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EFFECT OF INTEREST RATE ON THE STABILITY OF DEMAND FOR MONEY FUNCTION IN NIGERIA

Gwom, Ayuba Usman Department of Economics, Federal University of Lafia, Nasarawa State, Nigeria

Ilemona Adofu, Ph.D Department of Economics, Federal University of Lafia, Nasarawa State, Nigeria

Alhassan Abdulkareem, Ph. D Department of Economics, Federal University of Lafia, Nasarawa State, Nigeria

Abstract

The study investigated the effect of interest rate on the stability of money demand in Nigeria using annual time series data spanning 1986 to 2022. The study used real broad money demand (M2) as the dependent variable, while Lending Interest Rate (LIR), Monetary Policy Rate (MPR), Public Debt (PDT) and Real Gross Domestic Product (RGDP) as independent variables. The Autoregressive Distributed Lag (ARDL) regression was employed based on the outcome of the unit root tests. The bounds cointegration test revealed the presence of long-run relationship between the dependent and independent variables. The findings showed that in the long-run, lending rate (LIR) had an insignificant negative effect on the stability of real broad money demand in Nigeria, while MPR had an insignificant positive effect on the stability of M_2 money demand. Public debt (PDT) in the long-run had positive and insignificant effect, Real Gross Domestic Product (RGDP) in the long-run RGDP had significant positive effect on the stability of real broad money demand. The results showed that 72.40 percent of the changes in the stability of Money demand was explained by the explanatory variables and the estimated parameters were found to be stable. The study concluded that interest rate is has no significant effect on the stability of money demand function in Nigeria and recommended among others that the operating cost of deposit money banks should be reduced, and Central Bank of Nigeria should maintain a stable baseline interest rate in order to ensure stability in the demand for money function in Nigeria.

Keywords: Interest Rate, Monetary Policy Rate, RGDP, Public Debt, Demand for Money

1. Introduction

Interest rate plays important role in the transmission mechanism between the goods and money sectors of the economy and have a significant impact on various financial decisions such as investing, saving and money demand. Changes in interest rate can have a major effect on the economy and can influence consumer spending, business investment, and overall economic. Onakoya and Yakubu (2016) argued that interest rate reflects the time value of money or the principle that people would rather have money in the current period than in the future which will also depend on the general price level. Ezeaku, Ibe, Ugwuanyi, Modebe and Agbaeze (2018) asserted that in the classical theory, transmission mechanism reacts directly and indirectly. The direct mechanism is based on the demand for and supply of money, whereas the indirect mechanism has linkage with the banking system and operates through money and interest rate. The interest rate as a monetary policy tool facilitates the flow of funds from lenders to borrowers as it helps financial entities like money deposit banks to carry out their intermediation role. Models of international interest rate transmission typically emphasize exchange rate channels, trade channels, and financial channels as key determinants of the response of foreign economies to changes in interest

rates in another country.

Globally, interest seems to be stable in developed economies, a situation that could be attributed to the developed nature of their financial services and resources in these economies as well as the ability of the monetary authorities in those countries to effectively play their supervisory roles. The primary interest rate controlled by the Federal Reserve is the federal funds rate, which influences the interest rates throughout the economy. They reported that following the 2008 financial crisis, the Federal Reserve kept interest rates at historically low levels for an extended period to support economic recovery. This means that low rates can stimulate borrowing or increase in money demand, while high rates can act as a brake on economic activity. Alade (2015) reported that in countries like Australia, Canada, Chile, United Kingdom, Israel and South Africa the traditional interest rate is been identified as the most relevant channel of monetary policy transmission mechanism.

Prior to Structural Adjustment Programme (SAP) in 1986, interest rate in Nigeria was generally fixed by the CBN with periodic adjustments depending on the government sectoral priorities. Ojima and Fabian (2015) observed that on 31st July 1987, the CBN deregulated interest rate such that interest rate became market-driven where the forces of demand and supply determined interest rate level. This came about as a result of economic shocks of the 1980s and the financial repression which manifested through indiscriminate distortions of financial prices, interest rate inclusive. The basic assumption of the deregulated interest rate is that it makes loanable funds available to investors thereby reducing price distortion, leading to an increase in money demand. In a policy reversal of 1994, measures of regulation of interest rate management were re-introduced due to the perceived high rate of interest under the regulation of interest rate regime.

In Nigeria, the Monetary Policy Rate (MPR) is adopted as the operating instrument for monetary policy. The MPR has been one of the monetary policy tools employed by CBN in setting targets and directions of other rates (Aliyu, Saidu, Zubair & Dawood, 2017). The Central Bank of Nigeria uses the monetary policy rate to influence the movement of other rates of interest in the country. Hence, Awopegba, Afolabi, Adeoye and Akpokodje (2022) opined that the MPR is expected to communicate the decision of the Monetary Policy Committee and act as an anchor to other interest rates. Ojima and Fabian (2015) reported that as from 2004, the monetary policy committee of the Central Bank of Nigeria fixes the rates depending on performance of the economy. They stated further that in 2013, the lending rate was 17.10% while the monetary policy rate was 12% and saving rate 2.39% respectively. Akpunonu and Orajaka (2021) noted that recent statistics show that monetary policy rate for Nigeria has remained at 14% since July 2016, but it was reviewed downward by the Central Bank of Nigeria to 13.5% in March, 2019.

The stability of the money demand function primarily assesses the degree to which the relationship between the demand for money and its determinants remains consistent over time. The role of the interest rate in the determination of stability in the demand for money function in Nigeria dated back to the 1970s, in what is known as the *TATOO* debate, an acronym for Tomori (1972), Ajayi (1974), Teriba (1974), Ojo (1974) and Odama (1974), who were the economists that pioneered the debate on money demand, its determinants and stability issues. The debate drew a lot of attention in both academic and policy circles at that time and earned the acronym *TATOO* debate (Okafor, 2021). Since then, new entrants into the discussion have tended to build on the pioneering works of these great Nigerian scholars. The TATOO debate aimed at finding out the most appropriate definition of demand for money; the significance of income in the determination of the demand for money, and the stability of the demand for money function in Nigeria. According to Okafor (2021), while Tomori (1972) found interest rate and real income as major determinants of demand for money and concluded that the narrow measure of money demand (M1) is the most appropriate definition of money demand, Teriba (1974) on the other hand found long-term interest rate as a significant determinant of money demand function and M1 demand function was unstable due to instability. On the issue of income, in line with Tomori's assertion, Teriba and almost all the other scholars agreed that income is

the most significant determinant of money demand in Nigeria.

According to Okafor (2021), broad money (M2) grew by 6.52 per cent in October 2018 over its level at the end-December 2017; and annualized to a growth rate of 7.82 per cent, which was below the provisional benchmark of 10.48 per cent for 2018.These statistics suggest the existence of instability in broad money demand, and since the interest rate fundamentals have also changed over time, the relationship between interest rate and money demand as well as the level of its stability need to be examined. The instability in the money demand function calls into question whether available theories and empirical analyses are adequate. Scholars like (Manasseh, Nwakoh & Abada,2020, Jonathan & Bobola, 2020; Tule, Okpanachi, Ogiji & Usman,2018) among others conducted studies that captured the role of interest in the determination of money demand in Nigeria. Despite the availability of empirical studies on monetary policy rate and demand for money related variables, the absence of any consensus on role of interest rate and persistent instability in the interest rate due to changes in the Monetary Policy Rate (MPR) and other unresolved methodological issues have engendered renewed concern in the debate.

More so, the TATOO debate was associated with a period of low debt profile, the Nigeria debt profile has been on the increase both in its numerical figures and cost measured in terms of interest paid on such debts over time; hence the need to assess its effect on the stability of money demand function. Furthermore, though previous studies found income to be significant determinants of money demand in Nigeria, the emergence of economic recessions of 2016 and 2020 suggest the need for renewed empirical studies to validate earlier findings on the role of income in the determination of stability of demand for money function. Also, the proponents of the TATOO debate failed to use the Autoregressive Distributed Lag (ARDL) technique that takes care of autoregressive properties of monetary variables. Amidst these unresolves issues, the study evaluated the effect of interest rate on the stability of money demand function in Nigeria spanning 1986 to 2022.

2. Literature Review

2.1 Theoretical Framework

The study adopts the Keynesians theory of demand for money. The Keynesians theory was developed by Keynes (1936). The Keynesians theory faulted the classical view that the velocity of money was constant and developed a theory that placed emphasis on the role of interest rates in the determination of money demand. The income motive is the demand for money to bridge the gap or interval between the time income is received and when it is disbursed or spent. Therefore, if the interval is small, less cash will be held or a decrease in the demand for money by people for current transactions and verse and versa. The business motive for holding money on the other hand is meant to bridge the interval between the time business costs are incurred and period of receiving the proceeds from sales. The most important changes brought to the demand for money debate by Keynes is the speculative demand for money which is interest bearing in nature. Keynes posited that money held for speculative purposes is simply a liquid store of value since it is possible for the holder to invest such amount of money in interest bearing bonds or securities. This also implies that the demand for money for speculative purposes depend on changes in bond prices and the rate of interest. Keynes demand for money function takes the form:

$$M^d = f(Y, r) \quad (1)$$

Where M^d is the demand for money for transaction, precaution and speculation, y income level and r is the rate of interest. Ordinarily, when the interest rate is high, people would be encouraged to divert their transaction balances into securities like bonds which mean the speculative demand for money will increase. Accordingly, Keynesian speculative demand is predicated on the assumption that there is an inverse relationship between money demand and the rate of interest. The basic principle in the light of this assumption is that the value of money is in its purchasing power; hence money demand is the demand for its real rather than its nominal value that is associated with money illusion. The relevance of the

Keynesians theory to the present study could be viewed from the fact that in Nigeria, money is demanded for both transactions, precautionary and speculative purposes. Furthermore, the interest rate serves as the transmission mechanism that influences the choice between liquid and assets holding decisions.

2.2 Empirical Review

The role relationship between interest rate and stability of demand for money demand has attracted the attention of scholars in extant literature, yet the findings from these studies differ due to factors such choice of variables, data used and other methodological issues among others.

Humbatova and Ramazanova (2022) investigated the determinants of demand for money and its stability in Azerbaijan using monthly time series data spanning from January 2006 to November 2020. Vector Error Correction Model (VECM) and Impulse Response Function were employed to investigate the relationship between real money demand (M1), and macroeconomic variables, namely income, inflation, interest rate and exchange rate. The study found a long-run relationship between the variables and the VECM results showed that the demand for real money balances is positively related to income but it responds inversely to inflation, interest rate and exchange rate. Impulse Response Function confirms the result of VECM. The study also revealed that real money demand function is stable over the observed period.

Swaray (2022) investigated the stability of the money demand function that justifies the adoption of the monetary aggregate targeting framework by the Bank of Sierra Leone using quarterly data spanning from 2002 to 2018. The study used the ARDL regression technique. The results showed high income elasticity of money demand when narrow money was used and the long-run estimates revealed that the money demand function was stable.

Awopegba, Afolabi, Adeoye and Akpokodje (2022) examined the effect of monetary policy rate (MPR) on market interest rates in Nigeria using monthly data from 2002:M1 to 2019:M12. The study used the short-term interest rate (SINT) as a proxy for deposit rate and lending interest rate (LINT) lending rate. The nonlinear autoregressive distributed lag (NARDL) and threshold regression models were employed. The results of the threshold regression model revealed that the degree of the effect of MPR on SINT and LINT were above the estimated threshold of 11 and 13 percent respectively and is greater and significant than if MPR were to be below the threshold. The nonlinear ARDL model revealed that increasing MPR induces a positive effect on short-term and lending interest rates, while a negative effect holds if MPR is decreased.

Manasseh, Nwakoby, Abada and Okanya (2021) studied money demand in Nigeria covering 1981Q1 to 1918Q4.The study used broad money demand as the dependent variable, while interest rate, real exchange rate, income and inflation were the explanatory variables. The ARDL was used to estimate the mode. The findings revealed that the entire variable were cointegrated or had a long-run relationship, with an insignificant short-run adjustment path.

Nkalu (2020) investigated the demand for real money balances in Africa using panel time series data from Nigeria and Ghana between 1970 and 2014 using Panel Two-Stage Estimated Generalized Least Squares, cross-section Seemingly Unrelated Regression model. The results revealed that inflation, real interest rates, and official exchange rates were statistically significant determinants of real money balances.

Jonathan and Bobola (2020) investigated a mathematical relationship between the quantity of money demanded and determinants such as interest rate, income, price level, credit availability and frequency of payments among others. The study used the Vector Autoregressive method (VECM). The findings showed that the demand for money responds to shock in itself, shock in interest rate, shock in credit to private sector, shock in credit to government, and shock in domestic assets.

Ali (2020) assessed the determinants of money demand in Australia by using annual data from 1981 to 2017. The study used Autoregressive distributive lag (ARDL). The result of finding revealed the existence of cointegration between demand for money and its determinants. The findings also revealed that both real

interest rate and real GDP have positive impact on money demand while exchange rate relates negatively on demand for money. It was established that demand for money was insensitive to price, but was found to be stable.

Kayongo, Mukisa and Ukumu (2020) studied the determinants and stability of Uganda's real money demand function during financial liberalization. The study applied the ARDL estimation strategy on Uganda's Monetary Policy. The study used GDP, exchange rate, inflation, interest rate spread and foreign interest rate to explain Uganda's real money demand. The results found the existence of a stable long run money demand function and the error correction term was significant and negative. It was also revealed that financial innovations have not caused structural divergence in Uganda's long run money demand function as would have been expected. Income was significant and close to unity and therefore a good money demand indicator in both the short and long run.

Olaniyi (2019) examined whether there is a threshold above which the effect of the interest rate on economic and investment growth changes in Nigeria over the period 2006-2017. The study employed that threshold estimation technique. The findings showed that the estimated values of the interest rate thresholds were 21.1% for GDP growth and 22.6% for investment growth. The results revealed that interest rate contributes positively to economic growth when it is below 21.1%, but becomes a major concern beyond the 21.1% level and positively to investment growth when it is below 22.6% and becomes a major concern beyond the 22.6% level.

Tule, Okpanachi, Ogiji and Usman (2018) re-examined broad money (M2) demand and its stability in Nigeria using the Autoregressive Distributed Lag (ARDL) bounds testing procedure. The results indicated that a stable long-run relationship exists between M2 and its determinants including GDP, stock prices, foreign interest rates and real exchange rate. It was found that stock prices showed a significant and positive effect on the long-run broad money demand; reflecting increased `financial development and integration of the Nigerian economy into the global economic system. The study concluded that policymakers need to know how monetary policy affects the real economy and whether controlling money matters in achieving macroeconomic goal of stabilizing prices.

Ezeaku, Ibe, Ugwuanyi, Modebe and Agbaeze (2018) investigated the industry effects of monetary policy transmission channels in Nigeria within the period 1981-2014. The Error Correction Model (ECM) technique was employed. The findings from the estimates revealed that the private sector credit, interest rate and exchange rate channels have negative effects on real output growth, both in the long-run and in the short-run. The results also showed that in the Nigerian case, monetary policy transmission channels jointly have a long-run relationship with real output growth of the industrial sector, and disequilibrium in the system is corrected at the speed of 72.2% annually.

3. Methodology

3.1 Nature and Sources of Data

This study used annual time series data on interest rate and real broad money demand, spanning from 1986 to 2022. The choice of 1986 was predicated on the fact that it was the period that the CBN migrated to M2 measure of money demand, while 2022 was selected because it captures two periods of economic recession experienced in Nigeria. Therefore, annual time series data on Broad Money Demand (M2), Monetary Policy Rate (MPR), Lending or nominal Interest Rate (NIR) and Real Gross Domestic Product (RGDP) were sourced from the Central Bank of Nigeria (CBN) Bulletins, while data on Public Debt (PDT) were sourced from the World Development Indicators (WDI) respectively.

Table 1: Definition and Measurement of Variables

SN.	Variable(s)	Definition	Unit of Measurement
1	Real Broad Money demand (M2)	Measure of money demand expressed as a ratio of the price level (M/P) in the economy	Percentage

		multiply by 100	
2	Lending Interest rate	Rate of interest that Deposit Money Banks (DMBs) change for lending money	Percentage
3	Monetary Policy Rate (MPR)	Central Bank of Nigeria baseline interest rate upon which DMB pegged their interest rate	Percentage
4	Public Debt (PDT)	Total debt incurred by the government which consist of domestic and foreign expressed as a percentage of GDP	Percentage
5	Real Gross Domestic Product (RGDP)	Gross domestic Product (GDP) less inflation rate used as a proxy for income	Percentage

Source: Authors Compilation,2023

3.2 Model Specification

The specification of the model follows Keynesians theory of demand for money developed by John M. Keynes (1936). Keynes theory states that money demand is a function of income level (y) and interest rate (r) at a given period of time. In Keynes view, both transactions motive and precautionary motive depends on the scale variable (output) and the speculative motive depend on the opportunity cost variables (interest rate). The Keynesians money demand model is implicitly expressed as follows:

$$M_t^d = f(y, r) \qquad (2)$$

The major departure of Keynes model from the classical quantity theory of money demand is that Keynes model incorporates scale and opportunity cost variables used in defining money demand and its stability issues. The generic specification of the Autoregressive Distributed lag (ARDL) regression model showing both its short-run and long-run relationship is expressed as follows:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \beta_3 Z_{t-1} + \sum_{i=0}^{p} \lambda_i \Delta Y_{t-i} + \sum_{i=0}^{q} \psi_j \Delta X_{t-i} + \sum_{i=0}^{q} \phi_j \Delta Z_{t-i} + \varepsilon_t \qquad (3)$$

The ARDL model in equation 3 shows that the current value of variables depends on its own lag value and the lag values of X, Y, and Z used as explanatory variables. Therefore, building from theoretical Keynesians money demand function, the implicit specification of the relationship between the explanatory variables of interest rate and broad stability of money demand function in Nigeria is expressed as:

$$M_2 = f(LIR, MPR, PDT, RGDP) \qquad (4)$$

The explicit form of the Autoregressive Distributed Lag (ADRL) regression method adopts the model used in the empirical study of Nwude *et'al.*,(2018),with modification of variables and the study period. The long-run explicit specification of the original Model of the scholars is expressed as follows:

$$LogM/P = a_0 + a_1 \log RGDP_t + a_2 LogDIR_t + a_3 LogINF_t + a_4 LogEX_t + a_5 LogFIR_t + U_t \qquad (5)$$

Where, log = natural logarithm, α_0 = intercept term, M = nominal M2 money stock, P = domestic price level proxied by implicit price deflator, M2/P = real M2 money balances, RGDP = real income as a measured of scale variable proxied by real GDP, DIR = domestic interest rate proxied by the monetary policy rate (MPR). The MPR serves as an indicator for the rate for transaction in the money market as well as other deposit money banks retail interest rate (Operating target), INF represents inflation rate, EX denotes expected exchange rate proxied by the Nigerian naira/US dollar exchange rates, FIR proxy for foreign interest rate proxied by US 3-month treasury bill rates, U is the error term and t denotes current period.

3.3 Model Estimation Technique

The study adopts the Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran *et'al.*, (2001). The ARDL technique was used because of the many advantages it enjoys over other co-integration techniques. The merits of the method include; it can be applied for a small sample size; ARDL method is relieved of the order of integration amongst variables in such a way that it incorporates both the $I(0)$and $I(1)$variables; it can be used to estimate the short-run and long-run dynamic relationships in the demand for money functions simultaneously; the ARDL method distinguishes between dependent and explanatory variables and allows for the testing of the existence of a long run relationship between the variables; and the method can be applied even when the variables have differing optimal number of lags (Kayongo, Mukisa & Okumu,2020) Based on the explanatory variables as specified in equation 3 and the empirical model in equation 5, the modified ARDL in its explicit form takes the form:

$$\Delta M_{2t} = \beta_0 + \beta_1 M_{2\,t-i} + \beta_2 LIR_{t-i} + \beta_3 MPR_{t-i} + \beta_4 PDT_{t-i} + \beta_5 RGDP_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta M_{2t-i}$$

$$+ \sum_{i=0}^{p} \psi_j \Delta LIR_{t-i} + \sum_{i=0}^{p} \phi_j \Delta MPR_{t-i} + \sum_{i=0}^{p} \theta_j \Delta PDT_{t-i} + \sum_{i=0}^{p} \delta_j \Delta RGDP_{t-i} + \varepsilon_t \qquad (6)$$

Where; M_2 is Broad Money Demand, LIR is the Lending interest rate, MPR denotes Monetary Policy Rate, PDT is the total Public Debt, RGDP represents Real Gross Domestic Product, a proxy for income and t = Time period. The dynamic ARDL Error Correction Model (ARDL-ECM) form of equation 7 takes the following form:

$$\Delta M_{2t} = \beta_0 + \beta_1 M_{2\,t-i} + \beta_2 LIR_{t-i} + \beta_3 MPR_{t-i} + \beta_4 PDT_{t-i} + \beta_5 RGDP_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta M_{2t-i}$$

$$+ \sum_{i=0}^{p} \psi_j \Delta LIR_{t-i} + \sum_{i=0}^{p} \phi_j \Delta MPR_{t-i} + \sum_{i=0}^{p} \theta_j \Delta PDT_{t-i} + \sum_{i=0}^{p} \delta_j \Delta RGDP_{t-i} + \rho_i ECM_{t-1} + \varepsilon_t \qquad (7)$$

The model shows both the short-run and long-run specification and the Error Correction Mechanism (ECM). The Error Correction Model denoted by ECM_{t-1} is a measure of the adjustment path to a long-run equilibrium relationship between the variables, where ρ is a parameter measuring the speed of adjustment or adjustment path from short-run disequilibrium due to a shock to a long-run equilibrium level. Therefore, sign of the ECM_{t-1} must be negative, its coefficient must be less than one and statistically significant to ensure convergence of the dynamics to the long-run equilibrium, p's are the lag length and ε_t is the white noise error term. The *apriori* expectation uses the sign and size of the estimated coefficients of parameters of the explanatory variables of interest rate to either validates or invalidates economic theory regarding how the variables relate.

The estimated coefficients of Monetary Policy Rate (MPR) and Lending Interest Rate (LIR) are expected to be negative, showing an inverse relationship between these opportunity cost variables and stability of money demand function, RGDP as a measure of income is expected to have a positive coefficient showing that money demand is a positive function of income and public debt (PDT) is expected to have a negative coefficient because debts attracts interest that may reduce liquidity preference in the economy. The null hypotheses to tested at 0.05 level based on the ARDL bounds test is expressed as follows: $Ho = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ as against $H_1 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$,where the parameters $\beta_1 - \beta_2$ are the long-run parameter measuring the long-run relationship between the dependent and independent variable, while $\lambda, \varphi, \phi, \theta, \delta$

on the other hand are parameters for the short-run relationship between the variables.

4. Results and Discussion

Table 2: Results of Descriptive Statistics

Variable	M2	LIR	MPR	PDT	RGDP
Mean	22.33543	18.25325	13.93541	37.14779	4.507367
Median	17.78298	17.58562	13.50000	35.21739	4.052034
Maximum	57.78157	29.80000	25.80000	120.8353	14.60438
Minimum	-2.010000	10.50000	6.000000	4.950816	-1.920000
Std. Dev.	15.77567	3.876047	4.695023	30.81344	3.800764
Skewness	0.617667	0.884259	0.982218	0.753918	0.509010
Kurtosis	2.457133	4.373489	4.036193	2.900584	2.885124
Jarque-Bera	2.806999	7.730113	7.604591	3.520321	2.618073
Probability	0.245735	0.020962	0.022319	0.172017	0.445287
Sum	826.4110	675.3702	515.6100	1374.468	166.7726
Sum Sq. Dev.	8959.382	540.8546	793.5567	34180.84	520.0489
Observations	37	37	37	37	37

Source: Author's Computation using E-views 13

The descriptive statistics results revealed that broad money demand (M_2) had an estimated mean of 22.34 percent and standard deviation or mean variability coefficient of 15.78 percent, LIR had a mean of 18.25 percent and standard deviation of 3.89 percent and MPR had a mean of 13.94 percent and standard deviation of 4.70 percent. The results also indicated that PDT had a mean of 37.15 percent and standard deviation of 2.90 percent, while RGDP had a mean of 4.51 percent and standard deviation of 3.80 percent. The results showed that LIR had a higher mean value than MPR, probably because the lending interest rate (LIR) is determined by Deposit Money bank while MPR which is the baseline interest rate upon which other rates of interest are pegged is determined by the Central Bank.

The results revealed that M_2, LIR, MPR, PDT and RGDP were positively skewed which implies that the distribution was tailed to the right. The findings also indicated that the kurtosis for M_2, PDT and RGDP were found to be less than 3, signifying the presence of platykurtic (flat or short-tailed) kurtosis, while LIR and MPR had coefficients that are greater than 3, indicating the presence of leptokurtic (slim or long-tailed) kurtosis. More so, the Jarque-Bera (JB) statistic showed that M_2, PDT and RGDP had its probability value greater than the level of significance ($p>0.05$) ; hence the null hypothesis was accepted and the study concluded that they were normally distributed, while LIR and MPR had p-value less that the level of significance (0.05) and the null hypothesis was rejected, meaning they were not normally distributed.

Table 3: Summary of Unit Root Test Results

Variable	ADF Coefficient	Order of Integration	PP Coefficient	Order of Integration
M_2	-3.501121**	1(1)	-3.486015**	1(1)
	(.0137)		(.0142)	
LIR	-4.171369***	1(1)	-4.416920***	1(1)
	(.0024)		(.0012)	
MPR	-3.035192**	1(1)	-3.184832**	1(1)
	(.0411)		(.0292)	

PDT	-6.090107***	1(1)	-6.161053***	1(1)
	(.0000)		(.0000)	
RGDP	-3.209352**	1(0)	-3.224264**	1(0)
	(.0276)		(.0267)	

*Note: *** implies significant at 1%,** significant at 5%*

Source: Author's Computation using E-views 13

The results of the ADF and PP unit root Tests in Table 3 revealed that M2, LIR, MPR and PDT were integrated at first differenced,1(1), while RGDP was integrated at level,1(0).The results justified the theoretical view that the results of the ADF and PP unit roots are not supposed to be significantly different. This implies that a mixture of 1(0) and 1(1) order of integration was established which justifies the appropriateness of the Autoregressive Distributed Lag (ARDL) regression technique for estimating the model.

Table 4: Results of Bounds Cointegration Test

Test Statistic	Coefficient	Level of Sig.	1(0)	1(1)
F-statistic	4.385383	10%	2.2	3.09
K	4	5%	2.56	3.49
		1%	3.29	4.37

Source: Author's Computation using Eviews 13

The findings in Table 4 revealed that at 4 degrees of freedom (k), the F-statistic for the bounds test had a coefficient of 4.385383. However, the results showed that at 5% level of significant, the coefficient of the lower and upper bounds were 2.56 and 3.49 respectively. Therefore, since the coefficient of the F-statistic was found to be greater than the upper bound, the null hypothesis of no cointegration was rejected. The study concluded that there was cointegration between the dependent and independent variables. In order words, there was a long-run relationship between the explanatory variables of interest rate and stability of broad money demand function. This suggests the need for the estimation of the ARDL Error Correlation Model (ECM) to determine the speed of adjustment from the short-run disequilibrium due a shock to a long-run equilibrium and long-run model.

Table 5: Results of ARDL -ECM and Long-Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.798065	0.133551	-5.975747	0.0000
D(M2(-1))	0.234894	0.153354	1.531709	0.1421
D(M2(-2))	0.881955	0.186933	4.718014	0.0001
D(M2(-3))	0.419698	0.154725	2.712536	0.0138
D(MPR)	3.528784	0.714863	4.936305	0.0001
D(MPR(-1))	0.523401	0.529025	0.989368	0.3349
D(MPR(-2))	-1.404023	0.523115	-2.683965	0.0147
D(MPR(-3))	-2.174951	0.608762	-3.572746	0.0020
D(PDT)	0.453588	0.176537	2.569374	0.0188
D(PDT(-1))	-0.441625	0.166572	-2.651263	0.0158

D(RGDP)	-1.918677	0.701847	-2.733755	0.0132
D(RGDP(-1))	-3.182584	0.707264	-4.499854	0.0002
D(RGDP(-2))	-0.143073	0.606534	-0.235886	0.8160
D(RGDP(-3))	-1.604558	0.604674	-2.653592	0.0157

R-squared	0.836100	Mean dependent var	0.298836
Adjusted R-squared	0.723958	S.D. dependent var	15.21538
S.E. of regression	7.994117	Akaike info criterion	7.291705
Sum squared resid	1214.212	Schwarz criterion	7.926587
Log likelihood	-106.3131	Hannan-Quinn criter.	7.505323
F-statistic	7.455713	Durbin-Watson stat	2.243922
Prob(F-statistic)	0.000057		

Long-Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIR	-2.060763	2.203222	-0.935341	0.3655
MPR	3.127267	3.741448	0.835844	0.4173
PDT	0.264047	0.190604	1.385322	0.1876
RGDP	3.765511	1.472930	2.556477	0.0228
C	-9.155071	25.58721	-0.357799	0.7258

Source: Author's Computation using E-views 13

The results of the ARDL-ECM regression in Table 5 revealed that COINTEQ* had a coefficient of -0.798065 and probability value of 0. 0000. This estimated coefficient met the three basic conditions for judging the adjustment path whenever cointegration has been established in a model. That is, the coefficient is negative, it is less than one and is statistically significant using the 0.05 rule of thumb. This implies that 79.81 percent of the short-run disequilibrium will be adjusted to attain equilibrium in the long-run annually, indicating a faster speed of adjustment.

The results of the short-run estimates revealed that $M_2(-1)$ had a coefficient of 0.234894 and p-value of 0.1421 or $p>0.05$; hence the null hypothesis was accepted. The study concluded that the period previous value of broad money demand had an insignificant positive effect on its current value. The results indicated that a percentage increased in broad money demand in the previous period as associated with 0.14 percent increase in broad money demand in the current period. The results also established that $M_2(-2)$ had a coefficient of 0.881955 and p-value of 0.0001 or $p<0.05$, signifying that the null hypothesis was rejected and the conclusion is that two lag periods of M_2 had significant positive effect on the current value of M_2. Thus, a percentage increased in two lag periods of M_2 led to 0.88 percent increase in M_2. Jonathan and Bobola (2020) found that demand for money responds to shock in itself, shock in interest rate, shock in credit to private sector and shock in credit to government.

In the short-run, MPR had a coefficient of 3.528784 and p-value of 0.0001 or $p<0.05$ which implies that MPR in the current period had significant positive effect on the stability of M_2, such that a percentage increased in MPR was associated by about 3.52 percent increase in the stability of M_2. More so, short-run estimates of PDT had a coefficient of 0.453588 and p-value of 0.0188 or $p<0.05$ signifying that in the short-run, PDT had significant positive effect on the stability of money demand function and that a percentage increased in PDT leads to 0.45 percent

increase in the stability of M_2 in the current period. Furthermore, it was revealed that RGDP in the short-run had a coefficient of -1.918677 and p-value of 0.0132 or p<0.05, indicating that it had significant negative effect on M2. The results revealed that a percentage increased in the current value of RGDP leads to about 1.92 percent decrease in the stability of M_2. Also, Akaike Info criterion (AIC) was found to be the most appropriate information criterion because it had the smallest coefficient of 7.291705 when compared with others. The Durbin Watson (DW) coefficient of 2.243922, which is approximately 2 revealed that the model was free from the problem of serial correlation or the covariance of the error terms was absent. The coefficient of the adjusted R square showed that 72.40 percent of the changes in the dependent variable was due to changes in the explanatory variables of the independent variable. The model was therefore found to be a good-fit of the relationship between the variables.

The long-run estimates showed that lending interest rate (LIR) had a coefficient of -2.060763, p>0.05, which means that the null hypothesis was accepted and the conclusion was that in the long-run, lending interest rate had insignificant negative effect on the stability of M_2. Thus, a percentage increase in LIR leads to 2.06 percent decrease in M_2. Evans and Adjei (2014) found that high lending rates affected borrowers' ability to pay back because they cannot make enough returns from their businesses to service their loans. It was also found that MPR had a coefficient of 3.127267 and p<0.05, indicating that a percentage increase in MPR led to 3.13 percent increase in the stability of M_2. Bakkihs (2023) found a positive and statistically significant relationship between monetary policy rate and interest rate in Nigeria in the short-run. The findings also revealed that PDT had a coefficient of 0.264047 and p>0.05, signifying an insignificant positive effect of PDT on M_2, but that a percentage increase in PDT leads to 0.26 percent increase in the stability of M2, while RGDP had a coefficient of 3.765511 and p<0.05 depicting a significant positive relationship between RGDP and stability of M_2 money demand. Thus, a percentage increase in RGDP leads to 3.77 percent increase in the stability of broad money demand in Nigeria. Adi and Riti (2017) found that real income and inflation rate positively affect demand for money. The results revealed that the coefficients of LIR and RGDP agreed with the *apriori* expectation, while that of MPR and PDT negates the postulations in economic theory.

Table 6: Model Diagnostic Tests Results

Test Statistic (s)	Test	Coefficient	Df.	p-value
Breusch-Godfrey LM Test:	Serial Correlation	0.607688	Prob. F(2,12)	0.5605
Breusch-Pagan-Godfrey:	Heteroskedasticity	0.677300	Prob. F(18,14)	0.7841
Ramsey RESET Test:				
t- statistic	Specification Error	1.130382	13	0.2787
F-statistic		1.277763	(1, 13)	0.2787
Likelihood ratio		3.093880	1	0.0786
F-Statistic	Overall Significance	7.455713		0.000057
Adjusted R Square	Goodness-of-Fit	0.657405		
Jarque-Bera	Normality	0.647498		0.723432

Source: Author's Computation using Eviews 13

The model diagnostic tests results in Table 6 revealed that the Breusch-Godfrey LM test which is an F-statistic for serial correlation had a coefficient of F(2,12=0.607688, p=0.5605), which implies that p>0.05. The null hypothesis was accepted and the study concluded that there was no serial correlation in the estimated model, which also means that the estimated model was not spurious. The Breusch-Pagan-Godfrey F-statistic for heteroscedasticity revealed that F(18,14=0.677300, p=.07841), which means

p>0.05.Also, as a residual test, the null hypothesis was retained and the conclusion drawn was that the estimated model was homoscedastic. That is, it has a constant variance in line with the basic assumption of linear regression analysis.

More so, the Ramsey RESET Test of linearity or model mis-specification found that the probability values of the t-statistic, F-statistic and the Likelihood ratio test respectively are greater than 0.05 (p>0.05). Thus, the null hypothesis of the absence of model mis-specification error or presence of linearity was accepted and the study concluded that the model was correctly specified. The adjusted R square coefficient of 0.723958 implies that about 72.40 percent of the variations or changes in the stability of M_2 was explained by changes or variations in LIR, MPR, PDT and RGDP), while only 29.60 percent of the changes on the other hand was caused by other variables not included in the estimated model, but captured by the error term. The implies that the estimated model was found to be a good-fit of the relationship between the variables if the relationship is plotted on a scattered diagram. The F-Statistic for the test of overall significance of the model revealed that p<0.05, suggesting that the estimated model was found to be significant and reliable for monetary policy formulation and implementation. The normality test results showed that the Jarque-Bera (JB) test had a coefficient of 0.647497 and probability value of 0.723432 or p>0.05. The null hypothesis was accepted and the conclusion drawn is that the distribution was found to be normal. This is further justified by the coefficients of the Skewness and Kurtosis estimated as 0.087855 and 3.663350 that are within the 0 and 3 rule of thumb.

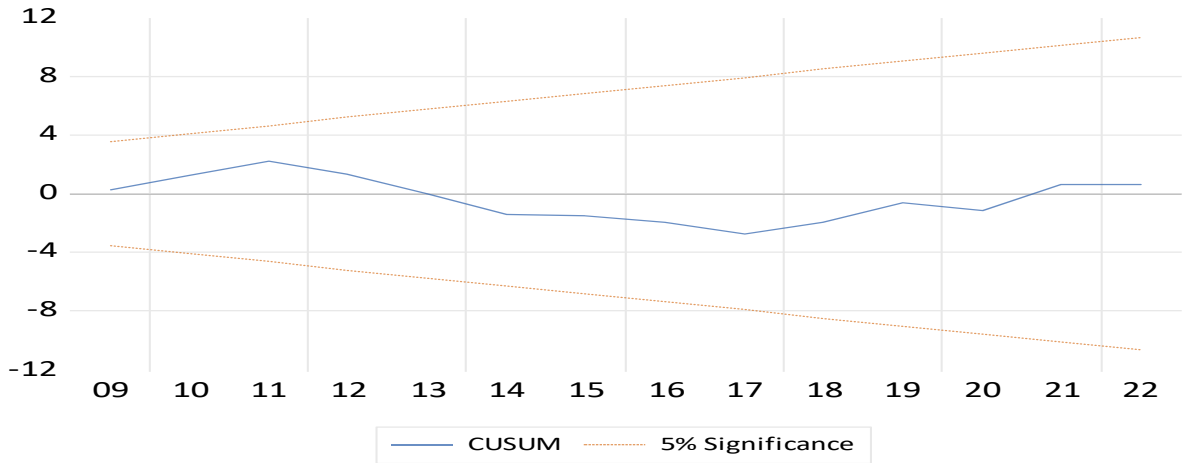

Figure 1: CUSUM Parameter Stability Plot

The results of the CUSUM plots in figure 1 revealed that the estimated parameters were found to be within the 5 percent level of significance. That is, the blue line graph is in-between the two red lines (boundaries), indicating that the estimated parameters were found to be stable within the period. This supports the findings of Ali (2020) who found a stable long-run demand for money function.

4.1 Discussion of Findings

The findings revealed that in the long-run, lending interest had an insignificant negative effect on the stability of real broad money demand in Nigeria. This suggests that in the long-run, an increase in the lending interest rate will leads to an insignificant decrease in the demand for real broad money. Thus, interest rate is not a significant determinant of stability of money demand. Contrary to this finding, Kapingura (2014) found that the coefficient of domestic interest rate is positively related to real money demand, while Ben-Salha and Jaidi (2014) found out that final consumption expenditure and interest rates are the only determinants of money demand in the long run.

The results revealed that in the short-run monetary policy rate (MPR) was found to have a significant positive effect on the stability of real broad money demand, but two lag periods revealed that MPR had an insignificant negative effect on real broad

money demand. Thus, the positive coefficient of MPR could be due to the periodic review of the policy rate by the Monetary Policy Committee of the CBN. This result is consistent with the conclusion of Nwude *et'al.*, (2018) who also found that short-term interest rate exhibits a positive and significant relationship with demand for money. However, in the long-run, MPR was found to have an insignificant positive effect on the stability of real broad money demand (M_2) in Nigeria. Awopegba *et'al.*,(2022) established that MPR induces a positive effect on short-term and lending interest rates and a decrease in MPR had a negative effect on the rate of interest, which suggest an increase in money demand. The results are theoretically consistent, as a decrease in MPR is expected to lead to a decrease in lending interest rate and an increase in money demand.

Furthermore, the results established that current public debt (PDT) in the short-run had significant positive effect on the demand for real broad money, but previous period level of public debt (PDT-1) had significant negative effect on money demand in the short-run. Contrary to this, Alenoghena (2019) found that the fiscal policy variables had a stable long-run equilibrium relationship with money demand in Nigeria. The effect of public debt on the stability of real broad money demand in the long-run was found to be positive and insignificant. Akindipe (2018) posited that domestic debt can have severe implications on the financial system of a country if the increase in the debt discourages financial intermediaries from lending to the private sectors as the ratio of private credit to GDP is a good indicator of financial development. The author argued that where there is an interest rate ceiling, banks will prefer to lend majorly to the government and this will retard the financial development.

Similarly, the results of the analysis showed that Real Gross Domestic Product (RGDP) had an insignificant negative effect on the stability of real broad money demand in the short-run in the current period, but it had significant negative effect on the stability of M_2 in the long-run. Kayongo *et'al.*,(2020) in their study also revealed that income is significant and a good money demand indicator in both the short and long run. The findings revealed that in the long-run, RGDP had significant positive effect on the stability of real broad money demand in Nigeria. That is, an increase in real GDP in the long-run leads to an increase in the stability of real broad money demand. This is quite intuitive since people with higher income are more likely to have greater transactions need; hence the need for them to hold more cash balances. This is consistent with the conclusions of Iyoboyi and Pedro (2013) and Nwude *et'al*., (2018) that real gross domestic product has positive and significant relationship with demand for money. This justifies the theoretical view that money demand is a positive function of income. The findings further revealed that the model was a good-fit of the relationship between interest rate and stability of real broad money demand (M_2) because about 72.40 percent of the changes in M_2 was explained by the explanatory variables. This contradicted the findings of Kapingura (2014) who found the demand for money function to be unstable. The F-Statistics also established that the model was statistically significant at 0.05 level; hence it was found to be reliable and valid for the formulation and implementation of monetary policy on interest and stability of real broad money demand in Nigeria. On stability, the study found that real broad money demand function was stable.

5. Conclusion and Recommendations

The study investigated the effect of interest rate on the real broad money demand in Nigeria. The reviewed of literature revealed that these variables have been widely studied, but there are variations in findings. The findings from this empirical study revealed that lending interest rate (LIR) in the long-run had an insignificant negative effect on the stability of real broad money demand in Nigeria. Also, short-run monetary policy rate (MPR) in the current period was found to have a significant positive effect on the stability of real broad money demand. In the long-run, MPR had an insignificant positive effect on the stability of M2 money demand, while public debt (PDT) in the short-run had significant positive effect on the demand for real broad money. The effect of public debt on real M2 money demand stability in the long-run was found to be positive and insignificant, Real Gross Domestic Product

(RGDP) had an insignificant negative effect on the stability of real broad money demand in the short-run, but had a significant positive effect on the stability of real broad money demand in the long-run. The stability test revealed that the model was stable and the conclusion drawn is study interest rate had insignificant effect on the stability of real broad money demand in Nigeria.

i. The insignificant effect of interest rate on stability of money demand implies that Deposit Money Banks and other financial institutions that lend money to the public should introduce measures that can help in reducing their operating cost to enable them charge lower lending interest rate.
ii. The positive effect of the Monetary Policy Rate (MPR) implies that the Central Bank should maintain a stable baseline interest rate in order to achieve stability in real broad money demand function in Nigeria.
iii. The Central Bank of Nigeria should introduce measures that would improve fiscal discipline by limiting excessive demand for public debt that attract high interest rates in order to promote stability in the real broad money demand function in Nigeria.
iv. The positive long-run effect of the real GDP on money demand suggests the need for government through the Central Bank of Nigeria to diversify the economy by investing more on critical sectors that can help in raising real domestic output and stability in real broad money demand function in Nigeria.

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