

Monetary Policy Under Inflationary Pressure: Causal and Long-Run Evidence from Nigeria

Olamide Micheal Adediwura^{1*}, Ifeoluwa Alao-Owunna², Emmanuel Omobolaji Oladeji³

^{1,2,3}Adeleke University, Ede, Osun State, Nigeria

ABSTRACT: The paper examines how monetary policy and inflation have interacted and how this interaction pattern has changed between 1990 and 2023 in Nigeria. It also analyses the change of both variables over-time by evaluating the degree to which the monetary policy affects inflation, as well as examining whether there is a causal relationship between monetary policy action and inflationary results during the study period. In an effort to achieve these goals, the research uses yearly time-series data of money supply, interest rate, gross domestic product (GDP), exchange rate and inflation, which were extracted from World Development Indicators (WDI) database. To address the second objective, the study utilise the Dynamic Ordinary Least Squares (DOLS) technique to provide an evaluation of the long-run relationship between the variables and to overcome the endogeneity problems that may arise. In the third objective, causal linkages were tested using the Toda-Yamamoto causality framework. Before model estimation, a sequence of preliminary statistical tests was performed in order to get to know the characteristics of the data. These are descriptive statistics, correlation analysis, unit root test, as well as selection of lag length and Johansen cointegration test. The findings demonstrate that there is long run positive statistical significance between money supply and inflation with coefficient of money supply being 0.756 (t-statistic ≈ 4.89 , $p \approx 0.01$). On the other hand, the interest rates show zero but statistically significant negative correlation with inflation rate with a coefficient of -0.234 (t-statistic ≈ -2.17 , $p < 0.05$). The DOLS model is associated with a good level of explanatory power, showing a value of 0.78 adjusted R-squared, and thus implying that monetary policy variables are associated with a large part of long-run inflation trends in Nigeria. Nevertheless, Toda-Yamamoto causality results fail to support the short-run causality between money supply or interest rates and inflation. Interestingly, the marginal evidence ($p \approx 0.08$) is that inflation can Granger-cause money supply changes, and this denotes the reactive monetary policy framework in Nigeria. Overall, the results indicate that the monetary policy of Nigeria is largely reactive, where inflation has a greater impact on liquidity changes compared to proactive monetary policy countering the effects of inflation. By employing econometric techniques such as DOLS and the Toda-Yamamoto causality framework, this study enriches the empirical literature on inflation management in developing economies and provides valuable insights for designing more forward-looking and effective monetary policy strategies in Nigeria.

KEYWORDS: Money Supply, Interest rate, Gross domestic product (GDP), Dynamic Ordinary least square (DOLS).

1.0 INTRODUCTION

The monetary policy is important in controlling inflation, but it determines the effectiveness of the policy depending on the inflation regime and the economic circumstances. The rate of prevailing inflation, the economy structure, and external shocks are among the factors that affect its effect on inflation (Dan, 2013; Amarasekara, 2008). The inflation itself has always been an essential macroeconomic issue in Nigeria and greatly influenced the economic growth, investment, and living standards (Obiora et al., 2023; Olusola et al., 2022; Idris, 2021). Inflation in Nigeria can be defined as a period of continuous acceleration in the overall level of prices and has been predetermined by structural inadequacies, fiscal dynamics, and international economical effects (Asekunowo, 2016). The Central Bank of Nigeria (CBN) has been using different monetary policy frameworks over the years to restrain inflation with varying degrees of success (Lawrence, 2023; Okotori and Gbalam, 2020; Okwori and Abu, 2017; Ojo, 2013). All around the world, developed economies have been able to adopt monetary policy frameworks such as inflation targeting, monetary aggregates targeting, and policies that rely on the interest rates (Ruch, 2021; Kim and Mehrotra, 2018; Filardo, et al., 2016; Filardo and Genberg, 2012). These frameworks focus on central bank independence, strong data systems, and efficient communication,

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which are essential in the attainment of stable inflation (Asuquo, 2021). Nevertheless, the applicability of such strategies in the developing countries is usually undermined by institutional and structural constraints (Frankel, 2010; Kadioglu, et al., 2000). External shocks, which include commodity price volatility, exchange rate instability, structural constraints (poor infrastructure and weak institutional frameworks) make inflation volatile in Sub-Saharan Africa much more than in developed economies (Asuquo, 2021; Mazorodze, 2021; Nissanke, 2019; Nguyen, et al., 2017). Although some African nations such as Nigeria have implemented the monetary policy frameworks that are more compatible with the specifics of their economies, however, the effectiveness of these policies have been frequently obstructed by a weak fiscal discipline and the lack of financial mechanisms that would support them (Adam et al., 2018; Chavula et al., 2017; Adam, 2008).

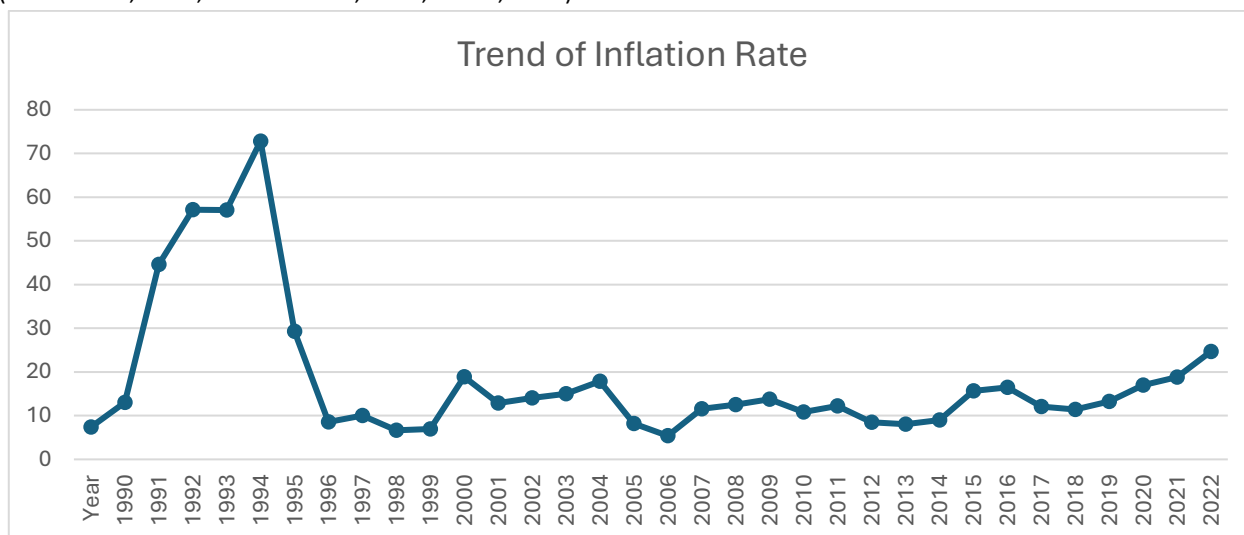


Figure 1: Trend of Inflation Rate in Nigeria (1990-2023)

In Nigeria, changes in the monetary policy of the country have manifested in the inflation trends. Inflation in the 1960s and 1970s was quite moderate given the agricultural production and minimal import reliance. The CBN monetary policy of this time had been largely development-oriented, which concerned the provision of credit to drive economic growth (Nwafor, 2022; Fayomi and Ehiagwina, 2019). Nevertheless, this was changed in 1986 when the Structural Adjustment Program (SAP) was adopted, and such policies as currency devaluation, the withdrawal of subsidies, fiscal deficits led to hyperinflation, reaching up to 40 percent per annum (Mars, 2011; Okome, 1996). In **figure 1** the Consumer Price Index (CPI) of Nigeria covering 1990 to 2023 displays consistent inflationary volatility that is attributable to structural weaknesses, policy fluctuations and external shocks. There was moderate inflation in 1990 (7.36 percent) but it escalated steeply in the early nineties, reaching 44.59% in 1992 and 57.17% in 1993 and record high in 1995 with exchange rate instability, fiscal deficits and political uncertainty leaving it high until 1996. There was a sharp restraint between 1995 and 1998 where CPI fell to 29.27 and 6.9 percent respectively. The 1999-2007 was boasting a comparatively stable time picture, exchanging between 6% and 18% inflation rates and with a peak in 2001 (18.87) caused by subsidy reforms. CPI fell to an average of 5 percent to 17 percent between 2008 and 2014 with a lower of 10 percent in 2013-2014 as the monetary control had more strength and agricultural production became better. Inflation was making a return since 2015 despite decreasing to 9.01percent in 2016 after oil price collapse, currency devaluation and recession, it had been high at approximately 12-13 percent between 2017 and 2020. Since 2020, inflation rates have become particularly acute, as CPI went up to 24.66 percent by 2023 after COVID-19 impacts, food distribution pressure, and exchange rate stresses caused by CPI alone, and as a deeper look reveals, the irritation of inflation in Nigeria is structural and persistent.

Monetary aggregate targeting was employed by the CBN in the 1990s as a way of regulating money supply and stemming out inflation (Okwori & Abu, 2017). Nevertheless, at an average of 20% inflation rose because fiscal indiscipline and foreign shocks, such as falling oil prices, were among the factors. The emergence of the Monetary Policy Rate (MPR) as a guide in 2006 to the monetary policy represented a new era in which inflation remained within single-digit rates during stable periods and double-digit rates during oil price shocks (Aderinto, 2019). Over the recent years, inflation has remained high due to structural problems, volatility of exchange rate, and fiscal strains. Alterations in the exchange rates, elimination of fuel subsidies, and the COVID-19 pandemic are some of the most recent events that have driven inflation spikes to 20-25 percent (Okeke et al., 2024; Olawoye and Erediauwa, 2023; Aitalohi, 2021).

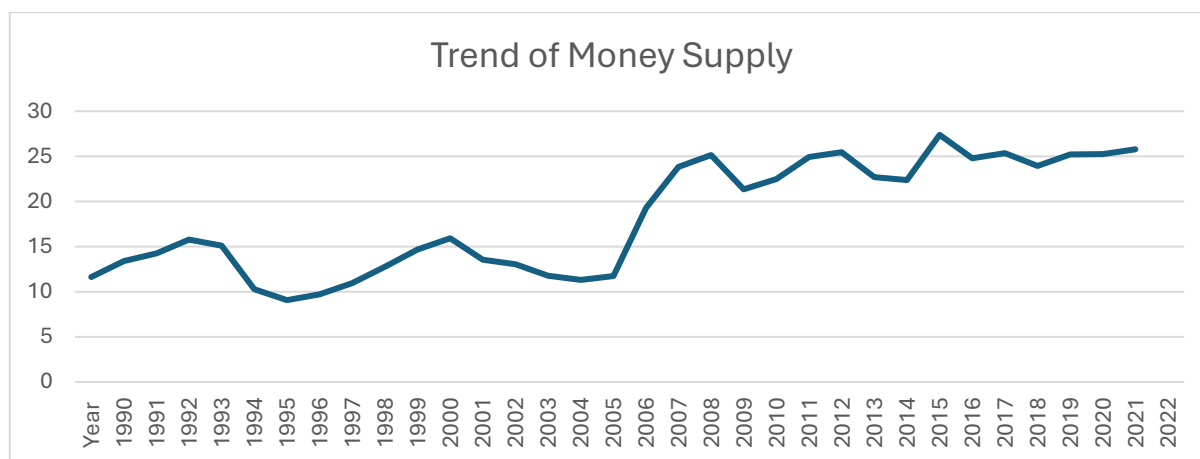


Figure 2: Trend of Money Supply in Nigeria (1990-2023)

Figure 2 illustrates the dynamics of money supply growth in Nigeria, 1990-2023 showing specific trends defined by monetary policy, political grounds, and external shocks. Post-SAP expansionary policies also led to an increase in money supply; the money supply increased steadily to 13.64 percent in 1990 to 15.79 percent in 1994 and then sharply declined to 9.06 percent in 1995 as tight monetary controls were created to control the mid-1990s inflation. The period between 1998 and 2003 preceded a moderate recovery whereby the economy started recording growth of between 9.73 and 15.90 aided by economic liberalization and the returning investor confidence. Between the years 2004 and 2010, the money supply has been unstable, ranging between 13.53 percent and 11.30 per cent due to reforms on the banking sector, change in administration and the 2008 global financial crisis. The expansion increased at a rapid rate between the year 2011 and 2015 as the growth increased by 11.73 percent to 23.81 percent as a result of the windfalls in oil revenue and the accommodative monetary policy. Money supply began to recover sharply after the oil price shock of 2014-2016, reaching its highest point (27.38 percent) in 2018 and settling between 25-26 percent between 2019-22 due to a combination of desired CBN action and post-COVID-19 stabilisation steps.

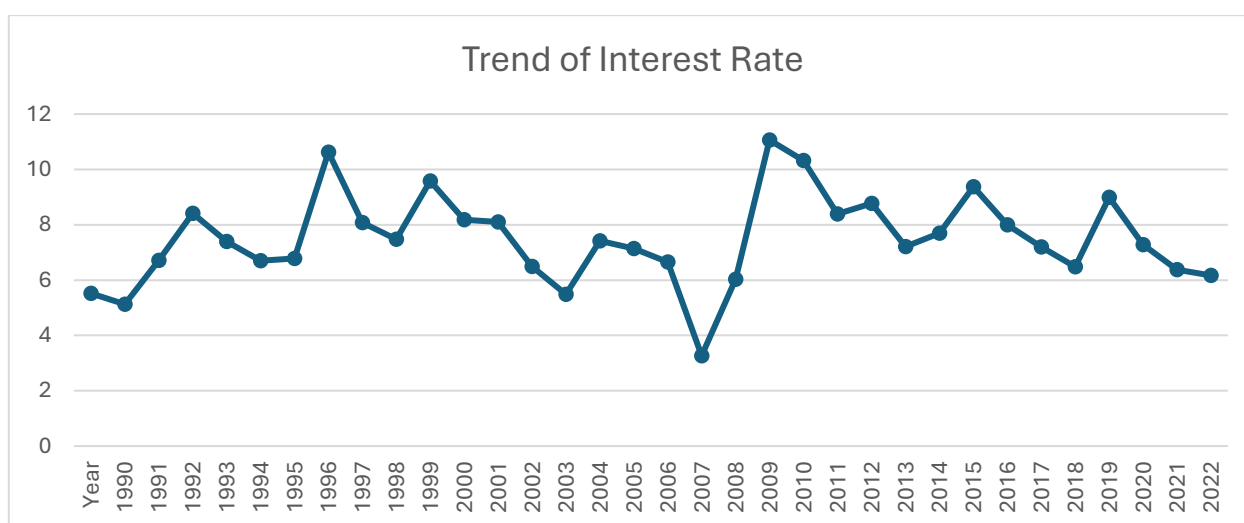


Figure 3: Trend of Interest rate in Nigeria (1990-2023)

According to **Figure 3**, there are significant changes in the interest rates of Nigeria during the years 1990-2023, driven by the monetary policy changes, inflation control, political regime changes and external shocks. The rates went up to 5.52 percent in 1990 to 8.41 per cent in 1993 under post-SAP tightening and then changed to 7.39 percent in 1994 to revive the economy. The period between 1995 and 1997 saw relatively steady rates ranging between 6.70-6.78 percent with focus on conservative policy where inflation control coupled with growth have been balanced. Transition in politics and initial banking reforms were a factor in the volatility between the years 1998 and 2001, with the highest rates of volatility standing at 10.63 percent in 1998 and later subsiding at 7.48 percent in 2000. Between 2002 and 2006, interest rates were maintained at between 8 and 8.2 percent, an indication that it was attempting to support the credit of the concerned sector and having control over the inflation. The interest rate was affected by the global financial crisis, which went down to 5.48 percent in 2008 and 6.50 percent in 2010 as they implemented the accommodationist policies. In the period between 2011 and 2014, the rates decreased to 3.27 percent to sustain growth in oil

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price falls, but has increased to 6.03 percent in 2016 with the depreciation of the naira and inflation due to recessions. During the post-recession years, the rates reached their highest point in 2017 (11.06 percent) and dropped to 6.17 percent in 2023, as the CBN balanced the recovery of the growth and the control of inflation with caution during COVID-19 shocks and oil prices volatility. Moreover, the Nigerian inflation is also shaped by the demand-side and supply-side factors (Onuorah, 2023). On the demand side, the factor of high increase in the money supply which in many cases has been associated with deficit financing by the government makes a big contribution. On the supply side, price shock on food, energy, and poor infrastructure induce pressure to the inflationary pressures. Foreign exchange volatility, especially depreciation of the naira has a direct effect of influencing the prices of imports with a consequential effect of inflating prices. The study will also examine the connection between monetary policy, inflation in Nigeria, and will take a systematic approach in the discussion of how the monetary policy instruments have changed and their success in solving the endemic inflation problems affecting the country.

The challenge of inflation control is one of the most influential macroeconomic problems in Nigeria because it affects the financial stability, economic growth, and quality of life (Muhammad, 2023; Yusuf & Mohd, 2022). Although monetary policy has been implemented as one of the essential tools in regulating inflation, it has not been effective and depended on the situation (D'Acunto, et al., 2024). The current literature shows that there is mixed evidence of why the monetary policy tools, including interest rates, money supply, and exchange rates help in the achievement of inflation in Nigeria and this is due to the dynamism and complexity of the economic structure and external environment of the country.

It has been observed in developed economies that credibility of central banks, strong institutional setups and finely tuned monetary policies play a key role in realizing stable inflation (Issler & Santos, 2018). Nevertheless, the success of the same tools in emerging economies, such as Nigeria, is limited by the issue of fiscal dominance, exchange rate volatility, external shocks, and structural shortcomings (Habibullah, 2019; Oyegun and Joshua, 2024). As an example, the literature on Nigeria provides conflicting information, and some researchers emphasize the importance of such monetary policy instruments as the interest rates and exchange rates (Musa and Amuta, 2021; Henry and Sabo, 2020), whereas others also consider their lack of effectiveness in the long term (Clement et al., 2021; Oyegun and Joshua, 2024). Moreover, a more comprehensive relationship between monetary policy and externalities, including international commodity prices, fiscal politics, structural limitations, etc., is insufficiently studied in the Nigerian context. The relevance of this gap is especially high because Nigeria depends on oil exports and it is susceptible to global economic changes, which tend to invalidate the effectiveness of national monetary policy. Regardless of several reforms, inflation in Nigeria has been high with alternative between single and double digit rates concerning internal and external shocks. Other short-term fiscal opportunities, like the Monetary Policy rate (MPR), have not been very effective in fixing inflation in a situation of exchange rate volatility and fiscal strains (Elisha et al., 2024). On the contrary, the effectiveness of long-term instruments, such as management of money supply, has shown inconsistency and thus there is necessity to have deeper research on the monetary-inflation relationship.

In view of these issues, it is significant to undertake an extensive evaluation of how the monetary policy instruments affect the inflation and the causal link between the monetary policy and the inflation in Nigeria. This kind of study is necessary to detect which circumstances are best suited to the use of particular monetary instruments and to examine how domestic monetary policies interact with external economic influences. The resolution of these problems would help in creating a more resilient and flexible monetary policy framework that can bring continuous inflation control in Nigeria.

2.0 LITERATURE REVIEW

Empirical results on the linkage between monetary policy and inflation have shown a variety of results with both the developed and the developing economies which echo the institutional strength, policy credibility and structural conditions. In general, thematic clusters in the literature were based on monetary credibility and expectations, monetary supply and inflationary dynamics, and the efficacy of the particular monetary policy tools, and the experience of most of the issues was evident in the case of Nigeria.

In more institutionally stable environments, particularly in developed ones, there has been a focus on central bank credibility and the role of mechanisms of monetary transmission. As studied by Issler and Santos (2018), the connection between central bank credibility and inflation expectations was investigated with the GMM estimating the HAC covariance and discovered that will experience a considerable effect of improving the credibility on the long-term inflation expectations of all the horizons. This highlights the role played by institutional trust in price stabilisation. Correspondingly, Bhattarai (2011) who studied the United Kingdom proved that exchange rate movements and money supply have a great impact on inflation, interest rates and economic growth, which indicates the interrelations between monetary policy variables in developed economies. This indicates that

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effective monetary policy, as well as plausible institutions, are important in anchoring the inflation expectations and maintaining macroeconomic stability.

In developing economies the inflationary affect of monetary policy is more evident but difficult to forecast and is usually limited by structural rigidities. Research like in Ghana (Abille and Mpuure, 2020) and Malaysia (Hossain, 2017) reported a significant and positive long-run effect between the money supply and inflation but not short-term effects. In a multi-country Asian study, Habibullah (2019) asserted the long-run causality between money supply and inflation using both Granger causality and ECM methods that corroborates the monetarist suggestion across the developing settings. Nevertheless, monetary policy is not that effective in all countries. In a study centered on South Africa, Bonga-Bonga (2017) noted that the effects of shocks in the monetary policy did not have any material effects on inflation rates, implying that structural and external forces could undermine the transmission of policy. Chaudhry et al. (2015) in Pakistan discovered that the levels of interest rates and money supply are one of the major causes of inflation and referred to the significance of the monetary aggregates in the process of inflation. These studies suggest that the role of money supply in driving inflation in developing economy is still prevalent but that such an effect is mediated by institutional and structural factors in the country.

According to empirical evidence in Nigeria, the evidence is varied and even contradictory and in this aspect, it reveals the complexity under which inflation control can be undertaken in a structurally constrained economy. Some of the researches affirm the importance of monetary variables. Musa and Amuta (2021) observed that in the long and short-term, interest rates, and exchange rates had a significant positive effect on the growth of inflation, whereas the monetary policy rate was effective in the short term. Likewise, Folorunsho and Abiola (2020) and Akindutire et al. (2019) found that inflation dynamics can be largely accounted by the amount of money supply and interest rates, although the impact of the exchange rate varies among studies. Other research, on the other hand, questioned whether the monetary policy can be effective in the control of inflation. Oyegun and Joshua (2024) and Clement et al. (2021) discovered that the effects of monetary policy instruments, such as money supply, and exchange rate did not produce significant increases in inflation in the short and long term, which indicates weak policy transmission. Henry and Sabo (2020) presented compelling evidence by revealing that even as money supply has a positive impact on inflation, monetary policy rate and exchange rate have the potential to dilute it. More evidence is also pointing to the relevance of certain instruments and time frames. As noted by Okwori and Abu (2017), Akarara and Azebi (2018) and Fidelis and Zwall (2022), Treasury Bill Rate (TBR) is more likely to be effective in short- and long-term inflation control, although exchange rate and money supply are more likely to achieve success in short run and monetary policy rate in the long run in the control of inflation. The recent research, including Elisha et al. (2024) and Anachedo et al. (2023), adds to the discussion by associating monetary policy not just with inflation but also with economic growth, and assert that trade-offs do exist between price stability and economic growth.

3.0 DATA AND METHODOLOGY

3.1 Measurement of Variables and Sources of Data

The study utilised secondary data sources. The data were obtained from the World Development Indicators (WDI) and it cover thirty-three (33) years, between 1990 and 2023. The money supply and interest rate are the independent variables whereas the inflation rate is the dependent variable in this study. Further, the exchange rate and economic growth were used as the control variables in the analysis.

Table 1: Data Description and Sources

Variable	Reference(s)	Abbreviation	Measurement	Sources
Inflation rate	Adediwura et al., 2024	INF	Consumer Price Index (CPI)	WDI
Money supply	Babatunde & Kehinde, 2016;	MS	M2 (Broad Money Supply)	WDI
Interest rate	Adodo et al., 2018; Matthew, 2015	IR	Central Bank's policy rate or market interest rate	WDI
Gross Domestic Product	Matthew, 2015.	GDP	Annual GDP at constant prices	WDI
Exchange rate	Adodo et al., 2018; Matthew, 2015	ER	Naira/US Dollar exchange rate	WDI

3.2 Methodology

The theoretical foundation of this study is based on the Quantity Theory of Money (QTM) and Liquidity Preference Theory that present a complement to the effectiveness of monetary policy in curbing inflation in Nigeria. Quantity Theory of Money, attributed to Irving Fisher (1956) holds that there must be a direct proportionality relationship between level of prices and money supply, when all the other factors are kept constant i.e. the velocity of money and output. It is expressed as:

$$MV = PY \quad (1)$$

Where M is the money supply, V is velocity of money, P represents price level (inflation) and Y denotes real output. In this framework, any rise in the supply money leads directly to an increase in prices and hence monetary control is central in the management of inflation. Nevertheless, the restrictive conditions of QTM also require a more diverse account offered by the Liquidity Preference Theory of Keynes. According to Keynes, the demand of money is related to income and interest rates: in The General Theory of Employment, Interest and Money (1936), he stated that:

$$M^d = f(Y, r) \quad (2)$$

where M^d is money demand, Y is real income, and r is the interest rate. The money is demanded as transaction, precautionary and speculative money and speculative demand decreases with increase in interest rates. Therefore, change of interest rates affects the demand of money and investment and inflation rates. The application of this theory to the Nigerian setting is that the Central Bank has depended on the tightening of money by increasing the interest rates in order to reduce inflation. However, the volatility of the exchange rates and structural rigidities tend to undermine the monetary transmission, which underscores the necessity of having a coordinated and integrated policy framework.

3.3 Estimation Techniques

Since all the variables in the model are order-one, I(1), this study utilised the Dynamic Ordinary Least Squares (DOLS) method to determine the long-run relationship between the monetary policy variables and inflation in Nigeria. In this regard, DOLS tends to be optimal since it offers more effective and unbiased long-run predictions in cases when variables are I(1) and cointegrated, and it adjusts the endogeneity and serial correlation by adding leads and lags of differenced regressors.

$$INF_t = \beta_0 + \beta_1 MS_t + \beta_2 IR_t + \beta_3 \ln GDP_t + \beta_4 ER_t + \varepsilon_t \quad (3)$$

In order to use the DOLS estimator, the model is enriched by leads and lags of the differenced regressors in the form of the following model:

$$INF_t = \beta_0 + \beta_1 MS_t + \beta_2 IR_t + \beta_3 \ln GDP_t + \beta_4 ER_t + \sum_{j=-q}^q \gamma_{1j} \Delta MS_{t-j} + \sum_{j=-q}^q \gamma_{2j} \Delta IR_{t-j} + \sum_{j=-q}^q \gamma_{3j} \Delta \ln GDP_{t-j} + \sum_{j=-q}^q \gamma_{4j} \Delta ER_{t-j} + \varepsilon_t \quad (4)$$

where INF_t denotes the inflation rate, MS_t represents money supply, IR_t is the interest rate, $\ln GDP_t$ captures real output, and ER_t denotes the exchange rate. The operator Δ indicates first differences, q is the number of leads and lags included, β_1 – β_4 measure the long-run effects of the monetary policy variables on inflation, and ε_t is a white-noise error term.

The DOLS framework, by taking advantage of the cointegrating properties of the I(1) variables, estimates constant parameter estimates in the long run, and therefore forms a solid foundation on which we can measure the efficacy of the monetary policy in the control of inflation in Nigeria. In a bid to investigate the causality direction of the inflations and monetary policy, the paper assumes the Toda and Yamamoto (1995) causality method. The approach can enable valid Granger causality inference whether the variables are stationary or cointegrated, thus being free of pre-testing biases. Following Rambaldi and Doran (1996), an augmented Vector Autoregressive (VAR) model of order $(k+d_{max})$ is estimated, where k denotes the optimal lag length and d_{max} represents the maximum order of integration among the variables.

The model specification for the Toda-Yamamoto causality test is as follows:

$$Y_t = \beta_0 + \sum_{i=1}^k \beta_i X_{t-i} + \sum_{j=1}^k \alpha_j X_{t-j} + \sum_{j=1}^{k+d_{max}} \gamma_j X_{t-j} + \sum_{n=k+1}^{k+d_{max}} \gamma_n X_{t-n} + \varepsilon_t \quad (5)$$

Where:

Y_t and X_t = dependent and independent variables (e.g., Inflation Rate and monetary policy instrument)

β_t and α_t = are the coefficients of the variables within the optimal lag structure k,

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Y_m and δ_n = are the coefficients of the additional lags introduced to ensure robustness of the causality test, d_{max} = is the highest order of integration among the variables, ε_t = is the white noise error term.

4.0 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 2: Descriptive Statistics of Data

	CPI	MS	IR	LNGDP	ER
Mean	18.27805	18.18383	7.485513	13.61211	161.2171
Median	12.94178	15.90097	7.333976	13.62798	130.2483
Maximum	72.83550	27.37879	11.06417	13.89174	645.1941
Minimum	5.388008	9.063329	3.268333	13.33606	8.038285
Std. Dev.	15.90202	6.142791	1.622724	0.211036	143.1965
Skewness	2.180389	0.027623	0.066566	-0.084398	1.426739
Kurtosis	6.855094	1.352526	3.419433	1.362196	5.185437
Jarque-Bera	47.99403	3.736179	0.274335	3.840431	18.30117
Probability	0.000000	0.154418	0.871824	0.146575	0.000106
Sum	621.4536	600.0664	254.5074	462.8116	5481.383
Sum Sq. Dev.	8344.851	1207.484	86.89667	1.469701	676672.9
Observations	34	33	34	34	34

Sources: Author's compilation (2026).

The descriptive statistics in **Table 2** reveal important characteristics of the study variables. The Consumer Price Index (CPI) as a measure of inflation has a high average of 18.28% with high volatility (standard deviation = 15.90%), with the highest inflation rates recorded in the peak value of 72.84. Its skewness is positive (2.18), its kurtosis is high as (6.86) and Jarque Ber probability is 0.0000 that may suggest that it has a non-normal distribution due to inflation spikes. The mean of money supply (MS) is 18.18 and has a moderate range of variability (standard deviation = 6.14), skewness is close to zero, (skewness = 0.028) and the distribution is not skewed (kurtosis = 1.35) and the Jarque-Brauna probability 1544 (0.16). The interest rate (IR) shows the low dispersion (1.62) with the average of 7.49 and the interest rate has a near-normal distribution as the skewness (0.067), kurtosis (3.42), and Jarque-Bra value (0.8718). The real output, which is gauged by the logarithm of GDP (LNGDP) is quite steady, with a mean of 13.61, very low variability (standard deviation = 0.21), a small negative skewness (-0.084), and is approximately normally distributed (Jarque-Brauna statistic = 0.1466). However, the exchange rate (ER) is highly volatile, with a mean of 161.22, a high standard deviation of 143.20, and a maximum of 645.19 being characterised by high depreciation of the currency, its skew (1.43) is positive, Kurtosis (5.19) is high, the Jarque-Brau probability system is 0.0001 indicating that it has a non-normal distribution. On the whole, MS, IR and LNGDP are found to be close to normality, whereas CPI and ER think of marked non-normality, highlighting the fluctability and the extreme values in the process of inflation and exchange rates in Nigeria throughout the study period.

4.2 Unit Root Test

Table 3: Unit Root Test

	ADF Test at Levels	Critical Value at 5%	ADF Test at First Difference	Critical Value at 5%	Order of integration
INF	-2.1784	-2.9540	-4.6451	-2.9571	I(1)
MS	-2.2541	-3.5578	-4.5679	-2.9604	I(1)
IR	-3.9713	-2.9540	-6.5543	-2.9604	I(1)
LnGDP	-2.6430	-2.9640	-4.5384	-3.5578	I(1)
ER	-2.6016	-3.5530	-5.3654	-3.5578	I(1)

Source: Author's Compilation (2026)

The unit root test results in **Table 3** examine the stationarity properties of the variables using the Augmented Dickey-Fuller (ADF) test at levels and first differences. At the 5% significance level, a variable is considered stationary when the ADF statistic is more negative than the critical value. The results show that Inflation (INF), Money Supply (MS), Log of GDP (Lngdp), and Exchange Rate (ER) were non-stationary at levels but became stationary after first differencing, indicating that they are integrated of order one,

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I(1). Conversely, the Interest rate (IR) was at the same stationary level indicating that the rate is of order zero, I(0), but the rate was also at the same stationary level when it was first differentiated. Generally, the results demonstrate a combination of I(0) and I(1) variables with most of them becoming stationary at the first difference.

4.3 Co-Integration Test

Table 4: Result of Johansen Juselius test for cointegration

Hypothesized No. of C.E(s)	Eigen value	Trace Statistic	Critical value @ 0.05	Max-Eigen Statistic	Critical value @ 0.05
$C \leq 0$	0.939147	182.9529	69.81889	83.97884	33.87687
$C \leq 1$	0.834192	98.97403	47.85613	53.90778	27.58434
$C \leq 2$	0.593484	45.06624	29.79707	27.00397	21.13162
$C \leq 3$	0.335687	18.06228	15.49471	12.27005	14.26460
$C \leq 4$	0.175579	5.792227	3.841466	5.792227	3.841466

Sources: Author's compilation (2026).

To examine the existence of a long-run relationship among the variables in objective two, the Johansen–Juselius cointegration test was employed. Table 4 results give a very good case on long-run equilibrium relationships between the variables. The trace statistics indicate up to five cointegrating equations, as all trace values exceed their 5% critical values. Likewise, the maximum eigenvalue statistics indicate that there are at least three cointegrating relationships, and the test statistics are above the critical value to the third rank. Overall, the results confirm the presence of multiple long-run relationships among Inflation, Money Supply, Interest Rate, Economic Growth, and Exchange Rate.

4.4 Dynamic Least Squares (DOLS) Estimation

Table 5: Estimated Regression Model Result using Dynamic Least Squares (DOLS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MS	2.424402	0.779802	3.108996	0.0171
IR	-4.508616	2.402026	-1.877005	0.1026
LNGDP	-25.81903	8.219091	-3.141349	0.0163
ER	0.142943	0.040854	3.498865	0.0100
C	336.7497	104.8336	3.212230	0.0148
R-squared	0.843888	Mean dependent var		23.33777
Adjusted R-squared	0.804861	S.D. dependent var		5.304402
S.E. of regression	2.343198	Sum squared resid		131.7738
Long-run variance	5.757591			

Sources: Author's compilation (2026).

Table 5 has provided estimates of the DOLS performance of the model that reveal a high level of explanatory power ($R^2 = 0.8439$; Adjusted $R^2 = 0.8049$). There is a positive and statistically significant relationship between Money Supply (MS) and inflation ($\beta = 2.4244$, $p = 0.0171$) meaning that monetary growth increases the pressure of inflation. The outcome is congruent with the classical monetary theory and supports previous results of Abille and Mpuure (2020), Folorunsho and Abiola (2020), Habibullah (2019), and Hossain (2017). The positive but significant impact of the Exchange Rate (ER) on the inflation is also positive ($\beta = 0.1429$, $p = 0.0100$).

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implying that the depreciation of money leads to an increment of domestic prices due to the increment of import prices. This is a consistent finding with Panopoulou and Pittis (2024) and reflects traditional exchange lessons exchange rate-inflation dynamics in the small open economies.

On the other hand, the Interest (IR) has negative but statistically not significant relation with inflation ($\beta = -4.5086$, $p = 0.1026$), which shows poor empirical evidence of contractive monetary policy channel. This observation is somewhat inconsistent with theoretical predictions and can indicate rigidities of structure and failing monetary transmission mechanisms, as observed by Clement et al. (2021) and Bonga-Bonga (2017). Economic Growth (GDP) shows that it has negative and statistically significant impact on inflation ($\beta = -25.8190$, $p = 0.0163$), implying that with an increase in output; tends to stabilize long-run inflationary pressures, as is predicted by theories of growth-stabilisation. Overall, the research confirms that long-term money supply increases and continuous devaluation of the exchange rate are the major macroeconomic factors behind the inflation in Nigeria over the long run. This stand point is in line with the empirical data cited by Adewale (2025), Allwell and Alex (2025), and Dalhatu et al. (2024). Economic growth on the other hand shows stabilising effect in the macroeconomic system as the findings reveal that stable growth may be supported by moderate inflation levels and a regulated rate of exchange rate depreciation. Nonetheless, high inflation has a negative influence on the economic performance, which supports the findings of Oyadeyi et al. (2025), Obiaje (2023), and Adaramola and Dada (2020). Moreover, there is evidence that indicates that interest rate policy has poor long run effects on the management of inflation. In line with Dalhatu et al. (2024), the impact of interest rate adjustments seems to have short-term effects only, and the ability of interest rates to prevent inflationary pressure is mixed or weak in the long run.

4.5 The Toda and Yamamoto (1995) Causality Estimation

Table 6: Estimated Toda and Yamamoto (1995) Causality

Dependent variable: CPI			
Excluded	Chi-sq	df	Prob.
MS	1.967126	2	0.3740
IR	0.465154	2	0.7925
All	2.290601	4	0.6825
Dependent variable: MS			
Excluded	Chi-sq	df	Prob.
CPI	5.007907	2	0.0818
IR	1.146477	2	0.5637
All	5.689710	4	0.2236
Dependent variable: IR			
Excluded	Chi-sq	df	Prob.
CPI	1.514272	2	0.4690
MS	1.681735	2	0.4313
All	3.082393	4	0.5441

Source: Author's Compilation (2026)

This study uses the Toda and Yamamoto (1995) test of causality shown in **table 6** to

to test the causality between monetary policy and inflation in Nigeria between 1990 and 2023. This method is suited because it enables testing of causality robustly without the use of pre-tests that would establish stationarity or cointegration which would induce biasness in the conventional approaches of Granger causality. Table 6 results indicate that, in the case of an inflation (CPI) as a dependent variable, money supply and interest rate do not Granger-cause inflation. In particular, the chi-square outcome of the money ($\chi^2 = 1.9671$, $p = 0.3740$) and interest rate ($\chi^2 = 0.4652$, $p = 0.7925$) are statistically non-significant at the 5 percentage level. This is also validated by the joint causality test ($\chi^2 = 2.2906$, $p = 0.6825$), that does not point out a direct causal impact of the monetary policy instruments on the inflation in the short-term. On the other hand, an inflection depicts a weak feedback effect with the money supply serving as the dependent variable with minor Granger causality at 10% level of significance ($\chi^2 = 5.0079$, $p = 0.0818$), indicating by which the effect of inflation increases the supply of money. Nevertheless, the amount of causal impact of

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interest rate on money supply is nonsignificant ($p = 0.5637$), and the joint test is also not able to prove the causality ($p = 0.2236$). On the same note, one finds that in cases where the interest rate is the dependent variable, both the inflation as well as the money supply do not Granger-cause movements in the interest rates which is represented by the statistically insignificant p -values of 0.4690 and 0.4313 respectively. This finding is supported by the joint causality test ($\chi^2 = 3.0824$, $p = 0.5441$).

Overall, the results shows that there is no statistically significant cause and effect relationship between the variables of monetary policy and inflation in Nigeria within the study period. It is a finding that contrast the long-run relationships found under DOLS estimation, which implies that the monetary variables are correlated with inflation in long-run, but they do not have immediate causality on the short-run. This variance can be an indication of policy lag, fiscal dominance, external shock or poor monetary transmission mechanism. The findings are also in line with other recent empirical findings of Altinisik and Yucememis (2024), Dritsaki (2017), and Cioran (2014) who also find weak or no short-run causality between monetary aggregates and inflation. Moreover, the marginal evidence of the explanation of money supply changes caused by inflation is that the monetary policy of Nigeria has mostly been reactive and not proactive which is in agreement with the results of Williams (2012) and Altinisik and Yucememis (2024).

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The results of this research paper give an indication that as much as monetary policy tools like money supply and interest rates play a significant role in determining inflation in the long-term, they do not have direct causal effects in the short-run. The impossibility of maintaining long-run relationship and short-run causality implicates structural inefficiencies and lagging of policies as well as the contribution of external shocks to the inflationary process. In addition to this, the demonstrations of inflation-related developments in money supply indicate that the monetary authorities might have used reactive position policy but not proactive monetary policy targeting of inflation. These observations highlight the importance of more future-oriented and future-thinking monetary policies in order to regulate the inflation processes.

5.2 Recommendation

Considering the results of the empirical research and the theoretical explanations, the following recommendations can be offered:

1. Monetary authorities should to strengthen the predictive functions of inflation targeting through further investment in the more sophisticated econometric forecasting model and real-time data analytics.
2. It would be necessary to have more synergy in the actions of both monetary and fiscal policy to minimize the policy inconsistencies and alleviate the disruptive impact of both external and internal shocks on the inflation process.
3. Effective communication strategies should be given priority by the central bank of Nigeria (CBN) to have a better way of anchoring the inflation expectations, which is important in the context of the workability of any inflation-targeting framework.
4. Monetary policymakers should to undertake structural changes that help to lift the efficiency of the monetary transmission system with the main one being the reinforcement of the financial sector, enhancement of financial inclusion, and institutional credibility.
5. It is necessary to focus on constructing policies that are pro-cyclical in response to inflation signals as opposed to being ex post cyclical when there is an inflation outcome.

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