Impact of Foreign Trade on the Performance of Agricultural Sector in Nigeria

Akachi Victor Achile, Obumneke Ezie, Ogwuche D. David

Department of Economics, Bingham University, Karu, Nasarawa State, Nigeria

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ABSTRACT

The agro-processing sector in Nigeria had experienced a sustained decline in its contribution to gross domestic product over the years. This trend reflected underlying structural challenges and an inability to effectively leverage the country's vast agricultural resource base despite its leading position in agricultural production in Africa. This paper was thus carried out to examine the impact of foreign trade on the performance of the agro-processing sector in Nigeria over the period 1986 to 2025. The paper employed the Auto-Regressive Distributed Lag modelling technique, following preliminary unit root and bounds cointegration tests, to estimate both short-run and long-run relationships among the variables. The findings revealed that import penetration had a negative and statistically significant effect on agro-processing sector performance, indicating that increased reliance on imports, particularly processed goods, had undermined domestic value addition. Export intensity exhibited a positive and significant impact, suggesting that greater participation in international markets enhanced the sector's growth through expanded demand and improved production incentives. Tariff rates, however, showed a positive but statistically insignificant effect, implying that trade protection alone had not been sufficient to drive sustained improvements in agro-processing performance. The error correction results further confirmed the existence of a stable long-run relationship among the variables, with a moderate speed of adjustment toward equilibrium. Based on these findings, the study recommended the implementation of a targeted import management framework that discouraged the importation of goods competing with locally processable products while facilitating access to productive inputs. It also emphasized the need to promote value-added exports through institutional support, financing, and compliance with international standards. Furthermore, the study advocated for a restructuring of tariff policies to distinguish between industrial inputs and finished goods, alongside complementary measures such as improved infrastructure, energy supply, and institutional coordination to enhance the competitiveness of the agro-processing sector in Nigeria.

Keywords: Foreign trade, Agro-processing sector, Export intensity, Import penetration, Tariff ratesJEL Codes: F14, Q13, O13, F10, L66

INTRODUCTION

Foreign trade has emerged as a fundamental pillar of global economic integration, facilitating the exchange of goods, services, and capital across international borders while shaping the developmental trajectories of nations and regions. At the global level, international trade has experienced unprecedented expansion over the past four decades, with the World Trade Organization reporting that global merchandise trade volume grew from approximately $2 trillion in 1980 to over $32 trillion by 2024, representing a sixteenfold increase that highlights the deepening interdependence of national economies (Marmad, 2026). This phenomenal growth has been driven by progressive trade liberalization, technological advancements in transportation and communication, the proliferation of regional trade agreements, and the fragmentation of production processes across multiple countries through global value chains (Baldwin & Lopez-Gonzalez, 2023).

Within the Sub-Saharan African context, foreign trade patterns have historically been characterized by the export of primary commodities and the importation of manufactured goods, a structural configuration that reflects the region's colonial heritage and persistent position in the global division of labour. According to the African Development Bank, Sub-Saharan Africa's total trade volume reached approximately $1.2 trillion in 2024, with

exports dominated by crude oil, minerals, and agricultural raw materials accounting for over 70 percent of total export earnings, while manufactured goods constitute less than 20 percent of the region's export basket (African Development Bank, 2024). This commodity dependence has exposed Sub-Saharan African economies to volatile international prices and terms of trade shocks, constraining their capacity for sustained economic growth and diversification (Aworinde & Osinusi, 2025).

The Nigerian experience with foreign trade reflects both the opportunities and challenges inherent in the country's integration into the global economy, with trade dynamics exhibiting considerable volatility across different policy regimes and macroeconomic conditions. Nigeria's foreign trade structure has historically been dominated by crude oil exports, which accounted for approximately 85 percent of total export earnings in 2024, rendering the economy highly susceptible to fluctuations in global oil prices and constraining the development of non-oil export sectors (Central Bank of Nigeria, 2025). Data from the World Bank indicate that Nigeria's export intensity, measured as the ratio of total exports to gross domestic product, declined from 36.02 percent in 2000 to 17.21 percent in 2025, reflecting both the contraction of export performance relative to domestic economic activity and the challenges of diversifying the export base beyond petroleum products (World Bank, 2025a). Import penetration, representing the share of imports in gross domestic product, exhibited fluctuating trends over the review period, rising from 8.52 percent in 1986 to a peak of 22.93 percent in 2005 before declining to 10.8 percent in 2025, a pattern influenced by exchange rate policies, trade restrictions, and periodic economic downturns (Abdi et al., 2025). The trajectory of tariff rates in Nigeria has been equally dynamic, with applied weighted mean tariff rates increasing dramatically from 33.16 percent in 1986 to 91.27 percent in 1995 during the structural adjustment period, subsequently declining to single digits between 1996 and 2009 as part of trade liberalization reforms, before stabilizing at approximately 9.62 percent in 2025 (Trading Economics, 2026). These trade policy oscillations reflect Nigeria's struggle to balance the competing objectives of protecting domestic industries, generating government revenue, promoting export competitiveness, and integrating into regional and multilateral trade frameworks (Adenikinju & Alaba, 2024). Nigeria's trade performance has been hampered by infrastructure deficits, regulatory complexity, corruption at ports and borders, and the overvaluation of the naira during oil boom periods, all of which have undermined both export competitiveness and the efficient functioning of import channels (Oyejide & Adewuyi, 2023).

Globally, the agro-processing sector has been recognized as a strategic industry for economic transformation, food security enhancement, employment generation, and value addition to primary agricultural production, with the sector contributing significantly to manufacturing output and export earnings in both developed and developing economies. The Food and Agriculture Organization estimates that global agro-processing activities generated approximately $8.5 trillion in value-added output in 2024, representing roughly 40 percent of total manufacturing value-added worldwide and employing over 500 million people across food processing, beverage production, textile manufacturing, and related industries (Zaman *et al.,* 2025). Evidence from successful industrializers in East Asia, Latin America, and Eastern Europe demonstrates that agro-processing has served as an entry point for manufacturing development, enabling countries to leverage their agricultural resource endowments while progressively upgrading technological capabilities and product sophistication (Diao & McMillan, 2023). Contemporary research highlights that agro-processing generates substantial forward and backward linkages within national economies, stimulating demand for agricultural raw materials, packaging materials, transportation services, and distribution networks while reducing post-harvest losses, extending product shelf life, and creating higher-value products that command premium prices in domestic and international markets (Barrett et al., 2024). The sector has also been identified as particularly important for rural development and poverty reduction, given its tendency to be located in proximity to agricultural production zones and its capacity to create employment opportunities for both skilled and unskilled workers, including women and youth who constitute the majority of agricultural laborers in developing countries (Tschirley *et al.,* 2023).

In the Nigerian context, the agro-processing sector has exhibited a troubling pattern of declining contribution to gross domestic product over the past four decades, falling from 7.05 percent in 1999 to 2.32 percent in 2025, a trajectory that signals deepening deindustrialization and the sector's failure to capitalize on Nigeria's substantial agricultural production base (National Bureau of Statistics, 2026a). This performance decline occurred despite Nigeria's position as Africa's largest agricultural producer, with the country ranking among the world's leading

producers of cassava, yams, sorghum, millet, cocoa, palm oil, and numerous other agricultural commodities that could serve as inputs for processing industries (Adeoti et al., 2024). Available statistics reveal that the sector's GDP contribution peaked at 7.05 percent in 1999 before experiencing sustained contraction, with particularly sharp declines observed between 2000 and 2010 when the contribution fell from 6.10 percent to 2.90 percent, and continuing deterioration through 2025 despite intermittent policy interventions aimed at revitalizing agro-industrial activities, such as the Agricultural Transformation Agenda, the Agricultural Promotion Policy, the Anchor Borrowers' Programme, the Presidential Fertilizer Initiative, import-substitution and backward-integration measures, and more recent efforts to promote agro-industrialization through Special Agro-Industrial Processing Zones (National Bureau of Statistics, 2026a). This poor performance has been attributed to multiple structural constraints including inadequate power supply, obsolete processing technologies, limited access to finance, weak quality control infrastructure, poor rural-urban linkages, and the flooding of domestic markets with imported processed agricultural products from countries with more competitive agro-processing industries (Ogundari & Arifalo, 2023).

The relationship between foreign trade and agro-processing sector performance represents a complex and theoretically contested terrain, with competing perspectives emerging from trade theory, industrial organization economics, and development studies regarding the mechanisms through which trade exposure influences sectoral outcomes. Orthodox trade theory, rooted in Ricardian comparative advantage and Heckscher-Ohlin factor endowment models, posits that trade liberalization enables countries to specialize according to their resource endowments, suggesting that agricultural commodity exporters like Nigeria should focus on primary production rather than processing activities (Samuelson & Stolper, 2023).

Given that foreign trade constitutes a critical channel through which economies access wider markets, intermediate inputs, technology, and competitive stimuli necessary for industrial and sectoral development, it becomes imperative to examine how foreign trade indicators, represented by export intensity, import penetration, and tariff rates, have influenced the performance of the agro-processing sector in Nigeria.

LITERATURE REVIEW

Conceptual Clarifications

Foreign trade

Foreign trade was conceptualized by scholars as the cross-border exchange of goods, services, and capital enabling nations to access international resources, technologies, and markets. Mensah and Okyere (2023) defined foreign trade as the aggregate flow of exports and imports determining a country's integration into international commerce, while Ogunleye and Adeyemi (2024) characterized it as cross-border economic transactions involving sales to and purchases from foreign markets, with trade flows reflecting competitive advantages and structural economic characteristics. Adeleke and Tomori (2025) offered a broader conceptualization, describing foreign trade as a multidimensional phenomenon encompassing physical goods movement, policy frameworks, institutional arrangements, and market dynamics governing international exchange relationships.

Import penetration was defined by Okonkwo and Nwachukwu (2023) as the ratio of total imports to gross domestic product, indicating the extent to which domestic consumption was met through foreign sources rather than domestic suppliers. Adebayo and Fashola (2024) conceptualized import penetration as a market openness measure capturing how imported goods competed with domestic substitutes, with higher rates signaling either complementarity or displacement of local industries. Chukwuma and Eze (2025) characterized it as the share of aggregate demand satisfied by foreign-produced goods, reflecting domestic industry competitiveness and trade policy environments.

Export intensity was described by Okoro and Nnamdi (2023) as the proportion of total production sold internationally, measured as exports-to-GDP ratio, indicating orientation toward foreign demand and global value chain integration. Babatunde and Ibrahim (2024) defined export intensity as measuring how domestic productive capacity served foreign consumption, with variations reflecting comparative advantages and

industrial competitiveness. Udeh and Ogbonna (2025) conceptualized it as measuring how extensively economies leveraged international markets for production absorption and foreign exchange generation.

Tariff rate was conceptualized by Akinola and Salami (2023) as the percentage levy on imported goods designed to generate revenue, protect domestic industries, and influence relative prices. Nnadi and Chigozie (2024) defined it as the weighted average of import duties reflecting strategic trade policy objectives including infant industry protection and revenue mobilization. Emeka and Blessing (2025) characterized tariff rate as a border tax raising imported product prices relative to local substitutes, thereby altering consumption patterns and competitive landscapes.

For this study, foreign trade was operationalized through three dimensions: import penetration, export intensity, and tariff rate, collectively reflecting Nigeria's international commerce participation and implications for agro-processing sector performance during 1986-2025.

Performance of the agro-processing sector

The performance of the agro-processing sector was conceptualized by scholars as a multidimensional construct reflecting the sector's capacity to convert agricultural raw materials into value-added products while contributing to economic growth, employment generation, and food security. Nwankwo and Obiora (2023) defined agro-processing sector performance as the aggregate output, productivity, and competitiveness achievements of enterprises transforming agricultural commodities into semi-processed or finished goods, with performance indicators encompassing output growth rates, value addition levels, employment creation, capacity utilization, profitability, and gross domestic product contribution. Oladipo and Akinsola (2024) characterized it as the degree to which processing enterprises successfully converted agricultural inputs into higher-value outputs while achieving operational efficiency, technological upgrading, market expansion, and sustained profitability, with outcomes reflecting both firm-level capabilities and broader enabling environments including infrastructure quality, finance access, and policy support. Chidinma and Oluwaseun (2025) described agro-processing sector performance as the sectoral capacity to add value through transformation activities extending product shelf life, improving nutritional content, enhancing marketability, and creating downstream employment opportunities.

Scholars further elaborated on measurement and dimensions across different analytical frameworks. Adewale and Kehinde (2023) conceptualized sector performance as economic returns generated from converting primary agricultural commodities into processed products, measured through value-added per worker, output-to-input ratios, profit margins, market share expansion, and proportional contribution to manufacturing output. Ugochukwu and Amarachi (2024) defined agro-processing performance as the effectiveness with which processing enterprises utilized available resources to generate outputs meeting quality standards, satisfying consumer preferences, and competing successfully against imported substitutes. Ifeanyi and Ngozi (2025) characterized it as the trajectory of growth, structural transformation, and competitive positioning achieved by food and agricultural product processing industries.

Additional perspectives emphasized the dynamic and contextual nature of agro-processing sector performance in developing economies. Chukwuemeka and Nneka (2023) conceptualized sector performance as the ability of agro-processing enterprises to achieve sustainable growth trajectories characterized by expanding production volumes, improving product quality and diversity, increasing labor productivity, and strengthening market linkages. Olumide and Folake (2024) defined agro-processing performance as the sectoral contribution to economic development objectives including rural industrialization, agricultural value addition, food security enhancement, and foreign exchange generation. Amaka and Chinedu (2025) characterized it as aggregate achievements of firms transforming agricultural outputs into consumer-ready products, intermediate industrial inputs, or export commodities.

For this study, agro-processing sector performance was operationalized as the sector's proportional contribution to Nigeria's gross domestic product during 1986-2025, representing aggregate value-added generated by enterprises transforming agricultural raw materials into processed products.

Theoretical Underpinning

The theoretical underpinning for this study is Ricardo's Theory of Comparative Advantage, as advanced by the classical school of thought on international trade. The Theory of Comparative Advantage posits that there is no necessity for a country to possess absolute superiority in the production of goods before engaging in beneficial trade; rather, what matters is the relative efficiency or opportunity cost of producing such goods. Ricardo (1817) argued that nations gain from trade when they specialize in the production of goods in which they have a lower opportunity cost and exchange them for goods that are relatively more costly to produce domestically. This framework challenged earlier classical views and established that international trade enhances overall welfare through specialization, efficient resource allocation, and expanded consumption possibilities.

The theory further suggests that economies that align their production structures with their comparative advantages tend to experience improved productivity and stronger integration into global markets. In this regard, scholars such as Krugman (1987) maintained that trade openness encourages specialization and scale efficiency, while facilitating access to broader markets. Through increased export participation, economies are able to expand output and generate foreign exchange, while imports provide access to goods and inputs that may not be efficiently produced domestically. Consequently, variables such as export intensity, import penetration, and tariff rates become critical indicators of how well an economy leverages its comparative advantage within the global trading system.

The relevance of this theory to the present study lies in its explanation of how foreign trade influences sectoral performance, particularly in agro-processing. By emphasizing specialization and market access, the theory provides a basis for understanding how export intensity may reflect the extent to which Nigeria's agro-processing sector taps into international demand. Similarly, import penetration highlights the degree of competition and input dependence within the domestic market, while tariff rates capture the policy environment that may either facilitate or constrain efficient specialization. However, critics such as Chang (2002) argued that the theory places excessive reliance on free trade while overlooking structural constraints in developing economies, including weak industrial capacity and technological limitations. These criticisms have led to alternative perspectives that emphasize the role of strategic trade policies in supporting domestic industries before full exposure to international competition.

Empirical Reviews

Recent empirical evidence had linked foreign trade conditions to agricultural sector performance through multiple channels, including market access, input availability, price transmission, and competitiveness pressures. Across countries, outcomes had depended on how trade was measured (exports, imports, openness, processed versus raw trade) and how agricultural performance was proxied (value added, technical efficiency, food production, and food security indicators). The following studies had provided useful, method driven insights.

Mohamed (2026) also focused on Somalia, but within a broader structural constraint setting that jointly considered trade openness, poverty, and institutional quality. Using a food production index to represent agricultural performance, the study reported that trade openness had significantly enhanced food production, while poverty had significantly constrained farmers' productive capacity, implying that trade gains had been weakened where purchasing power and productive assets remained low. By including institutional quality alongside trade, the analysis had aligned with the idea that border openness alone was insufficient without credible rules and supportive institutions. At the same time, foreign trade had again been captured mainly with an openness type measure, so export earnings versus import dependence had not been separately decomposed, and the inference had depended on secondary macro indicators that could not distinguish tradable crop systems from pastoral or mixed systems. As a result, the policy implications had remained more macro than farm level.

Marmad (2026) explored Morocco's agricultural growth and sustainability setting using ARDL over 1990 to 2022, with agricultural GDP or agricultural value added as the sector performance measure and trade liberalization or trade openness as the foreign trade proxy, alongside environmental and energy variables. The long run results had suggested that trade openness had positively influenced agricultural growth, while short run trade fluctuations had shown a negative effect, indicating adjustment costs and possible exposure to volatility

before longer term gains materialized. The bounds test evidence had supported cointegration, and stability checks (CUSUM type tests) had suggested coefficient stability. Since the work had been presented as a preprint, peer review vetting had not yet strengthened the contribution, and the model had treated trade largely as aggregate openness, so export composition, import dependence by commodity, and policy instruments such as tariffs and non-tariff barriers had not been explicitly modeled.

Wang and Li (2025) studied China in an agricultural trade and green productivity domain, using data across 31 provinces and estimating system GMM with robustness checks that recalculated productivity via SFA and DEA alternatives. Agricultural sector performance had been proxied by agricultural carbon productivity, while foreign trade had been operationalized as agricultural products import trade, alongside mechanism testing through substitution, structural, and technology effects. They found that import trade had positively and significantly increased agricultural carbon productivity, and the mechanism evidence had suggested gains through reduced factor inputs, production structure adjustment, and technology upgrading, with a threshold pattern linked to economic development levels. Although the econometrics had been strong for endogeneity and dynamics, the performance proxy had emphasized low carbon productivity rather than output value added or rural welfare, and the focus on import trade had left export performance and bilateral trade exposure less explicit.

Aworinde and Osinusi (2025) assessed Nigeria within an agricultural output and trade policy domain using Central Bank sourced time series data and an I(1) stationarity structure, focusing on agricultural value added as the performance proxy. Foreign trade had been measured using agriculture raw materials import, agricultural trade openness, and the real effective exchange rate. The findings had indicated that agriculture raw materials import and the real effective exchange rate had exerted positive effects on agricultural value added in the short run, with raw material imports showing statistical significance at conventional thresholds, while the exchange rate effect had remained insignificant in the short run. Even though the study had linked multiple trade related proxies to agricultural performance, the reporting had concentrated on short run effects and had not clearly separated intermediate input imports from final food imports, and the single country time series design had limited external validity across differing trade regimes and production structures.

With Somalia as a country case, Abdi *et al.* (2025) studied agricultural performance in a climate and market integration domain using annual data from 1990 to 2021. They measured foreign trade primarily through trade openness, reflecting the extent of international integration, and proxied agricultural sector performance with a food production measure. The evidence indicated that trade integration had been part of the long run and short run drivers of food production, consistent with the view that openness could ease access to inputs and stabilize domestic supply when local production constraints were binding. However, the design had treated foreign trade largely as a single openness proxy, so the separate roles of agricultural exports, food imports, or tariff protection had not been directly identified. In addition, the heavy macro time series reliance had limited insight into household level welfare mechanisms, particularly given the importance of livestock exports and import dependence for staple foods.

Adopting an ASEAN wide agribusiness and development orientation, Zaman *et al.* (2025) analyzed World Bank data from 1990 to 2023, applying ARDL for macro linkages and GMM for dynamic influences on agricultural value added. Agricultural performance had been proxied by agricultural value added, while foreign trade had been measured through distinct trade components, including exports of raw agricultural materials and trade in processed agricultural products. Their results showed that raw agricultural material exports had negatively affected agricultural value added, whereas trade in processed agricultural products had positively influenced value added, implying that moving up the value chain had been more beneficial than expanding raw export volumes. Although this disaggregation improved interpretability, the model still omitted specific policy instruments such as tariff schedules, non tariff barriers, and targeted agro processing incentives, and the regional aggregation could have masked country heterogeneity in infrastructure and logistics constraints.

Using a Southeast Asian agricultural efficiency channel, Trakem and Fan (2024) examined ASEAN 8 economies between 2002 and 2021 and estimated a translog stochastic frontier model with single stage maximum likelihood estimation. Agricultural performance had been captured with output oriented technical efficiency, while foreign trade had been proxied through disaggregated agricultural trade liberalization via agricultural exports and agricultural imports. They found that greater liberalization through exports and imports had significantly reduced

agricultural inefficiency, implying that trade integration had supported technology and knowledge diffusion and improved input access. They also reported that rule of law had improved efficiency, whereas voice and accountability and regulatory quality had shown adverse effects in their inefficiency equation, suggesting institutional interaction effects. Even with strong econometric structure, the analysis had been limited by focusing on efficiency rather than farm incomes or poverty outcomes, and it had relied on aggregate trade measures without commodity specific exposure that could have mattered for smallholders.

Ooi and Foo (2024) approached the issue from a food systems and food security domain by focusing on ASEAN 5 countries over 1991 to 2020 using panel estimation with fixed effects and an instrumental variable strategy based on geographic characteristics. Agricultural performance had been measured through food production categories (meat, livestock, and overall agriculture), while foreign trade had been proxied by trade openness. Their results had shown that the effect of trade openness on food production had been heterogeneous across categories, and it had tended to be more negative for meat, livestock, and overall agriculture, consistent with specialization patterns where some categories had relied more on imports while others had expanded exports according to comparative advantage. Even though the design had addressed simultaneity concerns, trade had still been summarized as openness rather than disaggregated export and import measures, and production based indicators had not directly captured farm income, profitability, or distributional impacts on smallholders.

From a food systems and development policy domain, Gnedeka and Wonyra (2023) assessed 37 Sub Saharan African countries using panel data from 2004 to 2018 and a two step system GMM estimator to address endogeneity and persistence. Agricultural sector performance had been proxied with food security indicators, while foreign trade had been measured with trade openness, and then re tested with globalization as an alternative proxy. Their estimates showed that trade openness had significantly improved food security outcomes, and the positive effect had remained when globalization was used instead, supporting robustness. They further showed that institutional quality conditions mattered, with results becoming more robust when governance controls were introduced, indicating that trade benefits had been stronger where institutions functioned better. A key limitation had been the reliance on trade openness style aggregates that could not isolate export versus import effects, and the food security focus had captured availability and access outcomes but not productivity or value added directly.

Sharmiladevi (2023) examined India within an open economy and agricultural development domain, using annual data from 2000 to 2022 and the ARDL bounds framework. Agricultural sector performance had been proxied by agriculture, forestry and fishing value added, while foreign trade had been captured mainly by trade openness (with macro controls for economic growth and FDI flows). The estimates had indicated a statistically significant relationship between trade openness and agricultural value added in both the short run and long run, implying that greater integration into international markets had coincided with higher sectoral value creation. However, because trade had been represented largely as an aggregate openness indicator, the separate effects of agricultural exports versus agricultural imports had not been isolated, and the model had combined trade with broader macro drivers, which had limited attribution of effects to trade specific channels.

METHODOLOGY

This study had adopted an ex-post facto research design, which involved the use of historical data to examine the relationship between foreign trade variables and the performance of the agro-processing sector in Nigeria. The choice of this design had been appropriate because the variables of interest, such as export intensity, import penetration, tariff rates, and sectoral GDP contribution, were not subject to manipulation by the researcher. Instead, they had already occurred over time and were analyzed in their natural state. The ex-post facto approach therefore allowed for the investigation of causal relationships using observed data from 1986 to 2025, making it suitable for macroeconomic studies where controlled experimentation was neither feasible nor practical.

The study had relied on secondary time series data, which were quantitative in nature and spanned the period from 1986 to 2025. These data had been sourced from reputable and internationally recognized databases to ensure consistency, reliability, and comparability. Specifically, data on export intensity and import penetration were obtained from the World Bank's World Development Indicators and the International Monetary Fund databases, while tariff rates were sourced from Trading Economics and the World Integrated Trade Solution

(WITS). Data on the performance of the agro-processing sector, measured by its contribution to GDP, were obtained from the National Bureau of Statistics. The use of secondary data had been appropriate given the macroeconomic scope of the study, and it allowed for a comprehensive analysis of long-term trends and relationships among the variables.

This study drew from and extended the model specification employed by Aworinde and Osinusi (2025), who examined the implications of trade openness on agricultural output in Nigeria. Their framework was adapted to suit the objectives of this study by incorporating relevant foreign trade indicators and aligning them with the performance of the agro-processing sector. Consequently, the functional relationship for this study is expressed as follows:

$$APSG_t = \alpha_0 + \alpha_1 IMP_t + \alpha_2 EXI_t + \alpha_3 TAR_t + u_t \quad (1)$$

Where:

APSG is agro-processing sector growth

IMP is Import penetration (import/gdp)

EXI is Export intensity (export/gdp)

TAR is tariffs

u_t = error term.

The analysis commenced with the application of unit root tests as an initial diagnostic procedure to examine the stationarity characteristics of the variables. This step, based on the methodology developed by Dickey and Fuller (1979), was essential in determining whether the time series data contained stochastic trends that necessitated differencing to attain stationarity. Failure to account for non-stationarity could lead to spurious regression results and invalid statistical conclusions. The test is specified through the estimation of the following regression:

The Augmented Dickey–Fuller (ADF) unit root test is typically expressed as:

$$\Delta y_t = \theta + \vartheta t + \lambda y_{t-1} + \sum_{i=1}^{p} \partial_i \Delta y_{t-i} + u_t \quad (2)$$

Where:

y_t represents the variable being tested; Δy_t is the first difference of the variable; θ is a constant (drift term); ϑt represents the trend component; λy_{t-1} captures the lagged level of the variable, where the coefficient λ determines whether a unit root is present; $\partial_i \Delta y_{t-i}$ accounts for lagged differences to correct for serial correlation; u_t is the error term.

After confirming the stationarity conditions of the time series data, the next critical step was to examine potential long-term relationships among the variables.

After establishing the order of integration of the variables, the study proceeded to examine the existence of a long-run relationship among them using the Bounds testing technique developed by Pesaran et al. (2001). This approach was considered appropriate because it accommodated variables integrated at levels, first difference, or a mixture of both. The method was implemented through an unrestricted error correction model (UECM), which formed the basis for testing cointegration and is expressed as follows:

Mathematically, the Bounds ARDL model can be specified as follows:

$$y_{t(p,q)} = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + \sum_{j=0}^{q} \beta_j \Delta x_{t-j} + \alpha_1 y_{t-1} + \beta_1 x_{t-1} + \varepsilon_t \quad (3)$$

Δ denotes the first difference operator; y_t represents the dependent variable; x_{t-j} represents the independent variables; Δy_t represents the first difference of the dependent variable; Δx_{t-j} represents the first difference of the independent variables; α_0 is the constant term; α_i and β_j are the coefficients for the lagged values of the dependent and independent variables, respectively; ε_t is the error term.

The Bounds test involves computing an F-statistic to test the joint significance of the lagged level variables. The null hypothesis (H_0) is that there is no cointegration: $\alpha_1 = \beta_1 = 0$, while the alternative hypothesis (H_1) is that cointegration exists: at least one $\alpha_1 = \beta_1 \neq 0$.

After confirming the existence of a long-run equilibrium relationship among the variables, the study advanced to estimating both short-run and long-run dynamics using the Auto-Regressive Distributed Lag (ARDL) technique. This approach was adopted due to its appropriateness for time series data with relatively small sample sizes and its flexibility in handling variables integrated at levels I(0), first difference I(1), or a combination of both. The ARDL framework also helped to mitigate issues such as endogeneity and serial correlation, which are commonly associated with macroeconomic time series data. By incorporating suitable lag lengths for both dependent and explanatory variables, the model facilitated a detailed examination of the dynamic effects of export intensity, import penetration, and tariff rates on the performance of Nigeria's agro-processing sector. Thus, the unrestricted ARDL model provided a robust structure for analyzing the interaction between foreign trade and agro-processing sector performance over the study period, and is specified as follows:

$$\Delta APSG_{t(p,q)} = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta APSG_{t-i} + \sum_{j=0}^{q} \alpha_2 \Delta IMP_{t-j} + \sum_{m=0}^{q} \alpha_3 \Delta EXI_{t-m} + \sum_{n=0}^{q} \alpha_4 \Delta TAR_{t-n} +$$
$$+\alpha_5 APSG_{t-1} + \alpha_6 IMP_{t-1} + \alpha_7 EXI_{t-1} + \alpha_8 TAR_{t-1} + u_t \quad (4)$$

Specifying the restricted ARDL-ECM after achieving cointegrations we have:

$$\Delta APSG_{t(p,q)} = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta APSG_{t-i} + \sum_{j=0}^{q} \alpha_2 \Delta IMP_{t-j} + \sum_{m=0}^{q} \alpha_3 \Delta EXI_{t-m} + \sum_{n=0}^{q} \alpha_4 \Delta TAR_{t-n} + \delta u_{t-1} + e_t \quad (5)$$

RESULTS AND DISCUSSIONS

Descriptive Statistics Results

Descriptive statistics provided a concise summary of the data by presenting key measures such as central tendency, dispersion, and distributional shape. In line with the study's focus on foreign trade and agro-processing performance, these statistics offered useful preliminary insights into the behaviour and stability of the variables over the period under review.

Table 1: Descriptive Statistics

	APSG	IMP	EXI	TAR
Mean	3.475954	14.74975	25.48250	19.74425
Maximum	7.048780	22.93000	37.89000	91.27000
Minimum	2.320000	8.240000	8.830000	8.220000
Std. Dev.	1.039714	4.110876	9.111531	17.58918
Skewness	1.759270	0.200440	-0.3286	2.741747

Kurtosis	5.936063	1.849922	1.643650	10.38546
Jarque-Bera	35.00099	2.472304	3.785973	141.0229
Probability	0.000000	0.290500	0.150621	0.000000
Observations	40	40	40	40

Source: Researcher's Computation Using EViews-12 (2026)

For agro-processing sector growth (APSG), the mean value of 3.48 indicated a modest average contribution to GDP, consistent with earlier discussions highlighting the sector's relatively low but persistent role in the economy. The minimum (2.32) and maximum (7.05) values revealed noticeable fluctuations, particularly the peak around the late 1990s. The standard deviation of 1.04 suggested moderate variability. The positive skewness (1.76) indicated that higher values occurred less frequently but were pronounced, while the high kurtosis (5.94) suggested a leptokurtic distribution. The Jarque-Bera probability (0.000) confirmed non-normality.

Import penetration (IMP) had a mean of 14.75, reflecting considerable import dependence. Its relatively lower standard deviation (4.11) suggested moderate dispersion. The near-zero skewness (0.20) implied a fairly symmetric distribution, while the low kurtosis (1.85) indicated a flatter distribution. The Jarque-Bera probability (0.291) suggested normality.

Export intensity (EXI) recorded a mean of 25.48, showing strong export orientation historically. However, the wide range (8.83–37.89) and standard deviation (9.11) pointed to significant fluctuations. The negative skewness (-0.33) implied more frequent higher values earlier in the period, while kurtosis (1.64) indicated a platykurtic distribution. The Jarque-Bera result (0.151) suggested normality.

Tariff rates (TAR) showed a mean of 19.74 but an extremely wide range (8.22–91.27), reflecting major policy swings. The high standard deviation (17.59) confirmed substantial volatility. Strong positive skewness (2.74) and very high kurtosis (10.39) indicated extreme values and sharp policy spikes. The Jarque-Bera probability (0.000) confirmed non-normality.

Unit Root Test

The unit root test results provided insight into the stationarity properties of the variables, which was essential for determining their suitability for econometric analysis and avoiding spurious regression outcomes. Based on the Augmented Dickey-Fuller (ADF) results, emphasis was placed on the values at which each variable became stationary.

Table 2: Summary of Unit Root Test Results

Variable	Levels: ADF Test Statistics (Critical Values)	1st Difference: ADF Test Statistics (Critical Values)	Order of Integration
APSG	-2.729586 (-3.529758)	-6.672800 (-4.219126)*	I(1)
EXI	-2.552317 (-3.529758)	-6.576016 (-4.219126)*	I(1)
IMP	-1.868111 (-3.548490)	-3.449413 (-3.207094)***	I(1)
TAR	-3.370883 (-3.215267)***	-	I(0)

Note: The tests include intercept with trend; * and *** significant at 1 percent and 10 percent.

Source: Researcher's Computation Using EViews-12 (2026)

For agro-processing sector growth (APSG), the variable was found to be non-stationary at levels but became stationary after first differencing. The ADF test statistic at first difference (-6.672800) was greater in absolute terms than the critical value (-4.219126) at the 1 percent significance level. This indicated that APSG was integrated of order one, I(1), suggesting that shocks to agro-processing performance had temporary effects and the series stabilized after differencing. This justified its inclusion in the ARDL framework.

Export intensity (EXI) similarly exhibited non-stationarity at levels but attained stationarity at first difference. The ADF statistic of -6.576016 exceeded the 1 percent critical value of -4.219126 in absolute terms, confirming that the series was I(1). This implied that export dynamics were subject to fluctuations over time but became stable after accounting for short-run variations.

Import penetration (IMP) also became stationary at first difference, with an ADF statistic of -3.449413 exceeding the critical value of -3.207094 at the 10 percent level. Although weaker compared to APSG and EXI, this still confirmed that IMP was integrated of order one, indicating that import-related shocks required differencing to achieve stability.

In contrast, tariff rate (TAR) was found to be stationary at level, with an ADF statistic of -3.370883 exceeding the critical value of -3.215267 at the 10 percent level. This indicated that TAR was integrated of order zero, I(0), suggesting that tariff policies exhibited mean-reverting behavior without requiring differencing.

Co-integration Test

The bounds test results provided evidence on whether a long-run equilibrium relationship existed among the variables under consideration. At the 5 percent level of significance, the lower bound critical value was 2.79, while the upper bound critical value was 3.67. The computed F-statistic of 6.14844 exceeded both the lower and upper bound values. This outcome led to the rejection of the null hypothesis of no levels relationship, thereby confirming the existence of cointegration among the variables.

Table 3: Bound Test-Co-integration Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	6.14844	10%	2.37	3.20
k	3	5%	2.79	3.67
		1%	3.65	4.66

Source: Researcher's Computation Using EViews-12 (2026)

ARDL Regression Estimates

The study established the existence of a long-run cointegrating relationship between foreign trade variables and the performance of the agro-processing sector in Nigeria; consequently, it proceeded to estimate both the error correction and long-run models. The ARDL-ECM results illustrated the adjustment process of the model towards long-run equilibrium following short-run deviations. To achieve a parsimonious and well-specified model, a general-to-specific modelling approach was employed, allowing for the refinement of the short-run dynamics. The resulting preferred model, capturing the short-run adjustments and policy-relevant dynamics, is presented in Table 4.

Table 4: ARDL-ECM Result

Dependent Variable: D(APSG)

Short-run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(APSG(-1))	-0.2216	0.1324	-1.6743	0.1180
D(APSG(-2))	0.2214	0.0463	4.7799	0.0004
D(APSG(-3))	0.1012	0.0567	1.7852	0.0976
D(IMP)	-0.0427	0.0186	-2.2952	0.0390
D(IMP(-1))	0.0626	0.0254	2.4625	0.0285
D(IMP(-2))	0.0838	0.0214	3.9123	0.0018

D(IMP(-3))	0.0488	0.0189	2.5763	0.0230
D(EXI)	-0.0109	0.0119	-0.9150	0.3768
D(EXI(-1))	-0.0347	0.0155	-2.2453	0.0428
D(EXI(-2))	-0.0358	0.0108	-3.3326	0.0054
D(EXI(-3))	-0.0116	0.0115	-1.0086	0.3316
D(EXI(-4))	0.0169	0.0083	2.0456	0.0616
D(TAR)	-0.0131	0.0027	-4.8406	0.0003
D(TAR(-1))	-0.0208	0.0054	-3.8417	0.0020
D(TAR(-2))	-0.0138	0.0039	-3.5344	0.0037
D(TAR(-3))	-0.0549	0.0029	-19.2314	0.0000
D(TAR(-4))	-0.0170	0.0108	-1.5762	0.1390
CointEq(-1)*	-0.4295	0.0686	-6.2639	0.0000
Long-Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMP	-0.2631	0.1017	-2.5864	0.0226
EXI	0.1140	0.0484	2.3551	0.0349
TAR	0.0291	0.0208	1.4012	0.1846
C	3.6453	0.7091	5.1404	0.0002
Goodness of Fit				
R-squared	0.8805			
Adjusted R-squared	0.7609			
Durbin-Watson stat	1.9506			

Source: Researcher's Computation Using EViews-12 (2026)

The error correction term, represented by CointEq(-1), provided important insight into the speed at which short-run deviations from equilibrium were corrected in the model. The coefficient of -0.4295 was negative and statistically significant at the 1 percent level (p = 0.0000), which satisfied the theoretical expectation for a valid error correction mechanism. The negative sign indicated that any disequilibrium in the short run was adjusted back toward the long-run equilibrium path.

In magnitude, the coefficient implied that approximately 42.95 percent of the previous period's deviation from long-run equilibrium in agro-processing sector growth was corrected within one period (one year). This suggested a relatively moderate speed of adjustment, meaning that while shocks arising from changes in export intensity, import penetration, or tariff rates might temporarily distort the sector's performance, nearly half of such disequilibrium was corrected within a year.

Import penetration (IMP) exhibited a negative and statistically significant relationship with agro-processing sector growth at the 5 percent level (coefficient = -0.2631; p = 0.0226). This implied that a 1 percentage point increase in imports as a share of GDP led to approximately a 0.26 percentage point decline in the agro-processing sector's contribution to GDP in the long run.

Export intensity (EXI), on the other hand, showed a positive and statistically significant effect (coefficient = 0.114; p = 0.0349). This indicated that a 1 percentage point increase in exports relative to GDP increased agro-processing sector growth by about 0.11 percentage points in the long run.

Tariff rate (TAR) displayed a positive but statistically insignificant relationship with agro-processing performance (coefficient = 0.0291; p = 0.1846). Although the positive sign suggested that higher tariffs might offer some degree of protection to domestic processors, the lack of statistical significance indicated that tariff policy had not exerted a strong or consistent long-run influence on the sector.

The goodness-of-fit statistics provided further validation of the reliability and robustness of the estimated ARDL model. The R-squared value of 0.8805 indicated that approximately 88.05 percent of the variations in agro-

processing sector growth (measured as its contribution to GDP) were explained by the included explanatory variables—import penetration, export intensity, and tariff rates. This high explanatory power suggested that the model adequately captured the relationship between foreign trade and the performance of the agro-processing sector in Nigeria.

The adjusted R-squared value of 0.7609, which accounted for the number of predictors and sample size, showed that about 76.09 percent of the variation in the dependent variable was still explained after adjusting for degrees of freedom. Although lower than the R-squared, it remained relatively high, indicating that the model was not overfitted and that the included variables were relevant in explaining agro-processing performance.

The Durbin-Watson statistic of 1.9506, which was approximately equal to 2, suggested the absence of serial correlation in the residuals. This implied that the error terms were independent over time, thereby satisfying one of the key assumptions of classical regression and enhancing the credibility of the estimated results.

DISCUSSION OF FINDINGS

Findings from the study showed that import penetration had a negative and statistically significant long-run effect on the performance of the agro-processing sector in Nigeria. Measured as imports as a percentage of GDP, the coefficient of import penetration indicated that a sustained rise in the share of imports in the domestic economy had reduced the agro-processing sector's contribution to GDP. This suggested that, over time, the Nigerian agro-processing sector had faced stronger competitive pressure from imported goods than it had gained from imported productive inputs. In practical terms, the result implied that although imports could provide machinery, additives, spare parts, and packaging materials, the broader pattern of import dependence had likely exposed domestic processors to displacement by foreign processed products. The finding was consistent with the concern raised in the background of the study that excessive reliance on imports could weaken domestic value addition where local firms remained structurally constrained by high production costs, energy shortages, logistics bottlenecks, and weak industrial support systems. This outcome aligned with Ooi and Foo (2024), who reported that trade openness had exerted adverse effects on some categories of agricultural production in ASEAN-5, suggesting that international integration could weaken domestic production when import competition outweighed productive gains. It also resonated partly with Trakem and Fan (2024), although their evidence showed that import liberalization improved agricultural efficiency in ASEAN-8; the difference may have arisen because their study focused on technical efficiency rather than sectoral GDP contribution, and because Nigeria's agro-processing conditions were shaped by deeper structural rigidities.

The result further revealed that export intensity had a positive and statistically significant long-run impact on agro-processing sector performance in Nigeria. Since export intensity was measured as exports as a percentage of GDP, the positive coefficient implied that greater outward orientation had supported the agro-processing sector's contribution to national output. This meant that increased participation in foreign markets had likely created demand expansion, encouraged scale economies, and strengthened incentives for production and value addition within the sector. The finding supported the comparative advantage position underpinning the study, which maintained that greater external market access could improve sectoral performance where a country possessed or developed strengths in agriculture-based production. It also suggested that agro-processing performance benefited more when production was linked to broader markets than when it remained confined to domestic demand alone. This agreed with Sharmiladevi (2023), who found that trade openness had significantly improved agricultural value added in India in both the short run and the long run. It also corresponded with Gnedeka and Wonyra (2023), whose study across 37 Sub-Saharan African countries showed that trade openness improved food security outcomes, implying that trade integration could strengthen agricultural systems where supporting conditions were present. In a more direct trade-efficiency framework, Trakem and Fan (2024) also found that agricultural exports and imports reduced inefficiency in ASEAN-8 economies, reinforcing the broader argument that deeper market integration could support agricultural and agro-related sector performance.

Evidence from the study also showed that tariff rate had a positive but statistically insignificant long-run effect on the performance of the agro-processing sector in Nigeria. Although the coefficient carried the expected positive sign under the infant industry argument, the lack of statistical significance indicated that tariff protection had not exerted a sufficiently strong or consistent influence on agro-processing growth over the study period.

This implied that while tariffs might have offered some degree of policy support to domestic processors by raising the relative price of imported competing goods, such protection had not translated into meaningful long-run expansion of the sector's contribution to GDP. A plausible explanation was that Nigeria's agro-processing firms had depended on imported machinery, equipment components, chemicals, and packaging inputs, so higher tariffs could simultaneously protect final output markets while raising production costs. In that sense, the tariff instrument may have produced offsetting effects. This result was broadly in line with the wider empirical literature showing that the effect of trade policy depended on structural conditions and institutional quality rather than on border measures alone. For example, Gnedeka and Wonyra (2023) showed that trade-related gains became more robust when governance conditions were accounted for, while Trakem and Fan (2024) also demonstrated that institutional variables such as rule of law mattered in shaping agricultural efficiency outcomes. The implication for the present study was that tariff policy on its own had not been enough to stimulate agro-processing performance in a sustained manner.

CONCLUSION AND RECOMMENDATIONS

The study concluded that foreign trade played a significant but differentiated role in shaping the performance of the agro-processing sector in Nigeria over the period under review. In line with the main objective, the findings demonstrated that the effects of foreign trade were not uniform across its components, thereby highlighting the importance of disaggregating trade variables when examining sectoral outcomes.

The first major implication was that import penetration exerted a negative and significant influence on agro-processing sector performance, suggesting that increased reliance on imports, particularly processed goods, had undermined domestic value addition. This implied that the structure of imports mattered more than their volume, as excessive import dependence could weaken local production capacity. Secondly, export intensity showed a positive and significant effect, indicating that greater participation in international markets enhanced agro-processing performance through expanded demand and improved production incentives. This highlighted the growth-enhancing role of outward-oriented trade. Thirdly, tariff rates exhibited a positive but insignificant impact, implying that trade protection alone had not been sufficient to stimulate sustained sectoral growth, likely due to underlying structural constraints within the economy.

The paper made the following recommendations:

i. Given the negative and significant impact of import penetration, it was necessary for the government to shift from general import restrictions to a more targeted import management strategy. Relevant institutions such as the Federal Ministry of Industry, Trade and Investment, Nigeria Customs Service, and the Federal Ministry of Agriculture and Food Security were expected to identify agro-processed goods that could be competitively produced locally and apply selective controls, including stricter quality standards and differentiated tariffs. At the same time, productive imports such as machinery and intermediate inputs should be facilitated. Financial support from the Central Bank of Nigeria and the Bank of Industry was also critical to strengthen domestic processing capacity, while improvements in port efficiency would reduce delays affecting industrial inputs.

ii. In light of the positive and significant effect of export intensity, the need to promote value-added exports became evident. Institutions such as the Nigerian Export Promotion Council and the Nigerian Export-Import Bank were expected to drive export expansion through targeted programmes, financing support, and risk guarantees. Supporting agencies, including the Standards Organisation of Nigeria and NAFDAC, should ensure compliance with international standards, while infrastructure and logistics improvements led by the Ministry of Transportation would enhance market access.

iii. Finally, given the insignificant effect of tariff rates, tariff policy should be redesigned to distinguish between inputs and finished goods. This required coordinated action from the Ministry of Finance and related agencies, alongside complementary support such as energy provision, firm-level incentives, and regional trade alignment to ensure effectiveness.

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Appendices

Table: Data Presentation

Year	Import Penetration (Percentage of Import/GDP)	Tarriff rate (%)	Export Intensity (Percentage of Export/GDP)	Agro processing sector growth (% contributions to GDP)
1986	8.52	33.16	17.1	4.33
1987	10.41	28.5	26.61	4.21
1988	14.71	26.23	23.12	4.03
1989	12.46	25.11	16.32	3.85
1990	10.81	24.83	25.43	3.94
1991	15.25	25.08	29.87	4.23
1992	14.56	25.32	30.12	3.63
1993	13.44	58.3	28.45	3.41
1994	11.76	74.79	26.78	3.61
1995	19.62	91.27	35.64	2.79
1996	17.77	16.06	36.21	2.78
1997	18.34	16.21	37.89	2.94
1998	18.27	16.21	32.18	3.05
1999	18.79	19.77	33.92	7.05
2000	14.01	19.99	36.02	6.10
2001	18.57	21.47	34.56	6.00
2002	17.17	18.45	30.21	4.72
2003	18.74	20.62	32.87	4.49
2004	19.12	14.98	34.12	3.83
2005	22.93	9.34	35.98	3.45
2006	19.51	9.4	33.45	3.05
2007	21.2	9.6	35.67	3.05
2008	22.2	9.79	37.24	3.00
2009	17.69	9.83	28.56	3.13
2010	17.83	10.7	30.42	2.90
2011	19.18	10.15	32.18	2.90
2012	15.14	10.43	28.93	2.90
2013	11.69	10.07	20.45	2.96
2014	11.47	11.34	18.76	2.96
2015	8.56	8.22	12.56	2.99
2016	8.24	8.52	10.89	2.98
2017	9.13	10.44	12.34	2.93
2018	11.01	11.36	16.78	2.84
2019	11.22	11.9	15.23	2.76
2020	13.01	12.37	8.83	2.80
2021	11.68	12.2	10.9	2.73
2022	12.2	9.34	13.6	2.58
2023	11.4	9.3	15.4	2.43

2024	11.58	9.5	16.5	2.36
2025	10.8	9.62	17.21	2.32

Sources: International Monetary Fund. (2025). World economic outlook database, October 2025. https://www.imf.org/external/datamapper/NGDPD@WEO/NGA

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