SAHEL INTERNATIONAL JOURNAL OF
ECONOMIC AND DEVELOPMENT STUDIES
Volume 1 | Issue 1 | January-June 2026

Agricultural Sub-Sector Outputs and Economic Growth in Nigeria, 1985–2024: Evidence from an ARDL Bounds Testing Approach

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Abstract

Agriculture remains central to Nigeria's pursuit of diversified, non-oil-driven growth, yet the relative contribution of its sub-sectors to national output remains empirically unclear despite decades of policy attention. This study examined the effect of crop production and fisheries output on economic growth in Nigeria between 1985 and 2024, determined the causality between agricultural output and growth, and identified which sub-sector contributed most significantly to growth. Annual time-series data on real gross domestic product, crop production, fisheries output, gross fixed capital formation, and total labour force were analyzed using the Autoregressive Distributed Lag (ARDL) bounds testing approach and the pairwise Granger causality test, following unit root and diagnostic testing. The ARDL bounds test confirmed a long-run cointegrating relationship among the variables (F = 22.45). Crop production and fisheries output both exerted positive and statistically significant long-run effects on growth, with crop production contributing most significantly (long-run elasticity of 0.64, against 0.25 for fisheries), while gross fixed capital formation showed an unexpected negative effect and labour force was statistically insignificant. Causality ran unidirectionally from crop production to growth, and from growth to fisheries output and capital formation. The error correction term (–0.26) confirmed a moderately fast return to long-run equilibrium following short-run shocks. The study concludes that agricultural sub-sector performance, particularly crop production, meaningfully drives Nigeria's economic growth, and recommends sustained investment in crop production and improved execution of public capital expenditure.

Keywords: *Agricultural output; Economic growth; ARDL bounds testing; Cointegration; Nigeria*

1. Introduction

Agriculture has historically been among the oldest and most significant human occupations, providing food, raw materials, employment, and income for economic activity. Before the discovery of crude oil in commercial quantities, agriculture was the mainstay of the Nigerian economy, contributing over 60% of gross domestic product (GDP) and employing nearly 70% of the labour force in the 1960s, with cocoa, groundnut, palm produce, rubber and cotton driving export earnings (Central Bank of Nigeria [CBN], 2023; Anyanwu, 2009). The oil boom of the 1970s progressively diverted policy attention and investment away from agriculture toward petroleum, a neglect associated with declining productivity, weak rural infrastructure, and rising food-import dependence. Despite this, agriculture still contributes between 20%

and 35% of GDP in recent years and remains the dominant source of rural employment; Ahungwa, Ugural and Bekun (2017) found that the sector accounted for about 66.4% of variations in Nigeria's GDP between 1960 and 2016.

Successive governments have introduced interventions Operation Feed the Nation, the Green Revolution Programme, the Directorate of Food, Roads and Rural Infrastructure, the National Agricultural Land Development Authority, the Agricultural Transformation Agenda, and the Anchor Borrowers' Programme aimed at reviving the sector, with mixed outcomes owing to implementation challenges, insecurity, and inconsistent policy. Between 2021 and 2024, agriculture contributed about 28% of GDP and employed roughly 40% of the labour force, yet Nigeria imported about ₦16 trillion worth of food in the same period, more than double the value of food exports (National Bureau of Statistics [NBS], 2024a, 2024b). This widening gap between domestic agricultural production and food demand underscores the need to understand how individual agricultural sub-sectors, rather than agriculture as an undifferentiated aggregate, contribute to national economic growth. This study addresses this gap by disaggregating agricultural output into crop production and fisheries and estimating their differential long-run and causal effects on economic growth in Nigeria.

The broad objective of the study is to examine the effect of selected agricultural sub-sector outputs on economic growth in Nigeria between 1985 and 2024. Specifically, the study sought to (i) examine the effect of crop production and fisheries output on economic growth; (ii) determine the causal relationship between agricultural output and economic growth; and (iii) identify which of the two sub-sectors contributes most significantly to economic growth. Correspondingly, the study tested the null hypothesis (H_0) that agricultural sub-sector outputs (crop production and fisheries) have no significant effect on, or causal relationship with, economic growth in Nigeria, against the alternative (H_1) that they do.

The study is significant on both academic and policy grounds. Academically, it contributes to the sparse but growing literature that disaggregates Nigeria's agricultural output by sub-sector rather than treating agriculture as a single homogenous aggregate, and it extends the empirical record to 2024, capturing recent structural developments post-COVID-19 recovery, currency reforms, and heightened farm insecurity that earlier studies could not observe. From a policy standpoint, identifying which agricultural sub-sector most reliably drives growth, and establishing the direction of causality between agriculture and growth, can help policymakers, development planners, and agricultural financing institutions allocate scarce public resources toward the interventions most likely to yield measurable growth returns, rather than spreading support thinly and indiscriminately across all sub-sectors. The findings should also be of interest to students and researchers of development economics seeking an updated, methodologically robust

reference point for further work on agriculture-growth linkages in Nigeria and other structurally similar developing economies.

2. Literature Review

2.1 Conceptual Review

Agricultural output refers to the total quantity or value of goods and services generated from agricultural activities within an economy over a given period, comprising outputs from crop production, livestock, forestry, and fisheries (Oje-Okoro, 2019). In Nigeria, agriculture accounts for a substantial share of GDP and employs a large proportion of the labour force, with the sector's GDP contribution historically rising from an average of about 38% between 1992 and 1996 to roughly 40% between 1997 and 2001. Crop production has consistently constituted the largest component of agricultural output, accounting for about 87.6% of agricultural GDP in earlier estimates (Odetola & Etumnu, 2013) and roughly 70% of agricultural output between 2021 and 2024, while the broader sector recorded an average annual growth rate of about 2.9% over the same period (NBS, 2024b). Livestock production, concentrated mainly in northern Nigeria, contributed about 21% of agricultural output over 2021–2024 but continues to face endemic and transboundary animal disease, weak veterinary governance, and constrained market and cold-chain infrastructure (NBS, 2024b; FAO, 2023). Forestry, a smaller component at roughly 5% of agricultural output over the same period, supports industrial raw-material supply, employment, and environmental protection, but faces mounting deforestation pressure estimated at between 0.72% and 2.38% annually (NBS, 2024b; FAO, 2020). Fisheries, comprising inland, marine, and aquaculture production, accounted for about 4% of agricultural output between 2021 and 2024; despite Nigeria's extensive coastline and inland waters, domestic fish production remains well short of the country's consumption needs, underscoring considerable scope for aquaculture expansion (NBS, 2024b; FAO, 2023).

Economic growth, for its part, refers to the sustained increase in the productive capacity, national output, and income of an economy over time, and is commonly measured using Real Gross Domestic Product (RGDP) as a proxy (Todaro & Smith, 2020). Since Nigeria's independence, agriculture, crude oil, manufacturing, trade, and telecommunications have been the principal drivers of growth; before the discovery of oil, agriculture alone contributed more than 60% of GDP and employed a substantial share of the labour force (CBN, 2023). Growth performance has since fluctuated considerably, from the instability of the Structural Adjustment Programme era of the mid-1980s and 1990s, through relatively strong growth averaging 5% to 7% annually between 2000 and 2014 on the back of rising oil prices and non-oil sector expansion, to the recessions of 2016 and 2020 associated with falling oil prices, exchange-rate pressure, and the COVID-19 pandemic. Despite these fluctuations, agriculture has continued to contribute between

20% and 35% of GDP in recent years and remains one of the largest employers of labour in the country (NBS, 2023).

2.2 Theoretical Literature Review

The Physiocrats' theory of economic growth, associated with eighteenth-century French economists led by François Quesnay, held that agriculture is the principal source of national wealth because it alone produces a net surplus beyond the cost of production. The theory divided society into a productive class of farmers, a proprietary class of landowners, and a comparatively "sterile" class of traders and manufacturers who were seen as merely transforming existing wealth rather than creating new wealth, and it advocated reinvestment of agricultural surplus alongside limited government interference in economic activity. Although superseded by later growth theories, the Physiocratic emphasis on agriculture as a wealth-generating sector remains a useful historical anchor for studies, such as this one, that examine agriculture's contribution to national output.

The Lewis (1954) dual-sector model explains growth in developing economies through the transfer of surplus labour from a traditional, low-productivity agricultural sector to a modern, higher-productivity industrial sector. As labour moves into industry, aggregate output, employment, and profits rise, with reinvested profits supporting further industrial expansion, while agriculture continues to supply food, raw materials, and capital for industrial development. Applied to Nigeria, the model implies that productivity gains in agriculture can simultaneously free up labour for industrial growth while sustaining the food and raw-material base on which that growth depends.

The Harrod-Domar model, developed independently by Harrod (1939) and Domar (1946), explains economic growth as a function of the savings rate and the productivity of capital, with investment playing a dual role of expanding aggregate demand and productive capacity simultaneously. For a developing economy such as Nigeria, the model implies that investment in agriculture through mechanization, irrigation, storage, and transportation can raise food production, generate employment, and increase foreign exchange earnings, providing part of the theoretical basis for including gross fixed capital formation in the model estimated in this study.

The Solow-Swan model (Solow, 1956; Swan, 1956) extended the Harrod-Domar framework by introducing labour force growth and technological progress, alongside capital accumulation, as determinants of long-run growth, and by allowing for diminishing returns to capital. Because it accommodates capital, labour, and productivity within a single production framework, the Solow-Swan model provides the theoretical anchor adopted for this study and is discussed in detail in the following sub-section.

Taken together, these four theories offer a progressively richer account of how agriculture relates to growth. The Physiocrats correctly identified agriculture as a source of surplus but offered no formal role for capital or labour mobility; Lewis (1954) added a mechanism, labour transfer, through which agricultural performance shapes industrial expansion, but treated agricultural productivity itself as broadly static; Harrod (1939) and Domar (1946) introduced capital investment as a formal growth determinant but, in their original form, left no room for diminishing returns or technological change; and Solow (1956) and Swan (1956) resolved this by allowing capital, labour, and technology to interact within a single, more general production framework capable of accommodating sectoral disaggregation. It is this cumulative theoretical progression, culminating in the Solow-Swan framework, that justifies the model specified in section 3.2, in which agricultural sub-sector outputs, capital formation, and labour force jointly determine economic growth.

2.3 Theoretical Framework

This study is anchored on the Solow-Swan growth theory developed independently by Solow (1956) and Swan (1956). The theory emerged as a refinement of the Harrod-Domar model, which emphasized savings and investment as the sole determinants of growth; Solow and Swan argued that capital accumulation alone cannot sustain long-run growth because of diminishing returns to capital, and introduced technological progress as the factor responsible for continuous growth in output and productivity over time. Because the theory accommodates capital, labour, and technology within a single production framework, it provides a robust foundation for examining how agricultural sub-sector outputs, capital formation, and labour force interact to determine economic growth in Nigeria.

At the heart of the model is the aggregate production function, commonly expressed in Cobb-Douglas form as $Y = Ak\,L^{1-\sigma}$, where Y is total output, K is capital stock, L is labour input, A captures the level of technology, and σ is the output elasticity of capital. The model predicts that as more capital is added to a fixed quantity of labour, the marginal product of capital declines, so that economies cannot rely indefinitely on capital deepening to sustain growth; long-run growth instead depends on technological progress, which shifts the entire production function upward. This has direct relevance to Nigerian agriculture: a farmer who continues to hire more laborer's without improved tools, seeds, or irrigation will eventually see diminishing additional output per worker, whereas the adoption of tractors, fertilizers, and irrigation shifts the production function and raises output from the same plot of land illustrating the model's central message that sustainable growth requires technological advancement and productive investment, not merely the expansion of labour and capital inputs.

The model also introduces the notion of steady-state equilibrium, reached when capital per worker is such that investment is just sufficient to replace depreciated capital and equip new entrants to the labour force; at this point, output per worker remains constant absent an exogenous technological shock. For Nigerian agriculture, this suggests that without continuous improvements in farming technology, research, and extension services, the sector may stagnate at a low-level equilibrium where output barely keeps pace with population growth, and that breaking out of this requires policies promoting mechanization, agro-processing, climate-smart agriculture, and human capital development. The theory further distinguishes transitional dynamics, during which an economy moves toward its steady state amid high returns to investment and rapid growth, from long-run growth, which is driven entirely by technological progress a distinction of particular relevance to Nigeria, where low capital intensity and widespread use of traditional farming methods suggest the agricultural sector remains in a transitional phase in which increased investment can still yield substantial growth dividends.

The theory also justifies the control variables included in this study: gross fixed capital formation captures the role of capital accumulation, which raises the capital stock and temporarily lifts the growth rate until the economy converges to its steady state, while total labour force accounts for the contribution of human effort to production, with the model further noting that rapid labour force growth without corresponding capital accumulation can dilute capital per worker and lower productivity. The retained agricultural sub-sector variables, crop production and fisheries output, represent the sectoral outputs through which capital and labour are productively employed, consistent with the model's emphasis on total factor productivity. The model has, however, been criticized by Romer (1986) for treating technological progress as exogenous, and by Lucas (1988) for underestimating the role of human capital accumulation and knowledge spillovers in driving growth; the assumption of diminishing returns may also understate the extent to which institutional weaknesses, market failures, and infrastructural deficits such as poor rural roads, inadequate storage, and insecurity in Nigeria constrain productivity gains independently of capital scarcity. Despite these limitations, the model remains well suited to this study: it offers a clear analytical framework linking capital, labour, and productivity to growth, resonates with the current policy discourse on agricultural mechanization and transformation in Nigeria, and justifies the ARDL technique adopted here, which allows both short-run transitional dynamics and long-run steady-state relationships among the variables to be examined.

2.4 Empirical Review

A substantial body of Nigerian evidence links agricultural performance to economic growth, though findings on the relative contribution of individual sub-sectors, methodology, and causality remain mixed. Odetola and Etumnu (2017) used growth-accounting and Granger causality techniques on data spanning

1960–2015 and found that agricultural output contributed positively and significantly to growth, with unidirectional causality running from agriculture to GDP and crop production accounting for the largest share of agricultural growth. Ahungwa, Ugural and Bekun (2017), applying trend analysis and multiple regression to data covering 1960–2016, similarly found that agriculture maintained a positive and statistically significant relationship with GDP despite fluctuations in sectoral performance, and concluded that revitalizing the sector would support balanced, sustainable growth.

Using Ordinary Least Squares (OLS) on 1980–2016 data, Onunze (2017) found that agricultural productivity exerted a positive and significant effect on economic growth, while inflation exerted a negative effect. Emeh (2017) applied an Error Correction Model within a Solow-growth framework to 1981–2012 data and found a long-run relationship among real GDP, agricultural output, capital formation, and labour force, with agricultural output positive and significant in both the short and long run. Eze and Nwibo (2014), disaggregating agricultural output into crop production, livestock, forestry, and fisheries over 1981–2012, found that crop production contributed most to GDP growth, with livestock and fisheries contributing positively but less strongly a sub-sectoral pattern broadly consistent with the results obtained in the present study.

Applying the ARD bounds testing approach, Oyinbo and Rekwot (2018) confirmed a long-run equilibrium relationship between agricultural production and GDP, with agricultural output positive and significant in both the short and long run, and emphasized the sector's role in employment generation and poverty reduction; Matthew and Mordecai (2016) similarly found, using ARDL on 1981–2014 data, that agriculture exerted a positive and significant effect on growth in both the short and long run and served as a stabilizing sector during oil price shocks and recessions. Ojo, Akinlo and Ojo (2021) used Fully Modified and Dynamic OLS on 1985–2019 data to address possible endogeneity and found a strong positive effect of agricultural output on real GDP, alongside evidence that technological advancement and mechanization had improved agricultural productivity in more recent years.

Using OLS regression, Olajide (2019) found a positive and statistically significant relationship between agricultural output and GDP over 1970–2010, while Odetola and Etumnu (2013), decomposing GDP into sectoral contributions over 1960–2011, found that agricultural output stimulated growth mainly through employment generation and food-supply stabilization. Abula and Ben (2016) and Adofu, Abula and Audu (2010) both used regression-based techniques to confirm a positive and significant effect of agricultural output on economic growth, recommending increased investment in mechanization, credit access, and rural infrastructure. Oyinbo and Rekwot (2014) found bidirectional causality between agricultural credit, agricultural output, and GDP growth over 1980–2012, while Aminu and Anono (2019) found that, relative to the petroleum sector, agriculture maintained a more stable and consistent positive relationship with

growth, supporting the case for economic diversification. Closest in spirit to the present study, Sunday, Samuel and Inimfon (2021) examined the impact of agricultural sub-sector outputs crop production, livestock, forestry, and fisheries on Nigeria's economic growth and found that crop production contributed most positively to growth, with livestock and fisheries contributing positively but at lower magnitudes and forestry showing a comparatively weak contribution.

Beyond the studies reviewed above, further evidence exists on the specific channels through which agriculture affects growth. Iganiga and Unemhilin (2011) found that federal government agricultural expenditure exerted a positive impact on agricultural output, reinforcing the expenditure-side findings of Ideba et al. (2019) and Edeh et al. (2020), while Akanbi and Du Toit (2011), using a macro-econometric model of the Nigerian economy, found that agriculture played a significant role in determining aggregate output alongside oil revenue and government spending. Ewubare and Eyitope (2015) examined agriculture's role in poverty reduction and found that agricultural growth was associated with a significant decline in poverty incidence, extending the agriculture-growth nexus into welfare outcomes. Focusing specifically on livestock, Nwankpa (2017) found that livestock production exerted a positive, though comparatively modest, economic impact relative to crop production, a pattern broadly consistent with the sub-sectoral ranking obtained by Sunday et al. (2021) and, indirectly, by the present study. Onunze (2016), in an earlier companion study to Onunze (2017), similarly found that agricultural development positively influenced economic growth over 1980–2016, while Peter, Tarila and Oghenefejiro (2020) linked agricultural funding specifically to sectoral performance and found that access to finance was a significant determinant of output growth. Using a regional case-study approach, Okolo (2004) and the Nigerian Technical Working Group on Agriculture and Food Security (NTWG, 2009) both documented that Nigeria's agricultural growth through the 1990s and 2000s remained largely extensive, driven more by expansion of cultivated land than by productivity gains, a structural pattern that helps explain why capital formation may not translate straightforwardly into higher agricultural output in the Nigerian context.

2.5 Research Gap

Despite this substantial body of evidence, important gaps remain. First, many earlier studies relied mainly on OLS and other traditional estimation techniques that may not adequately capture both short-run and long-run relationships among macroeconomic variables, particularly where variables exhibit a mixed order of integration (Adofu et al., 2010; Onunze, 2017), which may partly explain the inconsistencies observed across the literature; this study addresses that gap by adopting the ARDL bounds testing approach, which is suited to variables integrated at I(0) and I(1). Second, most earlier studies cover periods ending around 2016–2019 (Oyinbo & Rekwot, 2018; Ojo et al., 2021), leaving recent developments post-COVID-19 recovery, rising food inflation, exchange-rate instability, insecurity in farming communities, and

recent agricultural reforms inadequately captured; this study extends the analysis to 2024 to incorporate these developments. Third, several studies focus on aggregate agricultural output without adequately accounting for other growth-related variables such as capital formation and labour force (Izuchukwu, 2017; Olajide, 2019), risking omitted-variable bias; this study addresses that gap by incorporating gross fixed capital formation and labour force as control variables alongside disaggregated crop production and fisheries output.

3. Methodology

3.1 Research Design and Data

The study adopted an ex-post facto research design, relying on historical annual time-series data covering 1985 to 2024 that could not be manipulated by the researcher. Data on real GDP (RGDP), crop production (CROP), fisheries output (FISH), and total labour force (TLAB) were sourced from the World Development Indicators of the World Bank and the Central Bank of Nigeria Statistical Bulletin. Data on gross fixed capital formation (GFCF) were supplemented from Index Mundi.

3.2 Model Specification

The functional form of the model is specified as:

RGDP = f(CROP, FISH, GFCF, TLAB) ..... (3.1)

where RGDP is real gross domestic product; CROP is crop production output; FISH is fisheries output; GFCF is gross fixed capital formation; and TLAB is total labour force.

The econometric (log-linear) form, in which all variables are expressed in natural logarithms so that coefficients are read as elasticities, is specified as:

$$ln\,RGDP_t = \beta_0 + \beta_1 ln\,CROP_t + \beta_2 ln\,FISH_t + \beta_3 ln\,GFCF_t + \beta_4 ln\,TLAB_t + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.2)$$

where β_0 is the constant term, β_1–β_4 are parameters to be estimated, and μ_t is the error term.

The corresponding ARDL error-correction specification is:

$$ln\,RGDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta ln\,RGDP_{t-i} + \sum_{i=1}^{p} \alpha_{2i} \Delta ln\,CROP_{t-i} + \sum_{i=1}^{p} \alpha_{3i} \Delta ln\,FISH_{t-i} + \sum_{i=1}^{p} \alpha_{4i} \Delta ln\,GFCF_{t-i} + \sum_{i=1}^{p} \alpha_{5i} \Delta ln\,TLAB_{t-i} + \lambda_1 ln\,RGDP_{t-1} + \lambda_2 ln\,CROP_{t-1} + \lambda_3 ln\,FISH_{t-1} + \lambda_4 ln\,GFCF_{t-1} + \lambda_5 ln\,TLAB_{t-1} + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

where Δ is the first-difference operator, p is the lag length, and λ_1–λ_5 are the long-run coefficients. All coefficients were a priori expected to be positive (β_1–$\beta_4 > 0$), on the assumption that increases in agricultural production, capital, and labour enhance food supply, employment, industrial inputs, and overall economic activity.

3.3 Estimation Technique

Descriptive statistics were used to summarize the behavior of the series, and the Augmented Dickey-Fuller (ADF) test was used to determine their order of integration, as required by the ARDL approach. The ARDL bounds test of Pesaran, Shin and Smith (2001) were applied to test for a long-run relationship, after which the ARDL model was estimated to obtain long-run coefficients and a short-run error-correction model (ECM). The pairwise Granger causality test was used to establish the direction of causality between agricultural output and growth. Diagnostic tests (serial correlation, heteroskedasticity, normality, and multicollinearity) and the CUSUM/CUSUMSQ stability tests of Brown, Durbin and Evans (1975) were conducted to validate the estimated model.

3.4 Scope of the Study

The study is scoped to two of Nigeria's four agricultural sub-sectors, crop production and fisheries, alongside gross fixed capital formation and total labour force as control variables, over the period 1985 to 2024.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1:

	lnRGDP	lnCRP	lnFISH	lnGFCF	lnTLBF
Mean	10.48249	8.839829	5.117411	29.75440	17.99404
Median	10.49756	9.016212	5.182620	29.74918	18.00480
Maximum	11.28763	9.789381	5.956459	30.06865	18.54573
Minimum	9.631547	7.687497	3.704999	29.36601	17.41023
Std. Dev.	0.583759	0.740203	0.696811	0.186165	0.321006
Skewness	-0.007035	-0.152385	-0.359172	-0.254235	-0.102089
Kurtosis	1.394529	1.385931	1.929244	2.151298	1.980418
Jarque-Bera	4.296225	4.496839	2.770895	1.631394	1.802060
Probability	0.116704	0.105566	0.250212	0.442331	0.406151
Sum	419.2998	353.5932	204.6964	1190.176	719.7618
Sum Sq. Dev.	13.29022	21.36814	18.93630	1.351640	4.018748

	lnRGDP	lnCRP	lnFISH	lnGFCF	lnTLBF
Observations	40	40	40	40	40

Source: Author's computation using EViews 9 (2026).

Table 1 presents the descriptive statistics of the log-transformed series. Where all five variables are approximately symmetric (skewness close to zero) and platykurtic, and the Jarque-Bera probability for each exceeds 0.05, indicating that none departs significantly from normality an early indication that the series are well behaved and suitable for further econometric analysis.

4.2 Augmented Dickey-Fuller (ADF) Unit Root Test

Table 2:

Variable	ADF Stat. (Level)	P-value (Level)	Decision (5%)	ADF Stat. (1st Diff)	P-value (1st Diff)	Decision (5%)	Order of Integration
lnRGDP	-1.129892	0.6939	Non-stationary	-3.834284	0.0057	Stationary	I (1)
lnCRP	-0.946271	0.7625	Non-stationary	-5.966553	0.0000	Stationary	I (1)
lnFISH	-0.876167	0.7839	Non-stationary	-8.334835	0.0000	Stationary	I (1)
lnGFCF	-1.442410	0.5511	Non-stationary	-10.28030	0.0000	Stationary	I (1)
lnTLBF	1.646780	0.9973	Non-stationary	-3.642612	0.0093	Stationary	I (1)

Source: Author's computation using EViews 9 (2026).

The Augmented Dickey-Fuller test was applied to each series at level and at first difference (Table 2). All five variables were non-stationary at level (probabilities exceed 0.05) but became stationary after first differencing (probabilities below 0.05), and are therefore integrated of order one, I (1). Livestock output, initially part of the conceptual model, could not be confirmed stationary at either level or first difference and was consequently excluded from the final empirical model, since its inclusion would have violated the order-of-integration requirement of the ARDL bounds testing technique. Because none of the retained variables is I (2) or higher, the pre-condition for applying the ARDL bounds testing approach is satisfied.

4.3 ARDL Model Estimation

Table 3: ARDL (1,0,0,2,0) Model Estimation Dependent Variable: lnRGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNRGDP (-1)	0.730713	0.041558	17.58288	0.0000
LNCRP	0.172005	0.034327	5.010714	0.0000
LNFISH	0.068615	0.023265	2.949287	0.0061
LNGFCF	-0.064134	0.044290	-1.448030	0.1580
LNGFCF (-1)	-0.069993	0.044211	-1.583151	0.1239
LNGFCF (-2)	-0.090843	0.044388	-2.046569	0.0495
LNTLBF	0.065969	0.074893	0.880849	0.3854
C	6.485387	1.692142	3.832649	0.0006

R-squared	0.998964	Mean dependent var	10.52607
Adjusted R-squared	0.998723	S.D. dependent var	0.565825
S.E. of regression	0.020221	Akaike info criterion	-4.779481
Sum squared resid	0.012267	Schwarz criterion	-4.434726
Log likelihood	98.81014	Hannan-Quinn criter.	-4.656820
F-statistic	4134.220	Durbin-Watson stat	2.242525
Prob(F-statistic)	0.000000		

Source: Author's computation using EViews 9 (2026).

With all series confirmed I (1), the ARDL model was estimated, with EViews 9 selecting the optimal lag structure by the Akaike Information Criterion over a maximum of two lags across 162 candidate models. The selected model was ARDL (1, 0, 0, 2, 0) RGDP enters with one lag of itself, crop production and fisheries enter contemporaneously, GFCF enters with two lags, and labour force enters contemporaneously (Table 3). The model fits the data extremely well, with an adjusted R^2 of 0.9987 and a highly significant F-statistic (4134.22, $p < 0.01$), while the Durbin-Watson statistic of 2.24 suggests the model is free of serious first-order autocorrelation.

4.4 ARDL Bounds Test for Cointegration

Table 4: ARDL Bounds Test Result

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	22.45234	4

Critical Value Bounds

Significance	I (0) Bound	I (1) Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Author's computation using EViews 9 (2026).

The ARDL bounds test of Pesaran, Shin and Smith (2001) were applied to test the null hypothesis of no long-run relationship among lnRGDP, lnCRP, lnFISH, lnGFCF and lnTLBF. As shown in Table 4, the computed F-statistic of 22.45 lies far above the upper I (1) bound of 3.49 at the 5% level, and even above the 1% upper bound of 4.37, so the null hypothesis of no long-run relationship is strongly rejected. A stable, cointegrating relationship therefore exists among agricultural sub-sector outputs, capital formation, labour force and economic growth in Nigeria over 1985–2024.

4.5 Long-Run and Short-Run Estimates

Table 5: Long-Run Coefficients Dependent Variable: lnRGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRP	0.638741	0.096345	6.629745	0.0000
LNFISH	0.254801	0.089821	2.836768	0.0081
LNGFCF	-0.835430	0.357702	-2.335550	0.0264
LNTLBF	0.244978	0.276002	0.887596	0.3818
C	24.083552	8.056903	2.989182	0.0055

Source: Author's computation using EViews 9 (2026).

Table 5 reports the long-run coefficients. Crop production has a positive and highly significant long-run effect on real GDP: a 1% increase in crop production raises real GDP by about 0.64% (p = 0.0000), holding other variables constant. Fisheries output also has a positive and significant long-run effect, with a 1% increase raising real GDP by about 0.25% (p = 0.0081). Gross fixed capital formation shows a negative and significant long-run coefficient (−0.84, p = 0.0264), contrary to a priori expectation, while total labour force is positive but statistically insignificant (p = 0.3818).

Table 6: Short-Run (Cointegrating Form) Coefficients Dependent Variable: D(lnRGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCRP)	0.196934	0.045510	4.327291	0.0002
D(LNFISH)	0.056245	0.026105	2.154546	0.0394
D(LNGFCF)	-0.059676	0.033238	-1.795442	0.0827
D (LNGFCF(1))	0.095261	0.032397	2.940384	0.0063
D(LNTLBF)	0.090726	0.162724	0.557545	0.5813
CointEq (-1)*	-0.257716	0.037196	-6.928654	0.0000

Source: Author's computation using EViews 9 (2026).

The short-run error correction model (Table 6) shows an error correction term, CointEq (−1), of −0.2577, which is negative and highly significant (p = 0.0000), confirming that the model is dynamically stable and converges back to long-run equilibrium after a shock. About 25.8% of any disequilibrium between real GDP and its long-run determinants is corrected within one year, implying full convergence in a little under four years.

4.6 Diagnostic and Stability Tests

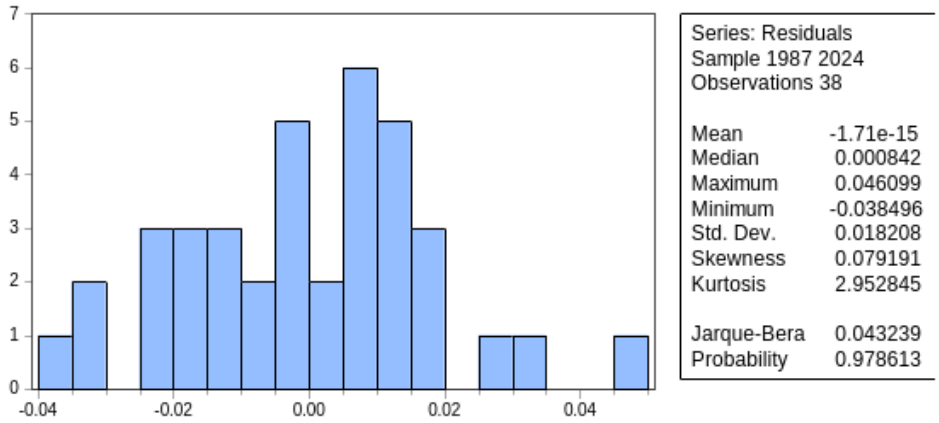
(a) Breusch-Godfrey Serial Correlation LM Test

Statistic	Value	Test	Prob.
F-statistic	0.253325	Prob. F(2,28)	0.7780
Obs*R-squared	0.675375	Prob. Chi-Square (2)	0.7134

(b) Heteroskedasticity Test: Harvey

Statistic	Value	Test	Prob.
F-statistic	1.646771	Prob. F (7,30)	0.1606
Obs*R-squared	10.54824	Prob. Chi-Square (7)	0.1596
Scaled explained SS	7.856171	Prob. Chi-Square (7)	0.3454

(c) Histogram and Normality Test of Residuals



Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LNRGDP(-1)	0.001727	17686.72	50.65813
LNCRP	0.001178	8723.684	54.23552
LNFISH	0.000541	1372.103	20.66118
LNGFCF	0.001962	161583.1	5.416325
LNGFCF(-1)	0.001955	160852.1	5.723771
LNGFCF(-2)	0.001970	161987.0	6.043712
LNTLBF	0.005609	169376.8	45.85966
C	2.863345	266092.3	NA

Source: Author's computation using EViews 9 (2026).

A diagnostic test confirmed the reliability of the estimated model (Table 7). The residuals show no serial correlation, are homoskedastic, and are normally distributed. Variance Inflation Factors ranged from 5.42 to 54.24, with three regressors exceeding the conventional threshold of 10 a reflection of the strong co-movement typical of trending macroeconomic series rather than a specification error; because the ARDL bounds testing framework re-expresses the model in terms of a single error-correction term, this does not invalidate the long-run and short-run estimates, though individual short-run coefficients should be

interpreted with some caution. The CUSUM and CUSUMSQ plots of recursive residuals remained within the 5% critical bounds throughout the sample period, confirming that the model's parameters were structurally stable and can be relied upon for policy interpretation.

4.7 Granger Causality Test

The pairwise Granger causality test (Table 8) shows that crop production Granger-causes real GDP (F = 3.94, p = 0.0291), but not the reverse (p = 0.1799), indicating unidirectional causality from crop production to growth. For fisheries and capital formation, the reverse pattern holds: real GDP Granger-causes fisheries output (F = 6.78, p = 0.0034) and GFCF (F = 6.74, p = 0.0035), but neither Granger-causes real GDP. No significant causal relationship, in either direction, was found between real GDP and total labour force.

Table 8: Pairwise Granger Causality Test (Lags: 2)

Null Hypothesis	Obs	F-Statistic	Prob.
LNCRP does not Granger Cause LNRGDP	38	3.94288	0.0291
LNRGDP does not Granger Cause LNCRP		1.80791	0.1799
LNFISH does not Granger Cause LNRGDP	38	0.64293	0.5322
LNRGDP does not Granger Cause LNFISH		6.78087	0.0034
LNGFCF does not Granger Cause LNRGDP	38	1.95131	0.1581
LNRGDP does not Granger Cause LNGFCF		6.74121	0.0035
LNTLBF does not Granger Cause LNRGDP	38	1.99379	0.1522
LNRGDP does not Granger Cause LNTLBF		2.17569	0.1295

Source: Author's computation using EViews 9 (2026).

4.8 Discussion of Findings

The long-run results confirm the a priori expectation that crop production and fisheries output positively affect economic growth. Crop production's larger elasticity (0.64 against 0.25 for fisheries) reflects its dominant share of Nigeria's agricultural output and is consistent with earlier Nigerian ARDL-based studies such as Matthew and Mordecai (2016) and Ojo, Akinlo and Ojo (2021). That crop production also Granger-

causes growth, while fisheries output does not, supports the "agriculture-led growth" hypothesis specifically for crop production and identifies it as the sub-sector meriting the greatest policy attention among the two examined.

The negative long-run coefficient on gross fixed capital formation, though contrary to the standard neoclassical prediction that capital accumulation raises output (Solow, 1956), is not uncommon in Nigerian macro-econometric studies. It plausibly reflects the fact that a substantial share of Nigeria's capital formation has flowed into petroleum and non-tradable real-estate investment rather than productivity-enhancing capital in tradable sectors, compounded by the volatility and inconsistent execution of public capital projects. Total labour force's statistically insignificant effect suggests that mere growth in workforce size, without corresponding productivity gains, has not translated into a measurable independent effect on real GDP a pattern consistent with Nigeria's persistently high underemployment in agriculture and the informal sector.

That real GDP Granger-causes fisheries output and capital formation, rather than the reverse, suggests that broader economic expansion drives demand for fish products and investable resources, rather than these sub-sectors independently driving growth. Overall, the results support a nuanced but genuine agriculture-growth relationship in Nigeria: one in which crop production is a leading driver of national output, while fisheries output and capital formation behave more as outcomes of growth than as its causes.

These findings should be read against the empirical literature reviewed in section 2.4. The dominant, causally significant contribution of crop production echoes the sub-sectoral rankings reported by Eze and Nwibo (2014) and Sunday, Samuel and Inimfon (2021), both of whom similarly found crop production to be the strongest positive contributor among Nigeria's agricultural sub-sectors, and lends further support to the general agriculture-growth relationship documented by Odetola and Etumnu (2017), Ahungwa, Ugural and Bekun (2017), and Onunze (2017). The result also refines this literature in one respect: whereas most reviewed studies treat agricultural output as a single aggregate and report a uniformly positive, causally active relationship with growth, the present disaggregated results show that this causal, growth-driving role is concentrated in crop production specifically, while fisheries output behaves more as a beneficiary of growth than as an independent driver a distinction that aggregate-level studies are, by construction, unable to detect. The unexpected negative long-run effect of capital formation, meanwhile, stands somewhat apart from studies such as Ideba et al. (2019) and Edeh, Ogbodo and Onyekwelu (2020), which found public agricultural expenditure and capital spending to positively influence output; the difference is plausibly explained by the fact that those studies examined agriculture-specific expenditure, whereas gross fixed capital formation in the present study captures economy-wide investment, a large share of which is not agricultural and may compete with, rather than complement, agricultural productivity gains. Consistent

with the structural explanation offered by Okolo (2004) and the NTWG (2009), this pattern is compatible with a growth process that remains only partially anchored in productivity-enhancing agricultural investment.

5. Conclusion and Recommendations

This study examined the effect of crop production and fisheries output on economic growth in Nigeria over 1985–2024 using the ARDL bounds testing approach and the pairwise Granger causality test. The results confirm a long-run cointegrating relationship among real GDP, crop production, fisheries output, gross fixed capital formation, and total labour force, and show that crop production and fisheries output both exert positive and statistically significant long-run effects on growth, with crop production the more important of the two. Gross fixed capital formation exerts an unexpected negative long-run effect, while labour force is statistically insignificant. Causality runs unidirectionally from crop production to growth, and from growth to fisheries output and capital formation, and the significant, correctly signed error correction term confirms that the estimated system is dynamically stable. On this basis, the null hypothesis that agricultural sub-sector outputs have no significant effect on, or causal relationship with, economic growth in Nigeria is rejected.

The study concludes that agricultural sub-sector performance, particularly crop production, meaningfully and causally drives Nigeria's economic growth, and that the composition and consistency of capital investment, rather than its sheer volume, may matter more for growth than is often assumed an issue that falls outside the immediate scope of this study but merits closer policy and research attention.

These findings also speak back to the Solow-Swan framework adopted in section 2.3. The strong, causally significant contribution of crop production is consistent with the model's emphasis on productive factor inputs as drivers of output, while the negative long-run coefficient on capital formation illustrates the model's own caution that capital accumulation alone, without corresponding gains in total factor productivity and efficient allocation, need not translate into higher output a reminder that Nigeria's agricultural sector, and its broader economy, likely remain in the transitional phase the model describes, where the returns to well-directed investment and technological upgrading are still substantial but have yet to be fully realized.

More broadly, the results suggest that Nigeria's path to faster and more diversified growth runs less through the sheer scale of investment or workforce expansion than through the productivity and targeting of both: directing capital toward tradable, productivity-enhancing uses in agriculture, and equipping the

labour force with the skills to make use of it, appear, on this evidence, more promising levers than expanding aggregate investment or employment in isolation.

Recommendations

Arising from the findings, the study puts forward the following recommendations. First, government at the federal and state levels should prioritize investment in crop production, through subsidized inputs, expanded rural road and irrigation infrastructure, and strengthened extension services, given its demonstrated position as the strongest and most causally significant driver of growth among the sub-sectors examined; targeted support for staple and export crops alike would help consolidate this contribution while also addressing Nigeria's persistent food-import bill.

Second, policymakers should design targeted credit and insurance schemes for fisheries operators and invest in aquaculture technology, hatchery development, and post-harvest processing and cold-chain facilities, so as to consolidate the sub-sector's positive long-run contribution and help close the substantial gap between Nigeria's fish consumption needs and domestic production identified in the conceptual review.

Third, the Federal Government and Budget Office should review the composition and execution rate of public capital expenditure, prioritizing the completion of productivity-enhancing agricultural and agro-allied projects over the initiation of new, poorly monitored ones, and should examine why aggregate capital formation has not translated into higher measured growth, with a particular view to redirecting investment away from non-tradable and rent-seeking uses and toward tradable, productivity-enhancing sectors including agriculture.

Fourth, policy attention should shift from merely expanding the size of the workforce to improving its quality, through agricultural skills training, vocational education, and support for youth entrepreneurship in agribusiness and agro-processing, so that labour force growth translates into productivity gains rather than disguised underemployment. Finally, given the uneven track record of past agricultural interventions discussed in the literature review, future programmes should build in independent monitoring and evaluation from inception, so that policy learning from earlier schemes such as the Anchor Borrowers' Programme can inform the design of subsequent interventions.

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