Modelling the Demand for Money Function in Nigeria: Is There Stability?

Bassey Nsikan Edet[1]
Akwa Ibom State University, Ikot Akpaden, Mkpat Enin, Akwa Ibom State, Nigeria

Solomon Ubong Udo
Hutton School of Business, University of the Cumberlands, Williamsburg

Okon Ubokudom Etim
Akwa Ibom State University, Ikot Akpaden, Mkpat Enin, Akwa Ibom State, Nigeria

Abstract
This study adopts the Keyne's Liquidity Preference and Friedman Restated Hypothetical approaches to formulate appropriate demand for money models in Nigeria. Data sourced from the Central Bank of Nigeria for the period 1986-2013 were analyzed using the Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) tests for unit root, Engle-Granger (1987) Co-integration and error correction modeling technique as well as the Chow test of stability. The unit root test result revealed that only real income, real interest rate, Treasury bill rate and inflation rate were stationary at levels while others were stationary at first difference. Result further revealed that while income (Y) enhances the desire to hold money, interest rate (RT) and expected inflation rate (EXINF) impacted negatively on money demand indicating that during inflationary expectation and periods of lower interest rates, asset holders switch out of money assets into real assets. Hence, inflationary expectation and interest rate were vital determinants of asset substitution in Nigeria. Surprisingly, real interest rate and inflation rate fail to significantly explain the variation in demand for money in Nigeria for the study period. Result of the Friedman restated hypothetical model showed that increase in return to other money assets such as Savings deposit, Equity and Treasury bill reduces economic agent's desire to hold money. The stability test result further revealed that money demand was stable in Nigeria for the sampled period. Accordingly, to enhance money demand, policies that would increase real money income, reduce money banks interest rate and returns on other money bank securities, as well as inflation rate while ensuring macroeconomic stability should be pursued. The study further makes case for the use of interest rate as a tool for monetary stability at the expense of real rate of interest.

Keywords: Liquidity preference, demand and money
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[1] **Corresponding author:** Department of Agricultural Economics and Extension, Akwa Ibom State University, Ikot Akpaden, Mkpat Enin, P.M.B. 1167, Uyo, Akwa Ibom State, Nigeria. Tel: +2348035535782, E-mail: nebass2005@gmail.com

I. Introduction

There have been widespread controversies in the literature on the formulation of appropriate model for the demand function for money in many developing countries. This arises from the likely debate between the Keynesian and the Monetarist economists. While the Keynesian built their model on the premise that money is held for precautionary, speculative and transaction motives and that real income and nominal transactions are the major reasons for holding money balances (Keynes, 1936), the Monetarist pioneered by Friedman introduced the wealth constraint into the demand function. According to the Keynesian tradition, the demand function for money is formulated as if there are two separate amount of money demanded for two broad needs. That is, for transaction purpose, which facilitate the exchange of goods and services by the society and the precautionary and speculative motives that insured against unforeseen occurrences and taking advantage of financial market's profit (Mai-lafia, 2002). Friedman faulted Keynes model by the inclusion of yield on bonds, human capital, equities, physical non-human goods and financial assets that are substitutable. In his opinion, wealth can be held by investors in the form of money, bond, equity, shares, commodities and human wealth and that the demand for money depends on the rate of return on income and the aforementioned assets. In order to determine the respective yield on the various forms of assets, Friedman took into consideration the expectation around asset prices due to inflation. Accordingly, he pioneered the inclusion of the expected rate of inflation in the relationship between money demand and real interest rate in his model.

Nigeria like other developing economies has witnessed a wide instability in monetary policies which is partly attributed to undeveloped nature of her capital market, persistent corruption, mismanagement of the oil revenue since 1970s, effect of financial economic crisis of 2008 as well as series of reforms that has taken place. Example of such reforms include: the introduction of SAP and the subsequent deregulation of interest rate which was aimed at stimulating a free market oriented policy where restriction were lifted and nominal interest rates were market determined as well as the banking sector merger/ acquisition of 2005. Several developed countries case study have also shown the instability of money demand due to financial reforms (Caporale and Gil-Alara,2005; Maki and Kitasaka,2006). As a result, the formulation of appropriate demand for money model which is the basis for the execution of appropriate and sound monetary policies continues to remain a subject of disagreement amongst scholars. Argument has mounted on what variables should be incorporated in the demand for money function; on the appropriate definition of money; on the stability of variables that are included in the model as well as on the appropriate measure of the opportunity cost of holding money and the issue of adjustment between money balances.
Research on the demand for money has increased considerably and is attributed to the following: (i) First, stable money demand function contributes to broader economic growth and rising standard of living (Nduka and Chukwu, 2013). (ii) Secondly, a good understanding of the stability and robust determinants of demand for real money balances form the core in the conduct of monetary policy as it enables a policy-driven change in monetary aggregate to have predictable influences on output, interest rate and ultimate price (Nachega,2011; Halicioglu and Ugur,2005). (iii) Thirdly, the relationship between demand for money and its main determinants is an important building block in macroeconomic theories and is a crucial component in the conduct of monetary policy (Goldfield, 1994). (iv)Fourthly, government estimation of the demand for money function is very important for successful monetary and credit policy design and management in an economy (Afolabi, 1994). (v) Fifth, appropriate money demand and supply management policies by CBN is necessary for economic development requires money to be stable and functional (Nwafor, et al., 2007). Lastly, in addition to its being crucial in understanding the behavior of critical macro-econ variables (Essien, et al., 1996), a stable money demand function is useful for explaining and even predicting the behavior of other aspect of the macro economy (Carpenter and Lange, 2002). In their studies in developed countries, Sicklos and Barton (2001), reported that the importance of money demand can be seen in terms of the information which it provides on real money gap which assist policy formulation in forecasting future variations in the level of inflation or aggregate output. Sriram,(2001) attributed the increased interest on empirical research on demand for money to (a) its role in macro-economic analysis especially in selecting appropriate monetary policy actions (ii) concern among Central Banks and researchers in the impact of the movement towards flexible exchange rate regime (iii) globalization of capital market (iv) ongoing domestic financial liberalization and innovations (v) advancement in time series econometrics and country-specific issues.

Central Banks in developing countries has strived to maintain price stability through proper foreign exchange, debts, inflation rate and interest rate management. Unarguably, a stable money demand function act as a stabilizing policy which if well estimated can evade monetary distortion thereby bringing about stability of the overall financial system. Since the stability of money is necessary in setting monetary policy, a proper understanding of the determinants of money demand is necessary for economic stability. Accordingly, this study aimed at formulating an econometric model that best describe the demand for money function in Nigeria. It would also examine the extent to

which asset holder's decision to hold their wealth in the various forms of financial assets such as treasury bills, savings deposits, government bond etc will affect their demand for money.

II. Empirical literature on the demand for money

A considerable body of literature has investigated the demand for money in various countries of the world. For instance, Nell (2003) for South Africa, Haliciogu and Ugur (2005) for Turkey; Bahmani-Oskoee and Rehman (2005) for seven Asian countries. In Tanzania, Adam, kessy, Nyella and O' Connel (2001) reported that there exists a stable co-integrating relationship between real money balance and its determinants. Abdullah et al., (2013) examine the determinants of money demand by using disaggregated approach. Others include Nwafor et al (2007); Akinlo, (2006) and Valdkhani and Alauddin (2003). Among the array of economic variables cited by these studies as determinants of money demand include GDP, interest rate, inflation rate, degree of openness, financial innovations on the economy, exchange rate etc. Most widely investigated relationship in the demand for money has been the relationship among inflation, interest rate and income (Akinlo, 2006; Owoye and Onafowova,2007; Nwafor et al. 2007). Friedman (1980) showed that real rate is invariant with regards to changes in expected inflation. Dua (1988) reported a direct influence of actual level of growth with demand for money. They showed that negative real rate was vital for growth to be effective. Katafono (2001) in his empirical work in Fugi used real rate of interest as determinants of real money balance. His result revealed a negative real rate with insignificant interest rate elasticity. Fisher and Moore (1995) reported a negative relationship between GDP and short-term nominal interest rate while Dwyer (1981) saw no influence of periodic changes in money supply on expected real rate.

Attempt to estimate the demand for money function in Nigeria started in the early 1972 with the "TATOO DEBATE". The debate among a group of scholars started in respect of Tomori (1972) work who reported that income, interest rate and real income were the major determinants of money supply in Nigeria. In response to this finding, researchers such as Teriba (1974), Ojo (1974), Ajayi,(1974) and Odama (1974) questioned the significance of income in money demand function in Nigeria; the stability of the function and the choice of appropriate definition of money in Nigeria. For instance, with respect to the choice of appropriate definition of money in Nigeria, while Ajayi (1974) reported that M2 performs better than M1, Tomori(1974) argued that M1 is better than M2. With respect to income, Teriba (1974), Ajayi,(1974) and Odama (1974) agrees that income is the most vital determinants of money demand in Nigeria. Also, considering interest rate, Teriba (1974) argued that long run interest rate is significant (unstable) while short-term rates are insignificant (stable).

Following suit, Nduka and Chukwu (2013) examined the long-run demand for real broad money function and its stability in Nigeria for the period 1986 to 2011 using ADF and the Philip Perron test for Unit root, Engle and Granger 1987 approach for co-integration and the CUSUM stability tests. Result confirm the existence of a stable, long run relationship 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 rates. Bitrus (2011) examined the demand for money in Nigeria using annual time series data for 26 years on both narrow and broad money, income, interest rate, exchange rate and the stock market. The study uses the multiple regression analysis, unit root test for stationarity and CUSSUM stability test. Result reported that money demand function was stable during the period under investigation and that income was the most significant determinant of demand for money. Iyoboyi and Pedro (2013) estimated a narrow money demand function of Nigeria from 1970-2010 using the autoregressive distributive lag bounds test approach to Co-integration. Augmented Dickey Fuller (ADF) and the Phillip-Perron unit root tests were carried out. Result revealed the existence of a Co-integrating relationship among narrow money demand, real income, short-term interest rate, real expected exchange rate, expected inflation rate and foreign real interact rate for the study period. The study reported that real income and interest rate were significant variables explaining the demand for money in Nigeria.

III. Theories of the demand for money

There exist several broad and diverse arrays of the demand for money theories in the literature each addressing a broad variety of hypothesis. These theories share the same variables among them as determinants of money balances. As reported by Judd and Scadding,(1982), these theories highlights a relationship between the quantity of money demanded and a set of few important economic variables linking money to the real sector of the economy. Example of these theories in the literature include: the original quantity theory of money (Fisher, 1911), the Keynesian theory of liquidity preference (Keynes,1936), the modernize version of Friedman (1956), Tobin (1956 and 1958) and Baumol (1952). However, in this work, four theories behind the demand for money shall be reviewed and includes:

III.I. Keynes liquidity preference theory

Keynes (1936) developed the liquidity Preference theory in his book "the general theory of employment, interest and money". Keynes theory explicitly highlights three motives behind the desire to hold money to include transaction motive, precautionary motive and the speculative motive. While the transaction motive was based on the role of money as function of exchange, the precautionary motive was based on its function as a store of wealth. Keynes believed that interest rate too was important in determining the demand for money while dividing assets that constitute a store of wealth into money and bonds. As reasoned by Keynes, the expected return on money was zero while that on bond was based on interest payment and expected rate of capital gain. He also assumed that interest rate could fall to a point where it may not be able to rise again; this was Keynes position of liquidity trap where the economy will be thrown into recession. According to Keynes, people intention to hold money would be related to real income (Y) and the interest rate (i).

Keyne developed a demand for money equation which states that the demand for real money balance (m/p) is a function of interest rate (i) and real income (y).
i.e $M/p^d = f (i , y)$

According to Mishkin (1992), Keynes model maintained that velocity is not constant but instead positively related to interest rates which fluctuate substantially. The main result of Keynes's postulation was that the demand for real money balance is negatively related to real rate and positively related to real income

III.II. Friedman restatement theory

Because of the widespread criticism that collapsed the quantity theory in 1960, Milton Friedman, a member of the quantity theorist in conjunction with the Chicago economist restated the quantity theory thereby offering more explanation on the expenditure theory of demand for money. Friedman viewed money as one way of holding wealth. He proposed that money is held as asset that attracts opportunity cost. The rate of interest expresses the relationship between stocks (wealth) and flows (income). Assuming Y is the total flow of income and r the interest rate, and then the total wealth is

$W = Y/r$ …….(1)

Friedman maintained that wealth can be held in many forms and units that are substitutable; such forms include money, equity, bonds, physical non-human goods and human capital. According to him, all these are expected to yield some returns which would depend on the volume of goods that unit correspond to or the price level, P.

If the price level P does not change, then the nominal income stream purchased for the bond (rb) and equity (re) at time zero will equal

Rb- 1/Rb (drb/dt)……..(2)

Re + 1/p (dp/dt) – 1/re (dre/dt) ……(3)

However, the physical goods held by people are similar to that of bond and equity shown above except that the annual stream they yield is in kind rather than money and thererfore depend on price. If we introduce the price level at time zero, the value of holding wealth in physical form will be

1/P (dp/dt)……(4)

This defines the real return from holding a unit asset as physical goods. The summation of equation (1), (2), (3) and (4) above along the line yield the Friedman demand for money function

M = f(P; rb-1/Rb (drb/dt); re + 1/P (db/dt)-1/re(dre/dt); 1/P(db/dt); W; Y; U)…….(5)

This can be rewritten as $M/P = f (Yp, rb-rm, re-rm, \pi e – rm)$

Where M/P = the demand for real money balance

Yp = real wealth which is a measure of wealth and is expected to be positive

Rm = the expected return on money that is expected to be negative

Rb= the expected return on bond that is expected to be negative

Re = the expected return on equity (common stock) that is expected to be negative

ΠIe = the expected inflation rate that is expected to be negative.

Friedman theory indicated that the demand for money is a function of permanent income and the expected returns on alternative assets relative to the expected return on money. From his assumptions, the fluctuations in the demand for money are small and the demand for money can be predicted accurately by the demand function.

If we accept Friedman preposition that demand for money is stable that is , interest rates were treated as stable or changing in the same proportion rather than treated as constant when prices do not change, then Rb = re + 1/P

(dP/dt). This implies that the nominal interest rate will be equal to real interest rate plus the percentage change in prices.

III.III. Baumol-Tobin Inventory Model

This demand model was developed by William Baumol and James Tobin; they demonstrated that money balances held for transaction purposes are sensitive to the level of interest rates. In their model framework, money which earns zero interest is held because it can be used to carry out transaction. This model assumed that interest rates are negatively related to the demand for money and the cash held for transaction purposes declines as interest rates rises. Taylor (1991) reported that the key assumptions in the inventory model are (i) the individual receive a known sum cash payment of T per period and spend it all evenly over the period of expenditure (ii) the individual may invest in bonds paying a known interest rate R per period or hold cash (money) paying zero interest and (iii) the individual sells bonds to obtain cash min equal amounts K, and incurs a brokerage fee (fixed) B per transaction. In this model, agents minimize the sum of brokerage cost (bt/k) and interest income forgone (rk/2). The model yields a square root relationship between demand for money and level of income, the brokerage fee and the bond interest rate.

Ln (m/p) = 0.5 Ln(b/2) – Ln (T) + Ln (r)…… (6)

Where Ln (b/2) is the expenditure on brokerage cost, Ln (T) is the expenditure on transaction while Ln (r) is the interest rate. Any increase in the price level will increase both b and t and thereby doubling M.

The Inventory model was further expanded by Taylor to include interest payment on money (i)

$Md = k/2 = [(b/2 \, T/r-i)]^{1/2}$ ……(7)

The transaction elasticity is ½ but the interest elasticity is now Er = -r/2 (r-i). Hence, the above model may be easily estimated in log-linear form with coefficients of ½ expected on T and (r- i); implying that the demand for money depends on the relative interest rate

III.IV. Post- Keynesian Theory

Following the pioneer work of keyne, numerous other models have been developed in the literature explaining the relationship between the demand for real money, income and interest rate. These can be grouped into the transaction demand, asset demand and the consumer demand theories of money.

III.IV.I The consumer demand theory

According to Kutafono (2001), this theory considers the demand for money as a direct extension of the traditional theory of demand for any durable good.

III.IV.II. The asset or portfolio theory

This theory emanates from the asset function of money and placed more emphasis on risk and expected returns of asset. It was developed by James Tobin and others in 1960. The portfolio balance focuses on interest rate as that which explains the demand for money and that which is directly and primarily affected by a change in the money supply. It centers on how individuals and the community allocate their holdings among alternative asset with the demand for each asset being measured as a proportion of total asset. This theory is based on the assumption that individual may prefer not to hold all its financial assets in one form but will hold them in a manner that is a very close substitute with money.

IV. Research Methodology

IV.I. Data source

Data for the study were secondary data sourced from various issues of Central Bank Statistical Bulletin and National Bureau of Statistics. Data employed covered the period 1986-2013

IV.II. Data Analysis and model specification

In analyzing the data, two sets of models were estimated and are shown in equation (9) and (10) below. The first model expresses the money balance (MP2) as a function of income (YT), interest rate (RT) and inflation rate (IFL). The second model was the Friedman's restated hypothetical model and was used to examine the effect of income, real rate of interest and asset holder's decision to hold their wealth in the various forms of financial assets on the demand for money. The various forms of financial assets considered here are treasury bills, Savings deposit and government bond. Among the array of tests carried out include:

IV.II.I. Test for stationarity

Studies by Engle and Granger (1987) have shown that most time series data are often non-stationary and as such using them for analysis results in spurious regression. To overcome this problem, this research adopted the Augmented Dickey Fuller (ADF) and the Phillip-Perron's (PP) unit root tests. The ADF test was preferred to the Dickey Fuller test since it include the first difference in lags such that the error term is distributed as white noise through the addition of additional lag length. The test procedure is given below:

$$\Delta Yt = \alpha + \rho \mathrm{Y}t-1 + \sum_{i-1}^{j} \mathrm{Y}\Delta \mathrm{Y}t - j + Ut \ldots \quad (8)$$

The decision rule is that the t-statistics of the various coefficients of ρ must be significantly different from their respective critical values. That is, the significance of ρ is tested against the null that ρ = 0 based on the t statistics obtained from the estimation obtained from equation (8). The null hypothesis is that the variables of interest is non-stationary (That is, it is integrated of order one, 1(1). Here the lag length j chosen for ADF ensure Ut is empirical white noise. If the null hypothesis of non-stationarity cannot be rejected, the variables are difference till they become stationary, that is, till the existence of a unit root is rejected.

IV.II.II. Co-integration test

After ascertaining the stationarity of variables, co-integration test was employed to analyze the data. According to Granger (1986), non- stationary variables are said to be co-integrated if their linear combination, namely the residual of co-integration regression are stationary. In testing for Co-integration, the study adopted the Maximum Likelihood Method developed by Johansan (1988 and 1991). Both Trace and Eigen value statistics were used to test for the number of Co-integrating vectors. The null hypothesis of the Trace test was that there exist at most r co-integrating vectors while that of the Maximum Eigenvalue was that the null of r= 0 was tested against the alternate that r = 1 and so on. Selection of the lag length for the co-integrating test was automatic. The empirical model is presented as follows:

$\Delta LnMP2_t = \beta_0 + \beta_1 LnYT_{t-2} + \beta_2 LnRT_{t-2} + \beta_3 LnINFL_{t-2} + ECMt\text{-}1 + Ut \ldots (9)$

$\Delta LnMP2_t = \beta_0 + \beta_1 LnYT_{t-2} + \beta_2 \Delta LnRRT_{t-2} + \beta_3 LnTBR_{t-2} + \beta_4 LnSDR_{t-2} + \beta_5 LnEXINF_{t-2} + \beta_6 LnREER_{t-2} + \beta_7 LnEQUI_{t-2} + ECMt\text{-}1 + Ut \ldots\ldots (10)$

Where: MP2 = Real money balance deflated by price changes using consumer price index (1984=100)

YT = Real money income proxy as GDP and adjusted for price changes (1984=100)

RRT = Real rate of interest (N/$)

EXINFL = Expected inflation rate (defined as the opportunity cost of holding money).

Three years average inflation rate was used as expected inflation rate based on the method of Iyoboh and Pedro, (2013).

SDR = Nominal return on money proxy as savings deposit rate

TBR = Returns on treasury bills proxy for bonds

EQUI = Nominal return on equity

RT = Interest rate prevailing (%)

INFL = Inflation rate (%)

Ln = Log linear transformation

Ut = Error term

IV.II.III. Testing for the short-run relationship

Having ascertained the existence of Co-integration among the variables, an over parameterized error correction model was estimated which initially consisted of 2 lag length to ascertain the effect of the independent variables on the demand for money. The over parameterized error correction model estimated is presented in equation (12a) and (12b) below:

$\Delta LnMP2t = \beta_1 + \beta_2 \Delta LnYT_t + \beta_3 \Delta LnYT_{t-1} + \beta_4 \Delta LnYT_{t-2} + \beta_5 \Delta LnRT_t + \beta_6 \Delta LnRT_{t-1} + \beta_7 \Delta LnRT_{t-2} + \beta_8 \Delta LnINFL_t + \beta_9 \Delta LnINFL_{t-1} + \beta_{10} \Delta LnINFL_{t-2} + \beta_{11} \Delta LnMP2_{t-1} + \beta_{12} \Delta LnMP2_{t-2} - ECM_{t-1} \ldots\ldots (12a)$

$\Delta LnMP2t = \beta_1 + \beta_2 \Delta LnYT_t + \beta_3 \Delta LnYT_{t-1} + \beta_4 \Delta LnYT_{t-2} + \beta_5 \Delta LnRRT_t + \beta_6 \Delta LnRRT_{t-1} + \beta_7 \Delta LnRRT_{t-2} + \beta_8 \Delta LnREER_t + \beta_9 \Delta LnTBR_t + \beta_{10} \Delta LnTBR_{t-1} + \beta_{11} \Delta LnTBR_{t-2} + \beta_{12} \Delta LnSDR_t + \beta_{13} \Delta LnSDR_{t-1} + \beta_{14} \Delta LnSDR_{t-2} + \beta_{15} \Delta LnEXINFL_t + \beta_{16} \Delta LnEXINFL_{t-1} + \beta_{17} \Delta LnEXINFL_{t-2} + \beta_{18} \Delta LnREER_t + \beta_{19} \Delta LnREER_{t-1} + \beta_{20} \Delta LnREER_{t-2} + \beta_{21} \Delta LnEQUI_t + \beta_{22} \Delta LnEQUI_{t-1} + \beta_{23} \Delta LnEQUI_{t-2} + \beta_{24} \Delta LnMP2_{t-1} + \beta_{25} \Delta LnMP2_{t-2} - ECM_{t-1} \ldots\ldots (12b)$

Where the variables are as defined in equation (9 and 10) above.

All the coefficients (β_s) of the ECM_{t-1} ($-1< \beta_8 < 0$) measures the deviation from the long-run equilibrium in period (t-1).
In obtaining the parsimonious dynamic ECM for the model, Hendry (1995) approach was adopted where insignificant lagged variables were gradually eliminated from the estimated parameterized model till the final parsimonious ECM shown in equation (13) and (14) were obtained

$\Delta LnMP2t = \beta_1 + \beta_2 \Delta LnYT_t + \beta_5 \Delta LnYT_{t-2} + \beta_2 \Delta LnRT_t + \beta_3 \Delta LnRT_{t-1} + \beta_4 \Delta LnINFL_t + + \beta_5 \Delta LnMP2_{t-2} + ECM_{t-1}$ ……………………..(13)

$\Delta LnMP2t = \beta_1 + \beta_2 \Delta LnYT_t + \beta_3 \Delta LnYT_{t-1} + \beta_4 \Delta LnRRT_t + \beta_5 \Delta LnTBR_t + \beta_6 \Delta LnTBR_{t-2} + \beta_7 \Delta LnSDR_t + \beta_8 \Delta LnSDR_{t-2} + \beta_9 \Delta LnEXINFL_t + \beta_{10} \Delta LnREER_t + \beta_{11} \Delta LnEQUI_t + \beta_{12} \Delta LnEQUI_{t-2} + \beta_{13} \Delta LnMP2_{t-1} + \beta_{14} \Delta LnMP2_{t-2} + ECM_{t-1}$ .... (14)

IV.II.IV. Testing for stability of demand for money model
The essence of this test was to check for parameter consistency in the model with view to ascertaining whether the model specification is valid in policy simulation (Okon et al. 2005). Accordingly, the data set was divided into two subsamples and the Chow (1960) test was adopted. This was done for both model 1 and model 2.This test is based on the Ftest as shown:

$$F = \left(\frac{(\sum e_p^2 - \sum e_1^2 + \sum e_2^2)/K}{(\sum e_1^2 + \sum e_2^2)/(n_1 + n_2 - 2K} \right) \quad \text{…………………………………………….} (15)$$

Where: F = observed F ratio at $n_1 + n_2$ -2K degree of freedom
$\sum e_p^2$ = pooled residual sum of squares with $n_1 + n_2$ observation; $\sum e_1^2$ = residual sum of squares with n_1 observation; $\sum e_2^2$ = residual sum of squares with n_2 observations; K= number of estimated parameters including the intercept' n_1 = number of observation in the first subgroup (1986- 2000) and n_2 = number of observation in the second subgroup (2001-2013)
Decision rule: The null hypothesis of structural stability is rejected if the calculated value of F exceeds its critical value at any chosen level of significance.

V. Result and Discussion
In this section, the results of the unit root test, co-integration test as well as the stability tests are presented and discussed.

Table 1: Result of Unit Root test for variables used for the Analysis

Logged Variable	**Augmented Dickey- Fuller Level**	**First Difference**	**OT**	**Phillip - Peron Level**	**First Difference**	**OT**
MP2	-1.4640	-6.2577*	1(1)	-2.1163	-4.8916*	1(1)
YT	-3.6273**	-4.5117*	1(0)	-4.6578	-6.6834*	1(0)
RRT	-4.4873*	-6.4326*	1(0)	-3.8332	-4.8740*	1(0)
EXINFL	-3.3044	-5.1663*	1(1)	-3.1064	-5.0546*	1(1)
SDR	-3.5067	-4.6832*	1(1)	-2.9963	-4.8535*	1(1)
TBR	-4.4115*	-5.5743*	1(0)	-4.1646	-8.7142 *	1(1)
EQUI	-2.8431	-3.6459**	1(1)	-2.1234	-4.6437*	1(1)
REER	-1.9881	-5.5326*	1(1)	-2.2678	-3.7754**	1(1)
RT	-2.8633	-4.1293**	1(1)	-3.0514	-4.1442 **	1(1)
INFL	-4.8634*	-5.8862*	1(0)	-4.3108	-7.1816*	1(0)
		Critical values				
1%	**-4.41**	**-4.44**		**-4.40**	**-4.41**	
5%	**-3.62**	**-3.63**		**-3.61**	**-3.62**	

Note: OT means order of integration. Critical values (CV) are defined at 1 and 5% significant levels and asterisks * and ** represent 1 and 5% significance level respectively. Variables are as defined in equation (8 and 9).

V.I. Unit root test for variable use in the analysis
Table 1 presents the stationarity test conducted using ADF and Phillip-Perron test. Results revealed that income (YT), real rate of interest (RRT), Treasury bill rate (TBR) and Inflation rate (INFL) were stationary at levels.

However, the other variables attained stationarity after first differencing at either the 1 or 5 % level of significance. This validates the use of Co-integration.

V.II. Result of Co-integration test for Model 1 and Model 2

Table 2 and Table 3 presents the results of the Johansen Maximum Likelihood Co-integration test based on Trace and Maximum eigenvalue tests for the Keynes Liquidity preference model (model1) and the Friedman Restated hypothetical approach (model 2). Result in Table 2 revealed the existence of 3 co-integrating vectors for the Trace and Maximum Eigen value test respectively. That of Table 3 shows the existence of 5 and 3 co-integrating vectors for the Trace and the Maximum Eigen value test respectively. Hence, the null hypothesis of non-co-integration of r = 0 is rejected in both cases. The existence of co-integration among the variables is a sufficient proof of the existence of a long-run equilibrium relationship between the demand for money and the explanatory variables. This validates the use of error correction model for the analysis.

Table 2: Result of Johansen Co-integrating Test (Unrestricted Constant) for model 1

	Trace Test K=2			**Maximum Eigen value test k=2**			
H_O	**H_A**	**Trace Test**	**Critical H_O Value 5%**	**H_A**		**Max Eigen Statistics**	**Critical Value 5%**
$r \leq 0$	$r > 0$	199.4735	54.5532**	$r \leq 0$	$r > 0$	102.8668	49.3174 **
$r \leq 0$	$r > 1$	110.3632	22.0528 **	$r \leq 0$	$r > 1$	70.7921	30.1875 **
$r \leq 0$	$r > 2$	30.4479	14.0486**	$r \leq 0$	$r > 2$	12.8113	9.5736**
$r \leq 0$	$r > 3$	2.8854	3.8442	$r \leq 0$	$r > 3$	2.8854	3.8442

Note: Trace and Max Eigenvalue test indicates 3 co-integrating equations each at the 5 % level.
** Denote rejection of the hypothesis at the 0.05 levels and r represent number of co-integrating vectors and k represents the number of lags in the unrestricted co-integration test.

Table 3: Result of Johansen Co-integrating Test (Unrestricted Constant) for model 2

	Trace Test K=2			**Maximum Eigen value test k=2**			
H_O	**H_A**	**Trace Test**	**Critical H_O Value 5%**	**H_A**		**Max Eigen Statistics**	**Critical Value 5%**
$r \leq 0$	$r > 0$	263.6651	121.5123**	$r \leq 0$	$r > 0$	110.9278	98.3213 **
$r \leq 0$	$r > 1$	186.7432	94.6324 **	$r \leq 0$	$r > 1$	74.5254	64.0675 **
$r \leq 0$	$r > 2$	146.3663	63.7188**	$r \leq 0$	$r > 2$	51.6055	43.7685**
$r \leq 0$	$r > 3$	78.3793	41.5862**	$r \leq 0$	$r > 3$	30.3243	33.1886
$r \leq 0$	$r > 4$	41.6545	28.1167 **	$r \leq 0$	$r > 4$	18.81902	21.9543
$r \leq 0$	$r > 5$	16.6330	20.2145	$r \leq 0$	$r > 5$	13.8732	15.1415
$r \leq 0$	$r > 6$	9.8661	11.3926	$r \leq 0$	$r > 6$	7.6197	8.6234
$r \leq 0$	$r > 7$	1.8875	4.3514	$r \leq 0$	$r > 7$	1.8875	4.3514

Note: Trace and Max Eigenvalue test indicates 5 and 3 co-integrating equations at the 5 % level.
** Denote rejection of the hypothesis at the 0.05 levels and r represent number of co-integrating vectors and k represents the number of lags in the unrestricted co-integration test

V.III. Result of the demand for money model using income, interest rate and inflation rate

Table 4 presents the parsimonious error correction models estimated from the ECM analysis that was carried out to ascertain the short-run effect of the explanatory variables on the demand for money using income (YT), interest rate (RT) and inflation rate (INFL) in Nigeria. The parsimonious error correction model shown in table 4 was obtained by dropping some insignificant lagged variables based on Henry (1995) method. The diagnostic test showed R^2 of 0.5311, implying that about 53.11% of the variability in money demand is explained by the explanatory variables in the model. The Durbin Watson statistics of 1.998 close to two shows the absence of serial correlation in the model. The F-statistics value of 8.073 (< p< 0.01) denotes the goodness of fit of the estimated model. The error correction model coefficient carried the expected negative sign and was significant at the 5 percent level. This shows the existence of a long run steady state equilibrium relationship between money demand and the explanatory variables. The slope coefficient of the ECM (-0.05311) shows a feedback of about 5.316 percent of the previous year's disequilibrium from long-run elasticity of demand for money and the explanatory variables. This shows a very slow speed of adjustment.

From the result, the coefficient for income (YT) was positive and significantly related to money demand at the 1 percent level. Its coefficient (0.40541) indicates that a unit increase in real income would increase real money balance by 0.4054 percent. From its coefficient, the elasticity for real broad money is less than unity, thereby supporting the Keynes transaction and precautionary theories of money demand (Keyne, 1936). This result corroborates those of Bitrus (2011), Nwafor et al (2007) and Nduka and Chukwu (2013) in Nigeria.

The interest rate (RT) coefficient and past value of interest rate (RT_{t-1}) were negative and significantly related to real money balance at the 5 and 1percent significance levels respectively. Its coefficient shows that increasing interest rate and previous interest rate by 10 percent would reduce the real money balance by 7.468 percent and 2.421 respectively. This is in line with aprori expectation because at higher interest rate, asset holders would prefer to invest their money in other interest yielding assets rather than holding on to it. This finding justifies the use of interest rate by monetary authorities as a tool for monetary stability. The negative coefficient of interest rate follows the Friedman quantity theory of money. This finding support those of Nduka and Chukwu (2013) , Bassey et al.(2012), Nyong, (2001) and Iyoboyi and Pedro (2013). Bitrus (2011) also reported a negative and insignificant value in Nigeria. Beyond this, the Keynesian theory which stipulates that interest rate acts indirectly in regulating monetary equilibrium is justified here.

The coefficient for inflation rate (INFL) was negative and insignificant. This is expected because inflation reduces the value of money thereby reducing the desire of asset holders to hold cash. Bitrus (2011) also reported a negative and insignificant relationship between inflation and demand for both narrow and broad money in Nigeria. Bitrus (2011) attributed the insignificant value of inflation rate to the fact that income are at subsistence level in Nigeria, therefore, people need to hold cash to finance daily transaction even when inflationary expectation is high.

Table 4: Parsimonious ECM estimates for the determinants of money demand(Model 1)

Variable	Coefficient	Standard error	T- statistics	Prob
Constant	-4.36226	1.09624	3.9793	0.0000
$\Delta Ln\text{YT}_t$	1.21623	0.37932	3.20634	0.0016
$\Delta Ln\text{YT}_{t-2}$	-0.00450	0.00514	0.88845	0.4065
ΔLn RT	-0.74684	0.36540	-2.04373	0.0364
$\Delta Ln\text{RT}_{t-1}$	-0.24211	0.03912	6.15232	0.0000
ΔLnINFL	-0.03348	0.22022	-0.15206	0.8595
$\Delta Ln\text{MPT}_{t-2}$	0.03024	0.12333	0.24491	0.6869
ΔLnECM_{t-1}	-0.05311	0.02517	-2.11005	0.0304
Diagnostic Test				
$R^2 = 0.584$	Durbin Watson = 2.013			
Fstat = 9.075**	Normality Test =2.332***	Shwartz Information Criterion = 31.219		

Note: ** and *** denotes significant at 5 and 1 percent respectively. All variables are in logs.

V.IV. Result of the demand for money using the Friedman's hypothetical approach

The result of the parsimonious error correction models that was estimated to ascertain the short-run effect of the explanatory variables on the demand for money using the Friedman restated hypothetical model (model 2) in Nigeria is presented in Table 5. The model was obtained by dropping some insignificant lagged variables based on Henry (1995) method till a more reliable model with higher R^2 and ECM and other parameter estimates were obtained. The diagnostic test showed R^2 of 0.721, implying that about 72.1% of the variability in money demand is explained by the explanatory variables in the model. The Durbin Watson statistics of 2.12 shows the absence of serial correlation in the model. The F-statistics value of 3.561 ($< p < 0.01$) denotes the goodness of fit of the estimated model. The error correction model coefficient carried the expected negative sign and was significant at the 5 percent level. This shows the existence of a long run steady state equilibrium relationship between money demand and the explanatory variables. Its slope coefficient (-0.4211) shows a feedback of about 42.11 percent of the previous year's disequilibrium from long-run elasticity of demand for money and the explanatory variables. This shows a moderate speed of adjustment.

With respect to estimated parameters, the coefficient for real wealth proxy by real income (YT) and past value of real income (TY_{t-1}) carried the expected positive signs and were significant at the 1 and 5 percent levels,

respectively, implying that increasing these variables will increase the demand for money. The elasticity of their coefficients was well above unity, implying that income is perfectly elastic to money stock. Their coefficients also show that increasing real income by 1 percent will increase the nominal balance by 1.99234 and 1.6610 percentages respectively. The plausible justification for this is that any increase in either the previous or current income of asset holders would invariably increase their desire to hold money presumably to meet up daily transaction. Iyoboyi and Pedro (2013) and Nduka and Chukwu (2013) reported similar findings.

The coefficient for Treasury bill (TBR) and past value of Treasury bill rate which was proxy for bond were both negative sign and significant at 1 and 5 percent levels. their coefficients show that a 10 percent return in Treasury bill and past value of Treasury bill rate will reduce the demand for real money by 0.6753 and 1.1949 percentages respectively. This is expected because asset holders would prefer to take advantage of the excess return on the Treasury bill rather than holding on to money and even investing on other money asset especially when the return on other money asset is lower than that of the Treasury bill. This finding lends support to Friedman (1956) postulation.

Table 5: Parsimonious ECM estimates for the determinants of money demand (Model 2)

Variable	Coefficient	Standard error	T- statistics	Prob
Constant	0.8379	0.3439	2.4361	0.0173
$\Delta LnYT_t$	1.9923	0.4620	4.3110	0.0001
$\Delta Ln\ YT_{t-1}$	1.6110	0.5634	2.8594	0.0162
$\Delta LnRRT_t$	0.0361	0.0816	0.4434	0.6507
$\Delta LnTBR_t$	-0.0675	0.0314	-2.1506	0.0210
$\Delta LnTBR_{t-2}$	-0.1194	0.0113	10.4891	0.0000
$\Delta LnSDR_t$	-0.2421	0.0391	6.1521	0.0000
$\Delta LnSDR_{t-2}$	0.0048	0.0069	0.6956	0.4193
$\Delta LnEXINF_t$	-0.0429	0.0217	1.9715	0.0738
ΔLnREER	-0.0033	0.0042	0.7694	0.4431
ΔLn EQUI	-0.4413	0.1917	-2.3018	0.0177
$\Delta Ln\ EQUI_{t-1}$	-0.4323	0.1946	-2.2211	0.0181
$\Delta Ln\ MP2_{t-2}$	0.0266	0.0294	0.9053	0.3681
$\Delta LnECM_{t-1}$	-0.4211	0.17521	-2.15736	0.0312
Diagnostic Test				
$R^2 = 0.721$	Durbin Watson = 2.12			
Fstat = 13.561**	Normality Test = 6.241**	Shwartz Information Criterion = 44.8793		

Note: ** and *** denotes significant at 5 and 1 percent respectively. All variables are in logs.

The Savings deposit (SDR) coefficient was also negative and significant at the 1 percent level of probability. Its coefficient shows that a 1 percent increase in savings deposit rate would reduce real money balance by 0.2421 percent. This is justified in that increase in return on money asset was supposed to reduce the demand to hold money because people would prefer to invest in these money assets so as to take advantage of the high return in them. This finding further supports the Friedman Liquidity Preference Theory. The coefficient for expected inflation rate (EXINF) carried a negative sign and was significant at the 1 percent level. Its coefficient shows that a 10 percent increase in inflationary expectation would reduce real money balance by 0.429 percent. This result is surprising given that people are expected to demand more money during period of expected inflation so as to compensate for the anticipated loss in value of purchasing power. However, the plausible explanation for this negative coefficient of EXIF rate would be because asset holders would prefer to switch out of money assets to other forms of assets when the expected inflation rate is high. Also, any expectation in the rise in inflation rate would discourage savings because of the reduction in the value of money. Hence, agents would prefer to hold real assets as hedges with view to cushioning inflationary effects. The negative coefficient follows the Friedman's quantity theory of money. This finding also support those of Bitrus (2011) and Bassey et al.(2012). Nduka and Chukwu (2013), also reported that people prefer to hold real assets as hedges during period of rising inflation.

The coefficient for nominal real exchange rate (REER) carried a negative sign but was not significant. From its coefficient, a 1 percent increase in the REER would reduce real money balance by 0.0032 percent. This finding is not surprising given that increase in exchange rate implies depreciation in domestic currency. Therefore, any

increase in exchange rate will be perceived as a decline in wealth, hence, facilitating a fall in the demand for domestic currency because people would prefer to opt for foreign currency with higher value. This finding conflicts with Iyoboyi and Pedro (2013). The equity (EQUI) coefficient and coefficient for previous value of equity ($EQUI_{t-1}$) were both negative and significant at the 5 percent levels. From the result, a 1 percent increase in these variables would reduce money stock by 0.4413 and 0.4323, respectively. The negative sign conforms to theoretical postulation because any increase in the return on equity is expected to reduce people's urge to hold money. This is true because people would prefer to invest their money in equities rather than holding on to it. This finding is in line with Friedman (1956) proposition.

V.V. Result of stability test

The results of the test for model stability using the Chow Break point for 2000 yield F- statistic values of 1.6774 and 0.9137 and p values of 0.105 and 0.369 for model 1 and model 2 respectively, denoting that the null hypothesis of the model stability cannot be rejected in both cases. Therefore, we conclude that the money demand function has been stable. That is that the broad money demand between the two periods does not change in both models. This validates the use of the model for policy simulation. Studies such as Nduka and Chukwu (2013) and Bitrus (2011) reported separately that money demand in Nigeria were stable.

VI. Conclusions

This study follows the Liquidity Preference and Friedman Restated Hypothetical approaches to formulate an appropriate demand for money for Nigeria. Result revealed that the major determinants of money demand were real income (Y), Interest rate (IR) and expected inflation rate (EXINF). While income enhances the desire to hold money, interest rate and expected inflation rate impacted negatively on money demand. This justifies the use of interest rate by monetary authorities as a tool for monetary stability. Surprisingly, real interest rate and inflation rate were insignificant in determining the demand for money in Nigeria. Result of the Friedman restated hypothetical model showed that increase in return to other money assets such savings deposit, equity and Treasury bill reduces economic agent's desire to hold money. Result further showed that during inflationary expectation and periods of lower interest rates, asset holders switch out of money assets into real assets. Hence, inflationary expectation and interest rate were vital determinants of asset substitution in Nigeria. Result of the stability test revealed that money demand was stable in Nigeria for the sample period.

VII. Recommendations

The following recommendations are derived from the finding:

(i) To enhance the demand for money, policies that would increase real money income should be pursued. Such policies should be tailored towards creating employment, reducing prices of goods and services as well as increasing salaries and wages of workers. Care should, however, be taken so as not to trigger inflation.

(ii) Interest rate and inflationary expectation were found to exert significant negative
Influence on money demand, therefore, to increase money demand, emphasis should be directed towards reducing money banks interest rate and returns on other money bank securities as well as inflation rate while ensuring macroeconomic stability.

(iii) Also, monetary authorities should rely on interest rate as a tool for monetary stability at the expense of real rate of interest.

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