Interest Rates and Inflation in Nigeria: Empirical Evidence from the Autoregressive Distributed Lag Model

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Abstract: - Policymakers and scholars continue to have extensive conversations about the relationship between interest rates and inflation in Nigeria. This is because, despite the efforts of Nigerian policymakers and regulatory authorities to achieve a high level of sustainable growth, the economy continued to witness stunted growth over the years, primarily due to double-digit inflation that continuously erodes value. In light of this, this study looked at how interest rates have affected Nigeria's inflation rate over the last 16 years.

The research design for this study is ex-post facto, using time series data for 68 quarters between Q1, 2006 to Q4, 2022. Data were obtained from the databases of the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the World Development Indicator (WDI). The study utilized the Autoregressive Distributed Lag (ARDL) model to analyze the effect of interest rates on inflation in Nigeria, while the Augmented Dickey-Fuller (ADF) and Phillip-Perron were employed for the stationarity test.

The results of the analysis showed that interest rates have a long-run significant cointegrating relationship with the inflation rate (Adj R2 = 0.48; F-stat (4, 63) = 19.61 $p < 0.05$). The study therefore recommends that the CBN could alternate its approach to managing inflation in Nigeria by regulating the amount of money in circulation in addition to solely utilizing the interest rates through the MPR's operation. Furthermore, since the CBN has little control over the other elements, monetary policy by itself is unable to reduce inflation in Nigeria. To guarantee the elimination of all barriers to reducing inflation in Nigeria, the report recommends that the monetary authority work in tandem with the fiscal authority and all pertinent ministries, departments, and agencies (MDAs).

Key-Words: - Interest Rates, Inflation Rate, Money Supply, Monetary Policy Rate, Prime Lending Rate, Institutional Quality, Infrastructure Deficit.

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1 Introduction

The rate of inflation in the economy and the way monetary impulses are transferred to the real sectors of the economy are two important topics in macroeconomics. The unique features of the channels via which monetary policy and interest rates are transmitted are of ongoing interest to scholars and policymakers. Fluctuations in interest rates have a significant effect on businesses' and individuals' investment and saving decisions, which in turn affects the demand side of the economy. Before receiving their money back from selling their final goods, businesses rely on borrowings from banks and other financial intermediaries to pay for their manufacturing expenses. Monetary policy also affects the cost side of the economy because borrowing from financial intermediaries would come with a cost that is set by the interest rates. This is commonly known as the working capital channel of monetary transmission because it is predicated on the notion that companies require working capital to conduct their operations. Given the possibility that monetary tightening raises the short-term interest rates, higher interest rates

inevitably lead to higher costs for working capital and higher inflation.

Most countries aim to attain both low and steady inflation and strong economic growth through their macroeconomic policies, [1], [2], [3]. Inflation is the general increase in the level of prices for goods and services in any economy. Many empirical studies have been devoted to the beneficial and consequential impact that inflation has revealed on the overall economy. This has led to intense disputes in the literature on economics and finance, [4]. Every economy should prioritize achieving commodity price stability since it is widely acknowledged to be a necessary condition for sustained growth and development. "Inflation" is the barrier preventing this from happening. As a result of inflation's detrimental effects on savings, investment, and price stability, as well as its negative social and economic ramifications, the main objective of any monetary policy should be to achieve low inflation rather than raise output or lower unemployment, [5]). Consequently, it is imperative to conduct a detailed analysis of inflation as it is a very intricate economic phenomenon, with a particular focus on the mechanisms via which inflationary impulses enter the economy.

Several developing nations lack a comprehensive grasp of inflation, whereas industrialized nations are better aware of how inflation affects economic growth, what variables influence inflation, and the optimal level of inflation to promote growth, [6]. According to empirical research, inflation has a detrimental impact on economic growth in the medium and long term, [7], [8]. Hence, [9] noted that rising inflation has not been embraced by any school of thought due to its negative distribution and social effects. However, the fact that a particular amount of inflation is necessary for achieving economic progress and ensuring its sustainability, however, serves as evidence in favor of inflation. For this reason, [8] pointed out that there are several potentially positive channels via which inflation affects economic growth.

2 Review of the Literature

2.1 Statement of the Problem

Several important variables are important drivers of inflation, including the money supply, interest rate, national output, exchange rate, wage rate, trade openness, and expectations, [10], [11]. However, the exact extent of the relationship between interest rates and the inflation rate in Nigeria has generated diverse opinions in the empirical literature and several studies have shown conflicting results. This study therefore established the level and direction of the interaction between interest rates (proxied by prime lending rate, monetary policy rate, money supply growth, and institutional quality) on the one side and inflation rate on the other hand. The study also examined how changes in the proxies for interest rates affect the dynamics of the inflation rate in Nigeria.

The research advances knowledge on previous studies firstly by the adoption of the Autoregressive Distributed Lag (ARDL) model to compare the data used for the analysis. While earlier contributions to the literature evaluated the empirical fit of forward-looking models for inflation using the GMM (generalized method of moments) estimator, this study employed the ARDL as an alternate model that avoids some of the issues that GMM estimates face. Secondly, the study introduced Money Supply Growth and Institutional Quality as control variables of interest rates to account for the role of money supply and institutional quality in controlling inflation in Nigeria.

2.2 Empirical Review

Several studies have looked into the relationship between interest rates and inflation rates in recent times. [12], investigated the correlation between Nigeria's interest rate and inflation rate between 2007 and 2019. For the empirical analysis, the unit root and Johansen co-integration tests were used in the study. To ensure robustness, the study's independent variable, interest rate, was substituted with the monetary policy rate, maximum lending rate, and deposit rate. Then, the inflation rate's responses to each of the interest rate proxies were determined. The study discovered that while the inflation rate did not react strongly to interest rates in the short term, it did so in the long term. Put another way, it was discovered that while interest rates were not remarkably effective at controlling inflation in the near term, they were likely to become important and relevant in the long run.

According to, [13], monetary policy has no appreciable long-term effect on Nigeria's ability to control inflation. According to the study, money supply has a negative and insignificant impact on Nigeria's ability to control inflation in the short- and long-terms, while the Treasury bill rate has a short-term negative and significant impact and a long-term positive but insignificant impact.

From a different methodological angle, [14], examined the Fisher effect for the UK. The nonlinear Autoregressive Distributed Lag (ARDL) model, recently created by [15], was used to achieve this goal for the periods of 1995M1–2008M9, and 2008M10–2018M1. The model created two new scenarios, that is, increases and decreases in the inflation rate from the changes in the original inflation rates. This allowed the researchers to investigate the Fisher effect concerning inflation spikes and drops independently. Only in the first scenario do the empirical results suggest asymmetrically partial Fisher effects for the UK in the long run. Furthermore, for the first time, the study attempted to define and present an alternative interpretation of the partial effect idea for the UK.

In, [16], the authors applied the VAR Granger Causality test on time series data of United Kingdom (UK) annual interest rates and inflation rates from 1989 to 2017 and found that there is a bilateral causality between the two variables.

In, [17], the researchers examined the relationships among monetary policy, economic growth, and inflation in the Ghanaian economy for the period of 1982-2017. Employing the ARDL cointegration model, the study's results demonstrated that interest rates have a substantial long-term impact on economic growth, albeit a negative one. This suggests that higher interest rates tend to stifle inflationary pressures and economic growth.

Using panel data covering the years 2006 to 2013, [18], concentrated on assessing the causal relationship between interest rate and inflation rate in the economies of the South Asian Association for Regional Cooperation (SAARC). Two scenarios were chosen to evaluate this relationship. The first scenario empirically evaluated the causal relationship between changes in inflation rate and loan interest rates, while the second scenario examined the relationship between real interest rates and inflation rates. The outcomes of the first scenario demonstrated that there is no correlation between changes in lending rates and changes in the rate of inflation. In contrast, the second scenario demonstrated a clear cause-and-effect link between the inflation rate and the real interest rate.

In, [19], the authors studied the impact of money supply on macroeconomic variables in Nigeria from 1985 to 2016. The study found that real gross domestic product and inflation are significantly and positively impacted by limited money supply. On the other hand, the impact of large money supply on real gross domestic product and inflation is insignificant.

To provide fiscal and monetary policies that can support an effective economy moving forward, [20], studied the correlation between inflation and interest rates in Swaziland. The study used a quantitative and confirmatory methodology to examine quarterly secondary data on interest rates and inflation rates from 2010 to 2014, obtained from the Central Statistical Department of Swaziland, the Swaziland National Library, and the Central Bank of Swaziland. The study used Microsoft Excel and a descriptive analysis technique to examine the data and found that interest rates and inflation rates had a positive and significant link in Swaziland.

3 Methodology

3.1 Research Design

The study used an ex-post facto research design to examine the effect of interest rates on inflation in Nigeria. The use of the research design is supported by proven theoretical links between inflation and interest rates, as well as by the application of these correlations in earlier studies and the availability of useful data. Some previous studies have also employed this research design, [21], [22], [23].

3.2 Statement of Hypotheses

The objective of the study is to analyze the effect of interest rates on the inflation rate in Nigeria. Hence the testable hypotheses are:

$H_0$1: Interest rates have no significant effect on inflation in Nigeria.

H_a1: Interest rates have a significant effect on inflation in Nigeria.

3.3 Method of Data Analysis

This study examined how interest rates affect Nigerian inflation. The study employed both descriptive and inferential statistics to evaluate time series data. Statistical metrics including mean, minimum, maximum, and standard deviation were used to do the descriptive analysis. To assess the degree of correlation and identify any issues with multicollinearity among the explanatory variables, Pearson's Product Moment Correlation and Variance Inflation Factor (VIF) were utilized.

The time series properties of the variables were investigated using the unit root tests of the Phillip-

Perron test, and the Augmented Dickey-Fuller test before the regression analysis was estimated. To estimate the time series regression, the study employed the linear Autoregressive Distributed Lag (ARDL) model. The following rationales support this econometric technique: firstly, variables with varying orders of cointegration can be employed with the ARDL approach, [24]. This happens, for instance, when variables have a mixed order of I(0) and I (1). Secondly, small, or finite sample sizes can be employed with the ARDL technique, [25]. Thirdly, simultaneous calculations are made for the long-run and short-run parameters. Finally, the technique can take time series data structural breaks into account.

3.4 Model Specification

The Quantity Theory of Money addresses the indirect relationship between interest and inflation through the amount of money in circulation, and this theory served as the foundation for the model used to calculate the effect of interest rates on inflation rates. For this reason, the study used and modified the empirical models based on the earlier research of, [26], and, [9], to create the functional relationship shown in equation (1) below:

$$INF=f(PLR, MPR, MS, INSTQ) \quad (1)$$

Where INF is the inflation rate, PLR is the prime lending rate, MPR is the monetary policy rate, MSG is money supply growth, and INSTQ is institutional quality.
The estimable form of equation (1) is specified in equation (2).

$$INF_t = \beta_0 + \beta_1 PLR_t + \beta_2 MPR + \beta_3 MSG_t + \beta_4 INSTQ_t + \mu_t \quad (2)$$

Where the variables INF, PLR, MPR, MSG, and INSTQ are as explained earlier in equation (1).

β_0 is the constant term and μ_t is the disturbance term. The parameters β_i(I = 1, 2 . . , 4) are the coefficients of the respective variables.

The ARDL model for inflation is shown below:

$$\begin{aligned}\Delta INF_t = \alpha_0 &+ \sum_{i=0}^{n1} \alpha_1 INF_{t-i} + \sum_{i=0}^{n2} \alpha_2 \Delta PLR_{t-i} \\ &+ \sum_{i=0}^{n3} \alpha_3 \Delta MPR_{t-i} + \sum_{i=0}^{n4} \alpha_4 \Delta MSG_{t-i} \\ &+ \sum_{i=0}^{n5} \alpha_6 \Delta INSTQ_{t-i} + \beta_1 PLR_{t-1} \\ &+ \beta_2 MPR_{t-i} + \beta_3 MSG_{t-1} \\ &+ \beta_4 INSTQ_{t-1} + u_t \end{aligned} \quad (3)$$

The study expected an increase in prime lending rate to have a negative effect on inflation. This may be the result of rising lending rate trends, which are linked to high borrowing costs and tend to discourage people from borrowing money from banks to boost investment and consumption. Inflation was also expected to be negatively correlated with high monetary policy rates and to rise in response to an expansion of the money supply. Finally, it was anticipated that lower inflation would result from higher institutional quality.

4 Result & Analysis

4.1 Descriptive Statistics and Correlation

4.1.1 Descriptive Statistics

Table 1. Descriptive Statistics of Interest Rates and Inflation

Variables	Mean	Maximum	Minimum	Std. Dev.	Obs
INF	12.122	21.340	4.100	3.845	68
PLR	16.027	19.420	11.200	2.010	68
MPR	11.504	16.170	6.000	2.484	68
MSG	4.031	27.691	-7.269	5.289	68
INSTQ	0.011	0.427	-0.402	0.248	68

Source: Researcher's Computation 2023
Notes: Table 1 shows the mean, maximum, minimum, and standard deviation of the variables. The dependent variable is inflation (INF). The regressors are Prime Lending Rates (PLR), Monetary Policy Rate (MPR), Money Supply Growth (MSG), and Institutional Quality (INSTQ). The sample period is from 2006Q1-2022Q4 representing 68 quarterly observations. The estimation process was facilitated using EVIEWS 12.

Table 1 above shows the descriptive statistics of the variables used for the study. From the table, inflation has a mean value of 12.12 and a standard

deviation of 3.85. The high standard deviation of 3.85 is an indication that inflation levels in Nigeria are highly susceptible to changes during the period. The minimum value of 4.10 and maximum value of 21.34 also indicated that Nigeria had very volatile inflation rates between 2006Q1 and 2022Q4.

The prime lending rate has a mean value of 16.03 and a standard deviation of 2.01. The relatively low standard deviation of 2.01 indicates that the prime lending interest rate was less susceptible to changes during the period while the minimum value of 11.2 and maximum value of 19.42 indicate that Nigeria has different levels of prime lending rate during the study period.

The monetary policy rate has a mean value of 11.50 and a standard deviation of 2.48. The relatively low standard deviation of 2.48 is an indication that the monetary policy rate was less susceptible to changes between 2006Q1 and 2022Q4 while the minimum value of 6.00 and maximum value of 16.17 indicated that Nigeria has varying levels of monetary policy rate during the period.

Money supply growth has a mean value of 4.03 and a standard deviation of 5.29. The relatively high standard deviation of 5.29 indicated that money supply growth is highly susceptible to changes between the period of 2006Q1 and 2022Q4. The minimum value of -7.27 and maximum value of 27.69 indicated that Nigeria has very volatile levels of money supply growth and that both positive and negative money supply growths were recorded during the review period.

Institutional quality has a mean value of 0.011 and a standard deviation of 0.248. The standard deviation of 0.248 is relatively low, indicating that there exist weak institutions in Nigeria between the period the first quarter of 2006 and the fourth quarter of 2022. The minimum value of -0.402 and maximum value of 0.427 also indicated that, although very tight, Nigeria has different levels of institutional quality and that both positive and negative institutional quality were recorded during the review period.

4.1.2 Pearson Correlation Analysis

This section discusses the relationship between the interest rate variables and the inflation rate in Nigeria. The study emphasizes the extent of the relationship between Monetary Policy Rate (MPR), Prime Lending Rates (PLR), Money Supply Growth (MSG), and Institutional Quality (INSTQ) on the one hand, and Inflation Rate (INF) on the other hand for the period between 2006Q1 and 2022Q4.

Table 2. Correlation Matrix for Interest Rates and Inflation Rate

Variables	INF	PLR	MPR	MSG	INSTQ	VIF
INF	1.000					N/A
PLR	-0.442	1.000				1.108
MPR	0.188	-0.236	1.000			2.517
MSG	0.177	-0.089	-0.110	1.000		1.040
INSTQ	0.293	-0.058	0.752	-0.170	1.000	2.415

Source: Researcher's Computation 2023

Notes: Table 2 displays the Pearson pairwise correlation matrix. The dependent variable is the Inflation Rate (INF). The regressors are the Prime Lending Rate (PLR), Monetary Policy Rate (MPR), Money Supply Growth (MSG), and Institutional Quality (INSTQ). The sample period is from 2006Q1-2022Q4 representing 68 quarterly observations. The estimation process was facilitated using EVIEWS 12. The correlations are below the major diagonal and the last row titled VIF is the test for multicollinearity.

4.1.2.1 Interpretation

The results of the correlation analysis in Table 2 show that monetary policy rate, money supply growth, and institutional quality have positive relationships with inflation in Nigeria. This implies that increases in monetary policy rate, money supply growth, and institutional quality will lead to an increase in the level of inflation. The results also provided evidence that the prime lending rate has a negative relationship with the inflation rate in Nigeria. Thus, an increase in the prime lending rate will lead to a fall in the inflation rate. The test for multicollinearity was conducted and the variance inflation factor (VIF) for each of the explanatory variables was less than 10. The VIF were 1.108, 2.517, 1.040, and 2.415 for monetary policy rate, prime lending interest rate, money supply growth, and institutional quality, respectively. Therefore. the four regressors used in the estimated model were found to be uncorrelated with one another.

4.1.3 Result of the Stationarity Test

Stationarity tests were conducted to examine the time series properties of the variables over the study period. Specifically, the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) unit root tests were used to evaluate for stationarity in the series and the result is presented in Table 3.

Table 3. Result of the Unit Root Test

Variables	ADF	PP	Remarks
INF	-2.448	-2.181	
ΔINF	-7.367***	-7.347***	I(1)
PLR	-2.001	-2.318	
ΔPLR	-6.871***	-6.861***	I(1)
MPR	-2.261	-2.443	
ΔMPR	-4.694***	-4.766***	I(0)
MSG	-5.847***	-8.547***	
ΔMSG	-10.634***	-37.186***	I(1)
INSTQ	-2.241	-2.139	
ΔINSTQ	-3.721***	-3.567***	I(1)

Source: Researcher's Computation 2023
*Notes: Table 3 presents the unit root test. The dependent variable is the Inflation Rate (INF). The regressors are the Prime Lending Rate (PLR), Monetary Policy Rate (MPR), Money Supply Growth (MSG), and Institutional Quality (INSTQ). The sample period is from 2006Q1-2022Q4 representing 68 quarterly observations. The estimation process was facilitated using EVIEWS 12. The critical value at 5% for intercept and trend is -3.50 and for intercept alone is -2.93. ** and *** indicate significance at 5 and 1 percent, respectively.*

4.1.3.1 Interpretation

From the unit toot test in Table 3, the stationarity tests were carried out on the data using ADF and PP. The test showed evidence that the inflation rate (INF) was stationary at first difference. This was because the unit root statistic for the ADF and the PP unit root tests were more negative than the critical values at a 5 percent level of significance. In addition, there was evidence that Prime Lending Rate (PLR), Money Supply Growth (MSG), and Institutional Quality (INSTQ) were also stationary at first difference while Monetary Policy Rate (MPR) was stationary at the level at the 5 percent level of significance.

Therefore, due to the different order of integration of the variables, the Autoregressive Distributed Lag (ARDL) model approach to cointegration of Pesaran and Pesaran (2001), which allows for the combination of levels and first difference stationary variables was adopted for the analysis. The adoption of the ARDL approach to cointegration was also because the short-run and the long-run dynamics of the specified model were estimated concurrently.

4.2 Test of Hypotheses

Research Objective: Analyse the effect of Interest Rates on the Inflation Rate in Nigeria.

Research Question: What is the effect of Interest Rates on Inflation Rate in the Nigerian economy?

Research Null Hypothesis: Interest rates have no significant effect on inflation in Nigeria.

Table 4. Interest Rates and Inflation

Panel A: Long Run Estimates

Dependent Variable: INF				
Variable	**Coefficient**	**S.E**	**t-stat**	**Prob**
C	66.047	18.743	3.524	0.001
PLR	-2.296	0.751	-3.057	0.004
MPR	-1.553	0.773	-2.009	0.050
MSG	0.456	0.414	1.102	0.276
INSTQ	18.088	7.852	2.304	0.026

Panel B: Short -Run Estimates

Variable	Coefficient	S.E	t-stat	Prob
D(INF(-1))	0.196	0.094	2.081	0.043
D(INF(-2))	0.245	0.095	2.574	0.013
D(PLR)	-0.128	0.091	-1.415	0.163
D(PLR(-1))	-0.115	0.202	-0.567	0.573
D(PLR(-2))	-0.029	0.222	-0.130	0.897
D(PLR(-3))	0.348	0.215	1.618	0.112
D(MPR)	0.765	0.208	3.684	0.001
D(MSG)	0.199	0.193	1.030	0.308
D(INSTQ)	0.025	0.025	0.966	0.339
ECT(-1)	-0.177	0.035	-5.058	0.000

Panel C: Diagnostic Tests	**Statistic**	**Prob.**
Bound Test	7.869	0.000
Adjusted R-square	0.480	
F-Statistic	19.607	0.000
Serial Correlation	0.972	0.386
Heteroscedasticity	0.615	0.839
Linearity Test	1.458	0.151
Normality	1.719	0.423
	CUSUM	CUSUMSQ
Stability Test	Stable	Stable

Source: Researcher's Computation 2023
Notes: Table 4 reports the long-run estimates, short-run estimates, and the diagnostic tests for the relationship between interest rates and inflation rates. The dependent variable is the Inflation Rate (INF) and the regressors are the Prime Lending Rate (PLR), Monetary Policy Rate (MPR), Money Supply Growth (MSG), and Institutional Quality (INSTQ).

4.3 Interpretation

4.3.1 Bound Test

The bound test was used to ascertain the possibility of a long-run relationship with the results showing that the bound test statistics of 7.869 is statistically significant at a 5 percent significant level. The result implies the possibility that the variables have a long-run cointegrating relationship. Therefore,

based on the possibility of a long-run relationship between interest rates and inflation rate, the study estimates the long-run and the short-run elasticity. The empirical results for the model for the effects of interest rates and inflation rate, in the short and long runs, are reported in Table 4.

4.3.2 The Long-Run Dynamics

Panel A of Table 4 displays the ARDL model's estimated long-run coefficients. Long-term data suggested that the prime lending rate and inflation rate have a negative connection, meaning that a rise in the prime lending rate would cause Nigeria's inflation rate to decline. In other words, the inflation rate would drop by 2.269 percent for every 1% increase in the prime lending rate. The findings additionally demonstrated a substantial correlation between the prime lending rate and Nigerian inflation (PLR = -2.296, t-test = -3.057, $p < 0.05$). This suggests that the prime lending rate plays a major role in influencing variations in Nigeria's inflation rate.

The findings also indicated that there is a negative correlation between the inflation rate and the monetary policy rate, suggesting that raising the monetary policy rate would cause the inflation rate to decrease. As a result, a one percent increase in inflation will result in a 1.553 percent drop. The results also showed a substantial correlation between the monetary policy rate and Nigeria's inflation rate (MPR = -1.553, t-test = -2.009, $p < 0.05$), suggesting that the monetary policy rate is a major factor influencing fluctuations in Nigeria's inflation rate.

The findings also demonstrated a positive correlation between the money supply and the inflation rate, i.e., an increase in the money supply will result in a rise in inflation. That example, a one percent increase in the money supply will result in an inflation rate increase of 0.456 percent. Additionally, the results showed that there is no significant correlation between the growth of the money supply and the rate of inflation in Nigeria (MSG = 0.456, t-test = 1.102, $p > 0.05$). This suggests that variations in the level of inflation in Nigeria are not significantly influenced by the expansion of the money supply.

The outcome demonstrated evidence of a positive association between institutional quality and inflation rate, suggesting that rising institutional quality will inevitably result in rising inflation rates. Therefore, an increase in institutional quality of 1% will increase inflation of 18.088 percent. The results showed a significant association between the inflation rate in Nigeria and institutional quality (INSTQ = 18.088, t-test = 2.304, $p < 0.05$). This suggests that institutional quality has a substantial role in influencing changes in the inflation rate in Nigeria.

4.3.3 Short-run Dynamics

This subsection serves a dual function. To determine the degree of adjustment back to equilibrium using the error correction term, the first step is to determine if changes and the statistical significance observed in the long run also exist in the short-run model. The error correction term (ECTt-1) measures the short-run adjustment process, which demonstrates how soon variables recover from a shock and reach balance. To ensure stability, the coefficient of ECTt-1 needs to be statistically significant and have a negative sign.

The outcome of the regression analysis demonstrated that there is a brief and negligible correlation between the prime lending rate and the rate of inflation. This outcome is consistent with the long-term negative link, suggesting that the relationship between the prime lending rate and Nigeria's inflation rate is both a short- and long-term phenomenon. Furthermore, data indicates a positive and substantial short-term link between the inflation rate and the monetary policy rate. The varying outcomes over the long and short terms indicate that raising the policy rate by the monetary policy authority will worsen inflation in the short term but have a negative long-term effect on the rate of inflation. Additionally, the results showed that, but not significantly, the money supply and institutional quality had a favorable short-term association with the inflation rate.

The cointegrating term is found to have the correct sign and is significant as predicted, according to the short-run results, suggesting that any deviation from the steady state in Nigeria can be readily adjusted for. Consequently, Panel B of 4 reports an estimated coefficient for the ECTt-1 that is negative and statistically significant (ECT= -0.177, t-test = -5.058 $p < 0.05$). It can be inferred that during the next quarter, deviations from the inflation rate equilibrium path are adjusted by almost eighteen percent. Stated differently, Nigeria has a comparatively modest process of adjustment. Interest rates and inflation rates in Nigeria have a long-run equilibrium relationship, which is further supported by the statistical significance of the ECTt-1.

With an adjusted R-square of 0.480, it can be inferred that only approximately 48% of the variations in the inflation rate can be explained by the prime lending rate, monetary policy rate, money

supply growth, and institutional quality; the remaining 52% can be attributed to other factors that influence inflation rate fluctuations but are not included in the model. The F-test, which verifies the null hypothesis that every coefficient in the model is zero, indicates the overall fit of the model. The model fits the data well in this instance, as shown by the F-test's significance at the 5% level. Alternatively, the prime lending rate, monetary policy rate, money supply growth, and institutional quality are all major factors influencing changes in Nigeria's inflation rate, according to the F-test statistic of 19.607 with a probability value of 0.000. As a result, the alternative hypothesis—which holds that interest rates significantly affect inflation in Nigeria—was accepted and the null hypothesis—which holds that interest rates have no substantial influence on inflation—was rejected.

4.4 Post-Estimation Test

Five distinct kinds of diagnostic tests were conducted to ensure the reliability and validity of the parameter estimates and to enable the drawing of appropriate conclusions from the data. The F-statistic of 0.972 and a probability value of 39% are greater than the 5 percent level, indicating that the successive error terms are not serially associated, according to the data. Therefore, the results do not rule out the null hypothesis that the residuals show no serial connection. According to the study's findings, there was no correlation between the subsequent error terms in the estimated model for Nigeria's inflation and interest rates. This infers that the homoscedasticity null hypothesis could not be rejected, the heteroscedasticity results demonstrated that the F-statistic of 0.615 with a probability value of 84 percent is not statistically significant at the 5 percent level of significance. There is proof, therefore, that the error terms' variance is homoscedastic.

Moreover, the statistical significance of the Ramsey RESET test for linearity is not established; its F-statistic is 1.458, and its probability value is 15 percent, higher than the 5 per level. The findings thus show that there is a linear relationship between interest rates and the rate of inflation in Nigeria and that the estimated model is appropriately stated. Similar to this, the normality test Jarque-Bera statistic yielded an F-statistic of 1.719 with a probability statistic of 42%, which is higher than the significance level of 5%. As a result, the null hypothesis of normalcy was accepted. Panel C presents the results of the CUSUM and CUSUMSQ statistics.

4.5 Discussion of Empirical Findings

The objective of the study was accomplished through the application of the Autoregressive Distributed Lag (ARDL) model and the findings supported the existence of a long-term co-integrating relationship between interest rates and inflation rate in Nigeria over the period. The following outcomes were shown by the long-run and short-run elasticities in the presence of a long-run cointegrating relation.

In the long run, there is evidence that the prime lending rate and monetary policy rate have a negative relationship with the inflation rate, while money supply growth and institutional quality have a positive relationship with the inflation rate in Nigeria. In addition, there is evidence that prime lending rate, monetary policy rate, and institutional quality have long-run significant relationships with the inflation rate in Nigeria, while money supply growth has no long-run significant relationship with the inflation rate in Nigeria. The results of the hypothesis testing supported the rejection of the null hypothesis that interest rates have no significant effect on the inflation rate in Nigeria and the acceptance of the alternative hypothesis that interest rates have a significant effect on the inflation rate in Nigeria.

The results of this study also relate to the findings of some existing studies amongst which are, [12], who examined the interrelationship between interest rate and inflation rate in Nigeria for the period 2000-2019 and found that interest rates were weak instruments to curb inflation in the short run but inclined to be significant and relevant instruments in the long run, [13], who found that monetary policy has no significant impact on inflation control in Nigeria both in the short run and long run, [16], who conducted the VAR Granger Causality test on time series data of interest rate and inflation from 1989 to 2017 in the United Kingdom (UK) and found that there is a bilateral causality between the two variables and, [18], whose study focused on the evaluation of the causal relationship between interest rate and inflation rate in South Asian Association for Regional Cooperation (SAARC) economies by using panel data ranging from the year 2006 to 2013 to (i) empirically test the causal relationship between lending rate and changes in inflation rate and (ii) to consider the causal relationship between real interest rate and inflation rate. In the first case, the study found that there was no relationship between changes in the inflation rate and changes in lending rates in the SAARC economies while in the second scenario,

the study found a substantial cause-and-effect link between real interest rate and inflation rate.

The investigation of the money supply's effect on macroeconomic variables in Nigeria from 1985 to 2016 by, [19], found that narrow money supply has a positive and significant impact on inflation, whereas broad money supply has no significant impact on inflation while the study by, [20] investigated the correlation between interest rates and inflation rate in Swaziland and discovered a strong and positive relationship between the two variables.

5 Summary and Conclusion

The study examined the effect of interest rates on inflation and the empirical analysis and findings resulting from the analyses revealed mixed results. In the long run, there is evidence that the prime lending rate and monetary policy rate have a negative relationship with the inflation rate, while money supply growth and institutional quality have a positive relation with the inflation rate in Nigeria. In addition, there is evidence that prime lending rate, monetary policy rate, and institutional quality have a significant long-run relationship with the inflation rate in Nigeria, while money supply growth has no long-run significant relationship with the inflation rate in Nigeria. The result shows that in the short run, monetary policy rate, money supply growth, and institutional quality have a positive relationship with the inflation rate in Nigeria, while the prime lending rate, has a negative relationship with the inflation rate. In addition, there is evidence that in the short run, only the monetary policy rate has a significant impact on the inflation rate in Nigeria, while the prime lending rate, money supply growth, and institutional quality have no significant impact on inflation in Nigeria. Also, the results of the hypothesis testing support the rejection of the null hypothesis that interest rates have no significant effect on the inflation rate in Nigeria and the acceptance of the alternative hypothesis.

The study found that interest rates are significant factors influencing inflation in Nigeria. However, the directions of the effect are mixed. While the prime lending rate exerts the expected negative impact on inflation in Nigeria in both the short and long runs, the monetary policy rate only has a negative effect in the long run. The study also found that the effect of the combination of interest rates, money supply growth, and institutional quality on inflation in Nigeria is only 48%. This implies that there are other factors outside of the purview of the monetary policy mechanism that account for 52% of inflation in Nigeria.

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The study therefore concluded that interest rates are significant factors influencing inflation in Nigeria. Expectedly the relationship between interest rates and inflation is negative, however, this is mostly in the long run as shown by the effect of MPR on inflation. In the short run, the relationship was found to be positive, which was unexpected especially since the instrument is the important short-run instrument to manage inflation.

The study therefore recommends that in controlling inflation in Nigeria, the CBN should not focus only on the use of interest rates through the use operation of the MPR but also alternate by controlling the quantity of money supply in the economy as well. In addition, the monetary policy alone cannot curb inflation in Nigeria as the other factors are not within the purview of the CBN. Hence, the study recommends that the monetary authority collaborates with the fiscal authority and all relevant ministries, departments, and agencies to ensure the removal of all impediments to curbing inflation in Nigeria.

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