Journal of Economic Studies (JES)
Department of Economics,
Nnamdi Azikiwe University, Awka,
Anambra State, Nigeria.

Web: www.nauecojournals.com *ISSN 1119-2259*

TRADE POLICY REFORMS AND AGRICULTURAL REAL SECTOR PERFORMANCE: EVIDENCE FROM NIGERIA

*McRollins Efe Olotu[1] Amaka G. Metu[2,3] Kenechukwu Okeyika[2], & Uche Collins Nwogwugwu[2]

[1]Department of Economics, Novena University, Ogume, Delta State, Nigeria
[2]Department of Economics, Nnamdi Azikiwe University Awka, Nigeria
[3]Center for Economic Policy and Development Research (CEPDeR), Covenant University Ota, Nigeria

***Corresponding Email:** efeolotu@gmail.com & **Phone No:** +2348037751767

ABSTRACT

The real sector, comprising agriculture, manufacturing, and non-financial services, is a key indicator of economic development. It reflects resource utilization, employment generation, value addition, and a country's capacity for sustained growth. Among these sectors, agriculture remains particularly central in emerging economies such as Nigeria because it provides food, supplies raw materials to industries, and employs a significant proportion of the population. Despite its strategic importance, the role of trade policy in shaping agricultural performance in Nigeria remains insufficiently explored, especially with respect to non-linear effects. This study examines the impact of trade policy on Nigeria's agricultural sector using quarterly time-series data from 1990 to 2024. The analysis is anchored on the endogenous growth through focusing on three major trade policy instruments such as trade openness, trade tariffs, and terms of trade. Using the Fully Modified Ordinary Least Squares (FMOLS) estimation technique, we found that trade openness exerts a positive effect on agricultural output, although diminishing returns set in at higher levels of openness. Trade tariffs generally suppress agricultural performance, while their squared terms indicate that the negative effects weaken beyond certain thresholds. In addition, terms of trade exert a negative influence on the agricultural sector, reflecting its vulnerability to external price shocks in global markets. The study concludes that, while trade policy can stimulate agricultural growth, its effects are neither uniform nor linear. It therefore recommends that policymakers adopt price stabilization schemes to shield Nigeria's agricultural sector from adverse global price volatility.

Keywords: *Agricultural sector, trade policy, trade openness, terms of trade, FMOLS, Nigeria*

JEL Classification Codes: *F14, Q17, C22*

1.0. Introduction

The real sector of an economy refers to the segment directly involved in the production of goods and services. It represents the productive base of an economy and includes activities such as agriculture, manufacturing, and services (Chitedze, Nwedeh, Adenikinju & Abonyi, 2021). It is commonly measured using

indicators such as agriculture, manufacturing, and non-financial services (Chitedze et al., 2021). Agriculture remains central in emerging economies because it provides food, raw materials for industries, and employment for a large proportion of the population. Its importance in driving the real sector and sustaining overall economic growth is well established. Without food, all productive activities cease (Food and Agricultural Organisation [FAO], 2025). In Nigeria, agriculture played a dominant role prior to 1970, employing over 85% of the labour force, contributing about 65% of GDP, and accounting for approximately 80% of foreign exchange earnings (Metu, Nwogwugwu & Okeyika, 2019). However, following the oil boom of the 1970s, agricultural activity declined significantly. Food shortages emerged as domestic production weakened, leading to increased food imports and a shift from net exporter to net importer status. Large-scale agricultural enterprises collapsed, and agriculture's share of exports fell from about 70% in the 1960s to less than 2% in 2006 (Central Bank of Nigeria [CBN], 2007). This marked a major structural decline in the sector.

In response, the Nigerian government implemented several policy interventions aimed at revitalizing agriculture. These include the Nigerian Agricultural and Cooperative Bank (NACB) established in 1972, the Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1977, Operation Feed the Nation, the National Accelerated Food Production Programme, the Green Revolution, and the National Seed Multiplication Programme. Others include the National Agricultural Land Development Authority (NALDA), the Agricultural Transformation Agenda (ATA) in 2011, the Anchor Borrowers' Programme (ABP) in 2015, and the National Agricultural Technology and Innovation Policy (NATIP) in 2022. Collectively, these initiatives reflect sustained efforts to transform agriculture from subsistence-based production into a driver of economic growth (Maku & Kigbu, 2016; Metu et al., 2019).

Despite these interventions, agricultural performance in Nigeria remains unstable. In 1981, agriculture contributed 12.2% to GDP, rising to 23.4% in 1988. However, this was not sustained, as it declined to 21.4% in 2000, increased to 37% in 2002, and later fell to 26.7% in 2009. By 2020, it accounted for 24.1% of GDP, and by 2024 it stood at 20.4% (World Bank, 2024). These fluctuations reflect the sector's vulnerability to policy inconsistencies, external shocks, and structural constraints. At the global level, agricultural value added grew by only 1.2% in 2024, compared to 2.5% in Sub-Saharan Africa and 2.9% globally (World Bank, 2024), highlighting Nigeria's relatively weak performance. Against this backdrop, trade policy emerges as a key determinant of

agricultural performance. Trade policy, commonly measured through tariff rates, trade openness, and terms of trade, can either enhance or constrain agricultural development. Understanding how these dimensions influence agriculture is therefore essential for identifying pathways to sustained growth, competitiveness, and structural transformation in the real sector.

While existing studies such as Ly, Dong, Anh and An (2020); Sunge and Ngepah (2020); Gnedeka and Wonyra (2023); Huda (2024) have examined the relationship between trade policy and agriculture but relied on a single indicator of trade policy, particularly trade openness. This narrow approach may not adequately capture the multidimensional nature of trade policy and its implications for agricultural productivity. To address this gap, this study examined the effect of trade policy on agricultural productivity in Nigeria using a broader set of trade policy indicators, namely trade openness, tariff rates, and terms of trade. By incorporating these complementary measures, the study provides a more comprehensive assessment of Nigeria's trade policy stance.

In addition, the study moves beyond linear specifications by incorporating squared terms to capture potential non-linear effects. Finally, it employs the Fully Modified Ordinary Least Squares (FMOLS) technique, which corrects for endogeneity and serial correlation, ensuring robust long-run estimates. The findings are expected to highlight the importance of balanced and well-calibrated trade policies in enhancing agricultural productivity and supporting sustainable real sector growth in Nigeria.

The remainder of the study is organized as follows: Section 2 presents the literature review, Section 3 outlines the methodology, including model specification, data sources, and the estimation technique, Section 4 presents and discusses the empirical results, while Section 5 concludes the study and provides policy recommendations based on the findings.

2.0. Literature Review

2.1. Conceptual review

The agricultural sector encompasses crop production, livestock, fisheries, and forestry. In Nigeria, it remains a fundamental pillar of the economy because of its critical contributions to food security, employment creation and income generation, particularly in rural communities. Beyond providing raw materials for agro-based industries, the sector also supports livelihoods for a large proportion of the population and plays a significant role in national economic stability. As noted by Gnedeka and Wonyra (2023), agriculture continues to serve as the backbone of the Nigerian economy due to its central role in sustaining household welfare and promoting rural development. This broad scope and

economic relevance make the agricultural sector a vital component in discussions of sustainable growth and development in Nigeria.

Trade policy is conceptualized as a set of government interventions and strategic instruments that regulate the flow of goods and services across borders in order to influence domestic economic performance and external competitiveness. It encompasses policy measures such as tariffs, trade openness and terms of trade, which collectively determine the extent, cost, and structure of a country's integration into the global economy. For this study, trade policy is particularly relevant as it shapes **agricultural performance**, which is a critical component of the real sector outcomes.

Trade openness reflects the degree of integration between Nigeria and the global economy and determines the extent to which domestic producers interact with international markets. Increased openness can enhance **agricultural sector performance** by expanding export opportunities for agricultural commodities, improving access to modern inputs, and facilitating technology transfer that raises productivity (Huda, 2024). However, in developing economies such as Nigeria, where structural constraints and weak productive capacity persist, excessive openness may expose the agricultural sector to intense import competition, thereby suppressing domestic production. Thus, the effect of trade openness on agricultural performance operates through market access, competitiveness, and productivity channels (Huda, 2024).

Tariffs represent a direct policy instrument used to regulate the price competitiveness of imported and domestic goods. Through the imposition of taxes on imports, tariffs influence production incentives within the agricultural sector. Moderate protective tariffs may enhance **agricultural sector performance** by shielding domestic farmers from cheaper or subsidized foreign agricultural products, thereby encouraging local production expansion (Olanipekun, 2023). Conversely, high tariffs on imported agricultural inputs such as machinery, fertilizers, and agro-chemicals may raise production costs and reduce efficiency, thereby constraining output growth. Consequently, tariff policy affects agricultural sector performance through price mechanisms, cost structures, and resource allocation effects.

The terms of trade measure the relative price of exports to imports and reflect the external economic environment in which Nigeria operates. Improvements in the terms of trade can enhance foreign exchange earnings and increase the capacity to import essential agricultural inputs, thereby supporting **agricultural sector performance**. For a commodity-dependent economy, driven especially by oil exports, favourable terms of trade especially can indirectly stimulate

agricultural investment and production capacity (Ly et al., 2020; Sun & Zhang, 2024). However, persistent improvements in the terms of trade may also generate structural imbalances such as exchange rate appreciation and resource shifts away from agriculture, which may weaken the sector's competitiveness over time (Sunge & Ngepah, 2020). Therefore, the terms of trade influence agricultural sector performance through external price conditions, macroeconomic stability, and structural adjustment effects. Overall, the conceptual framework suggests that trade policy influences agricultural sector performance in Nigeria through market access, price incentives, cost structures, and external price conditions, with effects that may be both positive and negative depending on the prevailing economic structure and policy environment.

2.2. Empirical Literature Review

Anowor, Ukweni and Martins (2013) examined the effect of trade liberalization on agricultural performance in Nigeria using the Ordinary Least Squares (OLS) technique. The findings revealed that trade openness undermines agricultural performance in Nigeria. However, the study did not consider possible non-linear effects of trade openness, which limits the depth of its empirical analysis. On the other hand, Hart, Miljkovic and Shaik (2015) applied OLS and Stochastic Frontier Analysis to investigate the impact of trade openness on technical efficiency in the agricultural sector of the European Union (EU) from 1980 to 2007. Utilizing variables such as trade openness, foreign direct investment (FDI), agricultural GDP, capital, fertilizer usage, arable land, and labour, the results showed that trade openness exerted a negative effect on agricultural efficiency in the EU. Nevertheless, the study was geographically limited to developed economies and may not adequately reflect the realities of developing countries such as Nigeria.

Sunge and Ngepah (2020) investigated the impact of trade liberalization on agricultural productivity in Africa from 2005 to 2016 utilizing a dynamic fixed effects model and found that trade openness positively influenced agricultural productivity. However, the panel structure of the study may mask country-specific dynamics, particularly those relevant to individual economies like Nigeria. While Sun and Zhang (2021) examined the effect of trade openness on food production in Asia between 2001 and 2018 using a fixed effects model, the findings revealed that trade openness negatively affected food production. However, the study did not explore potential non-linear effects of trade openness.

Recent empirical literature in Nigeria has also examined the relationship between trade policy dynamics and sectoral performance, particularly within agriculture and the broader real sector. However, the findings remain

mixed, reflecting differences in methodology, time coverage, and policy measurement. For instance, Ibeh (2024) examined the relationship between trade policy and sectoral performance in Nigeria over the period 1960–2022, with particular emphasis on agriculture and manufacturing. The study employed historical policy classification distinguishing between pre- and post-Structural Adjustment Programme (SAP) regimes. The findings revealed that shifts from protectionist to liberalized trade regimes had produced mixed outcomes, with agriculture experiencing only modest improvements under liberalization. This suggests that trade policy reforms alone may not be sufficient to drive strong agricultural performance in Nigeria.

Similarly, Agada, Okoye and Eze (2023) investigated the impact of trade liberalization on agricultural crop output in Nigeria, focusing on major crops such as rice, wheat, cocoa, and cassava. Using a Vector Error Correction Model (VECM), the study found that trade openness enhanced the output of some crops in the long run while negatively affecting others. This indicated heterogeneous effects of trade policy across agricultural sub-sectors and confirmed that the impact of trade liberalization on agriculture was not uniform. Onogbosele (2025) extended the analysis to the broader real sector by examining the relationship between trade openness and real sector growth in Nigeria, covering agriculture and manufacturing, and applying an Autoregressive Distributed Lag (ARDL) approach. The findings showed that trade openness produced mixed short-run effects but positive long-run effects on manufacturing, while its impact on agriculture was weaker and, in some cases, negative in the short run. This underscored the asymmetric nature of trade openness effects across different real sector components. In a related but more macroeconomic study, Adekunle (2024) analysed the effect of trade openness on economic growth in Nigeria using time-series econometric techniques. The results indicated that trade openness generally promoted economic growth, although its effects were highly sensitive to macroeconomic conditions such as exchange rate instability. While the study is not agriculture-specific, it provides important macro-level evidence on the broader transmission channels through which trade policy influences productive sectors.

Despite growing empirical attention on the impact of trade policy on agricultural outcomes, several important gaps remain in the literature, particularly in developing economies such as Nigeria. First, most studies relied on trade openness as a single proxy for trade policy (Ly et al., 2020; Sunge & Ngepah, 2020), thereby neglecting multidimensional approach that jointly consider tariffs, trade openness and terms of trade. Second, many studies adopted linear specifications that

assumed constant marginal effects, thereby overlooking possible non-linear relationships and threshold effects in the impact of trade policy variables. To fill these gaps, this study contributes to the literature by providing Nigeria-specific evidence on the impact of trade policy on agricultural sector performance using a multidimensional framework that incorporates trade openness, tariffs, and terms of trade. Hence, this study offers a methodologically sound understanding of how trade policy dynamics influence agricultural sector performance in Nigeria by introducing non-linear specifications (squared terms) and employing the FMOLS technique to generate robust long-run estimates.

3.0. Methodology

3.1. Theoretical Framework

The theoretical foundation is anchored on the endogenous growth theory. This study extended the basic Romer (1990 in Cozzi, 2023) model to explicitly incorporate the channels through which trade policy influences real sector growth and hence the agricultural sector.

The production function for the final good sector is given by:

$$Y_t = A_t K_t^{\alpha} H_{Y,t}^{1-\alpha} \qquad 3.1$$

Where, Y_t= aggregate output; A_t= the level of technology or the stock of available ideas at time t; K_t= physical capital stock; $H_{Y,t}$= human capital employed in the final goods production sector; α = output elasticity of physical capital, $0 < \alpha < 1$.

In Equation 3.1, the total stock of ideas A_t is a function of the accumulated knowledge from past research. The accumulation of new ideas, $\dot{A}_t$, is determined in the research sector. We assume that new ideas are produced using human capital allocated to research ($H_{A,t}$) and the existing stock of knowledge (A_t).

3.2. Model Specification

Drawing from the reduced-form growth equation derived in the theoretical framework which established that real sector growth (g_y) is a function of trade policy (TP_t) and other growth determinants, we can operationalize these relationships with a model that links agricultural growth to trade policy measures and their squared terms:

$$AGRIO = \gamma_0 + \gamma_1 TOP_t + \gamma_2 TOP^2{}_t + \gamma_3 TTAR_t + \gamma_4 TTAR^2{}_t + \gamma_5 TOT_t + \gamma_6 TOT^2{}_t \qquad 3.2$$

Where, *AGRIO* = agricultural value added (or agricultural GDP); *TOP* = trade openness; *TTAR* = trade tariffs; *TOT* = term of trade, $TOP^2{}_t$ = squared term of trade openness (to capture non-linear effects); $TTAR^2{}_t$ = squared term of average tariff rate; $TOT^2{}_t$ = squared terms of trade. The control variables are *FDI* = foreign direct investment; *EXR* = exchange

rate; *ARA* = arable land per capita; *FER* = fertilizer usage; $\varepsilon_{2,t}$ = stochastic error term. Huda (2024) argues that FDI provides capital, technology transfer, and market access for agricultural development. Ochalibe, Okoye and Enete (2019) opine that exchange rate volatility has asymmetric effects on agricultural output and influences production decisions. On their own, arable land per capita and fertilizer usage exert substantial influence on agricultural productivity (Wudil & Musa, 2025). Arable land per capita reflects the availability of cultivable land relative to the population, which is crucial for assessing land pressure and potential output. Fertilizer usage enhances soil fertility and crop yields, directly impacting agricultural output. The collected data were analysed using the FMOLS method, which is appropriate for estimating long-run relationships among cointegrated time-series variables. FMOLS corrects for endogeneity and serial correlation problems common in time-series data, thereby providing reliable and efficient estimates (Gujarati, 2004). The data in this study are time series data spanning from 1990Q1 to 2024Q4 obtained from the Central Bank of Nigeria (CBN), the World Development Indicator (WDI) and the International Monetary Fund (IMF). This time frame was chosen to capture the evolution of Nigeria's trade policy reforms alongside developments in the agricultural sector such as the liberalization reforms of the 1990s, the policy shifts of the 2000s and more recent trade and agricultural strategies of the 2010s and 2020s. By examining nearly four decades of policy changes and sectoral performance, the study provides a comprehensive analysis of how different phases of trade reform have shaped the trajectory of Nigeria's agriculture sector.

4.0. Results Presentation and Analyses

This section presents and interprets the empirical findings of the study.

4.1 Descriptive Statistics

Table 4.1 presents the summary statistics of the variables employed in the empirical estimation.

Table 4.1: Summary of Descriptive Statistics

	Mean	Median	Min	Max	Std
Agricultural valued added (AGRIO, %)	24.95	25.17	19.99	36.97	3.77
Trade openness, TOP (% of GDP)	33.58	34.70	18.05	55.57	8.44
Terms of trade, TOT(index)	95.84	100.04	43.88	144.59	23.79
Trade tariff, TTAR (%)	25.55	23.65	12	50	9.912
Exchange rate, EXR (N/$)	198.10	132.15	8.04	1448.89	255.60
Foreign Direct Investment, FDI (%)	1.27	1.20	-0.04	2.90	0.83
Arable Land per head (ARA)	0.24	0.24	0.17	0.30	0.05
Fertilizer usage (FER)	10.55	8.51	4.15	21.78	5.76

Source: Researchers' computation, 2026

From Table 4.1, the terms of trade index averaged 95.8, with a wide range of 44 to 145, indicating Nigeria's vulnerability to fluctuations in global commodity prices. Trade-related indicators show a mixed pattern of openness and protection: the average tariff rate of 25.5 percent suggests a moderately protective trade regime, while trade openness averaged 33.6% of GDP, reflecting a semi-open economy characterized by import dependence alongside limited export diversification. The exchange rate also exhibited significant volatility, ranging from ₦8 to ₦1,448 per US dollar, highlighting repeated currency devaluations and episodes of macroeconomic adjustment. On the production side, agriculture accounted for an average of 24.9% of GDP, reaffirming its central role in Nigeria's economy.

4.2 Unit Root Test

The time-series properties of the variables were assessed using both the Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) tests and the result presented in Table 4.2.

Table 4.2: Summary of Unit Root Test Results

Variable	ADF Test		Philip-Perron Test		Assumptions
	ADF Statistics	**Order of Integration**	**PP statistics**	**Order of Integration**	
TOP	-4.862	I(1)	-5.853***	I(1)	None
TTAR	-4.416**	I(1)	-4.427**	I(1)	Intercept and trend
AGRIO	-4.027**	I(1)	-4.026***	I(1)	Intercept and trend
TOT	-9.575	I(1)	-9.525	(I(1)	Intercept and trend
EXR	- 5.799***	I(1)	-5.736***	I(1)	Intercept
FDI	-4.641***	I(1)	-3.656***	I(1)	Intercept and trend
FER	-5.622**	I(1)	-5.603***	I(1)	Intercept and trend
ARA	-4.444**	I(1)	-4.447**	I(1)	Intercept and trend
Critical Values					
1% level		-4.4678			
5% level		-3.6449			
10% level		-3.2614			

***Note**: *, **, and *** imply statistically significant at 10%, 5% and 1% respectively*

Source: Researchers' Computation, 2026

From Table 4.2, the results consistently indicate that all series are integrated of order one, I(1), irrespective of whether the test specification includes only an interceptor both intercept and trend. In each case, the null hypothesis of a unit root cannot be rejected at levels but is decisively rejected after first difference, with test statistics exceeding the 1% or 5% critical values. This pattern holds uniformly across the key dependent variables - agricultural output, manufacturing output, and non-financial services output as well as the trade policy indicators and macroeconomic control variables.

4.3. Cointegration tests and Lag Selection Criteria

The Johansen cointegration procedure was used to test the long-run relationship among the dependent variables. Prior to conducting the Johansen cointegration test, the optimal lag length for the underlying vector autoregressive (VAR) system was determined using multiple information criteria and presented in Table 4.3.

Table 4.3: Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
1	-27.45288	NA	1.52e-07*	4.132588	6.265966*	4.884703*
2	18.09506	56.62716	2.34e-07	4.319186	8.585941	5.823417
3	85.52298	58.31604	1.91e-07	3.323082*	9.723216	5.579429

*Note: * Indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error*

Source: Researchers' Computation, 2026

From Table 4.3, the Final Prediction Error (FPE), Akaike Information Criterion (AIC), and Hannan–Quinn Criterion (HQ) jointly selected three lags, while the Schwarz Criterion (SC) favoured one lag. Given the need to minimize residual autocorrelation without over-parameterizing the model, the three-lag specification was adopted as the preferred structure. This choice ensures sufficient dynamic adjustment while preserving degrees of freedom for subsequent inference.

Table 4.4 presents the summary of the cointegration test result.

Table 4.4: Summary of Cointegration Result

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None *	0.982151	390.9308	197.3709	120.7750	58.43354
At Most 1 *	0.875103	270.1558	159.5297	62.40787	52.36261
At Most 2 *	0.852867	207.7479	125.6154	57.49256	46.23142
At Most 3 *	0.830667	150.2554	95.75366	53.27662	40.07757
At Most 4 *	0.707452	96.97873	69.81889	36.87382	33.87687
At Most 5 *	0.594189	60.10492	47.85613	27.05603	27.58434
At Most 6 *	0.472398	33.04888	29.79707	19.18238	21.13162
At Most 7	0.262980	13.86650	15.49471	9.154201	14.26460
At Most 8 *	0.145362	4.712304	3.841465	4.712304	3.841465

*Note: Trace test indicates 7 cointegrating equation(s), while the Max-Eigenvalue test indicates 5 cointegrating equation(s) at the 0.05 level. * denotes rejection of the null hypothesis at the 0.05 level.*

Source: Researchers' Computation, 2026

From Table 4.4 the results for trace test and Max-Eigen test diverge. The trace test shows that there are seven cointegrating equations while the Max-Eigen test shows that there are five cointegrating equations. To reject the null hypothesis of no cointegration requires at least one cointegration. Thus, the null hypothesis is rejected at 5% significance level.

4.4. FMOLS Estimation Result

The FMOLS estimates of the impact of trade policy variables on agricultural sector

performance in Nigeria is presented in Table 4.5.

Table 4.5: Summary of FMOLS Estimation Result

	Coef.	Std. Erro	t-stat
Dependent Variable: AGRIO			
TOP	0.0805**	0.0354	2.2735
TOP²	-0.0530**	0.0224	-2.3614
TTAR	-0.1113*	0.0640	-1.7378
TTAR²	0.3548***	0.1081	3.2834
TOT	-0.6775***	0.1500	-4.5170
TOT²	0.0298***	0.0106	2.8224
FDI	0.1333**	0.0570	2.3366
EXR	-0.1197	0.1569	-0.7630
ARA	0.5193***	0.1721	3.0177
FER	0.4041***	0.0469	8.6166
Coeff.	0.3890**	0.1102	2.2280
Obs.	140		
S.E.	0.119		
R²	0.692		

*Note: *, **, and *** imply statistically significant at 10%, 5% and 1% respectively*

Source: Researchers' Computation, 2026

The results indicate that trade openness has a statistically significant positive effect on agricultural performance at the linear level (β = 0.0805; t = 2.27), suggesting that greater integration into international markets enhances agricultural output. However, the squared term of trade openness is negative and statistically significant (β = −0.0530; t = −2.36), implying diminishing returns to openness beyond a certain threshold and confirming a concave relationship. For tariffs, the linear term is negative and weakly significant (β = −0.1113; t = −1.74), while the squared term is positive and highly significant (β = 0.3548; t = 3.28). This indicates that tariffs initially reduce agricultural output—likely through increased input costs—but their marginal negative effects decline at higher levels, suggesting a convex relationship.

The results further show that terms of trade exert a strong negative and statistically significant effect on agricultural output (β = −0.6775; t = −4.52). This implies that favourable external price conditions, often driven by commodity booms, tend to weaken agricultural performance through resource reallocation and exchange rate pressures. However, the squared term of terms of trade is positive and significant (β = 0.0298; t = 2.82), indicating that the adverse effects diminish at higher levels of improvement. Similarly, FDI and arable land availability positively and significantly influence agricultural performance, while fertilizer usage also shows a strong positive effect. Exchange rate, although negative in sign, is statistically insignificant, suggesting limited direct responsiveness of agricultural output to exchange rate movements within the model.

The model explains a substantial proportion of variation in agricultural output with an R^2 value = 0.692, and the overall coefficient of determination is 0.3890; t = 2.23confirms the joint significance of the regressors.

4.6. Post-Estimation Tests

To ensure that the model is reliable and valid for statistical inferences, some diagnostic tests are carried out and the results are reported in Table 4.6.

Table 4.6: Post-Estimation Diagnostic Tests

Diagnostic test	F-statistic	Obs*R^2 / Statistic	P-value	Decision
Serial correlation (Breusch–Godfrey LM, 2 lags)	14.540	18.972	0.092	No serial correlation
Heteroskedasticity (Breusch–Pagan–Godfrey)	1.923	10.246	0.111	No heteroskedasticity
Normality (Jarque–Bera)	—	1.449	0.485	Residuals are normally distributed
Multicollinearity (Mean VIF)	—	4.571	—	No serious overall multicollinearity

Source: Researchers' Computation, 2026

The diagnostic results show that the residuals are not serially correlated, normally distributed and do not exhibit significant heteroskedasticity. The mean VIF indicates that overall multicollinearity is not severe. Thus, the estimation is reliable and valid.

4.3. Discussion of Findings

The findings suggest that **trade openness is associated with improved agricultural sector performance in Nigeria at low to moderate levels, although the relationship appears to become concave as openness increases further**. This implies that the gains from trade openness may not increase indefinitely. A plausible explanation is that, at the early stages of trade liberalization, improved access to larger markets, foreign technologies, and imported production inputs likely outweighs the adverse effects of international competition. However, beyond a certain threshold, increasing exposure to foreign competition, combined with persistent domestic structural constraints, may reduce the marginal benefits of greater openness. This interpretation is broadly consistent with the argument of Olapekun (2023), who suggests that developing economies often experience diminishing returns from trade liberalization where institutional capacity, infrastructure, and productive competitiveness remain weak. These findings therefore imply that trade openness alone may be insufficient to sustain agricultural productivity unless it is accompanied by complementary investments that strengthen the sector's productive capacity.

The estimated relationship between **tariff rates and agricultural performance appears to be more nuanced**. The negative linear coefficient suggests that higher tariffs may adversely affect agricultural output, possibly because they increase the cost of imported intermediate inputs such as fertilizers, machinery, and improved seeds. Nevertheless, the positive coefficient on the squared tariff term indicates that the magnitude of this adverse effect appears to decline as tariff levels increase, implying a convex relationship. One possible interpretation is that while moderate tariff increases may initially raise production costs, higher levels of protection could provide temporary support for domestic producers by reducing import competition and allowing local industries time to adjust. This interpretation should, however, be treated cautiously, as excessive protection could also reduce efficiency and competitiveness over time. The findings are broadly consistent with Sunge and Ngepah (2020), who argue that carefully designed tariff policies may support agricultural development when implemented alongside broader productivity-enhancing measures. Consequently, the results suggest that tariff policy may need to strike a balance between protecting domestic producers and ensuring affordable access to productive inputs.

The results further indicate that **terms of trade are negatively associated with agricultural sector performance, although this adverse effect appears to weaken at higher levels of improvement in the terms of trade**. A possible explanation is that favourable commodity price movements, particularly those driven by Nigeria's oil exports, may induce exchange rate appreciation and encourage the reallocation of productive resources away from agriculture, thereby reducing the sector's competitiveness. However, the positive squared term suggests that these contractionary effects may gradually diminish as the economy adjusts to changing external conditions. This could reflect gradual structural adaptation, policy responses, or improvements in the agricultural sector's resilience over time. Nevertheless, the estimated relationship should be interpreted with caution because the observed adjustment process may also be influenced by other macroeconomic factors not explicitly captured in the model.

Taken together, the findings provide evidence that **the effects of trade policy on agricultural performance are likely to be nonlinear and highly dependent on domestic economic conditions**. The results suggest that although greater openness and favourable external trade conditions may support agricultural growth, their effectiveness appears to be constrained by structural bottlenecks, production cost dynamics, and broader macroeconomic distortions. These findings therefore imply that

trade policy reforms are likely to produce better outcomes when implemented alongside complementary policies aimed at improving infrastructure, strengthening institutions, enhancing farmers' access to productive inputs, and increasing the competitiveness of domestic agriculture. This overall conclusion is consistent with the mixed evidence reported by Ibeh (2024), Agada, Okoye and Eze (2023), and Onogbosele (2025), who respectively found mixed agricultural outcomes under different trade-policy regimes, heterogeneous effects across crops, and weaker or negative short-run effects of trade openness on agriculture.

5.0. Conclusion and Policy Recommendations

5.1. Conclusion

This study examined the impact of trade policy dynamics on agricultural sector performance in Nigeria using FMOLS estimation over a time-series framework. The analysis focused on three key dimensions of trade policy, that is, trade openness, tariffs, and terms of trade, while accounting for possible non-linear effects. The findings show that trade openness enhances agricultural performance, although the effect diminishes beyond a threshold level. Tariffs exert a generally negative influence on agricultural output, while terms of trade have a strong contractionary effect, reflecting Nigeria’s vulnerability to external price shocks and structural imbalances. Overall, the results confirm that trade policy effects on agriculture are nonlinear and context-dependent, shaped by both domestic structural constraints and external economic conditions.

5.2. Policy Recommendations

The findings of this study have important implications for trade and agricultural policy in Nigeria. First, given the nonlinear effect of trade openness, trade liberalization should be implemented gradually and in a well-sequenced manner. While moderate openness appears to enhance agricultural performance, excessive exposure to international competition may reduce these benefits in the presence of structural constraints. Policymakers should therefore complement liberalization with investments in agricultural infrastructure, technology adoption, research and development, and market access to strengthen the sector's competitiveness.

Second, tariff policy should be carefully calibrated to balance the need for protecting domestic producers with ensuring affordable access to imported agricultural inputs. Rather than relying solely on tariff adjustments, the government should complement tariff reforms with targeted support measures, including improved access to agricultural credit, extension services, input subsidies, and incentives for domestic production of key agricultural inputs. Such complementary policies are likely to enhance productivity

while minimizing the adverse effects of higher production costs. Third, the negative effect of terms of trade on agricultural performance suggests the need for policies that reduce the sector's vulnerability to external shocks. Strengthening agricultural stabilization mechanisms, such as commodity price stabilization schemes and agricultural stabilization funds, alongside efforts to diversify exports and promote value addition in agriculture, may improve the resilience and long-term performance of the sector.

5.3. Limitations of the Study

This study is subject to certain limitations. The analysis relies on aggregate measures of agricultural performance, which may mask differences in the responses of individual agricultural subsectors to trade policy changes. Furthermore, the study focuses on long-run relationships using the FMOLS estimator and therefore does not capture short-run adjustment dynamics or potential structural changes associated with major policy reforms. Future research may address this limitation by employing dynamic nonlinear models to examine both the short-run and long-run effects of trade policy on agricultural performance.

References

Adekunle, I. A. (2024). Trade openness and economic growth in Nigeria: Time-series evidence. *International Journal of Trade and Economics*, *12*(3), 45–62.

Agada, M. A., Okoye, L. U. & Eze, C. N. (2023). Trade liberalization and agricultural crop output in Nigeria: Evidence from selected crops. *Journal of Agricultural Economics and Development, 15*(2): 88–104.

Anowor, O. F., Ukweni, N. O. & Martins, I. (2013). The Impact of Trade Liberalisation on Nigeria's Agricultural Sector. *Journal of Economics and Sustainable Development, 4*(8): 14–24.

Central Bank of Nigeria. (2007). *Annual report and statement of accounts for the year ended 31st December 2007*. https://dc.cbn.gov.ng/cbn_annual_report/13/?utm

Chitedze, I., Nwedeh, C. C., Adenikinju, A.&Abonyi, D. C. C. (2021). An econometric analysis of electricity consumption and real sector performance in Nigeria. *International Journal of Energy Sector Management, 15*(4),855–873.

https://doi.org/10.1108/IJESM-04-2020-0003

Cozzi, G. (2023). Semi-endogenous or fully endogenous growth? A unified theory. *Journal of Economic Theory, 213*, 105127. https://doi.org/10.1016/j.jet.2023.105732

F.A.O. (2025). FOSTAT database. Food and Agricultural Organization. Available at https://www.fao.org/faostat/en/?utm (Accessed 20th November, 2025).

Gnedeka, K. T.&Wonyra, K. O. (2023). New evidence in the relationship between trade openness and food security in Sub-Saharan Africa. *Agriculture & Food Security, 12*, 31–45. https://doi.org/10.1186/s40066-023-00439-z

Gujarati, D. N. (2004). *Basic Econometrics*. New York. McGraw-Hill.

Hart, J., Miljkovic, D.& Shaik, S. (2015). The impact of trade openness on technical efficiency in the agricultural sector of the European Union. *Applied Economics, 47*(12), 1230–1247. https://doi.org/10.1080/00036846.2014.993134

Huda, M. (2024). Trade openness and food security in Southeast Asia: Empirical Evidence. *Journal of International Development Studies, 18*(4), 210–228.

Ibeh, G. (2024). Trade policy and sectoral performance in Nigeria: Evidence from agriculture and manufacturing (1960–2022). *Nigerian Journal of Economic Studies, 22*(1), 55–73.

Ly, T. D., Dong, P. X., Anh, L. H.&An, P. T. (2020). The effect of international trade on food security at Southeast Asian countries. *WSEAS Transactions on Environment and Development, 16*, 180–188.

Maku, A. A. & Kigbu, Y. O. (2016). Federal government new policy of agriculture and integrated rural development: An appraisal. *International Journal of Advanced Academic Research, 2*(1), 1–13.

Metu, A. G., Nwogwugwu, U. C. C., & Okeyika, K. (2019). *Overview of the structure of the Nigerian economy*. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3605453

Ochalibe, A. I., Okoye, C.U. & Enete, A.A (2019). Analysis of exchange and interest rate policy instruments' dynamics on agricultural growth in Nigeria. *American Journal of Applied Statistics and Economics 3*(2): 24-32

Olanipekun, D. B. (2023). Trade and sectoral performance in Africa: Does technological innovation matter? *Innovation and Development, 15*(1), 25–39.

https://doi.org/10.1080/2157930X.2023.2229136

Onogbosele, A. (2025). Trade openness and real sector growth in Nigeria: Evidence from ARDL analysis. *Journal of African Development Studies, 29*(1), 77–95.

Sun, Z., & Zhang, D. (2021). Impact of trade openness on food security: Evidence from panel data for Central Asian countries. *Foods, 10*(12),https://doi.org/10.3390/foods10123012

Sunge, R., & Ngepah, N. (2020). The impact of agricultural trade liberalization on agricultural total factor productivity growth in Africa. *International Economic Journal, 34*(4), 571–598. https://doi.org/10.1080/10168737.2020.1836671

World Bank. (2024). *World development indicators*. World Bank Databank. https://databank.worldbank.org/source/world-development-indicators?utm

Wudil, A. H.& Musa, S. (2025). Trend analysis of Nigerian agricultural policy from 1960 to 2023. *FUDMA Journal of Sciences, 9*(6), 329–337. https://doi.org/10.33003/fjs-2025-0906-3597