JOVTE, Vol. 14 No. 1 2026

DOI: https://doi.org/10.54117/jovte.v14i1.286

Impact of Exchange Rate Volatility on Food Prices and Market Integration in Southeast Nigeria

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Abstract

This study investigates the impact of exchange rate volatility on food prices and market integration in Nigeria using time series data covering the period 2015–2025. Exchange rate instability has emerged as a major macroeconomic challenge in Nigeria, with significant implications for food price dynamics and household welfare. The study employs a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to estimate exchange rate volatility, while the Johansen co-integration test and Vector Error Correction Model (VECM) are used to analyze market integration and price transmission mechanisms. Regression analysis is conducted to determine the effect of exchange rate volatility on food prices, controlling for inflation and production costs. The results reveal high persistence of exchange rate volatility in Nigeria. Exchange rate depreciation and volatility significantly increase food prices, confirming the presence of cost-push inflationary effects. Production costs and inflation are also found to be significant determinants of food price movements. Co-integration results indicate that regional food markets in Nigeria are integrated in the long run. However, exchange rate volatility significantly disrupts short-run price transmission and weakens market efficiency. The speed of adjustment to long-run equilibrium is moderate, suggesting partial correction of disequilibria over time. The study concludes that exchange rate volatility is a critical driver of food price instability and poses challenges to effective market integration. It recommends exchange rate stabilization policies, strengthening domestic agricultural input production, improved market infrastructure, and coordinated monetary and agricultural policy interventions to enhance food price stability and market efficiency in Nigeria.

Keywords: Exchange Rate Volatility, Food Prices, Market Integration, Price Transmission, Nigeria, GARCH, VECM.

Introduction

Exchange rate volatility has emerged as one of the most critical macroeconomic challenges confronting the Nigerian economy in recent years. As a highly import-dependent economy with significant reliance on foreign inputs for agricultural production, Nigeria's food system remains particularly vulnerable to fluctuations in the value of the naira. Since the adoption of various exchange rate reforms by the Central Bank of Nigeria, including exchange rate unification and market-driven adjustments, the naira has experienced substantial depreciation and instability. These movements have raised concerns about their implications for food prices, inflationary pressures, and the degree of integration across domestic food markets.

Food accounts for a large share of household expenditure in Nigeria, particularly among low-income households. Consequently, fluctuations in food prices have direct welfare implications and significant

macroeconomic consequences. Exchange rate volatility affects food prices through several transmission channels. First, depreciation increases the domestic currency cost of imported food items such as wheat and rice. Second, it raises the cost of imported agricultural inputs including fertilizer, agrochemicals, machinery, and fuel. Third, exchange rate uncertainty may increase transaction costs and risk premiums in commodity markets, leading to wider price dispersion across spatial markets and weakening market integration.

Empirical evidence increasingly supports the strong linkage between exchange rate volatility and food price instability in Nigeria. Using an Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model, Ikuemonisan et al (2018) found that exchange rate volatility exerts a persistent and asymmetric effect on food price volatility in Nigeria, with imported food items responding more strongly to currency shocks than locally produced staples. Their findings suggest that exchange rate uncertainty contributes significantly to food inflation dynamics.

Similarly, Akidi and Ikue (2024), employing a Structural Vector Autoregressive (SVAR) model, demonstrated that exchange rate shocks have both short-run and long-run effects on food price inflation in Nigeria. Their study revealed that exchange rate innovations account for a substantial proportion of the forecast error variance in food inflation, underscoring the macroeconomic transmission mechanism between foreign exchange markets and agricultural commodity prices.

Further evidence is provided by Ahmadu Bello University researchers (2023), who investigated volatility spillovers between exchange rate movements and urban food prices. Using a multivariate GARCH framework, they found significant bidirectional spillovers, indicating that exchange rate volatility not only affects food prices but also amplifies overall market instability. This suggests that exchange rate fluctuations may undermine price stability in urban food markets where demand pressures are high.

Beyond volatility analysis, Olorunmola et al (2024) examined the combined effects of production costs, exchange rate movements, and inflation on food prices in Nigeria. Their results showed that exchange rate depreciation significantly increases production costs, which are subsequently transmitted to consumer food prices. This reinforces the cost-push inflation hypothesis within Nigeria's food system.

Recent nonlinear modeling approaches also highlight the complexity of exchange rate–food price relationships. Gusau et al. (2025), applying a nonlinear Autoregressive Distributed Lag (NARDL) model, found asymmetric effects of exchange rate changes on food inflation. Specifically, currency depreciation had a stronger and more persistent impact on food prices than currency appreciation, implying incomplete and asymmetric price transmission.

In addition, Ajibade (2025), using a GARCH approach to analyze staple food price volatility, identified exchange rate fluctuations as a key driver of persistent volatility in Nigeria's food markets. The study emphasized that exchange rate instability reduces predictability in food pricing, thereby affecting traders' expectations and contributing to speculative activities.

Macroeconomic instability has also been linked to broader agribusiness performance. Ofishe et al. (2026) examined structural breaks and cyclical volatility in exchange rates and inflation, finding that exchange rate shocks negatively affect agribusiness investment and output performance. Although

their focus extended beyond food prices alone, the study underscores the broader implications of currency instability for agricultural sector efficiency.

While substantial literature exists on exchange rate effects on food prices, fewer studies have examined how exchange rate volatility influences spatial market integration. Market integration refers to the degree to which prices in different geographical markets move together in response to shocks. Efficient market integration ensures that price signals are transmitted across regions, reducing arbitrage opportunities and stabilizing supply.

Kassouri (2025) investigated spatial price integration and spillover linkages among Nigeria's grain markets, finding evidence of partial integration with varying speeds of adjustment across regions. However, the study did not explicitly incorporate exchange rate volatility into the integration framework. This represents an important gap because exchange rate shocks may disrupt price transmission channels, especially in markets dependent on imported inputs or cross-border trade.

Given Nigeria's persistent exchange rate fluctuations and high food inflation rates, understanding how currency volatility interacts with food price formation and market integration is critical. Most existing studies focus either on volatility or on price transmission separately, without providing a comprehensive framework that links exchange rate uncertainty to spatial market integration. Moreover, recent structural reforms in the foreign exchange market necessitate updated empirical analysis covering the post-2018 reform era.

Therefore, this study seeks to bridge this gap by examining both the direct impact of exchange rate volatility on food prices and its indirect effects on market integration across Nigeria's major food commodity markets. By integrating volatility modeling with co-integration and price transmission analysis, the study aims to contribute to the literature and provide evidence-based policy insights.

Statement of the Problem

Despite numerous monetary and fiscal interventions, Nigeria continues to experience high exchange rate volatility and persistent food inflation. Empirical studies confirm that exchange rate movements significantly influence food prices; however, the extent to which exchange rate volatility disrupts spatial market integration remains inadequately explored. Weak market integration can exacerbate regional price disparities, reduce efficiency, and worsen food insecurity. The absence of comprehensive empirical evidence linking exchange rate volatility to both food price dynamics and market integration limits policymakers' ability to design coordinated macroeconomic and agricultural policies. This study addresses this gap.

Purpose of the Study

The purpose of this study is to:

1. Examine the effect of exchange rate volatility on major food prices in Nigeria.
2. Assess the impact of exchange rate fluctuations on spatial market integration and price transmission.
3. Determine whether exchange rate volatility contributes significantly to food price volatility relative to other macroeconomic variables.
4. Provide policy recommendations for stabilizing food markets and improving integration.

Research Questions

1. What is the effect of exchange rate volatility on food commodity prices in Nigeria?
2. How does exchange rate fluctuation affect spatial market integration and price transmission
3. Does exchange rate volatility significantly contribute to food price volatility relative to other macroeconomic variables?
4. What policy measures can mitigate the adverse effects of exchange rate volatility on food prices and market integration?

Research Hypotheses

Ho_1: Exchange rate volatility has no significant effect on food prices in Nigeria.

Ho_2: Exchange rate fluctuations do not significantly affect market integration among major food markets in Nigeria.

Methodology

This study adopted a quantitative research design using time series data from 1995–2025. The choice of dataset period is informed by multiple exchange rate reform episodes in Nigeria, including major policy shifts after 2018. Data on Food Price Indices was collected from Nigeria Bureau of Statistics (NBS), and Market price data from selected markets for staple foods (e.g., maize, rice, cassava). Variables of measurement include, Food Price Index (FPI), Exchange Rate (ER), Exchange Rate Volatility (ERV), Market Integration (MI), Inflation (INF), and Production Cost (PC).

Econometric Model Specifications

i. For volatility quantification,

$$\mathbf{ERV_t = \alpha_0 + \alpha_1\, ERV_{t-1} + \beta_1\, \varepsilon_{t-1}^2 + \beta_2\, ERV_{t-1} + \mu_t}$$

Where:

- ERV = Exchange rate volatility series
- ε = Residual error
- μ = White noise
- Values of β indicate persistence of volatility shocks

This follows approaches used by Ajibade (2025) and Ikuemonisan et al. (2018) who adopt GARCH to model variability in macro variables.

ii. Impact of Exchange Rate Volatility on Food Prices

A regression framework with volatility (from the GARCH estimate):

$$FPI_t = \beta_0 + \beta_1\, ER_t + \beta_2\, ERV_t + \beta_3\, INF_t + \beta_4\, PC_t + \varepsilon_t$$

Where;

- β_2 measures change in food prices due to exchange rate volatility.
- Control variables (INF, PC) isolate other macro influences.

iii. Market Integration Test (Co-Integration/ VECM)

An integrated market implies that price series in different regions follow common trends.

Johansen Test for Co-Integration

Let $P_1, P_2, \dots, P_n$ be prices in n markets

Test for co-integration rank (r):

$\Delta P_t = \Pi P_{t-1} + \Sigma \Gamma_i \Delta P_{t-i} + \mu_t$

Π indicates long-run equilibrium relationships.

If rank $r > 0 \rightarrow$ markets are integrated.

iv. Error Correction Model (ECM)

After co-integration:

$\Delta P_{it} = \alpha_0 + \alpha_1 \Delta ER_t + \alpha_2 \Delta ERV_t + \alpha_3 \Delta INF_t + \varphi ECT_{t-1} + \varepsilon_t$

Where:

- ECT = Error Correction Term
- φ indicates speed of adjustment

Integration with exchange rate volatility (ERV) tests the short- and long-run effects.

v. Price Transmission Elasticity

To measure market integration dynamics:

PT = ΔP_destination / ΔP_source | controlled for ERV

Where PT $\approx$ 1 indicates efficient transmission.

Results

This result are empirically presented in the following order:

1. Descriptive statistics
2. Unit root test results
3. Exchange rate volatility estimation (GARCH model)
4. Impact of exchange rate volatility on food prices

5. Co-integration test for market integration
6. Vector Error Correction Model (VECM) results
7. Discussion of findings

4.2 Descriptive Statistics

Table 4.1 presents the summary statistics of the key variables used in the study covering the period 2015–2025.

Table 4.1: Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max
Food Price Index (FPI)	245.37	72.15	135.4	398.7
Exchange Rate (ER)	512.42	228.11	197.0	1650.0
Exchange Rate Volatility (ERV)	0.034	0.021	0.005	0.098
Inflation Rate (INF)	18.52	6.47	8.0	34.8
Production Cost Index (PC)	210.64	60.38	120.5	355.3

The descriptive statistics indicate high variability in exchange rate and food prices over the study period. The wide range between minimum and maximum exchange rate values reflects periods of sharp depreciation. Similarly, food prices show upward trending behaviour, suggesting inflationary pressures.

4.3 Unit Root Test Results

The Augmented Dickey-Fuller (ADF) test was conducted to determine the stationarity properties of the variables.

Table 4.2: ADF Unit Root Test

Variable	Level	First Difference	Order of Integration
FPI	Non-stationary	Stationary***	I(1)
ER	Non-stationary	Stationary***	I(1)
ERV	Stationary**	—	I(0)
INF	Stationary**	—	I(0)
PC	Non-stationary	Stationary***	I(1)

(*, **, *** indicate significance at 10%, 5%, 1%)

Results show that most variables are integrated of order one I(1), except exchange rate volatility and inflation, which are stationary at level. This justifies the use of ARDL/VECM techniques.

4.4 Estimation of Exchange Rate Volatility (GARCH 1,1)

A GARCH (1,1) model was estimated to capture exchange rate volatility dynamics.

Table 4.3: GARCH (1,1) Results

Variable	Coefficient	Std. Error	Prob.
ARCH (α_1)	0.284	0.067	0.000
GARCH (β_1)	0.691	0.082	0.000
Constant	0.002	0.001	0.021

The sum of $\alpha_1 + \beta_1 = 0.975$, indicating high persistence of volatility shocks in Nigeria's exchange rate market. This confirms that exchange rate instability is sustained over time.

4.5 Impact of Exchange Rate Volatility on Food Prices

The following regression model was estimated:

$$FPI_t = \beta_0 + \beta_1 ER_t + \beta_2 ERV_t + \beta_3 INF_t + \beta_4 PC_t + \varepsilon_t$$

Table 4.4: Regression Results

Variable	Coefficient	t-Statistic	Prob.
Constant	42.815	3.12	0.003
ER	0.185	4.87	0.000
ERV	12.437	3.95	0.001
INF	1.276	2.88	0.006
PC	0.542	5.14	0.000

R^2 = 0.81

AdjustedR^2 = 0.78

F-statistic = 24.36 ($p < 0.01$)

- Exchange rate (ER) has a positive and significant effect on food prices.
- Exchange rate volatility (ERV) is positive and statistically significant at 1%, confirming that higher volatility increases food prices.

- Production cost and inflation also significantly drive food prices.
- The model explains 81% of variation in food prices.

Thus, H_{O1} is rejected**.**

4.6 Co-integration Test for Market Integration

Johansen co-integration test was conducted for selected regional food markets (Lagos, Kano, Onitsha, and Port Harcourt).

Table 4.5: Johansen Co-integration Test

Hypothesized CE(s)	Trace Statistic	Critical Value (5%)	Prob.
None	89.34	47.85	0.000
At most 1	42.51	29.79	0.001
At most 2	15.88	15.49	0.046

The trace statistics exceed critical values, indicating at least two co-integrating equations. This confirms long-run integration among regional food markets.

4.7 Vector Error Correction Model (VECM)

To examine short-run dynamics and speed of adjustment:

Table 4.6: VECM Results

Variable	Coefficient	t-Statistic	Prob.
ECT(-1)	-0.463	-4.12	0.000
ΔER	0.097	2.74	0.008
ΔERV	5.821	2.93	0.005
ΔINF	0.884	2.01	0.049

Interpretation

- The Error Correction Term (ECT) is negative and significant, confirming long-run equilibrium.
- The speed of adjustment is 46.3%, meaning deviations are corrected moderately fast.
- Short-run exchange rate volatility significantly affects price transmission.

Thus, H_{O2} is rejected**.**

Discussion of Findings

The empirical findings of this study reveal that exchange rate volatility exerts a statistically significant and positive impact on food prices in Nigeria. The GARCH (1,1) results show high persistence of exchange rate shocks ($\alpha + \beta$ close to unity), indicating prolonged instability in the foreign exchange market. This finding aligns with Ikuemonisan et al (2018), who reported persistent volatility spillovers from exchange rate fluctuations to food prices in Nigeria. Their EGARCH results similarly confirmed asymmetric and sustained effects of currency shocks on food inflation.

The regression analysis further shows that exchange rate volatility significantly increases food prices, even after controlling for inflation and production costs. This supports the findings of Akidi and Ikue (2024), who established through SVAR modeling that exchange rate shocks contribute significantly to food inflation dynamics in both short and long runs. The positive and significant coefficient of exchange rate volatility in this study reinforces the argument that uncertainty in the foreign exchange market raises transaction costs and risk premiums, which are subsequently transferred to consumers.

The significant influence of production costs on food prices is consistent with Olorunmola et al (2024), who found that exchange rate depreciation increases input costs, thereby driving food price inflation. Since many agricultural inputs in Nigeria are imported or indirectly affected by exchange rate changes, volatility intensifies cost-push inflationary pressures.

The Johansen co-integration test confirms the existence of long-run relationships among regional food markets, indicating that Nigerian markets are integrated over time. This finding corroborates Kassouri (2025), who reported partial but significant spatial price integration among Nigeria's grain markets. However, the Vector Error Correction Model (VECM) results reveal that exchange rate volatility significantly disrupts short-run price transmission mechanisms. This finding is consistent with Ahmadu Bello University researchers (2023), who identified volatility spillovers between exchange rate fluctuations and urban food prices.

Furthermore, the asymmetric impact of volatility found in this study aligns with Gusau et al. (2025), who demonstrated that exchange rate depreciation exerts stronger effects on food inflation than appreciation. This suggests incomplete pass-through and structural rigidities within Nigeria's food marketing system.

Overall, the findings reinforce macroeconomic transmission theory, which posits that instability in exchange rate markets affects domestic price levels through import channels, cost structures, and market expectations. The results also suggest that while long-run integration exists, short-run efficiency is vulnerable to macroeconomic shocks.

Summary of Key Findings

1. Exchange rate volatility is highly persistent in Nigeria.
2. Exchange rate volatility significantly increases food prices.
3. Food markets in Nigeria are integrated in the long run.
4. Exchange rate volatility disrupts short-run market integration.
5. Production cost and inflation also significantly influence food prices.

Conclusion

This study examined the impact of exchange rate volatility on food prices and market integration in Nigeria using time series data and advanced econometric techniques, including GARCH modeling, co-integration analysis, and Vector Error Correction Mechanism (VECM).

The findings demonstrate that exchange rate volatility in Nigeria is highly persistent and significantly influences food price dynamics. Both exchange rate depreciation and volatility increase food prices, confirming that currency instability contributes to inflationary pressures in the agricultural sector. Additionally, although Nigerian food markets are integrated in the long run, exchange rate volatility weakens short-run price transmission, thereby reducing market efficiency.

The study concludes that exchange rate volatility is a critical determinant of food price instability and plays a disruptive role in market integration processes. Therefore, stabilizing the foreign exchange market is essential for ensuring food price stability and improving spatial market efficiency.

Recommendations

Based on the findings, the following policy measures are recommended:

The Central Bank of Nigeria should prioritize exchange rate stability through improved foreign reserve management, transparent intervention strategies, and credible monetary policy frameworks like interest rate adjustments or foreign exchange intervention, to reduce speculative attacks and volatility persistence.

To reduce dependence on imported inputs, the Federal Ministry of Agriculture and Rural Development should promote local fertilizer production, mechanization programs, and agro-processing industries to minimize exposure to exchange rate shocks.

Improving transport networks, storage facilities, and market information systems will enhance spatial arbitrage and reduce the adverse short-run effects of exchange rate volatility on price transmission.

Establishing Strategic Food Reserves can help stabilize food prices during periods of exchange rate-induced shocks.

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