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MACROECONOMIC DETERMINANTS OF AGRICULTURAL PERFORMANCE IN NIGERIA: THE ROLE OF EXCHANGE RATE DEPRECIATION AND FOREIGN DIRECT INVESTMENT

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Abstract

Macrostability continues to influence the performance of the agricultural industry within the economy through various macroeconomic factors. The performance of the agricultural industry in Nigeria is also influenced by the state of the macroeconomic environment since it is sensitive to the international business environment. Therefore, this study focuses on analysing the impact of particular macroeconomic factors on agricultural performance in Nigeria for the period of 1981 to 2024, considering the following independent variables: exchange rate, inflation rate, lending interest rate and foreign direct investments, while agricultural performance is measured through agricultural value added to GDP. The impact of exchange rates on agricultural performance is significant in the short run but insignificant over the long run. Agricultural performance is impacted by exchange rates in the short term through quick adjustments, but this influence fades over time because of economic adjustment mechanisms. Lending interest rate is significant in the long run, indicating that higher borrowing costs reduce agricultural performance over time. Inflation rate and foreign direct investment are insignificant in the long run, although inflation is significant in the short run, while foreign direct investment is only significant through lagged effects, indicating delayed transmission rather than immediate or sustained impact. The error correction term is negative and significant, confirming adjustment toward long-run equilibrium. The study concludes that lending interest rate plays a more important role in determining agricultural sector performance in Nigeria in the long run, while exchange rate and inflation mainly influence short-run dynamics, and foreign direct investment remains weak in both periods. This indicates that agricultural performance in Nigeria is more sensitive to credit conditions than to external capital flows or price level changes in the long term. As such, policies should be directed toward improving access to affordable credit, maintaining exchange rate stability in the short run, and strengthening financial conditions within the agricultural sector.

Keywords: Agricultural Performance, Exchange Rate, Inflation, Interest Rate, Foreign Direct Investment, ARDL Model, Nigeria.

1. INTRODUCTION

The performance of agriculture plays an important part in determining the economic development of emerging nations such as Nigeria, considering its importance in terms of contributing to production, job creation, food security, and the entire process of economic diversification.

The part played by the agricultural sector in the economy cannot be overstated, because it encompasses how much agriculture contributes to structural change in the country towards sustainable development.

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For a long time, Nigeria has depended on agriculture for its major non-oil sector through its extensive arable lands and favorable climate (Sale, 2025). Nevertheless, agricultural performance in the country has been hindered by the existence of a very unstable macroeconomic environment, marked by continuous depreciation in the value of the currency, inflation, high-interest rates, and foreign direct investment, which are key to the process of production and investment (Kiri & Mustapha, 2025).

Although some economic approaches posit that exchange rate depreciation could be useful in increasing competitiveness and encouraging foreign direct investment in productive industries like agriculture by reducing the cost of assets (Okafor et al., 2021), there are those who argue that exchange rate depreciation causes increased costs of production because of the increased prices of imported equipment, fertilizer, and agrochemicals, leading to a disincentive for sustained growth in agricultural activities (Udoji et al., 2024).

However, agricultural output in Nigeria has increasingly been dependent on macroeconomic uncertainty, where exchange rates and foreign investments have been employed as indicators of economic feasibility (Ananwude et al., 2025).

A constant conflict between the wealth effect and cost of production effect defines the theoretical link between foreign exchange movements and agricultural performance in Nigeria. According to the IMF eLibrary, a depreciated local currency theoretically promotes foreign direct investments into agriculture because it reduces the costs involved when foreign firms enter the industry, allowing them to buy land, agricultural business resources, and labor at lower foreign currency prices (Iorember et al., 2024).

This investment flow would improve agricultural production in terms of technology, mechanization, and modernization of the agricultural system. On the contrary, continuous devaluation of the local currency within an economy highly dependent on importing agricultural inputs like fertilizers, irrigation systems, agricultural machinery, and agrochemicals makes the cost of production higher than the possible advantages (Zang & Xia, 2025).

The dual impact creates a challenging production scenario for the agricultural industry, whereby policymakers and investors have to weigh the benefits of foreign capital investment against the costs involved.

The recent trend witnessed in the Nigerian economy revolves around the adoption of drastic monetary measures to correct inherent structural weaknesses (Tyoga et al, 2026). In June 2023, the Central Bank of Nigeria (CBN) unified various exchange rates, introducing an arrangement based on “willing buyer, willing seller”, with an immediate adverse impact on the value of the Naira. This was meant to improve transparency and resolve the backlog in foreign exchange transactions.

Unfortunately, it resulted in a significant decline of over 40% in the value of the Naira in just one year against the US dollar (Emmanuel, 2026). This situation has brought about drastic changes in the macroeconomic environment under which agriculture operates, especially

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through the increase in costs incurred when purchasing inputs and also macroeconomic uncertainties in investment decisions. In addition, there have been changes in the risk environment for foreign direct investment, thereby affecting the inflow of capital in the production process including agriculture since some foreign investors are scaling down their operations or exiting the industry.

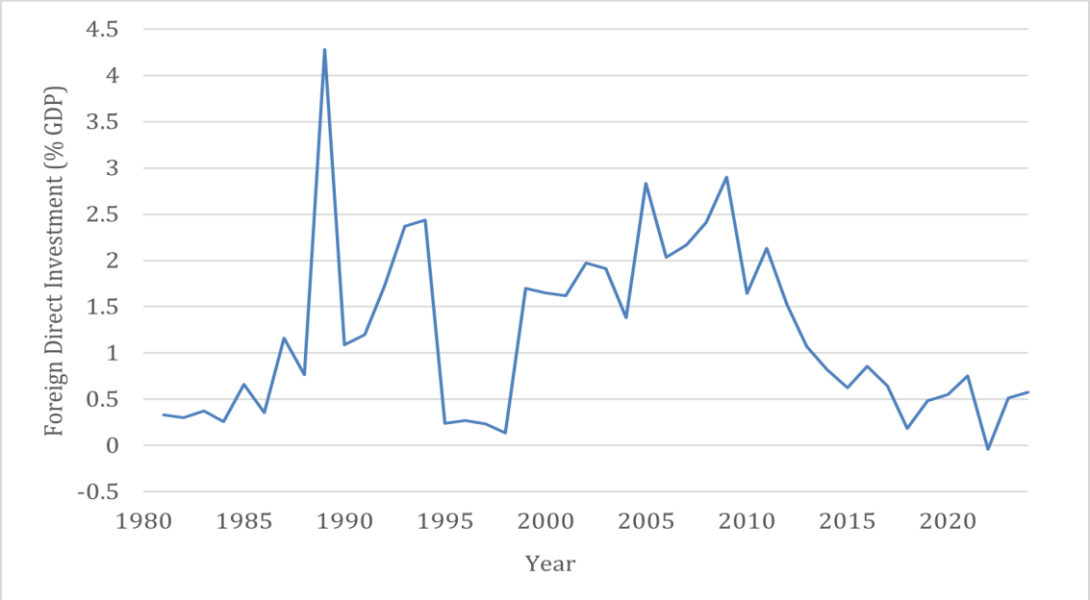

Figure 1: Foreign Direct Investment (% GDP) Trend in Nigeria 1981–2024

The history of macroeconomic performance in Nigeria has been marked by substantial volatility as can be seen from the foreign direct investment (FDI) and exchange rate changes during the past four decades. As shown in Figure 1, there has been great fluctuation in the case of FDI inflows.

The FDI inflows in the early 1980s were low but there has been a surge in the FDI inflows of the later 1980s and mid-2000s. But after 2011, the FDI inflows have gone through several declines indicating limited investments by foreign companies in Nigeria.

To complement this narrative, Figure 2 presents the trend of the Exchange Rate (LCU per US$), highlighting the systematic and aggressive decline in the value of the Naira versus the US dollar. In contrast to the stable trends from the earlier decades of the 1980s and up until the sudden vertical jumps after the currency flotation reforms in 2023, this graph shows the drastic reduction in the currency's worth.

Together, these graphs serve as visual proof for the reason for undertaking this study – the scissors effect between the increasing inflation and declining exchange rate results in a risky business environment. The visual information clearly indicates that the cost of conducting operations and servicing debts has risen to an extent that could discourage any foreign direct investment regardless of the wealth effect brought about by a weaker currency.

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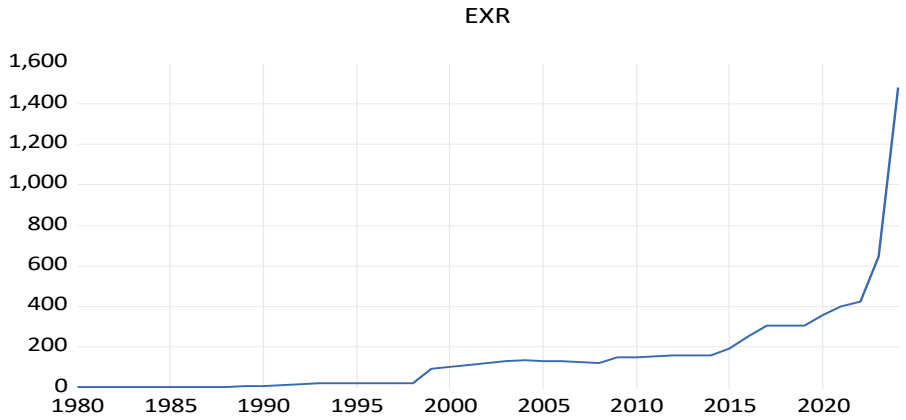

Figure 2: Exchange Rate (LCU per US$) Trend in Nigeria 1981–2024

Besides exchange rate movements, some of the most critical macroeconomic factors influencing agricultural production in Nigeria include inflation and interest rate levels. The country has been experiencing sustained hyperinflation that rose beyond 33% in early 2024, which has had negative impacts on consumer demands, costs of production, and increased the cost of financing agriculture in Nigeria (NBS, 2025).

The high-interest rate policy adopted to mitigate the effects of inflation has made it harder for farmers and agricultural businesses to borrow money, hence reducing their growth and production capacity (Akpan & Umoren, 2021). The situation has rendered the agriculture industry in Nigeria vulnerable to any changes in the macroeconomic environment.

As a result, the flow of agricultural finance and investments, including foreign direct investment, has been limited, with more focus on volatile short-term capital flows within the overall financial context (Sale, 2025). The current study is motivated by the immediate need to empirically examine the effects of modern macroeconomic shocks on agriculture value addition in Nigeria.

Through an analysis of data from 1981 to 2024, the study intends to establish the degree to which the depreciation of exchange rates, foreign direct investments, inflation, and interest rates affect agricultural performance, as well as whether capital flows externally can overcome macroeconomic instability in agriculture. The results from this study will be key in providing guidance on how to promote macroeconomic stability in Nigeria.

Research Questions

1) What effect does exchange rate depreciation have on agricultural performance in Nigeria?
2) What is the effect of Foreign Direct Investment (FDI) on agricultural performance in Nigeria?
3) How do macroeconomic variables such as inflation and lending interest rates influence agricultural performance in Nigeria?

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Research Hypotheses

$H_0$1: Exchange rate depreciation has no significant effect on agricultural performance in Nigeria.

$H_0$2: Foreign Direct Investments have no significant effect on agricultural performance in Nigeria.

$H_0$3: Macroeconomic variables such as inflation and lending interest rates have no influence on agricultural performance in Nigeria.

1.1 Contribution of the Study

This research adds to the existing body of knowledge by providing a detailed perspective on the relationship between macroeconomic instability and agricultural performance in a debt-burdened emerging market. The specific contributions are as follows:

Longitudinal Perspective: With the use of a strong 44-year-long database, the study covers numerous economic waves, including periods such as SAP, oil shocks, and most recently, the floating currency policy, giving it greater historical relevance compared to many current studies.

Short-term vs Long-term Effects: The paper provides an important distinction between short-term vulnerability and long-term effects on agriculture production in Nigeria, proving the country's high sensitivity to macroeconomic events like the devaluation of its exchange rates, but showing that the effects in the long run can be stabilized through changes in capital inflows and prices.

Empirical Validation and Policy Framework: The results of this study will serve as an empirical basis for developing macroeconomic and investment policy frameworks, especially for the CBN and FMARD, which would improve agriculture output in Nigeria. This study will also assist in bridging the gap that exists regarding whether the wealth effect or cost effect has a stronger impact on agricultural output due to exchange rate changes and foreign direct investment inflows in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Review

Agricultural performance is defined as the aggregate measures of how well the agricultural sector performs in an economy. It reflects the contribution of this sector to economic output, employment generation, food security as well as overall development goals. For many developing economies in structural transition, it is a measure of sectoral strength and resilience. The macroeconomic environment through exchange rate adjustments, inflation, interest rates and foreign capital inflows that affect production costs, investment behavior and the allocation of resources, is a crucial determinant of agricultural performance as well as its resilience to major shocks.

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Foreign Direct Investment (FDI) is the primary long-term capital inflows by individuals or business firms in one country into business operations in another country Micro, and it is usually associated with ownership of at least 10 percent of voting power in an enterprise (Adeagbo & Jimoh, 2023). The key motivation is typically access to new markets, cheaper production costs, natural resources or technology. FDI may include the sustainment of an identical business overseas or integration into a different level of the supply chain, e.g. acquiring input suppliers (CFI, 2019). It usually consists of equity capital, retained earnings, and short- or long-term loans. FDI however, can also lead to productivity gains, employment increases, technology transfer in addition to being part of the knowledge economy but leads to possible crowding out local firms and increased vulnerability of shocks from outside (Adewale et al., 2024).

Exchange rate depreciation means the decrease in the value of a domestic currency relative to foreign currencies which may be influenced by different factors such as trade deficits and inflation due to widespread monetary compulsions, weak investor confidence or also weaker reserves. For Nigeria, it is reflected in the gradual depreciation of its Naira against that US dollar. A depreciation raises the cost of imports and lowers the relative price of exports, which would improving trade balances but can come at a cost in terms of accelerating inflation and loss of purchasing power (Dogru et al., 2019). It can be caused by oversupply of currency, poor demand, extremely high inflation, debt burden, political instability or even interest rate differential that are not helpful. Despite supporting external competitiveness, however, the speed with which depreciation occurs may discourage investment in export industries and increase economic instability—and for import-dependent economies such as Nigeria (Mesagan et al., 2018), increase the cost of imported inputs and machinery.

Macroeconomic determinants refer to the large-scale economic factors such as inflation and interest rates that dictate the terms of investment, affect national output, and impact multinational investment decisions. They have an impact on domestic investment and economic stability, together with FDI and exchange rates. Long term economic determinants consist of investments in infrastructure, machines, education, and health. Increases in efficiency, sound institutions, and political stability all enhance economic performance (Nguyen 2025; Bloomenthal 2025).

2.2 Theoretical framework

The theoretical framework of this study combines the Two-Gap Theory, the Eclectic Paradigm, and Froot and Stein's Wealth Effect Model.

According to the Two-Gap Model, the underdevelopment of the economy is hindered by the existence of two crucial gaps: the savings gap and the foreign exchange gap (Adegboye et al., 2020). This model explains that while domestic savings cannot provide enough resources for investments, foreign exchange cannot facilitate the acquisition of capital items for productive activities like agriculture. Due to Nigeria's dependence on foreign resources for financing its economic activities and import-oriented mode of production, agriculture in the country is prone to savings and foreign exchange gaps, resulting in less domestic investment and high costs

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associated with foreign-exchange-driven imports of agricultural machinery, fertilizer, and technology (Adebayo and Gambiyo, 2020; Oladeji and Musa, 2022). In this case, foreign direct investment acts as a vital mechanism to ease the problem of financing constraints. The Eclectic Paradigm (OLI Framework) provides an explanation of the circumstances in which companies engage in foreign direct investments. The framework suggests that such investments are motivated by ownership advantages, location advantages, and internalization advantages (Dunning, 2000). The Nigerian agriculture industry offers location advantages in terms of availability of fertile lands, favorable weather, and access to a domestic market. Nevertheless, there are limitations to these benefits due to macroeconomic instability factors such as exchange rate fluctuations, inflation, and expensive borrowings, which raise risks and lower investment appeal. Moreover, poor infrastructure and costly transport also contribute to the inefficiency and profitability of agriculture investments, thereby influencing domestic and international participation in the industry (Anochie et al; Akpan & Umoren, 2021).

Froot and Stein's Wealth Effect Model describes how exchange rate movements affect foreign investment decisions in imperfect capital markets. According to Lajevardi and Chowdhury (2024), currency depreciation boosts international investors' relative wealth, allowing them to acquire domestic assets at lower actual costs than local investors. This mechanism implies that exchange rate depreciation may attract foreign direct investment in agriculture by lowering the acquisition price of farmland, agribusiness enterprises, and other productive assets. However, this effect coexists with growing production costs caused by imported inputs, resulting in competing dynamics that both affect agricultural performance (Lajevardi & Chowdhury, 2024).

These theories demonstrate that agricultural performance in Nigeria is influenced by a number of capital limitations, investment location conditions, and exchange rate movements. They contend that exchange rate depreciation influences agricultural performance through both cost and investment channels, whereas foreign direct investment serves as a conduit for capital and productivity effects. Inflation and interest rate fluctuations intensify these relationships by influencing manufacturing costs and financing capacity. As a result, the study will determine whether exchange rate depreciation, foreign direct investment, inflation, and interest rates have a significant impact on agricultural performance in Nigeria.

2.3 Empirical Literature

The empirical findings show mixed evidence about the relationship between exchange rate dynamics, foreign direct investment, and agricultural performance in Nigeria. Enilolobo et al. (2021) discovered that both exchange rates and foreign direct investments had a negative impact on agricultural output, implying that depreciated currency rates and foreign investments cannot always contribute to productivity gains due to fundamental sector inefficiencies. However, Amunigun and Oluwoye (2025) found that exchange rate, inflation, interest rate, and national output are significant in affecting agricultural exports, whereby macroeconomic instability, mainly exchange rate volatility and inflation, adversely affect export competitiveness because of increased production costs. Similarly, Ananwude et al. (2025) found that foreign direct investment has a significant positive influence across agricultural sub-sectors, suggesting that the influence of foreign direct investment is dependent on proper

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channeling to production areas like agriculture, livestock, forest products, and fisheries. Akpan and Umoren (2021) discovered that exchange rate, inflation, and interest rate significantly influence agriculture production, where inflation and interest rate decrease productivity due to high cost and low finance access, whereas exchange rate influences output differently during different time periods. Ibrahim et al. (2025) reported that inflation has a negative impact on agricultural output in the long term, interest rate constraints hinder the growth of the sector, and foreign exchange rates affect its performance both through costs and competitiveness. Chukwurimazu and Ezi (2025) showed further that exchange rate depreciation enhances the competitive advantage of exports in the long term but raises input costs in the short run, while higher interest rates decrease agricultural performance due to limited credit availability.

Iorember et al. (2024) reported that exchange rates and agriculture expenses had a positive effect on agricultural value-added, whereas energy prices had a significantly negative effect, indicating the importance of macroeconomic uncertainty and input costs with varying impacts on domestic investments and households' consumption levels. Also, Utuk et al. (2024) found out that in the long run, exchange rate, foreign direct investments, and human capital positively affect the agricultural value added while GDP per capita negatively affects it, thereby pointing out the importance of maintaining stable exchange rates, inflows, investments, and improving human capital.

Several studies found mostly weak or insignificant relationships. Munaji et al. (2025) discovered that interest rates have an insignificant negative influence on agricultural productivity, however agricultural credit variables such as bank loans had a greater impact. Adeagbo and Jimoh (2023) also found that foreign direct investment has a negative and insignificant impact on agricultural output since it is concentrated outside of the agricultural sector. Udoji et al. (2024) found that both the exchange rate and interest rate have positive but insignificant effects on agricultural output, indicating weak monetary variable transmission, whereas Okafor et al. (2021) discovered that the exchange rate has a significant effect on agricultural development, inflation has a negative effect, and the interest rate remains insignificant.

Other studies show mixed findings on investment dynamics. Okonkwo et al. (2021) discovered a positive correlation between exchange rate and foreign direct investment, but Debayo and Gambiyo (2020) reported a positive but weak association between exchange rate and FDI, with interest rates having a negative effect on FDI. Adewale et al. (2024) showed that exchange rate movements had a significant effect on FDI inflows, whereas Ohajieze and Ozoekwe (2025) discovered that exchange rate movements have a greater impact on FDI and inflation in the short run than in the long run. Furthermore, Nwankwo and Allison (2021) conclude that interest rates have a significant impact on private investment. This demonstrates how loan availability influences decision-making regarding investments.

Despite substantial academic research on the Nigerian agricultural and investment environment, there are still inconsistencies on the nature and scope of macroeconomic influence on agricultural performance. While some studies have shown greater agricultural output as a result of foreign direct investment and exchange rates, others highlighted cost

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problems and inefficient transmission. Furthermore, there is limited consideration for the combined impact of exchange rates, foreign direct investment, inflation, and interest rates in one empirical model. This study aims to address the identified gap by employing a combined approach to analysing the impact of macroeconomic factors on agricultural performance in Nigeria from 1981 to 2024.

3. METHODOLOGY

3.1 Research Design & Data Sources

The design utilised in this study is a quantitative research design, which employs ex-post facto methods based on analysis of already collected data to determine the relationship between variables without any external manipulation. The data utilised in the analysis are annual time series data from 1981 to 2024. Data are drawn from credible sources to ensure its validity. These data involve agricultural performance measured through agricultural value added, foreign direct investments, exchange rates, inflation rates, and interest rates obtained from World Bank World Development Indicators (WDI) and CBN Statistical Bulletin.

3.2 Variability Definition & Measurement

The Variables used for this study include Agricultural Performance as the dependent variable, and Exchange Rate (EXR), Foreign Direct Investment (FDI), Inflation Rate (INF), and Lending Interest Rate (ITR) as independent variables. Agricultural Performance is measured using the Agricultural Value Added (AVA) as an indicator of productivity, efficiency, and contribution of the sector to GDP within the agriculture industry in Nigeria (Iorember et al., 2024). EXR is measured as annual average official exchange rate of the Naira against the US Dollar and the influence of exchange rates on the performance will be achieved through pressure of input prices and export performance. FDI is calculated as net inflows expressed as a percentage of the GDP and it will represent long term foreign capital flows, which may increase agricultural productivity by ensuring efficient access to capital and technology transfer (Adeagbo & Jimoh, 2023). INF is the annual percentage change in the consumer price index, depicting macroeconomic stability where persistent rise in inflation may cause higher production costs and reduce planning certainty in the agricultural industry, whereas ITR is the annual lending rate, reflecting the cost of borrowing where higher rates limit credit access, increase financing costs, and constrain agricultural investment.

3.3 Model Specification

The study employs the econometric model below to capture the effect of changes in exchange rates, foreign direct investments, inflation, interest rate, and agricultural productivity in Nigeria, both in the short run and the long run. The above equations are derived based on the following relationships:

$$AVA = f(EXR, IFR, ITR, FDI)$$

Using econometrics, the regression model is stated as:

$$AVA = \beta_0 + \beta_1 EXR + \beta_2 IFR + \beta_3 ITR + \beta_4 FDI + \epsilon$$

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Where:

- AVA = Agricultural Value Added to GDP (% of GDP), Measure of agriculture performance
- β_0 = Intercept term
- $\beta_1 - \beta_4$ = Coefficients of the independent variables representing their respective impacts
- EXR = Official exchange rate (Naira per US$)
- IFR = Inflation rate (annual %)
- ITR = Lending interest rate (annual %)
- FDI = Foreign Direct Investment net inflows (% of GDP)
- ϵ = Error term

In this model, Agricultural Value Added(AVA) is considered the dependent variable, whereas Exchange Rate(EXR), Foreign Direct Investment (FDI), Inflation Rate(IFR), and Lending Interest Rate(ITR) are explanatory variables to represent important macroeconomic factors affecting agriculture performance, where EXR denotes cost and competitiveness-related variables, FDI denotes foreign capital investments to increase the efficiency of agriculture through transferring technology and financial benefits, IFR indicates the effects of price volatility on the cost of production, and ITR represents financial conditions through borrowing expenses. These variables have been taken collectively in order to consider the short-term as well as the long-term relationships between them, along with the natural log of exchange rates to enhance linearity and variance stability as well as enable the calculation of elasticity. It must be noted here that the selected time frame of analysis (1981-2024) covers different macroeconomic phases in Nigeria.

3.4 Estimation Technique

The ARDL-ECM framework is used in the study to examine the short- and long-run relationships between agricultural performance and its macroeconomic variables. It is appropriate for variable integration of order I(0) and I(1), allowing for flexible modeling of mixed stationarity qualities (Akpan & Umoren, 2021). The ARDL component captures the short-run effects of the exchange rate, foreign direct investment, inflation, and interest rates, whereas the ECM records the adjustment to long-run equilibrium, where a negative and substantial error correction term shows convergence following shocks (Ibrahim et al., 2025).

There are three stages to the estimating process. First, a Bounds Test with an F-statistic examines the long-run relationship between Agricultural Value Added and Exchange Rate (EXR), Foreign Direct Investment (FDI), Inflation Rate (INF), and Lending Interest Rate (ITR), with cointegration established when the F-statistic surpasses the upper bound. Second, long-run coefficients are estimated to account for equilibrium effects. Third, an Error Correction Model (ECM) is used to capture the short-run dynamics and adjustment speed. Furthermore, diagnostic tests such as the Breusch-Godfrey serial correlation test,

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heteroskedasticity test, and CUSUM stability test are used to assess model reliability and structural stability. All estimations are performed using EViews version 12.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1: Descriptive Statistics Result

	AVA	EXR	IFR	ITR	FDI
Mean	24.34579	144.4417	19.40136	17.27709	1.206539
Median	24.45736	101.0396	13.12650	16.92153	0.961468
Maximum	25.46629	536.9169	72.83550	31.65000	4.282088
Minimum	22.95992	49.77684	5.388008	8.916667	-0.039127
Std. Dev.	0.881385	112.4815	16.23182	4.733922	0.939830
Skewness	-0.211813	2.037757	1.795631	0.381453	0.982213
Kurtosis	1.449222	6.488425	5.275433	3.696876	3.831958
Jarque-Bera	4.738016	52.76138	33.13706	1.957381	8.343732
Probability	0.093574	0.000000	0.000000	0.375803	0.015423
Sum	1071.215	6355.433	853.6598	760.1921	53.08771
Sum Sq. Dev.	33.40412	544040.2	11329.30	963.6308	37.98105
Observations	44	44	44	44	44

Source: Author's Compilation (2026) from EViews

The descriptive statistics for Agricultural Performance, proxied by the natural logarithm of Agricultural Value Added (AVA), exchange rate (EXR), inflation rate (IFR), lending interest rate (ITR), and foreign direct investment (FDI) in Nigeria between 1981 and 2024 are displayed in Table 4.1 above. The results provide preliminary evidence on the characteristics and behaviour of the variables used during the period under investigation. It is observed that the average mean value of AVA is 24.35 while the standard deviation is low at 0.88, meaning that Agricultural Performance was stable through changes in the macroeconomic environment. This implies that the level of performance of the agriculture sector was consistent despite experiencing ups and downs.

On the other hand, the exchange rate (EXR) showed high variations with a mean value of ₦144.44 for every US dollar and a standard deviation of 112.48. This shows the presence of high variations in the exchange rate that caused high depreciation of the currency over the period analyzed. As a result, the prices of the input used by farmers were likely to be higher due to such depreciation. Moreover, the inflation rate (IFR) had an average of 19.40% and attained a maximum level of 72.84%, showing the existence of high inflation rates. Volatility under these circumstances will cause the cost of production to be higher, and their purchasing power is reduced, thereby causing poor agricultural productivity. The lending interest rate (ITR) was still relatively high with a mean value of 17.28%, suggesting that there was an expensive financing environment for the farmers to acquire agricultural credit.

The mean value of Foreign Direct Investment (FDI) was found to be 1.21% of GDP. Yet, due to the negative minimum, Nigeria had periods when there were capital outflows and lack of

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confidence from investors. Moreover, the results of Jarque-Bera statistics show that EXR, IFR, and FDI have non-normal distributions because of shocks to the economy, imbalances, and large variations. While, AVA and ITR have relatively normal distributions. Overall, the mixed distributional properties and varying levels of volatility support the suitability of the ARDL framework for analysing the relationship among the variables.

4.3 Unit Root Results

Table 4.2: Augmented Dickey Fuller (ADF) Unit Root Test Results

Variables	ADF Test Stat	Critical Value (5%)	Order of Integration	Probability
AVA	-4.5897	-2.9331	*I(1)*	0.0006
IFR	-3.0572	-2.9314	*I(0)*	0.0376
ITR	-6.8376	-2.9331	*I(1)*	0.0000
EXR	-4.4833	-2.9331	*I(1)*	0.0008
FDI	-3.8432	-2.9314	*I(0)*	0.0051

Source: Author's Compilation (2026) from EViews

Table 4.3: Phillips-Perron Unit Root Test Results

Variables	Phillips-Perron Test Stat	Critical Value (5%)	Order of Integration	Probability
AVA	-4.2960	-2.9331	*I(1)*	0.0015
IFR	-2.9150	-2.9314	*I(0)*	0.0519
ITR	-6.8409	-2.9331	*I(1)*	0.0000
EXR	-4.3610	-2.9331	*I(1)*	0.0012
FDI	-3.7975	-2.9314	*I(0)*	0.0058

Source: Author's Compilation (2026) from EViews

The outcomes from the two tests are broadly consistent, indicating mixed orders of integration among the variables. Agriculture value added (AVA), lending interest rate (ITR) and exchange rate (EXR), were found to be non-stationary at levels but became stationary after first differencing, suggesting that both series are integrated of order one, I(1). The inflation rate (IFR) and foreign direct investment (FDI) were stationary at levels, implying integration of order zero, I(0). The presence of both I(0) and I(1) variables supports the appropriateness of the ARDL modelling approach, which accommodates such combinations without requiring uniform integration orders, thereby providing a suitable framework for examining both short-run and long-run relationships.

4.4 Short-Run Results

Table 4.4: Short-Run ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Probability
D(AVA (-1))	0.093746	0.102410	0.915401	0.3704
D(AVA (-2))	-0.249976	0.095369	-2.621158	0.0160
D(AVA (-3))	-0.449147	0.086915	-5.167624	0.0000
D(EXR)	0.004055	0.000429	9.461193	0.0000
D(EXR(-1))	-0.001466	0.000553	-2.652882	0.0149
D(IFR)	-0.005954	0.002194	-2.713429	0.0130

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D(ITR)	-0.045986	0.009899	-4.645384	0.0001
D(ITR(-1))	-0.032270	0.009734	-3.315263	0.0033
D(ITR(-2))	-0.024495	0.010188	-2.404176	0.0255
D(FDI)	-0.030607	0.029748	-1.028861	0.3153
D(FDI(-1))	-0.121474	0.042470	-2.860256	0.0094
D(FDI(-2))	-0.130550	0.044008	-2.966536	0.0074
D(FDI(-3))	-0.138039	0.035655	-3.871513	0.0009
CointEq(-1)	-0.221593	0.030146	-7.350681	0.0000
R-squared	0.8831			
Adjusted R-squared	0.8247			
S.E. of regression	0.1386			
Sum squared resid	0.5001			
Log likelihood	30.8762			
Durbin-Watson stat	2.3767			

Source: Author's Compilation (2026) from EViews

The short-run results from the ARDL test provide insights into how agricultural output responds to macroeconomic and domestic shocks in Nigeria. The error correction term is negative and highly significant (CointEq(-1) = –0.2216, p = 0.0000), confirming the presence of a stable long-run equilibrium among the variables. Approximately 22% of deviations from long-run equilibrium are corrected each period, indicating that shocks to agricultural output are partially absorbed over time, reflecting a moderate speed of adjustment in the sector. This shows that Nigerian agriculture gradually returns to long-run trends after macroeconomic shocks. The model demonstrates high explanatory power, as reflected by an R-squared value of 0.8831, indicating that about 88.31% of short-run variations in agricultural output are explained by the included explanatory variables. Furthermore, the Durbin–Watson statistic of 2.3767 suggests the absence of serious autocorrelation problems, indicating that the dynamic specification is econometrically sound.

Lagged agricultural output significantly influences current performance. D(AVA(-2)) and D(AVA(-3)) are negative and significant (–0.249976, p = 0.0160; –0.449147, p = 0.0000). Past increases in output tend to dampen current growth, reflecting cyclical adjustment and the seasonal nature of agricultural production in Nigeria. This implies that agricultural output exhibits self-correcting tendencies as a result of supply constraints, seasonality and diminishing marginal returns in productivity.

Exchange rate movements have both immediate and lagged effects. The current effect is positive and significant (D(EXR) = 0.004055, p = 0.0000), while the first lag is negative and significant (D(EXR(-1)) = –0.001466, p = 0.0149). This outcome aligns with the a priori expectation that in the short run, naira depreciation may enhance agricultural output by improving competitiveness for exportable goods, but the delayed negative effect reflects higher input costs for imported agricultural materials. These dual significant effects highlight the complex influence of exchange rate fluctuations on Nigeria's agricultural sector productivity.

Inflation negatively affects agricultural output (D(IFR) = –0.005954, p = 0.0130), which is exactly in line with a priori expectations that inflation particularly cost-push inflation erodes

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real incomes, increases production costs, and weakens agricultural productivity. This outcome supports standard macroeconomic theory, which posits that high inflation distorts price signals and discourages productive investment in agriculture. Lending interest rates exhibit negative and significant effects through D(ITR) and its first two lags (D(ITR) = –0.045986, p = 0.0001; D(ITR(-1)) = –0.032270, p = 0.0033; D(ITR(-2)) = –0.024495, p = 0.0255). The sign aligns with a priori expectations since higher lending rates increase the cost of capital and should deter agricultural investment. This is consistent with empirical realities, where most farmers rely on informal credit systems or targeted government interventions rather than commercial bank lending. Foreign direct investment shows insignificant short-run effects (D(FDI) = –0.030607, p = 0.3153), the negative sign opposes a priori expectations that FDI should facilitate sectoral growth. Negative and significant lagged effects (D(FDI(-1)) to D(FDI(-3))) show that past FDI inflows appear to temporarily reduce agricultural output, possibly due to sectoral misallocation or delayed adjustment. This aligns with literature suggesting that FDI in Nigeria has historically concentrated in non-agricultural sectors, limiting its immediate benefits for agriculture.

Overall, the ARDL short-run results indicate that agricultural output in Nigeria is strongly influenced by past performance, exchange rate movements, inflation, and lending rates, while the impact of FDI is delayed. The magnitude and significance of these relationships reflect the structural characteristics of Nigeria's agricultural sector, its import dependence, sensitivity to inflation, limited credit access, and marginal exposure to FDI. These findings highlight that short-run agricultural performance is heavily influenced by macroeconomic conditions and that policy stability remains essential for enhancing sectoral resilience.

Table 4.5: F-Bounds Test for Cointegration

F-statistic	**7.273608**	
k (No. of Regressors)	4	
Significance	I(0) Bound	I(1) Bound
10%	2.20	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Author's Compilation (2026) from EViews

With the F-statistic value of 7.273, that clearly exceeds the upper bound critical values at all significance levels, most especially at 5% significance level with an upper bound is 3.49 we therefore reject the null hypothesis of no cointegration and conclude an existing long-run equilibrium relationship among the examined variables.

4.5 Long Run Results

Table 4.6: ARDL Long-Run Equation Results

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
EXR	-0.000592	0.004179	-0.141707	0.8887
IFR	-0.010353	0.009894	-1.046359	0.3073

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ITR	-0.107840	0.049019	-2.199964	0.0391
FDI	0.708079	0.396631	1.785232	0.0887
C (Constant)	26.17230	1.387165	18.86748	0.0000

Source: Author's Compilation (2026) from EViews

The long-run empirical results suggest that the Lending Interest Rate (ITR) serves as the primary driver of agricultural value added among the variables tested. At a 5% significance level (p=0.039), ITR is the only regressor that exerts a statistically significant influence. The negative coefficient (-0.1078) aligns with a priori expectations, indicating that as lending rates rise, the cost of capital for Nigerian farmers and agribusinesses increases. This likely creates a "crowding out" effect on investment, where high debt-servicing costs deter the modernization and expansion necessary to boost the sector's performance.

In contrast, other macroeconomic indicators specifically the Exchange Rate (EXR) and the Inflation Rate (IFR) demonstrate statistically insignificant effects (p=0.888 and p=0.307, respectively). This lack of significance implies that the long-term output of the agricultural sector remains relatively insulated from currency volatility and general price-level fluctuations within this specific model framework.

While Foreign Direct Investment (FDI) yields a positive coefficient (0.708), it fails to meet the 5% threshold for significance (p=0.088). Although there is a hint of a positive relationship, the data suggests that foreign capital inflows have not yet reached a critical mass or been sufficiently integrated into the local value chain to drive guaranteed long-run agriculture output growth.

Finally, the intercept (26.17) is both positive and highly significant (p=0.000). This suggests that a substantial portion of Nigeria's agricultural value added is determined by fundamental factors outside this model such as land fertility, traditional farming practices, or internal labor dynamics which continue to support the sector's baseline performance regardless of external macroeconomic shifts.

4.6 Diagnostic & Stability Tests

Table 4.7: Diagnostic Test Results

TEST	Null Hypothesis	F-statistics	Prob Value	Decision
Jarque-Bera Normality Test	Normal Distribution	0.7318	0.6935	Fail to reject H_0
Breusch-Godfrey Serial Correlation LM test	No Serial Autocorrelation	4.3231	0.0648	Fail to reject H_0
ARCH Heteroskedasticity Test	No Heteroscedasticity	0.2146	0.6458	Fail to reject H_0
Ramsey RESET Test	No misspecification	0.1955	0.6631	Fail to reject H_0

Source: Author's Compilation (2026) from EViews

The diagnostic tests collectively indicate that the model is robust and well-specified. The Breusch-Godfrey Serial Correlation LM Test produced an F-statistic of 4.3231 with a p-value

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of 0.0648, which means that at the 5% significance level we cannot reject the null hypothesis of no serial correlation. In essence, the residuals do not exhibit significant autocorrelation.

Furthermore, the ARCH test returned an F-statistic of 0.2146 and a p-value of 0.6458, confirming that the variance of the residuals is stable over time, with no evidence of heteroskedasticity or volatility clustering. The Ramsey RESET test, with a f-statistic of 0.1955 and a p-value of 0.6631, reinforces the notion that the model is correctly specified, showing no indication of omitted variables or misspecification in its functional form. Finally, the JarqueBera Normality Test, yielding a test statistic of 0.7318 and a p-value of 0.6935, supports the normality assumption of the residuals. Together, these tests provide strong evidence that the model is appropriately specified, with well-behaved residuals, ensuring reliable inference in this economic research.

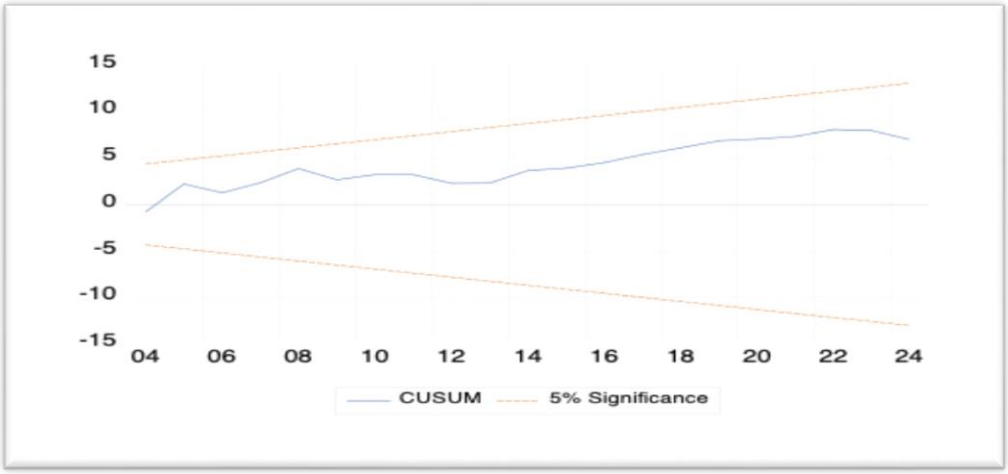

Figure 3: CUSUM Test Result (Author, 2026)

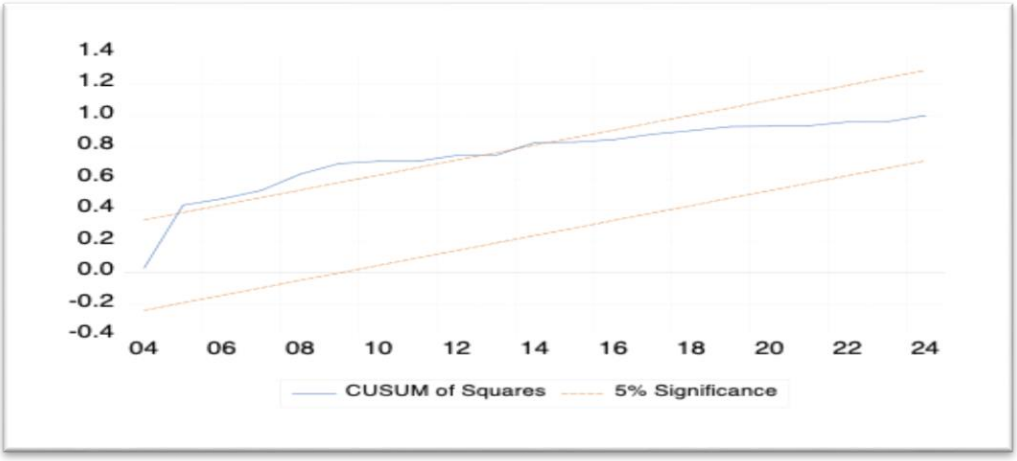

Figure 4: CUSUM of Squares Test Result (Author, 2026)

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The CUSUM plot reveals that the blue line consistently stays within the 5% significance boundaries. This suggests that the regression coefficients have remained stable throughout the sample period, with no indication of structural breaks in the model. Accordingly, the null hypothesis of parameter stability is not rejected. The CUSUM of Squares test confirms the structural stability of the model, as the blue line remains predominantly within the 5% critical boundaries throughout the sample period.

4.7 Hypotheses Testing

$H_0$1: Exchange rate depreciation has no significant effect on agricultural performance in Nigeria.

The short-run results show that exchange rate has a statistically significant effect on agricultural value added, as indicated by D(EXR) ($p = 0.0000$). This confirms that exchange rate fluctuations influence agricultural performance in Nigeria. In the long run, the relationship between exchange rate and agricultural value added is insignificant. As a result, the null hypothesis is rejected

Decision (Short run): Reject $H_0$1. Exchange rate depreciation has a significant effect on agricultural performance in Nigeria.

Decision (Long run): Accept $H_0$1. Exchange rate depreciation has no significant effect on agricultural performance in Nigeria.

$H_0$2: Foreign Direct Investments have no significant effect on agricultural performance in Nigeria.

The short-run results show foreign direct investment being statistically significant in D(FDI(-1)), D(FDI(-2)) and D(FDI(-3)), but statistically insignificant in D(FDI), indicating that its effect on agricultural performance occurs through lagged effects rather than immediate changes in FDI. However, the long run also reveals that foreign direct investment is statistically insignificant ($p > 0.05$), implying no sustained long-term impact on agricultural value added to GDP in Nigeria.

Decision (Short run): Accept $H_0$2. Foreign Direct Investments have no significant effect on agricultural performance in Nigeria.

Decision (Long run): Accept $H_0$2. Foreign Direct Investments have no significant effect on agricultural performance in Nigeria.

$H_0$3: Macroeconomic variables such as inflation and lending interest rates have no influence on agricultural performance in Nigeria.

Inflation rate exhibits a statistically significant short-run effect on agricultural value added to GDP ($p = 0.0130$), indicating that price level changes influence agricultural sector output dynamics. However, the long-run result shows an insignificant relationship between inflation rate and agricultural value added to GDP in Nigeria. Similarly, lending interest rate and its lagged terms are statistically significant in the short run, with negative coefficients, suggesting that higher borrowing costs adversely affect agricultural productivity. Lending interest rate is

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also statistically significant in the long run, indicating that lending rates influence agricultural sector performance in the long run.

Decision (Short run): Reject $H_0$3: Macroeconomic variables such as inflation and lending rates have significant influence on agricultural performance in Nigeria.

Decision (Long run): Partially reject $H_0$3: Inflation rate has no significant long-run relationship with agricultural performance in Nigeria, while lending interest rate significantly influences agricultural performance in Nigeria in the long run.

4.8 Discussion of Findings

The research offers insights into Agricultural Performance in Nigeria and its association with the selected macroeconomic indicators, including exchange rate, inflation rate, lending rate, and foreign direct investment. In the short run, the results show that agricultural performance exhibits an instantaneous reaction to changes in the exchange rate and displays a positive and significant impact. It indicates that in the short run, currency depreciation has the ability to affect agricultural performance through price considerations. Inflation rate also shows a statistically significant short-run effect on agricultural value added to GDP, indicating that price level changes influence agricultural sector output dynamics. Similarly, lending interest rate and its lagged terms are statistically significant in the short run with negative coefficients, suggesting that higher borrowing costs adversely affect agricultural productivity. However, foreign direct investment shows significance only in its lagged forms while the current value is insignificant, indicating that its effect on agricultural performance occurs with delay rather than immediately.

In the long term, the findings show that there is a significant impact only of lending interest rate on agricultural performance, while the effects of exchange rate, inflation, and foreign direct investment are insignificant. The long-run insignificance of the exchange rate indicates that its effect does not persist in determining agricultural performance over time. Inflation rate also remains statistically insignificant in the long run, confirming its weak long-term influence on agricultural performance in Nigeria. However, lending interest rate shows a significant long-run effect on agricultural performance, indicating that higher borrowing costs reduce agricultural sector output in the long run.

The error correction term is an indication of the presence of a long-run relationship among the variables and denotes a steady adjustment process toward equilibrium. This indicates that if there are any variations in the performance of agriculture due to macroeconomic factors, these variations are gradually corrected. However, the speed of adjustment will depend upon the persistence of macroeconomic factors.

These findings align with preceding empirical studies. Enilolobo et al. (2021) found that the exchange rate significantly impacts the level of agricultural productivity in an economy, notwithstanding structural constraints that prevent persistent advances in output. Similarly, the findings of Okafor et al. (2021) indicate that exchange rate has a significant influence on agriculture development while inflation has an insignificant influence on agricultural activities

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in Nigeria, as this variable plays a weak role in influencing the sector's development in the long run. Also, Adeagbo and Jimoh (2023) reported that foreign direct investment has no significant effect on agricultural output, reflecting weak sectoral absorption of foreign capital. More broadly, the results on inflation and foreign direct investment are consistent with studies that report weak or insignificant long-run effects of macroeconomic instability variables on agricultural performance in developing economies. Furthermore, Amunigun and Oluwoye (2025) found that inflation and interest rate significantly influence agricultural performance, while Nwankwo and Allison (2021) reported that interest rates significantly affect investment behaviour, indicating the importance of credit conditions in economic activity.

These findings support the Two-Gap Theory, as exchange rate limitations turn out to be a key structural determinant affecting agricultural production in Nigeria, while the inefficacy of foreign direct investment is consistent with the Eclectic Paradigm and Froot and Stein's Wealth Effect Model.

5. CONCLUSION AND POLICY IMPLICATIONS

5.1 Summary of Findings

This study assessed the effect of exchange rate movements and selected macroeconomic variables on agricultural performance in Nigeria from 1981 to 2024. It adopted the ARDL-ECM approach. The short-run estimates indicate that exchange rate has a statistically significant effect on agricultural performance, suggesting that currency movements influence agricultural performance through immediate price adjustments in the economy. The inflation rate also has a statistically significant short-run effect on agricultural value added to GDP, implying that changes in the general price level influence agriculture sector output dynamics. Similarly, lending interest rates and lagging terms are statistically significant in the short run, with negative coefficients, implying that greater borrowing costs reduce agricultural productivity. Foreign direct investment has a mixed short-run effect, being significant in its lagged forms but insignificant contemporaneously, meaning that its impact on agricultural performance happens gradually rather than immediately.

Long-run results show that the lending interest rate is the only significant predictor of agricultural performance in Nigeria, while the exchange rate, inflation rate, and foreign direct investment are all insignificant. The long-run impact of lending interest rates demonstrates that sustained increases in borrowing costs have a detrimental influence on agricultural performance by reducing access to credit and discouraging productive investment in the agricultural sector. The insignificance of exchange rate in the long run suggests that its effects are not persistent over time, while inflation and foreign direct investment similarly do not exert sustained long-term influence on agricultural value added. The error correction term demonstrates a marked adjustment to equilibrium, suggesting that any short-run deviation in agricultural performance is eventually corrected, thereby confirming the existence of a long-run relationship between the variables.

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When compared to related empirical studies undertaken in Nigeria and other emerging economies, the findings are mostly consistent with previous research. For example, Enilolobo et al. (2021), Okafor et al. (2021), and Udoji et al. discovered that exchange rates have an significant effect on agricultural productivity, although the effect of inflation and interest rates differs between studies. Adeagbo and Jimoh (2023) find that foreign direct investments have a minimal influence on agricultural outcomes due to structural constraints in the agriculture sector.

5.2 Policy Implications

Based on the empirical evidence, several major policy recommendations arise that can help to improve agricultural performance in Nigeria. First, the dominance of exchange rates in the short run means that exchange rate policy must be effectively implemented. The maintenance of stable exchange rates must be given much consideration by the Central Bank of Nigeria through greater transparency in the foreign exchange markets, less volatility, and efficient management of foreign reserves. It should also be observed that a weakening of the Nigerian currency will make importing of agricultural inputs such as fertilisers more costly. Second, the significance of lending interest rate in the long run shows that policy actions are required to address issues related to the provision of affordable loans to the producers in agriculture. The monetary authorities can make interest rate policy for the agricultural sector, along with the credit guarantee policy which makes the commercial banks less risky in this regard.

Third, while inflation is significant in the short run, the insignificance of inflation in the long run indicates that it only causes temporary distortions in costs and investments. As such, a combined approach for monetary and fiscal policies will be required in order to ensure price stability, and minimise uncertainties in the farming sector.

Fourth, the insignificance of foreign direct investment in both the short and long run demonstrates poor integration of foreign investments in the agriculture industry. As a result, efforts must be directed toward creating the required environment for investors to participate in agriculture. Shifting investment from other sectors to agriculture would be ideal in order to improve industrial efficiency. It would be excellent to shift investment from other industries to agriculture in order to increase industry efficiency.

Lastly, the results suggest that there is a need for institutional changes that would minimise the sensitivity of the economy to macroeconomic risks, especially with regard to exchange rate volatility. The mechanisation of agriculture, increased domestic production of critical factors, and import substitution policies represent vital measures toward building resilience and minimizing foreign currency reliance.

The findings further validate the Two-Gap Model, whereby limitations in productive capacity in developing countries are reflected through foreign exchange constraints, while the Eclectic Paradigm helps explain the weak impact of foreign direct investment due to absorptive capacity constraints in agriculture. Empirically, it becomes evident that exchange rate instability remains a key transmission channel affecting agricultural performance in Nigeria, highlighting the importance of macroeconomic stability in exchange rate management.

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5.3 Limitations and Future Research

Despite its robust findings, this study is subject to certain limitations. One constraint with this study concerns the utilisation of macroeconomic time series data from secondary sources, which might not adequately reflect the informal nature of agricultural production and its productivity trends. Therefore, important fluctuations in the production output and practices at the farm level may not be appropriately captured through the aggregation process of national data utilised in the study. Furthermore, the employment of annual aggregate data may overlook important regional variations in agricultural performance in Nigeria, which differs in terms of production environment and input availability among other factors. Lastly, while the ARDL technique is appropriate for variables of different orders of integration, it assumes linearity in its model specification.

The limitations outlined above can be overcome through future research which should employ disaggregated data at regional, state level, or even farm level data for a thorough examination of the relationship between macroeconomic variables and agricultural performance within various geographical locations and farming conditions. Future research may also incorporate the application of nonlinear econometric models or structural breaks that might help explain the effects of changes in policy or even climate conditions on the agricultural sector. Other variables that could be incorporated within future analysis to provide a broader analysis of the agricultural performance within Nigeria include climate variables, expenditure on agriculture, and technology usage.

References

1) Adebayo, O. O., & Akande, S. O. (2020). Impact of exchange rate depreciation on Foreign Direct Investment inflows in Nigeria: A Vector Error Correction Mechanism (VECM) approach. Journal of Economic Studies and Policy, 12(3), 45-62.

2) Adebayo, E. O., & Gambiyo, S. P. (2020). Economic analysis of the determinants of foreign direct investment (FDI) in Nigeria. *Arch Bus Res*, *8*(1), 74-81.

3) Adeagbo, K. A., & Jimoh, O. R. (2023). Impact of foreign direct investment on agricultural and manufacturing output in Nigeria. *International Journal of Business Economics and Management Science*, *2*(2). https://harvardpublications.com/hijbems/article/view/96

4) Adegboye, F. B., Adesina, T. F., Ojeka, S. A., Akinjare, V. A., & Olokoyo, F. O. (2020). Foreign direct investment, dual gap model and economic development in sub-Saharan Africa. *Cogent Social Sciences, 6*(1). https://doi.org/10.1080/23311886.2020.1743138

5) Adewale, A. M., Olopade, B. C., & Ogbaro, E. O. (2024). Effect of exchange rate on foreign direct investment in Nigeria. *ABUAD Journal of Social and Management Sciences*, *5*(2), 302-318.

6) Adewale, A., Olusegun, K., & Bello, M. (2024). Re-evaluating the exchange rate-FDI nexus in Nigeria: Evidence from recent currency reforms. Nigerian Journal of Economic and Social Studies, 66(1), 44–59

7) Agbeyeke, C. C., & Ezi, C. T. (2025). Exchange rate dynamics and agricultural sector performance in Nigeria: An empirical analysis. International Research Journal of Economics and Management Studies, 4(3), 254–265. https://doi.org/10.56472/25835238/IRJEMS-V4I3P129

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.20284704

8) Akpan, S. B., & Umoren, A. A. (2021). Agricultural production indicators and the dynamic macroeconomic variables in Nigeria: ARDL model approach. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 21(3), 111

9) Aliber, R. Z. (1970). A theory of Foreign Direct Investment. In C. P. Kindleberger (Ed.), The International Corporation (pp. 17-34). MIT Press.

10) Amunigun, A. A., & Oluwoye, J. O. (2025). Macroeconomic variables as determinants of agricultural exports in Nigeria. *International Journal of Research and Innovation in Social Science*, *9*(10), 2036. https://dx.doi.org/10.47772/IJRISS.2025.910000170

11) Ananwude, A. C., Nwobia, C. E., & Onyegiri, P. K. (2025). Foreign direct investment and agricultural sector performance in Nigeria: A disaggregated approach. *Innovare Journal of Social Sciences*, *13*(5). https://doi.org/10.22159/ijss.2025v13i5.55884

12) Anochie, U. C., Nsoja, J. E., & Efanga, U. O. (2022). Macroeconomic determinants and foreign direct investments in Nigeria. *Journal of International Money, Banking and Finance*, *3*(2), 189-199.

13) Bloomenthal, A. (2025) Macroeconomic Factor: Definition, Types, Examples, and Impact. https://www.investopedia.com/terms/m/macroeconomic-factor.asp

14) Central Bank of Nigeria (2024). Annual Statistical Bulletin. CBN Publications. cbn.gov.ng

15) CFI (November 30, 2019). Foreign Direct Investment (FDI) An international business investment. https://corporatefinanceinstitute.com/resources/economics/foreign-direct-investment-fdi/

16) De Walque, D. (2020). The use of financial incentives to prevent unhealthy behaviors: A review. Social Science & Medicine, 261, 113236. https://doi.org/10.1016/j.socscimed.2020.113236

17) Dogru, T., Isik, C., & Sirakaya-Turk, E. (2019). The balance of trade and exchange rates: Theory and contemporary evidence from tourism. Tourism Management, 74, 12-23. https://doi.org/10.1016/j.tourman.2019.01.014

18) Dunning, J. H. (2001). The Eclectic Paradigm as a set of envelopes for theoretical and empirical analysis of MNE activity. International Business Review, 10(2), 173-190.

19) Dunning, J.H. (2000). Multinational enterprises and the global economy: Edinburgh Gate, Harlow, Addison-Wesley, Wokingham

20) Ekundayo P. Mesagan & Olorunfemi Y. Alimi & Ismaila A. Yusuf, (2018). Macroeconomic Implications of Exchange Rate Depreciation: The Nigerian Experience, *Managing Global Transitions, University of Primorska, Faculty of Management Koper*, vol. 16(3 (Fall)), pages 235-258

21) Emmanuel, L. (2026). Dollar to Naira Exchange Rate 2026: CBN Official Rate vs Parallel Market — Everything You Need to Know. https://naijasabi.com.ng/dollar-to-naira-exchange-rate-cbn-black-market-2026/

22) Enilolobo, S. O., Esedeke, J. F., Nnoli, I. T., Hassan, C. O., & Babalola, A. B. (n.d.). Impact of exchange rate and foreign direct investment on agricultural productivity in Nigeria. *Bells University of Technology*.

23) Froot, K. A., & Stein, J. C. (1991). Exchange rates and Foreign Direct Investment: An imperfect capital markets approach. The Quarterly Journal of Economics, 106(4), 1191-1217.

24) Gobna, Wafure Obida & Abu, Nurudeen. (2010). Determinants of Foreign Direct Investment in Nigeria: An Empirical Analysis. *Global Journal of Human Social Sciences,* 10, 26-34.

25) Ibrahim, S., Labaran, K., & Salahudeen, S. B. (2025). Inflation and agricultural output in Nigeria: An ARDL re-examination of macroeconomic interactions. *FUDMA International Journal of Social Sciences*, *5*(2), 261.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.20284704

26) Iorember, P. T., Mohamed Yusoff, N. Y., Abachi, P. T., Usman, O., & Alola, A. A. (2024). Effect of exchange rate uncertainty, energy prices and sectoral spending on agriculture value added, household consumption, and domestic investment. *Heliyon*, *10*(9), Article e30138. https://doi.org/10.1016/j.heliyon.2024.e30138

27) Kiri, Nasiru Habu & Mustapha, Aminu Muhammad (2025). Analysis of Some Selected Macroeconomic Variables and Foreign Direct Investment (FDI) in Nigeria. Journal of Arid Zone Economy, 5(8).

28) Lajevardi, H., & Chowdhury, M. (2024). How does the exchange rate and its volatility influence FDI to Canada? A disaggregated analysis. *Journal of Risk and Financial Management, 17*(2), 88. https://doi.org/10.3390/jrfm170200

29) Liberto D. (2024). The Wealth Effect: Definition and Examples. Investopedia. https://www.investopedia.com/terms/w/wealtheffect.asp), A rise in home prices acts as a positive wealth effect for homeowners

30) Michael K. Fung & Arnold C. S. Cheng, 2021. "The Wealth Effects of Housing and Stock Markets on Consumption: Evidence across Nations Including China and Hong Kong", Modeling Economic Growth in Contemporary Hong Kong, Michael K. Fung, Bruno S. Sergi.

31) Munaji, D. N., Simon, S. G., & Shehu, A. (2025). Impact of interest rate on agricultural productivity in Nigeria; analysis of policy implication (subsidy removal 2012-2022). *International Journal of Business and Economics Research*, *11*(2), 1–22.

32) National Bureau of Statistics (September 22, 2025). https://www.facebook.com/NBSNigeria/posts/gross-domestic-product-gdp-grew-by-423-year-on-year-in-real-terms-in-the-second-/1106130715041883/

33) Nguyen, Q. K. (2025). Macroeconomic determinants of economic growth in low- and mid-income countries: new evidence using a non-parametric approach. Applied Economics Letters, 32(5), 680–685. https://doi.org/10.1080/13504851.2023.2283774

34) Nwankwo, S. N. P., & Allison, P. (2021). Effect of macroeconomic determinants on private sector investments in Nigeria, 1986-2020. Contemporary Journal of Management, 3(4), 14-27.

35) Sale, Z. (2025). Impact of foreign direct investment and agricultural output on economic growth in Nigeria 1990-2024. *International Journal of Economics and Financial Management*, *10*(9), 233–247. https://doi.org/10.56201/ijefm.v10.no9.2025.pg233.247

36) Ohajieze, J. G., & Ozoekwe, O. (2025). Asymmetric effect of exchange rate volatility on foreign direct investment and inflation in Nigeria. *Dspg multi-disciplinary journal*, *2*(2), 74-92.

37) Okafor, O. K., Isibor, A., & Okafor, C. O. (2021). Macroeconomic variables and Nigerian agricultural sector development. *British Journal of Management and Marketing Studies*, *4*(4), 9–20. https://doi.org/10.52589/BJMMS-TTLY6KLR

38) Okonkwo, J. J., Osakwe, C. I., & Nwadibe, E. (2021). Exchange rate and foreign direct investment in Nigeria. *Sciences*, *11*(1), 213-232.

39) Okonkwo, J. U., Ezenwa, O., & Madu, C. (2021). Real versus nominal exchange rates: Implications for FDI in Nigeria. Global Business Review, 22(4), 450–468.

40) Oladeji, B., & Musa, M. (2022). Effect of exchange rate volatility on foreign direct investment in Nigeria. *ScienceOpen Preprints*.

41) Tyoga M.S., Abbas U.I., & Gambo N.(2026) Macroeconomic Determinants of Foreign Direct Investment in Nigeria: Evidence from ARDL Modeling, European Journal of Accounting, Auditing and Finance Research, 14(2),1-11

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.20284704

42) Udoji, N. J., Abada, U. D., & Okuma, N. C. (2024). Effects of selected macroeconomic variables on Nigerian agricultural sector (1999-2022). *African Banking and Finance Review Journal*, *17*(17), 299–308. https://www.abfrjournal.com

43) Utuk, I. O., Udo, A., Akpan, B., Ekaetor, E. A., & Eduno, E. (2024). An empirical analysis of selected macroeconomic indicators and agricultural value added in Nigeria. *International Journal of Research and Innovation in Social Science*, *8*(1), 1374–1383. https://doi.org/10.47772/IJRISS.2024.801101

44) World Bank. (2024). World Development Indicators. World Bank DataBank. worldbank.org

45) Zang W. & Xia C. (eds.), Proceedings of the 2025 3rd International Conference on Digital Economy and Management Science (CDEMS 2025), Advances in Economics, Business and Management Research 336, https://doi.org/10.2991/978-94-6463-770-0_76

Appendices

Appendix A: Descriptive Statistics Result

Date: 05/05/26 Time: 18:53
Sample: 1981 2024

	LOG_AVA_C	EXR	IFR	ITR	FDI
Mean	24.34579	144.4417	19.40136	17.27709	1.206539
Median	24.45736	101.0396	13.12650	16.92153	0.961468
Maximum	25.46629	536.9169	72.83550	31.65000	4.282088
Minimum	22.95992	49.77684	5.388008	8.916667	-0.039127
Std. Dev.	0.881385	112.4815	16.23182	4.733922	0.939830
Skewness	-0.211813	2.037757	1.795631	0.381453	0.982213
Kurtosis	1.449222	6.488425	5.275433	3.696876	3.831958
Jarque-Bera	4.738016	52.76138	33.13706	1.957381	8.343732
Probability	0.093574	0.000000	0.000000	0.375803	0.015423
Sum	1071.215	6355.433	853.6598	760.1921	53.08771
Sum Sq. Dev.	33.40412	544040.2	11329.30	963.6308	37.98105
Observations	44	44	44	44	44

Appendix B: Unit Root Result (ADF)

Null Hypothesis: D(LOG_AVA_C_USD_) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.589794	0.0006
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOG_AVA_C_USD_,2)
Method: Least Squares
Date: 02/13/26 Time: 13:29
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_AVA_C_USD_(-1))	-0.765629	0.166811	-4.589794	0.0000
C	0.008409	0.050170	0.167617	0.8677

R-squared	0.344973	Mean dependent var	-0.017343
Adjusted R-squared	0.328598	S.D. dependent var	0.394313
S.E. of regression	0.323097	Akaike info criterion	0.624719
Sum squared resid	4.175665	Schwarz criterion	0.707465
Log likelihood	-11.11910	Hannan-Quinn criter.	0.655049
F-statistic	21.06621	Durbin-Watson stat	1.830545
Prob(F-statistic)	0.000043		

Null Hypothesis: IFR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.057212	0.0376
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IFR)
Method: Least Squares
Date: 02/13/26 Time: 13:37
Sample (adjusted): 1982 2024
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IFR(-1)	-0.379805	0.124232	-3.057212	0.0039
C	7.535536	3.100689	2.430278	0.0196

R-squared	0.185644	Mean dependent var	0.289053
Adjusted R-squared	0.165782	S.D. dependent var	14.35181
S.E. of regression	13.10831	Akaike info criterion	8.029764
Sum squared resid	7044.935	Schwarz criterion	8.111681
Log likelihood	-170.6399	Hannan-Quinn criter.	8.059973
F-statistic	9.346548	Durbin-Watson stat	1.581690
Prob(F-statistic)	0.003922		

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Null Hypothesis: D(ITR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.837625	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ITR,2)
Method: Least Squares
Date: 02/13/26 Time: 13:36
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ITR(-1))	-1.103613	0.161403	-6.837625	0.0000
C	0.227388	0.472867	0.480871	0.6332

R-squared	0.538921	Mean dependent var	0.093538
Adjusted R-squared	0.527395	S.D. dependent var	4.453914
S.E. of regression	3.061902	Akaike info criterion	5.122397
Sum squared resid	375.0097	Schwarz criterion	5.205144
Log likelihood	-105.5703	Hannan-Quinn criter.	5.152727
F-statistic	46.75312	Durbin-Watson stat	1.982153
Prob(F-statistic)	0.000000		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.483333	0.0008
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 02/13/26 Time: 13:38
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.674838	0.150522	-4.483333	0.0001
C	-4.723708	9.358869	-0.504731	0.6165

R-squared	0.334446	Mean dependent var	-1.426434
Adjusted R-squared	0.317807	S.D. dependent var	73.20643
S.E. of regression	60.46484	Akaike info criterion	11.08845
Sum squared resid	146239.9	Schwarz criterion	11.17120
Log likelihood	-230.8574	Hannan-Quinn criter.	11.11878
F-statistic	20.10027	Durbin-Watson stat	1.775820
Prob(F-statistic)	0.000060		

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.843259	0.0051
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 02/13/26 Time: 13:41
Sample (adjusted): 1982 2024
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.524599	0.136499	-3.843259	0.0004
C	0.646362	0.209923	3.079048	0.0037

R-squared	0.264846	Mean dependent var	0.005712
Adjusted R-squared	0.246916	S.D. dependent var	0.964155
S.E. of regression	0.836698	Akaike info criterion	2.526687
Sum squared resid	28.70258	Schwarz criterion	2.608603
Log likelihood	-52.32377	Hannan-Quinn criter.	2.556895
F-statistic	14.77064	Durbin-Watson stat	2.243373
Prob(F-statistic)	0.000414		

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Appendix C: Unit Root Result (PP)

Null Hypothesis: D(LOG_AVA_C_USD_) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.296041	0.0015
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.099421
HAC corrected variance (Bartlett kernel)	0.072990

Phillips-Perron Test Equation
Dependent Variable: D(LOG_AVA_C_USD_,2)
Method: Least Squares
Date: 02/13/26 Time: 13:43
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_AVA_C_USD_(-1))	-0.765629	0.166811	-4.589794	0.0000
C	0.008409	0.050170	0.167617	0.8677

R-squared	0.344973	Mean dependent var	-0.017343
Adjusted R-squared	0.328598	S.D. dependent var	0.394313
S.E. of regression	0.323097	Akaike info criterion	0.624719
Sum squared resid	4.175665	Schwarz criterion	0.707465
Log likelihood	-11.11910	Hannan-Quinn criter.	0.655049
F-statistic	21.06621	Durbin-Watson stat	1.830545
Prob(F-statistic)	0.000043		

Null Hypothesis: IFR has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.915062	0.0519
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	163.8357
HAC corrected variance (Bartlett kernel)	142.6679

Phillips-Perron Test Equation
Dependent Variable: D(IFR)
Method: Least Squares
Date: 02/13/26 Time: 13:45
Sample (adjusted): 1982 2024
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IFR(-1)	-0.379805	0.124232	-3.057212	0.0039
C	7.535536	3.100689	2.430278	0.0196

R-squared	0.185644	Mean dependent var	0.289053
Adjusted R-squared	0.165782	S.D. dependent var	14.35181
S.E. of regression	13.10831	Akaike info criterion	8.029764
Sum squared resid	7044.935	Schwarz criterion	8.111681
Log likelihood	-170.6399	Hannan-Quinn criter.	8.059973
F-statistic	9.346548	Durbin-Watson stat	1.581690
Prob(F-statistic)	0.003922		

Null Hypothesis: D(ITR) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.840952	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	8.928802
HAC corrected variance (Bartlett kernel)	8.707419

Phillips-Perron Test Equation
Dependent Variable: D(ITR,2)
Method: Least Squares
Date: 02/13/26 Time: 13:54
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ITR(-1))	-1.103613	0.161403	-6.837625	0.0000
C	0.227388	0.472867	0.480871	0.6332

R-squared	0.538921	Mean dependent var	0.093538
Adjusted R-squared	0.527395	S.D. dependent var	4.453914
S.E. of regression	3.061902	Akaike info criterion	5.122397
Sum squared resid	375.0097	Schwarz criterion	5.205144
Log likelihood	-105.5703	Hannan-Quinn criter.	5.152727
F-statistic	46.75312	Durbin-Watson stat	1.982153
Prob(F-statistic)	0.000000		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.361012	0.0012
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3481.902
HAC corrected variance (Bartlett kernel)	841.9502

Phillips-Perron Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 02/13/26 Time: 13:55
Sample (adjusted): 1983 2024
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.674838	0.150522	-4.483333	0.0001
C	-4.723708	9.358869	-0.504731	0.6165

R-squared	0.334446	Mean dependent var	-1.426434
Adjusted R-squared	0.317807	S.D. dependent var	73.20643
S.E. of regression	60.46484	Akaike info criterion	11.08845
Sum squared resid	146239.9	Schwarz criterion	11.17120
Log likelihood	-230.8574	Hannan-Quinn criter.	11.11878
F-statistic	20.10027	Durbin-Watson stat	1.775820
Prob(F-statistic)	0.000060		

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Null Hypothesis: FDI has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.797508	0.0058
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.667502
HAC corrected variance (Bartlett kernel)	0.635128

Phillips-Perron Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 02/13/26 Time: 13:56
Sample (adjusted): 1982 2024
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.524599	0.136499	-3.843259	0.0004
C	0.646362	0.209923	3.079048	0.0037

R-squared	0.264846	Mean dependent var	0.005712
Adjusted R-squared	0.246916	S.D. dependent var	0.964155
S.E. of regression	0.836698	Akaike info criterion	2.526687
Sum squared resid	28.70258	Schwarz criterion	2.608603
Log likelihood	-52.32377	Hannan-Quinn criter.	2.556895
F-statistic	14.77064	Durbin-Watson stat	2.243373
Prob(F-statistic)	0.000414		

Appendix D: ARDL Short Run & Bounds test

ARDL Error Correction Regression
Dependent Variable: D(LOG_AVA_C_USD_)
Selected Model: ARDL(4, 1, 3, 2, 4)
Case 2: Restricted Constant and No Trend
Date: 02/13/26 Time: 13:59
Sample: 1981 2024
Included observations: 40

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_AVA_C_USD_(-	0.093746	0.102410	0.915401	0.3704
D(LOG_AVA_C_USD_(-	-0.249976	0.095369	-2.621158	0.0160
D(LOG_AVA_C_USD_(-	-0.449147	0.086915	-5.167624	0.0000
D(IFR)	-0.005954	0.002194	-2.713429	0.0130
D(ITR)	-0.045986	0.009899	-4.645384	0.0001
D(ITR(-1))	-0.032270	0.009734	-3.315263	0.0033
D(ITR(-2))	-0.024495	0.010188	-2.404176	0.0255
D(EXR)	0.004055	0.000429	9.461193	0.0000
D(EXR(-1))	-0.001466	0.000553	-2.652882	0.0149
D(FDI)	-0.030607	0.029748	-1.028861	0.3153
D(FDI(-1))	-0.121474	0.042470	-2.860256	0.0094
D(FDI(-2))	-0.130550	0.044008	-2.966536	0.0074
D(FDI(-3))	-0.138039	0.035655	-3.871513	0.0009
CointEq(-1)*	-0.221593	0.030146	-7.350681	0.0000

R-squared	0.883151	Mean dependent var	0.026099
Adjusted R-squared	0.824727	S.D. dependent var	0.331295
S.E. of regression	0.138699	Akaike info criterion	-0.843811
Sum squared resid	0.500169	Schwarz criterion	-0.252703
Log likelihood	30.87622	Hannan-Quinn criter.	-0.630085
Durbin-Watson stat	2.376708		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.273608	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

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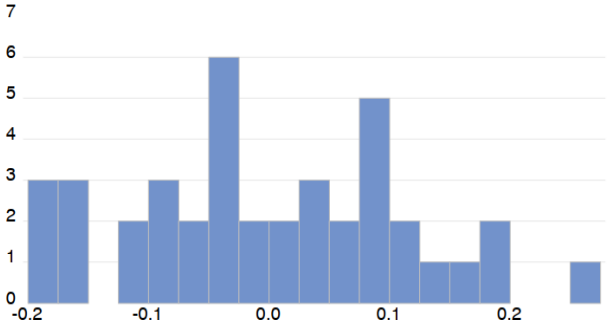
Appendix E: Normality Test



Series: Residuals
Sample 1985 2024
Observations 40

Mean	3.31e-15
Median	-0.003562
Maximum	0.261463
Minimum	-0.197779
Std. Dev.	0.113247
Skewness	0.150574
Kurtosis	2.409716
Jarque-Bera	0.731876
Probability	0.693546

Appendix F: ARDL Long Run & Bounds test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LOG_AVA_C_USD_)
Selected Model: ARDL(4, 2, 1, 3, 4)
Case 2: Restricted Constant and No Trend
Date: 02/13/26 Time: 14:37
Sample: 1981 2024
Included observations: 40

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.799600	2.414537	2.401952	0.0256
LOG_AVA_C_USD_(-1)*	-0.221593	0.083008	-2.669551	0.0143
EXR(-1)	-0.000131	0.000967	-0.135631	0.8934
IFR(-1)	-0.002294	0.002424	-0.946317	0.3547
ITR(-1)	-0.023897	0.016509	-1.447456	0.1625
FDI(-1)	0.156905	0.053901	2.910996	0.0084
D(LOG_AVA_C_USD_(-	0.093746	0.130966	0.715806	0.4820
D(LOG_AVA_C_USD_(-	-0.249976	0.116498	-2.145747	0.0437
D(LOG_AVA_C_USD_(-	-0.449147	0.100160	-4.484282	0.0002
D(EXR)	0.004055	0.000994	4.079969	0.0005
D(EXR(-1))	-0.001466	0.000973	-1.507738	0.1465
D(IFR)	-0.005954	0.002747	-2.167710	0.0418
D(ITR)	-0.045986	0.017770	-2.587887	0.0172
D(ITR(-1))	-0.032270	0.011741	-2.748416	0.0120
D(ITR(-2))	-0.024495	0.011674	-2.098314	0.0482
D(FDI)	-0.030607	0.038960	-0.785599	0.4409
D(FDI(-1))	-0.121474	0.060051	-2.022860	0.0560
D(FDI(-2))	-0.130550	0.065972	-1.978870	0.0611
D(FDI(-3))	-0.138039	0.053027	-2.603192	0.0166

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR	-0.000592	0.004179	-0.141707	0.8887
IFR	-0.010353	0.009894	-1.046359	0.3073
ITR	-0.107840	0.049019	-2.199964	0.0391
FDI	0.708079	0.396631	1.785232	0.0887
C	26.17230	1.387165	18.86748	0.0000

EC = LOG_AVA_C_USD_ - (-0.0006*EXR -0.0104*IFR -0.1078*ITR + 0.7081 *FDI + 26.1723)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	7.273608	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	40	Finite Sample: n=40		
		10%	2.427	3.395
		5%	2.893	4
		1%	3.967	5.455

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Appendix G: Heteroskedasticity Test

Heteroskedasticity Test: ARCH

F-statistic	0.214699	Prob. F(1,37)	0.6458
Obs*R-squared	0.224998	Prob. Chi-Square(1)	0.6353

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/13/26 Time: 14:50
Sample (adjusted): 1986 2024
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013727	0.003181	4.315459	0.0001
RESID^2(-1)	-0.075425	0.162780	-0.463356	0.6458

R-squared	0.005769	Mean dependent var	0.012786
Adjusted R-squared	-0.021102	S.D. dependent var	0.015125
S.E. of regression	0.015284	Akaike info criterion	-5.474113
Sum squared resid	0.008643	Schwarz criterion	-5.388802
Log likelihood	108.7452	Hannan-Quinn criter.	-5.443504
F-statistic	0.214699	Durbin-Watson stat	2.015403
Prob(F-statistic)	0.645824		

Appendix H: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 4 lags

F-statistic	4.323159	Prob. F(4,17)	0.0136
Obs*R-squared	20.17067	Prob. Chi-Square(4)	0.0005

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 02/13/26 Time: 14:46
Sample: 1985 2024
Included observations: 40
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_AVA_C_USD_(-	0.060594	0.152415	0.397559	0.6959
LOG_AVA_C_USD_(-	0.091473	0.151777	0.602679	0.5547
LOG_AVA_C_USD_(-	-0.148429	0.133987	-1.107786	0.2834
LOG_AVA_C_USD_(-	0.044824	0.086057	0.520863	0.6092
EXR	-0.000323	0.000798	-0.405431	0.6902
EXR(-1)	0.000320	0.000863	0.371270	0.7150
EXR(-2)	7.97E-05	0.000802	0.099280	0.9221
IFR	0.003445	0.002580	1.335178	0.1994
IFR(-1)	-7.61E-05	0.002751	-0.027669	0.9782
ITR	-0.006330	0.014496	-0.436664	0.6679
ITR(-1)	0.001567	0.010753	0.145752	0.8858
ITR(-2)	0.003144	0.011561	0.271942	0.7889
ITR(-3)	-0.002149	0.009381	-0.229068	0.8215
FDI	0.011839	0.030948	0.382549	0.7068
FDI(-1)	0.003766	0.034014	0.110727	0.9131
FDI(-2)	0.016776	0.034723	0.483140	0.6352
FDI(-3)	-0.026326	0.031798	-0.827902	0.4192
FDI(-4)	-0.005799	0.043918	-0.132037	0.8965
C	-1.194885	2.028954	-0.588917	0.5637
RESID(-1)	-0.432830	0.282713	-1.530987	0.1442
RESID(-2)	-0.815619	0.293304	-2.780799	0.0128
RESID(-3)	0.175958	0.327275	0.537645	0.5978
RESID(-4)	-0.131107	0.256100	-0.511937	0.6153

R-squared	0.504267	Mean dependent var	3.31E-15
Adjusted R-squared	-0.137270	S.D. dependent var	0.113247
S.E. of regression	0.120770	Akaike info criterion	-1.095528
Sum squared resid	0.247951	Schwarz criterion	-0.124423
Log likelihood	44.91057	Hannan-Quinn criter.	-0.744407
F-statistic	0.786029	Durbin-Watson stat	1.935077
Prob(F-statistic)	0.706144		

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Appendix I: RESET Test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LOG_AVA_C_USD_ LOG_AVA_C_USD_(-1) LOG_AVA_C_USD_(-2) LOG_AVA_C_USD_(-3) LOG_AVA_C_US -4) EXR EXR(-1) EXR(-2) IFR IFR(-1) ITR ITR(-1) ITR(-2) ITR(-3) F FDI(-1) FDI(-2) FDI(-3) FDI(-4) C

	Value	df	Probability
t-statistic	0.442183	20	0.6631
F-statistic	0.195525	(1, 20)	0.6631
Likelihood ratio	0.389152	1	0.5327

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.004842	1	0.004842
Restricted SSR	0.500169	21	0.023818
Unrestricted SSR	0.495327	20	0.024766

LR test summary:

	Value
Restricted LogL	30.87622
Unrestricted LogL	31.07080

Unrestricted Test Equation:
Dependent Variable: LOG_AVA_C_USD_
Method: Least Squares
Date: 02/13/26 Time: 14:52
Sample: 1985 2024
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_AVA_C_USD_(-1)	-0.558356	3.239945	-0.172335	0.8649
LOG_AVA_C_USD_(-2)	0.233872	1.318021	0.177441	0.8609
LOG_AVA_C_USD_(-3)	0.131311	0.762859	0.172130	0.8651
LOG_AVA_C_USD_(-4)	-0.316466	1.734449	-0.182459	0.8571
EXR	-0.002487	0.014828	-0.167700	0.8685
EXR(-1)	0.003707	0.021193	0.174896	0.8629
EXR(-2)	-0.000876	0.005389	-0.162508	0.8725
IFR	0.004432	0.023656	0.187370	0.8533
IFR(-1)	-0.002958	0.015251	-0.193941	0.8482
ITR	0.034746	0.183473	0.189378	0.8517
ITR(-1)	0.008428	0.044044	0.191353	0.8502
ITR(-2)	-0.005528	0.033445	-0.165299	0.8704
ITR(-3)	-0.014973	0.090047	-0.166277	0.8696
FDI	0.026821	0.135814	0.197485	0.8454
FDI(-1)	-0.040033	0.243247	-0.164576	0.8709
FDI(-2)	0.010586	0.062929	0.168217	0.8681
FDI(-3)	-0.000243	0.043134	-0.005639	0.9956
FDI(-4)	-0.111305	0.566481	-0.196486	0.8462
C	15.81412	22.78136	0.694169	0.4956
FITTED^2	0.034586	0.078216	0.442183	0.6631

R-squared	0.983693	Mean dependent var	24.42708
Adjusted R-squared	0.968202	S.D. dependent var	0.882530
S.E. of regression	0.157373	Akaike info criterion	-0.553540
Sum squared resid	0.495327	Schwarz criterion	0.290900
Log likelihood	31.07080	Hannan-Quinn criter.	-0.248217
F-statistic	63.49918	Durbin-Watson stat	2.377439
Prob(F-statistic)	0.000000		