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EVALUATING THE MODEL OF DEMAND FOR MONEY IN NIGERIA

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ABSTRACT

In Nigeria, demand for money is frequently affected by factors that regularly experience shocks in the economy. Therefore, regular adjustment and reforms are done to monetary policy which creates a lot of uncertainties in the market. This paper therefore examined the demand for money (narrow money, M1) in Nigeria, using quarterly time series data from 2006 to 2018, the study attempted multiple OLS regression analysis and ARDL. The result found out that money demand function cannot be appropriately estimated by OLS estimation technique due to the presence of the lagged value of both the dependent and independent variables. Although, the no long run relationship among the variables but the result indicates that M1 is largely influenced by inflation, exchange rate, MPR (Monetary Policy Rate), and savings as well as real GDP to some extent; particularly in the short run. It was observed from the analysis that economic units in Nigeria are shedding more of cash assets (Naira) as inflation increases while stocking up on foreign cash and assets (dollar and foreign denominated assets) as shown by the positive-related exchange rate.

Contribution/Originality: This study contributes to the existing literature by examining the demand for money (narrow money, M1) in Nigeria and using quarterly time series data from 2006 to 2018, the study attempted multiple OLS regression analysis and ARDL.

1. INTRODUCTION

1.1. Background to the Study

The subject of demand for money has always generated keen interest among research and theoretical economists in both the developed and developing countries. This high interest stems from the facts that demand for money plays a major role in empirical macroeconomics analysis and policy decision formulations. The interest has, however, heightened in recent years, and may attributable to concerns among central banks and researchers on the economic impact of the movement towards flexible hang rate regime, globalization of capital markets, ongoing domestic financial liberalization, advancement in time series econometrics, and some other country-specific issues. In Nigeria, the monetary authorities acknowledge that a sound specification and estimation of money demand function is essential in the selection of instruments and targets, so also is the fact that the transmission mechanism of monetary policy depends on how correct its specification and estimation. The Central Bank of Nigeria is charged with promoting monetary stability and a sound financial system in Nigeria (Central Bank of Nigeria (CBN), 2018; Research Department Central Bank of Nigeria, 2016). Therefore, in pursuit of its mandate, the monetary policy measures adopted by the Central Bank have direct and/or indirect effects on money demand. Deliberate policy-driven changes in monetary policy tools such as Monetary Policy Rate (MPR), Cash Reserve Requirement (CRR) and other reserve requirements induce fluctuations in interest rates, exchange rates and GDP, which in turn bring about changes in money demand in the economy. However, despite the enormity of the importance of monetary policy instruments as it affect demand for money; there is dearth of literature on the subject matter. Therefore, there is the need to constantly assess the model of demand for money with a view to determine its stability over time as well as its speed of adjustment to monetary policy changes. The study also aimed at creating a background to review the effectiveness of the Central Bank's monetary policies in the context of the overall macroeconomic stability; evaluate the determinants of money demand and their impacts on demand for money in Nigeria. In addition, the study will also provide a basis to advance recommendation in relation to monetary policy framework in the country.

2. LITERATURE REVIEW

2.1. Theoretical Review

Many of the theories on demand for money specify different explanatory variables ranging from inflation, interest rate, transactions, utility, wealth, etc. One important feature of these theories is that they share almost same determinant variables; however, they differ in the specific role and significance attached to each variable. In general, theoretical models of money demand have underpinned and motivated a great deal of empirical work.

The quantity theory examined the relationship between the total quantity of money M and the total amount of spending on final goods and services produced in the economy P×Y, where P is the price level and Y is aggregate output (Busari, 2005). In its basic form, the theory specifies that

$$MV \equiv PT \tag{1}$$

Where M is the quantity of money, V is the velocity of circulation; P is the price levels and T the volume of transactions. Because V cannot be measured empirically, Equation 1 becomes a mere identity. If we assume T moves approximately in tandem with the real GDP (Y), (1) leads to the standard form of quantity theory (see Equation 2:

$$MV \equiv PY \tag{2}$$

Which is still an identity and not yet a theory of money demand. A variant of the theory re-specifies demand for money as shown in Equation 3 and 4:

$$M^D = {}^{1}/_{\bar{Y}}\, PY \tag{3}$$

and then,

$$M^D = \bar{k}PY \tag{4}$$

Equation 4 shows that the demand for money is proportional to the amount of real transactions, represented by the real GDP; and is proportional to the price level. It can also be interpreted in a way that the demand for money is actually a demand for a real quantity of money as in Equation 5, where M^D/P represents the demand for real quantity of money:

$$M^D/_P = \bar{k}Y \tag{5}$$

One important difference between the cash balance approach and subsequent theories of the demand are the lack of an interest rate variable in the former. Moreover, the fundamental assumption of the quantity theory as regards stable velocity of money lacks empirical support.

The Liquidity Preference Theory emphasized the role and importance of interest rates. Keynes (1930) in his book titled "The General Theory of Employment, Interest and Money" introduced three motives for holding money (Essien, Onwioduokit, & Osho, 1996): (transaction motive, precautionary motive, speculation motive). The speculative demand for money is an inverse function of the rate of interest on bonds, i . Together with a transaction demand for money, and a precautionary demand for money, both being a direct function of income, Y, the total demand for money M^D (shown in Equation 6) now becomes:

$$M^D = M_S^D + M_T^D + M_P^D = f(i, Y) \quad (6)$$

However, a completely different approach was chosen by Baumol (1952) and Tobin (1956). The model seeks to determine the optimum level of demand for money considering the trade-off between one the opportunity cost of holding money in term of interest on securities foregone, and two, the transaction cost of converting money into securities.

That is, the total cost for the payments services (PS) is as given in Equation 7:

$$PS = TC + OC = Mi + (n - 1)c$$

$$= Mi + c\,({}^{PY}/_{2M}) - c \quad (7)$$

Where TC is the transaction cost of conversion, OC is the opportunity costs of holding money, n the number of transactions in a given period, *i* the interest rate of securities and M equals PY/2n (that is, the average money holdings in the period are determined by monthly income, PY, and the number of transactions).The minimum cost is obtained on differentiating PS with respect to M (see Equation 8):

$$\frac{\partial PS}{\partial M} = i - \frac{cPY}{2M^2} = 0$$

Which gives;

$$M = \sqrt{\frac{cPY}{2i}} \quad (8)$$

Taking the nominal transaction costs can be regarded as the product of the real transaction costs (C_R) and the price level (P), i.e. C = C_R.P, thus Equation 9 leads to the optimum real stock, which is identical with the optimum real money demand.

$$\frac{M}{P} = \sqrt{\frac{C_R Y}{2i}} \quad (9)$$

Using m for M/P and transforming into a natural logarithmic form, gives Equation 10:

$$\ln m = 0.5 \ln\left({}^{C_R}/_2\right) + 0.5 \ln Y - 0.5 \ln i \quad (10)$$

The conclusions derivable form the Baumol–Tobin money demand function is that the demand for non-interest bearing money in the sense of M1 depends positively on real income, negatively on interest rate, and positively on real transaction costs.

In addition, Friedman (1956) argues that the demand for money should be treated in the same way as the demand for goods or services. He defines the total wealth of an individual as sum of five components: money, bonds, shares, real assets and human capital. Therefore, a theory of demand for money would require information on each of the components and on the individual returns therefrom (Friedman, 1956). He stated the money demand function as Equation 11.

$$\frac{M^D}{P} = f(Y, w, i_m^e, i_B^e, i_E^e, \mu) \quad (11)$$

Where w is the fraction of wealth in non-human form, $i_m^e, i_B^e, and\ i_E^e$ are the expected nominal rates of returns on money, bonds and physical asset; and μ stands for other variables attached to services of money.

2.2. Empirical Review: Models of Money Demand Function

Dou (2018) observed that money demand and its stability have a great impact on the economy of a country. Since China's financial and monetary system has been in reform, there are many uncertainties in money demand. Especially, China's money demand has its own particularity. This paper studies the determinants of China's money demand through building a linear econometric model and SVAR model. The empirical results show that China's money demand is mainly decided by income, interest rate and expected inflation rate. However, other factors, such as financial innovation, government debt, capital mobility and currency substitution, play a relatively small role, mainly because China's financial and monetary system has been under reform. The regression results of sample data from different periods show that money demand in China is unstable, indicating that China's macro-economy has certain risks. This finding suggests that China should adopt prudent financial and monetary policies to cope with the uncertainty of money demand in the future.

Ben-Salha and Jaidi (2014) estimated the money demand function in Tunisia. The study assumed that unlike many previous money demand studies, the major components of real income are considered. Based on annual data ranging between 1979 and 2011 and the ARDL bounds testing approach, results reveal evidence of cointegration between the broad money demand and its determinants, namely the final consumption expenditure, the expenditure on investment goods, the export expenditure and the interest rate. The error correction model shows that the demand for money is only affected by the interest rate and the expenditure on investment goods in the short-run, while in the long-run the final consumption expenditure and the interest rate represent the major money demand determinants. These findings are robust to a variety of alternative money demand specifications and estimation methods. The Saikkonen–Lütkepohl cointegration test with structural shift and the Johansen–Mosconi–Nielsen structural break cointegration test are performed in order to control for structural change. In addition, the stability of the relationship is checked using the Chow stability test and the Hansen parameter instability test. In the light of the study, we advance that monetary policy in Tunisia should be based on a broad definition of money. Furthermore, the estimation of money demand functions must take into account the different expenditure components of real income.

Bhattarai (2014) observed that cash in advance and money in utility function models are used to examine whether the nature of fluctuations in economic activities and welfare in three interdependent economies are related to the stocks and growth rate of money. When the money is exogenously introduced in the form of cash in advance, it serves as a medium of exchange and the rate of return in real and nominal assets become equal. Idiosyncratic technological shocks generate fluctuations in the growth rates of capital, output, prices, money, consumption, investment, labour supply and lifetime utilities of households. When households have money endogenously in their utility functions, the stock of money in excess of that required for transactions causes inflation and reduces the amount of capital stock and output in these economies. Both CIA and MIU models support for a steady growth rate of money according to the growth rate of output. While the inflation targeting by manipulating the interest rates for macroeconomic stability is theoretically a prudent policy move, it is impossible for a central bank to eliminate business cycles that arise from shocks to production technology or to other structural features of an economy.

Iyoboyi and Pedro (2013) studied the narrow money demand function of Nigeria using data from 1970 to 2010, using (a) autoregressive distributed lag bounds test approach to cointegration; (b) Augmented Dickey Fuller (ADF); (c) Philips–Perron (pp) unit root tests. The result established that cointegration exists among narrow money demand, real income, short term interest rate, real expected exchange rate, expected inflation rate, and foreign real interest rate in the period under investigation; and that real income is a significant determinant of narrow money in both long and short run in Nigeria and interest rate is only significant in the long run nut not short run. Central Bank of Nigeria (CBN) (2018) re-examined the stability of the broad money (M2) demand function in Nigeria. The study employed Autoregressive Distributed Lag (ARDL) as well as bounds tests in relation to a set of quarterly time-series data from 1985(1) to 2016(4). It was then concluded that there was a stable long-run relationship between broad money and GDP, stock prices, foreign interest rates and real exchange rate. Darrat (1986) in his study of the demand for money function in Nigeria for 1963–1979. The study employed a more involved complex form of distributed lag framework for his model specification for currency, narrow money and broad money. Consideration was also given to the international monetary influences on domestic money holdings, through the inclusion of foreign interest rate, and also to income and expected inflation rate. The result found that income and inflationary expectation play significant roles in determining real balances; foreign interest rate exerted a significant negative impact on real money demand; and the demand for money function exhibited stability in the period under review. Currently, the Central Banks of Nigeria, in the formulation monetary policy, has invariably adopted the log-linear real demand for money function (for both broad and narrow money) alongside the partial adjustment framework, with the principal independent variables being real income, inflation rate and lagged real balances.

3. METHODOLOGY

3.1. Sources of Data

Given that both the broad (M2) and the narrow money (M1) were studied. Therefore, quarterly data were collected from the Central Bank of Nigeria (CBN) Database and Statistical Bulletin publications as well as from the database of the Nigeria Bureau of Statistics (NBS) for all the variables from 2006(Q1) to 2018(Q4). However, quarterly data for GDP were not available between 2006 and 2009 though annual series existed, and the annual series were subjected to the process of data segregation to obtain estimated quarterly series for GDP. Furthermore, variables (M1, GDP and exchange rate) were translated into log form and expressed accordingly

3.2. Estimation and Evaluation Techniques vis a vis Data Desegregation

Prior to 2010, quarterly data (both at nominal and real prices) were not available for Nigeria's GDP, except annual GDP series. That is, only annual data for those periods (2006 to 2009) were available and collected. Incidentally, quarterly and annual data for aggregate credits to private sector (CPS) were available. Therefore, upon further analysis it was found that there was a high positive correlation (98%) between annual GDP and credit to private sector (CPS). Given the high correlation and the fact that quarterly data on CPS were available for the period 2006 to 2009, the annual GDP data were linearly segregated into quarterly data for the period 2006 to 2009 using quarterly trends of CPS. The linear relationship used for the desegregation is:

$$GDP_q = \frac{(CPS_q - CPS_{q-1})}{Total\ Movement\ in\ CPS\ in\ a\ quarter}\ x\ Annual\ GDP$$

Where; GDP_q = GDP for a given quarter;

CPS_q = CPS movement for a given quarter;

Total Movement in CPS= 4th qtr. CPS minus 1st qtr. CPS

3.3. Model Specification

This study assumes that the demand for money in Nigeria is a function of real GDP, inflation rate, interbank lending rate, monetary policy Rate (MPR), Federal Government Treasury Bill rate, rate on savings and exchange rate. It then used a linear model of the form in Equation 12:

$$M1 = f(RGDP, INFR, EXR, TBY, SDR, IBR, MPR) \quad (12)$$

Where

M1=Money stock represented by M1.

RGDP=Real GDP.

INFR=Inflation rate.

EXR=Exchange rate.

TBY=Treasury bill yield.

SDR=savings deposit rate.

IBR=Interbank.

MPR=Monetary Policy Rate.

The model is expanded in the form (shown in Equation 13):

$$M1 = \beta_0 + \beta_1 RGDP + \beta_2 INFR + \beta_3 EXR + \beta_4 TBY + \beta_5 SDR + \beta_6 IBR + \beta_7 MPR + \varepsilon_t \quad (13)$$

Where ε_t is the error term.

Note that *M1, RGDP, and TBY* are in initially naira form and are converted to their logarithmic forms. Using a log model, functional form money demand Equation 14 now becomes:

$$\ln M1 = \beta_0 + \beta_1 \ln RGDP + \beta_2 INFR + \beta_3 EXR + \beta_4 \ln TBY + \beta_5 SDR + \beta_6 IBR + \beta_7 MPR + \varepsilon_t \quad (14)$$

Note that Real GDP (Y) is obtained after deflating by the consumer price index (CPI)

The OLS model has proved to be a reliable estimation technique for many types of linear models. It is particularly suited for many economic variables because economic variables are inherently linear especially over a short range. In the class of estimators, OLS estimates are the best linear unbiased linear estimators. That is, the estimates of the population parameters computed from linear least squares regression are the most optimal estimates; and, it is relatively easy to use. Expectedly, given the different theoretical and empirical works on the subject of demand for money, it is expected that the coefficient of income (GDP) will be positive, while coefficients of savings and treasury bill yield will be negative. For inflation and exchange rate, their coefficient could either take a negative or a positive form depending on the dominant behaviour of economic units. For interbank rate, the tendency is for it to be negatively correlated with demand for money.

Further, it should be noted that Narrow money (M1) is the stock of currency in circulation (C) plus demand deposits (D). That is, M1=C+D. This is distinct from broad money given as is the stock of narrow money (M1) as well as time, savings and foreign currency deposits with banks. It is given as

$$M2 = M1 + Time, savings\ and\ foreign\ currency\ deposit$$

Real GDP is a measure of a country's economic output deflated by the country's consumer price level (CPI) index. In the money demand function, real GDP is a proxy for wealth. The Exchange Rate is the rate of conversion of naira cash assets to dollar denominated cash assets. That is, the naira-to-dollar exchange rate. It serves as a proxy for an alternate form of cash assets to naira cash assets. Inflation measures the general level of increase in the prices of goods and services in an economy over a given period and it proxies the reduction in money value. Interest rate: This is cost of borrowing money, or conversely, the income earned from lending money. It is can also refer to the return or yield on bond or opportunity cost of deferring current consumption into the future. It represents the speculative motive and it's proxied, in the model, by interest rate on deposit, Monetary Policy Rate, treasury bill yield and interbank lending rate. Monetary Policy Rate (MPR) is the anchor rate set by the Central Bank of Nigeria as a reference for other rates while the Treasury bill yield: The yield on treasury bill which equates to the return earned on investing in treasury bill.

4. EMPIRICAL RESULTS AND INTERPRETATION

4.1. Graphical Representation of Money Stock (M1) and Other Variables

Figure 1 below depicts graphical relationship among the demand for money represented by (M) and the exogenous variables: Real GDP(Y), exchange rate (x), inflation (f) and treasury bill (g), savings deposit rate, interbank rate and MPR (p). A visual assessment of the trends as shown in the Figure 1 revealed that some of the variables (like MPR and interbank rate) do not share almost same appearance as the trend of the dependent variable (M1). There is an apparent close movement between M1 and Real GDP.

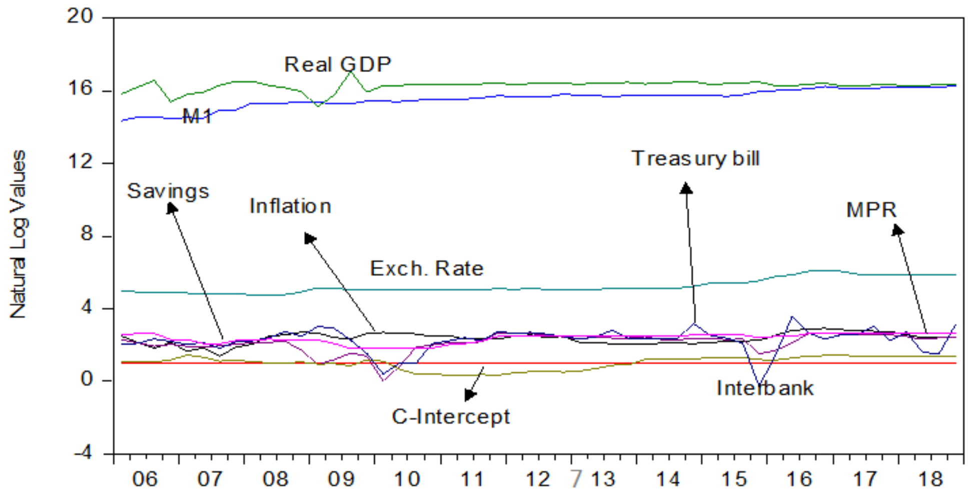

Figure-1. Graphical illustrations of M1 and other variables.

Table-1. Augmented dickey- fuller test results.

Variable	Order of Integration	T-ADF	Prob*	1% CV	5% CV	10% CV
M1	I(1)	-4.113684	0.0000	-3.584743	-2.928142	-2602225
RGDP	I(0)	-5.615693	0.0000	-3.565430	-2.919952	-2.597905
EXR	I(0)	-4.685323	0.0000	-3.565430	-2.919952	-2.597905
INF	I(1)	-10.77550	0.0000	-3.568308	-2.921175	-2.598551
INTR	I(0)	-7.529088	0.0000	-3.565430	-2.919952	-2.597905
MPR	I(1)	-6.253837	0.0000	-3.568308	-2.921175	-2.598551
SDR	I(1)	-6.345020	0.0000	-3.568308	-2.921175	-2.598551
TBY	I(1)	-5.898709	0.0000	-3.568308	-2.921175	-2.598551
Phillip-Perron Test Results						
M1	I(1)	-7.670905	0.0000	-3.568308	-2.921175	-2.598551
RGDP	I(0)	-5.615693	0.0000	-3.565430	-2.919952	-2.597905
EXR	I(0)	81965.80	0.0000	-3.565430	-2.919952	-2.597905
INF	I(1)	-14.66489	0.0000	-3.568308	-2.921175	-2.598551
INTR	I(0)	-7.525145	0.0000	-3.565430	-2.919952	-2.597905
MPR	I(1)	-6.307009	0.0000	-3.568308	-2.921175	-2.598551
SDR	I(1)	-6.306554	0.0000	-3.565430	-2.919952	-2.597905
TBY	I(1)	-6.866263	0.0000	-3.568308	-2.921175	-2.598551

In Table 1 above, the series were tested for stationarity of individual series using Augmented Dickey Fuller (ADF) test, this becomes necessary given the assumption that most economic variables are not stationary at level and following the basic requirement of interacting economic variables. Out of the eight variables tested, three variables (RGDP, EXR, and INTR) were integrated of order zero I(0), while the remaining five were integrated of order one (i.e. I(1)). In all, the study established that each of the series intended for estimating the behaviour of demand for money exhibits short run stability. Furthermore, the study attempted to affirm the result of the ADF test by using a non-parametric Phillip-Perron test on the same set of the variables, the results showed the same three variable with order I(0) and the same five variables with order I(1). Thus, it validates the finding of the ADF test.

Consequent upon the results of the unit root tests that affirmed the existence of short run stability of individual variable, it becomes necessary to test for group interaction and affirm a long run relationship. The result in Table 2 indicates the outcome of Johansen Cointegration (using Trace and Maximum Eigen) test. The result Unrestricted Rank (Trace) test indicates that there exist at most three (3) cointegrating equations; these were affirmed by the higher values of the Trace statistics when compared with the Critical Values at 5 percent significant level, given these, the study therefore rejects the null hypothesis. The result of the Maximum Eigen also led to the rejection of the null hypothesis as it indicates that there exist at most two cointegrating equation. We therefore affirm that there is a long run relationship among the variable.

Table-2. Johansen cointegration test.

Series: M1 EXR INF INTR RGDP MPR SDR TBY				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.710548	228.6089	159.5297	0.0000
At most 1*	0.648414	166.6207	125.6154	0.0000
At most 2*	0.573444	114.3556	95.75366	0.0000
At most 3*	0.477503	71.75504	69.81889	0.0000
At most 4	0.327056	39.29828	47.85613	0.0003
At most 5	0.243387	19.49363	29.79707	0.0156
At most 6	0.090817	5.548464	15.49471	0.0968
At most 7	0.015637	0.788043	3.841466	0.2067
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None*	0.710548	61.98822	52.36261	0.0000
At most 1 *	0.648414	52.26508	46.23142	0.0000
At most 2*	0.573444	42.60055	40.07757	0.0011
At most 3	0.477503	32.45676	33.87687	0.0002
At most 4	0.327056	19.80465	27.58434	0.0103
At most 5	0.243387	13.94517	21.13162	0.0853
At most 6	0.090817	4.760421	14.26460	0.2178
At most 7	0.015637	0.788043	3.841466	0.1529
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				

Table-3. Correlation matrix.

Variables	M1	RGDP	INF	EXR	TBY	SDR	IBR	MPR
M1	1	0.3812	0.5379	0.7832	0.3591	0.1351	0.1338	0.3959
RGDP	0.3812	1	-0.0986	0.1343	0.3220	-0.1490	-0.0749	0.0975
INF	0.5379	-0.0986	1	0.5579	-0.0291	-0.0045	0.0676	0.0380
EXR	0.7832	0.1343	0.5579	1	0.3381	0.5195	0.1112	0.5494
TBY	0.3591	0.3220	-0.0291	0.3381	1	0.0578	0.5250	0.7133
SDR	0.1351	-0.1490	-0.0045	0.5195	0.0578	1	0.0244	0.4432
IBR	0.1338	-0.0749	0.0676	0.1112	0.5250	0.0244	1	0.4160
MPR	0.3959	0.0975	0.0380	0.5494	0.7133	0.4432	0.4160	1

4.2. Interpretation of First OLS Result

Table 3 shows the result of estimation of linear relationship between M (M1) and all the variables. The p-values (probability values) of four variables (out of seven) are not significant. The p-values of F, G, N and P are 39.84%, 70.37%, 44.61% and 75.37%. That is, variables F, G, N and P are not significant in explaining the movement in demand for money. In other words, more than 50% of our chosen variables (four out of seven) cannot explain changes in M1 or demand for money. Given a R-squared value of 76.4% shows a good fit, however the Durbin-Watson statistic is 0.58, signifying the presence of autocorrelation. The presence of autocorrelation is further confirmed by the Serial Correlation test contained in Table 3. The probability of Chi-squared is less than 5%, indicating autocorrelation.

Table-4. 1st OLS estimation of money demand function.

Dependent Variable: M1				
Variables	**Coefficient**	**Std. Error**	**t-Statistics**	**Probability**
Constant	2.7602	2.4256	1.1380	0.2613
RGDP	0.4443	0.1499	2.9634	0.0049
INF	0.1503	0.1763	0.8527	0.3984
EXR	1.0296	0.1828	5.6317	0.0000
TBY	-0.0499	0.1304	-0.3828	0.7037
SDR	-0.3855	0.1559	-2.4732	0.0173
IBR	0.0542	0.0704	0.7689	0.4461
MPR	0.0803	0.2543	0.3157	0.7537
Other Parameters				
R-Squared	0.7647	Mean dependent Var.		15.5708
Adj. R-Squared	0.7273	S.D. dependent Var.		0.5084
S.E. of regression	0.2655	Akaike info criterion		0.3262
Sum square resid	3.1015	Schwarz criterion		0.6264
Log likelihood	-0.4812	Hannan-Quinn criterion		0.4413
F-Statistic	20.4314	Durbin-Watson statistics		0.5797
Prob(F-statistic)	0.0000			

4.3. Interpretation of Second OLS Result

Given the poor statistics generated from the above model (contained in Table 4) in terms of p-values of coefficients, R-squared, Durbin-Watson and autocorrelation test, the model is re-specified. The re-specification is aimed at elimination autocorrelation while obtaining a good fit. The new specification becomes:

$$M1 = \beta_0 + \beta_1 M1_{t-1} + \beta_2 RGDP_t + \beta_3 INF_t + \beta_4 EXR_t + \beta_5 TBR_t + \beta_6 SDR_t + \varepsilon,$$

Where the variables are in their log forms,

M1=Money stock represented by M1.

RGDP=Real GDP.

$M1_{t-1}$= Lagged value of M1.

INF=Inflation rate.

EXR=Exchange rate.

TBR=Treasury bill yield.

SDR=Savings deposit rate.

M is lagged by one level and introduced into the model as an independent variable to prevent the presence of autocorrelation. The resulting model is shown in Table 5. The p-values of the explanatory variables are significant in explaining the variation in M, except F. R-squared of 96.5% shows a good fit and Durbin-Watson of 2.52 indicates the absence of autocorrelation. This is further confirmed by serial correlation statistics in Table 6 below. Therefore, the money demand function (M) estimated by OLS technique becomes:

$$M1 = 0.1586 + 0.8441M1_{t-1} + 0.1009RGDP_t - 0.0233INF_t + 0.1436EXR_t - 0.0380SDR_t + \varepsilon_t$$

The new model is free from autocorrelation and is hereby presented below:

Table-5. 2nd OLS estimation of money demand function.

Dependent Variable: M1				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
Constant	0.1586	0.8608	0.1842	0.8547
$M1_{t-1}$	0.8441	0.0556	15.1791	0.0000
RGDP	0.1009	0.0546	1.8591	0.0696
INF	-0.0233	0.0613	-0.3807	0.7052
EXR	0.1436	0.0795	1.8062	0.0776
SDR	-0.0380	0.0563	-0.6753	0.5030
Other Parameter				
R-square	0.9645	Mean dependent var.	15.5946	
Adj. R-squared	0.9606	S.D. dependent var.	0.4835	
S.E. of regression	0.0960	Akaike info criterion	-1.7384	
Sum square resid	0.4149	Schwarz criterion	-1.5112	
Log likelihood	50.3297	Hannan-Quinn criterion	-1.6516	
F-statistics	244.5680	Durbin-Watson statistic	2.5232	
Prob(F-statistic)	0.0000			

Table-6. Post estimation diagnostics.

Serial Correlation Test			
Breuch-Godfrey Serial Correlation LM Test Null hypothesis: No serial correlation at up to 2 lags			
F-statistics	2..4639	Prob. F(2,43)	0.0970
Obs*R-squared	5.2436	Prob. Chi-Squared(2)	0.0727
Homoscedasticity Test			
Heteroscedasticity Test: Breuch-Pagan-Godfrey Null hypothesis: Homoskedasticity			
F-statistics	4.2620	Prob. F(5,45)	0.0029
Obs*R-squared	16.3898	Prob. Chi-Squared(5)	0.0058
Scaled explained SS	25.3824	Prob. Chi-Squared(5)	0.0001

Conversely, given the presence of lagged values of the dependent variable as regressors, OLS estimation of the model that already present itself as an ARDL model will yield biased coefficient estimates; therefore, ARDL bounds testing approach developed by Pesaran, Shin, and Smith (2001) was employed to test for presence of long run relationship among the variables is hereby required. This procedure, though relatively new method, has many advantages over the classical cointegration tests. The bounds tests suggest that the variables of interest are bound together in the long-run when narrow money (M1) is the dependent variable. However, the F-Statistics is higher than the critical values for I(0) bound but lower than the critical values for I(1) bound. This put the study at a crossroad and as well reduces the possibility of having a long run speed of adjustment see Table 7.

Table-7. Cointegration bound test result.

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.774954	7
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	1.92	2.89
5%	2.17	3.21
2.5%	2.43	3.51
1%	2.73	3.9

Table-8. Short run coefficients.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
M1(-1)	0.520696	0.144168	3.611735	0.0023
M1(-2)	0.356260	0.181161	1.966545	0.0668
M1(-3)	0.143230	0.169717	0.843936	0.4111
M1(-4)	-0.353142	0.137008	-2.577523	0.0202
EXR	3.52E-08	1.28E-08	2.753128	0.0141
EXR(-1)	-0.012819	0.131417	-0.097547	0.9235
EXR(-2)	0.178571	0.131438	1.358594	0.1931
INF	-1.210651	0.598870	-2.021561	0.0603
INF(-1)	0.294782	0.523537	0.563059	0.5812
INF(-2)	1.550495	0.420462	3.687597	0.0020
INF(-3)	-1.445361	0.379516	-3.808434	0.0015
INF(-4)	0.943221	0.306483	3.077558	0.0072
INTR	0.057933	0.092853	0.623920	0.5415
INTR(-1)	0.471100	0.184822	2.548939	0.0214
INTR(-2)	0.663295	0.203296	3.262708	0.0049
INTR(-3)	0.295069	0.145149	2.032874	0.0590
MPR	-2.993007	2.657931	-1.126066	0.2767
MPR(-1)	2.521902	2.968475	0.849561	0.4081
MPR(-2)	-7.539781	2.080061	-3.624789	0.0023
RGDP	-0.050160	0.075746	-0.662211	0.5173
RGDP(-1)	0.126696	0.083963	1.508959	0.1508
RGDP(-2)	0.121228	0.072817	1.664819	0.1154
RGDP(-3)	-0.295891	0.062053	-4.768385	0.0002
RGDP(-4)	0.225231	0.069056	3.261586	0.0049
SDR	-0.959672	4.750367	-0.202021	0.8424
SDR(-1)	5.942464	4.959648	1.198163	0.2483
TBY	2.919892	1.440714	2.026699	0.0597
TBY(-1)	-2.475186	1.335124	-1.853900	0.0823
TBY(-2)	2.528519	1.212742	2.084960	0.0535
TBY(-3)	-0.274169	0.919491	-0.298175	0.7694
TBY(-4)	1.881673	0.832242	2.260970	0.0380
C	2.430520	3.622738	0.670907	0.5118

R-squared	0.994485	Mean dependent var	15.65916
Adjusted R-squared	0.983801	S.D. dependent var	0.420080
S.E. of regression	0.053466	Akaike info criterion	-2.784809
Sum squared resid	0.045738	Schwarz criterion	-1.537341
Log likelihood	98.83541	Hannan-Quinn criter.	-2.313389
F-statistic	93.07605	Durbin-Watson stat	2.455294
Prob(F-statistic)	0.000000		

Table-9. Long run coefficients.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR	0.497820	0.409780	1.214846	0.2420
INF	0.397905	0.547759	0.726424	0.4781
INTR	4.467253	2.489339	1.794554	0.0916
MPR	-24.059928	16.212286	-1.484055	0.1572
RGDP	0.381746	0.581028	0.657018	0.5205
SDR	14.965340	16.491210	0.907474	0.3776
TBY	13.757783	10.071146	1.366059	0.1908
C	7.299834	11.024655	0.662137	0.5173

4.4. Policy Implication

The findings of this study reveal that movements in the prior (lagged) values together with movements in Real GDP, inflation, exchange rate and savings deposit rate can explain to a great extent changes in money demand in Nigeria. The direction (sign) of variables like Real GDP, inflation, and savings deposit rate conform to expectations. The findings suggest that the government, through the central bank, should employ balanced policies that encourage economic units to exhibit more confidence in naira assets as against foreign assets and stem the rate of dollarization of the economy.

5. CONCLUSION

The findings of this study reveals that movements in the prior (lagged) values together with movements in Real GDP, inflation, exchange rate and savings deposit rate can explain to a great extent changes in money demand in Nigeria. Of particular interest is the positive movement in exchange rate. Exchange rate increases as demand for money increases, suggesting that more of money demanded finds its way to the foreign exchange market. Citizens may have been replacing naira cash assets with dollar cash assets. The findings from the study suggest that the government, through the central bank, should employ balanced policies that encourage economic units to exhibit more confidence in naira assets as against foreign assets and stem the rate of dollarization of the economy. The study concludes that demand for narrow money in Nigeria is influenced by past demand as well as level of income, inflation, exchange rate and savings rate. Interbank lending rate and MPR do not have influence on the level of money demand.

6. RECOMMENDATIONS

Given the findings in this study, the following recommendations are proffered: The monetary authorities, The Central Bank of Nigeria, should employ balanced policies that encourage economic units to exhibit more confidence in naira assets as against foreign assets and stem the rate of dollarization of the economy

The Central Bank of Nigeria should develop come with an efficient policy around the components of narrow money (that is, currency in circulation and demand deposit) to curb the level of inflation in the country.

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