

# Exchange Rate Volatility and Export of Agricultural Produce in Nigeria

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**ABSTRACT:** *This study examined the effect of exchange rate variation on the export of agricultural produce in Nigeria. The specific objectives of the study include; examining the effects of exchange rate variation; Trade openness; Agricultural financing; and Agricultural employment on the export of agricultural produce in Nigeria. This study adopted the VAR estimation technique in ascertaining the nexus between exchange rate variation and the export of agricultural produce in Nigeria. Data for this study were sourced from World Development Indicators, WDI, a publication of the World Bank; Central Bank of Nigeria, CBN, Statistical Bulletin and Annual Reports for the various years; and the National Bureau of Statistics. The data covered a period of 35 years 1986 – 2021. The analysis began with a descriptive statistic, unit root test and a co-integration test to ascertain the suitability of the data that entered the model. Thereafter, the VAR estimation technique used in estimating the model for this study. The variables of the model include: AGRXPT, EXRV, TOPEN, AGRFIN and AGREMP. The results show that EXRV, TOPEN, AGRFIN and AGREMP exert a positive effect on AGRXPT. The study therefore concludes that EXRV, TOPEN, AGRFIN and AGREMP play a vital role in enhancing the export of agricultural produce in Nigeria. Based on that, the study recommends increased domestic production of agricultural produce, implementation of export oriented policies that will engender increased foreign exchange inflows towards a stable exchange rate system and adequate training and extension services to boost the competence of the labour force in the agricultural sector.*

**KEY WORDS:** exchange rate, volatility, export, agricultural produce, Nigeria

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## INTRODUCTION

Nigeria's economy which grew by 2.5% (year on year) in real terms in the second quarter of 2023. It is the 31st in the world based on the nominal Gross Domestic Product (GDP) value of \$504 Billion as at 2022, the 27th largest based on purchasing power parity and the largest economy in Africa. (National Bureau of Statistics, NBS, 2023). It is the most populous nation

in Africa and seventh in the world with a projected population of about 220 million for 2022 (World Bank 2022). According to Ake (1996), agriculture used to be the principal foreign exchange earner for Nigeria and the country was self-sufficient in food production in the 1960s and early 1970s and a major employer of the Nigerian working population. Statistics have shown that the share of agriculture in total output stood at 63.5% in 1960, making it the dominant economic activity during that decade (CBN, 2009). This was the scenario before the discovery of crude oil in commercial quantities in Nigeria. Agricultural activities in Nigeria centre on crop production, animal husbandry, fishing, food processing and forestry; and majority of the operators produce in small scale. The system of cultivation includes shifting cultivation, crop rotation, mixed farming and small-scale irrigated agriculture, which is practiced in the North. Livestock farming is largely nomadic while fishing is mainly artisanal with low technical inputs (Eyo, 2005).

Between 1970 and 1974, agricultural exports as a percentage of total exports fell from about 43% to slightly over 7%. From the mid-1970s to the mid-1980s, the average annual growth rate of agricultural export declined by 17%. The percentage of agricultural export relative to the total export value is still low in the country not minding the plausible Heckscher-Ohlin theory of international trade which identified resource endowment as a factor that encourage comparative cost advantage. Abolagba et al., (2010) emphasized the fact that Nigeria has lost its role as one of the world's leading exporters of agricultural commodities. In addition, the country is currently suffering from a declining as well as fluctuating income from its heavy dependence on oil exports and with the present situation in the oil market, it has become necessary for the country to reconsider its agricultural export position. According to Food and Agriculture Organization Statistics, FAOSTAT, (2017), Nigeria in 1961 exported 197,000 tonnes of cocoa beans. This increased to 304,000 tonnes in 1970 and declined steadily in the 1970s to 153,000 tonnes in 1980. The figure however rose up to as much as 485,000 tonnes in 2006, but, subsequently declined to 248,000 tonnes in 2017. On the other hand, 58,000 tonnes of natural rubber was exported in 1961 and this increased to 147,000 tonnes in 1990 and 151,000 tonnes in 2017. In recent times, the proportion of the GDP attributed to agriculture as at the fourth quarter of 2016 was 24% (NBS, 2017). The sector recorded an annual growth rate of about 3.5% and now employs about 30% of the total labour force (World Bank, 2011). GDP annual growth rate in Nigeria averaged 3.95% from 1982 until 2017, reaching an all-time high of 19.17% in the fourth quarter of 2004 and a record low of -7.81% in the fourth quarter of 1983. The Nigerian economy shrank by 0.5% year-on-year in the first quarter of 2017, following an upwardly revised 1.7% contraction in the previous period. The recession that hit the economy and the impact of COVID-19 Pandemic further exacerbated the contraction of the economy in 2020 and 2021. The economy showed signs of recovery in the second quarter of 2022 recording a 2.1% growth. (NBS, 2022)

Despite the contribution to the economy, Nigeria's agricultural sector faces many challenges which impact on its productivity and hence export of agricultural produce. These include; poor land tenure system, low level of irrigation farming, climate change and land degradation. Others are low technology, high production cost and poor distribution of inputs, limited financing, high post-harvest losses and poor access to markets. These challenges have stifled

agricultural productivity affecting the sector's contribution to the country's GDP as well as increased food imports due population rise hence declining levels of food sufficiency. For instance, between 2016 and 2019, Nigeria's cumulative agricultural imports stood at N3.35 trillion, four times higher than the agricultural export of N803 billion within the same period (PricewaterCoopers,PwC, 2019). The Government has implemented several initiatives and programmes to address the situation including the Agriculture Promotion Policy (APP), Nigeria–Africa Trade and Investment Promotion Programme, Presidential Economic Diversification Initiative, Economic and Export Promotion Incentives and the Zero Reject Initiative, Reducing Emission from Deforestation and Forest Degradation (REDD+); Nigeria Erosion and Watershed Management Project (NEWMAP); Action Against Desertification (AAD) Programme, among others. All these efforts aim to increase agricultural productivity in order to provide sufficient quantities of food to meet domestic demand as well as an abundance of commodity crops for export in the international market. Besides, they aim at reversing forest loss and degradation; promoting sustainable management of natural resources; rehabilitation of degraded lands and reducing erosion and climate vulnerability.

Over the years, Nigeria has pursued the objective of accelerating economic growth and development with a view to moving the economy to a more desirable state. The development of the agricultural sector which has the potential to generate foreign exchange earnings and improve the economy is one of the key policy initiatives of this objective. Exchange rate is among the critical macroeconomic instruments that help in the determination of a nation's international competitiveness in a modern economy. Consequently, policy makers and economic managers strive to ensure that exchange rate policies are adequately and appropriately structured to meet the aspirations of the various sectors of the economy (Odili, 2014). Exchange rate is the rate at which one local currency is exchanged for another. The appreciation or otherwise may strongly influence the overall performance of the economy and specifically the agricultural sector. This therefore means that exchange rate play a vital role in the attainment of optimal economic performance in most emerging economies like Nigeria.

The volatility of exchange rate assumed an alarming dimension in Nigeria with the introduction and implementation of the Structural Adjustment Program (SAP)in 1986 (Ayobami, 2019). One of the policy objectives of SAP was to ensure the exchange rate is market-determined as against the Central Bank of Nigeria (CBN) regulated rates. The weak productive and export base of the Nigerian economy restricted the inflow of foreign income (dollar inflow). Consequently, Nigeria could not achieve one of the macroeconomic goals which is exchange rate stability with her trading partners due to the exchange rate instability. The Naira maintained a constant fall against major currencies especially the US dollars. This inability to stabilize the Naira against the US dollars put the economy in a precarious situation and subjected it to the challenge of incessant and constant volatility and fluctuation of the exchange rate. This instability had serious implications for the economy.

Exchange rates affect trade by determining the relationship between international and domestic prices (Economic Research Service/ United States Department of Agriculture ERS/USDA, 2001). Changes in the real (inflation-adjusted) exchange rate result in the raising or lowering of prices of Nigerian goods in local currency terms around the world. An

appreciating Naira raises the price of Nigerian goods on the international market, while a depreciating lowers these prices. Exchange rate movements are particularly important for the agriculture sectors in a developing country such as Nigeria, where exports crops account for a major portion of agricultural production. Since the move to liberalized system, the economy has witnessed series of changes that have substantially affected the trend and stability of the rate. For example, the official exchange rate which was N0.65 to the U.S dollar on the average in the 1970s depreciated by over 39% to an average of N2.19 to the U.S dollar in the 1980s, and further depreciated by about 50% to reach an average of N25.92 to the dollar in the 1990s (Oyinlola, 2007). Today, the Naira has further depreciated by over 800% in 2024 going at 1USD to 1450:00NGN.

However, despite the large depreciation of the Naira over the last two decades, the performance of Nigeria's agricultural exports has been sluggish. While the value of agricultural exports has increased in absolute value, its share in aggregate exports has continued to move downward. In addition, the growth rate of the sector has been largely fluctuating. Furthermore, both the volume and the range of agricultural exports have declined sharply, and agricultural imports have also increased. While there may be many factors behind this dismal performance of agricultural exports in Nigeria, movements in the exchange rate may likely be an important factor. Ayobami (2019) noted that there are other factors that led to exchange volatility in Nigeria. Amongst them are the high quest of Nigerians on imported items; commodity-driven nature of Nigerian economy; multiple exchange rate regimes by policy makers; the non-resilience real sector (agricultural and manufacturing sectors) of the economy as well as racketeering and round tripping activities involved in foreign exchange operators.

In the post SAP era, several policies were adopted to mitigate fluctuations and attain stability in the exchange rates. These efforts seem to have proved abortive as the fluctuations continue to persist. The country's currency maintained a downward trend and this may impact greatly on agricultural export production. Furthermore, exchange rate fluctuations tend to discourage firms from undertaking investment, innovation and trade, it may also deter firms from entering into export markets, thereby weakening investors' confidence in the sector, and also raise the price of imported inputs such as seeds, fertilizers, pesticides, and capital equipment which may in turn reduce the agricultural productivity and income of farmers. Agricultural exports have been on the decline in Nigeria despite the numerous policy interventions put in place to ameliorate the situation. Therefore, the general objective of this study is to examine the effect of exchange rate volatility on export of agricultural produce in Nigeria. Specifically, this paper intends to:

- ascertain the effect of exchange rate volatility on export of agricultural produce in Nigeria.
- determine the impact trade openness on export of agricultural produce in Nigeria.
- examine the relationship between agricultural financing on export of agricultural produce Nigeria.

The period under empirical investigation will be between 1986 and 2021. The choice of this period is premised on the grounds that exchange rate fluctuations became more intense with the adoption of the SAP in 1986. One of the core objectives of SAP was to diversify the

productive base of the local economy towards encouraging total exports (agricultural produce export inclusive). The study considers agricultural exports aggregation to include the variety of products that make up agricultural exports in Nigeria.

## LITERATURE REVIEW

Several studies have been conducted to ascertain the nexus between exchange rate variation and agricultural exports in Nigeria and beyond. Using structural vector autoregressive (VAR) estimation technique, Shane, Roe and Somwaru (2008) investigated the relationship between exchange rate, foreign income and the United States agricultural exports utilizing annual time series data from 1980 to 2006. The VAR estimates showed that there is a significant negative effect of exchange rate on aggregate U.S. agricultural exports. Hashemi-Tabar and Akbari (2009) examined the link between agricultural exports and exchange rate volatility in Iranian economy using annual time series data covering the period 1956 to 2006. The authors employed the vector error correction (VEC) modeling technique and found that exchange rate volatility had an adverse effect on agricultural exports in Iran. Abule and Abdi (2012) investigated the impact of exchange rate variability on export of Ethiopia's agricultural products, utilizing annual time series data covering the period 1992-2010 and employing the Autoregressive Distributive Lag (ARDL) modelling technique, the results indicated the existence of a negative relationship between oilseeds and exchange rate variability. Using the granger causality analysis, Meusavi and Leelavathi (2013) examined the causal nexus between exchange rates and agricultural exports in India employing annual time series data from 1980 to 2010. The granger causality test showed no causal relationship between exchange rate and agricultural exports. This means that exchange rate does not predict significantly agricultural exports in India. Saeid and Leelavathi (2013) investigated the causal relationships between agricultural exports and real exchange rate in India, using time series data between 1980 and 2010 and employing the Granger causality analysis. The results revealed that there is no significant relationship between quantity of agricultural export and real exchange rate during the period under evaluation implying that both variables do not cause each other in either direction.

Bohl et al., (2018) investigated whether speculative activity in Chinese future markets for agricultural commodities destabilizes future returns. In order to capture speculative activity the study employed a speculation and a hedging ratio and the results showed that for most of the commodities, there were positive influences of the speculation ratio on conditional volatility. Chi and Cheng (2016) examined the short and long-run impacts of real income, bilateral exchange rate, and exchange rate volatility on Australia's maritime export volume to its major Asian trading partners using quarterly data for the period of 2000Q1-2013Q2. It was found that exchange rate volatility had a significant long-run effect in the majority of the cases examined, suggesting that exchange rate volatility was an important factor affecting maritime export volume.

In Nigeria, Gatawa and Mahmud (2017), analysed short and long-run impacts of exchange rate fluctuations on agricultural exports volume in Nigeria using secondary data obtained from Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics and International Financial Statistics of the International Monetary Fund (IMF) spanning over 34 years(1981-



2014). ARDL methodology was used as the method of analysis; the independent variables include official exchange rate, agricultural loans and relative prices of agricultural exports while the dependent variable is agricultural export volume. GARCH was used to estimate the volatility of exchange rates, and other diagnostic tests. The short-run results revealed that official exchange rate and agricultural loans have significant positive impact on agricultural export volumes which has the effect of expanding the dependent variable, while relative prices of agricultural exports has significant negative impact on agricultural exports volume which also has the effect of contracting the dependent variable. The long-run results revealed similar findings with the exception of official exchange rate which has statistically significant negative impact on agricultural exports volume. i.e. contrary to normal expectations. The study recommends the relevance of stabilizing exchange rate from the present downward trend and providing farm equipment and input on credit basis by the government and private sector institutions rather than loanable fund that can be redirected to other activities other than agriculture. Ogunkoya and Shobayo (2015) examined the effect of exchange rate fluctuation on Agricultural export in Nigerian 1986-2012. Using the OLS estimation technique on secondary data gathered from the Central Bank of Nigeria Statistical Bulletin for the various years, the study revealed that the impact of exchange rate variation on Agricultural export in Nigeria was null. Ettah et al (2019) focused on the effects of price and exchange rate fluctuations on Agricultural exports (cocoa) in Nigeria. Secondary data were collected from the publications of Central Bank of Nigeria (CBN): Statistical Bulletin, Economic and Financial Reviews, Bullion and Annual Reports and Statement of Accounts (various issues). Other sources included the Trade Summary and Abstracts of Statistics published by the National Bureau of Statistics and the International Statistics of the IMF. An export supply function for cocoa was specified and estimated using the Ordinary Least Squares Regression. Results showed that exchange rate fluctuations and agricultural credits positively affect cocoa exports in Nigeria. Results also revealed that relative prices of cocoa are insignificantly related to quantity of export, however, it has a negative sign which is in line with the a priori expectation. The result, therefore, implies a positive significant effect of exchange rate volatility on cocoa exports in Nigeria. The recommendation that agricultural credit schemes should be restructured in a way that should meet the needs of farmers; and such credit facilities should be made available and accessible to cocoa farmers in order to boost their production capacity. Exchange rate has impacted positively on cocoa export in Nigeria; hence, there should be a free market determination of exchange rate for export of cocoa in Nigeria. Udo and Nsikak (2022), examined the effect of exchange rate volatility on Nigeria's agricultural export performance using annual data from 1980-2015. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH-1,1) model was used to generate the exchange rate volatility series which was subsequently incorporated into the Autoregressive Distributed Lag (ARDL) Model for determining factors affecting agricultural exports (cocoa and rubber). The Bounds Test revealed long-run relationship among variables. The results indicated that exchange rate volatility did not significantly affect exports both in the short-run and the long-run. This may be partially attributed to the inelastic nature of agricultural commodities' supply particularly in the short run. It was also revealed that there was a positive and significant relationship between exchange rate, inflation, GDP, domestic prices, world prices and agricultural export.

Akinniran and Olatunji (2018) examined the effects of exchange rate on agricultural exports as well as the total agricultural export in Nigeria, using data from 1985 to 2010 and employing the Ordinary Least Squares (OLS) estimation technique. Result of the study showed that exchange rate has a significant negative effect on agricultural exports in Nigeria.

Babatunde and Shuaibu (2012) empirically examined the effect of real exchange rate on agricultural export in Nigeria using annual time series data covering the period 1980 to 2007. The study employed the Auto-Regressive Distributed Lag (ARDL) technique estimation technique. Results of the short run and long run estimates found that real exchange rate depreciation has a short run and long run positive relationship with agricultural exports while real exchange rate volatility has a negative relationship with agricultural exports in Nigeria. Omojimate and Akpokodje (2010) empirically examined the effect of exchange rate volatility on the exports of the panel of Communaute Financiere Africaine (CFA) countries with that of the non-CFA counterparts during the period 1986-2006. Exchange rate volatility series were generated utilizing the GARCH model. These series were then incorporated into an export equation and estimated using the OLS, fixed effect, first difference GMM and systems GMM equation techniques. The results reveal that the system GMM technique performed better than the other estimation techniques. Exchange rate volatility was found to negatively impinge on the exports of both panels of countries. However, exchange rate volatility has a larger effect on the panel of the non-CFA countries than on the CFA. The paper recommends the need to take appropriate monetary and fiscal policy actions to stem the rising exchange rate volatility.

Apparently, the literature review has shown that several studies have examined the influence of exchange rate variation on agricultural export in Nigeria. While some studies like Alegwu et al (2018); Ogunkoya & Shobayo (2019); Akinbode & Ojo (2015); and Udo & Nsikak (2022) revealed a negative relationship between exchange rate variation and agricultural exports, others like Babatunde & Shuaibu (2012), Gatawa & Mahmud (2017), Ettah et al (2018) concluded that a positive relationship exists between exchange rate variation and agricultural exports in Nigeria. Again, the trio of Gatawa & Mahmud (2017), Akinbode & Ojo (2015); and Udo & Nsikak (2022) adopted the auto-Regressive Distributed Lag (ARDL) technique in their studies, Ettah et al (2018) and Ogunkoya et al (2019) employed the OLS estimation technique, while Babatunde & Shuaibu (2012) and Alegwu et al 2018 adopted UECM and VECM respectively. This study while adopting the Vector Auto regression VAR methodology, considers agricultural export in aggregative terms. There seem to be paucity of empirical studies that examined the nexus between exchange rate variation and aggregate agricultural exports in Nigeria using the VAR approach. This provides a point of departure from existing studies and presents the gap that this current study intends to fill.

## **METHODOLOGY**

The model for this study is anchored on the Heckscher-Ohlin factor endowment theory and the elasticity theory. Based on the theoretical postulates, the equation for this study will be formulated and specified. The dependent variable is aggregate agricultural exports. The independent variables included exchange rate, agricultural land, agricultural labour force,

agricultural machineries, bank loans and advances to agriculture, oil price and average world price of agricultural commodities. Exchange rate was derived from the elasticity theory. Agricultural production resources such as agricultural land, agricultural labour force, agricultural machineries, were derived from the Heckscher-Ohlin factor endowment theory. Several other factors known to affect the export of agricultural exports such as bank loans and advances to agriculture, trade openness, and agricultural employment were captured and included in the model alongside the aforementioned agricultural export determinants.

In line with the Heckscher-Ohlin factor endowment theory, production capacity is a crucial factor influencing agricultural export performance. This means, countries abundant in factors of production such as land, labour and capital should specialize in producing commodities that requires such abundant resources. Thus, abundance of agricultural land, agricultural labour force and agricultural machineries should lead to an increase in agricultural production for export. Institutional agricultural support provides incentives for increased agricultural productivity. Hence, institutional agricultural support by way of granting loans and advances to farmers is capable of boosting agricultural productivity, thereby promoting agricultural export. From the foregoing, therefore, and following from Udo and Nsirik (2022); Gatawa and Mahmud (2017) and Tadesse and Badiane (2018), the functional form of the equation of this study can be expressed as follows with slight modifications:

$$\text{AGRXP} = f(\text{EXRV}, \text{TOPEN}, \text{AGRFIN}, \text{AGREMP}) \text{-----} 1$$

Where AGRXP = aggregate agricultural exports in Nigeria (in billion naira)

EXRV = Exchange Rate Volatility

TOPEN = Trade openness

AGRFIN = Agricultural Financing

AGREMP = Employment in the agricultural sector (in millions)

Equation 1 above is stated in its log form as stated below;

$$\ln \text{AGRXP} = \beta_0 + \beta_1 \ln \text{EXRV} + \beta_2 \ln \text{TOPEN} + \beta_3 \ln \text{AGRFIN} + \beta_4 \ln \text{AGREMP} + U_t \text{.....} 2$$

The theoretical a priori expectations about the signs of the coefficients of the parameters are as follows  $\beta_1 < 0$ ,  $\beta_2, \beta_3, \beta_4 > 0$ .

It is expected that agricultural financing and agricultural employment should have positive effect on agricultural exports in line with the Heckscher-Ohlin factor endowment theory. Thus, an increase in agricultural financing and agricultural employment should lead to an increase in agricultural production and hence agricultural produce for exports. In line with the elasticity theory, the devaluation of currency should lead to an improvement in the trade balance, provided that the sum of price elasticities of supply for exports and demand of imports in absolute terms is greater than one. This means that the devaluation/depreciation of the exchange rate should bring about an increase in agricultural exports, while the appreciation of the exchange rate should lead to the deterioration of agricultural exports. However, given the low price elasticity of supply for agricultural commodities export, it is expected that exchange rate movements may not exert positive effect but negative effect on export of agricultural produce. Lastly, trade openness should have positive effect on export agricultural of produce.



This paper adopts the vector autoregressive (VAR) approach for its estimation technique. VAR is a linear econometric model used to capture the interdependencies among multiple time series. VAR models generalize the univariate autoregressive model (AR model) by allowing for more than one evolving variable. For the estimation procedure for this study, some pre estimation tests was conducted to ascertain its suitability. They include: descriptive statistics, the correlation analysis, unit root test, as well as cointegration which were considered to ascertain the suitability of the variables, the data and the technique that will be employed.

## DATA SOURCES AND MEASUREMENT OF VARIABLES

The data for this study were sourced from secondary sources based on their applicability, reliability, and accessibility for empirical researches. They specifically obtained from the following sources:

- Central Bank of Nigeria CBN Statistical Bulletin: various issues.
- National Bureau of Statistics; and
- World Development Indicators WDI.

Annual data for the period 1986 – 2021 will be obtained for;

- Agricultural Exports
- Agricultural Employment
- Trade Openness
- Exchange Rate Volatility
- Agricultural Financing

**Table 1: Measurement and Definition of Variables**

Variable	Definition	Measurement	Source	Sign	Source of Data
<i>AGRXP</i>	Aggregate agricultural exports in Nigeria	Total value of agricultural exports in Nigeria	Udo & Nsikak (2022)	Positive	WDI 2022, NBS
<i>AGREMP</i>	Labour services in the agricultural sector in Nigeria (Total employment in the agricultural sector)	Labour force in the agricultural sector. 16 – 60 years	Udo & Nsikak (2022)	Positive	WDI 2022, NBS
<i>TOPEN</i>	The degree of a nation's involvement in global trade	export + import, percentage of GDP	Author	Positive	WDI 2021
<i>EXRV</i>	Movements (appreciation/depreciation in the real exchange)	Depreciation of the Naira against the USD	Udo & Nsikak (2022)	Negative	CBN Statistics Bulletin for the various years
<i>AGRFIN</i>	Strategic financial flows aimed at boosting productivity in the agricultural sector.	Agricultural Credit Guarantee Scheme funds	Author	Positive	WDI 2021 and CBN

Source: Author's Compilation, 2024

## PRESENTATION AND DISCUSSION OF RESULTS

The result presentation began with the descriptive statistics which examined the distribution of the data for the analysis. This is followed by examination of the time series properties of the data using unit root test and co-integration test. The essence of the test for stationarity and co-integration is to ascertain the order of integration of variables, as well as ascertain the existence of long run relation if the variables are not integrated of order zero.

### Descriptive Statistics

The descriptive statistics of the selected variables are shown in the table 2 below:

**Table 2: Descriptive Statistics**

	<b>AGRXP</b>	<b>AGREMP</b>	<b>TOPEN</b>	<b>AGRFIN</b>	<b>EXRV</b>
<b>Mean</b>	931.5872	4429.269	7.439043	25.19496	82.78627
<b>Median</b>	444.649	1309.543	5.33	20.09029	92.69335
<b>Maximum</b>	3080.317	15262.01	18.8	65.71668	305.7901
<b>Minimum</b>	153.076	7.5025	1.410541	-4.976077	0.610025
<b>Std. Dev.</b>	921.5633	5367.485	5.089927	20.3996	80.40635
<b>Skewness</b>	1.199187	0.883834	0.76397	0.500841	0.713608
<b>Kurtosis</b>	2.915807	2.270981	2.20574	2.084935	2.868118
<b>Jarque-Bera</b>	8.878904	5.636517	4.57174	2.837761	3.167107
<b>Probability</b>	0.011802	0.05971	0.101686	0.241985	0.205245
<b>Sum</b>	34468.73	163882.9	275.2446	932.2134	3063.092
<b>Sum Sq. Dev.</b>	30574043	1.04E+09	932.6647	14981.17	232746.5
<b>Observations</b>	35	35	35	35	35

**Source: Author's computations 2024**

The results of the descriptive statistics of AGRXP, AGREMP, TOPEN, AGRFIN and EXRV are presented in table 2 above. Normality test uses the null hypothesis against the alternative hypothesis of non-normality. If the probability value is less than JarqueBera Chi-Square at 5% level of significance, the null hypothesis of the regression is not rejected. Given the results in table 2, it is apparent that the hypothesis that all the variables are normally distributed cannot be rejected since all the probabilities are less than the JarqueBera Chi-square distribution. We utilize the mean based coefficient of Skweness and Kurtosis to check the normality of all the variables used. Skweness measures the direction and degree of asymmetry. The Skweness coefficient indicates normal curves for all the variables with the values ranging between +3 and -3. The positive Kurtosis indicates few cases at the tail of the distribution. However, these results suggest that the use of a VAR model is justified since the hypothesis that the error vector is Gaussian white noise cannot be rejected.

**Correlation Matrix**

The correlation matrix determines the existence of high linear relationship among the independent variables. The results are presented in the table below.

**Table 3: Correlation Matrix**

	<b>AGRXP</b>	<b>AGREMP</b>	<b>TOPEN</b>	<b>AGRFIN</b>	<b>EXRV</b>
<b>AGRXP</b>	1	0.9292591	-0.637426	0.7053257	0.7538186
<b>AGREMP</b>	0.9292591	1	-0.705575	0.6161651	0.8341214
<b>TOPEN</b>	-0.637426	-0.705575	1	-0.157526	-0.717564
<b>AGRFIN</b>	0.7053257	0.6161651	-0.157526	1	0.3579444
<b>EXRV</b>	0.7538186	0.8341214	-0.717564	0.3579444	1

**Source: Author's computation 2024**

An examination of the correlation matrix presented in the table above shows that there is a strong correlation between EXRV and AGRXP. The correlation coefficient is 0.7538. Thus, there is presumption that exchange rate volatility (EXRV) will impact positively on AGRXP.

**Unit Root Test.**

The Augmented Dickey Fuller ADF test was used to test for unit root in this study and the results presented in table 4 below.

**Table 4: ADF Unit Root Test Result**

<b>Variables</b>	<b>ADF Test Statistic</b>	<b>95% Critical value of ADF</b>	<b>Order of Integration</b>	<b>Remarks</b>
<b>DAGRXP</b>	-5.319	-2.948	i(1)	Difference Stationary
<b>DAGREMP</b>	-4.666	-2.957	i(1)	Difference Stationary
<b>DTOPEN</b>	-10.646	-2.954	i(2)	Difference Stationary
<b>DAGRFIN</b>	-7.568	-2.951	i(2)	Difference Stationary
<b>DEXRV</b>	-3.033	-2.948	i(1)	Difference Stationary

**Source: Author's Computation 2024.**

Unit Root Testing of the variables indicate that all the variables are difference stationary given the results as reported in Table 4., the researcher is justified to conduct co-integration test using the Johansen methodology.

**Co-integration Test Results**

The results of the multivariate co-integration test based on the Johansen's co-integration technique reveal that both the trace statistic and maximum Eigen value statistic confirm the existence of two co-integrating equations. The results are presented below.

**Table 5a: Johansen Co-integrated Test Result. (Trace Statistic)**

Variable	Eigenvalue	Trace Statistics	Critical value	Prob
AGRXPT	0.697668	91.92638	69.81889	0.0003*
AGREMP	0.582905	51.25455	47.85613	0.0232*
TOPEN	0.335998	21.52358	29.79707	0.3258
AGRFIN	0.171099	7.601575	15.49471	0.5089
EXRV	0.035284	1.221331	3.841466	0.2691

Source: Author's Computation 2024.

**Table 5b: Johansen Co-integrated Test Result. (Max-Eigen Statistic)**

Variable	Eigenvalue	Max-Eigen Statistic	Critical value	Prob
AGRXPT	0.697668	40.67183	33.87687	0.0067*
AGREMP	0.582905	29.73097	27.58434	0.0261*
TOPEN	0.335998	13.92201	21.13162	0.3715
AGRFIN	0.171099	6.380244	14.26460	0.5649
EXRV	0.035284	1.221331	3.841466	0.2691

Source: Author's Computation 2024

**Vector Auto-regressive VAR results**

The study adopted the VAR methodology as its main estimation technique in examining the nexus between agricultural exports and exchange rate volatility in Nigeria. The results are presented below:

**Table 6: Vector Auto regression Estimates**

Standard errors in ( ) &amp; t-statistics in [ ]

	AGRXPT	AGREMP	TOPEN	AGRFIN	EXRV
AGRXPT(-1)	0.176449 (0.18349) [ 0.96164]	-1.681448 (1.44148) [-1.16647]	-0.004852 (0.00904) [-0.53644]	0.001011 (0.00202) [ 0.50004]	0.012516 (0.01832) [ 0.68302]
AGRXPT(-2)	0.014140 (0.16021) [ 0.08826]	0.065431 (1.25864) [ 0.05199]	0.003600 (0.00790) [ 0.45590]	0.003114 (0.00177) [ 1.76319]	0.006807 (0.01600) [ 0.42547]
AGREMP(-1)	0.066382 (0.03111) [ 2.13387]	1.136174 (0.24439) [ 4.64903]	0.002898 (0.00153) [ 1.88984]	0.000163 (0.00034) [ 0.47450]	-0.004934 (0.00311) [-1.58829]
AGREMP(-2)	0.054813 (0.03294) [ 1.66397]	-0.264121 (0.25879) [-1.02062]	-6.38E-05 (0.00162) [-0.03928]	-0.000433 (0.00036) [-1.19272]	0.001753 (0.00329) [ 0.53302]
TOPEN(-1)	14.56838 (3.37132)	54.09103 (26.4851)	1.027872 (0.16618)	0.032890 (0.03716)	-0.447561 (0.33668)

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	[ 4.32127]	[ 2.04232]	[ 6.18531]	[ 0.88511]	[-1.32935]
TOPEN(-2)	-7.496878 (3.44907) [-2.17359]	-13.71410 (27.0959) [-0.50613]	-0.498405 (0.17001) [-2.93159]	-0.105271 (0.03802) [-2.76906]	0.321194 (0.34444) [ 0.93251]
AGRFIN(-1)	9.990223 (16.1539) [ 0.61844]	52.01687 (126.905) [ 0.40989]	0.869687 (0.79626) [ 1.09222]	0.683374 (0.17805) [ 3.83803]	-0.430716 (1.61321) [-0.26699]
AGRFIN(-2)	-31.08553 (17.6477) [-1.76145]	-124.8313 (138.640) [-0.90040]	0.634067 (0.86989) [ 0.72890]	0.214662 (0.19452) [ 1.10355]	0.273055 (1.76239) [ 0.15493]
EXRV(-1)	4.074985 (2.03126) [ 2.00613]	42.32492 (15.9576) [ 2.65233]	0.131276 (0.10013) [ 1.31112]	-0.016184 (0.02239) [-0.72284]	1.144059 (0.20285) [ 5.63986]
EXRV(-2)	-5.068306 (2.45608) [-2.06357]	-22.91224 (19.2950) [-1.18747]	-0.160316 (0.12107) [-1.32421]	-0.008432 (0.02707) [-0.31145]	-0.049763 (0.24528) [-0.20288]
C	290.6796 (126.313) [ 2.30127]	194.9005 (992.313) [ 0.19641]	-9.380709 (6.22621) [-1.50665]	1.731071 (1.39226) [ 1.24335]	2.293599 (12.6142) [ 0.18183]
R-squared	0.979320	0.960935	0.897696	0.917701	0.971226
Adj. R-squared	0.970703	0.944658	0.855069	0.883409	0.959237
Sum sq. Resids	630347.5	38903046	1531.562	76.58240	6286.483
S.E. equation	162.0632	1273.169	7.988434	1.786318	16.18446
F-statistic	113.6535	59.03625	21.05945	26.76187	81.00936
Log likelihood	-221.1397	-293.2845	-115.7900	-63.36568	-140.5020
Akaike AIC	13.26513	17.38768	7.245144	4.249468	8.657257
Schwarz SC	13.75395	17.87651	7.733967	4.738291	9.146081
Mean dependent	942.8853	4681.820	25.20545	7.478417	87.48026
S.D. dependent	946.8343	5412.016	20.98365	5.231510	80.16156
Determinant resid covariance (dof adj.)		1.14E+15			
Determinant resid covariance		1.73E+14			
Log likelihood		-822.0144			
Akaike information criterion		50.11511			
Schwarz criterion		52.55923			
Number of coefficients		55			

**Source: Author's Computation 2024.**

In order to examine the relationship between exchange rate volatility and export of agricultural produce, this research work estimated the VAR model built for this study. In this study the Akaike information criterion (AIC) was used to determine the lag length of the VAR model. However, two periods lag length were adopted for the study. The estimation result indicates that all the variables put together account for about 94.5% of the systematic change in exchange rate volatility and its influence on the export of agricultural produce. Their F-statistics in



general terms are significant across lags. The impact of EXRV on AGRXPT is positive and significant of 5% significance level in both lags 1 and 2. Also the impact of TOPEN on AGRXPT is positive and significant at 5% level in lag 1 and negative in lag 2. AGRFIN exerts a positive effect on AGRXPT at 5% in lag 1 and negative in lag 2. The results of the other control variables. The results show that there exists a positive relationship between export of agricultural produce and exchange rate volatility in Nigeria.

## DISCUSSION OF RESULTS

The discussion of the results of this study is presented based on the objectives of the study. The presentation begins with objective one.

**Objective one:** ascertain the effect of exchange rate volatility on export of agricultural produce in Nigeria. The results of the regression on the impact of exchange rate volatility on export of agricultural produce in Nigeria are discussed here. From table 6 above, the VAR estimates show that EXRV exerts a positive and significant on AGRXPT in lag 1 with a coefficient of 4.06 and a t-value of 2.00 and a negative but significant effect in lag 2 giving a coefficient of -5.07 and a t-value of -2.06. This however implies that a 1% increase in EXRV will result in a 4.06% increase in AGRXPT. This finding maybe attributed to the fact that in a bid to pursuing exchange rate stability, export oriented policies enacted by government brings about increase in the export of agricultural produce given the fact that agriculture is predominant in Nigeria and it is one of the veritable tools of enhancing real sector productivity (Okoh and Okungbowa 2023). The findings of this study agrees with those of Chi and Cheng (2016) and Gatawa and Mahmud (2017) and is in contrast with those of Akinbode and Ojo (2018).

**Objective two:** determine the impact trade openness on export of agricultural produce in Nigeria. The results of the regression on the impact of trade openness on export of agricultural produce in Nigeria are discussed here. From table 6 above, the VAR estimates show that TOPEN exerts a positive and significant on AGRXPT in lag 1 with a coefficient of 14.57 and a t-value of 4.32 and a negative but significant effect in lag 2 giving a coefficient of -7.49 and a t-value of -2.17. This however implies that a 1% increase in TOPEN will result in a 14.57% increase in AGRXPT. This is expected since trade openness measures the degree of a nation's involvement in the global trading system. It is basically measured as the ratio between the sum of exports and imports as a percentage of GDP. Increased agricultural produce exports indicates increasing participation in global trading system. The negative effect recorded in lag 2 may be attributable to the dwindling fortunes of the agricultural sector in Nigeria due to the constraints of funding, infrastructure, climate change etc. The findings of this study especially the positive effects of TOPEN on growth corroborate those of Okoh and Okungbowa (2023) and negate those of Siyakiya (2017).

**Objective three:** examine the relationship between agricultural financing on export of agricultural produce Nigeria. The results of the regression on the impact of agricultural financing the on export of agricultural produce in Nigeria are discussed here. From table 6 above, the VAR estimates show that AGRFIN exerts a positive and insignificant on AGRXPT

in lag 1 with a coefficient of 9.99 and a t- value of 0.61 and a negative and insignificant effect in lag 2 giving a coefficient of -13.81 and a t-value of -1.76. The results imply that a 1% increase in AGRFIN leads to a 9.9% improvement in AGRXPT in lag 1. This is expected given the apriori expectations. Adequate agricultural financing initiatives is imperative for agricultural sector performance [Adegboyega (2020); Aladejana and Aiyeomoni (2016); Aliero and Ibrahim (2012)].

For the other control variable in the model – AGREMP, the VAR estimates show that AGREMP exerts a positive and significant on AGRXPT across lags with a coefficient of 0.067 and 0.055 respectively and a t- value of 2.13 and 1.66 respectively across lags. Thus implying that a 10% increase in AGREMP will result in a 6.7% and 5.55% increases in AGRXPT. Labour is a critical factor in enhancing productivity. Agriculture is a major employer of labour in the sub-region and also source of food for human consumption as well as source of raw materials for industrial use.

### **Implication of Findings**

The findings of this paper have brought to the fore a number of issues that shall advance policy simulations and promote further research in the Nigeria and beyond. Some of the policy implications derived from these empirical results are listed below:

1. Exchange rate variation enhances increase in the export of agricultural produce in Nigeria. Export oriented policies aimed at stabilizing exchange rate volatility enhances the export of agricultural produce.
2. Trade openness exerts a positive and significant effect on export of agricultural produce in Nigeria. Trade openness is the degree of a country's involvement in international trade.
3. Agricultural financing is imperative for the performance of the agricultural sector in Nigeria.
4. Employment in the agricultural sector is a critical enabler of productivity in the agricultural sector.

### **CONCLUSION**

This paper was motivated by the paucity of studies in the extant literature on the exchange rate variation and export of agricultural produce nexus in Nigeria, especially studies that centred on the roles of exchange rate variation in enhancing agricultural sector performance. This study, therefore, sought to ascertain the impact of exchange rate variation on export of agricultural produce in Nigeria. The summary of the findings of this paper includes:

1. The results show that exchange rate variation EXRV in lag 1 has a positive and significant effect on export of agricultural produce AGRXPT in Nigeria and a negative but significant effect in lag 2.
2. The results show that trade openness TOPEN in lag 1 has a positive and significant effect on export of agricultural produce AGRXPT in Nigeria and a negative but significant effect in lag 2.

3. The results indicate that agricultural finance AGRFIN exerts a positive and insignificant effect on export of agricultural produce AGRXPT in Nigeria in lag1 and a negative but insignificant effect in lag 2.
4. The VAR estimates show that agricultural employment AGREMP exerts a positive and significant on AGRXPT across lags.

The result of this study has thrown up a number of issues. Central among them is the pivotal role that EXRV, TOPEN, AGRFIN and AGREMP in enhancing the export of agricultural produce in Nigeria. This study considered export of agricultural produce as the aggregation of total agricultural exports and was measured as the total value of agricultural exports in Nigeria. Exchange rate volatility is taken to mean movements (appreciation/depreciation) in the real exchange and was measured as depreciation of the Naira against the USD. Evidence from this study supports the proposition that improving levels of agricultural financing, employment in the agricultural sector and trade openness improves the export of agricultural produce in Nigeria. In Nigeria, stabilizing the ever gyrating exchange rate involves a mix of policies that are export oriented. This is because the exchange rate issues in Nigeria are closely related to demand and supply bottlenecks owing to abysmal levels of productivity. To address the depreciation of the Naira against the USD, concerted and deliberate policy measures must be put in place to improve our export potentials across the various sectors of the economy especially the real sector (the agriculture and manufacturing sectors).

### **Recommendations**

Based on the findings of this paper, the researchers make the following recommendations:

1. Increased domestic production of agricultural produce via a guarantee minimum price scheme that will propel investment in the agricultural sector as the results of this study has shown that agricultural financing exerts a positive effect on export of agricultural produce.
2. Implementation of export oriented policies that will engender increased foreign exchange inflows towards a stable exchange rate system in Nigeria.
3. Adequate training and extension services to boost the competence of the labour force in the agricultural sector to boost performance as the results of this study suggests a positive relationship between agricultural employment and export of agricultural produce.

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