

# Impact Of Selected Macroeconomic Variables On Agricultural Output In Nigeria (1981-2023)

Jonathan Oniore, Marvelous Aigbedion, Bako Simnom Bernice

*Department Of Economics, Bingham University, Nigeria.*

*Department Of Economics, Bingham University, Nigeria.*

*Department Of Economics, Bingham University, Nigeria.*

---

## **Abstract**

*Agriculture remains a critical driver of food security and an important source of raw materials for industrial production, thereby playing a significant role in Nigeria's overall economic growth. Despite its vast potential, the agricultural sector has been unable to adequately meet the food requirements of Nigeria's rapidly growing population, resulting in persistent gaps between food supply and demand. Macroeconomic conditions, particularly exchange rates, interest rates, inflation, and monetary policy stance, are widely recognized as key determinants of agricultural performance. Against this backdrop, this study examined the impact of selected macroeconomic variables on agricultural output in Nigeria over the period 1981–2023 using the Dynamic Ordinary Least Squares (DOLS) regression technique. The findings reveal that three out of the four explanatory variables exert a statistically significant influence on agricultural output in the long run. Specifically, the minimum lending rate to the agricultural sector, average exchange rate, and consumer price index conform to the study's a priori expectations. The results indicate that minimum lending rates extended by commercial banks are positively and significantly associated with agricultural output in the long run, suggesting that increased credit access supports agricultural productivity. Similarly, exchange rate movements exhibit a positive and significant long-run effect on agricultural output. In contrast, the consumer price index has a negative long-run impact, reflecting the adverse effects of inflationary pressures on agricultural production. However, the monetary policy rate, though statistically significant, does not align with a priori expectations, as it negatively affects agricultural output in the long run. Based on these findings, the study recommends that the Central Bank of Nigeria and commercial banks expand access to agricultural credit through targeted lending schemes such as the Anchor Borrowers' Program. Additionally, sector-specific lending to agriculture should be insulated from broad monetary tightening, alongside sustained exchange rate stabilization and effective inflation management policies.*

**Keywords:** *Agriculture; Exchange Rate; Lending Rate; Monetary Policy; and Nigeria*

---

Date of Submission: 17-02-2026

Date of Acceptance: 27-02-2026

---

## **I. Introduction**

Agriculture is the world's largest industry which employs more than one billion people and generates over \$1.3 trillion dollars' worth of food annually with pasture and cropland occupying around 50 percent of the earth's habitable land and provide habitat and food for multitude of species (Shyamoli & Arghadeep, 2022). In Africa, agriculture has been a cornerstone of African economies, contributing significantly to trade and industrial production. For instance, more than 80% of trade value and over 50% of raw materials for industries in many African countries originate from the agricultural sector (Osabohien *et al.*, 2020). Similarly, agriculture is predominant sector in the economies of most countries accounting for between 30 to 40 percent of gross domestic product and the sector is a leading source of jobs for over two-thirds of Africa's population (Saghir, 2014). Despite its essential role, the performance of agriculture in Africa has varied across countries. For example, in Nigeria, the agricultural sector remains a cornerstone of its economy playing a vital role in national development. It contributes significantly to the Gross Domestic Product (GDP), provides employment for a large segment of the population, and generates revenue through both export earnings and domestic market activities. Nigeria boasts immense potential for agricultural growth, with approximately 37 million hectares of arable land and diverse agro-ecological conditions conducive to year-round production (International Food Policy Research Institute [IFPRI], 2021). As a key driver of food security and an essential supplier to various industries, agriculture directly influences the broader trajectory of economic growth in Nigeria.

However, despite the recognized potential of agricultural sub-sector, the sector has struggled to meet the demands of Nigeria's rapidly growing population. Agricultural output and productivity has lagged behind, resulting in a widening gap between food supply and demand. The decline agricultural productivity in Nigeria, could be attributed to inadequate credit facilities, low yields of staple crops, and limited mechanization, which have kept yields below global averages (Chandio, 2019; World Bank, 2022). With an estimated population of over 200 million, Nigeria's current agricultural production is unable to meet the nation's food needs, operating at a production efficiency of less than 22% (Taiwo, 2020). This alarming discrepancy has prompted concerns about the fundamental macroeconomic factors constraining agricultural output and productivity.

From the available extant literature, macroeconomic indicators such as exchange rates, interest rates, consumer price index, and monetary policy rate have been identified to play a critical role in shaping the health and output of the agricultural sector. While these macroeconomic rates can stimulate growth and encourage investment, their volatility and misalignment with sectoral needs have often led to unintended consequences, including deregulation and market distortions. For instance, exchange rate fluctuations have weakened the purchasing power of the naira, making it more expensive for farmers to acquire imported inputs such as fertilizers, machinery, and pesticides. Similarly, Nigeria's inflationary trends, as reflected in the CPI which reached 117.34 index points in March 2025, have eroded farmers' profit margins. Rising costs for fuel, seeds, and labor continue to constrain profitability, particularly for smallholder farmers. Also, high interest rates and conservative lending practices have excluded many small-scale farmers from formal credit markets (Onwuasoanya, 2025). Similarly, smallholder farmers in developing countries often lack the necessary collateral, credit history, and other requirements to secure formal agricultural credit. This lack of access to formal credit limits their ability to invest in their farms, purchase inputs, and increase productivity, ultimately impeding the growth and development of the agricultural sector (Agbodji & Johnson, 2021).

Given the foregoing challenges, it has become increasingly important to examine the impact of selected macroeconomic variables on agricultural output in Nigeria. This understanding is critical for designing effective policies that can revitalize the sector, improve food security, and contribute to sustainable economic growth. Therefore, this paper provided a comprehensive analysis of how macroeconomic variables such as minimum lending rate by Commercial Banks to agriculture, Monetary policy rate, average exchange and consumer price index impact agricultural output in Nigeria. While existing literature has addressed broader economic trends or isolated agricultural issues, there remains a significant gap in studies that specifically and holistically assess these macroeconomic variables in the context of Nigeria's agricultural output and productivity. Addressing this gap is essential to unlocking the sector's full potential and ensuring that it contributes effectively to national development.

## **II. Literature Review**

### **Conceptual Review**

#### **Macroeconomic Rates**

Macroeconomic variables are vital indicators that reflect the overall health and performance of an economy (Vincent, 2019). Some of these variables are interest rate, exchange rate, inflation (captured through the Consumer Price Index), and monetary policy rate—are instruments utilized by governments and regulatory bodies to achieve core macroeconomic objectives such as price stability, sustainable economic growth, and a balanced external sector. They influence resource allocation, production decisions, and the overall economic environment. The extent of their impact on national development can be either beneficial or detrimental depending on prevailing conditions and policy effectiveness.

#### **Interest Rate**

The International Monetary Fund (IMF, 2025) defines the interest rate as the cost of borrowing money, usually expressed as a percentage of the principal amount. It plays a critical role in shaping credit availability, investment behavior, and consumption patterns. Alafif (2023) further explains that interest rates are foundational to economic decision-making, influencing borrowing, saving, and investing. They are determined by factors such as credit demand and supply, inflation expectations, and monetary policy. Alafif emphasizes that changes in interest rates significantly affect the broader economy. High interest rates often discourage investment and consumption, while lower rates encourage economic activity. Similarly, the Central Bank of Nigeria (CBN, 2016) highlights the role of interest rates in enabling credit flow within the economy, asserting that interest rates are instrumental in facilitating the intermediation function of financial institutions.

In the agricultural sector, interest rates have a direct effect on production and investment decisions. Access to affordable credit is crucial for farmers and agribusinesses to acquire inputs such as seeds, fertilizers, and equipment. High interest rates, often associated with inflationary pressures or restrictive monetary policies, can raise financing costs, discouraging investment in agriculture. Conversely, lower interest rates can enhance access to credit, encouraging investment in infrastructure and modern technology, thereby improving

productivity and food security. As noted by Illiyasu (2019), favorable interest rates can incentivize agricultural production by increasing credit availability and reducing tax burdens associated with production.

### **Exchange Rate**

Exchange rate is the price of one currency in terms of another is a critical macroeconomic variable with profound implications for trade, inflation, and economic competitiveness. The Central Bank of Nigeria (CBN, 2017) defines it as the current market rate at which one national currency is exchanged for another. Mordi (2006, as cited by CBN) describes the exchange rate as a dual-purpose instrument: it maintains international competitiveness and acts as a nominal anchor for domestic prices. Exchange rate movements significantly influence Nigeria's agricultural sector, which relies heavily on imported inputs such as machinery, fertilizers, and agrochemicals. Depreciation of the local currency increases the cost of these imports, leading to higher production costs and reduced profitability for farmers. Consequently, output may decline due to unaffordable input costs. On the other hand, a depreciated currency can enhance the export competitiveness of Nigerian agricultural products by making them cheaper in international markets. However, this benefit may be offset by the increased cost of imported inputs, thereby creating a dual-edged effect. The overall impact of exchange rate fluctuations on agriculture thus depends on the balance between increased export potential and rising input costs.

### **Consumer Price Index (CPI)**

The Consumer Price Index (CPI) is a widely used measure of inflation, reflecting the average change over time in the prices paid by consumers for a basket of goods and services. According to the International Monetary Fund (IMF, 2024), the CPI is a key indicator for monitoring inflation and evaluating changes in the cost of living. It provides insights into the purchasing power of a currency and serves as a tool for economic policy analysis. Similarly, the United States Bureau of Labor Statistics (BLS, 2023) defines the CPI as a statistical estimate constructed using the prices of a sample of representative items whose prices are collected periodically. These items include food, housing, clothing, transportation, medical care, and education, among others. The CPI thus acts as a gauge of price movements at the consumer level and is instrumental in indexing wages, pensions, and inflation-targeting by central banks.

In the context of agriculture, the CPI has a dual impact. On the demand side, rising consumer prices especially for food can lead to reduced purchasing power, particularly among low-income households. As food becomes more expensive, these households may cut back on their consumption, thereby reducing demand for agricultural products. On the supply side, high inflation increases input costs such as fuel, fertilizers, and labor, compressing profit margins for farmers and limiting reinvestment into productive activities. Sustained increases in the CPI can create uncertainty in the agricultural market, leading to lower productivity and investment. Consequently, inflation—when measured and interpreted through the CPI—presents a significant constraint to both agricultural production and food security (Chukwuemeka & Ibekwe, 2020).

### **Monetary Policy Rates**

Monetary policy rates (MPR) are benchmark interest rates set by a country's central bank to regulate liquidity, control inflation, and influence economic activity. The Central Bank of Nigeria (CBN, 2022) defines the MPR as the rate at which it lends to commercial banks, which in turn serves as the foundation for determining other interest rates in the economy. The MPR is the primary tool used to signal the central bank's stance on monetary policy—whether expansionary or contractionary. Changes in the monetary policy rate influence the cost of borrowing and the return on savings, thereby affecting aggregate demand, inflation, and economic output. A higher MPR is typically employed to combat inflation by making borrowing more expensive and reducing money supply. Conversely, a lower MPR is used to stimulate the economy by making credit cheaper and more accessible (Mishkin & Eakins, 2021).

In agriculture, the implications of monetary policy rates are particularly profound. When the MPR is high, borrowing costs increase, leading to reduced credit access for farmers and agribusinesses. This constrains investment in capital goods such as machinery, irrigation systems, and improved seed varieties. As a result, production may stagnate or decline due to limited financial input. On the other hand, a lower MPR encourages borrowing and investment in agricultural activities, contributing to improved productivity and food supply. As Olatunji and Adebayo (2024) noted, monetary policy has a direct bearing on the cost structure of agricultural enterprises and, by extension, the sector's overall performance. The effectiveness of monetary policy in supporting agriculture, however, also depends on the responsiveness of commercial banks in adjusting their lending rates in line with central bank signals.

### **Theoretical Framework**

The linkage of macroeconomic variables-interest rate, exchange rate, consumer price index (inflation), and monetary policy rates-to in explaining agricultural output in Nigeria can be understood using the Cobb-Douglas Production Function theory. The Cobb-Douglas production function is a widely used economic model that describes the relationship between output and two primary inputs: labour and capital as follows:

$$Q = AK^\alpha L^\beta \quad (1)$$

Where;  $\alpha + \beta = 1$ . The capital, K, represents the monetary value of physical assets necessary for production, such as buildings, machinery, and equipment. The labour, L, represents the productive effort of the workforce, measured in person-hours. The exponent  $\alpha$  is a value between 0 and 1 that measures the responsiveness or elasticity of output with respect to capital. A is a constant known as the total-factor productivity (TFP). The value of A is a ratio of output to total input, and reflects the overall quality or efficiency of the production process. The Cobb-Douglas formula can be easily generalized to include more than two factors of production. As technology improves, and the skill and education of the workforce increase, enterprises will convert labour and capital to output products more efficiently, meaning the total-factor productivity should rise over time (Utuk *et al*, 2024).

However, in order to facilitate empirical modeling in this research, Agriculture GDP was used to represent the dependent variable, and macroeconomic variables such as interest rates, exchange rates, consumer price index (inflation), and monetary policy rates served as independent variables. This made it possible for this paper to demonstrate how macroeconomic variables affects Nigeria's agriculture output. Equation (1) can now be written in a functional form as:

$$AGDP = f(\text{MLR}, \text{MPR}, \text{EXR}, \text{CPI}) \quad (2)$$

Where AGDP stands for agriculture contribution to gross domestic product as a measure of agriculture output and MLR, MPR, EXR, and CPI, are selected macroeconomic variables.

Applying the Cobb-Douglas production function to the agricultural sector in Nigeria offers a robust framework for understanding how macroeconomic variables influence agricultural output. Macroeconomic variables such as interest rates, exchange rates, consumer price index (inflation), and monetary policy rates affect the availability and cost of capital and labour inputs. For example, high interest rates increase the cost of borrowing capital for farm equipment or inputs, while inflation affects the real wages paid to labor and the prices of agricultural inputs. Exchange rate fluctuations influence the cost of imported inputs like fertilizers and machinery.

Furthermore, the Cobb-Douglas production function is suitable for this topic because it incorporates total factor productivity, which can capture the effects of technological changes, policy interventions, and efficiency improvements in agriculture that are often influenced by macroeconomic conditions. For instance, monetary policy rates can affect investment in agricultural technology and infrastructure, which in turn influence productivity. By including TFP, the model does not limit analysis to input quantities alone but also considers qualitative changes in production processes that macroeconomic stability or instability might cause. This comprehensive approach aligns well with the complex dynamics of Nigeria's agricultural sector, where both input levels and productivity are sensitive to macroeconomic fluctuations.

### **Empirical Review**

The impact of macroeconomic factors on Tanzania's agriculture sector growth between 1993 and 2023 was evaluated by Daudi and Muba (2025). The relationships between variables were estimated using the Auto Regressive Distributed Lag (ARDL) model. Results indicated that interest rates, exchange rates, and inflation have a statistically significant negative effect on agricultural sector growth at p-values of 0.0458, 0.042, and 0.014, respectively. The negative effect of these variables on agricultural sector growth means that, when these variables increase, agricultural sector growth decreases and vice versa, hence the study draws a conclusion that, exchange rate, interest rate, and inflation rate have negative effect on agricultural sector growth. The study recommends that policymakers should prioritize stabilizing these economic indicators and consider targeted support measures to mitigate their adverse effects ensuring the sector thrive amidst fluctuating macroeconomic conditions.

Bonny and Ayunku (2024) investigated the impact of selected macroeconomic variables on agricultural sector performance in Nigeria using time series data spanning from 1990 to 2021. Auto Regressive Distributed Lag (ARDL) model was employed. The findings reveal that credit to the private sector has a positive but insignificant impact on agricultural sector performance. Broad money supply, monetary policy rate, and inflation rate exhibit negative and insignificant impacts, while banks' lending rates show a positive and significant impact. Jointly, the selected macroeconomic variables have a weak but significant impact on agricultural sector performance. The results highlight that while macroeconomic variables collectively influence the sector, the lending rate plays a more critical role in agricultural growth. Based on these findings, the study

recommends improving access to agricultural credit through simplified loan processes and specialized financing products, enhancing monetary policy transmission to reduce financial intermediation frictions, and fostering a stable macroeconomic environment through effective inflation control and exchange rate management.

Olatunji and Adebayo (2024) examined the impact of monetary policy on agricultural productivity and food prices in Nigeria spanning from 1995 to 2023 using the Autoregressive Distributed Lag (ARDL) estimation method. Result revealed that while high interest rates negatively impact agricultural productivity and food prices in the long term, they may offer marginal short-term growth benefits. The study argues that elevated interest rates discourage investment in modern agricultural technologies and inputs, thereby suppressing productivity. Consequently, the authors advocate for policies aimed at lowering interest rates and expanding access to agricultural credit to ensure sustained growth.

Similarly, Osei and Appiah (2023), focusing on the Ghanaian agricultural sector using time series panel data from 1987 to 2021, and interest rate as a determinant of agricultural output discovered that, for interest rate, a one-unit decrease in interest rates significantly enhances agricultural output in the short run on the contrary an increase in interest rate will lead to a decrease in the production of agricultural resources thereby affecting the agricultural sector of any agrarian society. As a result, their time-series analysis underscored the importance of interest rate structure and timing in influencing sectoral outcomes, suggesting that macroeconomic policies must be precisely timed and targeted to maximize agricultural gains.

Further supporting this perspective, Okeke and Okeke (2022), using the Cobb-Douglas production function and data from 1995 to 2020, emphasized the need for massive investment in the agricultural sector. They found that fluctuations in macroeconomic variables such as money supply, inflation, and exchange rates positively influence output provided there is sufficient financial support from government and stakeholders. They opined that lack of financial support to farmers or agro-exporters could lead to a decline in the profit margins of these players thereby affecting their production and exportation of these products. They suggested that the government should look into making policies that will mitigate the easy fluctuations of both the interest rate and exchange rate of the country as the success of agricultural output as well as export depended to a large extent on the percentage increase of these two variables whether significant or not.

In a related study, Ochalibe *et al.* (2021), employing the Autoregressive Distributed Lag (ARDL) model, analyzed data from 1981 to 2020 and reported that while current-year interest rates negatively affect agricultural output, lagged interest rates tend to have a positive impact. In addition to this, exchange rate variations as a result of its insistent fluctuations were found to support output growth in the short term. However, the study recommends that policies should be implemented by the government based on their ability to facilitate low-interest credit availability as this will go a long way to enhance productivity.

Focusing specifically on inflation and exchange rate effects, Okafor and Isibor (2021) in the paper “macroeconomic variables and Nigerian agricultural sector development” using Time series data and an Ordinary Least Squares estimation technique and inflation as the independent variable concluded that inflation significantly hinders agricultural growth. Their analysis of time-series data from 1986 to 2020 identifies inflation as a major constraint to agricultural business expansion in Nigeria as it stifles purchase of agricultural inputs and as such hinders increase in profitability of agricultural products. To ensure increase in agricultural productivity and output there is the need to reinforce price stability in macroeconomic planning.

Chukwuemeka and Ibekwe (2020) utilizing the Ordinary Least Squares (OLS) method on the “the effects of exchange rate on agricultural sector output in Nigeria” from 1987 to 2019, showed that the agricultural sector responds sensitively to macroeconomic policy changes, especially those related to money supply (lending rates). Their findings highlighted that to maintain a positive and significant increase in agricultural productivity invariably known as output, it is important to recognize the role of exchange rates and money supply (lending rates) in driving agricultural output.

Oyetade *et al.* (2020) investigated the effects of macroeconomic factors on agriculture in Nigeria. Specifically, macroeconomic factors such as exchange rate and crude oil price over the period 1981-2016 were examined. This paper employed the Autoregressive Distributed Lag Bound test analysis since all the macroeconomic series used in the study are of mixed integrated order of stationarity. A Granger causality was also carried out in order to examine whether there is any predictive power of crude oil price for agricultural export. The findings showed that there exists a significant relationship between the agricultural export which is the dependent variable and the exchange rate but not in the case of the crude oil price. It also revealed that the variables do cause each other in some directions. In conclusion, there is long run relationship between exchange rates and agricultural export in Nigeria. The study recommended that investigation of various macroeconomic factors is required for an effective policy by the government for supporting of export growth in the country.

In a similar vein, Ochalibe *et al.* (2019) examined data from 1980 to 2018 and discovered a unidirectional and statistically significant relationship between interest rates and agricultural growth. A 1.83% decline in agricultural output was observed following interest rate increases, while exchange rate adjustments

had a positive effect. Their recommendation centred on stabilizing exchange rates and reducing interest rates to promote agricultural investment.

Obasaju and Baiyegunhi (2019), employing a Vector Error Correction Model (VECM) and variance decomposition, found that inflation and money supply significantly explain variations in real agricultural production. Notably, inflation exhibited a stronger influence on output, with the Granger causality test confirming its precedence in affecting agricultural productivity. The authors suggest that carefully calibrated interest rate policies are essential to ensuring price and output stability.

Enilolobo *et al.* (2019), in analyzing the effect of macroeconomic indicators on agricultural output in Nigeria using a quarterly panel data from 1981 to 2018, reported that fluctuations in Nigeria's inflation rate have a substantial negative impact on agricultural output. In this study it was found that the influence of exchange rate and cost of finance on agricultural output varies depending on the prevailing macroeconomic conditions which are determined by their volatility. This volatility further emphasizes the dynamic nature of these relationships as they could either lead to an increase or decrease in agricultural output and development.

Tiamiyu *et al.* (2017) provided an in-depth analysis on the economic revitalization through agricultural credit scheme fund in Nigeria using time series data from Central Bank Statistical Bulletin from 1981 to 2013. The data were analyzed using matrix Ordinary Least Squares Regression analysis. The result of the finding showed that there exists a positive statistical relationship between agricultural credit scheme and commercial bank loan to agriculture. ACGSF impacted positively and significantly on agriculture share to GDP. They emphasized that such schemes could stimulate agricultural productivity by ensuring access to reliable financing, thereby reducing credit risk.

Adisu *et al.* (2016), using a multivariate co-integration approach and considering commercial bank loans, interest rates, and food import values as variables discovered that all three variables significantly affect agricultural output positively. The study recommended an increase in financial investment in the agriculture sector from the government, arguing that a robust long-run relationship is attainable between agricultural productivity and macroeconomic variables especially when adequate funding is available.

Arene and Onyishi (2015), in their assessment of the role of interest rates in agricultural finance using Vector Error Correction Model (VERM), observed that amongst the employed economic rates in Nigeria (inflation, exchange rates, inflation rates and money supply), interest rate levels critically influence access to credit in Nigeria's agricultural sector which in turn helps farmers or local production industries the ability to purchase farming inputs that encourage long term production (increase in output). It is on the basis of this that they implored monetary authorities to carefully manage the dual impact of interest rates on both potential borrowers and investors.

### III. Data And Method

This paper depended on secondary data sourced from Central Bank of Nigeria Statistical Bulletin, 2024 from 1981 to 2023. In this paper, the selected research design is the ex-post facto design. The ex-post facto design is particularly suited for studies aiming to decipher statistical associations between dependent and independent variables, primarily to establish cause-and-effect relationships.

#### Model Specification

The model for this paper is based on the theoretical framework and model that was adapted from the work of Okeke & Okeke (2022) that investigated the effects of macroeconomic variables and agricultural output in Nigeria spanning from a period from 1995 to 2020. The model applied in the study is of the form:

$$AOG = \alpha + \beta_1 MS + \beta_2 CBLA + \beta_3 EXR + \beta_4 INT + \beta_5 RGEA + \beta_6 INF + \varepsilon_{it} \quad (2)$$

Where, In: Natural logarithm; AOG is Agricultural output growth; MS is Money supply; CBLA is Commercial bank loan to agriculture; EXR is Exchange rate; INT is Interest rate; RGEA is Recurrent government expenditure on agriculture; INF is Inflation rate; and  $\varepsilon$  = Error term (unexplained variation). However, the above model was modified by including macroeconomic variables such as exchange rate, minimum lending rate by Commercial Banks to agriculture, consumer price index, and monetary policy rate. Thus, the modified model is presented in semi-logarithm equation as:

$$\ln AGDP = \alpha + \beta_1 EXR + \beta_2 MRR + \beta_3 CPI + \beta_4 MPR + \varepsilon_{it} \quad (3)$$

Where, In: Natural logarithm; AGDP = Real agricultural GDP as a proxy for agricultural output; EXR = Average exchange rate; MLR = Minimum lending rate by Commercial Banks to agriculture; CPI = Consumer price index; MPR = Monetary policy rate; and  $\varepsilon$  = Error term (unexplained variation)  $\beta_0$  = The intercept or autonomous parameter estimate,  $\beta_1$  to  $\beta_4$  = Parameter estimate representing the coefficient of EXR, MLR, CPI,

and MPR respectively, and  $\varepsilon_t$  - other variables not explicitly included in the model. It is expected that  $\beta_1, \beta_2$  &  $\beta_4 > 0$  and  $\beta_3 < 0$ .

The paper used the Dynamic Ordinary Least Squares estimator engineered by (Stock & Watson, 1993) to examine the impact of macroeconomic variables on agricultural output in Nigeria. The DOLS method, developed by Stock and Watson (1993), incorporates leads and lags of the differenced independent variables into the regression to correct for any potential endogeneity and serial correlation in the error term. This feature makes DOLS particularly suitable for time-series data where these issues are common.

Mathematically, the DOLS model extends the traditional OLS regression by including leads and lags of the first differences of the independent variables. This is formulated as:

$$Y_t = \alpha + \beta X_t + \sum_{i=-k}^k \phi_i \Delta X_{t-i} + \varepsilon_t \tag{4}$$

Where,

$Y_t$  is the dependent variable (in this paper, AGDP);  $X_t$  is the vector of independent variables (MLR, MPR, EXR, CPI);  $\Delta X_{t-i}$  represents the first differences of the independent variables at leads and lags to control for serial correlation;  $k$  is the number of lags and leads;  $\varepsilon_t$  is the error term; and  $\alpha$  and  $\beta$  are parameters to be estimated. Thus, building equations (3) into the DOLS model, result as follows:

$$AGDP_t = \beta_0 + \beta_1 MLR_t + \beta_2 MPR_t + \beta_3 EXR_t + \beta_4 CPI_t + \sum_{i=1}^n \Delta \beta_1 MLR_{t-1} + \sum_{i=1}^o \Delta \beta_2 MPR_{t-1} + \sum_{i=1}^q \Delta \beta_3 EXR_{t-1} + \sum_{i=1}^r \Delta \beta_4 CPI_{t-1} + \varepsilon_t \tag{5}$$

Equation (5) represents the long-run relationship between the selected macroeconomic variables and agricultural output using the DOLS methodology. The coefficients  $\beta_1 - \beta_4$  will give insights into how each of the explanatory variables impacts agricultural output in Nigeria.

The DOLS approach is particularly useful because it introduces dynamics in the model specified while allowing for simultaneity bias. Thus the DOLS estimator of the cointegrating regression equation incorporates all variables in levels, in addition to leads and lags of values of the explanatory variables. To overcome the problem associated with the non-normal distribution of the standard errors of the cointegrating regression equation, the specified model was estimated by OLS using the Newey and West (1994) Heteroscedastic and Autocorrelation Consistent (HAC) covariance matrix estimator, whose standard errors are robust, ensuring the validity of the inferences about the coefficients of the variables entering the regressors in levels.

The DOLS allows for a robust estimation of the long-term macroeconomic variables on agricultural output in Nigeria. By using this approach, this paper addressed the potential distortions caused by simultaneous relationships and autocorrelation, common challenges in time-series analysis. Additionally, the use of DOLS in this paper is significant as it enhanced the credibility and reliability of this research findings. It provided a more accurate estimation of how selected macroeconomic variables are likely to influence Nigeria’s agricultural output in the long run. This methodological choice underscores this paper's commitment to rigor and precision in examining the nexus between macroeconomic variables and agricultural output in Nigeria.

#### IV. Results And Discussions

##### Descriptive Statistics

Table 1 presents the descriptive statistics for the paper.

**Table 1: Descriptive Statistics**

	AGDP	MLR	MPR	EXR	CPI
Mean	8972.016	22.60000	13.22093	127.5302	92.99767
Maximum	19306.50	36.10000	26.00000	626.0000	524.9000
Minimum	2303.500	10.00000	6.000000	0.600000	0.500000
Std. Dev.	6016.321	6.052744	3.993301	141.1517	124.2006
Skewness	0.423233	-0.270391	0.606244	1.485204	1.779996
Kurtosis	1.604532	2.680503	4.137381	5.218600	5.717533
Jarque-Bera	4.772709	0.706855	4.951744	24.62738	35.93820
Probability	0.091964	0.702277	0.084090	0.000004	0.000000
Observations	43	43	43	43	43

*Source: Author's Computation, 2025 (Eviews-12)*

From Table 1, Real agricultural GDP (AGDP) has a mean value of ₦8972.016 billion, standard deviation of ₦ 6016.321 billion, with minimum and maximum of 2303.500 and 19306.50 respectively. Minimum lending rate by Commercial Banks to agriculture (MLR) has a mean value of 22.60000 percent, with the standard deviation of 6.052744%, minimum and maximum values of 10.00000 and 36.10000 respectively. Comparably, Monetary policy rate (MPR), has an approximate average of 13.22093 percent and it ranges from 6.000000 (minimum) to 26.00000 (maximum), with a standard deviation of 3.993301%. Average exchange rate (EXR) has an approximate average of ₦ 127.5302 and it ranges from 0.600000 (minimum) to 626.0000 (maximum), with a corresponding standard deviation of ₦ 141.1517. While, Consumer price index (CPI) has an approximate average of 92.99767% and it ranges from 0.500000 (minimum) to 524.9000 (maximum), with a standard deviation of 124.2006 percent.

Table 1 displays the skewness coefficient, a measure of how far a distribution deviates from symmetry. All of the data variables have skewness values less than one, with the exception of EXR & CPI variables, which have coefficients that is greater than one (1.485204) and (1.779996), respectively. The entire data series are not platykurtic (not having negative values), as confirmed by the kurtosis result, which measures a distribution's degree of peakedness in relation to a normal distribution. Additionally, as evidenced by the probability values of each variable's corresponding Jarque-Bera statistics, except for EXR and CPI variables, the variables are nominally distributed. Since the accompanying Jarque-Bera probability values of these variables have a significance level greater than 5%, it may be concluded that they have a normal distribution.

**Correlation Analysis**

Correlation analysis provides the valuable insights into how each of the independent variables relates to the dependent variable. The correlation coefficients in this analysis help to identify whether these variables move together in a positive or negative direction and the strength of these relationships.

**Table 2: Correlation Matrix Result**

	AGDP	MLR	MPR	EXR	CPI
AGDP	1				
MLR	0.534580	1			
MPR	-0.071748	0.648175	1		
EXR	0.701614	0.526798	0.106864	1	
CPI	0.782741	0.496698	0.08725	0.678338	1

*Source: Author's Computation, 2025 (Eviews-12)*

The correlation coefficients presented in Table 2 are considerably below 0.8, indicating that there is no serious multi-collinearity in the model. By implications, all the variables are free from the problem of multicollinearity. Further, the correlation between Agriculture contribution to real gross domestic product (AGDP) and Consumer price index (CPI) was found to be the strongest at 78%. By implications rising inflation is strongly associated with higher agricultural output and agricultural output responds to inflationary pressures.

**Unit Root Results**

A unit root test, such as the Augmented Dickey-Fuller (ADF) test, is a common statistical method used to determine whether a time series data set is stationary. The ADF test checks for a unit root in a time series by testing the null hypothesis that the series has a unit root (non-stationary) against the alternative hypothesis that the series is stationary. The Augmented Dickey-Fuller (ADF) unit root test results are displayed in Table 3 as follows:

**Table 3 Traditional Unit Root Test Results**

Variable	Method	Level	First Diff.	Order of Integration
		Stat. (Prob.)	Stat. (Prob.)	
AGDP	ADF	-2.127905 (0.5158)	-5.511012*(0.0003)	I(1)
MLR	ADF	-2.936815 (0.4961)	-7.200649*(0.0000)	I(1)
MPR	ADF	-0.029362 (0.6865)	-8.471535*(0.0000)	I(1)
EXR	ADF	-2.567973 (0.3164)	-4.186483*(0.0000)	I(1)
CPI	ADF	-1.441205 (0.8305)	-8.391344*(0.0000)	I(1)

Note: \* Indicates stationary at the 1% level.

*Source: Author's Computation, 2025 (Eviews-12)*

Results in Table 3 revealed that all the variables were integrated at order one I(1). This implies that they were not stationary at the level until they were differenced once and they were said to be integrated of order one I(1).

**Cointegration Test**

Co-integration makes sure that even non-stationary individual series can have stationary linear combinations, indicating a constant long-term association between them. To determine whether the relevant variables have a long-term relationship, the Engle and Granger (Residual Based) Cointegration Test was employed. Table 4 summarizes the findings of the Co-integration test utilizing the Engle and Granger (Residual Based) Cointegration Test, building on the paper discussion of time series analysis and the investigation of the direct influences of macroeconomic variables on agricultural output in Nigeria.

**Table 4: Results of Engle and Granger (Residual Based) Cointegration Test**

Variable	ADF Test Statistic	Critical ADF Value	At level (Prob)	Remarks
Residual	-4.176533	-3.596616*	0.00	Co-integrated

*Note: \* significant at 1%*

*Source: Author's Computation, 2025 (Eviews-12)*

The ADF Test Statistic for the residuals in "Table 4: Results of Engle and Granger Residual Based Cointegration Test" is -4.176533, exceeding the critical value at the 1% significance level of -3.596616, suggesting co-integration. This is highly significant because it indicated that macroeconomic variables and agricultural output in Nigeria have an equilibrium relationship over the long run. The estimation of DOLS regression was then carried out.

**Dynamic OLS (DOLS) Regression Results**

The Dynamic Ordinary Least Squares (DOLS) Regression findings for the model are shown in Table 5 to provide some intriguing insights into the direct influences of macroeconomic variables such as average exchange rate, minimum lending rate, consumer price index, monetary policy rate on agricultural output in Nigeria from 1981-2023.

**Table 5: Dynamic Ordinary Least Squares (DOLS) Result  
Dependent Variable: LOG(AGDP)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MLR	0.081077	0.024638	3.290791	0.0032
MPR	-0.112108	0.035143	-3.190078	0.0041
EXR	0.009505	0.002106	4.514072	0.0002
CPI	-0.004593	0.004018	-1.143018	0.2648
C	8.012962	0.244787	32.73445	0.0000
R-squared	0.956632			
Adjusted R-squared	0.926462			
S.E. of regression	0.193988			
Long-run variance	0.069610			

*Source: Author's Computation, 2025 (Eviews-12)*

From Table 5, three out of the four explanatory variables used in this paper have statistically significant influence on agricultural output in the long run. Further examination of the data revealed that minimum lending rate by Commercial Banks to agricultural sector and average exchange rate are important in explaining agricultural output in Nigeria throughout the research period. Furthermore, minimum lending rate by Commercial Banks to agricultural sector, average exchange rate and consumer price index are in agreement with the paper apriori expectations. However, monetary policy rate does not conform to the paper apriori expectations in the long run.

The R-squared value of 0.956632 implies that the model is a good fit as over 96% variation in agricultural output is explained by the explanatory variables. Even after removing the effect of insignificant estimators, the adjusted R-squared value of 0.926462 implies that the model is still very good. Therefore, the paper's conclusions can be relied upon for formulating policy recommendations. While, the long-run variance of 0.069610 provided an estimate of the variability of the residuals over the long term. A relatively low long term variance indicated that the residuals (or errors) in the model are stable over time, suggesting that the model is reliable for predicting the long term relationship amongst selected macroeconomic variables such as average exchange rate, minimum lending rate, consumer price index, monetary policy rate and agricultural output in Nigeria from 1981-2023.

**Post Estimation Tests**

The study conducted a few diagnostic tests to assess the model's stability and applicability as well as the validity of the results. Results is as presented in Table 4.5 as follows:

**Table 6: Post-estimation Results**

Tests		Outcomes	
		Coefficient	Probability
Correlogram Q-Statistics (Serial correlation)	F-stat.	13.62591	0.208
Normality Test	Jarque-Bera	4.716708	0.094576

*Source: Author's Computation 2025 (Eviews-12)*

The Correlogram Q-Statistics was used to test for serial correlation in the residuals of the model. The F-statistic value of 13.62591, with a corresponding probability of 0.208, indicated that there is no evidence of serial correlation in the residuals at conventional significance levels. Serial correlation, if present, could bias the results and make the model unreliable. However, since the p-value is well above the common thresholds (0.05 or 0.01), we fail to reject the null hypothesis that there is no serial correlation. This outcome suggested that the model's residuals are independent over time, confirming that the DOLS estimates are consistent and that the findings regarding the relationship between selected macroeconomic variables and agricultural output is credible.

The Jarque-Bera test was used to assess the normality of the residuals. A Jarque-Bera statistic of 4.716708 with a probability of 0.094576 indicated that the residuals are normally distributed. The null hypothesis of the Jarque-Bera test is that the residuals are normally distributed. Given the p-value is significantly higher than 0.05, we do not reject the null hypothesis. Normality in the residuals is important for validating the assumptions underlying the DOLS regression, particularly for ensuring that the estimated coefficients are efficient and unbiased. The normal distribution of the residuals supports the reliability of the model's predictions and the overall significance of the selected macroeconomic variables in explaining agricultural output in Nigeria.

## V. Discussion Of Findings

From the estimated Dynamic Ordinary Least Squares (DOLS) regression results in Table 5, three out of the four explanatory variables used in this paper have statistically significant influence on agricultural output in the long run. Furthermore, minimum lending rate by Commercial Banks to agricultural sector, average exchange rate and consumer price index are in agreement with the paper apriori expectations. However, monetary policy rate does not conform to the paper apriori expectations in the long run.

On a basis of variable-by-variable analysis, the paper found that minimum lending rate by is positively and significantly related to the growth of agricultural output in Nigeria in the long run. Consequently, one percentage increase in minimum lending rate will lead to an increase in agricultural output in Nigeria by 0.08 percent in the long run. This outcome is consistent with the a priori expectations of the investigation. However, this paper outcome contradicts prior studies such as Bonny and Ayunku (2024), Ochalibe *et al.* (2021), Ochalibe *et al.* (2019) and Olarinde and Abdullahi (2014) that reported that interest rates negatively affect agricultural output.

On the other hand, the findings indicated that monetary policy rate affect agricultural output significantly and negatively in the long-run. Controlling for other factors, for instance, a 1 percent increase in monetary policy rate will decrease agricultural output by -0.11% in the long run. This outcome is inconsistent with the a priori expectations of the research; as the expected relationship between monetary policy rate and agricultural output could be positive. However, this paper outcome aligns with the study of Bonny and Ayunku (2024) who investigated the impact of selected macroeconomic variables on agricultural sector performance in Nigeria and found that monetary policy rate exhibit negative and insignificant impact on agricultural sector performance.

Also, the estimated impact of exchange rate on agricultural output is positive and significant in the long run. By implication, one percentage change or increase in exchange rate will lead to 0.09% increase in agricultural output in the long-run. This outcome is consistent with the a priori expectations of the investigation and studies such as Okeke and Okeke (2022), Ochalibe *et al.* (2021), Chukwuemeka and Ibekwe (2020) who all suggested that agricultural sector output responds positively to macroeconomic factors such as exchange rates, money supply and lending rates in driving agricultural output.

Furthermore, the estimated impact of consumer price index on agricultural output is negative in the long run. By implication, one percentage change or increase in consumer price index will lead to -0.04% decrease in agricultural output. This outcome is consistent with the a priori expectations of the investigation and some studies like Okafor & Isibor (2021), Enilolobo *et al.* (2019) that concluded that inflation hinders agricultural growth.

## VI. Conclusion And Recommendations

This paper investigated the impact of selected macroeconomic variables on agricultural output in Nigeria from 1981 to 2023 using the Dynamic Ordinary Least Squares (DOLS) Regression technique. Results

revealed that three out of the four explanatory variables used in this paper have statistically significant influence on agricultural output in the long run. Furthermore, minimum lending rate by Commercial Banks to agricultural sector, average exchange rate and consumer price index are in agreement with the paper apriori expectations. However, monetary policy rate does not conform to the paper apriori expectations in the long run. Specifically, this paper found that minimum lending rate by is positively and significantly related to the growth of agricultural output in Nigeria in the long run. On the other hand, the findings indicated that monetary policy rate affect agricultural output significantly and negatively in the long-run. Also, the estimated impact of exchange rate on agricultural output is positive and significant in the long run. While, the estimated impact of consumer price index on agricultural output is negative in the long run. Therefore, the following recommendations were raised from the research findings.

- i. The Central Bank of Nigeria (CBN) and Commercial Banks should increase access to agricultural credit, especially through targeted lending schemes (e.g., Anchor Borrowers' Programme), even if interest rates rise., since minimum lending rate is positively and significantly related to agricultural output in the long run.
- ii. The CBN should lower or exempt agricultural sector-specific lending from the broader monetary policy rate, creating a preferential MPR window for agriculture, due to the significant and negative impact of Monetary policy rate on agricultural output in the long run.
- iii. The Central Bank of Nigeria (CBN) should stabilize exchange rates through prudent foreign exchange management, as a stable and competitive naira can enhance the profitability of export-oriented agricultural production. This recommendation is as a result of the positive and significant impact of exchange rate on agricultural output in the long-run.
- iv. The monetary authority in Nigeria should adopt strong inflation management strategies, including, ensuring stable food prices through strategic grain reserves, reducing fuel and input price volatility through targeted subsidies or price stabilization schemes. These suggestions are apt consumer price index (proxy for inflation) has a negative and significant impact on agricultural output.

## References

- [1]. Adisu, A. (2016). Macroeconomic Factors And Agricultural Sector In Nigeria. *Procedia - Social And Behavioral Sciences*, 216, 400–410. <https://doi.org/10.1016/j.sbspro.2016.05.035>
- [2]. Agbodji, A. E., & Johnson, A. A. (2021). Agricultural Credit And Its Impact On The Productivity Of Certain Cereals In Togo. *Emerging Markets Finance And Trade*, 57(12), 3320-3336.
- [3]. Alafif, H. A. (2023). Interest Rate And Some Of Its Applications. *Journal Of Applied Mathematics And Physics*, 11(6), 1557–1569. <https://doi.org/10.4236/jamp.2023.116102>
- [4]. Bonny, D. T., & Ayunku, E. P. (2024). The Impact Of Selected Macroeconomic Variables On Agricultural Sector Performance In Nigeria. *African Journal Of Management And Business Research*, 17(1), 308-325. <https://doi.org/10.62154/ajmbr.2024.017.010525>
- [5]. Central Bank Of Nigeria. (2022). The Conduct Of Monetary Policy. Retrieved From <https://www.cbn.gov.ng/Monetarypolicy/Conduct.html> Central Bank Of Nigeria
- [6]. Chandio, A. A. (2019). Factors Influencing Agricultural Productivity In Developing Countries: A Systematic Review. *Journal Of Agricultural Studies*, 7(3), 123–135.
- [7]. Chukwuemeka, E., & Ibekwe, U. (2020). Effect Of Exchange Rate On Agricultural Sector Output In Nigeria (1987–2019). *International Journal Of Economic Development Policies*, 8(1), 45–58.
- [8]. Daudi, P. D., & Muba, S. (2025). The Effect Of Macroeconomic Factors On Agricultural Sector Growth In Tanzania. *Afr. J. Econ. Bus. Res.* 4(1), 19-38. <https://dx.doi.org/10.4314/ajebr.v4i1.2>
- [9]. Enilolobo, O. S., Mustapha, S. A., & Orija, F. O. S. (2019). Effect Of Macroeconomic Indicators On Agricultural Output In Nigeria. *Global Journal Of Management And Business Research: Economics And Commerce*, 19(4), 69–76.
- [10]. Iliyasu, A. S. (2019). An Empirical Analysis Of The Impact Of Interest Rate On Agriculture In Nigeria. *Journal Of Economics And Sustainable Development*, 10(22), 106–115.
- [11]. International Food Policy Research Institute (IFPRI). (2021). Unlocking The Potential Of African Agriculture: Opportunities And Challenges. Retrieved From <https://www.ifpri.org>
- [12]. International Monetary Fund. (2024). Consumer Price Index (CPI) - IMF Data. Retrieved From <https://data.imf.org/en/datasets/IMF.STA%3ACPIIMF> Data
- [13]. Mishkin, F. S., & Eakins, S. G. (2021). *Financial Markets And Institutions* (9th Ed.). Pearson Education.
- [14]. Obasaju, O. T. (2016). Macroeconomic Policy Instruments And Agricultural Sector Performance In Nigeria: A VECM Approach. *Nigerian Journal Of Economic And Social Studies*, 58(2), 213–230.
- [15]. Okafor, O. K., & Isibor, A. (2021). Macroeconomic Variables And Nigerian Agricultural Sector Development. *British Journal Of Management And Marketing Studies*, 4(4), 9–20.
- [16]. Okeke, D. C., & Okeke, O. R. (2022). Macroeconomic Variables And Agricultural Output In Nigeria. *Medicon Agriculture & Environmental Sciences*, 2(6), 43–49.
- [17]. Olatunji, O. A., & Adebayo, A. S. (2024). The Impact Of Monetary Policy On Agricultural Productivity And Food Prices In Nigeria. *ABUAD Journal Of Sustainable Development*, 9(1), 45–60.
- [18]. Osei, R. D., & Appiah-Kubi, K. (2023). Agriculture Growth In Ghana: A Time-Series Analysis With Macroeconomic Variables. *Cogent Economics & Finance*, 11(1). <https://doi.org/10.1080/23311932.2023.2244267>
- [19]. Onwuasoanya, O. (2025). Nigeria's Food Prices Surge Again In 2025 As Inflation Hits 21.79%. *The Junction*. <https://thejunction.ng/Nigerias-Food-Prices-Surge-Again-In-2025-As-Inflation-Hits-21-79/>
- [20]. Osabohien, R., Adeleye, N., & Dei Alwis, T. (2020). Social Protection Policies And Agricultural Output In ECOWAS: Empirical Evidence From Panel Data. *Heliyon*, 6(9), E04891.
- [21]. Oyetade, O. O., Asaley, A., Popoola, O., & Lawal, A. (2020). Agricultural Export And Macroeconomic Factors In Nigeria: The Bound Test Approach. *International Journal Of Energy Economics And Policy*, 10(2), 165-169.

- [22]. Saghir, J. (2014). Global Challenges In Agriculture And The World Bank's Response In Africa. *Food And Energy Security*, 3(2), 61–68.
- [23]. Shyamoli, S., & Arghadeep, D. (2022). Sustainability And Agriculture: A Futuristic Coherent Environmental Ethical Techniques. *Strad Research*, 9(1), 93-103.
- [24]. Stock, J. H; & Watson M. A. (1993). Simple Estimator Of Cointegrating Vectors In Higher Order Integrated Systems. *Econometrica*; 61:783-820.
- [25]. Tihamiyu, O. P., Bwala, R. W., & Alawole, O. O. (2017). The Impact Of Agricultural Credit Guarantee Scheme On Nigeria's GDP: A Sectoral Approach. *Journal Of Agricultural Finance And Policy*, 3(2), 89–99.
- [26]. U.S. Bureau Of Labor Statistics. (2023). Consumer Price Index (CPI) Home. Retrieved From <https://www.bls.gov/cpi/bureau-of-labor-statistics>
- [27]. Utuk, I. O., Udo, A. B., Akpan, B. L., Bassey, E. E., Okon, I. M. (2024). Effect Of Climate Change On Agricultural Sector: Evidence From Nigeria. *Wukari International Studies Journal*, 8 (5), 92-100.
- [28]. Williams, T. O. (2021). The Impact Of Fiscal And Monetary Policies On Agricultural Output In Nigeria: An Asymmetric Cointegration Analysis. *African Journal Of Agricultural Research*, 16(10), 1425–1435.
- [29]. World Bank. (2022). *World Development Report: Agriculture For Development*. The World Bank.