Exchange Rate Volatility and Food Security in Nigeria

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Abstract
Concerns regarding the sustainability of local food production are raised by Nigeria's ongoing problem of food insecurity in the face of unstable exchange rates, growing food import prices, and high inflation. The need to objectively investigate the effects of inflation, agricultural credit, food imports, and exchange rate volatility on Nigerian food production from 1986 to 2025 is the driving force behind this work. Food production index (FPI), a proxy for food security, was used as the regressor in the study. Other explanatory variables were inflation, credit to the agricultural sector, and the value of food imports. Annual time-series data were analyzed in EViews 14 using augmented Dickey–Fuller unit root tests, the autoregressive distributed lag (ARDL) bounds testing approach and an error correction model. The variables were integrated of mixed orders, and the bounds test (F = 7.85) confirmed a long-run relationship. Credit to the agricultural sector had a positive and significant long-run effect on the food production index (p = 0.048), while the exchange rate, food imports and inflation had insignificant effects. The error correction term (−0.149; p = 0.001) indicated that about 15% of any disequilibrium is corrected each year. Diagnostic and stability tests supported the model. The study recommends expanded and timely agricultural credit, supported by exchange rate and price stability and by policies that strengthen local food production.

Keywords: *Exchange Rate, Food Production Index, Agricultural Credit, Food Imports, Inflation, ARDL*

JEL Classification: F31, Q10, Q14, F14, E31, C22

1. Introduction

Nigeria's food security is a critical development challenge, as domestic food production is influenced not just by agricultural capacity, but also by macroeconomic instability, import dependency, agricultural finance availability, and rising production costs. Food security, defined as continuous physical and economic access to sufficient, safe, and nutritious food, is still a

major development concern in Nigeria (Food and Agriculture Organization [FAO], 1996). According to the October 2025 Cadre Harmonisé analysis, approximately 34.7 million Nigerians in 27 states and the Federal Capital Territory could face severe food and nutrition insecurity between June and August 2026, and it attributed persistently high food prices to a volatile naira-dollar exchange rate and high transportation costs.

Since the Structural Adjustment Program of 1986, the naira has been subjected to multiple administrative and market-based regimes, with continued instability. The Nigeria Customs Service recorded 62 exchange rate changes in the first quarter of 2025 alone, putting import cost predictability at risk (News Diary, 2025). Exchange rate fluctuation can impact food production in a number of ways, including increasing the cost of imported food and inputs in naira and influencing lenders' and farmers' investment choices. Aye et al. (2025) state that once they beyond a certain point, changes in food prices and currency rates have a substantial impact on food security. Ibrahim et al. (2025) reported a significant negative long-run elasticity of agricultural output to inflation, with rising interest rates restricting output through limited access to credit. Akpan and Udo (2021) discovered that the nominal exchange rate influences meat and milk production indices in the long run. Food security is still a major national concern despite Nigeria's significant agricultural potential, as seen by the country's continuing reliance on food imports, growing production costs, and deteriorating food affordability. 33.1 million Nigerians were expected to experience high levels of food insecurity during the June–August 2025 lean season, according to the Food and Agriculture Organization (FAO, 2024). The decline was partially attributed to economic hardship, rising inflation, currency devaluation, and shocks connected to climate change. Changes in the naira may also increase the domestic cost of imported food and put more strain on local producers, while exchange rate volatility may threaten domestic food production by raising the cost of imported agricultural inputs, machinery, fertilizer, and other production materials. The efficiency of current agricultural funding and import policies is called into question by the International Monetary Fund's (IMF, 2023) identification of poor agricultural input usage and inadequate productivity as significant barriers to food security in Nigeria. Similar to how insufficient credit to the agriculture sector may limit investment in cutting-edge farming technologies and productive capacity, high inflation may reduce farmers' purchasing power and raise output costs. The degree to which exchange rate volatility, the value of food imports, agricultural credit, and inflation jointly influence domestic food production over an extended period of time remains an important empirical question, even though recent studies have looked at exchange rate instability and food security in Nigeria (Sani et al., 2026). Consequently, this study examines the effect of exchange rate volatility on food production in Nigeria from 1986 to 2025, taking into account the value of food imports, credit to the agricultural sector and inflation, with a view to providing evidence that can inform exchange rate management, agricultural financing and policies aimed at strengthening domestic food production.

Literature Review

Conceptual Review

Food security exists when all people have continuous physical and economic access to sufficient, safe, and nutritious food that matches their dietary requirements (Food and Agriculture Organization [FAO], 1996). The notion is typically summarized in four dimensions: availability, access, utilization, and stability. Availability refers to how much food is produced or imported; access refers to whether households can receive it through income and pricing; utilization refers

to how safe and nutritious it is used; and stability refers to whether these conditions persist over time. This study focuses on availability, which is primarily influenced by trade and domestic production. The food production index (FPI), which measures the amount of edible, nutrient-dense food crops produced in relation to a base period, serves as a proxy for it. The FPI is appropriate for assessing macroeconomic factors since it captures supply and reacts directly to the cost and credit situations that farmers encounter. The price of one currency in terms of another is known as the exchange rate, and the degree of erratic variation in that price over time is known as exchange rate volatility. It is not the same as depreciation, which is a steady decline in the value of the naira, whereas volatility is the unpredictability surrounding that decline. The conditional variance of exchange rate returns from a GARCH-type model is typically used to quantify volatility (Akinbode & Ojo, 2017; Jeremiah et al., 2025). Since switching to market-determined currency rates in 1986, Nigeria has frequently seen volatility. There are three primary channels by which volatility can impact food production. First, it causes the price of imported inputs like machinery, fertilizer, and agrochemicals to increase and become unstable. Second, it contributes to inflation and food costs (Aye et al., 2025; Jeremiah et al., 2025; Salawu et al., 2026). Third, it creates uncertainty for lenders and farmers, which may cause investment to be delayed. The impact on the FPI is still an empirical matter because some research indicates that the short-run impact on agricultural supply may be restricted due to supply inelasticity (Akinbode & Ojo, 2017). The entire amount of food purchased from overseas in a particular year, expressed in naira or dollars, is known as the value of food imports. It shows the amount imported as well as the exchange rate and global pricing at which it was purchased. Nigeria imports staples like wheat and rice to fill in the gaps between domestic supply and demand; the amount of imports is influenced by domestic output, pricing, income, and population (Abdullahi, 2021; Adeniyi & Adeyemo, 2014; Okpara et al., 2025). There are two conflicting consequences of imports. They can lower prices and alleviate shortages in the short term. Persistent reliance may eventually put local producers in competition, reduce their motivation to increase output, and deplete foreign exchange (Ugwu et al., 2022). As a result, the overall impact on domestic food production is unclear. Because a lower naira increases the naira cost of the same volume of food, the value measure also relates imports to the exchange rate. Funds that farmers and agribusinesses receive from commercial banks, development organizations, and government-backed guarantee agreements like the Agricultural Credit Guarantee Scheme Fund are referred to as credit to the agricultural sector (Oyewale & Alliu, 2018; Saidi et al., 2024). It eases the liquidity constraint that restricts smallholder output by financing labour, equipment, seeds, fertilizer, and working capital. Only when credit is available, reasonably priced, and utilized effectively does it increase output. Its impact may be mitigated by high loan rates, collateral restrictions, and credit evaluation delays (Emenuga, 2019; Lawal, 2019), and there is conflicting information regarding its importance (Edith et al., 2021; Saidi et al., 2024). A persistent increase in the overall level of prices is known as inflation, and it is typically gauged by changes in the consumer price index. Food price fluctuations have a significant impact on headline inflation in an economy where food accounts for a significant portion of household spending, and the two are mutually reinforcing. When output prices lag, inflation can reduce real returns for farmers by increasing the cost of labour, transportation, and inputs (Ibrahim et al., 2025). Additionally, inflation reduces customers' actual purchasing power, which impacts food security's access component. Because price increases can also increase supply, its relationship with production is not always negative (Oziegbe et al., 2026).

Theoretical Review

Sen (1981) contended that hunger and famine result from both a lack of food and people's inability to demand it. The collection of food bundles that an individual can receive through their endowments—resources—and the trade entitlement mapping that turns those endowments into commodities constitute their entitlement. Production-based, trade-based, labor-based, and transfer-based entitlement channels are the primary ones. The method explains the significance of macroeconomic factors for food security. The trade-based and labor-based entitlements of households are weakened when food prices rise in relation to incomes due to exchange rate volatility, inflation, and expensive imports. Agricultural credit directly strengthens production-based rights for farming households, which rely on inputs and financing. Because the four explanatory factors have an impact on pricing, costs, and access, the theory connects them to food security. Because the strategy focuses on access rather than total output, it is less direct about aggregate supply. Thus, it serves as the mechanism that links macroeconomic conditions to food security in this study, and it is paired with a supply-side theory that explains how those factors impact output. Farmers' production decisions were represented by Nerlove (1958) as a partial adjustment of current output toward a desired level, where the desired level depended on projected prices. Due to fixed factors and output lags, farmers only gradually change their expectations based on historical prices. Thus, the short-run and long-run supply elasticities provided by the model are in line with the short-run and long-run estimations documented in ARDL research. Subsequent modifications incorporate credit limits, risk, and input costs into the expected-return computation. According to this concept, farmers expand output more cautiously since inflation and exchange rate fluctuation raise the uncertainty and expense associated with production. While financing loosens input restrictions and increases the ability to react to price changes, cheaper imports lower domestic pricing and may lower expected returns for local businesses. As a result, output, as determined by the FPI in this case, reacts to each of the four variables, with changes occurring over time. The anticipated indicators are good for credit and negative for food imports, inflation, and exchange rate volatility.

Empirical Review

Long-term cointegration between exchange rate changes and food price volatility in Nigeria was discovered by Aye et al. (2025), however the impacts varied depending on the commodity. Aye (2025), who studied the period from 1970 to 2021, found that once exchange rate uncertainty surpasses a certain point, it has a substantial impact on food security. Sylvanus et al. (2023) discovered that foreign exchange volatility had a negative but negligible impact on agricultural volume and value added using ARDL on data from 1986 to 2021. Using GARCH-based volatility and ARDL on data from 1980 to 2015, Akinbode and Ojo (2017) discovered no discernible impact of volatility on exports of rubber and cocoa. By applying NARDL to monthly data from 2000 to 2018, Daniel and Ige (2020) discovered that changes in exchange rates symmetrically increase the pricing of agricultural commodities. Salawu et al. (2026) discovered that between 1986 and 2024, there was a positive long-term pass-through from the exchange rate to food prices. According to Jeremiah et al. (2025), Nigerian inflation is increased by exchange rate volatility. Food imports lower food output throughout the short and long terms, according to Ugwu et al. (2022), who utilised ARDL on data from 1960 to 2020. Abdullahi (2021) discovered that between 1981 and 2019, food import demand was largely driven by population growth and food production. According to Adeniyi and Adeyemo (2014), food import volumes between 1981 and 2010 can be explained by lagging food production, income, population, and currency

rates. From 1986 to 2018, Otto et al. (2021) discovered a long-term correlation between rice output, consumption, imports, and economic growth. According to Okpara et al. (2025), the importation of consumables between 1982 and 2022 is greatly impacted by population expansion. Bank lending increased agricultural output both in the short and medium term between 1981 and 2016, according to Oyewale and Alliu (2018). In a similar vein, Emenuga (2019) discovered that between 1981 and 2017, commercial bank lending and the credit guarantee fund had favourable long-term effects on agricultural productivity. According to Edith et al. (2021), agricultural loans significantly increased agricultural output between 1981 and 2019. On the other hand, Saidi et al. (2024) observed that commercial bank credit did not significantly increase agricultural output between 1986 and 2023, whereas Lawal (2019) concluded that the guarantee fund and commercial bank credit had positive but negligible benefits. According to Ibrahim et al. (2025), agricultural output's long-run elasticity to inflation was significantly negative between 1981 and 2024. According to Akpan and Udo (2021), crop output and agricultural gross production indices are ultimately determined by the consumer price index. Oziegbe et al. (2026) discovered a strong positive correlation between a food security index and the consumer price index between 2002 and 2022, which they attribute to supply-side reactions. In a model of the volatility of poultry prices from 1991 to 2024, Edoja et al. (2026) discovered a negative long-run inflation coefficient. According to Akinbode et al. (2021), depreciation increases food price inflation whereas the food production index reduces it in the short term.

Research Gap

The examined studies usually treat the exchange rate, imports, credit, and inflation individually, and they primarily employ agricultural output, exports, or food prices as outcomes. Globalization and growth are the main topics of studies that employ the food production index (Onwe et al., 2024). Additionally, there is conflicting evidence, particularly regarding credit (Lawal, 2019; Oyewale & Alliu, 2018) and inflation (Ibrahim et al., 2025; Oziegbe et al., 2026). To the best of this study's knowledge, none of the assessed sources simultaneously look at inflation, agricultural credit, food imports, and exchange rate volatility as factors influencing the food production index from 1986 to 2025. This study uses current data to close that gap.

Methodology

Research Design

The study uses a quantitative, ex post facto research design based on 40 observations from Nigeria's annual time-series data from 1986 to 2025. Because the goal is to assess the long-term and short-term effects of macroeconomic variables on food production, and because the variables are historical records that the researcher cannot alter, the design is appropriate.

Theoretical Framework

The two theories discussed in Section Two form the basis of the investigation. Nerlove's (1958) supply response theory describes how output changes over time in response to prices, costs, and risk, whereas Sen's (1981) entitlement approach explains how macroeconomic conditions affect food security by altering people's authority over food. The two are combined to create the theoretical model.

From the supply side, the total amount of food produced in a given year is determined by the conventional production inputs and the macroeconomic conditions that dictate their availability

and cost. This is written as:

$$FPI_t = f(L_t, K_t, Z_t) \quad (3.1)$$

where FPI is the food production index, L is labour, K is capital and other farm inputs, and Z is the set of macroeconomic conditions that influence the cost, availability and profitability of production. Following Nerlove (1958), output adjusts only gradually to these conditions, so lagged output also enters the model. Following Sen (1981), Z contains the variables that alter the prices, costs and finance available to producers and consumers. The study focuses on four such variables:

$$Z_t = f(EXR_t, FIMP_t, ACR_t, INF_t) \quad (3.2)$$

where EXR is the exchange rate, FIMP is the value of food imports, ACR is credit to the agricultural sector and INF is inflation. Substituting Equation 3.2 into Equation 3.1 and holding the conventional inputs constant gives the functional model of the study:

$$FPI_t = f(EXR_t, FIMP_t, ACR_t, INF_t) \quad (3.3)$$

The theoretical expectations are as follows. A weaker or more unstable naira raises the cost of imported inputs and adds uncertainty to production decisions, so the expected sign of the exchange rate coefficient is negative. Larger food imports may compete with local producers and weaken their incentives, so the expected sign is negative. Agricultural credit eases input constraints, so the expected sign is positive. Inflation raises production costs and erodes farmers' returns, so the expected sign is negative. In summary, $\partial FPI/\partial EXR < 0$, $\partial FPI/\partial FIMP < 0$, $\partial FPI/\partial ACR > 0$ and $\partial FPI/\partial INF < 0$.

Model Specification

The mathematical form of Equation 3.3 is:

$$FPI_t = \beta_0 + \beta_1 EXR_t + \beta_2 FIMP_t + \beta_3 ACR_t + \beta_4 INF_t \quad (3.4)$$

Adding a stochastic error term gives the econometric form:

$$FPI_t = \beta_0 + \beta_1 EXR_t + \beta_2 FIMP_t + \beta_3 ACR_t + \beta_4 INF_t + \mu_t \quad (3.5)$$

where β_0 is the intercept, β_1 to β_4 are the long-run coefficients, and μ is the error term. The exchange rate, food imports and agricultural credit are expressed in natural logarithms (LN) to reduce skewness and to allow the coefficients to be read as the effect of a percentage change in the regressor. Inflation is already a rate and is kept in levels. The estimated model is therefore:

$$FPI_t = \beta_0 + \beta_1 LNEXR_t + \beta_2 LNFIMP_t + \beta_3 LNACR_t + \beta_4 INF_t + \mu_t \quad (3.6)$$

Because the variables may be integrated of different orders and the sample is small, the study uses the autoregressive distributed lag (ARDL) bounds testing approach of Pesaran et al. (2001). The approach does not require all variables to have the same order of integration, provided none is integrated of order two, and it performs well in small samples (Narayan, 2005). The general ARDL(p, q_1, q_2, q_3, q_4) model is:

$$FPI_t = \alpha_0 + \Sigma_{i=1}^{p} \varphi_i FPI_{t-i} + \Sigma_{j=0}^{q1} \theta_{1j} LNEXR_{t-j} + \Sigma_{j=0}^{q2} \theta_{2j} LNFIMP_{t-j} + \Sigma_{j=0}^{q3} \theta_{3j} LNACR_{t-j} + \Sigma_{j=0}^{q4} \theta_{4j} INF_{t-j} + \varepsilon_t \quad (3.7)$$

where α_0 is the intercept, φ are the coefficients of the lagged dependent variable, θ are the coefficients of the current and lagged regressors, p and q_1 to q_4 are the lag orders, and ε is a white-noise error term. The lag orders are selected automatically in EViews 14 using the Akaike information criterion (Akaike, 1974), with a maximum of three lags for the dependent variable and for each regressor.

To test for a long-run relationship, the ARDL model is rewritten as the unrestricted error correction (conditional error correction) model:

$$\Delta FPI_t = \alpha_0 + \Sigma_{i=1}^{p-1} \varphi_i \Delta FPI_{t-i} + \Sigma_{j=0}^{q1-1} \theta_{1j} \Delta LNEXR_{t-j} + \Sigma_{j=0}^{q2-1} \theta_{2j} \Delta LNFIMP_{t-j} + \Sigma_{j=0}^{q3-1} \theta_{3j} \Delta LNACR_{t-j} + \Sigma_{j=0}^{q4-1} \theta_{4j} \Delta INF_{t-j} + \lambda_1 FPI_{t-1} + \lambda_2 LNEXR_{t-1} + \lambda_3 LNFIMP_{t-1} + \lambda_4 LNACR_{t-1} + \lambda_5 INF_{t-1} + \varepsilon_t \quad (3.8)$$

where Δ is the first-difference operator, the terms with summation signs capture short-run dynamics, and λ_1 to λ_5 capture the long-run relationship. The bounds test is an F-test of the joint null hypothesis of no long-run relationship against the alternative that a long-run relationship exists:

$$H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0 \quad (3.9)$$

$$H_1: \text{at least one } \lambda_i \neq 0 \quad (3.10)$$

The computed F-statistic is compared with two sets of critical values. If it exceeds the upper bound, I(1), the null hypothesis is rejected and cointegration is confirmed. If it is below the lower bound, I(0), the null hypothesis is not rejected. If it lies between the bounds, the result is inconclusive. EViews 14 reports asymptotic bounds from Pesaran et al. (2001) and finite-sample bounds from Narayan (2005).

When cointegration is confirmed, the long-run model is obtained from the lagged-level coefficients of Equation 3.8:

$$FPI_t = \delta_0 + \delta_1 LNEXR_t + \delta_2 LNFIMP_t + \delta_3 LNACR_t + \delta_4 INF_t + u_t \quad (3.11)$$

where $\delta_0 = -\alpha_0/\lambda_1$ and δ_1 to $\delta_4 = -\lambda_2/\lambda_1$ to $-\lambda_5/\lambda_1$ respectively. The short-run dynamics and the speed of adjustment are captured by the error correction model (ECM):

$$\Delta FPI_t = \alpha_0 + \Sigma_{i=1}^{p-1} \varphi_i \Delta FPI_{t-i} + \Sigma_{j=0}^{q1-1} \theta_{1j} \Delta LNEXR_{t-j} + \Sigma_{j=0}^{q2-1} \theta_{2j} \Delta LNFIMP_{t-j} + \Sigma_{j=0}^{q3-1} \theta_{3j} \Delta LNACR_{t-j} + \Sigma_{j=0}^{q4-1} \theta_{4j} \Delta INF_{t-j} + \psi ECT_{t-1} + \varepsilon_t \quad (3.12)$$

$$ECT_{t-1} = FPI_{t-1} - (\delta_0 + \delta_1 LNEXR_{t-1} + \delta_2 LNFIMP_{t-1} + \delta_3 LNACR_{t-1} + \delta_4 INF_{t-1}) \quad (3.13)$$

where ECT is the error correction term and ψ is its coefficient, which measures the speed at which FPI returns to its long-run path after a shock. For the model to be stable, ψ must be negative and statistically significant, and it should lie between -1 and 0.

Variables, Measurement and Data Sources

Table 3.1 summarizes the variables. The study used annual secondary data for 1986 to 2025. The FPI and inflation were sourced from the World Bank's World Development Indicators, while the exchange rate, value of food imports and credit to the agricultural sector were sourced from the Central Bank of Nigeria's Statistical Bulletin.

Table 3.1
Variables, Measurement and Expected Signs

Variable	Symbol	Measurement	Expected sign
Food production index	FPI	Index of food crop production relative to a base period (dependent variable)	—
Exchange rate	LNEXR	Natural log of the official naira–US dollar exchange rate, used to capture exchange rate movement	Negative
Value of food imports	LNFIMP	Natural log of the value of food imports	Negative
Credit to agriculture	LNACR	Natural log of credit to the agricultural sector	Positive
Inflation	INF	Annual change in the consumer price index (%)	Negative

Estimation Procedure Using EViews 14

EViews 14 was used for all data analysis. The procedure followed these steps.

i. Data entry and transformation. The series were placed into a new annual notebook that covered the years 1986 through 2025. The log function in the genr command was used to create the logarithmic series LNEXR, LNFIMP, and LNACR from the raw series.

ii. Descriptive statistics. The group descriptive statistics view included the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and Jarque-Bera statistic for each series.

iii. Testing for unit roots. Each series was subjected to the augmented Dickey–Fuller (ADF) test at level and at first difference, with an intercept and automatic lag selection based on the Schwarz information criterion (maximum of nine lags). The ADF test is based on:

$$\Delta Y_t = \gamma_0 + \gamma Y_{t-1} + \Sigma_{i=1}^{k} \rho_i \Delta Y_{t-i} + \varepsilon_t \quad (3.14)$$

where Y is the series being tested, and the null hypothesis is that Y has a unit root ($\gamma = 0$). The null is rejected when the ADF t-statistic is more negative than the critical value, or when the MacKinnon (1996) probability is below 0.05 (Dickey & Fuller, 1979).

iv. ARDL estimation. The ARDL model was estimated by selecting Quick → Estimate Equation, choosing ARDL as the method, and entering FPI as the dependent variable with LNEXR, LNFIMP, LNACR and INF as dynamic regressors. The constant was restricted (Case 2), and the lag structure was chosen automatically by the Akaike information criterion.

v. Bounds test. The F-bounds test was obtained from View → ARDL Diagnostics → Bounds Test.

vi. Long-run and short-run estimates. The long-run coefficients and the error correction term (labelled COINTEQ) were obtained from View → ARDL Diagnostics → Error Correction Output and the cointegrating relation view.

vii. Diagnostic tests. The Breusch–Godfrey serial correlation LM test, the ARCH heteroskedasticity test, the Jarque–Bera normality test and the Ramsey RESET test were run on the estimated equation.

viii. Stability tests. The CUSUM and CUSUM of squares tests were run from the recursive estimates view.

Post-Estimation Diagnostic Tests

The Breusch (1978) and Godfrey (1978) test examines the null hypothesis of no serial correlation in the residuals. The ARCH test (Engle, 1982) examines the null hypothesis of no autoregressive conditional heteroskedasticity, based on the auxiliary regression:

$$\varepsilon_t^2 = a_0 + a_1\varepsilon_{t-1}^2 + v_t \quad (3.15)$$

The Jarque and Bera (1980) test looks at the null hypothesis that residuals are regularly distributed. The Ramsey (1969) RESET test tests the null hypothesis that the model is correctly defined by increasing the powers of the fitted values in the equation. The CUSUM and CUSUM of squares tests (Brown et al., 1975) look at parameter stability; a model is stable if the plotted statistic remains within the 5% critical boundaries.

Decision Rule

All hypotheses were tested at the 5% level of significance. For each null hypothesis (H_{01} to H_{04}), the null is rejected if the probability value of the long-run coefficient is below 0.05 and is not rejected otherwise.

Data Presentation, Analysis and Discussion of Findings

Preliminary Tests

Descriptive Statistics

Table 4.1

Descriptive Statistics

Statistic	FPI	LNEXR	LNFIMP	INF	LNACR
Mean	77.5445	4.4043	12.1233	19.9613	4.5554
Median	77.5800	4.8593	12.2451	13.1000	4.1722
Maximum	125.3200	7.2695	15.8504	72.8000	8.1919
Minimum	29.3800	0.5596	6.6870	5.4000	0.1352
Std. deviation	28.2889	1.6010	2.4926	16.8363	2.0820
Skewness	0.0797	−0.5312	−0.6253	1.6875	−0.2655
Kurtosis	1.9588	2.6182	2.4330	4.7673	2.5861
Jarque–Bera	1.8491	2.1244	3.1420	24.1899	0.7555
Probability	0.3967	0.3457	0.2078	0.0000	0.6854
Observations	40	40	40	40	40

Note. Source: Author's computation using EViews 14.

Over the course of 40 years, the food production index ranged from 29.38 to 125.32, with an average of 77.54 (Table 4.1). Inflation has the greatest variation in relation to its mean (standard deviation of 16.84), with an average of 19.96%, a minimum of 5.40%, and a maximum of 72.80%. These series are roughly normally distributed because the Jarque–Bera probabilities of FPI, LNEXR, LNFIMP, and LNACR are more than 0.05. A right-skewed distribution with extreme values is indicated by inflation's Jarque–Bera probability of 0.0000, positive skewness (1.69), and kurtosis above 3 (4.77).

Unit Root Test

Table 4.2

Augmented Dickey–Fuller Unit Root Test Results

Variable	Level t-stat.	Prob.	5% critical value	First diff. t-stat.	Prob.	5% critical value	Order
FPI	−0.5237	0.8751	−2.9434	−3.0991	0.0353	−2.9434	I(1)
LNEXR	−1.8433	0.3548	−2.9390	−6.4392	0.0000	−2.9411	I(1)
LNFIMP	−1.7555	0.3963	−2.9390	−7.8528	0.0000	−2.9411	I(1)
INF	−3.6893	0.0083	−2.9411	—	—	—	I(0)
LNACR	−1.2974	0.6212	−2.9390	−7.0417	0.0000	−2.9411	I(1)

Note. Test equation includes an intercept; lag length selected automatically using the Schwarz information criterion (maximum lag = 9). Probabilities are MacKinnon (1996) one-sided p-values.

Table 4.2 demonstrates that FPI, LNEXR, LNFIMP, and LNACR have unit roots at the level, as their probability surpass 0.05, and become stable after initial differencing. At the level, inflation is stationary. The series are thus integrated of mixed orders, I(0) and I(1), with no I(2). This supports the ARDL bounds testing method.

ARDL Model Selection and Bounds Test

After controlling for lags, the ARDL model was calculated using 37 observations from 1989 to 2025. The Akaike information criterion chose ARDL (3, 0, 0, 1, 0), indicating three lags of FPI, no lags of LNEXR and LNFIMP, one lag of LNACR, and no lag of INF. The boundaries test results are shown in Table 4.3.

Table 4.3

ARDL Bounds Test for Cointegration

Significance level	I(0) bound	I(1) bound	F-statistic	Decision
10%	2.460	3.460	7.8546	Above I(1)
5%	2.947	4.088	7.8546	Above I(1)
1%	4.093	5.532	7.8546	Above I(1)

Note. Null hypothesis: no levels relationship. Number of dynamic regressors (k) = 4; case 2 (restricted constant); sample size = 38. Finite-sample bounds shown are for n = 35, the closest tabulated size below the sample.

The null hypothesis of no levels association is rejected since the F-statistic of 7.8546 is greater than the upper bound at the 10%, 5%, and 1% levels. Inflation, food imports, agricultural credit, FPI, and the exchange rate are all cointegrated. A stable long-term link between the variables is implied by the F-bounds test statistic (7.8546).

Error Correction Model

Table 4.4

Error Correction Term and Model Fit

Item	Value
COINTEQ (ECT) coefficient	−0.1486
Standard error	0.0410
t-statistic	−3.6233
Probability	0.0010

The error correction term is -0.1486, with a probability of 0.0010. The value is negative, between -1 and 0, and significant at the 1% level, confirming the long-run association discovered in the boundaries test. Each year, approximately 14.9% of the FPI's divergence from its long-run course is rectified, resulting in a full correction of around 6.7 years (1/0.1486). As a result, the adjustment process is slow.

Long-Run Estimates

Table 4.5: *Long-Run Coefficients (Dependent Variable: FPI)*

Variable	Coefficient	Std. error	t-statistic	Prob.
LNEXR	1.2578	8.3172	0.1512	0.8807
LNFIMP	−4.0767	6.4381	−0.6332	0.5311
LNACR(−1)	17.6319	8.5633	2.0590	0.0477
INF	−0.0053	0.2169	−0.0245	0.9806
C	53.6452	57.6731	0.9302	0.3593

Note. Selected model: ARDL (3, 0, 0, 1, 0); sample 1989–2025; 37 observations.

The estimated long-run equation is:

$$FPI_t = 53.6452 + 1.2578LNEXR_t - 4.0767LNFIMP_t + 17.6319LNACR_{t-1} - 0.0053INF_t \quad (4.1)$$

Interpretation of Results

Exchange Rate (LNEXR)

With a probability of 0.8807, the long-run coefficient of LNEXR is 1.2578. The coefficient is statistically insignificant, but the sign is positive instead of the anticipated negative sign. An increase in FPI of just roughly 0.013 index points (1.2578/100), which is indistinguishable from zero, is linked to a 1% increase in the exchange rate. Because there is no discernible long-term impact of the exchange rate on the food production index, the null hypothesis H_{01} is not rejected.

Value of Food Imports (LNFIMP)

The coefficient of LNFIMP is -4.0767 with a probability of 0.5311. The negative sign corresponds to the expected sign, although the effect is small. A 1% increase in food imports results in a 0.041-point decrease in the FPI. The null hypothesis H_{02} is not rejected, indicating that food imports have no substantial long-run effect on the food production index.

Credit to the Agricultural Sector (LNACR)

The coefficient of LNACR (−1) is 17.6319, with a probability of 0.0477. It shows the predicted

positive sign and is significant at the 5% level. A 1% increase in agricultural credit the previous year corresponds to an increase in FPI of around 0.176 index points (17.6319/100). Credit to the agricultural sector has a positive and significant long-run influence on the food production index, rejecting the null hypothesis (H_{03}).

Inflation (INF)

The coefficient of INF is -0.0053, with a probability of 0.9806. The sign is negative, as expected, but the coefficient is nearly zero and inconsequential. A one-percentage-point increase in inflation results in a 0.005-point decrease in the FPI. The null hypothesis H_{04} is not rejected, indicating that inflation has no substantial long-run influence on the food production index.

Model Fit, Diagnostic and Stability Tests

Table 4.6a: *Model Fit*

Item	Value
R-squared	0.5720
Adjusted R-squared	0.5331
F-statistic (probability)	14.7036 (0.0000)
Durbin–Watson statistic	1.8978

Note. R-squared and F-statistic are for the error-correction (first-difference) form of the model.

Table 4.6b: *Post-Estimation Diagnostic Tests*

Test	Null hypothesis	Statistic	Prob.	Decision
Jarque–Bera	Residuals are normally distributed	0.1556	0.9252	Not rejected
Breusch–Godfrey LM (2 lags)	No serial correlation	F = 0.2289	0.7970	Not rejected
ARCH (1 lag)	No heteroskedasticity	F = 0.1439	0.7068	Not rejected
Ramsey RESET	Model is correctly specified	F = 0.4855	0.4919	Not rejected

Note. Source: Author's computation using EViews 14.

Figure 4.1
CUSUM Stability Test

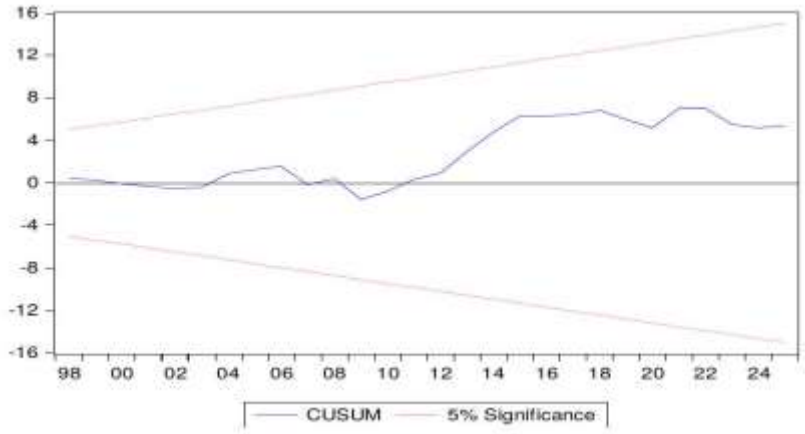
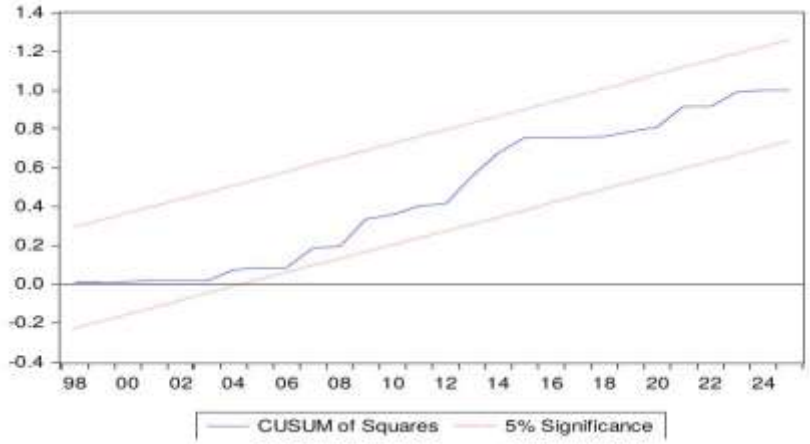


Figure 4.2
CUSUM of Squares Stability Test



Model Adequacy

The model accounts for 57% of the variation in the first difference of FPI ($R^2 = 0.5720$; adjusted $R^2 = 0.5331$). The F-statistic (14.7036, $p < 0.01$) indicates that the explanatory variables are jointly significant. The Durbin-Watson statistic of 1.8978 is near to two, indicating no significant first-order autocorrelation. The diagnostic tests in Table 4.6b all have probability greater than 0.05, indicating that the residuals are normal, serially uncorrelated, and homoskedastic, with no specification error in the model. The CUSUM and CUSUM of squares plots (Figures 4.1 and 4.2) remain within the 5% boundaries, indicating that the parameters are stable across the sample time.

Discussion of Findings

Exchange Rate and Food Production

The insignificant effect of the exchange rate on the food production index is consistent with Sylvanus et al. (2023), who found that foreign exchange fluctuation had a negative but insignificant effect on agricultural volume and value added in Nigeria over 1986–2021. It also agrees with Akinbode and Ojo (2017), who found no significant effect of exchange rate volatility

on agricultural exports in the short or long run, and who attributed this partly to the inelastic supply of agricultural commodities. It differs from Aye (2025), who found that exchange rate uncertainty significantly affects food security once it exceeds a threshold, and from Aye et al. (2025), who found a long-run relationship between exchange rate fluctuations and food price volatility. One reading of these results is that exchange rate movements work mainly through prices and consumers' access to food, as the entitlement approach (Sen, 1981) suggests, and less through the physical volume of output. Daniel and Ige (2020) and Salawu et al. (2026) found that exchange rate changes are passed on to agricultural and food prices. The findings of the present study suggest that these price effects do not necessarily translate into significant changes in production in the long run, possibly because farm output responds slowly to price signals, as supply response theory (Nerlove, 1958) predicts. The recent exchange rate instability in Nigeria may therefore raise food costs without yet showing up in the production index.

Food Imports and Food Production

The negative but insignificant coefficient of food imports contrasts with Ugwu et al. (2022), who found that food imports significantly reduced food production in Nigeria in both the short and long run over 1960–2020. The sign agrees with theirs, which is consistent with the view that imports can weaken incentives for local producers. The lack of significance in this study may reflect the composition of imports. Abdullahi (2021) found that food production is itself a determinant of food import demand, so imports and production may move together, which blurs a one-way effect from imports to output. The shorter sample may also matter, since Ugwu et al. (2022) used a much longer period. Policy waivers on food imports in 2024 and 2025 may have further weakened the link between import values and local production in recent years.

Agricultural Credit and Food Production

The positive and significant effect of agricultural credit is the key finding of the study. It agrees with Oyewale and Alliu (2018), Emenuga (2019) and Edith et al. (2021), who found that bank credit raised agricultural output or productivity in Nigeria. It contrasts with Lawal (2019) and Saidi et al. (2024), who found positive but statistically insignificant effects of commercial bank credit on agricultural output. A possible reason for the difference is the dependent variable: this study measures the volume of food produced, whereas some earlier studies used agricultural sector output, which includes non-food activities. The effect operates with a one-year lag, since the significant term is LNACR (−1). This fits supply response theory (Nerlove, 1958), under which output adjusts gradually, and it is consistent with the production cycle, in which credit used to buy inputs shows up in output in the following season. It also supports the entitlement approach (Sen, 1981), since credit strengthens the production-based entitlement of farming households.

Inflation and Food Production

The insignificant effect of inflation differs from Ibrahim et al. (2025), who found a significant negative long-run elasticity of agricultural output with respect to inflation over 1981–2024, and from Akpan and Udo (2021), who found the consumer price index to be a significant long-run determinant of crop and agricultural production indices. It also differs from Oziegbe et al. (2026), who found a significant positive relationship between the consumer price index and food security. The negative sign agrees with Ibrahim et al. (2025), but the coefficient is near zero. The mixed evidence across studies suggests that the effect of inflation depends on the sample, the

measure of output and the other variables in the model. In this study, inflation ranged from 5.4% to 72.8% and is non-normally distributed (Table 4.1), so a linear coefficient may not capture its effects well. Inflation may also operate indirectly, through interest rates and the availability of credit, so that its effect is partly absorbed by the credit variable.

Implications for the Study

Taken together, the data imply that, among the four variables, access to agricultural finance is the most important macroeconomic factor influencing Nigeria's long-term food production level. Exchange rate, import, and inflation conditions continue to have an impact on food costs and household food access, prompting the Cadre Harmonisé to forecast that about 34.7 million Nigerians will endure acute food and nutrition insecurity between June and August 2026. However, this study reveals that these three variables have no substantial direct long-term effect on food production volume.

Summary, Conclusion and Recommendations

Summary of Findings

The study examined the effect of exchange rate volatility on food security in Nigeria, measured by the food production index, from 1986 to 2025, with the value of food imports, credit to the agricultural sector and inflation as other explanatory variables. Using the ARDL bounds testing approach in EViews 14, the study found the following:

i. The exchange rate had an insignificant long-run effect on FPI.
ii. The value of food imports had a negative but insignificant long-run effect on FPI.
iii. Credit to the agricultural sector, lagged one year, had a positive and significant long-run effect on FPI.
iv. Inflation had a negative but insignificant long-run effect on FPI.
v. The error correction term (−0.1486; p = 0.0010) was negative and significant, indicating that about 15% of disequilibrium is corrected annually.
vi. The model passed the normality, serial correlation, heteroskedasticity, specification and stability tests.

Conclusion

The study reveals that credit to the agricultural sector is the only one of the four variables that has a statistically significant long-run effect on Nigerian food output. Exchange rate movements, food imports, and inflation have no substantial impact on the food production index between 1986 and 2025, despite the fact that the indications of the food import and inflation coefficients are consistent with theory. The slow rate of adjustment demonstrates that food production responds only gradually to shocks. Food security policy should thus mix policies that increase food output, such as agricultural funding, with those that safeguard household food access from exchange rate and price shocks.

Recommendations

Based on the findings, the study recommends the following:

i. To safeguard food access, maintain exchange rate stability. Monetary authorities should keep reducing exchange rate instability since it has been shown to affect food prices and household access to food, even if the exchange rate had no discernible impact on output.
ii. Control food imports so they complement local production rather than take its place.

Import exemptions ought to be short-term, focused on real shortages, and supported by initiatives that increase domestic production.

iii. Extend and focus on loans for agriculture. Since its effects take time to manifest, the Central Bank of Nigeria, the Federal Ministry of Agriculture and Food Security, and commercial banks should expand accessible credit to food producers, particularly smallholders, and make sure that it reaches farmers prior to the planting season. In order to ensure that funds are spent efficiently, guarantee schemes and lending programs should also lower collateral requirements and processing delays. They should also be linked to training and input access.

iv. Control inflation and protect farmers from shocks to input costs. During times of high inflation, monetary and fiscal authorities should aim for price stability and think about providing farmers with targeted input support.

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