Vector Autoregressive Model and Autoregressive Distributed Lag in the Effectiveness of Monetary Policy in Controlling Inflation in Nigeria

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Abstract

The research investigated the effectiveness of vector autoregressive model and autoregressive distributed lag in controlling inflation using monetary policy in Nigeria. Secondary quarterly data spanning from 1999Q1 to 2023Q4 with Money Supply, Treasury bills rate, monetary policy rate and exchange rate were adopted as control variables to investigate their relationship with inflation and to assess the dynamic Correlations among instruments used in monetary policy inflation in the Nigeria economy. Long run relationship between te variables were established by co-integration test, stationarity was achieved after first differencing, Ordinary Least Square (OLS) was use to estimate the parameter of the model. The research discovered that exchange rate and money supply has a unidirectional causality with inflation and inflation has a uni-directional relationship with monetary policy rate while exchange rate has a bi-directional relationship with money supply. While the empirical result of vector autoregressive and autoregressive distributed the empirical findings suggest that the monetary policy rate, money supply, and Treasury bill rates have a statistically significant positive effect on inflation in Nigeria. Moreover, exchange rate depreciation is associated with an acceleration in inflationary pressures.. But ARDL give the best result base on the model performance from the analysis using akaike information criterion (AIC). INF AIC = 4.500590, EXG AIC = 8.363651, M2 AIC = 16.8217 which are less than that of VECM. The findings align with the expectations of economic theory. Consequently, the study concludes that money supply, treasury bill rates, monetary policy, and exchange rates significantly influenced inflation during the period examined. Based on this, the study offers the following recommendations: Gradual increases in MPR can reduce demand-pull inflation without causing undue economic disruption and Implement To control the money supply and curb inflationary pressures, the monetary authorities should strengthen the use of open market operations and reserve requirements. Additionally, there is a need to conduct a fresh analysis of the monetary policy rate's effectiveness, as it proved inadequate in managing Inflation dynamics in Nigeria throughout the examined timeframe.

Keywords: Autoregressive, correlation, inflation, monetary, policy

1.0 INTRODUCTION

Economic growth stands as a fundamental policy goal for any government, given its pivotal role in alleviating poverty, fostering employment opportunities, and narrowing the inequality gap (Anowor, 2016). It elevates the general standard of living, facilitates more equitable income distribution, and hastens the provision of essential needs for the majority (Uwakaeme, 2015). Measured With regard to per capita income, economic growth signifies the overall output of the economy output of goods and services produced within a country For a selected year, adjusted for population size(Uwakaeme, 2015). This output is influenced by a nation's The availability of economic resources, along with the scale and expertise of the labor for**ce** level of its labor force, and the technological efficiency of its capital stock. Thus, the pace of economic growth hinges on the expansion of these resources—both physical and human—as well as improvements in overall productivity (Okwo, 2012).

While monetary policy is widely recognized as a key driver of economic growth and development due to its influence on various economic indicators (Anowor, 2016), the exact role of money in the economy remains a contentious topic among modern economists. Money directly impacts aggregate expenditure by affecting the availability of credit and indirectly through its influence on interest rates. A lower interest rate environment tends to expand the money supply, which often correlates with higher inflation levels (Okwo, 2012). Changes in money demand also alter interest rates, which subsequently influence investment demand—ultimately leading to shifts in national income (Okwo, 2012).

Monetary policy is traditionally viewed as a core tool for economic stabilization. It is employed to regulate the volume, pricing, accessibility, and flow by regulating money and credit to accomplish specific macroeconomic objectives (Obadeyi, 2016). Among the various transmission mechanisms, interest rates are perhaps the most significant. As interest rates climb, the financial burden of loans intensifies. , thereby dampening components of aggregate demand that are sensitive to interest changes. Moreover, rising short-term interest rates lower asset prices, reducing consumption via the wealth effect and discouraging investment through Tobin's q-theory (Ridhwana, 2014).Another notable transmission mechanism is the credit channel, where tighter monetary policy leads to reduced bank lending, thus constraining economic activity. Additionally, Within small, open economies, the exchange rate channel plays a vital role; monetary tightening typically leads to currency appreciation, which can suppress export-driven growth (Ridhwana, 2014).In the case of Nigeria, monetary policy has consistently been a key instrument for achieving macroeconomic goals such as employment generation, economic development, Macroeconomic price steadiness and external payment balance. Yet, despite heightened reliance on monetary interventions, Nigeria continues to grapple with persistent economic challenges. High unemployment, low investment levels, soaring inflation, and exchange rate volatility continue to hamper the country's growth prospects (Nwoko, 2016). These issues are further compounded by a sluggish and erratic growth trajectory, declining productivity, and structural deficiencies, all of which are characteristic of a developing economy burdened by debt and uncertainty.

Empirical studies.

One of the primary macroeconomic goals for policymakers in developing countries is achieving sustainable economic growth, which is typically supported by maintaining low inflation levels. Extensive economic literature, including Fischer (1993), consistently highlights that persistently high inflation rates adversely affect economic growth. Conversely, The correlation between low inflation rates and robust Economic performance has been on the rise shown to have a positive impact. (De Gregorio, 1992), (Khan, 2000).

(Darrat, 1985) An empirical investigation was carried out on inflation levels in Nigeria, Libya, and Saudi Arabia, with a focus on the role of money as a central factor in identifying the sources and forms of inflation within these countries. The analysis revealed that rising money supply, coupled with sluggish growth in real income, is closely linked to increased inflationary pressures in these economies.

Chimobi (2010) This study employed both the cointegration technique and the Granger causality framework to explore the dynamic relationship between inflation and economic growth in Nigeria.

The empirical results revealed no evidence of a long-run cointegrated relationship between the two variables over the period examined. To further substantiate this finding, the Granger causality test was conducted at the second and fourth lag intervals, revealing a unidirectional causality from inflation to economic growth. Based on these results, Chimobi asserted that elevated inflation does not promote economic growth; rather, it exerts a deleterious effect on economic performance.

2.0 MATERIALS AND METHODS

2.1 Materials

A range of software tools will be utilized to clean data, conduct statistical evaluations, and build predictive models. In the preliminary phase, Microsoft Excel 2016 will serve as the platform for organizing the raw data. During this stage, the data will be systematically arranged and sorted to ensure it is properly structured for further analysis. Once the dataset is prepared in Excel, it will then be imported into **Eviews 12 student version**. Eviews will be used for detailed analysis, including stationarity test of the time series data and checking there co-integration the macroeconomics variables will serve as unique identifiers to determine the change in the variables over time of collection. The statistical modeling will employ **a** Vector Autoregressive and Autoregressive Distributed Lag Approach**,** implemented using Eviews libraries.

2.2 Vector Autoregressive model

The Vector Autoregression (VAR) model is developed based on the statistical characteristics of time series data. Every endogenous variable is regressed on its own lags and the lags of all other endogenous variables, thereby generalizing the concept of a univariate autoregressive model to a multivariate framework. This multivariate extension allows for the analysis of multiple time series variables simultaneously. The VAR approach was introduced into the field of economics by C. A. Sims in 1980, which significantly advanced the use of dynamic modeling in economic analysis. The VAR model of order *p*, denoted as VAR(p), is mathematically expressed as follows:

:

$$y_t = \alpha + \sum_{i=1}^{k} \phi_1 y_{t-1} + \sum_{i=1}^{k} \phi_2 y_{t-2} + . . . + \sum_{i=1}^{k} \phi_p y_{t-p} + u_t \qquad (2.1)$$

for t= 1,2, … T

y_t Is the column vector of observation variables at time (t), ϕ_i For i=1, 2 . . . p are fixed (K x K) coefficients for lagged values, α_i is a fixed intercept term, U_t is white noise, P is a positive integer of the lag order, t is the total number of samples.

The above equation can be write as

$$INF_t = \alpha_1 + \sum_{i=1}^{k} \phi_1 INF_{t-1} + \sum_{i=1}^{k} \phi_2 MPR_{t-2} + \sum_{i=1}^{k} \phi_3 EXR_{t-3} + \sum_{i=1}^{k} \phi_4 TBR_{t-4} + \sum_{i=1}^{k} \phi_5 M2_{t-5} + u_{1t} \qquad (2.2)$$

$$EXR_t = \alpha_2 + \sum_{i=1}^{k} \phi_1 INF_{t-1} + \sum_{i=1}^{k} \phi_2 INT_{t-2} + \sum_{i=1}^{k} \phi_3 EXR_{t-3} + \sum_{i=1}^{k} \phi_4 TBR_{t-4} + \sum_{i=1}^{k} \phi_5 M2_{t-5} + u_{2t} \qquad (2.3)$$

2.3 Autoregressive Distributed Lag Model

The ARDL method is well-suited for estimating Dynamic (short-run) and stable (long-run) interactions, especially when dealing with small sample sizes. It relies on the Ordinary Least Squares (OLS) technique to establish co-integration among variables. (Duasa 2007).

The generalized ARDL (p, q) model is specified as:

$$Y_t = \gamma_o + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=0}^{q} \beta_i X_{t-i} + \varepsilon_{it} \quad (2.4)$$

i= 1 … k;

P, q are the optimal lag orders of the observation variables and explanatory variable,Y_t = is a vector of the observation variables at time (t), X_t = are the explanatory variables that are allow to be purely I(0) or I(1) or co-integrated, β and δ = are coefficient, γ = is the constant, ε_{it} = is a vector of the error term or A white noise vector process (where observations are serially uncorrelated or independent).

The above ARDL model is express as follow to illustrate our model ARDL (p,q_1, q_2, q_3, q_4)

$$INF_t = \gamma_o + \sum_{i=1}^{p} \delta_i INF_{t-i} + \sum_{i=0}^{q} \beta_{i1} INT_{t-i} + \sum_{i=0}^{q} \beta_{i2} EXR_{t-i} + \sum_{i=0}^{q} \beta_{i3} TBR_{t-i} + \sum_{i=0}^{q} \beta_{i4} M2_{t-i} + \varepsilon_{it} \quad (2.5)$$

$$EXG_t = \gamma_o + \sum_{i=1}^{p} \delta_i EXG_{t-i} + \sum_{i=0}^{q} \beta_{i1} INT_{t-i} + \sum_{i=0}^{q} \beta_{i2} EXR_{t-i} + \sum_{i=0}^{q} \beta_{i3} TBR_{t-i} + \sum_{i=0}^{q} \beta_{i4} M2_{t-i} + \varepsilon_{it} \quad (2.6)$$

2.4 Lag Selection

To run a VAR and ARDL model there is need to choose the proper lag order with lag length determined through commonly used information criteria, including AIC and the Schwarz Criterion

2.5 Unit Root Test

Before proceeding to the empirical analysis, it is essential to perform pre-estimation diagnostic tests to examine the time series characteristics of the data—particularly through descriptive statistics and unit root testing. This study utilizes the Augmented Dickey-Fuller (ADF) test to assess the stationarity of the selected variables, and it is expressed as follows:

$$\Delta y_t = u + \beta t + \alpha y_{t-1} + \sum_{i=1}^{k} C_t \Delta y_{t-i} + \varepsilon \quad (2.7)$$

2.6 Co-integration Test

Co-integration refers to the presence of a long-term Stable long-term relationship between the time series variables. evidence obtained from the unit root test determines whether the co-integration procedure can be applied, which is only possible if all the variables are either stationary at level or integrated of the same order (i.e., all non-stationary).

it is given as.

$$\Delta Y_t = Y_{t-1} + \sum_{i=1}^{k-1} \Delta Y_{t-1} + \varepsilon_t \quad (2.8)$$

H_0: There is no co-integration among the variables

H_1: There is co-integration among the variables

2.7 ARDL Bound Test of Co-Integration

This ARDL cointegration approach was created by (Pesaran, 1999). This approach offers three key advantages over traditional co-integration methods. Firstly, it does not require that all variables included in the analysis Should be integrated of the same order. This method can be utilized whether the underlying variables are integrated of order I(1), I(0), or a mix of both. For the execution of the bounds test procedure for co-integration, the conditional ARDL model—denoted as ARDL(p, q_1, q_2, q_3, q_4) for a system involving five variables—is specified as follows:

$$lnINF_t = a_{oi} + b_{1i}inINF_{t-i} + b_{2i}lnINT_{t-i} + b_{3i}lnEXR_{t-1} + b_{4i}lnTBR_{t-i} + b_{5i}lnM2_{t-1} + \sum_{i=1}^{p}\delta_i\, lnINF_{t-i} + \sum_{i=0}^{q}\beta_{1i}\, lnINT_{t-i} + \sum_{i=0}^{q}\beta_{2i}\, lnEXR_{t-i} + \sum_{i=0}^{q}\beta_{3i} ln\, TBR_{t-i} + \sum_{i=0}^{q}\beta_{4i}\, lnM2_{t-i} + \varepsilon_{it}$$

If there is co-integration, the error correction model (ECM) representation is specified as;

$$INF_t = \gamma_o + \sum_{i=1}^{p}\delta_i\, INF_{t-i} + \sum_{i=0}^{q}\beta_{i1}\, INT_{t-i} + \sum_{i=0}^{q}\beta_{i2}\, EXR_{t-i} + \sum_{i=0}^{q}\beta_{i3}\, TBR_{t-i} + \sum_{i=0}^{q}\beta_{i4}\, M2_{t-i} + \varphi ECT_{t-1} + \varepsilon_{it}$$

2.8 Granger Causuality

The Granger Causality test is employed to determine whether one variable can be used to forecast another. This test will help identify whether there is a unidirectional, bidirectional, or the lack of any causal connection between monetary policy, inflation, and the other selected variables in the study. The model can be expressed as follows:

$$y_t = \alpha_1 + \sum_{i=1}^{n}\beta i\, x_{t-1} + \sum_{j=1}^{m}\gamma j\, y_{t-1\,j} + e_{1t} \quad (2.9.1)$$

$$x_t = \alpha_2 + \sum_{i=1}^{n}\theta i\, y_{t-1} + \sum_{j=1}^{m}\delta j\, x_{t-1} + e_{2t} \quad (2.9.2)$$

H_0: monetary policy does not granger cause Inflation
H_1: monetary policy granger causes Inflation
Decision Rule: The null hypothesis will be rejected if the p-value is less than 0.1 and the F-statistic exceeds 3.

2.9 Data Source and Description

The data used in this thesis consists of secondary quarterly data extending from the first quarter of 1999 to the fourth quarter of 2023. It was sourced from the Central Bank of Nigeria's 2023 Statistical Bulletin and includes variables such as inflation, monetary rate decisions, Treasury bill yields, the exchange rate, and the money stock for the empirical analysis.

3.0 RESULTS AND DISCUSSIONS

3.1 Descriptive Statistics of the macroeconomic variables

Table 3.1: Descriptive Statistics on the Variables

Metric	EXG	INF	M2	MPR	TBR
Mean	212.7147	12.9248	16635.77	12.9644	12.8176

Median	153.85	12.275	12515	13	13.34
Maximum	843.79	28.15	78831.12	20.5	18.98
Minimum	86.32	0.58	609.0302	6	6.13
Std. Dev.	135.793	5.221976	16521.35	3.375978	3.702234
Probability	0	0.234511	0	0.961667	0.172111
Sum	21271.47	1292.48	1663577	1296.44	1281.76
Sum Sq. Dev.	1825534	2699.634	2.70E+10	1128.325	1356.947
Observations	100	100	100	100	100

3.2 Lag Order Specification

Table 3.2: show the VAR Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2209.800	NA	5.60e+14	48.14783	48.28489	48.20315
1	-1747.222	864.8208	4.14e+10	38.63526	39.45758	38.96715
2	-1679.663	118.9630*	1.65e+10*	37.71006*	39.21765*	38.31853*
3	-1664.999	24.22735	2.09e+10	37.93475	40.12761	38.81981
4	-1648.527	25.42429	2.57e+10	38.12014	40.99827	39.28178
5	-1623.289	36.21076	2.66e+10	38.11497	41.67837	39.55319
6	-1608.669	19.38649	3.53e+10	38.34064	42.58931	40.05544
7	-1585.257	28.50161	3.98e+10	38.37516	43.30910	40.36654
8	-1568.146	18.97181	5.30e+10	38.54664	44.16585	40.81460

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

According to Akaike information criterion and Schwarz information criterion the model will use two lags for its variables.

3.3 The result of ADF unit root test

Table 3.3: Unit Root Test

	LEVEL		FIRST DIFF		
VARIABLE	**t-stats**	**Prob**	**t-stats**	**Prob**	**ORDER**

EXG	2.91646	1	-6.0225	0.00001	I(1)
INF	-1.6788	0.4387	-7.4465	0.00001	I(1)
M2	1.02806	0.9966	-5.718	0.00001	I(1)
MPR	-1.9003	0.331	-9.42	0.00001	I(1)
TBR	-2.4368	0.1344	-10.487	0.00001	I(1)

3.4 Co-Integration Test

Table 3.4: show the Co-integration test result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.345139	94.87848	69.81889	0.0002
At most 1 *	0.257244	53.81521	47.85613	0.0124
At most 2	0.149684	24.96862	29.79707	0.1626
At most 3	0.062003	9.240306	15.49471	0.3436
At most 4	0.030769	3.031450	3.841465	0.0817

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.345139	41.06327	33.87687	0.0059
At most 1 *	0.257244	28.84659	27.58434	0.0343
At most 2	0.149684	15.72832	21.13162	0.2411
At most 3	0.062003	6.208856	14.26460	0.5865
At most 4	0.030769	3.031450	3.841465	0.0817

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

3.5 Vector Error Correction Model

Table 3.5: Vector Auto Regressive Model

Error Correction:	D(INF)	D(EXG)	D(M2)	D(MPR)	D(TBR)
CointEq1	-0.021238	0.369102	-57.68392	-0.008246	-0.026775
	(0.02194)	(0.14416)	(9.72479)	(0.01125)	(0.01441)
	[-0.96813]	[2.56036]	[-5.93163]	[-0.73320]	[-1.85755]
D(INF(-1))	0.134993	0.240716	-4.963867	0.114383	0.042463
	(0.10174)	(0.66858)	(45.1014)	(0.05216)	(0.06685)
	[1.32685]	[0.36004]	[-0.11006]	[2.19285]	[0.63520]
D(EXG(-1))	0.002876	0.351951	28.94368	-0.004832	-0.004644
	(0.01074)	(0.07061)	(4.76289)	(0.00551)	(0.00706)
	[0.26770]	[4.98478]	[6.07691]	[-0.87723]	[-0.65779]
D(M2(-1))	0.000110	0.017960	-0.240623	6.11E-05	-0.000234
	(0.00025)	(0.00167)	(0.11252)	(0.00013)	(0.00017)
	[0.43508]	[10.7673]	[-2.13844]	[0.46932]	[-1.40563]
D(MPR(-1))	0.062569	1.279104	19.10371	-0.016848	0.009213
	(0.21199)	(1.39310)	(93.9757)	(0.10869)	(0.13929)
	[0.29515]	[0.91817]	[0.20328]	[-0.15501]	[0.06614]
D(TBR(-1))	-0.173367	-2.120320	23.05299	0.050458	-0.040585
	(0.16591)	(1.09030)	(73.5495)	(0.08506)	(0.10902)
	[-1.04494]	[-1.94472]	[0.31344]	[0.59318]	[-0.37228]
C	0.064677	-6.908961	759.7881	-0.013316	0.146572
	(0.32546)	(2.13874)	(144.276)	(0.16686)	(0.21385)
	[0.19873]	[-3.23038]	[5.26622]	[-0.07980]	[0.68540]
R-squared	0.078105	0.677311	0.614542	0.071086	0.048189
Adj. R-squared	0.017321	0.656035	0.589127	0.009839	-0.014567
Sum sq. resids	611.7044	26416.58	1.20E+08	160.7945	264.0985
S.E. equation	2.592687	17.03796	1149.350	1.329275	1.703579
F-statistic	1.284961	31.83418	24.18046	1.160637	0.767874
Log likelihood	-228.7888	-413.2982	-826.0260	-163.3188	-187.6324
Akaike AIC	4.812016	8.577514	17.00053	3.475894	3.972089
Schwarz SC	4.996656	8.762154	17.18517	3.660535	4.156729
Mean dependent	0.181020	7.658571	797.9203	0.005510	-0.035918
S.D. dependent	2.615437	29.05094	1793.076	1.335863	1.691305

VECM

- The error correction terms in the short-run models (e.g., D(INF), D(EXG), etc.) indicate The rate at which deviations from the long-run equilibrium-term equilibrium are corrected.
- For D(INF): The coefficient of CointEq1 is -0.0212, meaning only 2.12% of the disequilibrium is corrected in each period, reflecting a slow adjustment to long-term equilibrium.
- For D(EXG): The coefficient is 0.3691, suggesting that deviations in the exchange rate return to equilibrium more rapidly.
- For D(M2), D(MPR), and D(TBR): Negative coefficients show that these variables also adjust toward the long-term equilibrium, though the rates of adjustment vary.

Short-Run Dynamics:

- The lagged differences (e.g., D(INF(-1))) capture short-term dynamics:

- **D(INF(-1))**: The lag of inflation Shows a positive direction of impact, though not statistically significant its own changes (t-statistic = 1.33).
- **D(EXG(-1))**: Past Variations in the exchange rate significantly impact inflation (t-statistic = 4.98).
- **D(M2(-1))**: The short-term The relationship between money supply and inflation is not statistically significant but it has a notable effect on D(EXG).
- **D(MPR(-1))** and **D(TBR(-1))**: The short-term effects of these variables on inflation are generally insignificant.

3.6 ARDL Bounds Tests for Co-integration

Table 3.6 ARDL Bounds Test of co-integration

TEST STATISTIC	VALUE	K
F-statistics	4.692724	4
Critical value Bounds		
Significance	I(O) BOUND	I(1) BOUND
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

The result from Table 3.6 shows that the F-statistic value = 16.65744 Is higher than the upper critical bound values (I(1) = 3.09, 3.49, 3.87,4.37) at all the significance levels (10%, 5%, 2.5% and 1%), and thus, it was concluded that there exists a unique long-run relationship among the variables.

3.7 ARDL ERROR CORRECTION MODEL

TABLE 3.7.1 show the result for ARDL ECM for inflation

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	0.310097	0.091879	3.375070	0.0011
CointEq(-1)*	-0.387052	0.071018	-5.450082	0.0000

R-squared	0.252267	Mean dependent var	0.181020
Adjusted R-squared	0.244478	S.D. dependent var	2.615437
S.E. of regression	2.273358	Akaike info criterion	4.500590
Sum squared resid	496.1431	Schwarz criterion	4.553345
Log likelihood	-218.5289	Hannan-Quinn criter.	4.521928
Durbin-Watson stat	2.081149		

ARDL ECM INF (CointEq(-1)):

- The error correction term's coefficient is **-0.3871** ($p < 0.01$), indicating that approximately 38.71% of the deviation from the long-term equilibrium in inflation is corrected in each quarter.
- This is statistically significant, indicating a relatively quick adjustment to equilibrium.
- THE Lagged inflation (D(INF(-1))): Coefficient = **0.3101** ($t = 3.37$), significant positive effect highlights a stronger short-term impact of past inflation on current inflation compared.

Table 3.7.2 show the results for ARDL ECM for Exchange rate

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXG(-1))	0.377206	0.074601	5.056335	0.0000
D(M2)	0.000353	0.001203	0.293821	0.7696
D(M2(-1))	0.015960	0.001159	13.77222	0.0000
D(MPR)	-2.257491	1.223779	-1.844689	0.0685
D(TBR)	1.671135	0.960069	1.740640	0.0853
D(TBR(-1))	-2.198892	0.942630	-2.332721	0.0220
CointEq(-1)*	-0.195618	0.035935	-5.443665	0.0000

R-squared	0.739442	Mean dependent var	7.658571
Adjusted R-squared	0.722262	S.D. dependent var	29.05094
S.E. of regression	15.31010	Akaike info criterion	8.363651
Sum squared resid	21330.31	Schwarz criterion	8.548292
Log likelihood	-402.8189	Hannan-Quinn criter.	8.438334
Durbin-Watson stat	2.028086		

ARDL ECM EXG (CointEq(-1)):

- Coefficient = **-0.1956**, indicating that about 19.56% Discrepancies from the long-term equilibrium are rectified per quarter.
- This is statistically significant ($t = -5.44$, $p < 0.01$), suggesting a moderate speed of adjustment.

Table 3.7.3 show the results for ARDL ECM for Money supply

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-0.392758	0.163865	-2.396837	0.0186
D(EXG)	3.138788	6.570196	0.477731	0.6340
D(EXG(-1))	26.88947	4.968620	5.411858	0.0000
CointEq(-1)*	0.066124	0.008944	7.392741	0.0000

R-squared	0.635948	Mean dependent var	797.9203
Adjusted R-squared	0.624329	S.D. dependent var	1793.076
S.E. of regression	1099.012	Akaike info criterion	16.88217
Sum squared resid	1.14E+08	Schwarz criterion	16.98768
Log likelihood	-823.2264	Hannan-Quinn criter.	16.92485
Durbin-Watson stat	2.042113		

ARDL ECM M2 (CointEq(-1)):

- Coefficient = **0.0661**, indicating that approximately 6.61% of the disequilibrium in the money supply is corrected in each quarter.
- This is highly significant ($t = 7.39$, $p < 0.01$), confirming that the system adjusts to the long-term equilibrium, albeit at a slow pace.

3.8 Granger Causality Test

Table 3.8 show the Result for granger causuality

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision
EXG does not Granger Cause INF	98	4.37728	0.0152	Reject
M2 does not Granger Cause EXG	98	60.5539	1.E-17	Reject
EXG does not Granger Cause M2	98	19.2482	1.E-07	Reject
M2 does not Granger Cause INF	98	3.80805	0.0257	Reject
INF does not Granger Cause MPR	98	2.94305	0.0576	Reject

Table 3.8 presents the results of the Granger causality analysis. The findings reveal that we fail to accept the null hypothesis for the following relationships at the 5% significance level: EXG does not Granger Cause INF, M2 does not Granger Cause INF, INF does not Granger Cause MPR, M2 does not Granger Cause EXG, and EXG does not Granger Cause M2. However, the opposite hypotheses cannot be rejected. These results suggest the presence of One-way causal relationships between EXG and INF, M2 and INF, and INF and MPR. a bidirectional between M2 and EXG and EXG and M2.

4.0 CONCLUSIONS

The analysis of monetary policy effect on inflation in Nigeria using VAR and ARDL for our data over the past twenty four years reveal Critical understanding of the dynamics of monetary policy and inflation. The study demonstrated higher monetary policy rates, increased money supply, and rising Treasury bill rates contribute to higher inflation.in Nigeria. Additionally, depreciation of the exchange rate contributes to inflationary growth. These findings align with the expectations outlined in economic theory. Specifically, the study revealed that; The ARDL ECM results for INF,EXG and M2 as dependent variable indicate The analysis confirms a robust long-run equilibrium relationship between inflation and its core determinants, as evidenced by the statistically significant error correction term, CointEq(−1), with a coefficient of -0.3871 and a p-value of 0.0000. This underscores the economy's tendency to return to long-term stability following short-term disruptions. Focusing on the exchange rate (EXG), the ECM results further reveal that imbalances from the long-term equilibrium are corrected at an average speed of 19.56% per quarter, reinforcing the presence of long-run convergence. In the short run, past movements in the exchange rate exert the policy had A pronounced and statistically validated effect on inflation money supply dynamics, as shown by the large and statistically significant coefficient of 26.88947. These findings collectively highlight the dual role of exchange rate movements in both short-term monetary fluctuations and long-term price stability offering informed recommendations to policy makers focused on maintain macroeconomic balance. The significant positive error correction term CointEq(−1) 0.066124 with a p-value of 0.0000 confirms stable long-run equilibrium relationship and a slow adjustment speed of 6.61% per quarter back to equilibrium.

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