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Research Paper

Trade Policy and Agricultural Productivity in Nigeria: Evidence from A Var Model

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ABSTRACT
This study investigates the relationship between trade policy and agricultural productivity in Nigeria from 1985 to 2023 using a Vector Autoregressive (VAR) framework. The analysis incorporates impulse response functions, variance decomposition, Granger causality tests, and an error correction mechanism. Results indicate the presence of a long-run equilibrium relationship, with a speed of adjustment of about 73.7 percent following short-run shocks. The findings show that agricultural productivity is largely driven by its own past performance, while trade policy does not exert a significant causal influence on productivity. Instead, changes in agricultural productivity tend to precede adjustments in trade policy, suggesting a largely reactive policy stance. The study therefore recommends the adoption of proactive trade policies and increased investment in domestic agricultural drivers to support sustainable productivity growth.

Keywords: *Trade policy; Agricultural productivity; Vector Autoregressive (VAR); Granger causality; Error correction mechanism; Nigeria*
JEL CODE: Q17, F13, C32, Q13.

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I. INTRODUCTION

Agriculture has long played a central role in Nigeria's economic development, providing employment, ensuring food security, and generating foreign exchange earnings. Before the emergence of crude oil as the dominant export commodity in the 1970s, the agricultural sector accounted for more than 60 percent of Nigeria's Gross Domestic Product and was the mainstay of rural livelihoods (Adewumi and Omotesho, 2002). The subsequent shift in policy attention toward the oil sector, however, led to prolonged neglect of agriculture, resulting in declining productivity, rising rural poverty, and increasing food insecurity. This decline persists despite Nigeria's vast arable land and favourable agro-climatic conditions, suggesting that structural and policy-related constraints continue to limit the sector's performance.

Among these constraints, trade policy occupies a critical position due to its influence on input costs, market access, competitiveness, and investment decisions within the agricultural sector. In Nigeria, trade policy instruments such as tariffs, import restrictions, export incentives, subsidies, and trade agreements have been widely used as tools for agricultural revitalisation (World Bank, 2020). These measures are often intended to protect domestic producers, encourage agribusiness investment, and stimulate local production. Nevertheless, their effectiveness in improving agricultural productivity remains uncertain.

In recent decades, Nigeria has pursued trade liberalisation under regional and multilateral frameworks, including ECOWAS and the African Continental Free Trade Area (AfCFTA). While trade liberalisation is theoretically expected to enhance efficiency and productivity, empirical evidence for Nigeria remains mixed. Some studies argue that increased trade openness exposes domestic farmers to intense foreign competition, particularly in the presence of weak infrastructure, limited access to finance, and low technological adoption. Others maintain that openness can enhance productivity by facilitating access to improved inputs, technology, and broader markets (Yusuf and Adenegan, 2016). These contrasting perspectives highlight the need for context-specific empirical investigation.

Nigeria's trade policy environment has also been characterised by frequent reversals and abrupt policy shifts, including periodic import bans and tariff changes, which have contributed to uncertainty in agricultural markets and discouraged long-term investment. Although several policy initiatives, such as the Agricultural Promotion Policy and the National Agricultural Policy, were introduced to improve productivity and promote exports, their outcomes have been constrained by implementation challenges, inadequate infrastructure, and weak institutional coordination (Federal Ministry of Agriculture and Rural Development [FMARD], 2016). Consequently, the relationship between trade policy and agricultural productivity in Nigeria remains unresolved.

Against this background, this study empirically examines how trade policy has influenced agricultural productivity in Nigeria over time, while also identifying the key challenges and opportunities facing the agricultural sector within the context of international trade. By providing a data-driven assessment of this relationship, the study contributes to ongoing policy debates on how trade policy can be better aligned with Nigeria's agricultural development objectives.

II. REVIEW OF RELATED LITERATURE

2.1 Conceptual Review

1. Trade Policy

`Trade policy broadly describes the framework of rules and instruments through which governments regulate international trade flows. These instruments, including tariffs, quotas, subsidies, and trade agreements; are employed to influence import and export activities, protect domestic industries, and shape a country's competitive position in global markets (Bhagwati, 2004). Depending on national development objectives, trade policy may either restrict or facilitate cross-border trade. Protectionist trade policies rely on trade barriers to shield local producers from foreign competition, particularly in sectors considered strategic or vulnerable (Krueger, 1997). In contrast, liberal trade policies emphasise openness and reduced trade restrictions, allowing countries to specialise according to comparative advantage and potentially improve overall economic efficiency (Bhagwati, 2004).

2. Agricultural Productivity

Agricultural productivity refers to the efficiency with which agricultural inputs are transformed into outputs and is commonly measured as output per unit of land, labour, or capital (Food and Agriculture Organization [FAO], 2017). Productivity growth in agriculture is essential for improving food availability, raising farm incomes, and supporting broader economic development. Several factors influence agricultural productivity, including technological advancement, institutional support, and the policy environment. The adoption of improved seed varieties, fertilisers, and irrigation systems has been shown to enhance productivity, particularly in developing economies (Alene, 2010). In addition, institutional arrangements such as agricultural extension services, access to credit, and investment in research and development play a crucial role in enabling farmers to adopt productivity-enhancing innovations (World Bank, 2008). The policy environment, especially trade and pricing policies, also shapes farmers' incentives and production decisions, thereby affecting productivity outcomes (Kherallah et al., 2002).

2.2 Theoretical Literature

The relationship between trade policy and agricultural productivity can be explained through several established economic theories that provide useful insights, particularly within the context of developing economies such as Nigeria.

The theory of comparative advantage, originally advanced by Ricardo (1817), suggests that countries benefit from specialising in the production of goods in which they have lower opportunity costs and engaging in trade to obtain other goods more efficiently. Given Nigeria's extensive arable land and favourable climatic conditions, the country holds a comparative advantage in the production of several agricultural commodities, including cassava, cocoa, and yams. Trade policies that promote agricultural exports and reduce tariffs on essential production inputs such as fertilisers and farm machinery can therefore enhance productivity by allowing farmers to focus on crops where efficiency gains are highest. In contrast, restrictive trade measures that increase the cost of imported inputs may weaken production incentives and constrain productivity growth.

Closely related is the Heckscher–Ohlin theory, which explains trade patterns based on differences in factor endowments across countries. Nigeria's abundance of labour and land resources suggests that agriculture should play a dominant role in its export structure. Trade policies that facilitate the importation of capital-intensive inputs, while expanding access to international markets for agricultural products, are consistent with this framework. Lower tariffs on tractors, irrigation equipment, and processing technologies can improve production efficiency and output, thereby strengthening agricultural productivity (Heckscher and Ohlin, 1933).

Endogenous growth theory further highlights the role of policy in shaping long-term productivity outcomes through innovation, human capital development, and knowledge spillovers. According to Romer (1990), trade openness enhances access to advanced technologies, encourages foreign direct investment, and supports learning-by-doing processes. In the agricultural sector, open trade policies can enable Nigerian farmers to adopt improved production techniques and modern inputs, leading to sustained productivity improvements over time.

The New Trade Theory extends traditional trade models by incorporating economies of scale and market size effects. It argues that trade liberalisation can raise productivity by allowing firms and sectors to expand output, reduce average costs, and benefit from specialisation (Krugman, 1979). In Nigeria, agricultural value chains and agribusiness clusters stand to gain from policies that reduce export barriers, support agro-processing, and promote regional and international market integration. Such policies can improve resource allocation and enhance productivity across the agricultural sector.

Finally, the structuralist theory of trade and development, associated with Prebisch and Singer, cautions that unfavourable trade structures may limit the development prospects of primary commodity exporters. This perspective supports selective protection and active state intervention to strengthen domestic agricultural production and reduce vulnerability to external shocks (Prebisch, 1950). In Nigeria, moderate protective measures, such as tariffs on imported food products, may help shield local farmers from unfair competition and encourage domestic production. However, the theory also recognises the risks of excessive protection, which can lead to inefficiencies, rent-seeking behaviour, and reduced competitiveness if not carefully managed.

Taken together, these theories suggest that trade policy can either enhance or constrain agricultural productivity depending on its design, consistency, and alignment with domestic production structures. This study draws on these theoretical insights to empirically examine how trade policy has influenced agricultural productivity in Nigeria over time.

2.3 Empirical Review

Empirical studies examining the relationship between trade policy and agricultural productivity in Nigeria and other African economies have produced mixed results, reflecting differences in methodology, scope, and policy environments. Early studies focusing on Nigeria provide contrasting evidence on the effects of trade liberalisation. While some authors report that increased trade openness has adversely affected agricultural productivity, particularly due to weak domestic production structures and exposure to foreign competition (Akerele, 2015), others find that liberalisation enhances productivity by improving market access and encouraging efficiency gains (Oyewole, 2016; Udeaja, 2018). These divergent findings suggest that the impact of trade policy is highly context-dependent and influenced by complementary domestic conditions.

Several Nigeria-specific studies employing time-series techniques, including OLS, ARDL, VAR, and VECM frameworks, generally indicate that trade policy instruments play a significant role in shaping agricultural performance. For instance, evidence shows that trade policy reforms have contributed positively to agricultural development and productivity over the long run, although short-run effects are often weak or inconsistent (Adewuyi, 2018; Okoh, 2018). However, tariff-focused studies reveal that high tariff regimes can undermine agricultural productivity by increasing production costs and reducing competitiveness, particularly in input-intensive farming systems (Falola, 2019).

Beyond Nigeria, regional and cross-country studies provide additional insights into the broader African experience. Panel data analyses covering West Africa and sub-Saharan Africa largely suggest that supportive trade policies and increased openness are associated with improved agricultural productivity and export performance (Eboh, 2019; Adebayo, 2019). Similarly, gravity-model-based studies show that restrictive tariff structures negatively affect agricultural productivity and intra-regional trade, whereas trade-facilitating policies enhance agricultural exports and foreign exchange earnings (Nwokocha, 2020; Uzoamaka, 2020; Adeleke, 2020).

Despite the growing body of empirical evidence, several gaps remain in the literature. First, many studies rely on static or single-equation estimation techniques that may not adequately capture the dynamic interactions between trade policy and agricultural productivity. Second, existing evidence often focuses on either productivity or export performance, with limited attention to the feedback effects between trade policy and agricultural outcomes. Finally, few studies explicitly account for the possibility that agricultural productivity itself may influence trade policy decisions, particularly in economies where policy responses are often reactive.

This study addresses these gaps by adopting a dynamic econometric framework to examine the bidirectional relationship between trade policy and agricultural productivity in Nigeria over an extended period. By incorporating both short-run and long-run dynamics, the study contributes to a more nuanced understanding of how trade policy shapes agricultural productivity and how productivity outcomes, in turn, influence policy responses.

III. METHODOLOGY

3.1 Research Design

This study employs an ex post facto research design to examine the relationship between trade policy and agricultural productivity in Nigeria over the period 1985–2023. The choice of this design is appropriate given that the study relies on historical data and does not involve manipulation of the variables. The design allows for an objective assessment of how changes in trade policy and selected macroeconomic factors have influenced agricultural productivity over time.

3.2 Model Specification

The specification of the model is grounded in established economic theories linking trade policy to productivity outcomes. In particular, the Comparative Advantage Theory (Ricardo, 1817) suggests that trade openness and favourable trade policies enhance efficiency by allowing countries to specialize in sectors where they possess relative efficiency. Similarly, the Heckscher–Ohlin framework posits that countries like Nigeria, which are relatively abundant in land and labour, should experience improved agricultural productivity when trade policies facilitate access to capital-intensive inputs. Furthermore, the Endogenous Growth Theory (Romer, 1990) emphasizes the role of technological progress, investment, and policy environment in driving long-term productivity growth. In this context, variables such as technology level (TECHLV) and gross fixed capital formation (GFCF) are incorporated to capture innovation and capital accumulation effects, while inflation (INF) is included to control for macroeconomic stability, which influences production decisions.

Guided by these theoretical considerations, agricultural productivity is modeled as a function of trade policy and other macroeconomic variables:

ARPOD = f(TPOL,INF,TECHLV,GFCF)

Transforming the functional form into an estimable econometric model yields:

$$ARPOD_t = \beta 0 + \beta_1 TPOL_t + \beta_2 INF_t + \beta_3 TECHLV_t + \beta_4 GFCF_t + \mu_t \quad (1)$$

Where agricultural productivity (ARPOD) is proxied by total agricultural output, while trade policy (TPOL) is measured using the tariff rate on imports. Gross Fixed Capital Formation (GFCF) captures investment in physical capital, technology level is proxied by technical, scientific, and professional services, and inflation rate (INF) controls for macroeconomic instability. The error term (μ) captures other influences not explicitly included in the model.

3.3 Sources of Data

The study utilises secondary annual time-series data covering the period 1985–2023. Data were obtained from the Central Bank of Nigeria Statistical Bulletin and the World Bank Development Indicators. These sources are considered reliable and widely used in empirical economic research, ensuring data consistency and credibility. All series were utilized in their growth rates.

3.4 Unit Root Test

To determine the time-series properties of the variables, unit root tests were conducted to establish their order of integration. This step is necessary because the use of non-stationary variables in regression analysis can lead to spurious results, where apparent relationships exist without any meaningful economic interpretation (Studenmund, 2017).

The Augmented Dickey–Fuller (ADF) test was employed to examine the stationarity of each series. The test was performed at both levels and first differences under specifications that include an intercept and a deterministic trend. The ADF approach controls for serial correlation by incorporating lagged differences of the dependent variable, thereby improving the reliability of the test results. The outcome of the unit root test provides the basis for selecting the appropriate econometric technique for subsequent analysis.

$$\Delta X_t = \propto_0 + \propto_1 X_{t-1} + \sum_{i=1}^{m} \propto_2 \Delta X_{t-1} + \varepsilon_t \quad (3)$$

And that

$$\Delta X_t = \propto_0 + \delta t + \propto_1 X_{t-1} + \sum_{i=1}^{m} \propto_2 \Delta X_{t-1} + \varepsilon_t \quad (4)$$

Where X_t is a time series, t is a linear time trend, Δ is the first difference operator, β_0 is a constant, i is the optimum number of lags in the independent variables, and ε_t is random error term.

3.5 Estimation Technique

The study adopts the Vector Autoregression (VAR) framework to examine the dynamic relationships among agricultural productivity, trade policy, and selected macroeconomic variables. The VAR approach, as developed by Sims (1980), treats all variables in the system as endogenous and captures their interdependence over time. Unlike single-equation models, VAR allows each variable to be expressed as a function of its own lagged values and those of other variables, thereby accounting for feedback effects and dynamic interactions. The VAR model is particularly suitable for policy analysis because it does not impose strong a priori restrictions on causality among variables (Lütkepohl, 2005). This flexibility makes it appropriate for examining the interaction between trade policy and agricultural productivity in Nigeria.

$$ARPOD_t = a_0 + \sum_{p=0}^{q} b_{11} ARPOD_{t-i} + \sum_{p-1}^{q} b_{12}\mathrm{TPOL}_{t-i} + \sum_{p-1}^{q} b_{13}\mathrm{TECHL}_{t-i} + \sum_{p-1}^{q} b_{14}\mathrm{GFCF}_{t-i} + \sum_{p=1}^{q} b_{13}\mathrm{INF}_{t-i} + \mu_{it} \qquad Eq.5$$

$$TPOL_t = a_0 + \sum_{p=0}^{q} b_{21} TPOL_{t-i} + \sum_{p-1}^{q} b_{22}\mathrm{ARPOD}_{t-i} + \sum_{p-1}^{q} b_{23}\mathrm{TECHL}_{t-i} + \sum_{p-1}^{q} b_{24}\mathrm{GFCF}_{t-i} + \sum_{p=1}^{q} b_{25}\mathrm{INF}_{t-i} + \mu_{it} \qquad Eq.6$$

$$TECHLV_t = a_0 + \sum_{p=0}^{q} b_{31} TECHLV_{t-i} + \sum_{p-1}^{q} b_{32}\mathrm{ARPOD}_{t-i} + \sum_{p-1}^{q} b_{33}\mathrm{TOP}_{t-i} + \sum_{p-1}^{q} b_{34}\mathrm{GFCF}_{t-i} + \sum_{p=1}^{q} b_{35}\mathrm{INF}_{t-i} + \mu_{it} \qquad Eq.7$$

$$GFCF_t = a_0 + \sum_{p=0}^{q} b_{41} GFCF_{t-i} + \sum_{p-1}^{q} b_{42}\mathrm{ARPOD}_{t-i} + \sum_{p-1}^{q} b_{43}\mathrm{TOP}_{t-i} + \sum_{p-1}^{q} b_{44}\mathrm{TECHLV}_{t-i} + \sum_{p=1}^{q} b_{45}\mathrm{INF}_{t-i} + \mu_{it} \qquad Eq.8$$

$$INF_t = a_0 + \sum_{p=0}^{q} b_{41} INFL_{t-i} + \sum_{p-1}^{q} b_{42}\mathrm{ARPOD}_{t-i} + \sum_{p-1}^{q} b_{43}\mathrm{TOP}_{t-i} + \sum_{p-1}^{q} b_{44}\mathrm{TECHLV}_{t-i} + \sum_{p=1}^{q} b_{45}\mathrm{GFCF}_{t-i} + \mu_{it} \qquad Eq.9$$

Where $ARPOD_t$, $TPOL_t$, $TECHLV_t$ $GFCF$ and $INFR_t$ are all endogenous variables which are explained by their lag values and lag values of other explanatory variables. ρ is the optimum lag value of the predictant, k, m and q are the perpective optimum lag of the predictors while the b's are their repective partial regession coefficient and U_t, are their respective stochastic terms.
Transforming the VAR equations into VECM specifications correspond to:

$$\Delta ARPOD_t = a_0 + \sum_{p=0}^{q} b_{11} \Delta ARPOD_{t-q} + \sum_{p-1}^{q} \Delta b_{12}\mathrm{TPOL}_{t-q} + \sum_{p-1}^{q} \Delta b_{13}\mathrm{TECHL}_{t-q} + \sum_{p-1}^{q} \Delta b_{14}\mathrm{GFCF}_{t-q} + \sum_{p=1}^{q} b_{13}\Delta\mathrm{INF}_{t-q} + \O ECM + \mu_{it} \qquad Eq.10$$

$$\Delta TPOL_t = a_0 + \sum_{p=0}^{q} b_{21}\Delta TPOL_{t-q} + \sum_{p-1}^{q} b_{22}\Delta \mathrm{ARPOD}_{t-q} + \sum_{p-1}^{q} b_{23}\Delta \mathrm{TECHL}_{t-q} + \sum_{p-1}^{q} b_{24}\Delta \mathrm{GFCF}_{t-q} + \sum_{p=1}^{q} b_{25}\Delta \mathrm{INF}_{t-q} + \emptyset ECM + \mu_{it} \qquad Eq.11$$

$$\Delta TECHLV_t = a_0 + \sum_{p=0}^{q} b_{31}\Delta TECHLV_{t-q} + \sum_{p-1}^{q} b_{32}\Delta \mathrm{ARPOD}_{t-q} + \sum_{p-1}^{q} b_{33}\Delta \mathrm{TOP}_{t-q} + \sum_{p-1}^{q} b_{34}\Delta \mathrm{GFCF}_{t-q} + \sum_{p=1}^{q} b_{35}\Delta \mathrm{INF}_{t-q} + \emptyset ECM + \mu_{it} \qquad Eq.12$$

$$\Delta GFCF_t = a_0 + \sum_{p=0}^{q} b_{41}\Delta GFCF_{t-q} + \sum_{p-1}^{q} b_{42}\Delta \mathrm{ARPOD}_{t-q} + \sum_{p-1}^{q} b_{43}\Delta \mathrm{TOP}_{t-q} + \sum_{p-1}^{q} b_{44}\Delta \mathrm{TECHLV}_{t-q} + \sum_{p=1}^{q} \Delta b_{45}\mathrm{INF}_{t-q} + \emptyset ECM + \mu_{it} \qquad Eq.13$$

$$\Delta INF_t = a_0 + \sum_{p=0}^{q} b_{41}\Delta INFL_{t-q} + \sum_{p-1}^{q} b_{42}\Delta \mathrm{ARPOD}_{t-q} + \sum_{p-1}^{q} b_{43}\Delta \mathrm{TOP}_{t-q} + \sum_{p-1}^{q} b_{44}\Delta \mathrm{TECHLV}_{t-q} + \sum_{p=1}^{q} b_{45}\Delta \mathrm{GFCF}_{t-q} + \emptyset ECM + \mu_{it} \qquad Eq.14$$

Where $ARPOD_t$, $TPOL_t$, $TECHLV_t$ $GFCF$ and $INFR_t$ are all endogenous variables which are explained by their lag values and lag values of other explanatory variables. ρ is the optimum lag value of the predictor, q, and t are the perspective optimum lag of the predictors while the b's are their respective partial regession coefficient and U_t, are their respective stochastic terms.

3.6 Impulse Response Function (IRF)

The Impulse Response Function (IRF) is employed to trace the time path of the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables in the VAR system. According to Pesaran and Shin (1998), IRFs provide a dynamic representation of the interactions among variables by illustrating how shocks propagate through the system over time. In this study, the IRF is used to assess how shocks in trade policy, inflation, technology, and capital formation affect agricultural productivity across different time horizons.

3.7 Forecast Error Variance Decomposition (FEVD)

Forecast Error Variance Decomposition (FEVD) complements the impulse response analysis by quantifying the proportion of the forecast error variance of each variable that can be attributed to shocks in other variables within the VAR system. As noted by Lütkepohl (2005), FEVD provides insights into the relative importance of each innovation in explaining fluctuations in the variables over time. In this study, FEVD is used to determine the extent to which variations in agricultural productivity are explained by shocks to trade policy and other macroeconomic factors.

IV. DATA ANALYSIS AND DISCUSSION OF FINDINGS

This section presents the empirical analysis of the roles of trade policy on agricultural productivity in Nigeria: VAR approach analysis. The analysis interprets the estimated results, highlights key trends and patterns, and evaluates relationship between dependent and independent variables. Findings are discussed in the context of existing theoretical and empirical literature, providing insights into the topic of discussion.

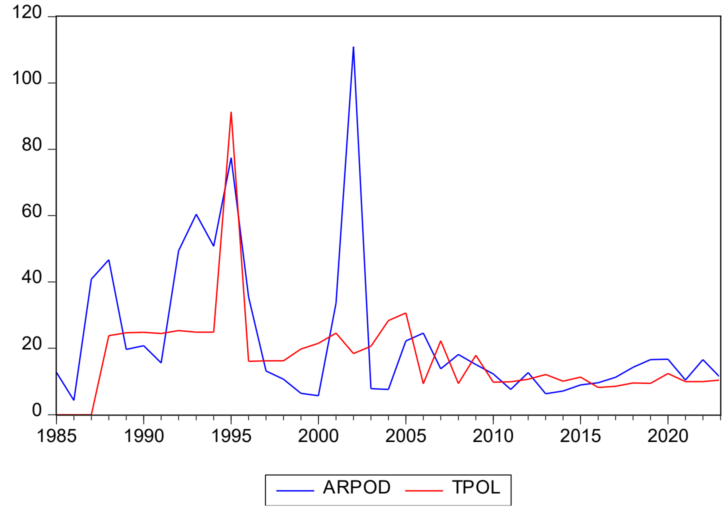


Figure 1: Trends of agricultural productivity and trade policy in Nigeria

Figure 1 presents the trends of agricultural productivity and trade policy in Nigeria from 1985 to 2023, highlighting three distinct phases.

Phase 1: 1985–1999 – Early Trade Liberalization and Structural Adjustment

During the early reform period, agricultural productivity exhibited significant volatility, rising from 4.28% in 1985 to a peak of 77.45% in 1995. Trade policy remained largely inactive until 1988, when tariff adjustments and easing of import licensing under the Structural Adjustment Program (SAP) began to take effect. Productivity gains during this period were lagged, suggesting that policy changes required time to influence production through input availability, market access, and credit channels. While trade policy contributed to these improvements, other macroeconomic factors such as inflation and weather variability also shaped outcomes. Overall, moderate evidence indicates that early trade liberalization positively influenced agricultural productivity, though the effect was gradual and conditional on supporting factors.

Phase 2: 2000–2009 – Commodity Price Boom and Agricultural Reform

Agricultural productivity reached its highest point in 2002 at 110.95%, followed by a sharp decline to 7.87% by 2004. During this period, trade policy was relatively stable, averaging 16–24%, aligned with World Trade Organization (WTO) commitments and focused on export promotion. Initial productivity gains coincided with rising global commodity prices and government revitalization initiatives. However, the subsequent decline highlights the limitations of trade policy alone in sustaining productivity, as weak institutional support, inadequate infrastructure, and adverse weather conditions constrained the sector. This period illustrates that trade policy can temporarily boost agricultural outcomes, but structural weaknesses may undermine long-term impacts.

Phase 3: 2010–2023 – Policy Retrenchment and Protectionism

In the most recent period, agricultural productivity remained moderate, fluctuating between 6.33% and 16.73%, while trade policy stabilized around 8–12%. Protectionist measures, including import restrictions on rice, poultry, and fertilizer, reflected an emphasis on food security and local content. Despite these interventions, productivity did not improve significantly, suggesting that restrictive trade policies may have increased input costs and hindered efficiency. The limited gains indicate a disconnect between trade openness and agricultural productivity, underscoring the need for complementary measures such as infrastructure development, access to finance, and effective extension services to translate policy into sustained growth.

Table 1: Correlation Matrix

	APROD	GFCF	INF	TECHLV	TPOL
APROD	1				
GFCF	0.243	1			
INF	0.084	0.070	1		
TECHLV	0.128	0.123	0.565	1	
TPOL	0.109	0.000	0.092	0.120	1

Source: Researcher's computation (E-views 10)

From the table1 above, it can be observed that all the matrix elements outside the leading diagonal are less than 0.8 which confirms absence of multi-collinearity, according to Cooper & Schindler (2009).

4.2 Unit Root Test Results

The test for unit root was conducted with the aid of Augmented Dickey Fuller (ADF) tests to ascertain whether time series data were stationary or non-stationary, and also to determine the number of times at which variables have to be differenced before becoming stationary.

Table 2: Unit Root Test Result

Variables	Level	1st Difference	2nd Difference	Order of Integration
APROD	-4.204 (0.000)**	---------------		1(0)
GFCF	-5.298 (0.000)**	---------------		1(1)
INF	-3.499 (0.001)**	---------------		1(0)
TECHLV	-4.962 (0.000)**	---------------		1(0)
TPOL	-4.735 (0.000)**	---------------		1(1)

Source: Researcher's computation with E-views10
Note: ** ADF probability values at 5% level of significance

4.3 Optimal Lag Length Criteria
Table 3: Lag Length Criteria
Endogenous variables: ARPOD GFCF INF TECHLV TPOL

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-778.8905	NA	5.64e+12	43.54947	43.76940*	43.62623
1	-759.6472	32.07204	7.88e+12	43.86929	45.18889	44.32987
2	-709.4724	69.68727*	2.12e+12*	42.47069	44.88995	43.31508*
3	-682.6123	29.84458	2.41e+12	42.36735*	45.88628	43.59555

Table 3 uses the Akaike Information Criterion for the study, the Akaike Information Criterion indicates an optimum lag length of two (2). Thus, the optimum lag length to be employed in the autoregressive distributive lag is two.

4.4 Co-integration Test

This test is adopted to examine whether or not our variables have a long-run relationship, (i.e., whether they sre co-integrated in the long run). We do this using the Johanson Co-integration test and the result is presented below

Table 4: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.852	133.239	69.818	0.000**
At most 1 *	0.540	62.318	47.856	0.001**
At most 2 *	0.318	33.534	29.797	0.018**
At most 3 *	0.296	19.341	15.494	0.012**
At most 4 *	0.156	6.3055	3.8414	0.012**

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
**** denotes rejection of the hypothesis at the 0.05 level**
***MacKinnon-Haug-Michelis (1999) p-values**

Table 5: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.
None *	0.852	70.920	33.876	0.000**
At most 1 *	0.540	28.783	27.584	0.035**
At most 2	0.318	14.193	21.131	0.349

At most 3	0.296	13.035	14.264	0.077
At most 4 *	0.156	6.305	3.841	0.012**

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
***** denotes rejection of the hypothesis at the 0.05 level***
MacKinnon-Haug-Michelis (1999) p-values

The co-integration test results presented in table 4 and 5 show that the variables used in this study have long-run relationship as the trace statistic indicates five co-integrating equation while the Eigenvalue indicates two co-integrating equation. This implies that the dependent variable can be sufficiently predicted in the long run using the explanatory variables. Hence, the vector error correction model is estimated to determine the speed of adjustment from short-run disequilibrium to long-run equilibrium.

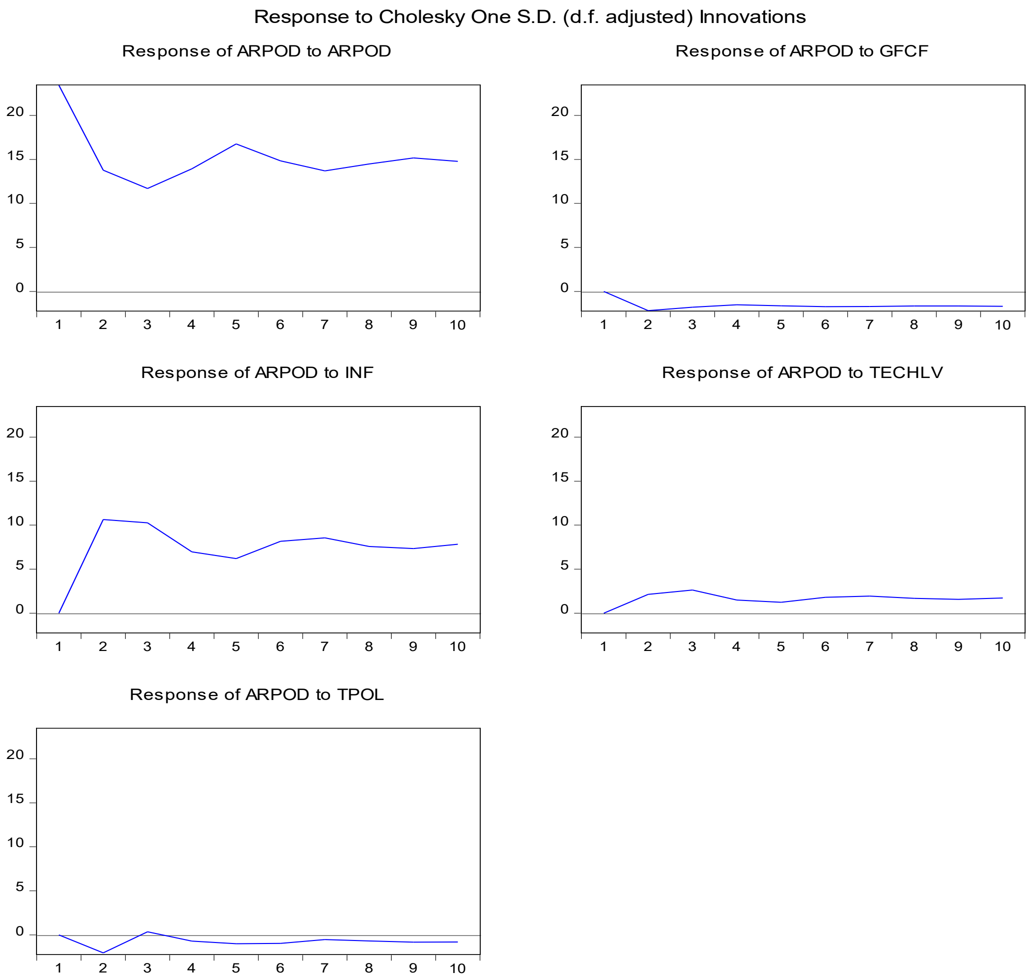
Table 6: Vector Error Correction Model Estimates

Variables	Coefficient	Standard Error	Student t-Test
GFCF(-1)	0.027	0.137	0.198
INF(-1)	-0.823	0.140	5.862
TECHLV(-1)	-0.197	0.034	5.784
TPOL(-1)	-0.200	0.166	-1.200

Source: Researcher's computation with E-views10

In the short run, the first lag of agricultural productivity positively influences its current value, with a coefficient of 0.051, indicating persistence in production levels. Interestingly, inflation shows a positive short-run impact (0.335), suggesting that temporary price increases may stimulate certain agricultural outputs. Gross fixed capital formation, however, exhibits a negative short-run effect (-0.148), indicating that capital investment may require time to translate into measurable productivity gains. Trade policy also negatively affects short-run productivity, with a coefficient of -0.303, implying that adjustments in trade measures may initially reduce agricultural output before long-term effects materialize.

The results indicate a nuanced relationship between trade policy and agricultural productivity. While trade policy reforms aim to enhance productivity, both short- and long-run estimates suggest that their effects are often negative or delayed, potentially due to implementation lags, structural constraints, and other macroeconomic shocks. Inflation demonstrates contrasting short- and long-run effects, highlighting the complexity of macroeconomic influences on agricultural outcomes. The positive impact of gross fixed capital formation in the long run underscores the importance of sustained investment in productive assets to support agricultural growth. Overall, the ECM confirms that despite short-term fluctuations, the system adjusts toward long-term equilibrium, reinforcing the need for coherent and consistent policy measures to improve agricultural performance in Nigeria.



1. Persistence in Agricultural Productivity

The result indicates that agricultural productivity is significantly influenced by its own lagged values, suggesting strong persistence in output performance over time. This implies that past improvements in agricultural practices, favourable climatic conditions, or policy interventions tend to have lasting effects on current productivity levels. The dominance of own shocks in the variance decomposition (approximately 77–78% in the long run) further confirms that internal sectoral dynamics play a more critical role than external policy variables. This finding is consistent with endogenous growth arguments that emphasize internal capacity and learning effects as drivers of sustained productivity.

2. Impact of Capital Formation

The negative coefficient of gross fixed capital formation in the short run suggests that aggregate investment does not immediately translate into agricultural productivity gains. This may reflect the structural composition of investment in Nigeria, where capital is largely concentrated in non-agricultural sectors such as oil and infrastructure. Consequently, increases in overall capital formation may have limited direct impact on agricultural output. However, the long-run positive adjustment observed in the VECM indicates that targeted and sustained investment can eventually enhance productivity.

3. Inflation and Productivity

Inflation demonstrates a positive short-run effect on agricultural productivity, indicating that rising output prices may temporarily incentivize increased production. However, this effect should be interpreted with caution, as persistent inflation can also increase input costs and reduce real income. The mixed impact of inflation highlights the importance of maintaining macroeconomic stability to support sustainable agricultural growth.

4. Role of Technology

Although technology shows a statistically significant relationship with agricultural productivity, the magnitude of its effect remains relatively small. This suggests that while technological progress contributes to productivity improvements, its impact is constrained by limited adoption, inadequate infrastructure, and weak extension services. The variance decomposition results further indicate that technological changes are influenced by external factors, reinforcing the need for policies that promote diffusion and accessibility of innovation.

5. Trade Policy Effects

Trade policy exhibits a negative short-run effect on agricultural productivity, with the estimated coefficient indicating that adjustments in tariffs or trade restrictions may initially disrupt production. This could be due to increased input costs or exposure to foreign competition without adequate domestic support. Furthermore, the Granger causality results show that agricultural productivity drives trade policy rather than the reverse, suggesting that policy actions in Nigeria are largely reactive. This weakens the effectiveness of trade policy as a proactive tool for enhancing agricultural productivity.

Table 7: Variance Decomposition of ARPOD:

Period	S.E.	ARPODGFCF	INF	TECHLV	TPOL	
1	23.44859	100.0000	0.000000	0.000000	0.000000	0.000000
2	29.43583	85.36851	0.554688	13.06756	0.523806	0.485441
3	33.45394	78.32887	0.716066	19.54411	1.024152	0.386803
4	36.96851	78.33705	0.754328	19.55168	1.002379	0.354571
5	41.12406	79.91444	0.767846	18.07316	0.898963	0.345589
6	44.55876	79.17447	0.804314	18.75090	0.929440	0.340880
7	47.47389	78.08697	0.838757	19.77363	0.987463	0.313186
8	50.26677	77.95018	0.855298	19.90360	0.992239	0.298681
9	53.07038	78.10007	0.864473	19.76515	0.977773	0.292528
10	55.70100	77.93794	0.877050	19.91502	0.983295	0.286691

Table 8: Variance Decomposition of GFCF

Period	S.E.	ARPODGFCF	INF	TECHLV	TPOL	
1	16.07255	0.899508	99.10049	0.000000	0.000000	0.000000
2	21.17676	10.39211	68.73770	20.04470	0.010058	0.815423
3	24.90363	16.54350	63.43876	18.39422	0.043505	1.580013
4	28.12164	17.97764	60.17147	20.20991	0.043673	1.597309
5	31.06637	20.45009	57.38873	20.22749	0.043675	1.890018
6	33.68529	20.92311	56.06038	21.07151	0.037150	1.907845
7	36.13393	21.93896	54.79511	21.21685	0.034123	2.014960
8	38.42149	22.47639	53.97453	21.46778	0.030204	2.051103
9	40.59119	23.04544	53.21263	21.60731	0.027775	2.106852
10	42.64002	23.37447	52.66397	21.80183	0.025469	2.134258

Table 9: Variance Decomposition of INF:

Period	S.E.	ARPODGFCF	INF	TECHLV	TPOL	
1	14.67170	25.19861	0.940428	73.86096	0.000000	0.000000
2	23.44847	35.37729	1.727866	60.97669	0.064118	1.854029
3	29.03883	41.59100	1.343592	55.19123	0.046397	1.827777
4	34.16254	44.05459	1.264820	52.60007	0.035354	2.045166
5	38.44375	43.93966	1.199758	52.80883	0.033209	2.018544
6	42.21882	44.16071	1.166650	52.60574	0.031100	2.035804
7	45.71068	44.78588	1.134465	52.00188	0.027002	2.050773
8	49.00395	45.21476	1.113499	51.57369	0.024527	2.073520
9	52.06926	45.31512	1.097704	51.48633	0.023317	2.077530
10	54.94526	45.42753	1.085666	51.38231	0.022258	2.082237

Table 10: Variance Decomposition of TECHLV

Period	S.E.	ARPODGFCF	INF	TECHLV	TPOL	
1	23.27256	8.217861	2.943732	0.776447	88.06196	0.000000
2	27.28045	10.53440	2.540948	13.08309	69.53241	4.309149
3	59.82003	45.50331	0.658447	36.55982	15.55358	1.724841
4	65.58106	47.99353	0.551508	35.83960	14.10771	1.507658
5	68.73631	47.40630	0.620764	34.89084	15.69237	1.389725
6	72.07721	46.18770	0.572448	36.24247	15.72823	1.269151
7	78.73905	46.78559	0.504332	37.42201	14.16403	1.124032
8	83.35510	47.34182	0.468760	37.51225	13.64159	1.035582
9	86.78331	47.29907	0.459684	37.51788	13.75504	0.968322
10	90.27966	47.09471	0.440600	37.89862	13.66498	0.901085

Table 11: Variance Decomposition of TPOL

Period	S.E.	ARPODGFCF	INF	TECHLV	TPOL	
1	16.19288	11.43586	3.654589	17.93085	0.716245	66.26246
2	18.54903	15.52832	2.834279	22.62013	0.572171	58.44510
3	22.50912	21.44212	2.477501	18.90056	0.961778	56.21804
4	25.19236	28.02400	2.118561	17.62615	0.836050	51.39523
5	27.87344	27.69346	1.949740	18.93561	0.782002	50.63918
6	30.03367	28.63298	1.807440	19.14294	0.709291	49.70736
7	32.18098	29.45343	1.735464	18.91068	0.715825	49.18460
8	34.18219	30.68208	1.649280	18.66358	0.691815	48.31325
9	36.07480	30.97691	1.593225	18.83375	0.672599	47.92352
10	37.84540	31.33820	1.542598	18.88284	0.652171	47.58419

The forecast error variance decomposition provides insights into the relative contribution of each variable in explaining the fluctuations of others over time, highlighting the interdependence among agricultural productivity, capital formation, inflation, technology, and trade policy in Nigeria.

Agricultural Productivity (ARPOD)
Initially, agricultural productivity is fully explained by its own innovations (100%), but its contribution declines to approximately 77–78% by the 10th period. Over time, other variables, including trade policy, gross fixed capital formation, inflation, and technology, begin to influence productivity more substantially. This indicates that while intrinsic factors drive short-term output, medium- to long-term agricultural performance depends increasingly on external macroeconomic and policy variables.

Gross Fixed Capital Formation (GFCF)
The explanatory power of GFCF decreases from nearly 99% at the initial period to 52.66% by the 10th period, suggesting that investment dynamics gradually become sensitive to other factors. This reflects the interconnectedness of capital formation with trade policy, inflation, technological progress, and agricultural outcomes, underscoring the need for coordinated macroeconomic strategies.

Inflation Rate (INF)
Inflation's own contribution to its variance declines from 73.86% to 51.38% over ten periods, indicating growing influence from structural and policy variables. This suggests that inflation in Nigeria is shaped not only by monetary dynamics but also by productivity, investment, and trade policy, particularly through import-export price effects and exchange rate movements.

Technology Level (TECHLV)
The variance in technology starts at 88.06% and falls sharply to 13.66% by the 10th period, highlighting its heavy dependence on external shocks. Technological progress in agriculture appears strongly influenced by

trade policy, capital formation, and foreign investment, emphasizing the importance of infrastructure, innovation support, and openness for effective technology adoption.

Trade Policy (TPOL)

Trade policy's self-explanatory variance declines from 66.26% to 47.58%, reflecting its partial endogeneity. While trade policy shapes investment, technology, and productivity, it is also influenced by macroeconomic conditions such as inflation and capital formation, indicating a feedback loop and an interactive policy environment.

Table 12: Granger Causality Test Result

Sample: 1985-2023

Lag Value: 2

Null Hypothesis	Observations	F-Statistic	Probability
TPOL does not Granger Cause ARPOD		0.323	0.725
ARPOD does not Granger Cause TPOL	37	2.953	0.066*
TECHLV does not Granger Cause ARPOD		0.053	0.9477
ARPOD does not Granger Cause TECHLV	37	19.600	3.E-06**
INF does not Granger Cause GFCF		9.000	0.000**
GFCF does not Granger Cause INF	37	1.303	0.285
TPOL does not Granger Cause INF		1.307	0.284
INF does not Granger Cause TPOL	37	3.920	0.030**

Source: Author's Computation Using E-Views 10

The Granger causality test results reveal the directional relationships among trade policy, agricultural productivity, technology, inflation, and capital formation in Nigeria, highlighting patterns of policy reactivity.

Trade Policy and Agricultural Productivity

Trade policy (TPOL) does not Granger-cause agricultural productivity (ARPOD), but agricultural productivity significantly Granger-causes trade policy. This suggests that trade policy adjustments in Nigeria tend to respond to changes in agricultural output rather than drive them. Policy implication: Nigerian trade policy in agriculture is largely reactive. To enhance productivity, proactive measures, such as targeted subsidies, favorable tariffs, and strategic trade agreements, should be implemented, rather than relying on post-hoc adjustments.

Technology and Agricultural Productivity

Technology level (TECHLV) does not Granger-cause agricultural productivity, whereas agricultural productivity Granger-causes technology. This indicates that technological investments and interventions are currently following productivity trends, rather than leading them. Policy implication: Strengthening innovation-led agricultural strategies is essential. Initiatives could include increased research and development (R&D), mechanization support, extension services, and incentives for adopting modern farming practices to make technology a proactive driver of productivity.

Inflation and Capital Formation

Inflation (INF) Granger-causes gross fixed capital formation (GFCF), while GFCF does not Granger-cause inflation. This suggests that inflationary pressures influence investment decisions in capital assets, likely affecting timing, magnitude, and efficiency of investments. Policy implication: Maintaining macroeconomic stability is critical to encourage productive capital formation. Authorities should prioritize controlled inflation to reduce uncertainty and stimulate long-term investment.

Inflation and Trade Policy

Trade policy does not Granger-cause inflation, but inflation Granger-causes trade policy. This reflects a reactive approach where trade measures, such as tariffs or import/export controls, are adjusted in response to price pressures. Policy implication: While responsive adjustments are necessary, a forward-looking and consistent trade framework would help prevent inflationary shocks and provide a stable environment for agricultural and trade planning

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study examined the relationship between trade policy and agricultural productivity in Nigeria using a VAR framework. Findings show that agricultural productivity is largely self-driven, while trade policy has limited direct impact. Technology and capital formation exert weak or negative effects, whereas inflation has a modest positive short-term influence. Overall, domestic factors and internal productivity drivers play a more significant role than trade policy in shaping agricultural performance.

5.2 Recommendations

1. Adopt Sector-Specific Trade Policies

Given the weak and negative impact of general trade policy on agricultural productivity, the government should design trade measures specifically tailored to the agricultural sector. This includes implementing targeted tariff structures, export incentives, and input subsidies that directly support farmers and agribusinesses.

2. Promote Proactive and Stable Trade Policy Frameworks

The finding that agricultural productivity Granger-causes trade policy suggests that Nigeria's trade policy is largely reactive. To improve effectiveness, policymakers should adopt a more forward-looking and stable trade policy framework that minimizes frequent reversals and provides long-term certainty for investors and farmers.

3. Increase Targeted Investment in Agricultural Infrastructure

Since gross fixed capital formation does not significantly enhance productivity in the short run, there is a need to redirect investment toward agriculture-specific infrastructure such as irrigation systems, rural roads, storage facilities, and mechanization. This will ensure that capital formation translates into real productivity gains.

4. Strengthen Agricultural Technology Adoption and Diffusion

Although technology contributes positively to productivity, its impact remains limited due to low adoption rates. Government and stakeholders should invest in research and development, extension services, and digital agriculture platforms to facilitate the widespread adoption of modern farming techniques.

5. Maintain Macroeconomic Stability, Particularly Inflation Control

The mixed effects of inflation on agricultural productivity highlight the need for stable macroeconomic conditions. Policymakers should implement measures to control inflation volatility, ensuring that rising prices do not erode farmers' purchasing power or increase input costs excessively.

6. Enhance Institutional Support and Policy Coordination

The weak impact of trade policy suggests underlying institutional challenges. Strengthening coordination among trade, agriculture, and finance ministries will improve policy implementation. In addition, improving access to credit, extension services, and market information will support farmers in responding effectively to policy changes.

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