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# Managing the Macroeconomic Uncertainties for optimal Performance of the Agricultural Sector in Nigeria

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## ABSTRACT

Investment in the agricultural sector had long been recognized as a critical driver of sustainable economic growth, necessitating deliberate policy support to enhance overall economic performance. However, persistent macroeconomic uncertainties—particularly fluctuations in consumer price index, exchange rates, and interest rates—had posed significant challenges to many developing economies, including Nigeria. These concerns continued to attract the attention of economic researchers and policymakers alike. This study investigated the influence of selected macroeconomic variables on agricultural productivity in Nigeria. It utilized secondary data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, covering the period from 1986 to 2023. The time series data were subjected to rigorous diagnostic and stability tests and were found suitable for empirical analysis. An Auto-Regressive Distributed Lag (ARDL) model was employed to assess the short-run and long-run relationships between macroeconomic variables and agricultural productivity. The empirical results, as indicated by the F-statistics and associated probability values, confirmed that the selected macroeconomic indicators exerted a statistically significant influence on agricultural productivity in Nigeria. Notably, interest rates exhibited a negative and significant relationship with agricultural productivity, underscoring the adverse effects of high borrowing costs on sectoral performance. Based on these findings, the study recommended that interest rates on agricultural loans should be consistently and deliberately reduced to stimulate investment in the agricultural sector and enhance its contribution to Nigeria's economic growth.

**Keywords**: Agricultural Output, Macroeconomic variables, Auto-Regressive Distributed Lag

## Introduction

Agriculture remains a strategic segment of Nigeria's economy, contributing significantly to Gross Domestic Product (GDP) and employment generation. Historically, it has been the second-largest contributor to GDP after the oil sector, accounting for approximately 41% of the country's GDP and providing employment for about 65% of the population (World Bank, 2007; Ogundipe et al., 2023). The agricultural sector contributes to national development through four primary channels: product contribution, factor contribution, market contribution, and foreign exchange earnings. Despite the sector's potential and the country's vast endowment of fertile land, water resources, and a youthful workforce, the performance of agricultural output has remained suboptimal over the years (Okonkwo & Yusuf, 2024).

Nigeria's agricultural growth has been hindered by several challenges, including weak access to modern inputs and technology, insufficient credit facilities, poor infrastructure, and, more importantly, persistent macroeconomic uncertainties. Between 1970 and 2000, agricultural productivity grew at an average rate of 1.7% per annum, lagging behind the population growth rate of about 2.7% (CBN, 2010). This underperformance has resulted in a widening food supply-demand gap, insufficient raw materials for agro-industries, and a decline in foreign exchange earnings from agricultural exports (Udih, 2014; Musa et al., 2023).

More recently, the sector has grappled with additional threats such as insecurity, including the destruction of farmlands by herdsmen and bandits, alongside economic disruptions from exchange rate volatility, inflationary pressures, trade fluctuations, and dwindling government revenue due to unstable oil prices (Afolabi et al., 2023). These macroeconomic instabilities have exacerbated the sector's fragility, undermining productivity, food security, and livelihoods, particularly in rural areas. While various policy frameworks have been introduced to revitalize the agricultural sector, including intervention schemes and financial incentives, the persistent volatility in Nigeria's macroeconomic environment continues to impede their effectiveness (Okonkwo & Yusuf, 2024). In light of current economic challenges—characterized by rising inflation, exchange rate depreciation, trade imbalances, and capital formation constraints—there is a growing urgency to understand how these macroeconomic variables influence agricultural output.

Consequently, this study investigates the effect of major macroeconomic indicators on agricultural productivity in Nigeria. Specifically, it assesses the impact of consumer price index, trade openness, exchange rate, interest rate, balance of trade, and gross fixed capital formation on the performance of the agricultural sector. The study employs an econometric modeling approach based on the autoregressive distributed lag (ARDL) bounds testing technique developed by Pesaran, Shin, and Smith (2001) to establish both short-run and long-run dynamics.

## LITERATURE REVIEW

### Keynesian Theory

Keynesian economics is a theory of aggregate demand and its influence on overall economic performance, including output, employment, and inflation. Propounded by John Maynard Keynes in the 1930s amidst the Great Depression, the theory emphasizes the role of government intervention in stabilizing economic fluctuations. Keynes advocated for increased public expenditure, tax reductions, and monetary expansion as tools to stimulate demand, raise output, and curb unemployment during periods of economic downturn (Blanchard, 2023). Within this framework, a decline in aggregate demand leads to reduced production and job losses, culminating in lower prices and wages. These, in turn, could incentivize capital investment and employment as the economy self-adjusts. This theory is relevant to the agricultural sector in Nigeria, as macroeconomic volatilities — such as inflationary pressures, unstable exchange rates, and fluctuating interest rates — directly affect agricultural output, pricing, and investment decisions.

### Endogenous Growth Theory

The Endogenous Growth Theory, pioneered by Arrow (1962), Romer (1986), and Lucas (1988), emerged as a response to the limitations of the Solow-Swan neoclassical model. Unlike exogenous models that attribute long-term economic growth to external factors like technological progress, the endogenous growth theory posits that economic growth is primarily driven by internal factors such as human capital development, innovation, policy environment, and macroeconomic stability (Romer, 1990; Afolabi et al., 2023). This theory underpins the current study, as it suggests that macroeconomic uncertainties—operating within the Nigerian economy—can influence overall economic performance and agricultural output specifically. By examining key macroeconomic variables, the study seeks to establish how these internal dynamics shape agricultural productivity in Nigeria.

### Empirical Review

Several empirical studies have explored the relationship between macroeconomic variables and agricultural productivity, within Nigeria and internationally. Conceptually, macroeconomic policy encompasses government strategies aimed at influencing aggregate economic indicators to achieve objectives such as price stability, full employment, and sustainable growth. These policies are often categorized as fiscal or monetary (Musa *et al*., 2023).

Cristea, et al (2015) investigated the influence of macroeconomic variables on agricultural output in Romania over a 20-year period using ANOVA analysis. The study revealed that while the exchange rate exerted an indirect

influence on agricultural performance, interest rates on credit and deposits had direct impacts on agricultural productivity.

Similarly, Kadir and Tunggal (2015) assessed the effects of macroeconomic variables on agricultural output in Malaysia from 1980 to 2014. The findings highlighted significant relationships between key macroeconomic indicators and agricultural performance, emphasizing the sensitivity of the sector to macroeconomic fluctuations.

In Nigeria, Arorioede and Ogunbadejo (2014) examined the impact of macroeconomic policies on agricultural growth using a Vector Autoregression (VAR) model. The study concluded that Gross Domestic Product (GDP), credit to agriculture, and exchange rates significantly and positively influenced agricultural output. Notably, a positive relationship was established between agricultural output and GDP growth.

Eyo (2008) conducted an empirical analysis of the relationship between the macroeconomic environment and agricultural sector growth in Nigeria, utilizing secondary data spanning 1970 to 2005. Applying the Ordinary Least Squares (OLS) technique, the study found that the prevailing exchange rate regimes did not support agricultural productivity, while inflation, government spending on agriculture, and private foreign investment showed varying degrees of influence.

Hashemi (2014) focused on Iran, analyzing the effect of macroeconomic variables on the agricultural sector between 1981 and 2011 using a VAR model. The results confirmed a long-term relationship between macroeconomic variables and agricultural output, with inflation shocks producing immediate but short-lived effects on agricultural prices.

More recent studies have expanded this inquiry by incorporating macroeconomic variables often neglected in earlier works. For instance, Afolabi et al. (2023) emphasized the importance of including trade openness, balance of trade, and gross fixed capital formation in assessing agricultural productivity in Nigeria. Their findings highlighted that these variables play critical roles in influencing agricultural performance amidst macroeconomic uncertainties.

Despite the growing body of literature, few empirical studies have comprehensively examined the combined effects of major macroeconomic variables — such as consumer price index, trade openness, exchange rate, interest rate, balance of trade, and gross fixed capital formation — on agricultural output in Nigeria. This gap underscores the uniqueness and relevance of the present study, offering fresh insights into how macroeconomic instability shapes agricultural productivity in Nigeria's volatile economic environment.

**Methodology**

This study is carried out using secondary data sourced from CBN statistical bulletin. Agricultural productivity is the dependent variable while Consumer price index, Exchange rate, Openness, Interest rate, Gross fixed capital formation and balance of trade serve as independent variables. The period covered is from 1986-2023. This study applied the autoregressive distributed lag (ARDL) cointegration technique. Pearsan et al (2000) averred that cointegration can be tested using the bound test irrespective of the cointegration order i.e whether the variables are purely 1(0) and or purely 1(1) or a mixture of 1(0) and 1(1) variables

**Model specification**

The Agricultural output growth rate is the dependent variable, while consumer price index, exchange rate, trade openness, Interest rate, gross fixed capital formation and balance of trade are the independent variables. The model for the effect of macroeconomic variables on Agricultural productivity in Nigeria could be stated as follows:

AGRIC = ( CPI_1, EXCH, OPEN, INTEREST, GFCF_1, BOT_1)

Where

AGRIC = Agricultural output
CPI_1 = consumer price index
EXCH = exchange rate
OPEN = trade openness
INTEREST= Interest rate
GFCF_1 = gross fixed capital formation
BOT_1 = balance of trade

Assuming a linear relationship between the dependent variable and independent variables, and using the econometrics model can be specified as follows:

$$AGRIC = \alpha_0 + \alpha_1 CPI\_1 + \alpha_2 EXCH + \alpha_3 OPEN + \alpha_4 INTEREST + \alpha_5 GFCF\_1 + \alpha_6 BOT\_1 + \mu_t$$

where $\mu_t$ = Error term

$\alpha_0$ = the constant term

$\alpha$'s = the parameters to be estimated

The apriori expectations are that $\alpha_1, \alpha_2, \alpha_4, < 0$ while $\alpha_3, \alpha_s, \alpha_6 > 0$

**Diagnostic test**

**Unit root test:** In time series analysis, before running the cointegration test the variables must be checked for stationarity. For this purpose, we use the conventional ADF tests. In the presence of variables integrated of order two we cannot interpret the values of F statistics provided by Pesaran, Shin and Smith (2001) or it will go boasted.

The ARDL model is written as follow:

$$\Delta AGRIC_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta AGRIC_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CPI\_1_{1t-1} + \sum_{i=0}^{n} \beta_{3i} \Delta EXCH_{2t-1} + \sum_{i=0}^{n} \beta_{4i} \Delta OPEN_{3t-1} + \sum_{i=0}^{n} \beta_{5i} \Delta INTEREST_{4t-1} + \sum_{i=0}^{n} \beta_{6i} \Delta GFCF\_1_{5t-1} + \sum_{i=0}^{n} \beta_{7i} \Delta BOT\_1_{6t-1} + \beta_8 AGRIC_{t-1} + \beta_9 CPI\_1_{t-1} + \beta_{10} EXCH_{t-1} + \beta_{11} OPEN_{t-1} + \beta_{12} INTEREST_{t-1} + \beta_{13} GFCF\_1_{t-1} + \beta_{14} BOT\_1_{t-1} + \varepsilon_t$$

Where $\Delta$ is the difference operator while $\varepsilon t$ is white noise or error term.

The vector error correction model is specified as follows:

$$\Delta AGRIC_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} AGRIC_{t-1} + \sum_{i=0}^{n} \alpha_{2i} \Delta CPI\_1_{1t-1} + \sum_{i=0}^{n} \alpha_{3i} \Delta EXCH_{2t-1} + \sum_{i=0}^{n} \alpha_{4i} \Delta OPEN_{3t-1} + \sum_{i=0}^{n} \alpha_{5i} \Delta INTEREST_{4t-1} + \sum_{i=0}^{n} \alpha_{6i} \Delta GFCF\_1_{5t-1} + \sum_{i=0}^{n} \alpha_{7i} \Delta BOT\_1_{6t-1} + \lambda ECM(-1) + \mu_t$$

$ECMt-1$ is the error correction term obtained from the cointegration model. The error coefficients ($\lambda 1$) indicates the rate at which the cointegration model corrects its previous period's disequilibrium or speed of adjustment to restore the long run equilibrium relationship. A negative and significant $ECMt-1$ coefficient implies that any short run movement between the dependent and explanatory variables will unite back to the long run relationship.

**Data Analysis and Results**

**Unit root test result**

The results of the Augmented Dickey Fuller (ADF) test obtained are as follow:

**The Unit root test Result**

| Variable | Level difference | Probability | Order of integration |
|---|---|---|---|
| AGRIC | 1.898550 | 0.9996 | I(0) |
| CPI_1 | -6.452998 | 0.0000 | I(0) |
| EXCH | -0.881013 | 0.3275 | I(0) |
| OPEN | 1.169961 | 0.9347 | I(0) |
| INTEREST | 0.844179 | 0.8887 | I(0) |
| GFCF_1 | 0.969200 | 0.9086 | I(0) |
| BOT_1 | -0.127936 | 0.6327 | I(0) |

**Source: Author's computation from the E-views result, 2025**

From the table above the results shows that one of the variablesis stationary at level

**Hetroscedasticity test**

Under the heteroscedasticity test, we make the following assumptions: if the chi-square calculated is less than the chi-square tabulated, we accept Ho otherwise we reject. The Heteroscedasticity result obtained is presented below:

| Heteroskedasticity Test: Breusch-Pagan-Godfrey | | | |
|---|---|---|---|
| F-statistic | 0.532903 | Prob. F(23,10) | 0.8975 |
| Obs*R-squared | 18.72374 | Prob. Chi-Square(23) | 0.7171 |
| Scaled explained SS | 0.948608 | Prob. Chi-Square(23) | 1.0000 |

For the variables under consideration, chi –square under 23 degrees of freedom chi square (23) = calculated = 18.72374, the chi-square (23) tabulated = 35.0.

DECISION: Since the $X^2$ calculated is greater than $X^2$ tabulated, we conclude that the error term of the variables under consideration are hetroscedastic.

**Bound Auto Regressive Distributed Lag (ARDL) testing approach**

Conducting the ARDL bounds test procedure, it is expected that the variables are I(0) or I(1), otherwise, the variable may be considered spurious. In the conduct of the ARDL test, we adopt the Augmented DickyFuller (ADF) test to determine the difference levels of the variables to find if they are I(0) and I(1) respectively. We therefore compute an F-statistics test procedure to test the long-run relationship in which the maximum lag length p is 3 in the ECM. The results for the bounds F-test is therefore presented as follows:

**The ARDL Bound test result**

ARDL Bounds Test
Date: 02/09/24 Time: 12:20

Sample: 1986- 2023
Included observations: 38
Null Hypothesis: No long-run relationships exist

| Test Statistic | Value | K |
|---|---|---|
| F-statistic | 14.57830 | 6 |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 2.12 | 3.23 |
| 5% | 2.45 | 3.61 |
| 2.5% | 2.75 | 3.99 |
| 1% | 3.15 | 4.43 |

**Source: Author's computation from the Eviews result, 2025**

The Bound test result from the table above indicates that the underling ARDL model can be established to determine the long-run slope-estimated coefficients and the short-run dynamic-estimated coefficients. The ARDL(1, 3) is selected based on Akaike information criterion (AIC) , and the estimated results are shown in Table below:

**Stability test**

To ensure the goodness of fit of the model, diagnostic and stability tests are conducted. Diagnostic tests examine the model for serial correlation, functional form, non-normality and heteroscedasticity. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) suggested by Brown, Durbin and Evans, (1975). To further confirm the stability of the estimated ARDL model, we used the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) test method to examine the recursive residuals. The two figures the CUSUM and CUSUMSQ tests remain within the area restricted by the lines; thus, we reject the null hypothesis for CUSUM and CUSUMSQ and conclude that the estimated ARDL model is effective with stable recursive residuals.

**Descriptive statistics**

The Jarque-Bera (JB) test statistic was used to determine whether or not the monetary policy variables follow the normal probability distribution. The descriptive statistics for the variables under consideration are therefore presented as follows:

**The descriptive statistics**

| | AGRIC | CPI_1 | EXCH | OPEN | INTEREST | GFCF_1 | BOT_1 |
|---|---|---|---|---|---|---|---|
| Mean | 150368.0 | 92.25324 | 67.46862 | 71.32816 | 45.01875 | 10262.58 | 1356508. |
| Median | 11768.30 | 63.49000 | 21.88610 | 77.25000 | 11.75000 | 12.09000 | 326454.1 |
| Maximum | 832048.4 | 272.0600 | 158.5526 | 158.2420 | 1247.458 | 379236.9 | 4971688. |
| Minimum | 268.1600 | 0.880000 | 0.544500 | 27.80000 | 3.720000 | 5.460000 | -85562.00 |
| Std. Dev. | 261184.7 | 96.10664 | 65.08670 | 23.60764 | 203.2279 | 62343.97 | 1677285. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Skewness | 1.671749 | 0.736890 | 0.249904 | 0.721325 | 5.828154 | 5.833333 | 0.772362 |
| Kurtosis | 4.263202 | 2.107251 | 1.231141 | 6.541128 | 34.98855 | 35.02778 | 1.993204 |
| Jarque-Bera | 19.69427 | 4.577249 | 5.208784 | 22.54044 | 1787.003 | 1791.246 | 5.241371 |
| Probability | 0.000053 | 0.101406 | 0.073948 | 0.000013 | 0.000000 | 0.000000 | 0.072753 |
| Sum | 5563618. | 3413.370 | 2496.339 | 2639.142 | 1665.694 | 379715.4 | 50190808 |
| Sum Sq. Dev. | 2.46E+12 | 332513.5 | 152506.0 | 20063.55 | 1486856. | 1.40E+11 | 1.01E+14 |
| Observations | 38 | 38 | 38 | 38 | 38 | 38 | 38 |

**Source: Author's computation from the Eviews result. 2025**

From the result table above, the descriptive statistics indicates that from 1986 to 2023, the six of the variables show an averaged positive mean value from 1356508to 45. 01875.The standard deviation showed that the highest standard deviation of (1677285.) is recorded by the BOT_1 while the least standard deviation of (23.60764) is recorded by OPEN. The skewness statistics from the table revealed that all the variables are positively skewed; the kurtosis coefficients showed that four of the variables are leptokurtic, suggesting that the distributions are high relative to normal distribution while one of the variables is mesokurtic, indicating not too flat topped and two other variable are platykurtic, indicating a flat topped. The probabilities of Jarque-Bera test of normality for the variables indicates that seven of the variables have values greater than 5% level of significance.

## Correlation

Under the correlation test, we conduct the test to ascertain the degree of relationship that exists between the dependent variable and the independent variables. This is done using the correlation matrix. The relationships among the studied variables depicted in the model were tested using correlation matrix and the result presented below:

**Correlation matrix**

| | AGRIC | CPI_1 | EXCH | OPEN | INTEREST | GFCF_1 | BOT_1 |
|---|---|---|---|---|---|---|---|
| AGRIC | 1.000000 | 0.791711 | 0.587102 | 0.458585 | 0.356421 | 0.360646 | 0.625149 |
| CPI_1 | 0.791711 | 1.000000 | 0.917163 | 0.415735 | -0.007192 | -0.001525 | 0.845442 |
| EXCH | 0.587102 | 0.917163 | 1.000000 | 0.366275 | -0.150545 | -0.147527 | 0.776820 |
| OPEN | 0.458585 | 0.415735 | 0.366275 | 1.000000 | 0.630243 | 0.622014 | 0.445243 |
| INTEREST | 0.356421 | -0.007192 | -0.150545 | 0.630243 | 1.000000 | 0.999718 | 0.167443 |
| GFCF_1 | 0.360646 | -0.001525 | -0.147527 | 0.622014 | 0.999718 | 1.000000 | 0.176334 |
| BOT_1 | 0.625149 | 0.845442 | 0.776820 | 0.445243 | 0.167443 | 0.176334 | 1.000000 |

**Source: Author's computation from E-views, 2025**

The correlation result shows that all the variables have positive relationships with the AGRIC. The relationships are actually at 79%, 58%,45%, 35%, 36% and 62% respectively. Hence, we conclude that there exist no multicollinearity among the variables under consideration.

**The ARDL dynamic regression result**

| | | | | |
|---|---|---|---|---|
| Dependent Variable: AGRIC | | | | |
| Method: ARDL | | | | |
| Date: 02/09/24 Time: 12:15 | | | | |
| Sample (adjusted): 1986 2023 | | | | |
| Included observations: 34 after adjustments | | | | |
| Maximum dependent lags: 3 (Automatic selection) | | | | |
| Model selection method: Akaike info criterion (AIC) | | | | |
| Dynamic regressors (3 lags, automatic): CPI_1 EXCH OPEN INTEREST GFCF_1 BOT_1 | | | | |
| Fixed regressors: C | | | | |
| Number of models evalulated: 12288 | | | | |
| Selected Model: ARDL(3, 1, 3, 3, 3, 3, 1) | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
| AGRIC(-1) | 0.239614 | 0.120113 | 1.994905 | 0.0740 |
| AGRIC(-2) | -0.406485 | 0.127099 | -3.198181 | 0.0095 |
| AGRIC(-3) | 0.489272 | 0.117011 | 4.181434 | 0.0019 |
| CPI_1 | -6191.414 | 1367.291 | -4.528235 | 0.0011 |
| CPI_1(-1) | 8972.944 | 1318.516 | 6.805338 | 0.0000 |
| EXCH | -2292.503 | 699.5297 | -3.277206 | 0.0083 |
| EXCH(-1) | 1041.740 | 967.4717 | 1.076765 | 0.3069 |
| EXCH(-2) | 3474.234 | 1049.010 | 3.311916 | 0.0079 |
| EXCH(-3) | -3574.466 | 783.1563 | -4.564179 | 0.0010 |
| OPEN | 13501.66 | 2435.492 | 5.543708 | 0.0002 |
| OPEN(-1) | 7136.873 | 2494.652 | 2.860870 | 0.0169 |
| OPEN(-2) | -2035.374 | 1677.545 | -1.213305 | 0.2529 |
| OPEN(-3) | -7179.725 | 1922.342 | -3.734885 | 0.0039 |
| INTEREST | -14105.94 | 3664.135 | -3.849732 | 0.0032 |
| INTEREST(-1) | -14064.85 | 5035.659 | -2.793051 | 0.0190 |
| INTEREST(-2) | -6912.367 | 4317.675 | -1.600947 | 0.1405 |
| INTEREST(-3) | -11821.48 | 3251.927 | -3.635223 | 0.0046 |
| GFCF_1 | 39.09943 | 11.40133 | 3.429375 | 0.0064 |
| GFCF_1(-1) | -25215.38 | 5192.542 | -4.856076 | 0.0007 |
| GFCF_1(-2) | 23312.08 | 5084.310 | 4.585102 | 0.0010 |
| GFCF_1(-3) | 8506.531 | 4414.146 | 1.927107 | 0.0828 |
| BOT_1 | 0.039093 | 0.017351 | 2.253054 | 0.0479 |
| BOT_1(-1) | -0.097748 | 0.021944 | -4.454492 | 0.0012 |

| | | | | |
|---|---|---|---|---|
| C | -299440.9 | 87173.76 | -3.434989 | 0.0064 |
| R-squared | 0.995034 | Mean dependent var | | 163568.4 |
| Adjusted R-squared | 0.983611 | S.D. dependent var | | 268709.5 |
| S.E. of regression | 34399.60 | Akaike info criterion | | 23.91747 |
| Sum squared resid | 1.18E+10 | Schwarz criterion | | 24.99490 |
| Log likelihood | -382.5969 | Hannan-Quinn criter. | | 24.28490 |
| F-statistic | 87.11309 | Durbin-Watson stat | | 2.154216 |
| Prob(F-statistic) | 0.000000 | | | |
| *Note: p-values and any subsequent tests do not account for model selection. | | | | |

**Source: Author's computation from the Eviews result, 2025**

From the result above, the coefficient of AGRIC (-3) is positively signed and statistically significant at 5% critical level; also, the variables, CPI (-1) and GFCF_1(-2) OPEN, EXCH (-2) and BOT_1 are positively signed and statistically significant at 5% critical level. It implies that, any unit change in the amount of agricultural output of the previous years will lead to 48% increases in the current year in Nigeria.

The coefficient of the variable INTEREST is negative. This result indicates that there is a negative relationship between interest rate, agricultural output in Nigeria during the period under review. Thus, unit change in interest rate will lead to a decrease in the current agricultural output growth of the economy.

Statistically, the F-statistic is 98.73039, and the probability of the null hypothesis for no significance in that regression is [0.000000]. The $R^2$ - (R-squared) which measures the overall goodness of fit of the entire regression shows the value as follows: 0.995034 = 99%, while the adjusted $R^2$ (0.983611)= 98%, shows that the independent variables explain the dependent variable to the tune of 98%. Also, the Durbin Watson (DW) statistics DW = 2.154216 which is greater than the $R^2$ shows that the overall regression is statistically significance. Furthermore, the t-ratios for those regressors are also meaningful, and their probabilities are below α(0.05). Thus, the null hypothesis βi = 0 is rejected, and those regressors are significant even at a confidence level of 95%.

**The short run effect of macroeconomic variables on the AGRIC productivity**

There is long-run equilibrium relationship among the variables in the regression model; however, it is the short-run that transmit to the long-run. Thus, Error Correction Mechanism (ECM) is therefore used to correct or eliminate the discrepancy that occurs in the short-run. The coefficients of the explanatory variables in the error correction model measure the short-run relationship. The assumption of the ECM states that if two variables are cointegrated, then, there is error correction mechanism to revise instability in short term (Engle & Granger, 1987). ECM is used to see the speed of adjustments of the variables to deviations from their common stochastic trend. ECM corrects the deviations from the long run equilibrium by short-run adjustments. This shows us that changes in independent variables are a function of changes in explanatory variables and the lagged error term in cointegrated regression. The ECM result is therefore presented below:

**The short run error correction dynamics**

| | |
|---|---|
| ARDL Cointegrating And Long Run Form | |

| Dependent Variable: AGRIC | | | | |
|---|---|---|---|---|
| Selected Model: ARDL(3, 1, 3, 3, 3, 3, 1) | | | | |
| Date: 02/09/24 Time: 12:16 | | | | |
| Sample: 1986 2022 | | | | |
| Included observations: 38 | | | | |
| Cointegrating Form | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| D(AGRIC(-1)) | -0.082787 | 0.094671 | -0.874469 | 0.4024 |
| D(AGRIC(-2)) | -0.489272 | 0.117011 | -4.181434 | 0.0019 |
| D(CPI_1) | -6191.413714 | 1367.290656 | -4.528235 | 0.0011 |
| D(EXCH) | -2292.502979 | 699.529685 | -3.277206 | 0.0083 |
| D(EXCH(-1)) | -3474.233744 | 1049.010246 | -3.311916 | 0.0079 |
| D(EXCH(-2)) | 3574.465768 | 783.156318 | 4.564179 | 0.0010 |
| D(OPEN) | 13501.655593 | 2435.491654 | 5.543708 | 0.0002 |
| D(OPEN(-1)) | 2035.374430 | 1677.545120 | 1.213305 | 0.2529 |
| D(OPEN(-2)) | 7179.724616 | 1922.341784 | 3.734885 | 0.0039 |
| D(INTEREST) | -14105.937220 | 3664.135110 | -3.849732 | 0.0032 |
| D(INTEREST(-1)) | 6912.367098 | 4317.675156 | 1.600947 | 0.1405 |
| D(INTEREST(-2)) | 11821.480444 | 3251.927083 | 3.635223 | 0.0046 |
| D(GFCF_1) | 39.099434 | 11.401328 | 3.429375 | 0.0064 |
| D(GFCF_1(-1)) | -23312.079834 | 5084.309616 | -4.585102 | 0.0010 |
| D(GFCF_1(-2)) | -8506.530761 | 4414.146180 | -1.927107 | 0.0828 |
| D(BOT_1) | 0.039093 | 0.017351 | 2.253054 | 0.0479 |
| ECM(-1) | -0.677599 | 0.124042 | -5.462654 | 0.0003 |
| ECM = AGRIC - (4104.9786*CPI_1 -1993.7964*EXCH + 16858.6792 *OPEN -69221.7868*INTEREST + 9802.7423*GFCF_1 -0.0866*BOT_1 -441914.3725 ) | | | | |

**Source: Author's computation from the Eviews result, 2025**

In the short run result, the coefficient of the lagged variable of the dependent variable AGRIC (-2) shows the value, -0.489272. This implies that a decreases in the agricultural output of the previous year reduces the growth of the current year AGRIC in the short term. The equilibrium error-correction coefficient ECM (−1) is -0.677599 which has the expected negative sign. The error correction term here is negative and significant meaning that there is a long run causality running from independent variables to dependent variable. It also confirms that all the variables are cointegrated or have long run relationship. We can therefore state that 67 percent gap between long run equilibrium value and the actual value of the dependent variable (AGRIC) has been corrected. It can be also said that the speed of adjustment towards long run equilibrium is 67 percent annually. Its t-ratio is -5.462654, and the probability of the null hypothesis being true for zero is [0.003], which is significant even when $\alpha = 0.05$. Thus, it can also be concluded that the adjustment is quite meaningful in the short-run ARDL relationship.

**The long run relationship of the between the selected macroeconomic variables on the AGRIC**

**The long run relationship result**

| Long Run Coefficients | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| CPI_1 | 4104.978635 | 593.252441 | 6.919447 | 0.0000 |
| EXCH | -1993.796400 | 751.824983 | -2.651942 | 0.0242 |
| OPEN | 16858.679191 | 5343.938806 | 3.154729 | 0.0103 |
| INTEREST | -69221.786829 | 21837.382284 | -3.169876 | 0.0100 |
| GFCF_1 | 9802.742319 | 3433.704204 | 2.854859 | 0.0171 |
| BOT_1 | -0.086563 | 0.023075 | -3.751454 | 0.0038 |
| C | -441914.372547 | 126419.430681 | -3.495621 | 0.0058 |

**Source: Author's computation from the E-views result, 2025**

The long-run elasticity of the independent macroeconomic variables contributing to AGRIC is 4104.978635 from 1986 to the present. Thus, we show that CPI, OPEN, GFCF have a positive effect on the agricultural output growth in the long run. This result is in line with apriori expectation with the exception CPI which was expected to be negative but turned positive after the analysis.

## Conclusion and Recommendations

### Conclusion

The agricultural sector remains a cornerstone of economic growth and development in Nigeria, serving as a major contributor to Gross Domestic Product (GDP) and a critical source of livelihood for a significant portion of the population. This study set out to investigate the long-run relationship between macroeconomic variables and agricultural productivity in Nigeria from 1986 to 2023, employing the Autoregressive Distributed Lag (ARDL) bounds testing approach.

The empirical findings confirmed the existence of a stable long-run relationship between agricultural productivity and key macroeconomic variables, namely the consumer price index, exchange rate, trade openness, interest rate, gross fixed capital formation, and balance of trade. The ARDL estimates revealed that increases in exchange rate, interest rate, and balance of trade adversely affect agricultural productivity in the long run. Conversely, consumer price index, trade openness, and gross fixed capital formation exerted a significant positive influence on agricultural output.

These results underscore the considerable sensitivity of Nigeria's agricultural sector to the macroeconomic environment. The study concludes that agricultural productivity is not isolated from macroeconomic fluctuations but is, in fact, largely shaped by them. Thus, policy distortions or instability in these macroeconomic indicators can either constrain or enhance agricultural output. The findings suggest that equipping farmers and agribusiness

stakeholders with a practical understanding of how these macroeconomic forces interact with agricultural productivity would be instrumental in improving sectoral performance. Ultimately, enhancing the resilience of the agricultural sector against macroeconomic volatility will strengthen its contribution to Nigeria's GDP and national food security.

## Recommendations

In view of the study's findings, the following actionable recommendations are proposed to improve agricultural productivity in Nigeria within the prevailing macroeconomic context:

I. **Review and Reduction of Agricultural Interest Rates:** The government, in collaboration with the Central Bank of Nigeria (CBN), should implement targeted policies to lower interest rates for agricultural loans. A preferential, single-digit interest rate regime for agribusinesses would stimulate capital investment in the sector and mitigate the adverse effects of high borrowing costs, particularly as the economy diversifies away from oil dependence.

2. **Stabilization of the Exchange Rate through Firm Monetary Policy Management:** Considering the negative long-run impact of exchange rate volatility on agricultural productivity, monetary authorities should adopt proactive and consistent monetary policy frameworks aimed at achieving a stable and competitive exchange rate. This would improve planning certainty for farmers, investors, and agribusiness exporters.

**3.Strengthen Import Restrictions on Locally Available Agricultural Commodities:** The government should sustain and expand import restrictions on agricultural products that can be viably produced domestically, such as rice, maize, and poultry products. This would not only protect local farmers from unfair foreign competition but also improve Nigeria's trade balance and encourage domestic agribusiness expansion.

**4.Enhancement of the Business Environment for Agricultural Investments:** To foster sustained capital formation in agriculture, the government must prioritize investments in critical public infrastructure—such as rural roads, irrigation systems, storage facilities, and rural electrification. Additionally, maintaining a stable consumer price index and deepening trade liberalization initiatives will create a more predictable and investment-friendly environment for both smallholder farmers and large-scale agribusiness enterprises

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