

## Disaggregated Agricultural Output and Macroeconomic Dynamics: Evidence from a Linear Framework

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### Abstract:

*This study investigates the impact of agricultural output on macroeconomic performance in Nigeria from 1980 to 2024. The Autoregressive Distributed Lag (ARDL) bounds testing was employed to examine the dynamics of short-run and long-run impact analysis. The stationarity properties of the variables are employed using the ADF, PP, and KPSS tests. The cointegration test confirms the existence of a co-movement between agricultural output variables and real gross domestic product. The results indicate that crop and forestry outputs exert significant positive effects on GDP, whereas livestock and fishery outputs are positive but statistically insignificant. Inflation also exhibits a positive and significant impact on real gross domestic product, while interest rate and exchange rate effects are negligible. In the short-run dynamics, the result revealed that changes in livestock and crop production significantly influence real GDP; the diagnostic tests confirm model stability, absence of serial correlation, homoskedasticity, and normality of residuals. Overall, the findings underscore the centrality of agriculture, particularly crop and forestry subsectors, in driving Nigeria's economic performance, highlighting the need for policies that enhance agricultural productivity, value chain development, and sectoral integration to sustain long-term economic growth.*

**Keywords:** Agricultural output, Crop production, Fishery production, Livestock production, Forestry production, Economic growth

### 1. Introduction

Nigeria's economy has experienced significant structural transformation since independence, shifting from a predominantly agrarian system to one heavily dependent on crude oil. Nevertheless, agriculture remains a vital sector, employing over 70% of the labour force and contributing about 22% to GDP (World Bank, 2023). Before the discovery of oil, agriculture was the backbone of the economy, accounting for more than 90% of foreign exchange earnings and federal government revenue (Central Bank of Nigeria, 2010). During the 1950s and 1960s, the sector contributed approximately 63% and 54% to Nigeria's Real Gross Domestic Product (RGDP), respectively. However, following the oil boom of the 1970s, agriculture's share of RGDP declined significantly to between 29.2% and 33.3% from 1970 to 1980 (Aigbokhan, 2011). Prior to the dominance of oil, Nigeria produced sufficient food for domestic consumption and generated foreign exchange through the export of cash crops such as cocoa, groundnut, rubber, palm oil, and hides. The country's vast arable land, favourable climate, evenly distributed rainfall, and warm temperatures provided strong comparative advantages in agricultural production.

These natural endowments positioned agriculture as the primary source of income for the majority of Nigerians. Agriculture plays a critical role in economic growth and development. It provides food and fibre for domestic consumption, supplies labour to the industrial sector, generates foreign exchange through exports, increases domestic savings, and enhances the purchasing power of rural households (Poonyth et al., 2001). Recognizing this importance, successive Nigerian governments have implemented various agricultural development programmes aimed at revitalizing the sector (Ogbonna & Osondu, 2015).

Historically, agriculture has made substantial contributions to Nigeria's GDP. For instance, the sector contributed ₦23.80 billion in 1981, rising to ₦50.29 billion in 1987 and ₦106.63 billion by 1990. This upward trend continued into the 2000s. More recently, agriculture has accounted for over 32% of GDP and employed more than 65% of the workforce (Matthew, 2019). Nigeria also possesses about 37 million hectares of arable land and diverse agro-ecological zones suitable for year-round agricultural production (IFPRI, 2021). To strengthen the agricultural value chain, several policy interventions have been introduced. One notable initiative is the Fadama programme, which began with Fadama I in 1990, supported by the World Bank. While Fadama I focused primarily on irrigation farming, Fadama II and Fadama III (which became effective in 2009) expanded to promote agricultural diversification and community-driven development, providing financial and technical support for various livelihood activities (Ukaa, 2015). Additionally, the National Economic Empowerment and Development Strategy (NEEDS I and II, 2001–2007) led to the development of the Food Security Strategy Document in 2009, emphasizing a value chain approach to agricultural development. The National Policy on Integrated Rural Development further aimed to integrate rural economies into national growth strategies, reduce rural–urban migration, provide infrastructure, and alleviate poverty.

Despite Nigeria's immense agricultural potential and export capacity, the economy remains overly reliant on crude oil. Many industries depend heavily on imported raw materials, and youth unemployment remains high (Noko, 2015). Overdependence on oil has distorted market forces and constrained sustainable economic growth (Okoh, 2004). Expanding competitiveness in international markets with diversified agricultural exports, rather than relying solely on crude oil, is essential for achieving sustainable economic development (Bekun, 2015). Failure to harness agricultural resources effectively has negatively affected Nigeria's balance of payments, employment levels, productivity, and overall purchasing power (Oyinbo et al., 2014). Although agriculture has demonstrated its pivotal role in promoting growth, employment generation, and poverty reduction (Agbadagbe, Musa & Ismail, 2024), the sector continues to face structural and policy-related constraints that limit its effectiveness.

It is for this reason that this study examines the impact of agricultural output on economic growth in Nigeria from 1981 to 2024. Following the introduction, the section two deals with the literature review, methodology is captured in section three, section four explains the result and findings while the study is concluded in section five.

## 2. Literature Review

### 2.1 Disaggregated Agricultural Output

Agricultural output refers to the total value of agricultural goods produced within a given accounting period, net of intra-sectoral consumption and prior to processing, and made available for domestic consumption or export. It

encompasses crops, livestock, poultry, dairy, and fishery products (Adeosun, Asare-Nuamah, & Mabe, 2021). Agricultural output is measured either in physical terms such as total production and yield per hectare or in monetary terms, including value added to Gross Domestic Product (GDP) (Oladipo et al., 2019). In developing economies, it serves as a critical indicator of economic performance and food security. In Nigeria, agricultural output remains central to livelihood sustenance and national food supply (Adeola & Ikpesu, 2016). Globally, more than half of the world's population depends directly or indirectly on agriculture for survival (United Nations Organisation, 2008). In recognition of its importance, the Nigerian government has introduced several initiatives, including the Agricultural Transformation Agenda (ATA), the Growth Enhancement Support (GES) Scheme, and the Central Bank of Nigeria Agricultural Loan Scheme (National Bureau of Statistics, 2022), all aimed at improving productivity and strengthening the agricultural value chain.

Economic growth has long been regarded as a primary objective of economic policy. Fadare (2022) notes that extensive scholarly attention has been devoted to understanding how sustained growth can be achieved. Traditional growth theories emphasize labour and capital as the principal factors of production influencing economic expansion (Khorravi & Karimi, 2023). However, the emergence of endogenous growth theory has broadened this perspective by highlighting the importance of human capital, innovation, and knowledge spillovers in explaining long-term growth (Bogdanov, 2021). Technological advancement is widely recognized as a critical driver of economic growth; nevertheless, Koutsoyiannis (2006) argues that while technology is a necessary condition for growth, it is not sufficient on its own without complementary institutional and structural adjustments.

Agricultural output is composed of four major sub-sectors: crop production, livestock production, fisheries, and forestry. Crop production involves the cultivation and harvesting of plants, including cereals, roots and tubers, oil seeds, fruits, vegetables, fibers, and cash crops (Oji, 2011). It remains the dominant contributor to Nigeria's agricultural GDP, accounting for an average of 83.5% of the sector's GDP between 1960 and 2020 (Central Bank of Nigeria, 2020). Fisheries include both capture fisheries and aquaculture, providing essential protein and supporting livelihoods for millions globally (Abbas & Ahmed, 2016). Livestock production involves the rearing of animals for meat, milk, eggs, leather, and other by-products, contributing significantly to agricultural gross output in both developed and developing countries (Bruinsma, 2003). Forestry encompasses economic activities related to forest resources, including logging and wood-based industries, and plays an important role in employment generation and rural industrialization, though its macroeconomic contribution is often undervalued in West Africa. The conservation model of agricultural development, formulated by Vernon Ruttan and Yujiro Hayami (1971), emphasizes sustainable intensification through improved land management, organic manure utilization, and labour-intensive capital formation. Rooted in the historical experience of the English Agricultural Revolution, the model promotes increasingly complex land-use systems to optimize land and water resources. According to the Food and Agriculture Organization (FAO, 2022), conservation agriculture aims to prevent the loss of arable land and regenerate degraded soils through practices such as maintaining permanent soil cover, minimizing soil disturbance, and diversifying crops. Udemezue and Osogbue (2018) observe that this approach has historically been the most accessible pathway for agricultural intensification among farmers worldwide. Its relevance to this study lies in its emphasis on productivity enhancement and sustainability, both of which are critical for long-term economic growth.

The diffusion approach to agricultural development provides another conceptual lens. It is based on the empirical observation of disparities in land and labour productivity across farmers and regions. This perspective posits that agricultural development can be accelerated through the effective dissemination of technical knowledge and improved farming practices. Historically, the diffusion of superior husbandry techniques has been a significant source of productivity growth, even in pre-modern societies. In Nigeria, this approach is reflected in recent policy initiatives such as the National Agricultural Technology and Innovation Policy (NATIP) (2022–2027). NATIP represents a deliberate effort by the Federal Government to promote knowledge-driven agricultural transformation. The policy prioritizes technological advancement, improved input distribution, and local sourcing of blending materials, with the objective of creating millions of jobs and enhancing productivity (FMARD, 2022). On the basis of theory, this study is adapted from Leoning et al. (2009), who developed an empirical growth model tailored to agricultural economies. Their framework allows for the testing of multiple hypotheses without imposing restrictive assumptions and accounts for the structural characteristics of developing economies with large agricultural sectors. This aligns with the dual-sector model advanced by Todaro and Smith (2003) in their exposition of Lewis' theory of development. They conceptualize underdeveloped economies as comprising a traditional agricultural sector characterized by surplus labour and low marginal productivity, alongside a modern industrial sector. According to this view, sustainable development requires structural transformation that integrates the rural and agricultural sectors into the broader development process.

## 2.2 Empirical review

The empirical literature on the relationship between agricultural output and economic growth reveals a broad consensus that agriculture plays a significant and positive role in promoting economic performance, particularly in developing economies. Across Nigeria and other emerging economies, studies consistently demonstrate the existence of both short-run and long-run relationships between agricultural output and economic growth, although differences emerge in methodological approaches, sectoral focus, and the inclusion of complementary variables. In Nigeria, studies such as Ekine and Onu (2018), Olajide et al. (2012), and Tolulope and Chinonso (2013), provide evidence that agricultural output contributes positively to Gross Domestic Product (GDP). While some adopt simple Ordinary Least Squares (OLS) techniques, others employ growth accounting frameworks or incorporate stationarity and co-integration tests. Despite variations in approach, their findings converge on the importance of agriculture as a driver of economic expansion. However, earlier works relying heavily on OLS estimation often pay limited attention to time-series properties, raising concerns about spurious regression and endogeneity.

Sub-sectoral analyses, such as Abubakar and Ibrahim (2019), extend the literature by examining the differential contributions of crop production, livestock, fisheries, and forestry. Their findings suggest that most agricultural sub-sectors maintain long-run linkages with economic growth, although forestry appears less significant. This highlights structural imbalances within the sector and suggests the need for targeted policy attention. Similarly, Ekine and Onu (2018) emphasize the positive contribution of livestock and fisheries, reinforcing the argument that agricultural growth is multidimensional rather than crop-dependent alone. Okonkwo et al. (2019) and Etea and Obodoechi (2019) broaden the analytical framework by incorporating macroeconomic variables, including government expenditure, gross capital formation, exchange rate, and interest rate. Their use of co-integration

techniques, Engle-Granger procedures, and Vector Error Correction Models (VECM) improves methodological rigor by distinguishing between short-run dynamics and long-run equilibrium relationships. These studies collectively underscore the importance of policy variables and macroeconomic stability in strengthening the agriculture–growth nexus. Nevertheless, limitations remain regarding structural breaks, model specification sensitivity, and limited treatment of institutional quality. Comparative evidence from outside Nigeria further strengthens the argument. Ghimire et al. (2021) confirm a long-run relationship between agricultural output and economic growth in Bangladesh, suggesting that the positive agriculture-growth linkage is not country-specific but characteristic of agrarian economies. Agyei and Idan (2022), using the Generalized Method of Moments (GMM) in an Asian context, introduce institutional quality as a moderating factor and demonstrate that strong institutions enhance the positive impact of agricultural output on growth. This contribution is particularly instructive, as many Nigeria-focused studies underemphasize the role of governance and institutional effectiveness.

Findings emanating from the study suggest that. First, there is strong empirical support for a positive and often long-run relationship between agricultural output and economic growth. Second, the magnitude and sustainability of this relationship depend on complementary factors such as government expenditure, macroeconomic stability, institutional quality, and technological advancement. Third, methodological robustness varies across studies, with more recent works employing co-integration, VECM, and GMM techniques providing stronger inferential reliability than earlier single-equation OLS models.

While the literature affirms agriculture as a critical engine of growth in developing economies but reveals major lacuna in comprehensive sectoral coverage, institutional integration, and the use of advanced econometric methods over extended time horizons. These gaps justify further empirical investigation using more robust modeling frameworks to capture the dynamic and structural complexities of the agricultural output economic growth relationship.

### 3. Materials and Method

This study utilizes secondary data from 1981 to 2024. The data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and the Federal Bureau of Statistics (FBS). A quasi-experimental research design is adopted to examine the impact of agricultural output on economic growth in Nigeria over the study period. Agricultural output is measured as crop production, fishing output, livestock production, forestry output, while macroeconomic performance is proxied by real Gross Domestic Product (GDP) which was sourced from the national institutions.

#### 3.1 Model Specification

The functional and econometric relationship between the dependent variable and the independent variables is seen in the equation below:

$$RGDP_t = \alpha_0 + \alpha_1 CRP_t + \alpha_2 liv_t + \alpha_3 FRS_t + \alpha_4 FIS_t + \alpha_5 EXCHR_t + \alpha_6 INFR_t + \alpha_7 INTR_t + \varepsilon_t \text{-----} (2)$$

Where: RGDP = Real Gross Domestic Product; (Proxy for economic growth), CRP = Crop Production, LIV = Livestock Production, FRS = Forestry Production, FIS = Fishery Production;  $\varepsilon_t$  = Random variable or Error term.

$$\begin{aligned}
 RGDP_t = & \beta_0 + \sum_{i=1}^p \beta_1 \Delta RGDP_{t-i} + \sum_{i=0}^{k_2} \beta_2 \Delta CRP_{t-i} + \sum_{i=0}^{k_3} \beta_3 \Delta LIV_{t-i} + \sum_{i=0}^{k_3} \beta_4 \Delta FRS_{t-i} + \sum_{i=0}^{k_2} \beta_5 \Delta FIS_{t-i} + \sum_{i=0}^{k_2} \beta_6 \Delta EXCHR_{t-i} \\
 & + \sum_{i=0}^{k_2} \beta_7 \Delta INFR_{t-i} + \sum_{i=0}^{k_2} \beta_8 \Delta INTR_{t-i} + \alpha_1 RGDP_{t-1} + \alpha_2 CRP_{t-1} + \alpha_3 CRP_{t-1} + \alpha_4 LIV_{t-1} + \alpha_5 FRS_{t-1} \\
 & + \alpha_5 FIS_{t-1} + \alpha_6 EXCHR_{t-1} + \alpha_7 INFR_{t-1} + \alpha_8 INTR_{t-1} + \alpha_9 ECT_{t-1} + \mu \varepsilon_{1t} \quad \dots (3)
 \end{aligned}$$

### 3.2 Estimation Technique

The estimation procedure begins with testing the stationarity properties of the variables employed in the model using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests. These tests are necessary to determine whether the time series variables are stationary or contain a unit root. A stationary series is characterized by a constant mean, variance, and covariance over time, whereas a non-stationary series lacks these properties and may exhibit persistent trends. The ADF test examines whether a variable reverts to its long-run equilibrium following a shock, while the Phillips–Perron test provides a robustness check by correcting for serial correlation and heteroskedasticity in the error terms, thereby addressing certain limitations of the ADF procedure. The inclusion of non-stationary variables in regression analysis without appropriate correction may result in spurious and misleading estimates.

Following confirmation of the order of integration, in determining cointegration, techniques such as the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran and Shin (1999) and Pesaran et al. (2001), as well as the Johansen and Juselius (1990) cointegration method, are commonly applied to establish long-run relationships among non-stationary series. These approaches also permit reparameterization into an ECM form, thereby providing estimates of both short-run adjustments and long-run coefficients. Given the robustness and versatility of cointegration techniques in handling non-stationary data and reconciling short-run dynamics with long-run equilibrium, they provide a suitable framework for analyzing the relationship between agricultural output components and economic growth.

## 4. Result Presentation and Analysis

### 4.1 Descriptive and Inferential Statistics

The unit root test results, optimal lag lengths, serial correlation results, stability test results, bound test results for the long run and short run, and the estimated coefficient for the dependent and independent variables are all included in this chapter's presentation of the empirical findings computed during the research.

Table 1: Descriptive Statistics

	RGDP	LIVESTOCK	FOREST	FISHRY	CROP	EXR	INF	INT
Mean	50245.55	743.5030	106.4283	399.1987	10163.32	159.5736	17.77386	17.32263
Median	12529.21	285.1253	40.17781	74.90835	4018.512	96.57250	11.41500	17.45478
Maximum	234425.9	2620.293	432.6216	2335.490	47779.28	790.2000	72.84000	31.65000
Minimum	139.3105	2.525025	1.159573	0.540481	12.81721	1.755000	5.380000	9.959167
Std. Dev.	68086.72	844.7149	127.4697	694.1632	13719.77	204.9078	16.86908	4.738586
Skewness	1.383796	0.790493	1.068807	2.022167	1.476284	1.973151	1.814027	0.379657

Kurtosis	3.852625	2.067406	3.023447	5.724240	4.190734	6.503264	5.228944	3.570933
Jarque-Bera	15.37531	6.176958	8.378231	43.59322	18.58177	51.05128	33.24011	1.654627
Probability	0.000458	0.045571	0.015160	0.000000	0.000092	0.000000	0.000000	0.437222
Sum	2210804.	32714.13	4682.844	17564.74	447186.2	7021.240	782.0500	762.1956
Sum Sq. Dev.	1.99E+11	30682363	698686.3	20720087	8.09E+09	1805449.	12236.34	965.5305
Observations	44	44	44	44	44	44	44	44

Source: Authors Computation

Real GDP (RGDP) records a high mean value of 50,245.55, while the median is substantially lower at 12,529.21. This large gap suggests that RGDP growth has been uneven, with relatively higher values in recent years driving up the average. The very high maximum (234,425.9) compared to the minimum (139.31) further confirms significant expansion over time. The large standard deviation (68,086.72) indicates considerable volatility in economic performance. The positive skewness (1.38) and kurtosis above 3 imply that RGDP is right-skewed with a leptokurtic distribution, suggesting the presence of extreme growth episodes. The Jarque–Bera statistic and its probability value indicate that RGDP is not normally distributed. With respect to agricultural output, crop production exhibits the largest mean value (10,163.32) among the agricultural subsectors, highlighting its dominant contribution to Nigeria’s agricultural sector and, by implication, to macroeconomic performance. Livestock output has a mean of 743.50, while fishery (399.20) and forestry (106.43) record relatively lower average values. Across all agricultural subsectors, the mean values exceed their medians, indicating right-skewed distributions and suggesting that output expansion has been more pronounced in later years. The standard deviations of crop output (13,719.77), livestock (844.71), and fishery (694.16) are relatively high compared to their means, indicating substantial fluctuations in agricultural production over time. The exchange rate has a mean value of 159.57, with a very wide range between the minimum (1.76) and maximum (790.20), reflecting the long-term depreciation of the naira and episodes of exchange rate instability. Its high standard deviation (204.91), strong positive skewness (1.97), and high kurtosis (6.50) indicate significant volatility and the presence of extreme movements, which are critical for understanding how agricultural output translates into macroeconomic performance. Finally, the Jarque–Bera test results show that most variables reject the null hypothesis of normality at conventional significance levels, except for the interest rate, which appears approximately normally distributed.

Table 2: Correlation Matrix

	LRGDP	FOREST	FISHRY	CROP	EXR	INF	INT	LLIVESTOCK
LRGDP	1							
FOREST	0.638072	1						
FISHRY	0.654168	0.605381	1					
CROP	0.780061	0.681761	0.66787	1				
EXR	0.746369	0.642176	0.634857	0.664404	1			
INF	-0.16652	-0.1407	-0.01062	-0.08557	-0.05146	1		
INT	0.072479	-0.17154	-0.15407	-0.16261	-0.05237	0.499751	1	
LLIVESTOCK	0.595654	0.699015	0.605956	0.735707	0.703325	-0.16731	0.094231	1

Real GDP (LRGDP) exhibits strong and positive correlations with all agricultural subsectors. The highest correlation is observed between LRGDP and crop output (0.7801), implying that crop production has the strongest linear association with overall economic performance among the agricultural components. LRGDP also shows notable positive correlations with fishery (0.6542), forestry (0.6381), and livestock (0.5957), indicating that improvements across these subsectors are generally associated with higher levels of real output. The correlations among the agricultural subsectors themselves are also positive and relatively high. Forestry is positively correlated with fishery (0.6054), crop output (0.6818), and livestock (0.6990), suggesting complementarities within the agricultural sector. Similarly, crop output is strongly correlated with livestock (0.7357) and fishery (0.6679), reflecting the interdependence of agricultural activities, such as the use of crop residues for livestock feeding and shared infrastructure and market channels. The exchange rate (EXR) displays a strong positive correlation with LRGDP (0.7464) and with all agricultural subsectors, particularly livestock (0.7033) and crop output (0.6644). This suggests that periods of exchange rate depreciation, which dominate the Nigerian experience over time, tend to coincide with higher nominal values of agricultural output and real GDP, possibly due to price effects, increased competitiveness of domestic production, or inflationary valuation effects. Inflation (INF) shows weak and negative correlations with LRGDP (-0.1665) and with all agricultural subsectors. This pattern suggests that higher inflation is generally associated with lower real economic performance and reduced agricultural output, potentially due to increased production costs, uncertainty, and erosion of purchasing power. The near-zero correlation between inflation and fishery output (-0.0106) indicates a very weak linear relationship, implying that fishery activities may be relatively less sensitive to inflationary pressures compared to other agricultural subsectors.

Interest rate (INT) exhibits weak correlations with most variables. Its correlation with LRGDP is small and positive (0.0725), suggesting a limited direct linear association between interest rates and real economic performance over the period. In contrast, interest rate is negatively correlated with forestry (-0.1715), fishery (-0.1541), and crop output (-0.1626), implying that higher borrowing costs may discourage agricultural investment and production. The moderate positive correlation between interest rate and inflation (0.4998) is consistent with monetary policy responses, where interest rates often rise in periods of high inflation.

Table 3: Variance Inflation Factor

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
FOREST	0.006347	6.479624	1.804619
FISHRY	0.002562	3.780529	1.229209
CROP	0.007680	31.73191	3.608230
EXR	2.00E-08	8.963097	5.530836
INF	1.05E-06	4.208502	1.970305
INT	1.59E-05	3.442777	2.346081
LIVESTOCK	0.006300	13.57381	2.043303
C	0.041139	2.769438	NA

Source: Authors Computation

The centered VIF values indicate that multicollinearity is generally within acceptable limits across the model. All centered VIFs are below the conventional threshold of 10, suggesting that multicollinearity is not severe enough to invalidate the regression estimates. Crop output (LCROP) records the highest centered VIF of 3.61, followed by the exchange rate (EXR) with a centered VIF of 5.53. While these values suggest moderate correlation with other regressors, they remain well below the critical level, indicating that the estimated coefficients can still be interpreted with reasonable confidence. Forestry (LFOREST), fishery (LFISHERY), livestock (LLIVESTOCK), inflation (INF), and interest rate (INTR) all exhibit relatively low centered VIF values, ranging between approximately 1.23 and 2.35. These low values imply weak linear dependence among these variables and the rest of the regressors in the model. In particular, fishery output shows the lowest centered VIF (1.23), indicating minimal multicollinearity and a high degree of independent variation. This strengthens the reliability of its estimated impact on real GDP.

Table 4: Unit Root Test (ADF) Result

VARIABLE	ADF	PP	KPSS
LFORESTI	-2.368715	-2.1183	0.1598*
LFISHERY	-1.887696	-2.3817	0.0729*
LCROP	-2.439677	-1.1283	0.2124*
LLIVESTOCK	-1.766310	-1.1228	0.1397**
RGDP	-1.791585	-1.3723	0.2238*
EXCHR	-6.908585	-2.0271	0.1322*
INTR	-2.555076	-1.4132	0.2132*
INF	-2.865494	-1.8263	0.1436
ΔLFORESTI	-3.647511**	-4.1183*	0.0671
ΔLFISHERY	-3.936962**	-4.1273*	0.0563
ΔCROP	-4.295458*	-3.9823*	0.0469
ΔLLIVESTOCK	-3.558679**	-4.9133*	0.3112
ΔRGDP	-3.398287*	-5.1836*	0.0801
ΔEXCHR	-3.62211**	-4.1223*	0.0232
ΔINTR	-7.486003*	-5.8263*	0.0225
ΔINF	-5.794361*	-4.1933*	0.0326

Sources: Authors Computation

The unit root properties of the variables were examined using the Augmented Dickey–Fuller (ADF), Phillips–Perron (PP), and KPSS tests. At levels, the ADF and PP statistics fail to reject the null hypothesis of a unit root for LFORESTI, LFISHERY, LCROP, LLIVESTOCK, RGDP, EXCHR, INTR, and INF, as the test statistics are not sufficiently negative at conventional significance levels. In contrast, the KPSS statistics for most variables are statistically significant, leading to rejection of the null hypothesis of stationarity. The combined evidence from the three tests therefore indicates that all variables are non-stationary in levels. However, after first differencing, the ADF and PP tests strongly reject the null hypothesis of a unit root for all variables, as indicated by statistically significant test statistics. Furthermore, the KPSS test statistics for the differenced series are largely insignificant,

implying failure to reject the null hypothesis of stationarity. This consistent pattern across the three tests confirms that all variables become stationary after first differencing.

Table 5: ARDL Bounds Test (Null Hypothesis: No long-run relationship exists)

Test Statistic	Value	K
F-statistic	8.759156	7
Critical Value Bounds		
Significance	I (0) Bound	I (1) Bound
10%	2.03	3.13
5%	2.32	3.5
2.5%	2.6	3.84
1%	2.96	4.26

Source: Author's Computation

The computed F-statistic from the bounds test is 8.76, with seven regressors included in the model ( $k = 7$ ). This value is compared with the critical value bounds provided by Pesaran et al.'s framework, which specifies lower bounds assuming all variables are integrated of order zero,  $I(0)$ , and upper bounds assuming all variables are integrated of order one,  $I(1)$ . The decision rule is that if the F-statistic exceeds the upper bound at a chosen significance level, the null hypothesis of no long-run relationship is rejected. In this case, the calculated F-statistic (8.76) is substantially higher than the upper bound critical values at all conventional significance levels. Specifically, at the 5 per cent level, the upper bound critical value is 3.50, while at the 1 per cent level it is 4.26. Since 8.76 exceeds even the 1 per cent upper bound, there is strong statistical evidence against the null hypothesis.

Table 6: Long-run dynamics

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LLIVESTOCK	0.140436	0.164655	0.852913	0.3999
LFOREST	0.396064	0.151701	2.610827	0.0135
LFISHRY	0.081807	0.094635	0.864449	0.3936
LCROP	0.446343	0.200197	2.229522	0.0327
INT	0.001040	0.006908	0.150481	0.8813
INF	0.006211	0.002652	2.341996	0.0254
EXR	-0.000045	0.000277	-0.162313	0.8720
C	3.454971	0.461804	7.481469	0.0000

Source: Author's computation

Given that most variables are expressed in logarithmic form, the coefficients can be interpreted as elasticities, except for the macroeconomic variables that are not logged. The results indicate that forestry output (LFOREST) has a positive and statistically significant effect on real GDP in the long run. Specifically, a 1 per cent increase in forestry output is associated with approximately a 0.40 per cent increase in real GDP, holding other factors constant. This finding underscores the importance of the forestry subsector in supporting Nigeria's macroeconomic performance through channels such as raw material supply, employment generation, and contributions to export earnings. Similarly, crop output (LCROP) exerts a positive and statistically significant influence on real GDP. The estimated coefficient of 0.45 implies that a 1 per cent increase in crop production leads to about a 0.45 per cent increase in real GDP in the long run. Livestock output (LLIVESTOCK) and fishery output (LFISHRY) both have positive coefficients; however, their effects are not statistically significant at conventional levels. With respect to the macroeconomic control variables, the interest rate (INT) shows a positive but statistically insignificant coefficient, indicating that interest rate movements do not exert a meaningful long-run influence on real GDP within the estimated model. In contrast, inflation (INF) exhibits a positive and statistically significant coefficient. The exchange rate (EXR) carries a negative but statistically insignificant coefficient, indicating that exchange rate movements do not have a strong long-run effect on real GDP once agricultural output and other macroeconomic factors are accounted for.

Table 7: Short-run ARDL model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LLIVESTOCK)	0.219229	0.100118	2.189707	0.0357
D(LFOREST)	0.157742	0.082124	1.920772	0.0634
D(LFISHRY)	0.032582	0.041264	0.789597	0.4354
D(LCROP)	0.177766	0.064067	2.774701	0.0090
D(INT)	0.000414	0.002744	0.150891	0.8810
D(INF)	0.002474	0.000833	2.969102	0.0055
D(EXR)	-0.000018	0.000109	-0.163927	0.8708
CointEq(-1)	-0.398273	0.100901	-3.947175	0.0004

Source: Author's computation

In the short run, changes in livestock output, D(LLIVESTOCK), exert a positive and statistically significant effect on real GDP. The coefficient of 0.22 implies that a 1 per cent increase in livestock output leads to approximately a 0.22 per cent increase in real GDP in the short run. Changes in forestry output, D(LFOREST), also show a positive effect on real GDP, although the coefficient is only marginally significant at the 10 per cent level. This indicates that short-run expansions in forestry activities may stimulate economic performance, but the effect is weaker and less robust compared to other agricultural subsectors. Fishery output, D(LFISHRY), while positively signed, is statistically insignificant, suggesting that short-term fluctuations in fishery production do not have a strong immediate impact on overall economic performance. Crop output, D(LCROP), emerges as one of the most influential variables in the short run. The coefficient of 0.18 is positive and statistically significant at the 1 per cent level, indicating that increases in crop production have a strong and immediate effect on real GDP. Among the

macroeconomic variables, changes in inflation,  $D(INF)$ , have a positive and statistically significant effect on real GDP in the short run. This result may reflect demand-driven price increases or expansionary economic conditions where higher output coincides with rising prices. In contrast, changes in interest rate,  $D(INT)$ , and exchange rate,  $D(EXR)$ , are statistically insignificant, suggesting that short-run movements in these variables do not exert a direct influence on real GDP within the estimated framework. The error correction term,  $CointEq(-1)$ , is negative and highly statistically significant, with a coefficient of  $-0.40$ .

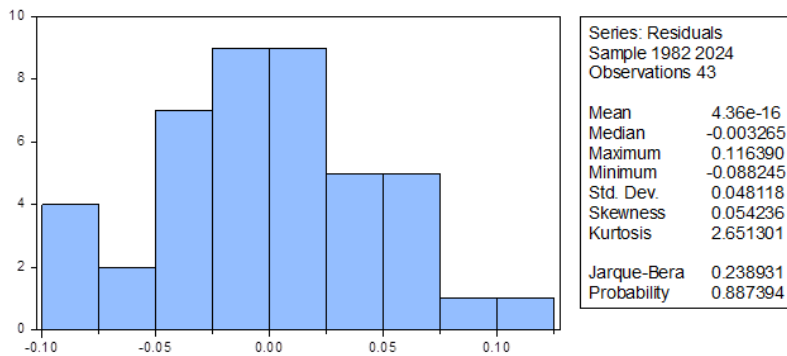


Figure 1: Normality Test

Source: Author's computation, 2026

The Jarque–Bera statistic of 0.239, with an associated probability value of 0.887, provides formal statistical evidence in support of residual normality, the residuals are normally distributed cannot be rejected. The normal distribution of the residuals enhances the reliability of the estimated coefficients and validates the use of standard inferential statistics in assessing the impact of agricultural output on macroeconomic performance in Nigeria.

Table 8: Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.627893	Prob. F(2,31)	0.5404
Obs*R-squared	1.674080	Prob. Chi-Square(2)	0.4330

Source: Author's computation, 2026

The test results show an F-statistic of 0.63 with an associated probability value of 0.54. Since this probability value is well above the conventional 5 per cent significance level, the null hypothesis of no serial correlation cannot be rejected. Similarly, the Obs\*R-squared statistic yields a value of 1.67 with a corresponding chi-square probability of 0.43. This result also exceeds the 5 per cent threshold, reinforcing the conclusion that serial correlation is not present in the model residuals.

Table 9: Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.662069	Prob. F(9,33)	0.7363
Obs*R-squared	6.576743	Prob. Chi-Square(9)	0.6811
Scaled explained SS	3.198145	Prob. Chi-Square(9)	0.9559

Source: Author's computation

The F-statistic of 0.662 with an associated p-value of 0.7363 suggests that the null hypothesis of homoskedasticity cannot be rejected at conventional significance levels (1%, 5%, or 10%). This means that there is no statistically significant relationship between the squared residuals and the explanatory variables in the model. Similarly, the Obs\*R-squared test yields a value of 6.5767 with a p-value of 0.6811, which also fails to reject the null hypothesis of constant variance. Finally, the scaled explained sum of squares test produces a value of 3.1981 with a p-value of 0.9559, which is far above conventional significance thresholds.

#### 4.2 Discussion of Results

The long run results of the ARDL model demonstrate that crop production and forestry output exert significant positive influences on real GDP in Nigeria. This finding aligns with recent empirical studies emphasizing agriculture's enduring role as a driver of macroeconomic performance. Umaru et al. (2025) show that agricultural value added significantly contributes to GDP growth, reinforcing the critical function of crop output within the agricultural sector. The predominance of crop production as a growth driver is further corroborated by national accounts and sectoral data, which indicate that crop production accounts for the majority share of agricultural GDP and underpins sectoral expansion in Nigeria (World Bank, 2023; FAO, 2023). Although livestock and fishery outputs show positive coefficients, they are statistically insignificant, indicating weaker long run impacts on real GDP. This pattern is consistent with findings by Awe, Adamu, and Oyelayo (2025) and Omoruyi and Edohen (2025), which highlight that the influence of livestock and fisheries tends to be less pronounced due to structural constraints such as limited commercialization, value-chain bottlenecks, and productivity challenges. Regarding macroeconomic variables, inflation displays a positive and statistically significant long-run relationship with GDP. While traditional growth theory often posits a negative effect of inflation on output, this positive association may reflect demand-driven dynamics or nominal growth effects in Nigeria, where inflation has co-varied with periods of economic expansion (Awe et al., 2025). This nuance aligns with contemporary evidence suggesting that inflation's impact on output can be context-specific, particularly in economies undergoing structural adjustments and sectoral shifts. Interest rates and exchange rate variables are statistically insignificant in both long-run and short-run forms, indicating that these macroeconomic factors do not exert a direct measurable influence on real GDP once agricultural output is accounted for. This finding resonates with analyses by the World Bank (2023) and FAO (2023), which show that the direct influence of interest rate and exchange rate fluctuations on agricultural output is often muted by weak financial intermediation and external sector constraints in Nigeria. In the short run, the positive and significant coefficients for changes in livestock and crop outputs suggest that these subsectors respond quickly to economic shocks and contribute to short-term GDP fluctuations. This observation aligns with

time-series evidence reported by Awe et al. (2025), which highlights heterogeneous dynamics among agricultural subsectors, with crop and livestock activities often driving seasonal or annual output fluctuations. Overall, the results reinforce the contemporary consensus that agriculture, particularly crop and forestry subsectors remains a cornerstone of economic activity in Nigeria, both in long-run growth and short-run dynamics. Empirical studies by Umaru et al. (2025), Awe et al. (2025), and Omoruyi and Edohen (2025), as well as analyses by the World Bank (2023) and FAO (2023), emphasize that strengthening agricultural productivity, expanding value chains, and enhancing structural linkages between agriculture and the wider economy are essential to sustaining growth.

## 5. Conclusion and Policy Implications

The study employed the Autoregressive Distributed Lag (ARDL) approach to examine both the long-run and short-run relationships between agricultural output comprising crop production, forestry, livestock, and fisheries and macroeconomic factors, including interest rate, inflation, and exchange rate, on Nigeria's RGDP. Among the macroeconomic variables, inflation exhibited a positive and significant relationship with GDP, while interest rate and exchange rate were statistically insignificant, implying limited direct long-term effects once agricultural output is accounted for. Forestry output showed a positive but marginally significant effect, while fishery output remained statistically insignificant. Inflation also positively influenced GDP in the short run, whereas interest rate and exchange rate changes continued to have no significant effect. The study concludes that agricultural output, particularly crop and forestry production, is a major driver of Nigeria's economic performance in both the short and long run. Livestock and fisheries, although contributing positively, have weaker impacts, likely due to structural and productivity constraints within these subsectors. The positive long-run association between inflation and GDP suggests that moderate inflation coincided with periods of economic expansion, though the policy implications of this finding require careful consideration. Interest rate and exchange rate variations appear to have limited direct effects on GDP when agricultural output is considered. Overall, the findings indicate that sustained investment in agricultural productivity and sectoral development is critical for maintaining Nigeria's long-term growth trajectory.

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