# **STABILITY OF DEMAND FOR MONEY IN NIGERIA**

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# ABSTRACT

The study examines the long-run demand for real broad money function and its stability in Nigeria for the period of 1986 to 2011. The study employs Augmented-Dickey Fuller (ADF) and Phillips-Perron (PP) tests for unit root, Engle-Granger (1987) approach for cointegration, CUSUM and CUSUMSQ tests for stability. The ADF and PP tests suggest that variables are mean reverting series after first order difference. The results of the stability and cointegration tests confirm that a stable, long-run relationship exists between demand for real broad money and its determinants: income, domestic real interest rate, expected rate of inflation, expected foreign exchange depreciation, and foreign interest rate. The empirical results show that the income elasticity and foreign interest rate coefficients are positive while, the domestic real interest rate, inflation rate, and exchange rate depreciation coefficients are negative respectively. Hence, the apex bank in Nigeria can target the broad money (M2) aggregate to achieve monetary policy objectives.

**Keywords:** money, demand, function, cointegration, Stability **JEL Classification Code:** C32, E41, E52

## 1. Introduction

The Central Bank of Nigeria (CBN) has over the years sought a predictable and stable money demand function. This is due to the fact that a stable money demand function contributes to broader economic growth and rising standard of living. Thus, the reexamination of the question whether demand for money has remained stable during the

financial system reform which started in 2005 in Nigeria is still necessary. It is often suggested that financial reforms could lead to an unstable demand for money and changes in money velocity and this in turn have consequences for monetary policy implementation. In countries where the Central Bank targets a money aggregate, for instance using reserve money to implement monetary policy, the effectiveness of monetary policy rests mainly on the stability of the monetary transmission mechanism as well as money velocity. When this relationship is subjected to unexpected shifts, monetary targets lose their transparency and are less able to accurately signal the appropriate stance of monetary policy. This argument has been used as a reason for moving to inflation targeting, which does not rely on the stability of money demand, but instead uses a broad range of information to assess the monetary policy stance (Dagher and Kovanen, 2011).

However, as conventionally agreed, a good understanding of the stability and robust determinants of the demand for real money balances forms the core in the conduct of monetary policy as it enables a policy-driven change in monetary aggregates to have predictable influences on output, interest rate, and ultimately price (Sriram, 1999; Nachega, 2011; Halicioglu and Ugur, 2005). Recently, interest rate has hightened in many countries triggered primarily by the concern among Central Banks and researchers on the impact of the movement toward flexible exchange rate regime, globalization of capital markets, ongoing domestic financial liberalization and innovation, advancement in time series econometrics and country – specific financial issues (Sriram, 2001).

Hence, a stable money demand function acts as a stabilization policy which depends on the ability of Central Bank to adjust money supply to its demand in order to avoid monetary disturbances from inhibiting real output. It is argued that the relationship between money supply on one hand and prices, income, and balance of payment on the other is determined by the demand for money, and such relationship plays an important role in macroeconomic theory. Several important factors have influenced and shaped the evolution of empirical research on the demand for money. First, there is evolving nature of theories on the demand for money. Second, the growing arsenal of econometric techniques that has permitted more sophisticated examination of dynamics, functional forms, and expectations. Third, and most importantly, research has been spared by the

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apparent breakdown of existing empirical models in the face of newly emerging data (Tahir, 1995). Thus, in line with maintaining price stability, the apex bank strives to promote and maintain monetary stability through the management of debt and foreign exchange rate. In essence, appropriate demand and supply management policies by the CBN necessary for economic development requires money to be stable and functional (Nwafor, Nwakanma, Nkansah and Thompson, 2007). Therefore, considerable effort has been made in the empirical literature – for both industrialized and developing countries – to determine the factors that affect long-run demand for money and assess the stability of the relationship between these factors and various monetary aggregates (Nachega, 2001).

With the presence of structural changes in the economy such as the structural adjustment programme (SAP) of 1986, the political economy of Nigeria which has been affected by several regime changes and political crises, the global economic and financial crisis which started in 2008 and innovations in the financial sector, it remains an empirical question whether monetary targeting remains relevant in the conduct of monetary policy. The CBN's focus on the price stability objective represents a major departure from past practices in which the promotion of rapid and sustainable economic growth and employment were the overriding objectives of monetary policy. Prior to 1986, in order to achieve its objective of sustainable growth and employment, the CBN relied on the use of direct (non-market) monetary instruments such as credit ceilings on the deposit-money of banks, administered interest and exchange rates, as well as prescription of cash reserves requirements. The most popular instruments of monetary policy were the setting of targets for aggregate credit to the domestic economy and the prescription of low interest rates. With these instruments, the CBN hoped to direct the flow of loanable funds with a view to promoting rapid development through the provision of finance to the preferred sectors of the economy (agriculture, manufacturing, and residential housing) (Onafowora and Owoye, 2007).

The developments in the Nigerian economy since 1986, and most importantly, the adoption of M2 as an intermediate target for monetary policy by the CBN pose two central questions: Is the real M2 money demand function stable as an intermediate target? Is the CBN justified in its choice of M2 as a target? The recent developments in monetary system and the increased openness may have caused the money demand

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function to be unstable. The monetary implications inherent in these questions cannot be over-emphasized. If the money demand function is unstable and experiences substantial shifts over time, then the income velocity of money will be unpredictable, and the quantity of money may not be a good predictor of economic activity. In other words, the choice of M2 as an intermediate target portends serious economic problem for Nigerian monetary authority if M2's demand function is found to be unstable (Onafowora and Owoye, 2007).

This study departs from previous Nigerian studies such as Anoruo (2002), Nwaobi (2002), Onafowora and Owoye (2007), Bitrus (2011) in two respects; First, by investigating the periods of global financial and economic crises and Second, by including yield on foreign real assets, and own rate of return as model variables. Including these variables is based on the evaluation of macroeconomic situation and developments in the financial system and due to the fact that Nigeria is an open economy.

### 2. Literature Survey

There is a plethora of studies on the demand for money in various countries. For instance, Adam, Kessy, Nyella, and O'Connell (2011) studied the demand for money  $(M_2)$  function in Tanzania. They reported that there exists a stable cointegrating relationship between real money balances and its determinants. In another study conducted on Hungarian economy, Dritsakis (2011) reported that narrow money demand function is stable over the period covered in Hungary. Similarly, Halicioglu and Ugur (2005) analyzed the stability of the narrow money  $(M_1)$  demand function in Turkey using annual data for the period 1950 to 2002. The results suggest a stable demand for money function in Turkey. In other studies conducted on Indian economy, Inoue and Hamori (2008) argued that when money supply is represented by M3, there is no long-run equilibrium, whereas there is long-run equilibrium when money supply is represented by M1 and M2 in India. In contrast, Das and Mandal (2000) considered M3 money supply and concluded that money demand function was stable in India for the period from 1981 to 1998.

There are few studies conducted on Nigerian economy. These studies employed different methodologies, data frequencies, and time periods, For example, Anoruo (2002) examined the stability of the Nigerian money demand function in the SAP era. The study employed the Hansen (1992) test of stability to argue that the Nigerian money demand function was stable in the SAP regime. Similarly, Nwaobi (2002) investigated money demand function for Nigeria using VEC and non-nested modeling approach. The study employed annual data from 1960 to 1995 to confirm that money demand function is stable in Nigeria. Onafowora and Owoye (2007) investigated the stability of the demand for money in Nigeria for the period of  $1986Q_1$  to  $2001Q_4$ . The results suggest a stable long-run demand for money in Nigeria within the period under review. Bitrus (2011) examined the demand for money in Nigeria with annual data on both narrow and broad money for the period 1985 to 2007. The results suggest that money demand function is stable in Nigeria. In a similar study, Bassey et al. (2012) investigated the effect of monetary policy on demand for money in Nigeria with annual data from 1970 to 2007 to report that there exists an inverse relationship between money, domestic interest rate, expected rate of inflation and exchange rate.

## 3. The model

In order to achieve the study objectives, we employed an open economy model to investigate the demand for money function. We adopted and modified the model originally proposed by Mundell (1963). Thus, this study includes yield on foreign real assets proxied by US short-term rate: ordinary funds, consistent series and exchange rate depreciation proxied by real exchange rate. Including these variables is based on the evaluation of macroeconomic situation and developments in the financial system and due to the fact that Nigeria is an open economy and has a high degree of openness as some studies show (see Nduka, 2013). The return on domestic money is the "own rate of interest", while the return on real assets is the expected rate of inflation.

Therefore, taking the natural logarithm of the model in order to estimate elasticity and semi-elasticity of the variables, we now specify a semi-linear model as follows:

where ln is natural logarithm,  $\beta_0$  is the constant term,  $M_2$  is broad money, P is price proxied by

consumer price index (CPI),  $\left(\frac{M_2^d}{P}\right)_t$  is real money balances, Y is scale variable

proxied by Gross Domestic Product (GDP), RIR is opportunity cost variable proxied by real interest rate,  $R^{f}$  is foreign interest rate proxied by US interest rate, ERRI is expected rate of inflation, ERD is expected foreign exchange depreciation proxied by real exchange rate, and U<sub>t</sub> is the error term.  $\beta_1 > 0$ ,  $\beta_2 < 0$ ,  $\beta_3 < 0$ ,  $\beta_4 < 0$ ,  $\beta_5 < 0$  or  $\beta_5 > 0$ 

The study employed annual data from 1986 to 2011 obtained from the Central Bank of Nigeria's Statistical Bulletins and the IMF's International Financial Statistics as well as extrapolation.

## **Empirical Results**

First, we performed unit root test on the variables using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) procedure to determine whether model variables are stationary and their order of integration. The results reported in the Tables 1 and 2 below, indicate that all variables are non-stationary at their level at 5% significant level, except expected foreign exchange depreciation, hence stationarity is achieved after first difference. Given the unit-root properties of the variables, we proceed to Engle-Granger (1987) cointegration test to establish whether a long-run relationship exists amongst the model variables.

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Variables	Levels	First Differences
Log(RM2)	-2.784 ***	-2.654***
Log(Y)	1.362	3.096**
RIR	-2.264	-4.734*
EXPRI	-1.557	-5.596*
$\mathbf{R}^{\mathrm{f}}$	-2.680	- 3.923*
ERD	4.939*	-

Table 1: ADF Unit Root Test (with intercept) Results

Note: \*, \*\*, and \*\*\* indicates significant at 1%, 5%, and 10% significant levels, respectively. Mckinnon critical Values for rejection of hypothesis of a unit root are: 1%(-3.7343), 5%(-2.9907), and 10%(-2.6348).

Variables	Levels	First Differences
Log(RM2)	-2.145	-3.516**
Log(Y)	1.344	3.584**
RIR	-2.103	-5.044*
EXPRI	-1.328	-4.989*
$\mathbf{R}^{\mathrm{f}}$	-1.909	- 3.626**
ERD	27.148*	-

Note: \*, \*\*, and \*\*\* indicates significant at 1%, 5%, and 10% significant levels, respectively. Mckinnon critical Values for rejection of hypothesis of a unit root are: 1%(-3.7204), 5%(-2.9850), and 10%(-2.6318).

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Variable	τ-ADF	5 percent critical value
(Residual)	-3.601360	-2.9907

The results of the cointegration tests are reported in table 3. Based on the ADF statistics, we reject the null hypothesis of no cointegration between Real money demand and its economic determinants at the 5% level of significance. The results show that there exists long-run relationship between RM2, Y, RIR, EXPRI, F<sup>f</sup> and ERD. Therefore, the variables are cointegrated.

#### Table 4: Regression Results

$$\begin{split} Ln(RM2)_t &= 0.138949 + 0.530273ln(Y)_t - 0.052278RIR_t - 0.052275EXPRI_t + \\ & (0.325200) \quad (10.78779)^* \quad (-6.380356)^* \quad (-6.199624)^* \\ & 0.023360R^f_t - 0.006134ERD_t \\ & (1.765214) \quad (-6.953950)^*. \end{split}$$
 R-squared 0.892296 Adj. R-squared 0.885370 F-Stat. 33.13891

Note: (\*) indicates rejection of the null hypothesis (i.e., not statistically significant) at 5% significant level. t-statistics are in the parentheses below the coefficients.

The signs of all the variables in table 4 are in line with economic theory, except foreign interest rate. The results show a positive and statistically significant relationship between demand for real money and income during the period studied. This implies that as income increased, people held more money. The coefficient (0.531) of the income variable indicates that the long-run income elasticity for real broad money is less than

unity. This is in line with Keynes' transaction and precautionary theories of money demand. Moreover, this result is consistent with other Nigerian studies like Btrus (2011), and Nwafor et al. (2007).

The domestic interest rate (opportunity cost variable), expected rate of inflation (assets substitution variable), expected foreign exchange depreciation (currency substitution variable), and foreign interest rate (capital mobility variable) variables entered the longrun money demand model in equation (1) with different signs. The coefficient of the domestic interest rate is negatively related to real demand for money and it is statistically significant. This suggests that the higher the rate of return on the alternative asset, the lower the demand for money. There is a negative and statistically significant relationship between expected rate of inflation and real money demand. This is because agents prefer to hold real assets as hedges during the periods of rising inflation. The coefficients of domestic interest rate and expected rate of inflation follow Friedman's quantity theory of money. The coefficient of the expected foreign exchange depreciation is negatively related to real demand for money and it is statistically significant. This implies that as the expected foreign exchange depreciation increased, returns from holding foreign money increased, and hence, agents substituted the domestic currency for foreign currency during the sample period. Similar results were reported by Bassey et al. (2012) who used data for the period 1970 to 2007 for Nigeria.

On the other hand, the coefficient of foreign interest rate is positively related to real money demand during the sample period but it is not statistically significant. This finding does not support the portfolio balance argument of capital mobility for Nigeria.

### **Stability Test Results**

Finally, to confirm the stability of the estimated model in table 4, the tests of cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) developed by Brown et al. (1975) are employed. Figures 1 and 2 provide the graph of CUSUM and CUSUMSQ, respectively. In carrying out this test, it is important that the CUSUM and CUSUMSQ statistics lie within the 5% critical bound. Thus, as can be seen from figures 1 and 2 below, the estimated long-run parameters of the real broad money demand function are stable. This is due to the fact that the plots of

CUSUM and CUSUMSQ lie completely within the 5% critical lines. Hence, we conclude that there is a stable real broad money demand function in Nigeria within the period under review.



Figure 1: Plot of Cumulative Sum of Recursive Residuals



Residuals



## **Conclusion and policy implications**

The study investigates the demand for real broad money function in addition to its stability between 1986 and 2011. The time series characteristics of the model were examined using the ADF and PP tests as well as the Engle-Granger (1987) residualbased test. The test of stability using CUSUM and CUSUMSQ tests suggest that a stable relationship exists between real broad money demand and its determinants. While the income elasticity and foreign interest rate coefficients are positive; the domestic real interest rate, inflation rate and exchange rate depreciation coefficients are negative. The policy implication of this finding is that the Central Bank of Nigeria could easily target the broad money aggregate to achieve its monetary policy objectives. However, the failure of the foreign interest rate to conform to a priori expectation is worth pointing

out due to the fact that this may suggest that foreign interest rate does not affect the demand for money in Nigeria. Hence, this finding requires further investigation.

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