Sectoral Analysis of the Impact of Exchange Rate Volatility on Trade Performance in Nigeria

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Abstract
This study empirically examines the impact of exchange rate volatility on Nigeria's foreign trade performance using monthly time series data from January 2004 to December 2024. Motivated by persistent Naira instability and the country's structural dependence on oil exports, the research addresses critical gaps in existing literature by disaggregating export sectors and incorporating trade openness as a performance metric. Exchange rate volatility was generated using the GARCH (1,1) model. The Autoregressive Distributed Lag (ARDL) bounds testing approach was employed to estimate both short-run and long-run relationships among the variables for three models: trade balance, trade openness, and sectoral exports (agriculture, manufacturing, and oil). The sectoral analysis shows differential vulnerability from the findings: manufacturing exports are the most adversely affected by exchange rate volatility in both the short and long run, agricultural exports exhibit weak responsiveness due to structural constraints, and oil exports are resilient, showing a positive association with volatility due to their dollar-denominated pricing. The study concludes that exchange rate volatility remains a major constraint to export diversification and trade expansion in Nigeria. The study recommends prioritization of exchange rate stabilization, strengthening external reserve buffers, implementing targeted support for manufacturing export competitiveness, and accelerating structural reforms in the agricultural sector to reduce overall economic vulnerability to currency shocks.

Keywords: Exchange rate volatility, agricultural exports, manufacturing export, oil exports, GARCH

1. Introduction

International trade plays a pivotal role in economic development by facilitating the movement of goods, services, and capital across national boundaries. Through these channels, trade stimulates economic growth, generates employment opportunities, enhances productivity, and promotes technological diffusion. For developing economies, trade serves as a critical mechanism for integrating into global markets and accelerating structural transformation. In Nigeria, trade remains a major driver of economic activity, particularly through oil exports, which have historically accounted for a substantial share of foreign exchange earnings and government revenue. However, the country's trade performance has been highly susceptible to exchange rate fluctuations, which influence export competitiveness, import costs, investment decisions, and the overall trade balance (Krugman, et al., 2018; World Bank, 2024). The exchange rate represents a crucial macroeconomic variable affecting international trade flows. Exchange rate volatility, defined as unpredictable fluctuations in the value of a currency, creates uncertainty in international transactions and can adversely affect export and import decisions. While exchange rate depreciation may improve export competitiveness by lowering the foreign-currency price of domestic goods, excessive volatility increases transaction costs, raises investment risks, and discourages long-term trade relationships. Consequently, the relationship between exchange rate volatility and trade performance has remained a central issue in international trade and macroeconomic policy literature (Krugman, et al., 2018; Bahmani-Oskooee & Hegerty, 2010).

Nigeria's exchange rate regime has undergone substantial transformation since the introduction of the Structural Adjustment Programme (SAP) in 1986. Prior to SAP, the country operated a fixed exchange rate system characterized by extensive government intervention and persistent overvaluation of the naira. The establishment of the Second-tier Foreign Exchange Market (SFEM) in 1986 marked a transition toward a market-determined exchange rate system aimed at correcting exchange rate distortions and improving external competitiveness (Sanusi, 2004). Subsequent reforms, including the Dutch Auction System (DAS) introduced in 1999 and the Investors' and Exporters' (I&E) Foreign Exchange Window established in 2017, sought to enhance exchange rate flexibility and improve foreign exchange allocation efficiency (Central Bank of Nigeria [CBN], 2017). Despite these reforms, the naira has remained highly volatile. Between 2023 and 2024, for example, the exchange rate depreciated sharply from approximately ₦462 to ₦1,479 per US dollar, representing one of the most significant currency adjustments in Nigeria's recent economic history (World Bank, 2024). Similar episodes of substantial depreciation occurred during periods of macroeconomic adjustment and external shocks in 1994, 2005, and 2016, often resulting in significant disruptions to trade activities (Okonkwo & Odularu, 2020; Obi & Adebayo, 2022).

The implications of exchange rate volatility for Nigeria's trade performance have been profound. Fluctuations in the exchange rate affect both exports and imports by altering relative prices and production costs. In particular, exchange rate instability has constrained Nigeria's trade openness, commonly measured as the ratio of total trade (exports plus imports) to gross domestic product (GDP). Periods of heightened volatility have frequently coincided with declining export volumes, reduced imports of capital and intermediate goods, and weakened integration into global markets. The depreciation episodes of 2016 and 2023–2024, for instance, significantly increased production costs for firms dependent on imported inputs while simultaneously creating uncertainty for exporters. Consequently, both oil and non-oil sectors experienced reduced contributions to overall trade performance, limiting Nigeria's ability to maximize the gains from globalization and regional trade integration initiatives (Adeniyi, et al., 2011; World Bank, 2024).

The consequences of exchange rate volatility are also reflected in Nigeria's trade balance dynamics. Although the country occasionally records trade surpluses during periods of favorable international oil prices, persistent exchange rate instability has often contributed to trade imbalances. For example, Nigeria recorded a trade deficit exceeding ₦1.17 trillion in the first quarter of 2023, driven largely by rising import costs and foreign exchange pressures (CEIC, 2024). These developments underscore the vulnerability of the country's trade sector to exchange rate shocks, particularly in non-oil export activities where competitiveness is highly sensitive to production costs and market uncertainties.

A sectoral examination of Nigeria's export structure further reveals significant differences in the response of various sectors to exchange rate fluctuations. Agricultural exports, including cocoa, rubber, and processed agricultural products, have generally remained weak and volatile, contributing less than one percent of total exports in most years. Although the sector's export share temporarily increased to approximately 4.21 percent in 2011, it subsequently declined to about 0.61 percent by 2024. Similarly, manufacturing exports, comprising textiles, chemicals, and processed goods, have remained persistently low, fluctuating within a narrow range of approximately 2.83–3.53 percent between 2023 and 2024 (CBN, 2024; NBS,2025). The sector continues to face challenges arising from dependence on imported raw materials, machinery, and intermediate inputs whose costs escalate during periods of currency depreciation (Nwankwo & Agu, 2021; Umoru & Agbonkhese, 2020). In contrast, the oil sector, which dominates Nigeria's export earnings, may respond differently to exchange rate movements because crude oil is priced internationally in US dollars. These sectoral differences suggest that exchange rate volatility may not affect all export sectors uniformly.

Despite extensive empirical investigations into the exchange rate–trade nexus, existing studies provide limited evidence regarding the differential effects of exchange rate volatility across export sectors in Nigeria. Most studies have either examined aggregate exports or focused on individual sectors without undertaking comparative analysis. For instance, Ikechi and Anthony (2020), Victor et al. (2022), and Ajudua (2020) investigated the effects of exchange rate volatility on trade balance and aggregate exports but did not distinguish between oil, agricultural, and manufacturing exports. Similarly, Okonkwo and Odularu (2020) focused on non-oil exports without separately analyzing agricultural and manufacturing exports, while Nwankwo and Agu (2021) concentrated exclusively on agricultural exports. Consequently, the relative vulnerability of Nigeria's agricultural, manufacturing, and oil sectors to exchange rate shocks remains insufficiently understood.

This study addresses this gap by conducting a sectoral analysis of the impact of exchange rate volatility on trade performance in Nigeria. Specifically, the study examines the differential effects of exchange rate volatility on agricultural, manufacturing, and oil exports to identify the sector most vulnerable to exchange rate shocks. By providing sector-specific evidence, the study contributes to the literature on exchange rate dynamics and international trade and offers valuable insights for policymakers seeking to design targeted exchange rate and export promotion policies capable of enhancing Nigeria's trade competitiveness and export diversification.

2. Literature Review

A substantial body of empirical research has examined the relationship between exchange rate volatility and trade performance, yet the findings remain inconclusive and highly context-dependent. Balomenou and Pajollari (2022) investigated this nexus for the United States and Canada using quarterly data from 2000 to 2018 within a Vector Autoregressive (VAR) model and reported a positive long-run relationship between exchange rate volatility and exports, a result that contradicts the conventional expectation that uncertainty discourages trade. However, their study aggregated all trade flows without sectoral disaggregation, masking potentially heterogeneous effects across different types of exports. Similarly, Chen et al. (2023) employed panel regression techniques on bilateral trade data between China and 190 partner economies from 1995 to 2018, estimating exchange rate elasticities for 1242 export categories, and found that exchange rate fluctuations negatively affect export values but that this effect is significantly smaller for more sophisticated products. While methodologically rigorous, this study's focus on China's highly diversified export basket limits its applicability to less diversified economies such as Nigeria, where agricultural and raw material exports dominate.

The asymmetric effects of exchange rate changes have received increasing attention, with important methodological implications. Baek and Koo (2023) applied the nonlinear

Autoregressive Distributed Lag (NARDL) approach to United States agricultural trade with selected emerging markets using quarterly data from 2000 to 2022 and demonstrated that currency depreciation had a larger positive effect on exports than the negative effect of an equivalent appreciation, indicating that linear models may produce biased estimates. Apanisile and Oloba (2020) employed the NARDL model on Nigerian data after separating real effective exchange rate into depreciation and appreciation regimes using partial sum processes based on logistic and exponential smooth-transition functions, confirming asymmetry in Nigeria's cross-border trade. Victor et al. (2022) utilized both linear ARDL and nonlinear ARDL models for Nigeria from 1986 to 2021 and found symmetric effects while confirming the J-curve phenomenon, where depreciation initially worsens then improves the trade balance. The contradiction between these asymmetry findings suggests that model specification and country context materially influence results.

Several African country studies provide useful comparative evidence using various estimation techniques. Mpungose et al. (2023) employed the ADF cointegration approach followed by VAR modelling on quarterly data from 1994 to 2021 for South Africa, findings revealed that terms of trade significantly affect exchange rates. Musyoki et al. (2022) used the GARCH model to measure exchange rate volatility and the Vector Error Correction Model (VECM) for analysis on monthly Kenyan data from 2010 to 2021, finding significant negative impacts on horticultural exports. Tembo and Mwansa (2022) similarly applied GARCH models to measure volatility and VECM for Zambian monthly data from 2010 to 2021, finding significant negative impacts of volatility on copper exports.

For Nigeria, Mohammed and Maduechesi (2021) employed ordinary least squares (OLS) using annual time series data from 1981 to 2019, finding a positive short-run relationship between exchange rate and total export, though their failure to address non-stationarity raises concerns about spurious regression. Sule et al. (2023) used multiple regression analysis on data from the CBN Bulletin spanning 2010 to 2021, reporting an insignificant relationship between exchange rate and export value in Nigeria, a finding that contradicts most other studies and may stem from their use of aggregate data. Ajudua (2020) adopted the Error Correction Mechanism (ECM) on annual data from 1986 to 2018. The result revealed a significant negative relationship between exchange rate and export performance in Nigeria both in the short and long run. Iheanachor and Ozegbe (2021) employed the ARDL technique on annual time series data from 1986 to 2019, reporting that excessive exchange rate fluctuations are detrimental to Nigeria's economic growth. Titus et al. (2022) used the Error Correction Model (ECM) on Kenyan time series data from 1966 to 2018, finding that foreign exchange reserves positively moderated the relationship between exchange rate volatility and international trade.

Despite the volume of research, most studies have treated exports as a homogeneous aggregate or examined only single sectors in isolation. Studies that have performed direct sectoral comparison for other countries, such as Torres-García et al. (2021) who employed panel data analysis on 21 manufacturing subsectors in Mexico, or Basu and Nambidiyattil (2023) who used EGARCH and ARDL for Tanzanian agricultural exports, cannot be directly generalized to Nigeria due to differences in institutional frameworks, financial development, and export composition. Consequently, the comparative vulnerability of Nigeria's agricultural, manufacturing, and oil sectors to exchange rate volatility remains undetermined in the existing literature.

The Marshall–Lerner condition provides the theoretical foundation for this study. Developed by Marshall (1923) and refined by Lerner (1944), the condition states that currency depreciation will improve a nation's trade balance if the sum of the absolute values of the price elasticities of demand for exports and imports exceeds unity. In essence, a weaker currency makes exports cheaper and imports more expensive, thereby increasing export volumes and reducing imports, provided demand responds sufficiently to price changes.

The validity of the condition depends heavily on the responsiveness of exports and imports to relative price changes, which varies across sectors. Oil exports typically exhibit low price elasticity because demand is determined largely by global market conditions rather than exchange rate changes, limiting the impact of depreciation on oil export volumes. Conversely, agricultural and manufacturing exports tend to show higher but less stable elasticities, as these sectors can respond more to price changes but remain sensitive to uncertainty. Persistent exchange rate fluctuations create uncertainty that complicates these sectoral responses. Therefore, examining the impact of exchange rate volatility on Nigeria's oil, agricultural, and manufacturing exports separately is essential for testing the Marshall–Lerner condition at the sectoral level and deriving targeted policy implications.

3. Methodology

3.1 Data Source and Measurement

The study utilized monthly time series secondary data covering the period from January 2004 to December 2024. The variables of interest include, Agricultural Export (AGEX), Manufacturing Export (MEXP) and Oil Export (OEXP) as proxy for Sectoral Trade Performance. The explanatory variables include the exchange rate (EXR), external reserves (ER) while control variables are Inflation Rate (INF) and Real Gross Domestic Products (RGDP). Data on EXR and INF were sourced from the Central Bank of Nigeria, Statistical Bulletin (2025) while the data on ER, RGDP, and the sectoral exports (AGEX, MEXP, OEXP) were sourced from World Bank's World Development Indicators (2025). The variable descriptions and their units of measurement are reported in table 1.

3.2 Model Specification

To determine which of the three export sectors, namely agriculture, manufacturing, or oil, is most susceptible to exchange rate volatility, this study adapted the models developed by Okonkwo and Odularu (2020) and Adeola and Ikpesu (2020). The original equations were modified by incorporating External Reserve (ER) and Real Gross Domestic Product (RGDP) as additional explanatory variables, while the dependent variable was replaced with sectoral exports, as specified in equation [1].

SEXP = ƒ (VOLEXR, ER, INF, RGDP) --------------------- [1]

The econometric form of the model is stated in equation 2:

$SEXP_t = \beta_0 + \beta_1 VOLEXR_t + \beta_2 ER_t + \beta_3 INF_t + \beta_4 RGDP + \mu_t$ ------------------- [2]

SEXP represents the dependent variable for sectoral exports and is disaggregated into three components: agricultural exports (AGEX), manufacturing exports (MEXP), and oil exports (OEXP).

VOLEXR is expected to negatively affect agricultural and manufacturing exports because uncertainty makes it difficult for exporters to plan and manage costs. The effect on oil exports is expected to be weak or insignificant since oil is priced in US dollars and is less sensitive to changes in the Nigerian currency. ER is expected to positively affect all three sectoral exports because higher reserves help stabilize the currency and provide foreign exchange to finance imports of production inputs. INF is expected to negatively affect agricultural and manufacturing exports because rising inflation increases production costs. The effect on oil exports is expected to be minimal since oil prices are determined by global markets. RGDP is expected to positively affect all three sectoral exports because economic growth increases productive capacity and export volumes.

Table 1 Variable Description and Units of Measurement

Variable	Description	Units of Measurement
SEXP	Sectoral Exports – total exports disaggregated into major sectors (agriculture, manufacturing, and oil)	% of Total Merchandise Export
AGEX	Agricultural Exports – value of agricultural goods exported	% of Total Merchandise Export
MEXP	Manufacturing Exports – value of manufactured goods exported	% of Total Merchandise Export
OEXP	Oil Exports – value of crude oil and petroleum products exported	% of Total Merchandise Export
VOLEXR	Exchange Rate Volatility – variation in the nominal exchange rate over a period, measured by GARCH model	No fixed unit (index value)
ER	External Reserves – total foreign currency assets held by the Central Bank to support the local currency and facilitate international trade	Billions of US Dollars (USD)
INF	Inflation Rate – Annual percentage change in the consumer price index (CPI)	Percentage (%)
RGDP	Real Gross Domestic Product – total value of goods and services produced in the economy, adjusted for inflation	Annual Change (%)

Source: *Author's Compilation, 2026*

3.3 Estimation Procedure

Generalized Autoregressive Conditional Heteroscedasticity (GARCH) Model

To capture exchange rate volatility, the study employs the GARCH (1,1) model developed by Bollerslev (1986), which is suitable for exchange rate series that exhibit volatility clustering. The specification consists of a mean equation and a variance equation:

Mean equation (exchange rate returns):

$EXR_t = \mu + \varepsilon_t$ -- [3]

Variance equation (conditional variance of exchange rate returns):

$h_t = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \beta_1 h_{t-1}$ ------------------- [4]

Where EXR_t is the log returns of the naira per US dollar exchange rate, h_t is the conditional variance representing exchange rate volatility, and ε_t is the error term. The sum $\alpha_1 + \beta_1$ measures volatility persistence, with a value near one indicating that shocks dissipate slowly, a characteristic of Nigeria's foreign exchange market.

Autoregressive Distributed Lag Model

This study adopts the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001) to investigate the effect of exchange rate volatility on agricultural, manufacturing, and oil exports in Nigeria. The ARDL approach possesses several advantages over other cointegration techniques such as those proposed by Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990). One major advantage of the ARDL technique is its suitability for studies with small sample sizes (Pesaran & Shin, 1999). In addition, the model can be applied when variables are integrated of order zero, I(0), order one, I(1), or a combination of both, provided none of the variables is integrated of order two, I(2) (Pesaran & Pesaran, 1997).

Furthermore, the ARDL framework effectively captures the appropriate lag structure within the data-generating process (DGP), especially under the general-to-specific modelling approach (Laurenceson & Chai, 2003). Another important feature of the technique is that the error correction model (ECM) can be derived from the bounds testing procedure through a simple ordinary least squares (OLS) transformation. The ECM explains the short-run adjustment process towards long-run equilibrium without losing long-run information (Pesaran & Shin, 1999). Additionally, the ARDL model simultaneously estimates both short-run and long-run relationships, thereby enabling a comparison of the extent to which agricultural, manufacturing, and oil exports respond to exchange rate volatility across different time horizons.

Based on these advantages, the study first examined the stationarity properties of the variables to ensure that none was integrated of order two, I(2), which is a necessary condition for ARDL estimation. To achieve this, the Augmented Dickey-Fuller (ADF) test developed by Dickey and Fuller (1979) and the Phillips-Perron (PP) test proposed by Phillips and Perron (1988) were employed. The null hypothesis for both tests states that the series contains a unit root, implying non-stationarity.

Thereafter, the Bounds Cointegration Test was conducted to ascertain the existence of a long-run relationship among the variables within the ARDL framework. The decision criterion involves comparing the computed F-statistic with the lower and upper critical bound values. When the F-statistic exceeds the upper bound, the null hypothesis of no cointegration is rejected, confirming the presence of a long-run relationship. Conversely, if the F-statistic falls below the lower bound, the null hypothesis cannot be rejected. The bounds testing approach is appropriate when variables are integrated at different orders, specifically I(0) and I(1), provided that none is integrated of order two, I(2).

To achieve the objective of this study, the ARDL model in equation 5 is estimated:

$$\Delta SEXP_t = \alpha_0 + \sum_{i=1}^{p} \delta_1 \, \Delta SEXP_{t\text{-}1} + \sum_{i=0}^{p} \delta_2 \, \Delta VOLEXR_{t\text{-}1} + \sum_{i=0}^{p} \delta_3 \, \Delta \mathrm{ER}_{t\text{-}1} + \sum_{i=0}^{p} \delta_4 \, \Delta INF_{t\text{-}1} +$$

$$\sum_{i=0}^{p} \delta_5 \, \Delta RGDP_{t-l} + \lambda_1 SEXP_{t-1} + \lambda_2 \mathrm{VOILEXR}_{t-1} + \lambda_3 \mathrm{ER}_{t-1} + \lambda_4 INF_{t-1} + \lambda_5 RGDP_{t-1} + u_t \text{--------[5]}$$

Where SEXP is specific terms are AGEX, MEXP, OEXP.
where α_0 and μ_t are the constant parameter and error term respectively. The expression with the signs of summation in the equation is error correction dynamics. The parameter coefficient denotes the short run effects and lambda (λ) is the corresponding relationship in the long run.

4. Result and Discussions

4.1 Descriptive Statistics

The summary statistics of the selected variables are presented in Table 2 and provide important insights into the distribution, variability, and normality of the data used in the analysis.

Table 2: Presentation of Descriptive Statistics Result

10	**EXR**	**VOLEXR**	**AGEX**	**MEXP**	**OEXP**	**ER**	**INF**	**RGDP**
Mean	350.92	2.64	1.00	4.38	91.12	3.14E+09	14.06	1.49
Med.	171.10	1.77	0.77	3.46	90.73	3.19E+08	12.4	2.16
Max.	1700.00	12.32	4.21	10.75	98.23	4.47E+09	34.8	6.29
Min.	118.70	0.8	0.40	0.96	84.04	1.44E+09	3	-8.34
Std. Dev.	330.53	1.94	0.86	2.52	3.67	6.72E+08	6.46	3.29
Skew.	2.31	1.97	2.85	0.86	0.21	-0.235378	1.36	-1.25
Kurt.	8.29	7.3	10.16	2.96	2.17	3.348012	4.89	4.67
Jarque-B	516.63	359	874.43	31.13	9.06	3.584311	114.13	94.91
Prob.	0.00	0	0.00	0	0.01	0.166601	0	0
Obs.	252.00	252	252.00	252	252	252	252	252

Source: *Author's Compilation, 2026*

The exchange rate (EXR) records a mean value of ₦350.92 per US dollar, with a median of ₦171.10, indicating that the distribution is skewed toward higher values in later periods. The wide range between the minimum (₦118.70) and maximum (₦1,700) reflects substantial depreciation of the naira over time, supported by a high standard deviation of ₦330.53. Exchange rate volatility (VOLEXR) has a mean of 2.64 and a median of 1.77, ranging from 0.80 to 12.32 with a standard deviation of 1.94, reflecting considerable fluctuations in exchange rate uncertainty.

Sectoral export statistics reveal important structural characteristics of Nigeria's export composition. Agricultural exports (AGEX) have a low mean of 1.00% and a median of 0.77%, confirming their minimal contribution to total exports. Manufacturing exports (MEXP) show a mean of 4.38% and a median of 3.46%, indicating a modest but unstable contribution. Oil exports (OEXP) dominate the export structure with a mean of 91.12% and a median of 90.73%, with a narrow range of 84.04% to 98.23% and a low standard deviation of 3.67, indicating consistent heavy dependence on oil.

External reserves (ER) have a mean value of 3.14 billion with a standard deviation of 0.67 billion, suggesting moderate variability. Inflation (INF) records a mean of 14.06% and a median of 12.4%, ranging from 3.00% to 34.80% with a standard deviation of 6.46%, reflecting periods of both stability and high inflation. Real GDP (RGDP) has a mean growth rate of 1.49% and a median of 2.16%, ranging from -8.34% to 6.29%, reflecting periods of contraction and expansion. Overall, the statistics confirm persistent exchange rate instability and dominance of oil exports over agriculture and manufacturing.

4.2 Correlation Matrix

The correlation coefficients in Table 3 shows the direction and magnitude of the relationship among the variables used in the study.

Table 3: Presentation of Correlation Matrix

	EXR	VOLEXR	AGEX	MEXP	OEXP	ER	INF	RGDP
EXR	1							
VOLEXR	0.03	1						
AGEX	-0.26	-0.15	1					
MEXP	-0.01	-0.12	-0.17	1				
OEXP	-0.12	0.21	-0.22	-0.59	1			
ER	-0.08	-0.23	0.1	-0.05	-0.15	1		
INF	0.84	0.02	-0.29	-0.13	-0.02	-0.26	1	
RGDP	-0.26	-0.47	0.12	-0.21	0.03	0.05	-0.11	1

Source: *Author's Compilation, 2026*

From Table 3, Exchange rate (EXR) shows a strong positive correlation with inflation (INF) at 0.84, indicating that naira depreciation is associated with rising prices. Exchange rate volatility (VOLEXR) has a weak positive correlation with oil exports (OEXP) at 0.21, but negative correlations with agricultural exports (AGEX) at -0.15 and manufacturing exports (MEXP) at -0.12, suggesting that volatility may hinder non-oil exports.

Agricultural exports (AGEX) show weak negative correlations with EXR (-0.26) and VOLEXR (-0.15), implying that exchange rate depreciation and volatility are associated with reduced agricultural export performance. Manufacturing exports (MEXP) exhibit a negative correlation with EXR (-0.01) and VOLEXR (-0.12), with a stronger negative relationship with trade balance (-0.64) and oil exports (-0.59), suggesting competition between manufacturing and oil sectors.

Oil exports (OEXP) show a weak negative correlation with EXR (-0.12) but a positive correlation with VOLEXR (0.21), indicating that volatility may have a different effect on oil compared to other sectors. External reserves (ER) show weak negative correlations with most variables except trade balance and trade openness. Real GDP (RGDP) exhibits negative correlations with VOLEXR (-0.47) and EXR (-0.26), suggesting that exchange rate instability and depreciation are associated with lower economic growth.

Regarding multicollinearity, no correlation coefficient exceeds the conventional threshold of 0.80 except for the relationship between EXR and INF (0.84). This suggests that EXR and INF may suffer from multicollinearity if included together in the same model specification. All other variable pairs exhibit correlations below 0.80, indicating no serious multicollinearity problems among the remaining variables.

4.3 Unit Root Test
The unit root test was carried out using Augmented Dickey Fuller (ADF) as shown Table 4

Table 4: Presentation of Augmented Dickey Fuller Unit Root Resul

Variable	Level (ADF Stat)	5% Critical Value	Prob.	First Difference (ADF Stat)	5% Critical Value	Prob.	Order of Integration
EXR	-1.842	-2.88	0.356	-5.921	-2.882	0.000	I(1)
VOLEXR	-2.104	-2.88	0.243	-6.337	-2.882	0.000	I(1)
AGEX	-2.011	-2.88	0.281	-5.102	-2.882	0.000	I(1)
MEXP	-1.934	-2.88	0.318	-5.447	-2.882	0.000	I(1)
OEXP	-3.556	-2.88	0.008	-	—	-	I(0)
ER	-2.223	-2.88	0.198	-4.973	-2.882	0.000	I(1)
INF	-3.102	-2.88	0.027	-	-	-	I(0)
RGDP	-1.775	-2.88	0.389	-5.211	-2.882	0.000	I(1)

Source: *Author's Compilation, 2026*

The unit root test results reported in table 4 indicates that the variables exhibit a mixed order of integration. Specifically, oil exports (OEXP) and inflation (INF) are stationary at level, implying they are integrated of order zero, I(0). In contrast, exchange rate (EXR), exchange rate volatility (VOLEXR), agricultural exports (AGEX), manufacturing exports (MEXP), external reserves (ER), and real GDP (RGDP) are not stationary at level but become stationary after first differencing, indicating they are integrated of order one, I(1). This combination of I(0) and I(1) variables justifies the use of the ARDL estimation technique, as it is suitable for models with variables of different integration orders, provided none is integrated of order two, I(2).

4.4 ARDL Bounds Test for Cointegartion
The existence of a long-run relationship among the variables was examined using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The results of the bounds test are presented in Table 5.

Table 5: ARDL Bound Test

Dependent Variables	Computed F-statistics	Upper Bound Critical Value at 5%	Lower Bound Critical Value @5%
AGEX	4.1008	3.490	2.560
MEXP	4.3344	3.490	2.560
OEXP	4.0691	3.490	2.560

Source: *Author's Compilation, 2026*

The ARDL bounds test results for agricultural exports (AGEX), manufacturing exports (MEXP), and oil exports (OEXP) show that all computed F-statistics—AGEX (4.1008), MEXP (4.3344), and OEXP (4.0691)—are higher than the upper bound critical value of 3.490 at the 5% level. This confirms the existence of a long-run relationship between exchange rate volatility, macroeconomic variables, and sectoral exports.

4.5 ARDL Result

The long-run and short-run coefficients of the ARDL Error Correction Model (ECM), which examine the effects of the explanatory variables on agricultural output, are presented in Table 6**.**

Table 6: Estimated Short Run and Long Run Coefficients using ARDL approach

	AGEX		**MEXP**		**OEXP**	
Short Run Result						
Variable	**Coeff.**	**T-stat.**	**Coeff.**	**T-stat.**	**Coeff.**	**T-stat.**
DVOLLEXR	-0.0259	-0.437 (0.6626)	-0.6107	-4.572*** (0.000)	0.5243	3.469*** (0.0006)
DVOLLEXR(-1)	-0.015	-0.357 (0.7967)	0.4165	3.583*** (0.004)	-0.4017	-2.678** (0.0079)
DLOGER	-0.3855	-0.988 (0.3545)	-2.3562	-2.814** (0.0048)	-0.7117	-0.713 (0.4767)
DLOGER(-1)	0.3811	1.651 (0.9330)	-0.5318	-1.64 (0.8386)	0.4883	0.488 (0.6402)
DINF	-0.0271	-1.354 (0.1284)	0.0077	0.084 (0.8386)	-0.0484	-1.03 (0.3040)
DINF(-1)	-0.003	-0.165 0.8680)	0.2186	1.35 (0.2124)	-0.0516	-1.098 (0.2734)
DRGDP	0.01	0.371 (0.7111)	0.0409	0.458 (0.2311)	0.1389	1.963 (0.0508)
DRGDP(-1)	-0.0015	-0.042 (0.9556)	0.0216	0.371 (0.2145)	-0.0042	-0.059 (0.9528)
ECT(-1)	-0.1017	-3.528*** (0.005)	-0.3734	-5.986*** (0.000)	-0.3491	-4.607*** (0.0000)
Long Run Result						
VOLLEXR	-0.0065	-0.394 (0.6936)	-0.1234	-3.456*** (0.0007)	0.0941	2.218** (0.02751)
LOGER	0.0214	0.193 (0.8470)	-0.1542	-0.618 (0.5371)	-0.2478	-0.824 (0.4110)
INF	-0.0024	-0.588 (0.5568)	-0.0148	-1.834 (0.1037)	-0.0014	-0.132 (0.8954)
RGDP	0.0008	0.098 (0.9218)	-0.0131	-1.539 (0.1252)	0.0069	0.298 (0.7660)

*, ** and *** indicate 1%, 5% and 10% significance level respectively.
Source: *Authors' Calculation using Eviews 12*

In the short run, exchange rate volatility has a negative but insignificant effect on agricultural exports (-0.0259; t = -0.437), indicating that agricultural exports do not respond meaningfully to short-term exchange rate fluctuations. However, volatility has a strong negative and statistically significant effect on manufacturing exports (-0.6107; t = -4.572), indicating a sharp decline in manufacturing exports when exchange rate uncertainty increases. In contrast, oil exports respond positively and significantly to exchange rate volatility (0.5243; t = 3.469), suggesting that the oil sector experiences short-run gains from exchange rate movements.

In the long run, exchange rate volatility continues to show a negative but insignificant relationship with agricultural exports (-0.0065; t = -0.394), confirming that agriculture remains largely unaffected. The negative and significant effect on manufacturing exports persists in the long run (-0.1234; t = -3.456), though the magnitude is smaller than in the short run. Oil exports maintain a positive and significant relationship with exchange rate volatility (0.0941; t = 2.218), indicating sustained benefits to the oil sector over time.

The error correction terms are negative and statistically significant for all three sectors: -0.1017 (t = -3.528) for agricultural exports, -0.3734 (t = -5.986) for manufacturing exports, and -0.3491 (t = -4.607) for oil exports. This confirms a stable long-run equilibrium relationship, with adjustment speeds of approximately 10% for agriculture, 37% for manufacturing, and 35% for oil exports annually. Based on the magnitude and significance of the coefficients, manufacturing exports are the most vulnerable to exchange rate volatility, followed by agriculture which exhibits weak and insignificant effects. Oil exports are not vulnerable and instead benefit from exchange rate volatility.

4.6 Post Estimation Test

The post-estimation diagnostic results confirm that the estimated models are reliable and well specified. For the agricultural exports model, the R^2 of 0.2656 indicates that the explanatory variables explain only about 27% of the variation in agricultural exports, suggesting that unobserved factors such as weather conditions, global commodity prices, and domestic infrastructure constraints play a larger role. The adjusted R^2 is close to the R^2, indicating no overfitting. For the manufacturing exports model, the R^2 of 0.5079 means that about 51% of the variation in manufacturing exports is explained by the included variables, representing a moderate fit. For the oil exports model, the R^2 of 0.5160 indicates that approximately 52% of the variation in oil exports is explained, the highest among the three sectors. The Durbin-Watson statistics for all three models range from 2.0051 to 2.0192, all approximately equal to 2, confirming no first-order serial correlation. The F-statistics are statistically significant for all models ($p < 0.01$ for manufacturing and oil, $p = 0.0030$ for agriculture), confirming that the explanatory variables jointly have a significant effect on each sectoral export. The Breusch-Godfrey test confirms no serial correlation across all models (p = 0.5139 to 0.8660). The Breusch-Pagan-Godfrey test confirms homoskedasticity (p = 0.1261 to 0.8113). The Ramsey RESET test confirms correct functional specification (p = 0.2845 to 0.7509). Overall, all three models pass the diagnostic tests, making them suitable for inference and policy recommendations.

4.7 Discussion of Findings

The empirical results reveal clear sectoral differences in vulnerability to exchange rate volatility in Nigeria. The manufacturing export sector is the most adversely affected, with a strong negative and significant effect in both the short run and long run. This finding aligns with the broader evidence from African country studies. Musyoki et al. (2022) found significant negative impacts of exchange rate volatility on Kenyan horticultural exports, while Tembo and Mwansa (2022) reported similar negative effects on Zambian copper exports. Although these studies focused on single sectors, they confirm that exchange rate volatility consistently harms export performance across different product categories in developing economies. The result also supports Ajudua (2020), who found a significant negative relationship between exchange rate and export performance in Nigeria, and Iheanachor and Ozegbe (2021), who reported that excessive exchange rate fluctuations are detrimental to Nigeria's economic growth.

The policy implication for manufacturing is clear: targeted support is urgently needed. Policymakers should provide access to foreign exchange at stable rates for imported inputs, offer incentives for local sourcing of raw materials to reduce import dependence, and develop export-oriented industrial zones. Strengthening the manufacturing base is critical for reducing Nigeria's dependence on oil and improving resilience to external shocks.

For the agricultural sector, exchange rate volatility shows a negative but weak and statistically insignificant effect in both the short run and long run. This weak response aligns with the findings of Sule et al. (2023), who reported an insignificant relationship between exchange rate and export value in Nigeria, though their study used aggregate rather than sectoral data. The low explanatory power of the agricultural model further suggests that unobserved factors such as weather conditions, global commodity prices, and infrastructure constraints play a larger role than exchange rate volatility. This finding also contrasts with Musyoki et al. (2022), who found significant negative impacts on Kenyan horticulture, suggesting that Nigeria's agricultural sector may be structurally different in its responsiveness to exchange rate movements.

The policy implication for agriculture is that exchange rate policy alone cannot drive export growth. Policymakers should invest in agricultural modernization, value addition, and agro-processing industries to enhance export competitiveness. Addressing infrastructure deficits, improving access to credit, and strengthening value chain

5. Conclusion and Policy Recommendations

This study investigated the effect of exchange rate volatility on agricultural, manufacturing, and oil exports in Nigeria with the aim of identifying the sector most exposed to exchange rate fluctuations. The results revealed that manufacturing exports are significantly affected by exchange rate volatility, agricultural exports respond weakly and insignificantly, while oil exports demonstrate a positive level of resilience. Based on these findings, the manufacturing sector emerges as the most vulnerable to exchange rate instability. The study therefore concludes that the effects of exchange rate volatility differ across sectors, implying that sector-specific policy measures are necessary.

In line with the findings, several policy recommendations are proposed. First, exchange rate stability should be prioritized because of the high sensitivity of manufacturing exports to currency fluctuations. This requires monetary authorities to strengthen foreign exchange market interventions in order to minimize excessive volatility. Second, there is a need to enhance the competitiveness of manufacturing exports through policies that guarantee stable access to foreign exchange for imported inputs, alongside industrial support incentives that can reduce disruptions caused by exchange rate instability.

Third, agricultural transformation should be intensified. Since agricultural exports do not significantly respond to exchange rate movements, structural challenges such as low productivity and poor integration within the value chain should be addressed through increased mechanization and investment in agro-processing. Fourth, export diversification policies should place greater emphasis on the manufacturing sector, given its stronger capacity to benefit from exchange rate incentives compared to agriculture. Fifth, as oil exports appear to gain from exchange rate fluctuations, oil revenues should be strategically utilised to strengthen external reserves and protect the economy from future volatility shocks. Finally, exchange rate and trade policies should be sector-specific, as a uniform policy approach is unlikely to effectively enhance Nigeria’s overall trade performance.

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