run while the short run impact of the exchange rate volatility is statistically insignificant. The policy implication is that the exchange rate volatility is only effective in the long run but not in the short run in the Nigerian economy.

Wilson and Choga (2015) investigated the relationship between exchange rate volatility and export performance in South Africa. Using GARCH methods, exports were regressed against real effective exchange rate, trade openness and capacity utilisation. The result obtained showed that exchange rate volatility had a significantly negative effect on South African exports between 2000 and 2011.

Zukarnain (2013) noted that there is a significant relationship between export and exchange rate volatility. It follows therefore that a performance of export trade in Nigeria lies in the volatility of real exchange rate in the country. The exchange rate is used to determine the level of output growth of the country export performance. Hence, the rate at which exchange fluctuates calls for a lot of attention.

Ewetan and Okodua (2013) examined the applicability of the Export-Led Growth (ELG) hypothesis for Nigeria using annual secondary time series data on the country's exports and GDP growth from 1970 to 2010.

The estimation results obtained from the co-integration test and granger causality test within the framework of a VAR model did not support the Export-Led Growth hypothesis for Nigeria.

Essien *et al.* (2011), Abedullah *et al.* (2009) and Saboor *et al*. (2009) as cited in Mbutor and Al-Hassan (2013) stated that timely and easy access to agricultural credit enables farmers to purchase the required input and machinery for carrying out farm operations and increase production. Fidan (2008), Silva and Ferreira (2012) and Karimi *et al.* (2014) adopted VAR model, Impulse Response Function and Variance Decomposition as method of analysis.

Olowe (2009) investigated the volatility of Naira/Dollar exchange rates in Nigeria using several variants of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models. He used monthly data over the period January 1970 to December 2007 and found that all the GARCH family models indicated that volatility was persistent and reported similar evidence for the fixed exchange rate and managed float rate regimes.

Omojimite and Akpokodje (2010) investigated Nigeria's trade performance during the period 1986-2007 and found small positive effects of exchange rate reforms on non-oil exports through the depreciation of the value of the country's currency (Naira).

Methodology

The study area is Nigeria. Nigeria is a federal republic in West Africa, bordering Benin Republic in the west, Chad and Cameroon in the east and Niger Republic in the North. Its coast in the South lies on the Gulf of Guinea in the Atlantic Ocean. It is made up of 36 states and the Federal Capital Territory (FCT). The nation is often referred to as the "Giant of Africa" due to its large population and economy. The country was self-sufficient in food but agriculture has failed to keep up with the rapid population growth as the country now partly relies on food imports to sustain itself.

The study employed time series secondary data obtained from Central Bank of Nigeria Statistical Bulletin which covered the period of 1981 to 2016. The variables used in the study include agricultural exports, real exchange rate, nominal exchange rate and agricultural credits.

Estimation procedure

The study examined the statistical properties of the data by conducting Augmented Dickey-Fuller and Johansen Co-integration tests. Against evidences from the tests conducted, the Vector Error Correction model was estimated. That is, after carrying out the co-integration test, VECM was used to explain the dynamic interrelationship among the stationary variables.

The Lagrange Multiplier (LM) proposed by Engel (1982) was employed to test for volatility and ARCH-GARCH (1, 1) model was also carried out to capture the effect of variance on the volatile time series. Impulse Response Function (IRF) was conducted to determine the extent to which exchange rate volatility impacts on agricultural export and the Granger Causality test was used to test for the direction of causality between the variables (i.e EXCR and AGE) due to the fact that the possibility of reverse causality between exchange rate and agricultural export has

been ignored in earlier studies.

Model Specification

This research made use of econometric procedure in estimating the relationship between the variables in question. The model is given as:

AGE = f (RER, NER, AC).....

….implicit function…. Equation (1)

Log AGE_t =α + $\beta_1$log RER_t +β_2 logNER_t + β_3LogAC_t + U_t _ Explicit function . Equation .....(2)

Where;

AGE_t = Agricultural export at time t (? billion)

Log AGE_t = log of agricultural export at time't (? billion)

RER= Real exchange rate (? /US$)

NER = Nominal exchange rate (? /US$)

AC = Agricultural credit to the sector (? billion)

t = time periods between 1981 to 2016

α , β_1, β_2, β_3 = Parameters to be estimated

U_t = Disturbance or error term

Log = logarithm

The data in this study are in billions (AGE and AC) are transformed into log forms in order to normalize them. The ADF t-statistics of the series are more negative than the critical values at 5%. Because the variables are all **I (1)** variables (i.e integrated of order I), this implies that a co-integration test should be carried out to find out if there exist a long-run relationship among the variables.

ARCH-GARCH (1, 1) model

These techniques were tested to see the presence of volatility in the series.

$AGE_t = \alpha_0 + \beta_1 AGE_{t-1} + U_t$.....(3)..

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$\sigma^2_t = \lambda_1 + a_1 U^2_{t-1} + a_2 \sigma^2_{t-1}$ .....(4)

$AC_t = \alpha_1 + \beta_2 AC_{t-1} + U_t$ ……..... (5)

$\sigma^2_t = \lambda_2 + a_3 U^2_{t-1} + a_4 \sigma^2_{t-1}$ ……..…(6)

$NER_t = \alpha_2 + \beta_3 NER_{t-1} + U_t$ ……(7)

$\sigma^2_t = \lambda_3 + a_5 U^2_{t-1} + a_6 \sigma^2_{t-1}$ ……(8)

$RER_t = \alpha_3 + \beta_4 RER_{t-1} + U_t$ …….(9)

$\sigma^2_t = \lambda_4 + a_7 U^2_{t-1} + a_8 \sigma^2_{t-1}$ …… (10)

Granger Causality model

This model was used to test the hypothesis which states that there is no significant relationship between exchange rate volatility and agricultural exports in Nigeria.

EXPORT = ? αi $REXCR_{t-1}$ + ?

? j $EXPORT_{t-1}$ + ? ?i $NEXCR_{t-1}$ + μ_{t1} …..

(11)

REXCR = ? αi $REXCR_{t-1}$ + ? ? j

$EXPORT_{t-1}$ + ? ?i $NEXCR_{t-1}$ + μ_{t2} …..(12)

NEXCR = ? αi $REXCR_{t-1}$ + ? ? j

$EXPORT_{t-1}$ + ? ?i $NEXCR_{t-1}$ + μ_{t3} …. (13)

Results and Discussions

Unit root test

Table 1 below shows the results of the Augmented- Dickey Fuller with assumption of trend and intercept. It indicates that all variables were non-stationary at level but however became stationary at first difference. This therefore makes all the variables to be integrated of order One (I[1]).

Table 1: Augmented Dickey-Fuller Unit Root Tests

Variables	At Level				1st difference				Remark
	LOGAGE	LOGAC	RER	NER	LOGAGE	LOGAC	RER	NER	
ADF test-statistics	-2.958625	-2.865400	-1.909983	-1.936405	-8.080134	-6.202203	-3.992641	-4.506479	I (1)
Critical val. at 1%	-4.243644	-4.243644	-4.243644	4.243644	-4.252879	-4.252879	-4.252879	-4.252879	I (1)
Critical val. at 5%	-3.544284	-3.544284	-3.544284	-3.544284	-3.548490	-3.548490	-3.548490	-3.548490	I (1)
Critical val.at 10%	-3.204699	-3.204699	-3.204699	-3.204699	-3.207094	-3.207094	-3.207094	-3.207094	I (1)
Probabilities	0.1577	0.1854	0.6281	0.6144	0.0000	0.0001	0.0186	0.0054	

Table 2: Johansen Co-integration Test

Null Hypothesis	Max Eigen Value	Trace statistic	Probability	Remark
None*	0.791229	84.41504	0.0000	Significant
At most 1*	0.471670	32.71994	0.0224	Significant
At most 2	0.289362	11.66484	0.1737	Not significant
At most 3	0.011818	0.392310	0.0341	Significant

******denotes rejection of the null hypothesis at 0.05 level*

Co-integration test

Table 2 above shows the results of the Johansen co-integration test. Based on both the maximum Eigene value of 0.791229 and the trace statistics of 84.41504, the test showed the existence of two co-integrating equations at 5 per cent level of significance which shows that there is a common trend in the process. The null hypothesis of 'none existence' and 'at most 1' co-integrating equations are rejected. This implies the existence of long run relationship among the variables of this model.

Vector error correction model (VECM)

Table 3 contains the VECM and its coefficients as well as their t-statistics and probability values. C(1) is the long run coefficient of the co-integrated model with logarithm of agricultural export (LOGAGE) as the dependent variable while C (2), C (3), C (4), C(5), C (6), C (7), C (8), C(9) and C(10) are the short run coefficients.

The Error Correction Term (ECT) has a coefficient of -0.688578 which is significant at 1%. This indicates that 68**%**

of the disturbance in the short run is corrected for every period under study. This implies that the system adjusts any observed disequilibrium during the period under study towards long run equilibrium at 68% speed of adjustment.

C (1) is the speed of adjustment towards long run equilibrium which is negative and significant implying that real exchange rate, nominal exchange rate and agricultural credit have long run influence on agricultural export. C (5) is positive and significant at 5%, C (6) and C (7) are both positive and significant at 1%. This implies that there is a significant direct relationship between agricultural exports and nominal exchange rate as well as agricultural credits.

From table 4, the probabilities of 0.0517 and 0.0498 for F-statistic and Obs* R-squared respectively are significant at 5%, hence we reject the null hypothesis that there is no ARCH effect. This rejection implies the presence of ARCH effect or volatility.

Table 3: Vector Error Correction Model (VECM)

	Variables	Coefficients	Standard Error	T-statistics	Probabilities
ECT		-0.688578	0.12211	-5.63901	0.0000*
C (2)	D(LOGAGE(-1))	-0.405074	0.13410	-3.02077	0.0033*
C (3)	D(LOGAGE(-2))	-0.128104	0.12101	-1.05859	0.2926
C (4)	D(LOGAC(-1))	0.075812	0.49772	0.15232	0.8793
C (5)	D(LOGAC(-2))	1.185303	0.51591	2.29750	0.0239**
C (6)	D(NER(-1))	0.070011	0.01085	6.45367	0.0000*
C (7)	D(NER(-2))	0.042347	0.01165	3.63483	0.0005*
C (8)	D(RER(-1))	-0.006244	0.00223	-2.79607	0.0063*
C (9)	D(RER(-2))	-0.010549	0.00263	-4.00883	0.0001*
C (10)	C	-0.378936	0.18530	-2.04493	-2.04493

(*) and (**) indicates significance at 1%, and 5%

Table 4: *ARCH EFFECT*-Testing for Volatility

Heteroskedasticity Test: ARCH

	t-statistic	probability	Significant level
F-statistic	4.07719	Prob. F(1,33)	0.0517
Obs*R-squared	3.84876	Prob. Chi-Square(1)	0.0498

The null hypothesis Ho: $?_1 = 0$ No ARCH effect
Alternative hypothesis H_1: $\gamma_1 ? 0$ Presence of ARCH effect

Standardized residuals

From figure 1 below, the line indicates fluctuations of the residual. Between the periods 1981 to 1984, the fluctuation is seen to be low and it increased in 1985 after which it fell again. Between the periods 1997 to 2004, there was an increase in the fluctuation except in 2002 and the fluctuation persisted for a long period of time. The fluctuation for the remaining periods hovered around negative to zero. This movement persisted till the end of the period under study. It also shows that periods of low volatility follow periods of low volatility for a long period of time and also periods of high volatility follow periods of high volatility for a long period of time. With this there is justification to run ARCH and GARCH models to test for volatility. This result conforms with the earlier studies by Osuntogun *et. al.* (1993), Obadan 1994 and Zukarnain (2013) who found significant relationship between exports and exchange rate volatility in Nigeria. Similarly, this result was also in line with the findings of Wilson and Choga (2015) conducted in South Africa among others.

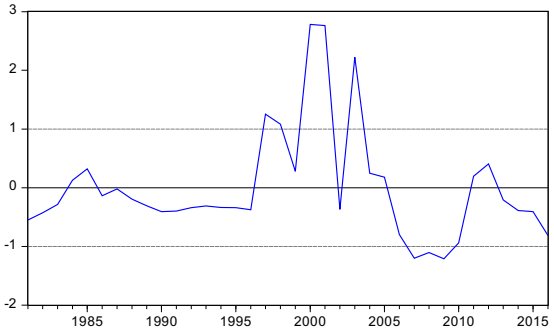

Figure 1 showing the fluctuations of the *Residual*

Arch and garch model

From table 5 above, the analysed model has two parts. The first part represents the mean equation while the second part represents the variance equation. From the mean equation, the residual is extracted and used to estimate the variance equation. The guideline is that the lower the value of the lag criteria, the better the model is. The ARCH-GARCH model of order (1, 1) is the best model as the Akaike info criterion (AIC) has the lowest value of 2.337219. The coefficients of the internal term (ARCH) is significant at 1%, this implies that the null hypothesis that states that the internal and external factors do not significantly determine agricultural export is rejected because previous year volatility can determine the current year volatility. The external factors (LOGAC, RER) are major determinants of agricultural export which are significant at 10% and 1% respectively. Hence diagnostic checking of the ARCH and GARCH model is carried out to ascertain whether the model is best fitted.

Diagnostic check (Post-test estimation)

Table 6 shows the results of heteroscedasticity test and since the probabilities are not significant and are greater than 5% level of significance. The null hypothesis is therefore accepted which implies that the model is free of any heteroscedasticity problem.

Normality test

The figure 2 showing the normality test is necessary to ascertain whether the residuals are normally distributed or not. The mean and median values of 0.033330 and 0.040077 are consistent as they lie within the limits of the minimum and maximum

Table 5: ARCH AND GARCH MODEL

ARCH-GARCH (1,1)
GARCH=C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	**Coefficient**	**Standard Error**	**z-statistic**	**Prob**
C	0.785308	0.142104	5.526292	0.0000*
LOGAC	-0.119732	0.063490	1.885851	0.0593***
NER	0.002790	0.003126	0.892461	0.3721
RER	0.003844	0.000850	4.523258	0.0000*
		Variance Equation		
C	0.003719	0.021621	0.172030	0.8634
RESID(-1)^2	1.731414	0.538825	3.213316	0.0013*
GARCH(-1)	0.123504	0.109694	1.125897	0.2602
R-squared	-0.016568	Mean dependent variable		1.619254
Adjusted R-square	-0.111871	S.D depdendent variable		1.349030
S.E of regression	1.422489	Akaike Ino criterion		2.337219
Sum squared resid	64.75118	Schwarz criterion		2.645125
Log likelihood	-35.06994	Hannan-Quinn criterion		2.444687
Durbin-Watson stat	0.798469			

(*) and (***) indicates significance at 1% and 10%

Table 6: Results of Heteroscedasticity test

Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistics	0.938273	Prob. F(3,32)	0.4336
Obs*R-square	2.910643	Prob. Chi-Square(3)	0.4056
Scaled explained SS	5.090680	Prob. Chi-Square(3)	0.1653

Null Hypothesis H_0: There is no heteroscedasticity in the model
Alt. Hypothesis H_1: There is heteroscedasticity in the model.

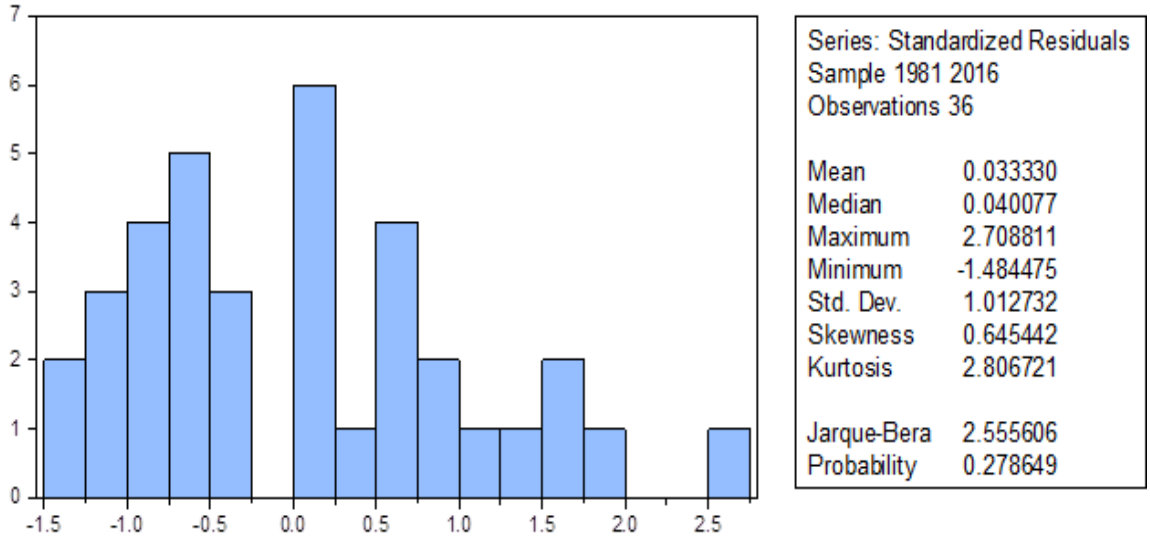

Figure 2 showing the Normality Test
Null Hypothesis H_0: residuals are normally distributed
Alt. Hypothesis H_1: residuals are not normally distributed

values of -1.484475 and 2.708811 respectively. The Jarque-Bera value of 2.555606 has a probability of 0.278649 which is not significant. Hence, we accept the null hypothesis. This implies that the residuals are normally distributed.

Impulse response function

Figure 3 depicts how the variables will react when there is a shock or innovation. The horizontal line is zero (0), any line or graph above it is positive and any below it is negative.

The graph shows a prediction into the future by 10 years. It shows the impulse response functions of the variables (agricultural export, real exchange rate, nominal exchange rate, and agricultural credit) as against shock in agricultural exports over a 10 year horizon.

It can be deduced from figure 3 that past export shocks had positive impact on current exports from year 1 to year 6. In year 7 it equilibrated and became negative afterwards. The response of agricultural credit to agricultural exports was negative from year 1 to year 10.

In the case of the response of nominal exchange rate (NER) to agricultural export (log), there was a positive response throughout the years. Response of real exchange rate (RER) to agricultural exports (log) was initially positive in years 1 and 2, it equilibrated in year 3 after which it became negative up till year 7 where it equilibrated again. It became positive afterward till year 10.

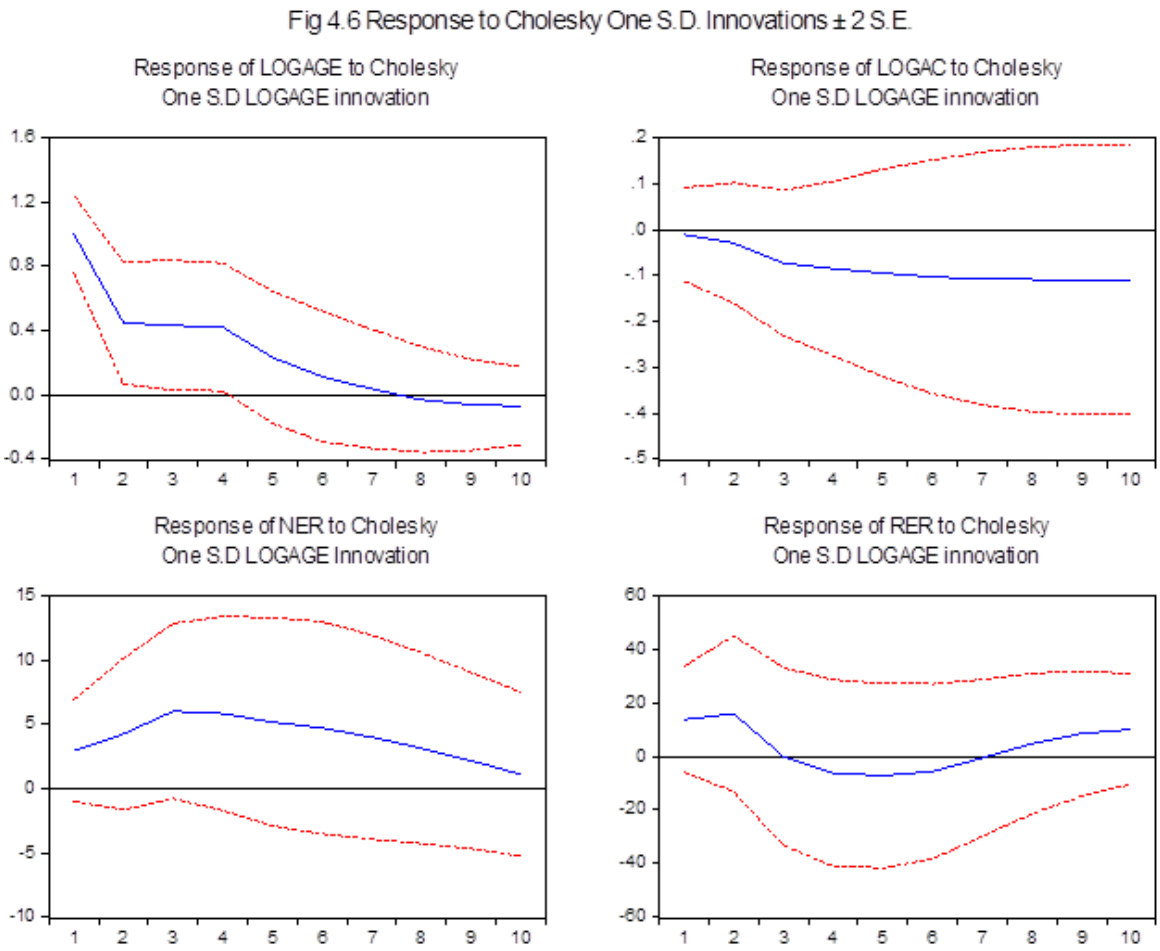

Figure 3: Graph showing impulse response function

Granger causality test

The granger causality test was carried out in order to determine the causal relationship between exchange rate and agricultural exports.

Table 7 shows F-statistics of 3.79028 and a probability of 0.0222 we reject the null hypothesis as it is significant at 1%. This implies that NER granger causes LOGAGE. Meanwhile with a probability of 0.9603 which is not significant, and an F-statistics of 0.09814 we accept the null hypothesis implying that LOGAGE does not granger cause NER. This indicates a unidirectional causality.

RER does not granger cause LOGAGE with a probability of 0.8951 and F-statistics of 0.20041. We accept the null hypothesis as the probability is not significant. Also LOGAGE does not granger cause RER with a probability of 0.7793 which is not statistically significant, and F-statistics of 0.36427. Hence, there is no direction of causality between the variables.

RER granger causes NER with an F-statistics of 2.39261 and a probability of

0.0914 which is significant at 10%. NER does not granger cause RER with an F-statistics of 0.73439 and a probability of 0.541 which is not significant at any level. Hence, we accept the null hypothesis. This implies that there exists a unidirectional causation between the two variables.

In general, the test shows that only one direction of causality which is unidirectional causality, exists among the pairs of causality tested on the series. This implies that we rejected the null hypothesis at 5 percent (0.0222) between NER and LOGAGE while RER and NER was rejected at 10 percent (0.0914) as indicated in table 7. This indicates a unidirectional relationship from NER to LOGAGE while the other predictor is from RER to NER. This therefore means that the causation flows from NER to LOGAGE as well as the other causation being from RER to NER since the hypotheses were rejected. Furthermore, the reason might not be unconnected to the fact that favourable nominal exchange with other countries may lead to more productivity of agricultural exports in Nigeria and the expected implications on the foreign reserve

Conclusion

The study empirically investigates the relationship among real exchange rate, nominal exchange rate, agricultural credit and agricultural export for the period 1981 to 2016. The results of unit root test indicates that agricultural export, real and nominal exchange rate as well as agricultural credit were integrated of order one (1). That is, they were found to be stationary at their first difference.

The result of the Johansen Co-integration test revealed two co-integrating equations at 0.05 level of significance, which indicated the existence of long term relationship between the variables. The results of the VECM estimation revealed that C (5) is positive and significant at 5%, C (6) and C (7) are both positive and significant at 1% respectively. This implies that there is a significant direct relationship between agricultural exports and nominal exchange rate as well as agricultural credits. The findings revealed that real exchange rate is significant in determining the volume of agricultural exports in Nigeria which was significant at 1% and this is in line with the findings of Kandil *et al.,* (2004), Young

Table 7: Granger Causality Test Result

Null Hypotheses	F-Statistic	Probabilities	Remarks
NER does not Granger Cause LOGAGE	3.79028	0.0222	Uni-direction
LOGAGE does not Granger Cause NER	0.09814	0.9603	No causality
RER does not Granger Cause LOGAGE	0.20041	0.8951	No causality
LOGAGE does not Granger Cause RER	0.36427	0.7793	No causality
RER does not Granger Cause NER	2.39261	0.0914	Uni-directional
NER does not Granger Cause RER	0.73439	0.5410	No causality

(2010), Essien *et al.,* (2011), Okputu *et al.,* (2012) and Umaru *et al.,* (2013). The Impulse Response test carried out for the impact of agricultural exports shock on agricultural credit revealed a negative effect from year 1 to year 10. It showed that the impact of agricultural export shock on nominal exchange rate was positive throughout the years, while the impact of agricultural export shock has both positive and negative effect on real exchange rate depending on whether the shock is an increase or decrease.

The findings of the granger causality test revealed that only one direction of causality which is unidirectional, exists from nominal exchange rate to agricultural export, and from real exchange rate to nominal exchange rate.

The autoregressive conditional heteroscedasticity and generalized autoregressive conditional heteroscedasticity results therefore revealed that exchange rate in Nigeria is highly volatile and may positively or negatively impact on the agricultural exports of the country. The study therefore concluded that real exchange rate is significant in determining the volume of agricultural exports in Nigeria which was significant at 1% and this is in line with the findings of Kandil *et. al.* (2004), Young (2010), Essien *et al* (2011), Okputu *et. al.* (2012) and Umaru (2013).

Only one direction of causality was found among the variables which is unidirectional, exists from nominal exchange rate to agricultural exports and from real exchange rate to nominal exchange rate. Also, an agricultural export was found to adjust quickly to short-run shocks and credit to the agricultural sector was also found to be non-significant is in line with the workings of Nwobi *et. al.* (2012).

The study therefore recommends that the Central Bank of Nigeria should provide more incentives to boost agricultural exports by improving on the stabilisation of exchange rate with a view to promoting a stronger Naira for economic growth and development.

Government should encourage export promotion strategies as well as promoting effective fiscal and monetary policies which will aim at achieving a realistic optimum rate for naira in Nigeria. This further suggests that Nigeria's exporting activities can be further boosted by policies aimed at achieving and maintaining a stable competitive real exchange rate.

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