AGRICULTURE AND POVERTY REDUCTION: A NIGERIAN PERSPECTIVE

David-Wayas, Onyinye Maria[1], Nwankwo, Michael C.[2], Nana, Danielle W.[3]

Department of Economics, University of Nigeria, Nsukka[1,2,3]

Abstract:
This study investigates the role of agriculture in poverty reduction in Nigeria from 1998 to 2024 using an Autoregressive Distributed Lag (ARDL) bounds testing approach. The research specifically assesses the long-run and short-run effects of agricultural productivity, credit access, and value-chain development on poverty reduction employing an Autoregressive Distributed Lag bounds testing approach to co-integration. Gross Domestic Product per capita is used as a robust proxy for poverty reduction. The findings confirm a stable long-run relationship among the variables. The results reveal that agricultural productivity, agricultural credit, and manufacturing output have a statistically significant and positive impact on poverty reduction in the long run. Conversely, government expenditure on agriculture and road infrastructure were found to be statistically insignificant, suggesting issues with the efficiency, targeting, or level of this spending. The Error Correction Model indicates a slow adjustment speed of 0.54% from short-run disequilibrium to long-run stability. The study concludes that enhancing agricultural productivity, expanding inclusive financing for farmers, and promoting agro-industrialization is crucial for poverty alleviation. It recommends that policy should not only focus on increasing budgetary allocations but, more critically, on ensuring the strategic efficiency and impact of public expenditure in the agricultural sector.

JEL Classification: O13, I32
Keywords: Agriculture; Role; Poverty Reduction; Nigeria; Perspective

1. INTRODUCTION

Agriculture has been the pillar of Nigerian society for millennia. Pre-colonial economies were based on diverse and productive food systems, such as the southern and northern yam and millet belts, which generated a high level of food sovereignty (Bassett, 2001). The colonial era (1884–1960) largely disrupted this equilibrium by remapping agricultural practice and policy in the form of export monocultures (palm oil, groundnuts, etc.), programmatically shifting land, labor, and political attention away from local food security toward extractive commodity production for international markets (Amin, 1972). This paradigmatic revolution established a long-term trajectory that benefited export income over local subsistence. The post-independence oil boom of the 1970s significantly amplified this neglect to an unprecedented level, as petroleum revenues eclipsed those from agriculture, stifled policy innovation, and widened a broad rural-urban divide. This formalized a model where, despite employing the majority of workers, agriculture became the be-all of high poverty and hunger. Nowadays, nearly 60% of rural families are still stuck in poverty, a direct result of policies that broke the natural connection between agriculture and community sustenance (World Bank, 2023).

Agriculture is one of the most effective tools to eliminate extreme poverty and boost economies. Growth in agriculture is two to three times more effective at reducing poverty than growth in other sectors (World Bank, 2018). This conclusion stands regardless of the method used or the poverty measures applied, with the greatest effects seen among the poorest populations. This is known in development economics as the "agricultural multiplier effect." The main reason is that agriculture is not just another sector; for many developing countries, it forms the backbone of the economy and serves as the primary safety net for the poor. Traditionally, the Nigerian economy had been agricultural in orientation before the discovery of oil in the late 1950s. During the 1960s, agriculture was the foundation of the economy, with more than 60% of GDP and more than 70% of export earnings, and with the country being a leading world exporter of palm oil, groundnuts, cocoa, and rubber (Central Bank of Nigeria, 2019). But the 1970s oil boom brought severe neglect of the agricultural sector, a situation widely described as "Dutch Disease." This caused a dramatic reversal from a net exporter of agriculture to a net food importer, with falling productivity, rural infrastructure underinvestment, and rising rural poverty.

Agriculture is a key part of the Nigerian economy. It employs about 34.31% of the workforce (World Bank, 2023) and contributes around 24% to the GDP in 2024. However, the latest figure for 2024 is 20.35%, which is down from 22.72% in 2023. In comparison, the worldwide average sits at 9.68%, drawing from data from 151 countries. Historically, Nigeria's average from 1981 to 2024 is 22.84%. The lowest value recorded was 12.24% in 1981, while the highest was 36.97% in 2002.

Figure 1: Agriculture contribution to Nigeria's GDP (1990- 2024).

(Insert figure 1 here)

Figure 1 shows the contribution of agriculture to Nigeria's GDP from 1990 to 2024. In the 1990s, agriculture contributed between 21% and 28% of GDP, before dropping sharply around 2000. The sector peaked in 2002 at about 37%, the highest value recorded during the period. After this peak, the contribution declined steadily, stabilizing between 20% and 24% from 2008 onwards. By 2024, agriculture accounted for about 20% of GDP. This indicates that while agriculture remains important, its relative share in Nigeria's economy has reduced over time.

The majority of the studies reviewed (Ogunniyi & Kehinde, 2015; Wossen et al., 2019; Ayanwale & Bamire, 2021) examined the impact of specific agricultural technologies or interventions on poverty at the micro-level, using household surveys and treatment-effect models. Meanwhile, other studies (Omotayo & Aderemi, 2017; Adegbite & Yusuf, 2024) used macro-level time-series data to establish a long-run relationship between broad agricultural output and poverty. However, few studies have integrated these approaches by using a macro-econometric framework to test the specific impact of key agricultural inputs, such as credit and value-chain development, on national poverty indicators. This study fills this gap by employing an Autoregressive Distributed Lag (ARDL) model to investigate the dynamic relationship. Furthermore, many of the domestic studies (Nwankwo & Akonu, 2019; Adedayo & Falade, 2019) focused heavily on descriptive statistics and primary data from specific regions, which limits the generalization of their findings. This creates a methodological gap for a comprehensive national analysis. To this end, this study utilized secondary time-series data from national sources like the CBN and World Bank, applying a robust econometric technique to provide a unified national perspective. In addition, foreign studies (Diao et al., 2016; World Bank, 2020) provide excellent diagnostic and simulation-based evidence; there is a lack of rigorous, econometric testing of the long-run co-integrating relationship between agricultural productivity (as opposed to general output) and poverty reduction in Nigeria. This study will explicitly employ the ARDL Bounds test to formally establish this long-run relationship. Against this backdrop, the present study is motivated by three objectives. First, to investigate the key constraints that limits the role of agriculture in poverty reduction in Nigeria. Second, assess the long-run and short-run effects of agricultural productivity, credit access, and value-chain development on poverty reduction in Nigeria. Third, examine how improvements in agricultural credit and value-chain development influence or strengthen the poverty-reducing impact of agricultural productivity in Nigeria. The findings of previous studies in this sector will be validated or disproved after this investigation. It will also contribute to the growing body of empirical studies that future scholars will have access to and as well offer useful insight for Nigeria's development policy.

II. MATERIALS AND METHODS

Data Source and Software Packages

This study employs quarterly secondary time series data that spans from 1998 to 2024. All variables were indexed. The data were obtained from different sources such as CBN Statistical Bulletin, Food and Agriculture Organization (FAO) statistics and World Development Indicators. The data were left in the raw form except real GDP and Agricultural Credit Scheme (ACGS). Most of data were not logged because they are rate. The statistical program utilized in the computation, modification, and preliminary analysis of data for this investigation is Microsoft Excel 16.0. All essential econometric tests and estimations for this empirical study, including the Autoregressive Distributed Lag (ARDL) bounds testing procedure, were conducted using E-views 13.0 econometrics software. Both packages were chosen because they have appealing user interfaces, are intuitive to use, are mathematically robust, and, most importantly, are well-suited for the sophisticated time-series estimation procedures and diagnostic tests utilized in this study.

Variables

- **DependentVariable: Gross Domestic Product Per Capita (Constant International Dollar), PPP (GDPPC)**

Gross Domestic Product per capita, PPP (constant 2021 international $) is the gross domestic product converted to international dollars using purchasing power parity rates and divided by the total population. An international dollar has the same purchasing power over GDP as a

U.S. dollar has in the United States. The selection of GDP per capita, PPP is critically justified by its role as a robust proxy for the poverty headcount ratio in this study. While the poverty headcount ratio directly measures the proportion of the population below the poverty line, data constraints often limit its use in time-series analyses. GDP per capita, PPP was chosen as the best proxy because it accounts for the relative cost of living and inflation rates across countries, providing a more accurate and comparable measure of the average individual's economic well-being and purchasing power within a nation.

- **Core Explanatory Variables:**

  - ***Agricultural Productivity (AGPROD)***
    Agricultural productivity refers to the ratio of agricultural outputs to agricultural inputs. It essentially measures the efficiency of the agricultural sector in converting land, labor, capital, and other resources into food and cash crops. This variable is included because enhancements in agricultural productivity are fundamental to economic development and poverty reduction. Higher productivity leads to increased food supply, which stabilizes food prices and improves food security. It also boosts the incomes of the majority of the population who depend on agriculture, thereby directly increasing their purchasing power and reducing poverty.
  - ***Agricultural Credit (AGRCRED)***
    Agricultural credit refers to the provision of loans, advances, and other financial services to farmers and agribusinesses to fund their production activities, purchase inputs, and invest in technology. Access to credit is a critical constraint for farmers in developing countries. Agricultural credit schemes provide the necessary capital for farmers to invest in improved seeds, fertilizers, machinery, and irrigation systems, which are essential for enhancing productivity. By easing capital constraints, agricultural credit enables farmers to increase their output and income, which has a direct and positive effect on their welfare and, by extension, on GDP per capita.
  - ***Manufacturing-Food, Beverages & Tobacco (MANUFAC)***
    This variable measures the total output of the manufacturing subsector comprising food processing, beverages, and tobacco. It represents value-added in this specific industrial segment. The manufacturing sector, particularly food and beverages, is a vital link between agriculture and the broader economy. A robust manufacturing sector in this domain creates demand for agricultural raw materials, provides stable markets for farmers, and adds significant value to primary products. This not only stabilizes agricultural incomes but also creates employment opportunities in processing, packaging, and distribution. The growth of this subsector is therefore a key indicator of industrial diversification and structural transformation away from a primary-product-dependent economy, which is crucial for sustainable increases in GDP per capita.

Descriptive and Correlation Analysis

Before estimating the ARDL model for this study, we conducted a series of pre-estimation tests to check the statistical properties of the time-series variables used. These tests help to avoid spurious regression and ensure that the long-run and short-run estimations are valid. The pre-estimation procedures include the unit root test and the ARDL Bounds test for co-integration.

Unit Root Test/ Stationarity Test

We carried out a stationarity test to examine the time-series characteristics of all the variables used in the model. For a time-series variable to be accurately estimated in a dynamic model, it must show time-invariant properties. This means the mean, variance, and covariance should remain constant over time. In other words, the stationarity test checks whether the statistical features of each variable change over time. The unit root test identifies the order of integration of each variable, whether I(0), I(1), or I(2). The ARDL Bounds Testing approach works only when the variables are integrated of order zero, I(0), order one, I(1), or a mix of both. If any variable is integrated of order two, I(2), the ARDL Bounds test cannot be used. While several unit root tests are available, this study uses the Augmented Dickey-Fuller (ADF) test to determine the stationarity properties of the variables used in the model.

Bounds Test for Co-integration

A co-integration test checks whether the variables share a stable long-run relationship. Co-integration is crucial in time-series econometrics because it avoids spurious regression by verifying whether variables move together in the long run. When the residuals from the estimated model are stationary, the variables are considered co-integrated. Among different co-integration techniques, the ARDL Bounds Test is preferred for several reasons; It addresses potential endogeneity among explanatory variables, It works whether the variables are I(0), I(1), or a combination of both, It performs well even with relatively small sample sizes, such as quarterly Nigerian data from 1990 to 2024. Using the ARDL Bounds Test, we expect the following outcomes: If no co-integration exists, we can estimate a short-run ARDL model, if co-integration exists; both the long-run model and the Error Correction Model (ECM) must be estimated.

Model Specification

This empirical study employs an autoregressive distributed lag (ARDL) bounds testing approach to co-integration as first proposed by Pesaran and Shin (1999) and later modified by Pesaran et al. (2001). An ARDL model estimates the dynamic relationship between a dependent variable and explanatory variables. The choice of the ARDL approach in this study is based on its flexibility, which means it can be applied when the variables are in different orders of integration, specifically when the variables are integrated of I(0) and I(1). It can also be applied in studies with a small sample size (Pesaran et al., 2001). Moreover, the

ARDL approach can estimate the long-run and short-run parameters of the model simultaneously. This study specifies a model where GDP per capita is the dependent variable, reflecting overall economic prosperity, which is intrinsically linked to poverty reduction. The explanatory variables are categorized into core agricultural variables and macroeconomic control variables. The model is first specified in its general form, after which separate models are specified for each of the study's three specific objectives.

The Functional Form of the Model is specified as:

$GDPPC_t$ =f($AGPROD_t$,$AGRCRED_t, MANUFAC_t$,$GDP\_GR_t, CPI_{t,}$ $GOVTEXP\_AGR_{t,}GOVTEXP\_-RD_t$) ……………………(1)

The Mathematical Form of the Model is specified as:

$$GDPPC_t = \beta_0 + \beta_1 AGPROD_t + \beta_2 AGRCRED_t + \beta_3 MANUFAC_t + \beta_4 GDP\_GR_t + \beta_5 CPI_t + \beta_6 GOVVTEXP\_AGR_t + \beta_7 GOVVTEXP\_RD_t \text{……………..(2)}$$

The Econometric Form of the Model is specified as:

$$GDPPC_t = \beta_0 + \beta_1 AGPROD_t + \beta_2 AGRCRED_t + \beta_3 MANUFAC_t + \beta_4 GDP\_GR_t + \beta_5 CPI_t + \beta_6 GOVVTEXP\_AGR_t + \beta_7 GOVVTEXP\_RD_t + \mu_t \text{…………..(3)}$$

Where:

Dependent variable

$GDPPC_t$ =Gross Domestic Product per capita (constant 2021 international $) at time t

Independent variables

$AGPROD_t$ = Agricultural Productivity at time t

$AGRCRED_t$ = Agricultural Credit at time t

$MANUFAC_t$ = Manufacturing (Food, Beverages & Tobacco)

Control Variables:

GDP_GR_t = Gross Domestic Product growth Rate at time t

CPI_t= Inflation (Consumer Price Index) at time t

$GOVTEXP\_AGR_t$= Government Expenditure on Agriculture at time t

$GOVTEXP\_RD_t$ = Government Expenditure on Infrastructure Construction at time t

μ_t = The stochastic error term at time t

β_0 = The constant or intercept term

β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 = The regressor parameters and slopes of the respective explanatory variables.

The Generalized specification of the ARDL model:

$Yt = \alpha oj + \sum \varphi 1iYt{-}ipi{=}1 \sum \varphi 2iXt{-}ipi{=}1 + \mu t$

• p = optimum lag length for the predicted parameter.

• q = optimum lag length for the predictors

ARDL specification for the model is given below:

$$\Delta LGDPPCt = \alpha_o + \sum_{i=1}^{p} \emptyset i\, \Delta LGDPPC_{t-i} + \sum_{i=0}^{q1} \beta 1i\, \Delta LAGPROD_{t-i} + \sum_{i=0}^{q2} \beta 2i\, \Delta LAGRCRED_{t-i} + \sum_{i=0}^{q3} \beta 3i\, \Delta LMANUFAC_{t-i} + \sum_{i=0}^{q4} \beta 4i\, \Delta GDP\_GR_{t-i} + \sum_{i=0}^{q5} \beta 5i\, \Delta CPI_{t-i} + \sum_{i=0}^{q6} \beta 6i\, \Delta GOVTEXP\_AGR_{t-i} + \sum_{i=0}^{q7} \beta 7i\, \Delta GOVTEXP\_RD_{t-i} + \gamma_1 LGDPPC_{t-1} + \gamma_2 LAGPROD_{t-1} + \gamma_3 LAGRCRED_{t-1} + \gamma_4 LMANUFAC_{t-1} + \gamma_5 GDP\_GR_{t-1} + \gamma_6 CPI_{t-1} + \gamma_7 GOVTEXP\_AGR_{t-1} + \gamma_7 GOVTEXP\_RD_{t-1} + \gamma t + \mu_t \ldots\ldots(4)$$

The variables (LGDPPC, LAGPROD, LAGCRED, LMANUFAC, GDP_GR, CPI, GOVTEXP_AGR, GOVTEXP_RD) and other similar terms with equation (4) remain the same as earlier defined. Where, Δ is the first difference operator, and $\alpha 0$ is the drift component. The expressions with summation sign (α1-α7) represent the short-run dynamics of the model, while the coefficients (γ1-γ7) represent long-run relationship, and μt is the serially uncorrelated disturbance with zero mean and constant variance.

III RESULTS

Descriptive Statistics

Table 1: Descriptive Statistics Results

(Insert Table 1 here)

Table 1 shows the summary statistics of the nature of the data set used in this study. Each variable has a mean, median, the maximum and minimum value, standard deviation, skewness, kurtosis, the Jarque-Bera statistic, and its probability. The mean values depict the average of each variable used in the study. The standard deviation is a measure of dispersion. It indicates how far or how close the data is dispersed in relation to its mean. From the result above, it can be observed that all the variables in the data set have low dispersion. This means that the values of the observation are closer to its mean value.

The skewness and kurtosis are also significant here. Skewness is a measure of the degree of asymmetry in a time series. For skewness, it can be near zero (symmetrical distribution), have a positive value (right-skewed distribution, i.e., longer right tail), or a negative value (left-skewed distribution, i.e., longer left tail). Skewness value of less than -1 or greater than 1 is said to be highly skewed. From the result, CPI and AGRCRED are highly skewed to the right. GOVTEXP_AGR, GOVTEXP_RD, MANUFAC, and GDP_GR have a longer right tail, whereas GDPPC and AGPROD have a longer left tail.

For kurtosis, it can be a normal distribution (near 3), a leptokurtic distribution (high peak, i.e., greater than 3), or a platykurtic distribution (flat peak, i.e., less than 3). From the result, GDP_GR, CPI, and AGRCRED are greater than 3, indicating a high peak, where as GDPPC, GOVTEXP_AGR, GOVTEXP_RD, MANUFAC, and AGPROD are less than 3, indicating a flat peak.

The Jarque-Bera test statistic is used to check if the data set is normally distributed. If the p-value of the JB test statistic is less than 0.05, then we reject the null hypothesis of normality and conclude that the variable of interest is not normally distributed. From the result above, GDPPC and GOVTEXP_RD are normally distributed, whereas GOVTEXP_AGR, MANUFAC, GDP_GR, CPI, AGRCRED, and AGPROD. Also, from the observation of the mean, the maximum, and the minimum values, we can conclude that there is no presence of outliers in the time series data.

Correlation Patterns

Table 2: Correlation Matrix of Variables

(Insert Table 2 here)

Table 2 shows the correlation matrix which depicts the relationship among the various variables used for this analysis. Multicollinearity exists if the independent variables are correlated with each other up to 0.80. From the table above, none of the independent variables are correlated with another up to 0.80, therefore it can be concluded that there is no presence of multicollinearity among the explanatory variables used in this study.

Unit Root and Integration Order

The unit root test is conducted to check the stationarity properties of the variables used in this study, that is, the behavior of the variables over time.

Table 3: Unit Root Test Result

(Insert Table 3 here)

Table 3 reports ADF results. None of the variables is integrated of I(2), validating ARDL. Gross Domestic Product per capita (LGDPPC) and Agricultural Productivity (LAGPROD) are I(0), while Agricultural Credit, Manufacturing (Food, Beverages & Tobacco), GDP Growth Rate, Inflation (Consumer Price Index), Government expenditure on Agriculture, and Government Expenditure on Roads are I(1). This mix of I(0) and I(1) confirms ARDL suitability.

Optimum Lag Selection

The choice of an optimum lag is critical in the estimation of the Autoregressive Distributed Lag (ARDL) model. The reason is that too many lags in the model leads to a loss of the degree of freedom.

Decision Rule: Select the lag length across the different information criteria with the least asterisked value. The least value best minimizes the error of the model**.**

Table 4: Lag-Length Estimation Result

(Insert Table 4 here)

Table 4 reports lag-length estimation results. AIC (Akaike Information Criterion) yields the least (asterisked value) as shown in table 4. It suggests an optimum lag length of 4. Hence, this study uses a lag length of 4.

Cointegration Test

This test is done in order to avoid spurious regression. When the variables used in the model are not all stationary at levels that is if some are integrated at first order. Then, the cointegration test is used to ascertain if there is an existence of a long run relationship between the variables by verifying if their linear combination is stationary at levels. This study adopts the Bounds Test.

Null Hypothesis (H_0): There is no cointegration

Alternative Hypothesis (H_1): There is cointegration

Decision Rule:

Reject H0 if the f-statistic is greater than the upper critical boundary at 5% level of significance. Otherwise, do not reject and conclude that there is no stable long run relationship.

Table 5: Bounds Test Cointegration Result

(Insert Table 5 here)

In table 5, since the f-statistic 5% level of significance is greater than both the upper and lower bounds, we conclude that there is a long-run relationship among the variables. The existence of cointegration makes it possible for the estimation of a long-run model in this study.

Regression Results

Table 6: Long-run Regression Results

(Insert Table 6 here)

The coefficient of LAGPROD is 0.034440, indicating that if all other variables in the model are held constant, a 1% increase in Agricultural Productivity leads to a 34% (constant 2021 international $) increase in Gross Domestic Product per capita, PPP in Nigeria in the long run. The coefficient of this variable is statistically significant. This means that Agricultural Productivity affects the Gross Domestic Product per capita positively. The coefficient of LAGRCRED is 0.001421, which shows that if all other variables in the model are held constant, a percentage increase in LAGRCRED leads to about 0.14% (constant 2021 international $) increase in Gross Domestic Product per capita, PPP in Nigeria in the long run. The coefficient of this variable is statistically significant. This means that the rate agricultural credit scheme affects the Gross Domestic Product per capita, PPP positively. The coefficient of LMANUFAC is 0.042691,which shows that if all other variables in the model are held constant, a percentage increase in LMANUFAC leads to 4%(constant 2021 international $) increase in Gross Domestic Product per capita, PPP in Nigeria in the long run. The coefficient of this variable is statistically significant. This means that manufacturing (Food, Beverages & Tobacco) affects the Gross Domestic Product per capita, PPP, positively.

Error Correction Model/ Short-run Model

Table 7: Error Correction Model (ECM) Representation.

(Insert Table 7 here)

Table 7 reports the ECM results. With a negative sign, the parameter of the error correction term which co-integrates the long-run and short-run effects shows conformity with economic expectations, suggesting the possibility of adjusting the lags or disequilibrium in the long run. The Error correction model has a coefficient of -0.005390 and it is statistically significant. This means that the disequilibrium in the model will be corrected or adjusted by 0.54% within the short-run period.

Summary of Findings

In examining the impact of agriculture on poverty reduction in Nigeria, this study modelled the relationship between agricultural variables and economic welfare by adopting the log of Gross Domestic Product per capita (LGDPPC) as the dependent variable, serving as a proxy for poverty reduction. The core independent variables of interest are agricultural productivity, agricultural credit, and manufacturing output. Other explanatory variables include; GDP growth rate, inflation, government expenditure on agriculture, and government expenditure on road infrastructure. The Autoregressive Distributed Lag (ARDL) technique was adopted for this analysis. The unit root test showed that while some variables, like LGDPPC and LAGPROD, were stationary at levels, the rest were integrated at order 1. The co-integration result confirmed the presence of a long-run relationship among the variables.

In the model, the t-test shows that the log of Agricultural Productivity (LAGPROD), the log of Agricultural Credit (LAGRCRED), the log of Manufacturing output (LMANUFAC), and the GDP Growth Rate (GDP_GR) are statistically significant whereas Inflation (CPI), Government Expenditure on Agriculture (GOVTEXP_AGR), and Government Expenditure on Roads (GOVTEXP_RD) are not statistically significant. The F-test reveals that the overall model is statistically significant. The coefficient of determination (R^2) shows that the independent variables explain up to 99.99% of the variations in the dependent variable, LGDPPC. This shows a very strong goodness of fit.

From the findings, this study suggests that agricultural productivity, agricultural credit, and manufacturing output positively and significantly affect poverty reduction (proxied by GDP per capita) in Nigeria in the long run. It also establishes that there is a stable long-run relationship between these agricultural factors and economic welfare. To account for the dynamics of adjustment, the Error Correction Model (ECM) establishes that any short-run disequilibrium in the model will be corrected and adjusted back to long-run equilibrium at a speed of approximately 0.54% per period.

Policy Implications

The significant positive impact of Agricultural Productivity (LAGPROD) on poverty reduction implies that policies designed to boost farm output are fundamental to improving economic welfare. Investing in the dissemination of improved seed varieties, modern farming techniques, and sustainable land management practices will directly increase the incomes of the majority of the population who depend on agriculture. This rise in rural incomes will stimulate demand for local goods and services, creating a positive multiplier effect throughout the rural economy. However, to be truly effective, these productivity gains must be supported by parallel investments in storage and processing facilities to minimize post-harvest losses and stabilize farmers' earnings.

The statistically significant and positive relationship between Agricultural Credit (LAGRCRED) and GDP per capita implies that enhancing access to finance is a critical constraint that must be addressed. Policies that expand the reach of formal credit to smallholder farmers will enable them to invest in productivity-enhancing technologies, quality inputs, and machinery. This will facilitate their transition from subsistence to commercial farming. The development of innovative financial products tailored to agricultural cycles, such as crop-specific loans with flexible repayment schedules, along with the use of mobile banking to reach remote farmers, can significantly de-risk farming and unlock its full potential as an engine for poverty reduction.

The strong positive effect of manufacturing output, specifically in Food, Beverages, and Tobacco (LMANUFAC) on welfare implies that policies promoting agro-industrialization are crucial. By adding value to raw agricultural produce domestically, the sector creates stable market demand for farmers, generates higher-wage employment beyond the farm gate, and reduces the nation's dependency on imported food items. Encouraging private investment in agro-processing through incentives and the development of staple crop processing zones will create backward and forward linkages, stabilize agricultural incomes, and drive structural transformation of the economy away from primary production.

The statistically insignificant result for Government Expenditure on Agriculture (GOVTEXP_AGR), despite its positive sign, carries a critical implication. It suggests that the current level and/or efficiency of public spending in agriculture are insufficient to yield a significant impact. This implies that policy must focus not just on increasing budgetary allocations but, more importantly, on ensuring that funds are effectively channeled to high-impact areas. This includes transparent implementation of input subsidy programs, revitalizing extension services to ensure knowledge transfer, and investing in rural infrastructure like irrigation and feeder roads that directly reduce production costs and market access barriers for farmers.

The unexpected negative and insignificant coefficient for Government Expenditure on Roads (GOVTEXP_RD) implies a potential issue with the quality, targeting, or maintenance of infrastructure projects. It suggests that merely increasing capital expenditure on road construction without ensuring strategic placement to connect agricultural hubs to markets, or without proper maintenance, may not yield the expected positive economic returns. The policy implication is a need for a strategic re-evaluation of infrastructure investments to prioritize cost-benefit analysis, ensure quality control, and focus on projects that directly enhance agricultural value chain efficiency and reduce logistics costs.

Policy Recommendations

The results show that agricultural productivity, agricultural credit, and manufacturing output are significant drivers of poverty reduction in Nigeria. To harness the full potential of the agricultural sector and its linkages to industry for improving economic welfare, this study proposes the following recommendations to the Government of Nigeria:

First, the government, in partnership with development organizations, should intensify efforts to boost farm yields. This can be achieved by establishing a robust system for the widespread distribution of high-yielding and climate-resilient seed varieties, promoting efficient fertilizer use, and supporting mechanization through the establishment of tractor-hiring schemes. The significant positive result for agricultural productivity confirms that such direct interventions to raise output per hectare are fundamental to increasing farmer incomes and national food security.

Second, given the significant positive impact of agricultural credit, there is an urgent need to bridge the financing gap for smallholder farmers. The government should work with the Central Bank of Nigeria to strengthen the implementation of existing credit schemes, ensuring they actually reach the intended beneficiaries. Furthermore, promoting the development of innovative financial products, such as index-based crop insurance and digital lending platforms tailored to farmers with no formal collateral, will de-risk agricultural production and encourage much-needed investment in the sector.

Third, to leverage the strong positive impact of manufacturing, the government should actively promote investment in agro-processing. This can be done by providing targeted incentives for establishing small and medium-scale industries in rural areas, developing Staple Crop Processing Zones (SCPZs) with reliable infrastructure, and enforcing policies that reduce the importation of finished goods that can be produced locally. This will create jobs, stabilize prices for agricultural produce, and capture more value within the Nigerian economy.

Fourth, the finding that government expenditure on agriculture is statistically insignificant, calls for a strategic review of public spending in the sector. It is recommended that the government shift focus from mere increases in budgetary allocation to ensuring the efficiency, transparency, and impact of every Naira spent. Funds should be strategically directed towards high-impact projects like rural feeder road maintenance, irrigation infrastructure, and effective extension services, with robust monitoring and evaluation frameworks to track outcomes.

Fifth, for government expenditure on roads to yield the expected positive economic returns, a new implementation model is required. The government should prioritize the rehabilitation and maintenance of existing roads that connect agricultural production zones to markets over the construction of new ones. Public investment in infrastructure must be guided by a detailed cost-benefit analysis to ensure it directly reduces logistics costs, minimizes post-harvest losses, and improves the profitability of farming.

Conclusion

The role of agriculture in poverty reduction in Nigeria is a fundamental issue with significant implications for national development. Utilizing time-series data and a robust econometric framework, this study has provided empirical validation for the critical importance of agricultural productivity, credit, and agro-industrialization. The findings affirm the central tenets of agricultural-led growth theories and establish a clear, significant link between targeted investments in the sector and improvements in economic welfare, as measured by GDP per capita. From these results, concrete policy recommendations have been developed to enhance the sector's contribution to poverty alleviation. Consequently, the government, private investors, development partners, agribusiness firms, and policymakers need to consider and refine these evidence-based recommendations into a practical and effective strategy for revitalizing Nigeria's agricultural sector and fostering inclusive economic growth.

Conflict of Interest

The authors declare that they have no conflict of interest. This research utilized publicly available secondary data and did not involve human participants or animals.

Ethical Approval

All data used in this study are publicly accessible through the central bank of Nigeria Statistical Bulletin, Food and Agriculture Organization (FAO) statistics, and World Bank's World Development Indicators.

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APPENDICES

Tables

Table 1: Descriptive Statistics (1998 – 2024)

	GDPPC	GOVTEXP_AGR	GOVTEXP_RD	MANUFAC	GDP_GR	CPI	AGRCRED	AGPROD
Mean	**4934.533**	**41.22823**	**100.4475**	**3794.414**	**4.733528**	**13.41239**	**537644.4**	**2577.903**
Median	**5418.807**	**38.54908**	**92.67446**	**2663.718**	**4.693564**	**12.51557**	**257256.6**	**2826.240**
Maximum	**6021.606**	**104.6544**	**279.2789**	**11142.22**	**15.96204**	**32.65155**	**2911060.**	**3452.114**
Minimum	**3213.778**	**-42.19978**	**-3.447027**	**557.0257**	**-2.179304**	**4.896071**	**26918.75**	**1030.799**
Std. Dev.	**904.8177**	**28.60888**	**81.62573**	**3058.364**	**3.560771**	**5.580602**	**711539.3**	**796.4585**
Skewness	**-0.73442**	**0.213884**	**0.472220**	**0.960311**	**0.554661**	**1.153167**	**1.814978**	**-0.76949**

	8							3
Kurtosis	**2.098024**	**2.639311**	**2.025988**	**2.786538**	**4.234477**	**4.779819**	**5.404194**	**2.223804**
Jarque-Bera	**13.36996**	**1.408872**	**8.283009**	**16.80458**	**12.39539**	**38.19119**	**85.30531**	**13.36930**
Probability	**0.001250**	**0.494387**	**0.015899**	**0.000224**	**0.002034**	**0.000000**	**0.000000**	**0.001250**
Sum	**532929.5**	**4452.648**	**10848.33**	**409796.7**	**511.2210**	**1448.539**	**58065594**	**278413.6**
Sum Sq. Dev.	**87600375**	**87576.09**	**712915.3**	**1.00E+09**	**1356.663**	**3332.314**	**5.42E+13**	**67875031**
Observations	**108**	**108**	**108**	**108**	**108**	**108**	**108**	**108**

Table 2: Correlation Matrix of the Variable

	LGDPPC(-1)	LGDPPC(-2	LGDPPC(-3	LGDPPC(-4	LAGPROD	LAGRCRED	LMANUFAC	GDP_GR	CPI__	GOVTEXP_A	GOVTEXP_RD	C
LGDPPC(-1)	0.008168	-0.00673	0.001509	-0.00291	0.000188	-3.76E-06	-6.30E-05	-1.72E-05	1.08E-07	-5.48E-08	2.21E-07	-5.64E-05
LGDPPC(-2)	-0.006729	0.011064	-0.00556	0.001229	-4.43E-05	4.74E-06	0.000118	5.17E-06	-3.96E-08	1.41E-07	-1.43E-07	-3.66E-05
LGDPPC(-3)	0.001509	-0.00556	0.005771	-0.00178	-3.70E-05	1.11E-07	-5.68E-05	1.65E-06	3.43E-08	-8.41E-08	1.85E-08	0.000226
LGDPPC(-4)	-0.002912	0.001229	-0.00178	0.003511	-0.000113	-1.91E-06	3.21E-05	1.04E-05	-3.34E-08	3.04E-08	-1.13E-07	-0.00028
LAGPROD	0.000188	-4.43E-05	-3.70E-05	-0.00011	7.86E-05	4.93E-07	7.42E-06	-1.63E-06	9.34E-09	1.03E-08	9.87E-09	1.20E-05
LAGRCRED	-3.76E-06	4.74E-06	1.11E-07	-1.91E-06	4.93E-07	3.98E-07	3.63E-07	-5.19E-09	-5.80E-10	2.67E-09	-2.66E-09	9.03E-08
LMANUFAC	-6.30E-05	0.000118	-5.68E-05	3.21E-05	7.42E-06	3.63E-07	0.000116	-5.47E-07	7.32E-08	4.14E-08	-5.29E-08	-0.00016
GDP_GR	-1.72E-05	5.17E-06	1.65E-06	1.04E-05	-1.63E-06	-5.19E-09	-5.47E-07	8.62E-08	-9.29E-10	2.14E-10	-3.72E-10	6.91E-08
CPI__	1.08E-07	-3.96E-08	3.43E-08	-3.34E-08	9.34E-09	-5.80E-10	7.32E-08	-9.29E-10	1.24E-09	8.73E-11	-6.11E-11	-4.28E-07
GOVTEXP_AGR	-5.48E-08	1.41E-07	-8.41E-08	3.04E-08	1.03E-08	2.67E-09	4.14E-08	2.14E-10	8.73E-11	8.93E-10	-1.56E-10	-2.16E-07
GOVTEXP_RD	2.21E-07	-1.43E-07	1.85E-08	-1.13E-07	9.87E-09	-2.66E-09	-5.29E-08	-3.72E-10	-6.11E-11	-1.56E-10	1.78E-10	1.23E-07
C	-5.64E-05	-3.66E-05	0.000226	-0.00028	1.20E-05	9.03E-08	-0.000161	6.91E-08	-4.28E-07	-2.16E-07	1.23E-07	0.000737

Table 3: Unit root diagnostics (ADF). Author's Computation

Variables	**ADF Statistic (level)**	**5% critical value**	**ADF Statistic (1st diff)**	**5% critical value**	**Order of integration**
LGDPPC	**-2.975102**	**-2.889753**	**----------**	**---------**	**I(0)**

LAGPROD	-3.466289	-2.889753	----------	--------	I(0)
LAGRCRED	0.509473	-2.889753	-4.815466	-2.890037	I(1)
LMANUFAC	-1.214711	-2.888932	-3.493129	-2.888932	I(1)
GDP_GR	-1.400424	-2.889753	-4.317946	-2.890037	I(1)
CPI	0.332925	-2.889753	-3.882339	-2.890037	I(1)
GOVTEXP_AGR	-0.170926	-2.889753	-7.893530	-2.889753	I(1)
GOVTEXP_RD	0.745873	-2.889753	-5.083419	-2.890037	I(1)

Table 4: Lag Length Estimation Result. Author's Computation

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1325.560	NA	18.96078	25.64538	25.84880	25.72779
1	91.44863	2588.766	9.53e-11	-0.374012	1.456720	0.367671
2	318.5602	379.9752	4.22e-12	-3.510774	-0.052724*	-2.109816*
3	376.1659	87.51630	5.04e-12	-3.387806	1.697561	-1.327574
4	501.1436	170.6427*	1.73e-12*	-4.560455*	2.152230	-1.840949

Table 5: Bounds Test Co-integration Results. Author's computation

F-statistic	28.707968	
	Critical Value Bounds	
Significance	I (0) (Lower Bound)	I (1) (Upper Bound)
10%	1.920	2.890
5%	2.170	3.210
1%	2.730	3.900

Table 6: Long-run Regression Results. Author's Computation

Dependent Variable: LOG GDPPC

VARIABLES	Coefficient	Std.Error	t-Statistic	Prob.
C	-0.003856	0.027141	-0.142079	0.8874
LAGPROD	0.034440	0.008864	3.885495	0.0002
LAGRCRED	0.001421	0.000631	2.252474	0.0272
LMANUFAC	0.042691	0.010781	3.959988	0.0002

GDP_GR	0.007299	0.000294	24.85308	0.0000
CPI	1.04E-05	3.52E-05	0.294091	0.7695
GOVTEXP_AGR	4.64E-05	2.99E-05	1.554088	0.1243
GOVTEXP_RD	-1.78E-05	1.34E-05	-1.331182	0.1871

R-squared:0.999966

Adjusted R-squared:0.999953

F-statistic:0.999953

Prob (F-stat): 0.0000

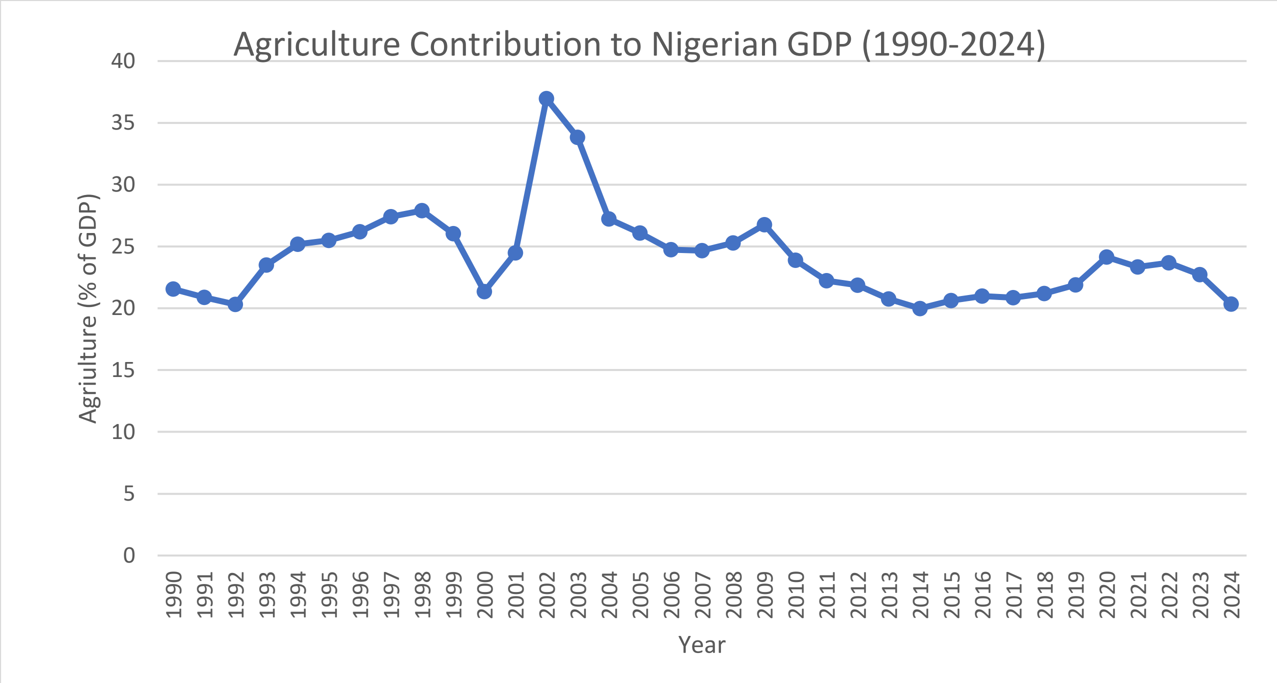
Durbin-Watson stat:1.520329

Table 7: Regression Result with ECM. Author's Computation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.005390	0.000319	-16.89878	0.0000
D(LGDPPC(-1))	-0.497968	0.084534	-5.890740	0.0000
D(LGDPPC(-2))	-0.545934	0.067758	-8.057120	0.0000
D(LGDPPC(-3))	-0.626738	0.051769	-12.10646	0.0000
D(LAGPROD)	0.034440	0.007574	4.547092	0.0000
D(LAGPROD(-1))	-0.012409	0.008999	-1.379004	0.1716
D(LAGPROD(-2))	-0.016173	0.009070	-1.783189	0.0782
D(LAGPROD(-3))	-0.022199	0.008313	-2.670191	0.0091
D(LMANUFAC)	0.042691	0.005204	8.202928	0.0000
D(GDP_GR)	0.007299	0.000252	29.01834	0.0000
D(GDP_GR(-1))	-0.000627	0.000266	-2.355188	0.0208
D(GDP_GR(-2))	-0.000448	0.000219	-2.045700	0.0439
D(GOVTEXP_AGR)	4.64E-05	2.35E-05	1.977776	0.0512
D(GOVTEXP_AGR(-1))	-6.90E-05	2.48E-05	-2.785860	0.0066
D(GOVTEXP_AGR(-2))	-7.34E-05	2.48E-05	-2.961764	0.0040
D(GOVTEXP_AGR(-3))	-8.92E-05	2.17E-05	-4.118992	0.0001
D(GOVTEXP_RD)	-1.78E-05	1.01E-05	-1.758966	0.0822
D(GOVTEXP_RD(-1))	1.51E-05	1.06E-05	1.425990	0.1576
D(GOVTEXP_RD(-2))	1.71E-05	1.04E-05	1.645487	0.1036
D(GOVTEXP_RD(-3))	2.16E-05	9.81E-06	2.203910	0.0303

Figures

Figure 1: Agriculture contributions to Nigeria's GDP (1990- 2024)



Source: Author's computation using data from World Development Indicators (World Bank, 2024)