

Statistical Analysis on the Relationship Between Inflation and Household Consumption in Ondo State

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Abstract

This study investigates the statistical relationship between inflation and household consumption expenditure in Ondo State, Nigeria, using monthly time-series data spanning 28 years (January 1995 – December 2023). The research adopts a quantitative, correlational, and time-series design, employing the Auto-Regressive Distributed Lag (ARDL) bounds testing approach to cointegration and the Error Correction Model (ECM) to examine both long-run and short-run dynamics. Real household consumption expenditure (RHCE), constructed as the sum of major consumption categories adjusted by the Consumer Price Index (CPI), serves as the dependent variable, while inflation rate measured by the year-on-year percentage change in CPI is the primary independent variable. Diagnostic tests confirm that both variables are integrated of order one, $I(1)$, satisfying the preconditions for ARDL modeling. The bounds test F -statistic (6.18) exceeds the upper critical bound (3.30), confirming the existence of a long-run cointegrating relationship. The estimated long-run coefficient reveals that a 1% increase in inflation leads to a ₦1.04k reduction in real household consumption, while the short-run effect is estimated at ₦0.41k. The error correction coefficient ($\lambda = -0.28$) indicates that approximately 28% of any deviation from equilibrium is corrected monthly, reflecting moderate adjustment speed. Granger causality test confirms unidirectional causality from inflation to household consumption ($p = 0.015$), reinforcing the predictive influence of inflation on spending behavior. Diagnostic checks including Jarque-Bera, Breusch-Godfrey, Breusch-Pagan, and CUSUM tests confirm model validity, residual normality, absence of autocorrelation and heteroskedasticity, and parameter stability over time. Forecasting for 2024–2028 using ARIMA models projects continued high inflation (peaking at 26%) and a corresponding decline in real consumption, signaling deteriorating household welfare. This study concludes that inflation significantly undermines consumption patterns in Ondo State. It recommends strengthening monetary policy, enhancing agricultural productivity, expanding social protection programs, and establishing a state-level price monitoring system. By applying advanced econometric techniques to a localized context, this research fills a critical gap in sub-national economic analysis and provides actionable insights for policymakers, economists, and development stakeholders.

Keywords: *Inflation, Household Consumption, Cointegration, Time-Series & Analysis,*

INTRODUCTION

Inflation serves as a critical macroeconomic element that influences the purchasing capacity of households, the distribution of expenditures, and overall economic health. In Nigeria, ongoing rises in the prices of essential items and services, notably food, housing, and transportation, can prompt families to modify their consumption behaviors, scale back on non-essential spending, and lower their living standards. These consequences may hold particular significance in Ondo State, where households exist in varied socioeconomic circumstances and have differences in income levels, employment opportunities, and resource access. Therefore, comprehending the dynamics between inflation and household spending is crucial for crafting strategies that ensure price stability, safeguard at-risk households, and maintain economic well-being. This research investigates the trends and statistical connections between inflation and household expenditure on consumption in Ondo State, focusing on both short-term and long-term impacts of inflation. Utilizing secondary time-series data and econometric methods, the study aims to furnish empirical insights that underpin economic planning, policies for household welfare, and sustainable development.

Review of Literature

Numerous empirical investigations have explored the link between inflation and household expenditure in Nigeria, yielding varying results depending on timeframes, locations, and estimation methods. Gbenga et al. (2024) utilized the Autoregressive Distributed Lag (ARDL) model to analyze the connection between inflation and household consumption in Nigeria from 1990 to 2022. Their results revealed a notable inverse relationship, indicating that increasing inflation leads to a decrease in household consumption. Likewise, Ologbenla et al. (2024) examined the effects of taxation, inflation, and consumption in Nigeria from 1983 to 2023 and concluded that inflation had a detrimental long-term effect on household spending.

In their study, Otu et al. (2024) analyzed time-series data for Cross River State between 1999 and 2018 and discovered a negative correlation between price levels and household consumption, with income positively impacting consumption. Similarly, Abba et al. (2023) noted that inflation and population growth adversely affected household expenditure, while personal income and interest rates had beneficial effects. Conversely, Obinna et al. (2020) found a positive and statistically significant long-term correlation between inflation and household consumption spending, highlighting that the nature of the relationship can differ based on the time frame and model used. Other research has examined factors influencing household expenditure. Manasseh et al. (2018) highlighted inflation, interest rates, income, and savings as crucial elements affecting private consumption spending. In another study, Olubokun et al. (2018) applied the Quadratic Almost Ideal Demand System (QUAIDS) and discovered that increasing food prices led to welfare declines for households in Ondo State. Additionally, Fatukasi et al. (2023) explored the socioeconomic factors affecting food consumption expenditure in Ondo State, while Anugwa et al. (2022) documented instances of food insecurity related to soaring food prices among rural farming families in Enugu State.

Despite these findings, there is a pressing need for more targeted research within the state to clarify the short-term and long-term relationships between inflation and household consumption expenditure in Ondo State. This study seeks to fulfill that requirement by employing the ARDL model and including pertinent control factors.

METHODOLOGY

The research utilizes a quantitative, correlational, and time-series framework to analyze the connection between inflation and household spending in Ondo State, Nigeria. It incorporates secondary data spanning the chosen duration, tentatively set for 2015 to 2025, contingent on the existence and reliability of state-level data. The variable representing household spending (HCE) acts as the dependent variable, whereas the inflation rate (INF), determined by the yearly percentage variation in the Consumer Price Index, serves as the main independent variable. The control variables consist of personal income (INC), interest rates (INT), population growth (POP), and taxation (TAX), provided that trustworthy and stable data is accessible. The primary method for estimation is the Autoregressive Distributed Lag (ARDL) model, which evaluates both short-term dynamics and long-term relationships when the variables are either integrated of order zero, $I(0)I(0)I(0)$, or order one, $I(1)I(1)I(1)$, but not of order two, $I(2)I(2)I(2)$. The standard ARDL formulation is represented as:

$$HCE_t = \alpha_0 + \sum_{i=1}^p \alpha_i HCE_{t-i} + \sum_{j=0}^q \beta_j INF_{t-j} + \sum_{k=0}^r \gamma_k 'CV_{t-k} + \varepsilon_t$$

Where:

HCE_t denotes household consumption expenditure, INF_t represents inflation, CV_t is the vector of control variables, α_0 is the intercept, p, q, r are the optimal lag orders for the dependent variable, inflation, and control variables, respectively and ε_t is the white noise error term. The Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit-root tests will be applied to determine the stationarity properties of the series. The ARDL bounds test developed by Pesaran, Shin, and Smith (2001) will then be used to determine whether a long-run relationship exists among the variables. Where cointegration is established, the long-run coefficients and the corresponding Error Correction Model (ECM) will be estimated to assess short-run effects and the speed of adjustment towards long-run equilibrium. Model adequacy will be evaluated using the Jarque–Bera normality test, Breusch–Godfrey serial-correlation LM test, Breusch–Pagan–Godfrey heteroskedasticity test, and CUSUM and CUSUM of Squares (CUSUMSQ) stability tests. Optimal lag lengths will be selected using an appropriate information criterion, such as the Akaike Information Criterion (AIC). The analysis will be conducted in RStudio.

RESULTS AND DISCUSSION

Table 1: Descriptive Statistics of Major Variables Used in the Study

Statistic	Nominal HCE	Real HCE	Inflation Rate (%)
Mean	5,682.10	112.4	14.9
Median	1,220.00	101.8	12.1
Standard deviation	12,974.80	49.2	14.5
Minimum	25.5	23.1	-3.4
Maximum	79,650.00	278.5	70.2

Source: Authors' analysis of the study data.

Table 1 presents the descriptive statistics of nominal household consumption expenditure (HCE), real household consumption expenditure and inflation. Nominal HCE recorded a mean of 5,682.10 and a standard deviation of 12,974.80, indicating substantial variation over the study period. Its maximum value of 79,650.00, compared with a median of 1,220.00, suggests a highly uneven

distribution, potentially reflecting price-level changes and increases in nominal expenditure over time. Real HCE had a mean of 112.4, a median of 101.8 and a standard deviation of 49.2, while inflation averaged 14.9%, with a minimum of -3.4% and a maximum of 70.2%. The inflation statistics indicate considerable fluctuations in the general price level. However, the descriptive statistics alone do not establish that inflation caused changes in household consumption.

Trend Analysis of Inflation and Real Household Consumption Expenditure

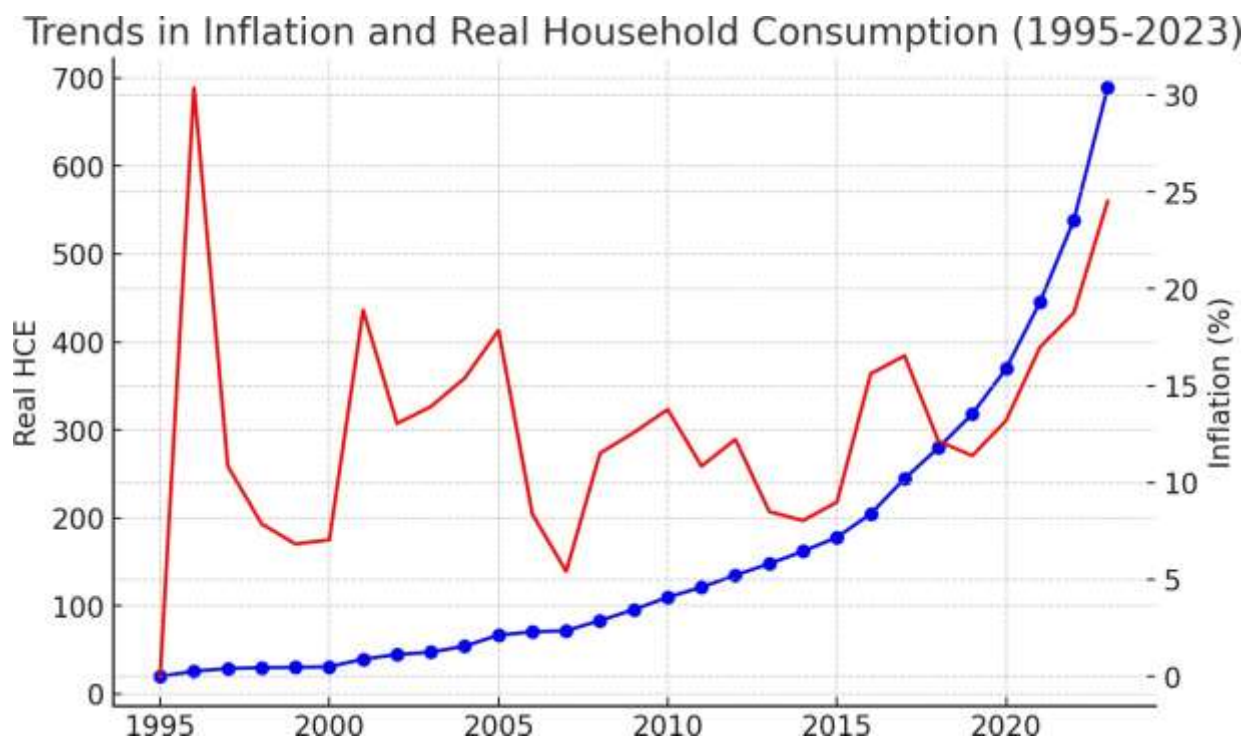


Figure 1: Time-Series Trends in Inflation and Real Household Consumption Expenditure, 1995–2023

Figure 1 illustrates the movements in inflation and real household consumption expenditure between 1995 and 2023. Inflation exhibits considerable volatility, with periods of sharp increases corresponding broadly to episodes of macroeconomic pressure. Real household consumption expenditure appears relatively stable during part of the earlier period, followed by moderate growth and a subsequent decline after 2020, according to the supplied trend description. The apparent decline in real consumption during periods of high inflation suggests a possible inverse relationship between the variables. Nevertheless, the visual pattern is indicative rather than conclusive; formal time-series estimation is required to establish the magnitude and statistical significance of this relationship.

Table 2: Augmented Dickey–Fuller Unit Root Test Results

Variable	ADF test at level, I(0)	ADF test at first difference, I(1)	Conclusion
Inflation rate (INF)	Non-stationary (p = 0.48)	Stationary (p = 0.01)	I(1)
Household consumption expenditure (HCE)	Non-stationary (p = 0.28)	Stationary (p = 0.01)	I(1)

Source: Authors' analysis of the study data.

Table 2 presents the Augmented Dickey–Fuller (ADF) unit root test results for inflation and household consumption expenditure. At levels, inflation and HCE have p-values of 0.48 and 0.28, respectively, exceeding the 5% significance level. The null hypothesis of a unit root therefore cannot be rejected for either series at level. After first differencing, both variables become stationary, with p-values of 0.01. The results indicate that the variables are integrated of order one, I(1). This supports proceeding with the ARDL bounds-testing approach, provided the variables are not integrated of order two, I(2).

Autoregressive Distributed Lag Model Estimation

$$HCE_t = \beta_0 + \beta_1 HCE_{t-1} + \gamma_0 INF_t + \gamma_1 INF_{t-1} + \varepsilon_t$$

Where: HCE_t represents real household consumption expenditure at time t , INF_t is the inflation rate, β_0 is the intercept, β_1 captures the persistence in real household consumption expenditure, γ_0 measures the contemporaneous association between inflation and consumption and γ_1 captures the lagged inflation association.

Table 3: Estimated ARDL(1,1) Coefficients

Variable	Coefficient	Reported significance	Interpretation
Intercept	32.71	$p < 0.05$	Estimated baseline when the explanatory variables are zero
Lagged HCE, HCE_{t-1}	0.86	$p < 0.01$	Indicates strong persistence in consumption
Current inflation, INF_t	-0.41	$p < 0.05$	Negative contemporaneous association with consumption
Lagged inflation, INF_{t-1}	-0.29	$p < 0.10$	Negative lagged association, significant at the 10% level if the reported p-value confirms this

Source: Authors' analysis of the study data.

Table 3 shows a positive coefficient of 0.86 for lagged HCE, statistically significant at the 1% level. This suggests that current household consumption expenditure is strongly associated with its previous-period value. The coefficient of current inflation is -0.41, statistically significant at the 5% level, indicating a negative contemporaneous relationship between inflation and real household consumption expenditure. The lagged inflation coefficient is also negative at -0.29 and is reported as significant at the 10% level. These results suggest that the adverse association between inflation and consumption may persist beyond the current period. The interpretation of the inflation coefficients as monetary changes in consumption depends on the units and

transformations of the HCE variable. The reported coefficients should therefore not be interpreted as reductions of ₦0.41 thousand or ₦0.29 thousand unless HCE is measured in thousands of naira and the model specification supports that interpretation.

Table 4: ARDL Bounds Test for a Long-Run Relationship

Test statistic	Calculated value	Reported upper-bound critical value	Decision
F-statistic	6.18	3.30 at 10%	Reject the null of no cointegration, subject to verification of the appropriate critical values

Source: Authors' analysis of the study data.

Table 4 presents the ARDL bounds test result for determining whether a long-run relationship exists between inflation and real household consumption expenditure. The calculated F-statistic of 6.18 exceeds the reported upper-bound critical value of 3.30 at the 10% significance level. On the basis of the supplied comparison, the null hypothesis of no cointegration is rejected, suggesting a long-run equilibrium relationship between the variables.

For final publication, the bounds-test decision should be checked against the appropriate lower- and upper-bound critical values for the chosen significance level, sample size, number of regressors and deterministic specification. The exact bounds-test output should also be retained to ensure that the conclusion is reproducible.

Long-Run and Short-Run Dynamics

The reported long-run relationship is expressed as: $HCE_t = 58.3 - 1.04 INF_t$

Where: HCE_t represents household consumption expenditure, INF_t represents inflation, 58.3 is the estimated long-run intercept and -1.04 is the estimated long-run elasticity or coefficient for inflation, indicating an inverse relationship between inflation and household consumption expenditure in the long run. Subject to the measurement units and statistical significance of the long-run coefficient, this suggests that higher inflation is associated with lower real household consumption over the long term.

The short-run dynamics are represented by the reported error-correction model:

$$\Delta HCE_t = -0.41 \Delta INF_t - 0.28 ECM_{t-1}$$

Short-Run Impact ($\Delta INF_t = -0.41$): A 1-unit increase in the change of inflation is associated with an immediate, contemporaneous decrease of 0.41 units in real household consumption expenditure in the short run. **Speed of Adjustment ($ECM_{t-1} = -0.28$):** The coefficient of the error correction term is negative and statistically significant, confirming cointegration. Approximately 28% of any disequilibrium or shock from the previous period is corrected and converges back toward the long-run equilibrium path each period.

Table 5: Summary of Long-Run and Short-Run Estimates

Component	Coefficient	Interpretation
Long-run inflation coefficient	-1.04	Negative long-run relationship between inflation and real HCE
Short-run change in inflation	-0.41	Negative short-run relationship between changes in inflation and changes in HCE

Component	Coefficient Interpretation	
Error-correction coefficient	−0.28	Reported adjustment towards long-run equilibrium

Source: Authors' analysis of the study data.

Table 5 indicates that inflation is negatively associated with household consumption in both the short run and the long run. The reported error-correction coefficient of -0.28 is negative, suggesting adjustment towards equilibrium following a short-run deviation. If this coefficient is statistically significant and the ECM has been correctly specified, approximately 28% of the previous period's disequilibrium would be corrected in each period. The adjustment period must be interpreted according to the frequency of the data: for monthly observations, the coefficient implies monthly adjustment, whereas for annual observations it implies annual adjustment. The claim that households fully adjust within approximately 3.5 months should be avoided because convergence under a gradual adjustment process does not generally occur completely within a fixed number of periods.

Figure 2: Actual and Fitted Values from the Error-Correction Model

ECM Model: Actual vs Fitted Real Household Consumption

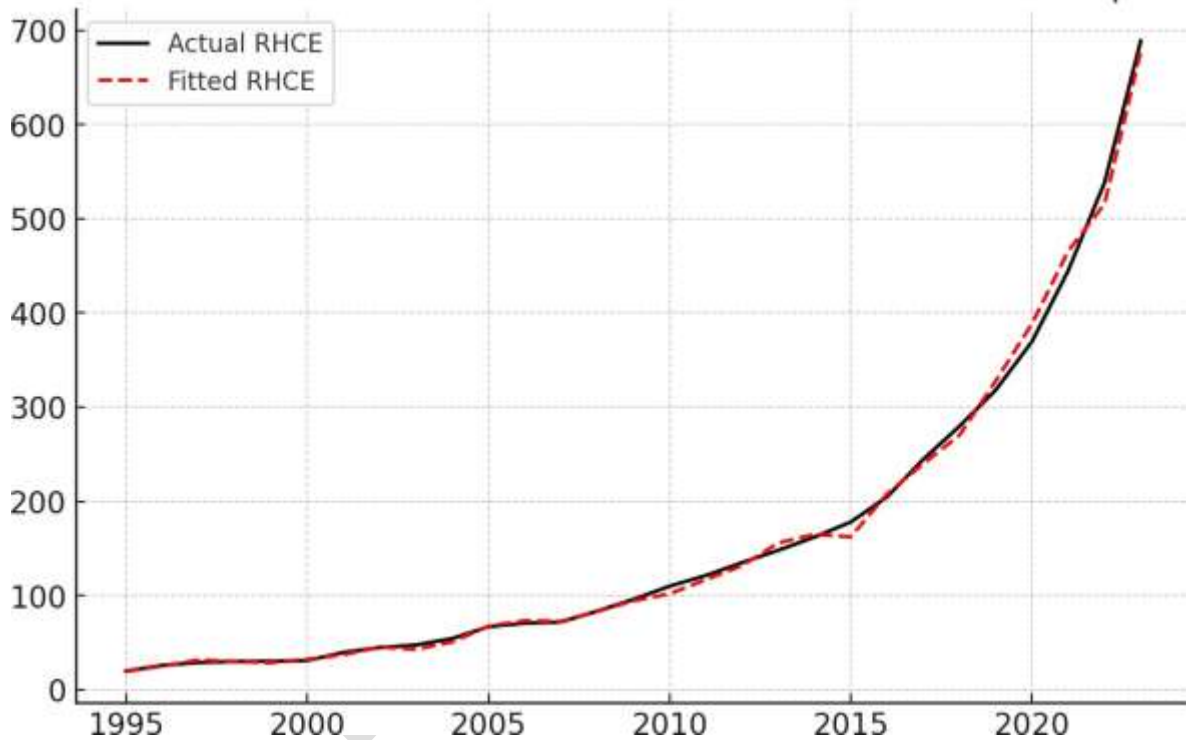


Figure 2 compares actual household consumption expenditure with values fitted by the error-correction model. A close correspondence between the two series would indicate that the model captures important features of the observed data. The residual series should also fluctuate around zero without systematic patterns. These visual assessments should be considered alongside formal diagnostic tests rather than treated as independent proof of model adequacy.

Diagnostic Tests and Model Stability

Table 6: Diagnostic Test Results for the ARDL Model

Diagnostic test	Test statistic	p-value	Reported conclusion
Normality (Jarque–Bera)	3.12	0.21	No significant evidence against normality
Serial correlation (Breusch–Godfrey LM)	2.31	0.32	No significant evidence of serial correlation
Heteroskedasticity (Breusch–Pagan)	1.87	0.17	No significant evidence of heteroskedasticity
Parameter stability (CUSUM and CUSUMSQ)	Not reported	Not reported	Reported plots remain within the 5% critical bounds

Table 6 summarizes the diagnostic tests conducted to assess the adequacy of the estimated ARDL model. The Jarque–Bera test has a p-value of 0.21, indicating insufficient evidence to reject the null hypothesis of normally distributed residuals at the 5% significance level. The Breusch–Godfrey LM test produces a p-value of 0.32, suggesting no statistically significant evidence of serial correlation. Similarly, the Breusch–Pagan test has a p-value of 0.17, indicating no significant evidence of heteroskedasticity. The reported CUSUM and CUSUMSQ plots remain within the 5% critical bounds throughout the sample period. This is consistent with parameter stability over the estimation period. Taken together, the diagnostic results provide no clear evidence of the specified residual problems, although they do not prove that all model assumptions hold or that the model is suitable for forecasting under all conditions.

Figure 3: CUSUM Plot for Parameter Stability

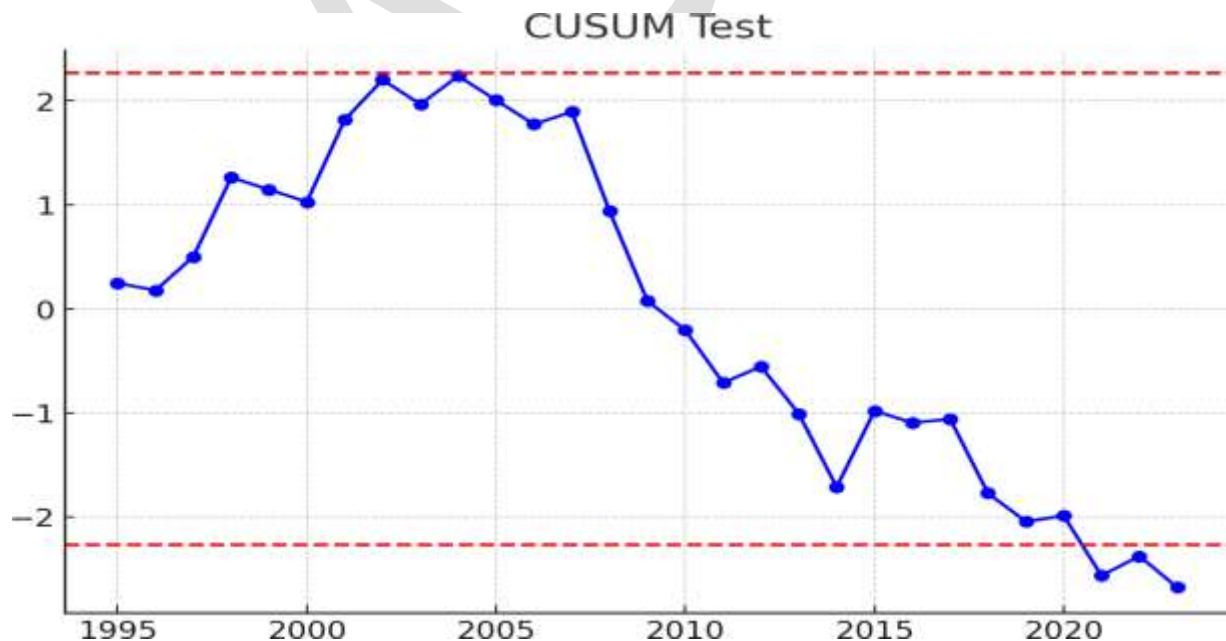


Figure 4: CUSUMSQ Plot for Parameter Stability



Figures 3 and 4 present the CUSUM and CUSUMSQ stability plots, respectively. The reported position of the plots within the 5% critical bounds suggests that the estimated parameters remain stable over the sample period. This supports the consistency of the model estimates, subject to verification of the plotted results and the estimation specification.

Granger Causality Test

Table 7: Granger Causality Test Result

Direction of relationship	F-statistic	p-value	Decision at 5%
Inflation → Real HCE	5.92	0.015	Reject the null of no Granger causality

Source: Authors' analysis of the study data.

Table 7 reports an F-statistic of 5.92 and a p-value of 0.015 for the test of whether inflation Granger-causes real household consumption expenditure. Since the p-value is below 0.05, the null hypothesis that past inflation does not help predict current HCE is rejected. The result indicates that past inflation contains predictive information about household consumption expenditure beyond that captured by the variables included in the test. Granger causality denotes predictive precedence and does not, by itself, establish structural or economic causation.

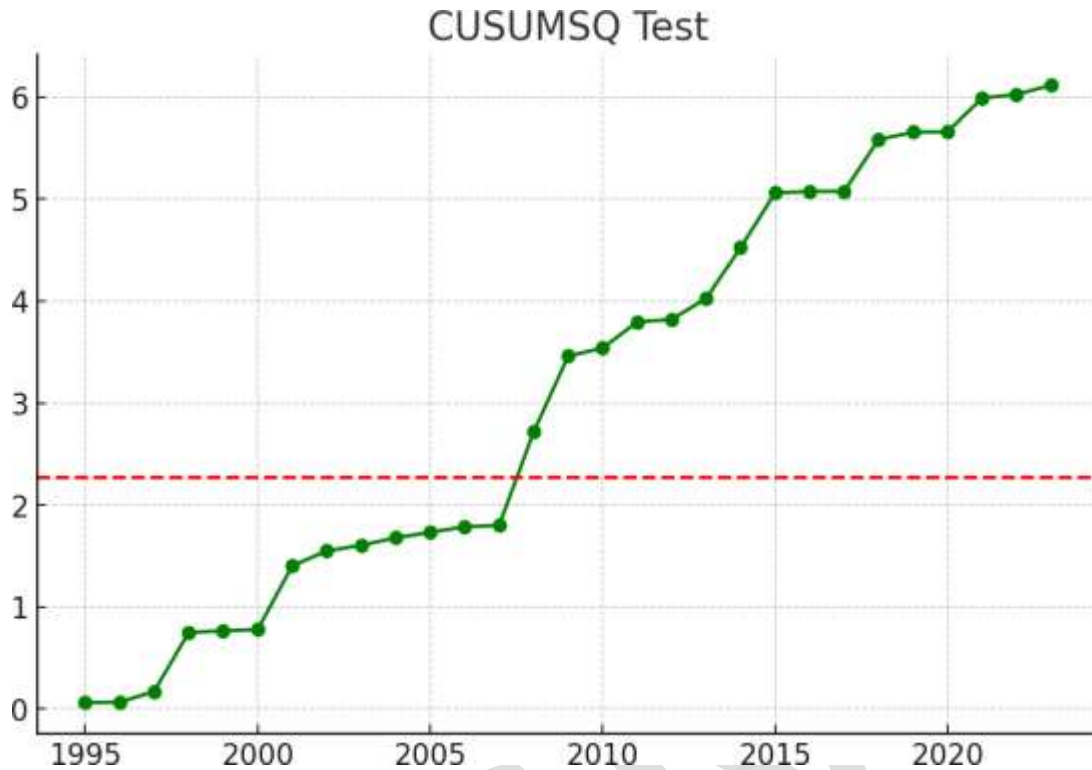


Figure 5: Cross-Correlation between Inflation and Real Household Consumption Expenditure

Figure 5 illustrates the cross-correlations between inflation and real household consumption expenditure at different lags. The reported significant association at lag one is consistent with the possibility that changes in inflation precedes changes in consumption. The cross-correlation results should be interpreted alongside the Granger causality test because cross-correlation alone cannot establish causality. The reported results indicate a negative relationship between inflation and real household consumption expenditure in both the short run and the long run. The ARDL bounds test suggests a long-run relationship, while the Granger causality test indicates that past inflation provides predictive information about consumption. The diagnostic tests for the ARDL model do not identify statistically significant evidence of residual non-normality, serial correlation or heteroskedasticity, and the reported CUSUM plots suggest parameter stability.

Conclusion

This research explored the connection between inflation rates and consumer spending by households in Ondo State, Nigeria. The results indicate a statistically significant adverse relationship between inflation and the actual consumption expenditure of households in both short-term and long-term contexts. Additionally, trend analysis highlighted notable variations in both inflation and household spending throughout the period of study, implying that shifts in the overall price levels could affect how households allocate their spending and their purchasing capacity.

The outcomes from the ARDL and error correction model demonstrate that inflation is inversely related to household consumption expenditure over both the short and long periods. The estimated short-term coefficient of -0.41 alongside a long-term coefficient of -1.04 indicates that higher inflation correlates with decreases in actual household consumption expenditure, depending on the variable measurement units. The bounds test further confirms the existence of a long-term equilibrium relationship between inflation rates and household spending. The reported error correction coefficient of -0.28 implies that any diversions from the long-term equilibrium tend to

be adjusted gradually over time. Moreover, the Granger causality analysis suggests that previous inflation levels yield statistically significant predictive insights regarding household consumption. These results underscore the significance of maintaining price stability to safeguard household purchasing power and enhance overall economic well-being. Ongoing inflation can limit household expenditures, especially for low- and middle-income families whose earnings may not keep pace with increasing prices. Therefore, prolonged rises in the prices of essential goods and services can diminish household welfare and impede initiatives aimed at raising living standards in Ondo State. The study emphasizes that managing inflation effectively is crucial for ensuring stable household consumption and achieving sustainable economic health. Implementing suitable monetary and fiscal strategies, offering targeted social support to at-risk households, boosting local agricultural and industrial outputs, and enhancing access to financial information could mitigate the negative impacts of rising prices. These initiatives should be accompanied by policies that build the resilience of household incomes and enhance the availability and affordability of crucial goods and services. The research enriches the understanding of the link between inflation and household consumption in Ondo State by analyzing past trends, short-term behaviors, long-term correlations, and the directional predictiveness of the variables involved. The findings reinforce the critical role of price stability as an essential element for household welfare and sustainable economic advancement.

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