ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

Inflation and Agricultural Growth in Nigeria: An Empirical Analysis of Nonlinear Responses to Inflation Changes (1981–2023)

Ihugba, Okezie A.[1]; Ihugba, Uchechi E.[2]; Eches, Eberechi E[2]; Okafor, Oluchi E.[2]

[1]Department of Economics, Alvan Ikoku Federal University of Education, Owerri
[2]Department of Agriculture, Alvan Ikoku Federal University of Education, Owerri

Publication Date: 2025/06/17

Abstract: The study examines the impact of inflation on agricultural growth in Nigeria using the Nonlinear Autoregressive Distributed Lag (NARDL) model. It focuses on the effects of positive and negative inflation, agricultural expenditure, and the monetary policy rate (MPR). The results show that positive inflation has a short-term positive effect on agricultural growth by increasing nominal prices and potentially boosting farmer revenues. However, this effect diminishes over time due to rising input costs and market inefficiencies. Negative inflation does not significantly affect agricultural growth, suggesting that inflation below a certain threshold does not significantly contribute to agricultural performance. The study also highlights the importance of policy stability, efficient agricultural expenditure, and managing inflation to maintain long-term agricultural growth. Policymakers should focus on managing inflationary pressures, promoting investment in agricultural infrastructure, and enhancing research and development, particularly in climate-resilient crop varieties. These measures are essential for sustaining agricultural productivity in Nigeria.

Keywords: *Inflation; Agricultural Growth; NARDL; Agricultural Capital Expenditure; Asymmetric Effects*.

JEL Codes: *E31: Q10: C22: Q14: C32:*

How to Cite: Ihugba, Okezie A.; Ihugba, Uchechi E.; Eches, Eberechi E; Okafor, Oluchi E. (2025). Inflation and Agricultural Growth in Nigeria: An Empirical Analysis of Nonlinear Responses to Inflation Changes (1981–2023). *International Journal of Innovative Science and Research Technology*, 10(5), 4626-4643. https://doi.org/10.38124/ijisrt/25may1899

I. INTRODUCTION

Agriculture is a vital sector in Nigeria's economy, generating employment, food security, and GDP. However, it faces challenges like inflation, which affects production, investment decisions, and market dynamics. Understanding the relationship between inflation and agricultural growth is crucial for developing economies like Nigeria, where agriculture is sensitive to price stability; understanding the relationship between inflation and agricultural growth is critical for designing effective policies to foster sustainable development.

Inflation's impact on agriculture is complex, with moderate inflation promoting growth through investment and output, while high inflation can destabilize markets and erode farmers' purchasing power (Ebem, 2025). The relationship between inflation and agricultural growth is often nonlinear, with varying effects depending on the magnitude and direction of inflationary shocks. Inflation surges may have more severe effects than mild deflation, reflecting asymmetric responses in the agricultural sector.

The trends depicted in Figure 1 (See Annex 1) provide a visual representation of Nigeria's inflation and agricultural growth patterns from 1981 to 2023. These trends reveal significant fluctuations, with inflation peaking at 72.84% in 1995 while agricultural growth experienced notable increases. The stabilization policies implemented post-1996 brought some relief, yet recent inflation rates, including 24.7% in 2023; highlight persistent macroeconomic challenges such as structural inefficiencies, currency depreciation, and global economic shocks.

Interestingly, as the figure illustrates, agricultural growth does not exhibit a clear linear relationship with inflation. For example, the high agricultural growth recorded in 2002 occurred alongside moderate inflation. However, since 2016, inflation has shown a consistent upward trajectory, while agricultural growth has remained relatively modest, reflecting the limited efficacy of agricultural policies in an environment of rising inflation. The figure further underscores how economic instability during the 1990s and early 2000s, marked by unprecedented inflation rates, significantly affected the agricultural sector's resilience.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

Existing studies on inflation and agriculture in Nigeria (Ebem, 2025; Rilwan and Mustapha, 2024; Widdows, 2024; Obiora et al., 2023; Njegovan and Tomaš, 2020; Akpaeti, Agom, and Frank, 2018) have largely focused on linear relationships, often neglecting the possibility of asymmetries and nonlinear dynamics. While researchers like Ekekwe and Njoku (2024) and Anidiobu, Okolie, and Oleka (2018) Ihugba, Ebomuche, and Ezeonye, (2015) have explored the broader macroeconomic implications of inflation, there is limited literature on its specific effects on agriculture. Moreover, understanding short-term versus long-term effects and the threshold levels of inflation that significantly impact agricultural growth remains an underexplored area.

This study aims to bridge these gaps by employing a Nonlinear Autoregressive Distributed Lag (NARDL) model to analyze the nonlinear and asymmetric effects of inflation on agricultural growth in Nigeria from 1981 to 2023. The model's ability to distinguish between positive and negative changes in inflation provides a nuanced understanding of how inflationary dynamics influence agricultural performance.

The findings from this study are expected to provide valuable insights for policymakers, highlighting the need for tailored interventions to stabilize inflation and support the agricultural sector. By addressing the complex interplay between inflation and agriculture, this research contributes to the broader discourse on economic resilience and food security in Nigeria.

The remainder of the paper is structured as follows: Following the introduction, the literature review presents a comprehensive overview of existing research on inflation and its effects on agriculture, highlighting key findings, theoretical frameworks, and gaps in the literature. The methodology section outlines the research design, data collection methods, and analytical techniques used to investigate the impact of inflation on agricultural production. Next, the results section presents the findings of the study, while the discussion interprets these results in the context of existing literature, providing insights into their implications and also, the diagnostic tests. Finally, the conclusion summarizes the main findings, discusses policy recommendations, and suggests areas for further research.

II. LITERATURE REVIEW

➢ *Theoretical Framework*

Various theories have been proposed to link inflation to agricultural output through both direct and indirect means:

- Real Balance Effect: According to Patinkin (1965), Real Balance Effect theory, an increase in the money supply in the economy first affects demand and relative price levels before impacting absolute prices. Patinkin aimed to unify the monetary and real sectors through this impact. In the agricultural sector, this important concept suggests that inflation reduces the real value of money, thereby impacting consumers' purchasing power and agricultural growth. Inflation may increase input costs for farmers, but prices may not immediately adjust, affecting their ability to increase the prices for crops immediately, which could hinder agricultural expansion. This is particularly relevant in developing economies like Nigeria, where agriculture heavily relies on domestic markets.
- Cost-push inflation, also known as wage-push inflation, occurs when overall prices increase due to increases in the cost of wages and raw materials. Higher production costs can decrease the aggregate supply, or total production, in an economy. Consumers pass on price increases from production if the demand for affected goods remains unchanged, leading to cost-push inflation (Kenton, 2025). Supply-side factors like rising input costs often cause inflation in developing economies like Nigeria. This can be particularly harmful in agriculture, as it increases production costs without necessarily increasing output prices. This squeeze on profit margins can discourage investment and reduce agricultural growth. For instance, fuel prices can directly affect the price of agricultural goods relying on long-distance transportation.
- Demand-pull inflation: It transpires when the demand for goods and services surpasses the available supply in the economy. As demand escalates, the quantity of products and services available for acquisition may either remain constant or diminish. Demand-pull inflation exerts higher pressure on prices resulting from supply limitations a phenomenon economist characterize as an excess of currency pursuing a limited quantity of products. An escalation in aggregate demand may also result in this form of inflation (Chen, 2024). Increased demand-driven inflation could potentially benefit the agricultural sector, particularly if it leads to an expansion in consumption or government investment. Higher incomes could stimulate food product demand, stimulating agricultural output. Nigeria's agricultural exports could benefit from higher global demand during inflationary periods, influenced by exchange rates and commodity prices.
- Inflation and Investment in Agriculture: In theory, inflation can significantly reduce agricultural investment due to increased uncertainty and high interest rates. Farmers may face increased borrowing costs, limiting their ability to purchase necessary inputs like machinery and irrigation systems (Ebem, 2025). This reduced capital investment can hinder long-term agricultural productivity and growth, making it less attractive for long-term investments.
- Nonlinear Relationships between Inflation and Agricultural Growth: Recent research suggests that the impact of inflation on growth may be nonlinear, with agricultural output potentially differing significantly in high and low inflation periods. This is particularly relevant in Nigeria, where inflation rates have fluctuated over the past few decades. The threshold effects by Ball (1992), a nonlinear response theory, propose that the relationship between inflation and agricultural growth undergoes changes upon reaching specific thresholds, such as 10–15%. Moderate inflation may stimulate

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

growth, but once it surpasses a critical level, it may erode real income, reduce investment, and dampen agricultural growth. Models such as the Nonlinear Autoregressive Distributed Lag (NARDL) model can test this theory. Inflation can lead to asymmetric effects (Tan and Dufresne, 2002). In Nigeria, agricultural producers and consumers react differently to rising and falling inflation. During inflationary surges, farmers may benefit temporarily from higher prices but may eventually lose profits due to rising input costs. Conversely, during deflationary periods, input costs may fall, but agricultural producers may face lower demand due to reduced consumer purchasing power.

➢ *Previous Empirical Studies*

Numerous studies have investigated the link between inflation and agricultural growth in Nigeria, but most focus on linear models, neglecting the potential for nonlinearities or asymmetric effects, despite the diverse methodologies and perspectives used.

- *Linear Models and Inflation-Agriculture Relationship*

Studies demonstrate that, depending on the macroeconomic context and the linear effects of inflation, inflation can either enhance or hinder agricultural output. Notably, the study by Ebem (2025) examined the impact of inflation on Nigeria's agricultural output, highlighting its significant negative impact on productivity, farmer income, and food security. Despite Nigeria's agricultural potential, inflation remains a persistent issue, affecting input costs, production processes, and market prices. The study looks at the connection between inflation rates and agricultural output using both the Autoregressive Distributed Lag (ARDL) Model and the Vector Error Correction Model (VECM). The study demonstrates that long-term agricultural growth requires stable economic policies. Similarly, Rilwan and Mustapha (2024) also looked at the link between inflation rate, agricultural output, and economic growth in Nigeria from 1990 to 2022. They used descriptive statistics, correlation analysis, the ADF unit root test, the Auto Regressive Distribution Lag (ARDL), and Granger causality. They discovered a long-term correlation between inflation and agricultural output, as well as a negative correlation between inflation and agricultural output. However, agricultural output has a positive relationship with economic growth. The study also found unidirectional and bidirectional causality between agricultural output and economic growth. The findings suggest that the government can achieve optimal economic performance through active stabilisation and economic intervention policies. Widdows (2024) provide empirical evidence supporting the notion that inflation influences agricultural growth in a straightforward manner, though they focus on specific periods of inflationary pressure and neglect the asymmetry that could arise during high versus low inflation periods.

Obiora et al. (2023) also contribute to this linear perspective, examining the link between inflation and agricultural performance in the context of Nigeria's agricultural policy environment. Their study suggests that inflation significantly impacts food prices, particularly among rural farming households. Factors such as low agricultural productivity, extreme weather, exchange rates, transportation, government policies, insurgency, energy crises, the Russian-Ukraine war, market competition, and hoarding contribute to inflation-induced food security issues. The study recommends comprehensive policy actions to counteract inflation, including stabilizing rates, enhancing agricultural productivity, improving infrastructure, reinforcing safety nets, and strengthening governance. Akpaeti et al. (2018) studied the impact of inflation on farmers' income and agricultural investments in Nigeria to promote sustainable growth and financial transformation in the agricultural sector. Their results showed a positive and highly significant inflation coefficient of 4.74 percent, with a low correlation between inflation and farmers' income and a strong positive relationship between inflation and agricultural investments. The study recommends that the Federal Government, Central Bank of Nigeria, and other stakeholders formulate monetary policies to control inflation and maintain growth.

- *Nonlinear and Asymmetric Effects in Inflation-Growth Studies*

In contrast to the linear models, research indicates that the impact of inflation on growth may not be uniform and could vary significantly during different inflation regimes (e.g., high vs. low inflation).Unlike linear models, this suggests that the effects of inflation may not be uniform. Ekekwe and Njoku (2024) make a significant contribution to this field by analyzing the threshold effects of inflation on macroeconomic performance from 1981 to 2022, utilizing the Error Correction Model (ECM) test approach. The results suggest that high or volatile inflation rates can hinder economic growth and development.

Similarly, Anidiobu et al., (2018) explore the asymmetry of inflation and its impact on Nigeria's economic growth from 1986 to 2015. The research employed an ex post research design, focusing on events that the researcher could neither control nor manipulate. The study concluded that inflation had a positive and non-significant effect on economic growth. The study recommends tight monetary policy measures to stabilize inflationary pressures and political leaders to minimize unjustified public spending and promote fiscal prudence. This finding aligns with Ihugba et al., (2015) study that examined the relationship between inflation and economic growth using data from 1970 to 2013. The study indicates a positive relationship between inflation and economic growth, demonstrating that an increase in inflation does not hinder economic growth. The rising cost of goods and services is not due to an increase in real GDP, but rather the cost of production, particularly energy.

Njegovan and Tomaš (2020) focus on nonlinear cointegration techniques to examine the analyses inflation and agricultural and food product prices in Serbia, focusing on the global changes affecting the national context. It highlights the importance of agri-food product and input prices, as well as the influence of the world monopolistic structure on inflation.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

Ngoc (2020) investigated the asymmetric effect of inflation and money supply on economic growth in Vietnam from 1990 to 2017. The results show that inflation has a negative and asymmetric long-term impact, while money supply has a positive short- and long-term impact. High inflation rates can destruct economic activities, indicating the need for authorities to plan monetary policies and control inflation rates for long-term sustainable development.

In Kenya, Hongo et al. explored the impact of unemployment-inflation on subjective well-being (SWB) and output growth on unemployment. It finds that the output gap regulates the inflation-unemployment tradeoff, and unemployment trades off with long-term shocks in cyclical output. Unemployment negatively impacts fiscal policy in the long run. Implementing labor supply and fiscal side policies in the short run is necessary to alleviate SWB.

Boujelbene's (2021) study investigates the inflation-growth relationship in North African countries from 1980 to 2016 using dynamic panel threshold regression. Findings show a nonlinear relationship between CPI inflation and economic growth rates, with inflation above a certain threshold negatively impacting growth. The cost of inflation increases with the quality of institutions, including political instability and democracy. The study highlights the importance of an inflation threshold for economic agents.

Hossain et al. (2021) examine the link between inflation and Bangladesh's economic development using a nonlinear autoregressive distributed lagged (NARDL) method. Using data from 1986 to 2017, the study found a positive long-run and short-run relationship between GDP growth and inflation rates. The study also found that positive inflation has a significant short-term impact on growth rates.

The relationship between inflation and agricultural growth is well-documented, but there are gaps in the literature, especially in nonlinear and asymmetric effects. Most studies use linear models, which do not account for the difference in inflation's impact during high versus low periods. This is particularly evident in Nigeria, where inflation rates have fluctuated significantly. More research is needed to test nonlinear models and explore how inflation asymmetrically influences agricultural output. Additionally, country variations in inflation impact and institutional quality's role in inflation-agriculture dynamics are also underexplored.

III. METHODOLOGY

➢ *Model Specification*

The study uses the Nonlinear Autoregressive Distributed Lag (NARDL) model to examine the nonlinear and asymmetric effects of inflation on Nigeria's agricultural GDP, capturing both short-term and long-term asymmetric relationships.

- *The Model is Specified as:*

$$\Delta AGDP_t = \alpha + \sum_{i=1}^{\rho} \beta_i \Delta AGDP_{t-i} + \sum_{j=0}^{q} \gamma_j^{+} \Delta INF_t^{+} + \sum_{j=0}^{q} \gamma_t^{-} \Delta INF_t^{-} + \sum_{k=0}^{q} \delta_k Z_{t-k} + \phi_1 AGDP_{t-1} + \phi_2 INF_t^{+} + \phi_3 INF_t^{-} + \phi_4 Z_t + \varepsilon_t \quad (1)$$

Where:

$\Delta AGDP_t$ = Change in agricultural GDP at time t (dependent variable).

INF_t^{+} *and* INF_t^{-} = Positive and negative changes in inflation (independent variable)

Z_t = Control variables, including agricultural expenditure (AGEXP) and monetary policy rate (MPR).

$\phi_1, \phi_2, \phi_3, \phi_4 =$ Long-run coefficients.

$\beta_i, \gamma_j^{+}, \gamma_j^{-} =$ Short-run coefficients.

ε_t = Error term

➢ *Data Description*

The study utilizes data from 1981-2023 from the Central Bank of Nigeria and World Development Indicators to analyze agricultural GDP, inflation rates, and macroeconomic indicators. The detailed information on the variables, their measurement, expected relationships, and the data sources, please refer to Table 1 in the Annex 2.

➢ *Estimation Procedure*

- *Stationarity Test:*

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are designed to ascertain whether the variables are stationary at level I(0), first difference I(1), or beyond. The NARDL approach can accommodate variables integrated at I(0) or I(1)I but not I(2).

- *Decomposition of Inflation:*

Inflation (INF) is decomposed into its positive (INF^{+}) and negative (INF^{-}) components using partial sum decomposition:

$$INF_t^{+} = \sum_{i=1}^{t} \max(\Delta INF_i, 0), INF_t^{-} = \sum_{i=1}^{t} \min(\Delta INF_i, 0)$$

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- *Bounds Testing for Cointegration:*

The F-Bounds test will be applied to determine the existence of a long-run relationship among the variables.

- *Estimation of NARDL Model:*

✓ Long-run and short-run asymmetries in the relationship between inflation and agricultural GDP will be estimated.
✓ The coefficients of INF^+ and INF^- will reveal whether inflation has an asymmetric effect on agricultural GDP.

- *Diagnostic Tests:*

The robustness of the model will be verified using:

✓ Breusch-Godfrey LM Test: Tests for serial correlation.
✓ Breusch-Pagan-Godfrey Test: Checks for heteroscedasticity.
✓ Jarque-Bera Test: Assesses residual normality.
✓ CUSUM and CUSUMSQ Tests: Evaluate model stability.

➢ *Justification for Methodology*

A highly ethical individual's negative transformation may astonish you, yet their beneficial transformation may not elicit the same response. These two adjustments in opposing directions (negative and positive) do not have the same power to affect you. However, the impacts are not symmetric but rather asymmetric. Asymmetry constitutes a form of nonlinearity. Economic variables often exhibit asymmetry. In actuality, nonlinearity in the social sciences frequently exhibits asymmetry, which underpins the human predicament (Shin, Yu, and Greenwood-Nimmo, 2014).

A standard regression model using time series data presumes a fixed coefficient. A modification (either upward or downward) in the control variable exerts a consistent influence across time, which is not invariably true. Also, well-known cointegration methods like EG-ECM, VECM, bound testing, ARDL, and others offer a steady rate of return to long-term equilibrium (constant ECT) after a shock. Nonetheless, this may not consistently apply in the presence of market friction (Dufrénot & Mignon, 2002). Symmetric methodologies appear to skew the assessment of an asymmetric connection, potentially leading policymakers to significantly erroneous policy decisions (Enders, 2015). The conventional cointegration test fails to account for asymmetries in macroeconomic variables.

Consequently, researchers have employed a variety of methodologies, such as smooth transition regression ECM, Markov-switching ECM, and threshold ECM, to elucidate this disparity. The non-linear autoregressive distributed lag (NARDL) model introduced by Shin et al. (2014) incorporates asymmetrical interactions in both the short and long term. Furthermore, the model integrates asymmetries into the dynamic alteration process. Furthermore, Ibrahim (2015) contends that the model is applicable to both the aggregate order of level and the initial difference.

Ahmed and Mortaza (2010) assert that there is a prevalent notion that inflation does not have a linear impact on the growth rate. In Nigeria, there exists an unbalanced link between inflation and agricultural growth. Consequently, the analysis uses control variables (AGEXP and MPR) to account for fiscal and monetary influences, providing a robust understanding of the inflation-agricultural growth nexus through both short-term and long-term estimates. To investigate asymmetries in both short- and long-term interactions, we have employed the NARDL approach in this research.

➢ *Expected Contribution*

This methodology allows for the identification of nonlinear and asymmetric effects of inflation on agricultural GDP, offering actionable insights for policymakers. It highlights the role of government expenditure and monetary policy in stabilizing agricultural growth amidst inflationary pressures.

IV. RESULTS AND THE DIAGNOSTIC TESTS

➢ *Unit Root Test and BDS Test*

Time-series data analysis requires checking the order of integration to avoid spurious outcomes from regression. A time series X is stationary when its mean and variance do not vary throughout the time range, and the covariance between two observations differs only on the difference between two time periods. We widely use two standard tests for a unit root to test the stationarity of time series variables: the Phillips-Perron (PP 1988) and the Augmented Dickey-Fuller (ADF) tests. The Schwarz information criterion (SIC) selects the optimum lag structure for the ADF test, while the Newey-West Bandwidth automatically selects the PP test.

If the p-value is less than 5%, the unit root test rejects the null hypothesis; otherwise, it cannot. The output of unit root tests indicates that the AGDP growth rate and inflation rate are stationary at a 1% significance level. The nonlinear autoregressive distributed lagged (NARDL) model allows the variables to be stationary at a 1% significance level, implying that not a single variable is I(2).

The results of the unit root test, presented in Table 2 (see Annex 3), indicate the stationarity properties of the variables under consideration:

- LAGDP variable is non-stationary at the level but becomes stationary after differencing once.
- There is no need for differencing as PINF remains stationary at the level.
- NINF is stationary at the level according to the PP test, but the ADF test suggests it requires differencing to become stationary. Since the PP test is more robust to serial correlation, NINF can be considered stationary at the level based on the PP test.
- LAEXP is non-stationary at the level but becomes stationary after first differencing.
- MPR remains stationary at the level, negating the need for differencing.

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➢ *Model Selection Process*

The summary of the top-ranked models based on Akaike Information Criterion (AIC) is presented in Figure 2 (see Annex 4). The model selected, ARDL (1, 4, 2, 4, 2) with the lowest AIC value of -1.524904, efficiently captures variable relationships without overfitting. The model will be utilized for further analysis, estimating both short-term and long-term relationships.

➢ *Bounds Testing for Cointegration*

Table 3 (see Annex 5) presents the ARDL Bounds Test results, showing an F-statistic exceeding the 5% significance level, indicating a long-term relationship between agricultural growth, inflation, and control variables.

The findings rejects the null hypothesis that there is no long-run relationship between variables, as the computed F-statistic (16.92457) exceeds the critical value for I(1) at all common significance levels (10%, 5%, 2.5%, and 1%), indicating a significant long-run relationship (cointegration) between the variables in the model. This suggests that the variables are cointegrated and share a long-term equilibrium relationship, indicating a stable long-run relationship allowing for the estimation of long-run and short-run relationships using the ARDL/NARDL framework.

➢ *Estimation of NARDL Model*

- *Long-Run Asymmetries*

Table 4 (see Annex 6) presents the long-run estimates derived from the NARDL model. The Table reveals that agricultural growth in Nigeria is strongly influenced by positive inflation and capital expenditure on agriculture. The coefficient of 0.871522 indicates that agricultural growth (LAGDP) is positively correlated with its previous value, taking a lagged effect to influence current growth. Positive inflation (PINF), which encourages investment and production, has a positive effect on agricultural growth. However, the effects of positive inflation may take time to manifest, and the relationship between negative inflation (NINF) and agricultural growth is not statistically significant. The current level of agricultural capital expenditure (LAEXP) does not have a significant effect on agricultural growth, and the Monetary Policy Rate (MPR) does not significantly influence agricultural growth. The results suggest that inflation, particularly positive inflation, and capital expenditure on agriculture play significant roles in shaping agricultural growth in Nigeria.

- *Short-Run Asymmetries*

Table 5 (see Annex 7) presents the short-run results of the NARDL model, highlighting the immediate and lagged effects of independent variables on Nigerian agricultural growth. These findings illustrate the responsiveness of agricultural growth to inflation (both positive and negative), agricultural expenditure, and changes in the monetary policy rate. The results provide valuable insights into the transient impacts of policy interventions and macroeconomic fluctuations on agricultural performance.

The NARDL model's short-run results reveal the immediate and lagged impacts of inflation, agricultural expenditure, and monetary policy rate on agricultural growth. The results are as follows:

- Positive inflation increases agricultural growth by increasing nominal prices, potentially boosting farmers' revenues. However, the initial positive impact of inflation reverses over time, indicating sustained inflationary pressures erode agricultural productivity due to rising input costs and market inefficiencies.
- A decrease in inflation does not immediately impact agricultural growth, while a reduction in inflation initially dampens growth due to reduced nominal revenues in the agricultural sector, as indicated by the negative but statistically insignificant coefficients.
- Increased agricultural expenditure has a delayed positive impact on growth, with a positive coefficient of 0.063919. The lagged effects indicate that excessive or inefficient expenditure may have adverse effects, and poorly managed or delayed agricultural expenditure may hinder growth. The current effect is positive but marginally insignificant, while the lagged effects are positive and marginally significant, indicating a delayed boost to agricultural growth.
- Changes in the monetary policy rate have minimal impact on agricultural growth, while higher interest rates in the previous period reduced growth due to increased borrowing costs for farmers, with a positive but statistically insignificant current effect.
- The Error Correction Term (CointEq(-1)) has a coefficient of -0.128488, a highly significant negative (p=0.0000) that indicates a stable long-run relationship between variables, correcting approximately 12.85% of deviations in each period.

➢ *Diagnostic Tests*

The validity and robustness of the regression model were assessed through diagnostic tests, focusing on key assumptions such as residual autocorrelation, heteroskedasticity, normality, model specification, and coefficient stability. Table 6 (see Annex 8) summarizes the results, including statistical measures, p-values, and conclusions.

The diagnostic test results presented in Table 6 (see Annex 8) and Figure 3 (see Annex 9) confirm that the estimated model is robust, well-specified, and stable. The CUSUM and CUSUM of Squares tests validate the model's stability, revealing no issues with residual autocorrelation, heteroskedasticity, or normality. These results bolster confidence in the reliability and validity of the findings derived from the model.

V. DISCUSSION OF FINDINGS

➢ *Relating the Results to the Theoretical Framework*

The theoretical framework in part two provides several economic theories explaining the relationship between inflation and agricultural growth, focusing on Nigeria. These theories highlight the direct and indirect effects of inflation

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

on agricultural output, investment, costs, and market conditions. The NARDL model is used to test these implications, considering nonlinearities and asymmetric effects. Below is a discussion of how the results in Table 4 align with these theoretical concepts:

- The Real Balance Effect theory suggests that inflation reduces the real value of money, impacting purchasing power and agricultural growth. The results in Table 4 reflect this theory in the sense that positive inflation initially boosts agricultural growth by raising nominal prices, boosting revenues in the short run. However, the positive effects of inflation are eventually reversed, reducing purchasing power, real income, and ultimately dampening agricultural productivity over time. This is due to farmers' inability to adjust crop prices rapidly enough to keep up with rising input costs, a key point from the Real Balance Effect theory.
- Cost-push inflation is a phenomenon where rising wages and input costs decrease aggregate supply and production, especially in economies like Nigeria where agriculture relies heavily on domestic markets. This inflation can lead to negative effects on the agricultural sector, as inflation increases input costs without a proportional increase in output prices, shrinking farmers' profit margins and discouraging investment. This could explain the insignificance of current agricultural expenditure (LAEXP) in the results, as delayed or inefficient spending may not offset the impact of rising input costs.
- Demand-pull inflation occurs when demand outpaces supply, leading to higher prices and potentially stimulating agricultural output. In the short run, increased demand may boost agricultural output due to higher incomes or government investment. However, the long-term impact of inflation, as reflected by lagged effects, suggests that once inflation is sustained, the initial benefits may be outweighed by increased costs and challenges in keeping up with higher input prices. Thus, while demand-pull inflation temporarily benefits agricultural growth, its long-term effects may be negative.
- Inflation can deter investment in agriculture due to increased uncertainty, higher interest rates, and reduced purchasing power. The lagged impact of agricultural expenditure on growth suggests that current expenditure has a marginally insignificant effect, while investments made today have a delayed effect on agricultural growth. This aligns with the theory that inflation increases uncertainty and raises the cost of capital, reducing investment in long-term agricultural projects like infrastructure, machinery, and irrigation systems. The Monetary Policy Rate (MPR) likely reflects this theory, as high interest rates could raise borrowing costs for farmers.
- The NARDL model suggests that inflation's impact on agricultural growth is nonlinear, with threshold effects. Moderate inflation may stimulate growth, while high inflation may reduce it. This theory aligns with the findings that positive inflation has both short-term and long-term effects, with long-term negative effects. Threshold effects explain why moderate inflation may be beneficial.
- The negative Error Correction Term (CointEq(-1)) supports a stable long-term relationship between agricultural growth and explanatory variables, indicating a nonlinear and dynamic adjustment process. Despite short-term fluctuations, Nigeria's agricultural growth adjusts to reach long-term equilibrium, with policy interventions or economic shifts correcting deviations.

➢ *Relating the Results to Previous Empirical Studies*

- Linear Models and Inflation-Agriculture Relationship: Previous studies in Nigeria, including those by Ebem (2025), Rilwan and Mustapha (2024), and Obiora et al. (2023), have found a negative linear relationship between inflation and agricultural output. These studies, using ARDL and VECM models, suggest that inflation leads to higher input costs, reduced farmer income, and hampers food security. However, our findings reveal that positive inflation initially boosts agricultural growth but then reverses, supporting the notion that inflation, while offering short-term gains in nominal prices, ultimately reduces growth due to escalating costs. This highlights the importance of controlling inflation to ensure long-term agricultural growth. Our results provide deeper insight into the time-dependent nature of inflation's impact, which is often overlooked in linear models. By incorporating the NARDL model, the study addresses asymmetries in the relationship between inflation and agricultural output.
- Nonlinear and Asymmetric Effects in Inflation-Growth Studies: Recent studies have highlighted the nonlinear and asymmetric effects of inflation on agricultural growth, moving beyond linear models. The NARDL model, which accommodates these complexities, aligns with these findings. Studies like Ekekwe and Njoku (2024) and Anidiobu et al. (2018) emphasize that inflation does not have a uniform effect, and the threshold effects of inflation, where moderate inflation may stimulate growth but high inflation dampens it, are particularly relevant to your study. Your results resonate with this literature, particularly the asymmetric response to inflation. Studies like Hossain et al. (2021) found a positive long-run and short-run relationship between inflation and economic development, similar to your findings. Your study expands this by focusing specifically on agricultural growth in Nigeria, demonstrating the delayed impacts of agricultural expenditure and lagged inflation effects, which were less explored in previous work. Your findings support the threshold inflation theory and provide a more granular understanding of this dynamic in the Nigerian context.

VI. CONCLUSION

The study examines the relationship between inflation and agricultural growth in Nigeria using the Nonlinear Autoregressive Distributed Lag (NARDL) model. It finds that positive inflation can boost nominal prices and farmer revenues in the short term, but over time, it leads to higher

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

input costs and market inefficiencies, resulting in a negative long-term impact on agricultural productivity. The study suggests that sustained inflation can undermine agricultural growth by eroding real income and increasing production costs.

The study reveals that agricultural capital expenditure has a delayed impact on agricultural growth, suggesting that timely investments can significantly enhance productivity. However, the Monetary Policy Rate and negative inflation do not show significant short-term or long-term effects on agricultural growth, suggesting that policies related to inflation control and investment may have a more significant impact on the sector's performance.

The study suggests that moderate inflation may provide short-term benefits to agricultural growth, but its long-term sustainability is compromised if it continues to rise unchecked. It also suggests that policies aimed at stabilizing inflation and promoting strategic agricultural investments are crucial for long-term growth, in line with theories like the Real Balance Effect and nonlinear relationships.

Overall, this study provides empirical evidence on the nonlinear and asymmetric effects of inflation on agricultural growth in Nigeria, emphasizing the importance of stable economic policies, particularly those managing inflation and promoting efficient agricultural expenditure, for long-term growth and sustainability in the agricultural sector.

➢ *Policy Recommendations*

The study's findings lead to the following policy recommendations to boost Nigeria's agricultural growth:

- Nigeria's Central Bank should implement monetary policy adjustments like raising interest rates and reducing the money supply to control high inflation, prevent rising production costs, and maintain agricultural growth, while also implementing an inflation-targeting framework.
- The government should promote long-term agricultural investment through tax incentives, subsidies for new technologies, and infrastructure development, while increasing public and private sector investments to improve productivity, supply chains, and provide farmers with capital.
- The government should prioritize efficient agricultural expenditures, focusing on targeted investments in rural infrastructure, agricultural research, climate-resilient crop varieties, and enhanced implementation and monitoring processes.
- Policymakers should adopt a flexible agricultural policy framework to manage asymmetric inflation and support smallholder farmers during high-inflation periods. This involves monitoring inflation trends and adjusting policies accordingly. Targeted support for inputs and price stabilization mechanisms can help farmers cope with fluctuating market conditions.

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ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 1

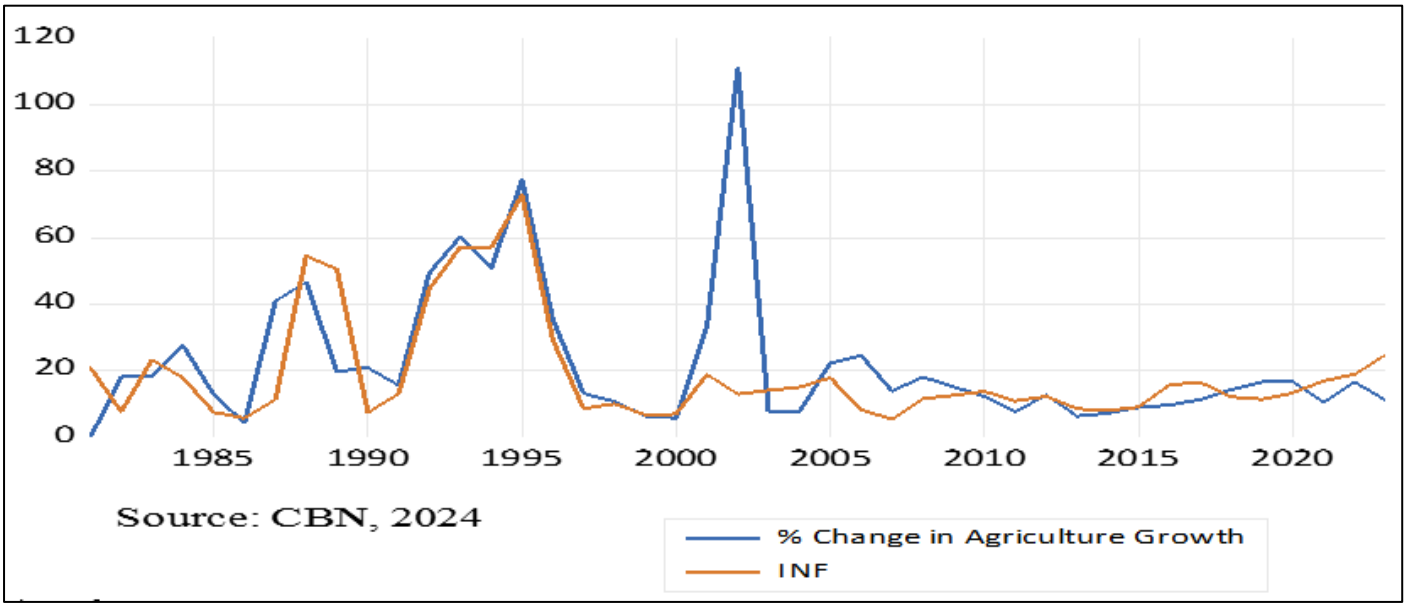

Fig 1 Trends in Inflation and Agricultural Growth (1981–2023)

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 2

Table 1 Measurement of Variables and Data Sources

Variable	Description	Measurement	Expected Sign	Source
AGDP	Agricultural GDP (dependent variable)	Annual agricultural GDP (₦ billion)	N/A	CBN Statistical Bulletin, 2023, C.1.1
INF	Inflation (independent variable, disaggregated into positive and negative changes)	Annual % change in CPI	Mixed	https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?subcat=11&locations=NG
AGEXP	Capital expenditure on economic services as a proxy for agriculture expenditure because it covers broader spending areas that could benefit agriculture.	Total government capital expenditure on economic services	Positive	CBN Statistical Bulletin, 2023, B.1.3
MPR	Monetary policy rate (proxy for interest rate)	Minimum rediscount rate (1981-2005) Monetary policy rate (2006-2023)	Negative	CBN Statistical Bulletin, 2023, A.11

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 3

Table 2 Unit Root Tests Result of all Variables

Variables	ADF Test Statistic		PP Test Statistic	
	Level	1st Diff	Level	1st Diff
LAGDP	-2.32	-4.10*	-2.32	-4.15*
PINF	-6.63*	-7.80*	-6.70*	-22.28*
NINF	-0.73	-4.10*	-6.66*	-33.52*
LAEXP	-0.63	-6.77*	-0.64	-6.76*
MPR	-3.27*	-6.70*	-3.20*	-7.70*

Source: Authors computation using Eviews 12, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 4

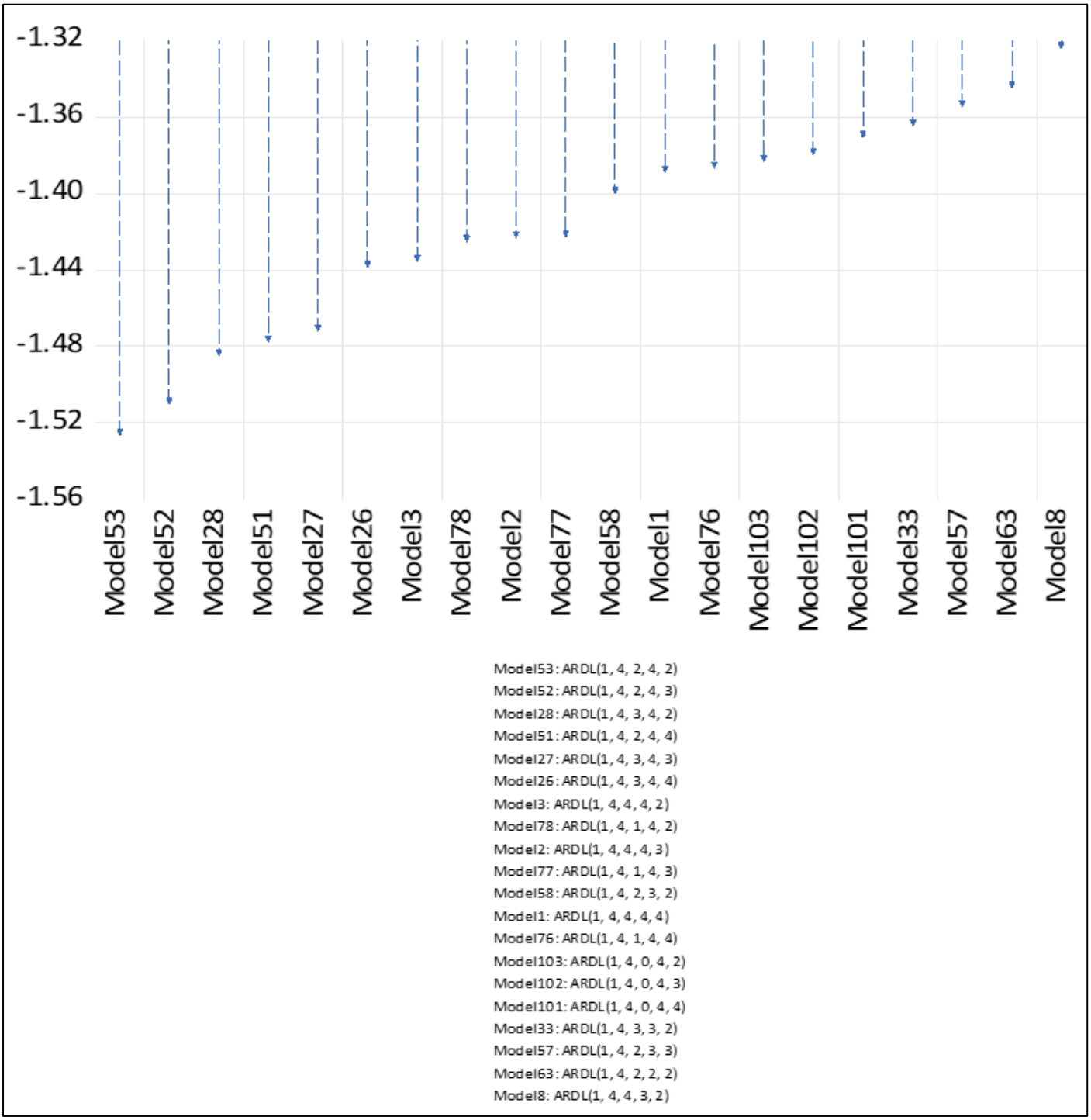

Fig 2 Akaike Information Criteria (top 20 models)

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 5

Table 3 F-Bounds Test results

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	16.92457	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's calculations, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 6

Table 4 NARDL Long Run Estimate (1, 4, 2, 4, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LAGDP(-1)	0.871522	0.043672	19.95595	0.0000
PINF	0.003142	0.001010	3.111051	0.0053
PINF(-1)	0.003606	0.001147	3.142906	0.0049
PINF(-2)	0.001372	0.001092	1.256274	0.2228
PINF(-3)	0.002081	0.001058	1.966543	0.0626
PINF(-4)	0.002965	0.000861	3.444822	0.0024
NINF	-0.000156	0.000217	-0.722072	0.4782
NINF(-1)	0.000343	0.000194	1.773446	0.0907
NINF(-2)	0.000367	0.000197	1.862139	0.0766
LAEXP	0.063919	0.049429	1.293140	0.2100
LAEXP(-1)	0.141476	0.058622	2.413370	0.0250
LAEXP(-2)	-0.161494	0.056484	-2.859112	0.0094
LAEXP(-3)	-0.005033	0.058545	-0.085968	0.9323
LAEXP(-4)	0.098940	0.048903	2.023179	0.0560
MPR	0.005495	0.006505	0.844727	0.4078
MPR(-1)	-0.012726	0.007581	-1.678745	0.1080
MPR(-2)	0.018357	0.006561	2.797934	0.0108
C	0.190519	0.158816	1.199620	0.2436
R-squared	0.998997			

Source: Author's calculations, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 7

Table 5 NARDL Short-run Result

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(PINF)	0.003142	0.000740	4.246754	0.0004
D(PINF(-1))	-0.006418	0.000978	-6.561566	0.0000
D(PINF(-2))	-0.005047	0.000916	-5.511181	0.0000
D(PINF(-3))	-0.002965	0.000618	-4.799179	0.0001
D(NINF)	-0.000156	0.000145	-1.078852	0.2929
D(NINF(-1))	-0.000367	0.000142	-2.588036	0.0172
D(LAEXP)	0.063919	0.037052	1.725103	0.0992
D(LAEXP(-1))	0.067586	0.036748	1.839167	0.0801
D(LAEXP(-2))	-0.093907	0.036872	-2.546847	0.0188
D(LAEXP(-3))	-0.098940	0.037001	-2.674017	0.0142
D(MPR)	0.005495	0.005240	1.048553	0.3063
D(MPR(-1))	-0.018357	0.005349	-3.431568	0.0025
CointEq(-1)*	-0.128478	0.011458	-11.21273	0.0000
R-squared	0.787366			

Source: Author's calculations, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 8

Table 6 Summary of Diagnostic Test Results

Test	Test Statistic	Critical Value/ Threshold	p-Value	Decision	Remark
Breusch-Godfrey LM Test	F = 1.572828	N/A	0.2333	Accept null hypothesis of no autocorrelation	Indicates non residual autocorrelation.
Ramsey RESET Test	F = 0.002503	N/A	0.9606	Fail to reject null hypothesis	No evidence of model misspecification.
Heteroskedasticity Test (Breusch-Pagan-Godfrey)	F = 1.197319	N/A	0.3437	Fail to reject null hypothesis of homoscedasticity	No heteroskedasticity detected.
Normality Test (Jarque-Bera)	JB= 1.521019	N/A	0.467428	Fail to reject null hypothesis	Residuals are normally distributed.
Stability (CUSUM)	Within bounds	N/A	N/A	Model is stable	No structural instability detected.
CUSUM of Squares Test	Within bounds	N/A	N/A	Model is stable	No structural instability detected.

Source: Author's calculations, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may1899

ANNEX 9

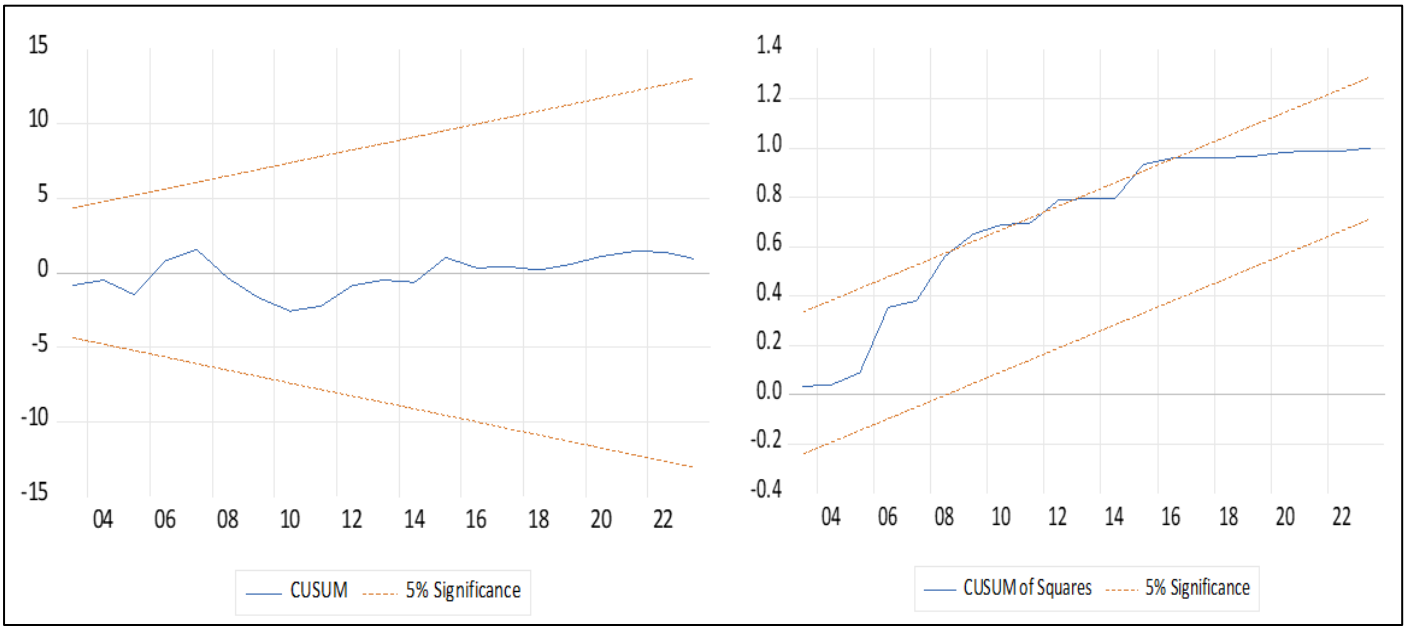

Fig 3 Stability Result