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### REAL EXCHANGE RATE FLUCTUATION AND AGRICULTURAL OUTPUT: THE NIGERIAN EXPERIENCE

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#### Abstract

*Agricultural sector holds a dominant place in Nigerian economy. The sector with its heavy reliance on imported inputs and its contribution to export earnings has rendered the sector highly sensitive to exchange rate fluctuations. The rate of fluctuations affects the costs of imported inputs, export competitiveness, consumer purchasing power, and investment flows. This study is an assessment of the impact of exchange rate fluctuations on agricultural output growth in Nigeria. The study used time-series data spanning from 1981 to 2023 which were obtained from the World Bank World Development Indicators (WDI) dataset and employed the Autoregressive Distributed Lag (ARDL) model for estimation. The results show strong persistence in agricultural output, with the first lag positive and highly significant (0.8665,  $p=0.0002$ ) at 5% significance level and the second lag negative and significant ( $-0.5641$ ,  $p=0.0303$ ) at 5% level of significance, indicating cyclical fluctuations. Exchange rate effects are dynamic; while current value is insignificant ( $p=0.7158$ ), short-run depreciation raises output (0.1988,  $p=0.0045$ , 5% level) and prolonged depreciation reduces it ( $-0.2139$ ,  $p=0.0050$ , 5% level). Inflation has no immediate effect (0.0019,  $p=0.9409$ ) but shows a delayed negative impact ( $-0.0595$ ,  $p=0.0472$ ) at 5% level of significance. Interest rates exhibit weak short-run gains (0.2415,  $p=0.0810$ ), negative intermediate effects, and a strong long-run recovery (0.3527,  $p=0.0046$ ) at 5% significance level. Based on the findings the study concludes that exchange rate stability, controlled inflation, and affordable credit are necessary complements if agricultural output is to benefit from openness rather than be undermined by it. The study therefore recommends stabilising exchange rates through stronger foreign reserves and export diversification, while promoting local production of agricultural inputs to reduce import dependence. Interest rate policies should also ensure affordable credit access for farmers and agribusinesses, balanced with measures that safeguard long-term growth. These strategies would enhance resilience and sustain agricultural productivity in the face of macroeconomic fluctuations.*

**Keywords:** Real exchange rate, Exchange rate fluctuations, Agricultural output

**JEL Classification:** F31; Q10; O47; F41

#### INTRODUCTION

The agricultural sector plays a pivotal role in Nigeria's economy, accounting for a significant portion of its Gross Domestic Product (GDP) and providing employment to a large percentage of the population (Salisu & Alamu, 2023). According to Praburaj (2018) achieving accelerated growth and sustainable development is impossible unless industry and services grow in tandem with agriculture. However, agricultural sector output growth of the Nigerian economy has not yet been able to reflect the potential benefits of agriculture. This has been attributed to reasons which include; government neglect, insufficient investment, structural weaknesses in macroeconomic management, market limitations, environmental and climatic challenges as well as security issues (Adekunle et al., 2021; Adekunle & Aregbesola, (2025); Nyamida, 2023).

Historically, Nigeria operated under a fixed exchange rate system, but in 1986 the government shifted to a market-determined regime under the Structural Adjustment Program, which gradually developed into the current managed float arrangement (Lawal et al., 2021). The primary rationale for this shift was to enhance the country's trade balance. Following the sharp decline in oil revenues and foreign reserves during the 2014–2015 oil crisis, the Central Bank of Nigeria (CBN) devalued the naira twice between November 2014 and February 2015 in an attempt to ease pressure on the domestic currency, reflected in the widening disparity between official and parallel market rates (Budget Office of the Federation, 2019). These devaluations, however, fell short of expectations. Subsequently, in June 2016, the naira was partially floated, accompanied by frequent CBN interventions through dollar injections into the foreign exchange market (Ishaq, 2021). To further curb imports and preserve limited foreign reserves, the CBN restricted access to foreign exchange for 41 items including rice, poultry, and palm oil products at the official window (Budget Office of the Federation, 2019). In addition, the Federal Government raised import tariffs on these goods and, in some cases, prohibited their importation altogether. More recently, the CBN eliminated the exchange rate cap at the official window, effectively permitting the naira to float freely against the U.S. dollar and other international currencies (Iorember et al., 2024).

The agricultural sector performance is highly sensitive to macroeconomic conditions, particularly fluctuations, which shape the competitiveness of domestic production and the costs of imported inputs. Exchange rate fluctuations therefore have important implications for both producers and consumers in the agricultural value chain (Adekunle et al., 2021). Depreciation of the local currency generally enhances the competitiveness of domestic agricultural goods by making imports more expensive and encouraging a shift toward locally produced alternatives. It can also strengthen the export potential of Nigerian produce by lowering relative prices in global markets, hence bringing a rise in export volume (Sheldon, 2017; Valdes et al., 2020). On the other hand, exchange rate appreciation tends to erode competitiveness, as cheaper imports attract consumer demand and place pressure on domestic farmers who rely on both intermediate imports and export markets (Adekunle et al., 2021). When such dynamics are not effectively managed, the resulting misalignment in relative prices may weaken incentives for production and undermine long-term sector performance (Adu-Gyamfi, 2017).

Beyond the direction of exchange rate movement, volatility itself poses additional challenges. In Nigeria, where agriculture depends heavily on imported machinery, fertilizers, and other critical inputs, the consequences of exchange rate instability are particularly acute (Orji et al., 2019). Frequent and unpredictable fluctuations increase uncertainty for farmers and agribusinesses, raise risks in production and investment decisions, and can generate broader macroeconomic instability.

This situation underscores the need to better understand how exchange rate fluctuations affect agricultural output in Nigeria. This study therefore seeks to establish whether depreciation or appreciation exerts a stronger influence on agricultural performance, and to assess how exchange rate volatility shapes outcomes in the sector. It considers the influence of inflation and interest rates as additional macroeconomic factors, offering insights for policies aimed at exchange rate stability and sustainable agricultural development. This is of top priority and significance given the country's persistent food security challenges, rising import bills, and policy drive toward self-sufficiency and economic diversification. Clear insights into the exchange rate–agriculture nexus

can guide policymakers in designing exchange rate and trade policies that stabilise the sector, protect farmers, and promote growth in both domestic and export markets.

## LITERATURE REVIEW

### *Conceptual Clarification*

#### *Exchange Rate*

Exchange rate represents the value of one nation's currency in relation to that of another (Ogunjobi, 2022). It indicates how much of one currency is required for conversion into another and is determined within the foreign exchange market, where continuous transactions take place among a wide range of buyers and sellers. As Lipsey and Crystal (1999) noted, when one currency appreciates, the other necessarily depreciates. According to Abel and Bernanke (1998) an increase in the real exchange rate, assuming constant demand conditions, reduces a country's net exports. Exchange rate appreciation happens when less units of the local currency trade for higher units of the foreign currency while exchange rate depreciation happens when higher units of the local money trade for less units of the foreign currency (Ogunjobi, 2022).

#### *Exchange Rate Fluctuation*

Exchange rate fluctuation, also described as exchange rate movement, refers to changes in the value of one currency relative to another over time (Shehu & Youtang, 2012). When the rate deviates from its benchmark or equilibrium, it is said to have moved away from equilibrium. In such situations, monetary authorities may intervene and determine the rate based on their assessment of macroeconomic conditions (Ishaq, 2021). In practice, no exchange rate system is a pure float, where values are left entirely to market forces. Instead, most countries, including Nigeria, operate a managed float system in which monetary authorities periodically intervene in the foreign exchange market to achieve specific policy goals (Ishaq, 2021; Lawal et al., 2021).

#### *Agricultural Output*

Agricultural output comprises output sold (including trade between agricultural holdings); changes in stocks; output for own final consumption; output produced for further processing by agricultural producers; and intra-unit consumption of livestock (Organisation for Economic Cooperation and Development [OECD] – FAO, 2023). Steensland and Zeigler (2021) further differentiated agricultural 'output' from 'yield which have often been used interchangeably. According to them agricultural output refers to the total quantity produced, while yield indicates the amount of output generated per unit of production, typically per unit of land. According to Farm Business Survey (2016) agricultural output is the measure of individual crop and livestock output. This comprises crop enterprise output which is the total value of crops produced on the farm, excluding any losses in the field or storage. It includes crops used for feed, seed, and consumption by the farmhouse, and by farm labour; by-products, forage and the additional value generated from agricultural activities beyond the primary crop and livestock production. This includes sales of fodder and by-products, as well as revenue from short-term land leasing for grazing or forage production; the total value generated from livestock and livestock products on the farm and miscellaneous output which covers the value of output from those activities which are still within the agricultural cost centre but do not fall within either livestock or crop enterprise output. These will include revenue from way leaves, agricultural hire work, sundry woodland sales, contract farming rent, miscellaneous insurance receipts and compensation payments.

### ***Empirical Review***

Previous studies have explored the relationship between exchange rate fluctuations and agricultural output with differing conclusions which are discussed in the literature review presented below. Ogunjimi (2020) explored both symmetric and asymmetric effects of exchange rate fluctuations on Nigeria's agricultural sector from 1981 to 2016 using ARDL and NARDL methodologies. The findings indicated positive short-run stimulation of agricultural performance by exchange rate dynamics without exhibiting asymmetric effects, suggesting that both appreciation and depreciation have similar impacts on output.

In another relevant study, Awolaja and Okedina (2020) analyzed real exchange rate changes on aggregate and sectoral agricultural output from 1981 to 2021 using a nonlinear ARDL framework. Their results indicated that real exchange rate appreciation positively affected aggregate and sectoral outputs in the long run while depreciation had negative impacts. Olakunle et al. (2021) investigated the possible asymmetric effects of real exchange rate dynamics on agricultural performance from 1981 to 2016 using the Bounds test for cointegration. They found no long-run relationship between real exchange rates and agricultural output; however, they noted that lagged real appreciation had a more substantial short-run effect compared to depreciation.

Ogunjobi et al. (2022) analyzed how exchange rates influenced Nigeria's agricultural exports from 1981 to 2019, using the ARDL model and Granger causality test. While the study examined factors like interest rates, inflation, and loans, the research primarily focused on the exchange rate's impact on agricultural exports. Findings indicated that the exchange rate significantly affected agricultural exports in the long run, suggesting that higher exchange rates led to increased agricultural exports over time, without any causal relationship between them. Nnoli et al. (2023) examined the interplay between inflation and exchange rates on agricultural exports from 1986 to 2019 using ADF tests, Phillips-Perron tests, Granger causality tests, and ARDL modeling. They established unidirectional causality from exchange rates to inflation and found that both factors positively influenced agricultural export value. This finding partially validates the study of Ogunjobi et al. (2022), reinforcing the significance of exchange rates in export dynamics.

Eniekezimene et al. (2023) further examined the asymmetric impact of exchange rates on agricultural output covering the period from 1981 to 2021 using a non-linear autoregressive distributed lag (NARDL) model. Their findings revealed that while the long-term effect showed that an appreciation in the exchange rate raised real agricultural GDP by approximately 8.8%, depreciation only raised it by 0.11%. This suggests a positive influence of exchange rates on agricultural production over time. Most recently, Odey et al. (2023) investigated the impact of exchange rate dynamics on agricultural sector performance using time series data obtained from various Nigerian statistical sources. They employed ARDL and GARCH estimation techniques to analyze overall agricultural output as well as crop, livestock, and fishery production in relation to changes in exchange rates. Their results revealed significant long-run relationships among these variables; however, they concluded that responsiveness of outputs to changes in exchange rates is negative and statistically significant.

Lastly, Mukhebi (2024) examined the effect of currency exchange rates on agricultural exports in Kenya over the period from 1982 to 2022 using causal research design grounded in purchasing power parity theory. Findings indicated a significant positive impact of exchange rates on agricultural export performance at a 5% significance level, suggesting similar dynamics may exist



across different African economies. These studies indicate that exchange rate fluctuations affect agricultural exports, but their impact on agricultural output is conditional, influenced by factors like government spending, weather conditions, and inflation. The existing literatures on exchange rate fluctuations and agricultural output in Nigeria highlights several gaps, including inconsistent findings regarding the direction and magnitude of exchange rate impacts, particularly between short-term and long-term effects.

## METHODOLOGY

### *Theoretical Framework*

This study was grounded on the Mundell-Fleming model. The Mundell-Fleming model, also known as the IS-LM-BoP model, provides insights into how an open economy operates under different exchange rate regimes. The Mundell-Fleming model, developed by Robert Mundell (1963) and Marcus Fleming (1962), extends the IS-LM model to an open economy, analysing the impact of fiscal and monetary policies under different exchange rate regimes. It suggests that under a fixed exchange rate, fiscal policy is effective, while monetary policy is ineffective, as the central bank must maintain the exchange rate (Obstfeld et al., 2005). In contrast, under a floating exchange rate, monetary policy is effective, but fiscal policy's effectiveness diminishes due to exchange rate adjustments. The model also considers capital mobility, where perfect mobility leads to rapid capital flows based on interest rate differentials, and imperfect mobility allows for more pronounced domestic policy effects. The Mundell-Fleming model describes the short-term interactions between an open economy's nominal exchange rate, interest rate, and output level.

A flexible exchange rate regime may allow for a natural adjustment in response to economic shocks, affecting input costs and international competitiveness (International Monetary Fund [IMF], 2023). This suggests that exchange rate policies influence agricultural production. Flexible exchange rates can boost agricultural exports and production but may raise input costs, while fixed exchange rates limit monetary policy effectiveness, making fiscal policies effective for agricultural support. Relating this to the agricultural sector output growth of Nigeria operating a floating exchange rate system, capital mobility impacts investment in agriculture through interest rates and international capital flows. When interest rates are high in a country, foreign investment (both public and private) may flow into the agricultural sector, potentially boosting productivity and growth. Similarly, exchange rate fluctuations affect the cost of imports and exports for agricultural goods, influencing sector performance in a flexible.

### **Model Specification**

This study utilised the autoregressive distributed lag (ARDL) model. The stationarity of the time series was tested using the Augmented Dickey-Fuller (ADF) unit root test. To establish the relationship between real exchange rate and agricultural output, the study specifies a functional relationship that expresses agricultural output as a function of exchange rate, inflation and interest rate as follows.

$$AVAD = f(EXR, INFL, INTR) \dots\dots\dots i$$

The econometric model is specified in a log-log form as:

$$\ln AVAD_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INFL_t + \beta_3 \ln INTR_t + \mu_t \dots\dots\dots ii$$

Where: AVAD= Agricultural Value Added, EXR = Exchange rate, INTR = Interest rate, INFL = Inflation rate,  $\beta_0$  is the intercept term,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$  are the model parameters and  $\mu_t$  is the stochastic error term.

The coefficients  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  are theoretically expected to take either positive or negative signs, with their validity assessed against established economic theory.

### ***Data Description, Measurement and Source***

This study employed a quantitative approach using time-series data from 1981 to 2023. The study period of 43 years was chosen to capture key trends and ensure a comprehensive analysis of Nigeria's agricultural output, covering economic shifts, policy changes, and major global events, thus enhancing the reliability of findings. Data on Nigeria's Agriculture value-added, exchange rate, inflation rate and interest rate were obtained from the World Bank World Development Indicators (WDI) 2024. Agriculture Value Added (Agriculture, forestry, and fishing, value added) which is the dependent variable is measured as percentage of GDP which in turn gives the value for agricultural sector output growth. The independent variables are; exchange rate (the explanatory variable) is measured in LCU per US\$, (period average), inflation measured is by the consumer price (annual %) and interest rate is lending interest rate measured in percentage. This is as indicated in Table 1. By incorporating these variables the study better isolates the impact of exchange rate movements on agricultural output in Nigeria while controlling for other relevant factors that could influence agricultural productivity.

Table 1: Data Description

Variables	Description	Measurement	Source
AVAD	Agriculture value-added (Iorember et al., 2024)	Measured as a percentage (%) of GDP	World Bank World Development Indicators (WDI), 2024.
EXR	Exchange rate (Iorember et al., 2024)	Measured in LCU per US\$, (period average)	World Bank World Development Indicators (WDI), 2024.
INFL	Inflation (Ogunjobi et al., 2022)	Measured as consumer prices (annual %)	World Bank World Development Indicators (WDI), 2024.
INTR	Real interest rate (Lawal et al., 2021)	Measured in percentage (%)	World Bank World Development Indicators (WDI), 2024.

Source: Authors' computation, 2025

## **RESULTS AND DISCUSSION**

### ***Descriptive Analysis***

The descriptive statistics for the five variables in this study are summarised in Table 1, which spans the years 1981 through 2023 (43 years). The average value of the exchange rate is close to 116.52%, whereas the average value of the log of agricultural value-added is close to 8.8%. Standard deviations of the series from their respective means show that the exchange rate was the most volatile (approximately 108.78%), and the log of real agricultural GDP was the least volatile (approximately 0.73%).

Table 2: Descriptive Statistics of the Variables

Variables	Observations	Mean	Maximum	Minimum	Standard Dev.
LNAVAD	43	3.111683	2.504743	3.609974	0.202425
LNEXR	43	3.712427	-0.481739	6.111038	2.029816
LNINFL	43	2.698675	4.288204	1.684176	0.665429

LNINTR	43	2.808168	3.454738	2.187922	0.290620
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Source: Author's Computation, 2025

From table 2 above, LNAVAD has a mean value of 3.1117 indicating stable average agricultural output, Maximum and minimum values of 3.6099 and 2.5047 respectively, showing moderate variation in output. Standard Deviation of 0.2024 suggests low volatility in agricultural output. The mean value for Exchange Rate (LNEXR) which is 3.7124 reflects the average exchange rate over the period. Maximum value of 6.1110 and Minimum value of -0.4817 indicate very high fluctuations, indicating frequent depreciation. The standard deviation of 2.0298 indicates high volatility, suggesting economic instability. Inflation Rate (LNINFL) on the other hand has a mean value of 2.6987 indicating moderate inflation levels. However, the maximum value of 4.2882 and Minimum values of 1.6842 reflect some periods of high inflation. Standard Deviation of 0.6654 indicates moderate variability in inflation. The mean value (2.8082) of Interest Rate (LNINTR) indicates relatively stable interest rates. With a maximum value of 3.4547 and a minimum value of 2.1879, it is the most stable economic indicator, exhibiting minimal fluctuations. Having a standard deviation of 0.2906, it exhibits the least volatility, reflecting stable and controlled monetary policies.

### Unit Root Test Result

Table 3: Unit Root Test Result

Variables	ADF Statistics	Critical Value (5%)	P-Value	Order of Integration
LNAVAD	-5.194147	-5.175710	0.0478	I(0)
LNEXR	-9.848701	-5.175710	< 0.01	I(0)
LNINFL	-6.360438	-5.175710	< 0.01	I(0)
LNINTR	-5.957368	-5.175710	< 0.01	I(0)

Source: Author's Computation, 2025

Table 3 shows that the dependent variable LNAVAD is stationary (has no unit root) at level (I(0)) The independent variables LNEXR, LNINFL and LNINTR were also stationary at level (I(0)). This confirms that the ARDL estimation is appropriate.

Table 4: ARDL Test Result

Variable	Coefficient	Prob.*
LNAVAD(-1)	0.866546	0.0002
LNAVAD(-2)	-0.564101	0.0303
LNAVAD(-3)	0.166661	0.4481
LNAVAD(-4)	-0.303481	0.0850
LNEXR	-0.020842	0.7158
LNEXR(-1)	-0.008563	0.8871
LNEXR(-2)	0.198814	0.0045
LNEXR(-3)	0.164974	0.0520
LNEXR(-4)	-0.213922	0.0050
LNINFL	0.001878	0.9409
LNINFL(-1)	-0.059500	0.0472
LNINTR	0.241462	0.0810
LNINTR(-1)	-0.244450	0.1078

LNINTR(-2)	-0.243778	0.0954
LNINTR(-3)	0.039165	0.7868
LNINTR(-4)	0.352743	0.0046
C	2.268268	0.0182
@TREND	-0.017297	0.1581
R-squared	0.903052	
Adjusted R-squared	0.824571	
Prob(F-statistic)	0.000000	
Durbin-Watson stat	2.180382	
Breusch-Godfrey Serial Correlation LM Test	F-Stat: 2.031909 Prob. F: 0.1586	
Heteroskedasticity Test: Breusch- Pagan-Godfrey	F-Stat: 1.045125 Prob. F: 0.4559	

Source: Author's Computation, 2025

#### Analysis and Discussion of ARDL Test Results

The findings indicate that past agricultural output significantly influences current output. The positive and highly significant coefficient of LNAVAD(-1) (0.8665,  $p = 0.0002$ ) suggests strong output persistence, meaning that previous agricultural performance has a direct impact on future output. This suggests that improvements in agricultural productivity tend to carry over, reinforcing growth momentum. However, the negative and significant coefficient of LNAVAD(-2) (-0.5641,  $p = 0.0303$ ) implies that agricultural output may experience fluctuations over time, potentially due to cyclical factors such as climate variations, government policies, or investment cycles. The alternating but insignificant coefficients of LNAVAD(-3) and LNAVAD(-4) further suggest a possible oscillatory pattern in agricultural value-added, reinforcing the need for policies that ensure sustained growth. The persistence of agricultural output underscores the need to consolidate past gains through sustained investment in modern farming practices, irrigation, storage infrastructure, and extension services that strengthen continuity in production. Since the results also reveal short-run fluctuations in output, it points to the need for policies that provide stability and reduce volatility in the sector.

The exchange rate impact on agricultural output is complex and time-dependent, consistent with the mixed findings in the literature. The current exchange rate (LNEXR) is statistically insignificant ( $p = 0.7158$ ), indicating that immediate exchange rate fluctuations do not have a direct effect on agricultural output. However, the lagged exchange rate variables reveal a dynamic relationship. The coefficient of LNEXR(-2) is 0.1988 ( $p = 0.0045$ ), suggesting that exchange rate depreciation boosts agricultural output in the short run. This is likely because a weaker currency makes Nigerian agricultural exports more competitive, increasing demand for local produce. This finding is consistent with Ogunjimi (2020), who reported that exchange rate movements stimulated agricultural performance in the short run. Conversely, the coefficient of LNEXR(-4) is -0.2139 ( $p = 0.0050$ ), indicating that prolonged currency depreciation in the long run eventually harms agricultural output. This is likely due to the increased costs of imported inputs, such as fertilizers, pesticides, and machinery, which outweigh the initial benefits of higher export competitiveness. This finding supports Awolaja and Okedina (2020) and Odey et al. (2023), who concluded that prolonged depreciation negatively affects agricultural output by raising



production costs. It also aligns with Eniekezimene et al. (2023), who found that exchange rate appreciation had a much stronger positive impact on agricultural GDP than depreciation (8.8% vs. 0.11%), reinforcing the idea that sustained depreciation has diminishing returns.

This difference in magnitude between the positive short-term effect (0.1988) and the negative long-term effect (-0.2139) suggests that while exchange rate depreciation provides temporary relief, it eventually becomes a burden on the sector. It indicates that while short-term depreciation can support agricultural output by improving export competitiveness, prolonged depreciation is harmful because of its inflationary effect on imported inputs such as fertilizers, machinery, and fuel. This suggests that without complementary policies to promote local input production and reduce import dependency, the benefits of exchange rate depreciation may be short-lived. Hence, the need for exchange rate stability and for policies that encourage domestic production of critical agricultural inputs to reduce the vulnerability of farmers to currency fluctuations.

The results show that inflation does not have an immediate impact on agricultural output (LNINFL = 0.0019,  $p = 0.9409$ ). However, the negative and significant coefficient of LNINFL(-1) (-0.0595,  $p = 0.0472$ ) suggests that inflation exerts a delayed adverse effect on agricultural output. This implies that rising production costs gradually reduce farmers' purchasing power and investment capacity, leading to lower productivity over time. This finding is in contrast to Nnoli et al. (2023), who suggested that inflation could positively influence agricultural export value. The contrast could stem from differences in focus, as this study emphasizes domestic output, whereas Nnoli et al. (2023) examined export-oriented agricultural activities where price competitiveness plays a larger role. The delayed but significant adverse effect of inflation points to the gradual erosion of farmers' purchasing power and investment capacity. This highlights the importance of controlling inflation, alongside interventions such as subsidizing key inputs, improving rural transport systems, and lowering transaction costs to cushion farmers from inflationary pressures.

The current interest rate (LNINTR = 0.2415,  $p = 0.0810$ ) has a weakly significant positive effect, suggesting that higher interest rates may initially encourage investment in agriculture, possibly through increased lending opportunities or improved returns for investors in agribusiness. However, lagged interest rate variables (LNINTR(-1) and LNINTR(-2)) are negative and marginally significant, indicating that higher borrowing costs eventually suppress agricultural output. This suggests that while initial increases in interest rates may attract investment, the higher cost of borrowing ultimately reduces farm productivity and capital expansion over time. Interestingly, LNINTR(-4) has a strong positive effect (0.3527,  $p = 0.0046$ ), suggesting that after an initial decline, agricultural output recovers, possibly due to delayed investment adjustments or government interventions. This suggests that while higher interest rates may stimulate short-term financing and attract investment into agriculture, they become restrictive when sustained at high levels, limiting the capacity of farmers and agribusinesses to borrow and expand operations. The later positive recovery effect suggests that long-term financing adjustments or policy interventions can restore stability. This underlines the importance of maintaining affordable agricultural credit schemes, supported by development finance institutions and concessional lending programs, to ensure that short-term financing needs are met without creating long-run constraints.

In essence, the varying impacts of exchange rate, inflation, and interest rate on agricultural output, as shown in the ARDL results, are consistent with the Mundell-Fleming framework, which emphasises how external shocks, policy choices, and capital movements shape output dynamics hence, the importance of coordinated policies that ensure macroeconomic stability while supporting growth in agriculture. The constant term ( $C = 2.2683$ ,  $p = 0.0182$ ) is statistically significant, indicating that factors not explicitly captured in the model contribute to agricultural output. Meanwhile, the trend variable ( $@TREND = -0.0173$ ,  $p = 0.1581$ ) is not significant, suggesting that agricultural output does not exhibit a strong long-term trend over the period under analysis.

The model diagnostics indicate that the estimated ARDL model is robust. The high R-squared value of 0.9031 and the adjusted R-squared of 0.8246 suggest that the independent variables collectively explain a large proportion of the variations in agricultural value-added. The highly significant F-statistic ( $p = 0.000000$ ) further confirms the model's overall reliability. The Durbin-Watson statistic (2.1804) suggests no serious autocorrelation issues, while the Breusch-Godfrey Serial Correlation LM test ( $p = 0.1586$ ) indicates that serial correlation is not a major concern. Additionally, the Breusch-Pagan-Godfrey heteroskedasticity test ( $p = 0.4559$ ) confirms that the model does not suffer from heteroskedasticity, meaning that the residuals are homoscedastic.

## CONCLUSION

This study was undertaken to assess the impact of exchange rate movement on agricultural output in Nigeria from 1981 to 2023. The study was grounded on the Mundell-Fleming model and ARDL was adopted as the estimation technique. The ARDL model result highlights the significant influence of past agricultural output, exchange rate fluctuations, inflation, and interest rates on Nigeria's agricultural sector. While agricultural output exhibits strong persistence, exchange rate movements have mixed effects, inflation negatively impacts output with a lag, and interest rates show both positive and negative effects at different time horizons. The findings furthermore reinforce the core Mundell-Fleming insight that exchange rate and interest rate policies have asymmetric short-run and long-run effects on output. In the short run, depreciation and higher interest rates can boost agricultural performance through competitiveness and capital inflows. But over time, depreciation fuels input-cost inflation, and high interest rates suppress borrowing and investment, both of which hurt output. This means that for agriculture in an open economy like Nigeria's, macroeconomic stability is as important as sectoral policies. Exchange rate stability, controlled inflation, and affordable credit are necessary complements if agricultural output is to benefit from openness rather than be undermined by it.

### *Policy Recommendations*

Based on the findings, several policy measures can be implemented to improve agricultural output in Nigeria. First, ensuring exchange rate stability is essential to mitigate the adverse effects of exchange rate fluctuations on agricultural production. Government interventions to manage exchange rate volatility, such as stabilising the naira and promoting domestic production of agricultural inputs, can help sustain output. Short-term exchange rate depreciation can be beneficial for agricultural exports, but excessive depreciation should be avoided to prevent long-term cost burdens. Furthermore exchange rate management policies should consider time-lagged effects to avoid short-term benefits leading to long-term economic strain.

Second, inflationary pressures should be addressed to prevent the negative effects of rising prices on agricultural production. Inflation control measures are essential to prevent rising costs from eroding agricultural productivity over time. Policies aimed at reducing inflation, such as subsidising key agricultural inputs and enhancing market efficiency, would be beneficial in maintaining farmers' purchasing power and investment capacity.

Third, interest rate management should be carefully handled to balance the need for affordable credit with financial stability. The mixed effects of interest rates suggest that while lower interest rates can encourage investment in agriculture, excessive fluctuations create uncertainty. Policymakers should focus on interest rate policies that balances short-term borrowing costs with long-term investment incentives to ensure sustainable agricultural development as well as providing targeted agricultural credit facilities with flexible repayment terms to support farmers. Lastly, given the high persistence of agricultural value-added, consistent government investment in agriculture is necessary to sustain growth. Investments in infrastructure, storage facilities, and mechanization can enhance productivity and resilience in the sector.

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