

Effects of Exchange Rate on Nigerian Agricultural Productivity

***Okechukwu Stanley Chidinna and Onwujiariri Eberechukwu Bede**

Federal College of Land Resources Technology, Owerri, Imo State, Nigeria.
E-mail: *okechukwustanley55@gmail.com; Phone number: +234 706 053 4375

Abstract:

This research evaluates the influence of exchange rate dynamics on Nigeria's agricultural productivity from 1981 to 2024. The persistent fluctuations of the Naira and their implications for agricultural growth motivated this investigation. While theoretical perspectives argue that exchange rate variations affect productivity through changes in input costs, export competitiveness, and opportunities for import substitution, empirical findings remain inconclusive. Employing time series data from Central Bank of Nigeria (CBN) bulletins, the study applied the Autoregressive Distributive Lag (ARDL) bounds testing approach to capture long-run interactions. Results show that exchange rate changes exert no significant independent effect on agricultural productivity ($p = 0.1129$). However, agricultural foreign direct investment (FDI) and trade openness were found to significantly drive agricultural Gross Domestic Products (GDP). Jointly, exchange rate, FDI, and trade openness explained about 99% of the variations in the model. These outcomes suggest that the influence of the exchange rate on productivity is likely indirect, mediated by structural and institutional factors. The study therefore recommends targeted exchange rate policies that reflect the specific realities of agriculture and strategies to shield the sector from the negative effects of currency instability.

Keywords: *Exchange Rate, Agricultural Productivity, Trade Openness, Foreign Direct Investment, Autoregressive Distributed Lag.*

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Introduction:

The relationship between exchange rate and agricultural productivity has been a subject of considerable debate in development economics, particularly for developing countries like Nigeria, where agriculture remains a significant economic sector (Krueger et al., 2023). Exchange rate movements theoretically affect agricultural productivity through multiple channels: input costs (especially imported fertilisers and machinery), export competitiveness of

agricultural products, import substitution opportunities, and overall price competitiveness in both domestic and international markets (Oyejide, 2019; Bahmani-Oskooee and Kandil, 2017).

Despite the sector's historical significance, Nigeria's agricultural development has consistently been overshadowed by the oil industry (Uzor, 2022). Agriculture nonetheless contributes about 23% to national GDP, supplies foreign exchange, and provides employment for a

large share of the rural population (CBN, 2019). Thus, the exchange rate volatility became particularly prominent since the Structural Adjustment Program (SAP) of the 1980s (Ayanwale, 2023; Usman, 2012).

The Nigerian naira has experienced significant volatility over the past four decades, with major devaluations occurring in 1986 (from ₦1.2 to ₦4.6 per Dollar), 1999 (from ₦21.9 to ₦92.7 per Dollar), 2016 (from ₦197 to ₦305 per Dollar), and most recently in 2024 (from ₦1,461 to over ₦1,520 per Dollar) (CBN, 2024; NESG, 2024). These exchange rate movements should theoretically have substantial impacts on agricultural productivity through several transmission mechanisms. In Nigeria, agriculture depends heavily on imported inputs such as fertilisers, pesticides, and machinery, with import dependency ratios exceeding 80% for fertilisers and 90% for agricultural machinery (Okenru, 2023). Exchange rate depreciation raises the cost of these inputs, potentially reducing agricultural productivity (Akpokodje, 2022). Second, exchange rate movements affect the redundancy of Nigerian agricultural exports across borders. A depreciated Naira should make Nigerian agricultural products more competitive abroad, potentially stimulating productivity growth (Ogunleye, 2008; Nwankwo and Njogo, 2013). Third, exchange rate depreciation can encourage import substitution in agricultural products, providing incentives for increased domestic production (Izuchukwu et al., 2014).

The theoretical foundation for exchange rate effects on agriculture is well-established in economic literature. The Dutch Disease model, particularly relevant for Nigeria as an oil-dependent economy, predicts that resource booms leading to currency appreciation can harm agricultural competitiveness (Corden and Neary, 2020). Conversely, currency depreciation following resource price declines should enhance agricultural productivity through improved competitiveness (Gylfason et al., 1999).

Despite these theoretical linkages, the empirical linkage between the exchange rate and agricultural productivity in Nigeria is not yet clear. International studies have shown mixed results: while Krueger et al. (2023) found significant negative effects of exchange rate overvaluation on agriculture across 18 developing countries, more recent studies by Bahmani-Oskooee and Kandil (2007) report inconclusive results. Nigerian-specific studies have been equally mixed. Oyejide (2019) found limited effects of exchange rate changes on agricultural performance during the early SAP period, while Akpokodje (2022) documented significant negative effects of exchange rate volatility on agricultural exports. Ogunleye (2008) and Nwankwo and Njogo (2013) found no significant relationship between exchange rate and agricultural productivity, suggesting that other factors may dominate.

This ambiguity in the literature, combined with Nigeria's persistent exchange rate volatility and the need to understand its implications for agricultural development, motivates this study. The continued decline in agricultural productivity per capita (from 2.8% annual growth in the 1960s to less than 1% in recent decades) despite significant exchange rate movements suggests that the relationship may be more complex than theoretical models predict (World Bank, 2020; NESG, 2024).

The general objective of this study is to examine the effect of exchange rate fluctuations on agricultural productivity in Nigeria. Specifically, the study seeks to:

1. Determine the extent to which exchange rate variations influence agricultural productivity in Nigeria.
2. Assess the effect of foreign direct investment on agricultural productivity.
3. Investigate the relationship between trade openness and agricultural productivity.

Research Hypotheses

To achieve these objectives, the following null hypotheses were tested:

- **H₀₁:** Exchange rate fluctuations have no significant effect on agricultural productivity in Nigeria.
- **H₀₂:** Foreign direct investment has no significant impact on agricultural productivity in Nigeria.
- **H₀₃:** Trade openness does not significantly influence agricultural productivity in Nigeria.

THEORETICAL FRAMEWORK

Trade Theory and Agricultural Productivity

Trade theory, particularly the Heckscher-Ohlin model, provides insights into how exchange rate movements affect agricultural productivity through comparative advantage mechanisms. Nigeria, being relatively abundant in land and agricultural labour, should have a comparative advantage in agricultural production. Exchange rate depreciation enhances this comparative advantage by making agricultural exports more competitive and imports more expensive.

This theoretical framework suggests that exchange rate depreciation should stimulate agricultural productivity by encouraging specialisation in agricultural production and increasing the profitability of agricultural activities. However, the theory also recognises that the availability of complementary inputs (such as imported fertilizers and machinery) can affect the realisation of comparative advantage (Ogundu, 2023).

Conceptual Framework

Concept of Exchange Rate

The exchange rate is a fundamental macroeconomic price that reflects how one currency is exchanged for another. It directly shapes international trade, capital flows, and

competitiveness. For an economy like Nigeria that participates in both imports and exports of agricultural products, the level and stability of the exchange rate are crucial (Sozovska, 2014).

By altering the relative prices of domestic versus foreign goods, the exchange rate influences production, consumption, and investment decisions. A strong currency makes imports cheaper but undermines the competitiveness of exports, while a weaker currency encourages exports but raises the cost of imported goods and inputs. This dual role makes exchange rate management an essential policy concern.

In Nigeria, the exchange rate exists in two forms:

- **Official Rate:** fixed or guided by the Central Bank of Nigeria (CBN).
- **Market Rate:** largely determined by demand and supply of foreign exchange.

When demand for foreign currency exceeds supply, the naira depreciates; the reverse occurs when foreign exchange supply increases. Thus, the exchange rate has direct implications for input prices, inflation, employment, government revenue, and the wider balance of payments (CBN, 2019).

Empirical Review

Empirical research on the role of the exchange rate in agricultural productivity reveals mixed outcomes across countries and time periods.

- **Cross-country evidence:** Schiff and Valdés (1992) found that overvalued exchange rates significantly reduced agricultural output in developing economies by cutting profitability and discouraging investment. Similarly, Krueger et al. (2023) showed that correcting exchange rate distortions could raise agricultural production between 5–15% in 18 developing countries studied.
- **Mixed global findings:** Bahmani-Oskooee and Kandil (2017) reported inconsistent effects across countries, with

some experiencing gains and others losses from exchange rate volatility.

- **Evidence from Nigeria:** Early Nigerian studies, such as Oyejide (2019), found that depreciation made exports more competitive but simultaneously raised the cost of imported inputs, resulting in only modest effects. Akpokodje (2022) observed that exchange rate volatility harmed agricultural exports, particularly in subsectors tied to external markets.

Other studies highlight a weak or insignificant link. Ogunleye (2008), examining 1970–2003, concluded that exchange rate depreciation had no significant impact on agricultural productivity. Similarly, Nwankwo and Njogo (2013) (1981–2010) found no meaningful relationship, attributing the outcome to the dominance of small-scale subsistence farmers who are less connected to global markets.

- **Related sectoral studies:** Oriavwote and Oyovwi (2018) investigated drivers of real exchange rate in Nigeria and identified capital flows and price levels as key determinants, while Akinlo and Lawal (2018) found a long-run positive effect of exchange rate depreciation on industrial production. Yaqub (2018) reported contractionary effects of exchange rate movements on agriculture and manufacturing, but expansionary effects on services, concluding that Nigeria's structural conditions limit the benefits of depreciation in core productive sectors.

Taken together, these findings highlight that the link between exchange rate and agricultural productivity in Nigeria is context-dependent. While theoretical frameworks predict strong connections, domestic structural factors such as reliance on imported inputs, prevalence of subsistence farming, and weak value chains moderate the outcomes.

METHODOLOGY

Research Design

The study adopted an ex-post facto design, since it relied on historical secondary data, which could not be manipulated by the researcher. This design was appropriate for analysing the statistical properties of the data and identifying long-run relationships among the variables of interest.

The procedure involved two key stages:

1. Conducting a unit root test using the Augmented Dickey-Fuller (ADF) technique to determine the stationarity of the series.
2. Estimating the specified model using the Autoregressive Distributed Lag (ARDL) framework, which is suitable for variables integrated at mixed levels of stationarity.

Model Specification

The model was informed by trade theory and purchasing power parity theory, with the hypothesis that exchange rate movements significantly affect agricultural productivity through input costs, export competitiveness, and investment channels. The model is specified as follows:

$$\text{AGRIGDP} = f(\text{EXCHR}, \text{AFDI}, \text{TOP}) \dots (4.1)$$

Where the exchange rate (EXCHR) is the primary variable of interest, others serve as control variables.

$$\text{In linear form: } \text{AGRIGDP}_t = \beta_0 + \beta_1 \text{EXCHR}_t + \beta_2 \text{AFDI}_t + \beta_3 \text{TOP}_t + U_t \dots (4.2)$$

Transforming to natural logarithm to address heteroscedasticity:

$$\text{LnAGRIGDP}_t = \beta_0 + \beta_1 \text{LnEXCHR}_t + \beta_2 \text{LnAFDI}_t + \beta_3 \text{LnTOP}_t + U_t \dots (4.3)$$

Where:

AGRIGDP_t = Agricultural Gross Domestic Product (proxy for agricultural productivity)

- **EXCHR_t** = Exchange Rate (Naira per US Dollar)
- **AFDI_t** = Foreign Direct Investment to Agriculture

- **TOP_t** = Trade Openness
- **β₀, β₁, β₂, β₃** = Parameters to be estimated
- **U_t** = Error term

RESULTS AND DISCUSSION

Unit Root Test

The Augmented Dickey–Fuller (ADF) test was used to check for stationarity in the data series. Results revealed that the variables exhibited mixed levels of integration: Agricultural GDP (AGRIGDP), Exchange Rate (EXCHR), and Agricultural FDI (AFDI) were stationary after first differencing, while Trade Openness (TOP) was stationary at the level. Since the variables were not uniformly integrated, the ARDL Bounds test approach was applied, making it appropriate for the analysis.

Long Run ARDL Estimates

Table 1: Long Run ARDL Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHR	11.774195	6.924803	1.700293	0.1129
AFDI	90.570934	7.271164	12.456181	0.0000
TOP	51.980482	7.055591	7.367276	0.0000
C	1597.883204	204.094716	7.829126	0.0000
R-squared	0.999267			
Adjusted R-squared	0.998083			
F-statistic	843.8509			
Prob(F-statistic)	0.000000			

E-views Result.

The ARDL model was estimated to assess the long-run relationship between agricultural productivity and the independent variables.

Key results showed:

- **Exchange Rate (EXCHR):** Positive coefficient (11.77), implying a direct relationship with agricultural productivity. However, the p-value

(0.1129) indicated the effect was not statistically significant.

- **Agricultural FDI (AFDI):** Strong positive effect (coefficient = 90.57) and statistically significant ($p < 0.01$). This suggests FDI is a major driver of agricultural output.

- **Trade Openness (TOP):** Positive and significant (coefficient = 51.98; $p < 0.01$), meaning increased openness to trade enhances agricultural performance.

The overall model recorded a very high R-squared value of 0.999, indicating that about 99% of the variation in agricultural productivity was explained jointly by the three variables.

Test of Hypotheses

Individual Effects (t-tests)

Table 2: Individual Results (t-tests)

Variables	t-statistics	p-value @ 5% sig. level	Decision
EXCHR	1.7002	0.1129	Accept H_0
AFDI	12.4561	0.0000	Reject H_0
TOP	7.3672	0.0000	Reject H_0

E-Views Result

- H_{01} (Exchange rate has no significant effect): Accepted, since the p-value (0.1129) > 0.05 .
- H_{02} (FDI has no significant effect): Rejected, as $p < 0.01$, showing FDI significantly drives agricultural productivity.
- H_{03} (Trade openness has no significant effect): Rejected, since $p < 0.01$, confirming a significant link between trade openness and agricultural productivity.

Joint Effects (F-test)

The F-statistic (843.85, $p < 0.000$) confirmed that exchange rate, FDI, and trade openness jointly exert a significant impact on agricultural productivity, even though the exchange rate alone was not significant.

4.3 Adjusted R-square

The adjusted R-squared (0.998) demonstrated an excellent model fit, meaning the explanatory variables accounted for nearly all observed variations in agricultural productivity during the study period.

Multicollinearity Test

Table 3: Results of Variance Inflation Factor (VIF)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
EXCHR	5.44617	5.3672	1.9797
AFDI	7.30236	2.7349	8.8410
TOP	7.00201	8.31976	4.333801
GEXPEC	1.038348	17.5092	5.94468
C	15.5277	38.1088	NA

Variance Inflation Factor (VIF) analysis showed that all variables had centred VIF values below the threshold of 10, suggesting no severe multicollinearity problems in the model.

Discussion of Findings

The findings confirm the existence of a long-run relationship among exchange rate, FDI, trade openness, and agricultural productivity. However, unlike FDI and trade openness, which showed strong positive significance, the exchange rate was found to be insignificant, despite having a positive coefficient.

This result contrasts with theoretical expectations that depreciation should improve agricultural competitiveness but aligns with earlier Nigerian studies (e.g., Nwankwo and Njogo, 2013; Ogunleye, 2008), which reported weak or no significant effects of exchange rate on agriculture. One plausible explanation is that Nigeria's agricultural sector is dominated by subsistence farmers who rely less on imported inputs and produce mainly for domestic markets. Such structural characteristics reduce the sensitivity of the sector to currency fluctuations.

The strong significance of FDI highlights the importance of external investment in improving productivity through capital inflows, technology transfer, and modern farming techniques. Similarly, trade openness proved beneficial by facilitating access to larger markets and encouraging specialisation, consistent with trade theory.

Conclusion and Recommendation

This study examined how exchange rate movements, agricultural foreign direct investment (FDI), and trade openness affect agricultural productivity in Nigeria between 1981 and 2024. The ARDL bounds test confirmed a long-run relationship among the variables. Results revealed that while the exchange rate had a positive coefficient, its effect on agricultural productivity was statistically insignificant. In contrast, agricultural FDI and trade openness both had

significant positive effects, serving as key drivers of growth in the sector.

The joint effect of the three variables was significant, explaining almost 99% of the variations in agricultural productivity. This indicates that although exchange rate changes alone may not strongly determine the sector's output, the combined influence of currency movements, investment inflows, and trade liberalisation is substantial.

The study concludes that the insignificance of the exchange rate may reflect the unique structure of Nigeria's agriculture, which is largely subsistence-based, domestically oriented, and only marginally integrated with global markets. Farmers in this system are less exposed to imported inputs or export markets, thereby limiting the sector's sensitivity to currency fluctuations.

The study recommends that Policymakers should focus on a comprehensive exchange rate policy reform that will consider the agricultural sector's unique characteristics and the development of mechanisms to insulate agricultural productivity from exchange rate volatility. These reforms should include improving market access, developing value chains, and promoting the commercialisation of agriculture.

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