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Original Research

RETHINKING MONEY DEMAND FUNCTION IN NIGERIA USING TODA-YAMAMOTO APPROACH

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ABSTRACT

This study examined the demand for money in Nigeria from 1980 to 2019, employing various techniques of econometric analysis. The study was motivated to determine whether Keynes liquidity preference theory holds in Nigeria and to ascertain whether money demand function is stable in Nigeria. The Augmented Dickey Fuller (ADF) unit root test showed that the variables were stationary at different levels. The test of stability showed that the estimated parameters for the study are stable within the period under study. Thus, money demand function is stable in Nigeria. Considering a year period lag in the estimated money demand function, it was found that there was a positive relationship between money demand and real income during the period of study. It implies that increase in real income (gross domestic product) leads to increase in the demand for money, as predicted by economic theory. The real income (gross domestic product) coefficient is 0.09 which is less than unit and is consistent with the transactions and precautionary theories. However, the inflation rate both at a year and two years period lags had negative signs, and were consistent with a priori expectations. The coefficient of –0.002 and -0.001 respectively showed that the demand for money in Nigeria will decrease by about 0.2% or 0.1% when the inflation rate (at a year or two year lag) rises by 1%. The result indicated that the higher the rate of expected inflation (i.e. higher returns on the alternative assets), ceteris paribus, and the lower is the demand for money in Nigeria. Hence, people would tend to switch to other money alternatives when inflation is anticipated, because they promise higher rates of returns. In the light of the findings, it was recommended that Central Bank of Nigeria should pursue policy aimed at changing the level of income which will influence the demand for money in the same direction.

Keywords: Money demand, Nigeria, Liquidity preference, Toda-Yamamoto, CUSUM test

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INTRODUCTION

There is no gain saying that a well specified money demand function is of great essence in the conduct of monetary policy. Goldfield (1994) asserts that a very important building block in macroeconomics is the relationship between demand for money and its determinants; hence it forms an important component in conducting monetary policy. Both developed and developing countries have paid utmost attention to money demand analysis, as it remains one of the central issues in macroeconomic literature which have attracted research attention. Money demand and its determinant have therefore formed the basis for macro-economic theory formulation and implementation. For ages, it has performed very significant roles and it is still playing it now as it will continue to play it in years to come. Both developed and developing countries affirm that increase in national output (GDP) economic growth cannot be possible without money (Abiola and Egbuwalo, 2012). Thus, without money, nations of the world cannot achieve significant growth in national output.

The study of demand for money raises the question on why individuals prefer to hold cash instead of investing it. In the bid towards providing an answer to why people prefer cash to investment, the interest of various economists have been attracted ranging from Irving Fisher in the early 1900, Lord Maynard Keynes in the early 1936, Williams Baumol, James Tobin to Milton Friedman among others. Keynes (1936) in his general theory of employment, interest and money introduced the liquidity preference concept which ushered in the development of modern macroeconomic theory, hence leading to development of the demand for money theory. In his word, individuals demand for money for three main reasons which are precautionary, transactionary and speculative motive. In Keynes tradition, according to Mai-Lafia (2002), money demand function was developed as if there were two aspects of money demanded separately. This stems from the disaggregation of money demand motives into transactionary, precautionary and speculative motives such that demand for money for both transactionary and precautionary motives depends on income while demand for money for speculative purposes depends on the prevailing rate of interest.

Many policies of Central Bank of Nigeria which were aimed at ensuring liberalization and deregulation of the economy beginning from the 1980s have shifted between economic tools

of money, swapping policies that directly affect money supply and bank rates. Given that it has been established that interest rate targeting as an instrument of monetary policy may lead to stability in money demand as opposed to financial market liberalization previously upheld by developed countries prior to the economic meltdown, it becomes necessary to carry out a test of stability on demand for money function in less developed countries, for instance Nigeria. However, empirical studies have been carried out in Nigeria especially since the adoption of Structural Adjustment Programme (SAP) in the late 1980s (Owoye and Onofoora, 2007). Among these studies, numerous variables were modeled of which most of them found a stable demand for money in Nigeria. According to Carpenter and Lange (2002), anxiety over the stability of money demand function has led to continuous and unabated search for it and this has been compounded by the recent break-down hitherto stable relationships which gave rise to re-specification and remodeling of money demand function during the war period.

The motivation behind the study stems from the major problem of money demand in Nigeria and is therefore the problem of persistent inflationary pressure, unemployment, increased money reserve ratio and interest rate in spite of monetary policy measures adopted and applied over the years. There is equally the problem of general feeling that a continuous decrease in rate of interest will have adverse consequence on demand for money which will lead to inflation, denying the intended benefit of monetary policy use. It is therefore, important to carry out an investigation on the stability of money demand function since it will enable policy makers select and adopt the correct monetary policy instruments in the pursuit of various macroeconomic goals. In the course of this study, further empirical evidence on money demand is provided by modeling broad money demand against income, interest rate and inflation in Nigeria. More so, two research questions were formulated to guide the study: 1) To what extent has Keynes liquidity preference theory held in Nigeria and 2) What is the level of stability for demand for money in Nigeria? Therefore the crux of this current study lies in addressing these research questions to fill the gap in extant literature.

2.0 REVIEW OF RELATED LITERATURE

2.1 Conceptual and Theoretical Review

Many literature works have considerably examined the demand for money in both advanced and less advance nations for instance, see Omotor (2009), Vuong and Tran (2010), Calza, Gerdesmeier, & Levy (2001) among others. When it comes to considering the demand for money function stability in Nigeria, vividly, great amounts of empirical study still needs to be done. Monetary policy together with fiscal policy in determining this study is meant to aid further research as little literature has been added to the concept of monetary economics. Though money is anything that is universally acceptable as a medium of exchange and transactions and the standard unit of debt payments serves four basic functions in modern economics; money includes standard of measurement, medium of exchange, store of value and means of future payment. Both the traditional and the modern theories of money demand function is what this section seeks to synoptically highlight.

2.1.1 Classical Theory of Money Demand

The classical school evolved through the concerted efforts and contributions of economists like Adam Smith, J. B Say, David Ricardo, A.C Pigou and others who share the same belief (Abiola and Egbuwalo, 2012). The classical model theory of money demand is built upon Say's law of market which holds that "supply creates its own demand". What this means is that if goods and services are produced and brought to the market, it will attract demand sufficient enough to ensure market clearance, so that there will be no need to lay off workers and create unemployment in the economy (Nduka and Chukwu, 2013). The classical economists postulate that it is supply that creates demand and not demand creating supply. The theory of money, according to Irving Fisher, is very closely related to that of Say. His theory came in the form of an equation of exchanges which establishes that the price level operating in an economy depends on the total stock of money (money supply). In his "purchasing power of money" published in 1911, Fisher introduced his equation of exchange (MV= PT) in his analysis of the determinant of price level. According to the theory, the value of money is inversely related with the price level which on its own depends on the stock of money available. Hence, any change in the money stock brings about an equal change in the level of prices. In other words, "other things remaining

the same, as the quantity of money in circulation increases, the price level also increases in direct proportion and the value of money decreases and vice versa". Fisher's theory has been extended as can be found in the Cambridge version of quantity theory popularly known as the "cash balance approach". The Cambridge economists conclude equally that price level is positively and proportionally related to money stock (Iyoboyi and Pedro, 2013).

2.1.3 Keynesian Theory of Money Demand

Again, John Maynard Keynes developed general analysis on the income-expenditure. Keynes (1936) gave an alternative approach to the interpretation of variation in nominal income; he laid emphasis on a rising relationship between stock of money and money income. Keynes liquidity preference theory made a remarkable turnaround in the debate on the theory of money for demand. Keynes (1936) published his general theory which was very critical of the quantity theory. According to him, the quantity theory was wrong in singling out the price level as the variable which principally determines the demand for money and whose movement is principally determined by variations in money stock. Keynes reasoned that such role is filled not by the price level but by interest rate in accordance with his theory of liquidity preferences. In his book, "the general theory of employment, interest and money", Keynes (1936) propounded his own theory of demand. According to Keynes, money demanded is as a result of its liquidity while liquidity simply means conversion of an asset into raw cash.

2.1.4 Friedman's Quantity Theory

The Keynesian theory is the most widely criticized from another set of economists popularly known as the monetarists. These set of economists was led by Milton Friedman (Aiyedogbon et al, 2013). Friedman (1956) restated his quantity theory of money and the process outlined the various determinants of money demand. His theory is based on his assumption that people hold cash not for the sole purpose of precautionary, transactionary and speculative motives. His argument was that rate at which money changes hand can be predicted such that there is high level of stability in money demand function. He equally opined that money demand is not dependent on interest rate. The implication is that the quantity of money demand can be accurately predicted given a demand for money function. In his money demand function,

Friedman (1956) specified money demand being dependent on the following variables: rate of interest on bond, rate of interest on equity, price level, rate of changes in price over time, ratio of human to non-human wealth, wealth of economic actors and tastes and preference (Abiola and Egbuwalo, 2012). The conclusion from thesis is that money demand depends on the rate of return on these investments and upon income.

2.1.5 Baumol-Tobin Theory of Money Demand

Baumol and Tobin (1958) in formulating theory of money demand sought to provide a defense for Keynes as he proposed that money demand is both interest and income dependent in line with the Keynesian's assertion. This stands in defense of Keynesians against those who opposed the appropriateness of Keynes theory of liquidity. Two economists forwarded what is known today as "squares root" of money holding in its simplest context. They viewed demand for money from the perspectives of risk in their "liquidity preference as behaviour towards Risk". Similarly, in his "Transactions Demand for Cash: An inventory theoretic approach", Baumol (1952) employed the equation above in his analysis of money demand. $M = (KY/2R)^{1/2}$ which in its simplest form means that nominal money holdings for cost minimizing is inversely related to the square root of rate of interest operating in the market and equally has a direct relationship with square root of planned nominal expenditure. In real terms, this can equally be explained through deflation of nominal variables. Laidler (1977) pointed out that "Keynes did not regard the demand for money arising from the transactions and precautionary motives as technically fixed in their relationships with the level of income and therefore emphasizes that the most important innovation in Keynes' analysis is his speculative demand for money".

2.2 Empirical Literature

Essentially, empirical researches on money demand abound; but outcomes of these researches are diverse depending on the technique employed in the study, the variables chosen, the scope covered and the intellectual disposition and inclination of the researcher. In this regards, Rao and Kumar (2007) opine that since the future rate of inflation has been included as a point of emphasis especially for less developed economics especially because of under developed monetary and financial system and absence of market determining the rate of interest,

financial asset representing one of core protection against price instability and as an alternative to assets in portfolio of non-banking public.

Several empirical works have been done to understand the dynamics of money demand in Nigeria, starting from the "TATOO" debate articulated in Tomori (1972). For instance, Abiola and Egbuwalo (2012) tested the validity of Friedman's theory. The study made use of time series data between 1970 and 2008 and due to presence of autocorrelation that is usually associated with time series variables, techniques of co-integration econometrics was employed specifying wealth of the economic agents, i.e. permanent income, human to non-human wealth ratio, change over time on price rate, return rate on equity, rate of interest return on bond is being determined by money demand. The study made use of ordinary least square estimation technique to estimate the parameters of economic relationship existing between the specified variables. Findings show that only human to non-human wealth ratio conforms to a priori expectation while other variables are not in conformity with Friedman's model. Just as in its original form, the model specified a positive relationship exists between demand for money and that of human wealth to non-human wealth, but the result shows an inverse (negative) relationship that exists between the two which according to the researchers resulted to the per capital income (PCI) decreasing situation in Nigeria over time. There is other submission coming from the work which includes that since price has a positive relationship with demand of money, it gives validity to Friedman's re-submission.

Teriba (1974) studied the demand for money in the Nigerian economy. His study made use of double log specification using ordinary least square technique and with a time series data between 1958 and 1972. The study showed a significant income elasticity of demand for money and an insignificant interest rate elasticity of demand for money.

In another analysis of the demand for money stability in Nigeria during the period of the structural adjustment programme, Anono (2002) used the cointetegration technique in his investigation. Estimates from the Johansen cointegration analysis which was the methodology of the study that real rate of discount, discount, economics activities and real M2, are co-integrated, for the period under study, hence there is stability in money demand function as shown by CUSUM and CUSUMSQ stability test. As shown in the finding, M2 is a very reliable instrument

for monetary policy as it can be used to spur economic growth through stimulation of economic activities.

The endogenous structural break date for the demand was estimated for the period spanning from 1960-2008 by Omotor (2011) who used Gregory and Hansen's technique to test for cointegrating equations between money demand and its potential determinants as was specified in the model. Findings from the study support earlier studies and conclude that there is stability in money demand function in Nigeria within the period studied. The study recommended that Central Bank of Nigeria should continue to use money supply as an instrument of monetary policy giving its effectiveness in stabilizing the economy.

Akinlo (2006) made use of an autoregressive distributed lag model (ARDLM) alongside CUSSUM and CUSSUMSQ test. His finding was that income interest rates and exchange rate should be co-integrated with broad money (M2). While CUSUM test result showed a weak report of money demand for Nigeria stability. Omotor (2009) also used the auto-regressive distrusted lag (ARDL) technique and the result also showed stability in money demand for Nigeria.

Gbadebo and Oladapo (2009) examined how finance were being operated after the period of Structural Adjustment Programme (SAP) in 1986 and whether the operation has any effect on money demand in Nigeria. In doing this, Engle and Granger 2-step co-integration technique was employed to carry out the test, the result gotten showed there exists a negative (inverse) relationship between cash balance demand and interest rates, while innovations into financial system within the period of study was found to have no significant effect on demand for money in Nigeria. In lieu of the recent global financial meltdown, Sani, Olorunsola, Stephen, Uyaebo & Abiodun (2014) examined the money demand function in Nigeria. The study sought to determine whether the basic characteristics of money demand has changed in recent years. Specifically, the study examined the presence of long run stability in money demand using quarterly data for the period 1991: Q1 -2013 Q4, while there are structural breaks possibilities which investigation was carried out and was accounted for. It was discovered that there are both intercepts and regime shifts in 2007 as observed by Gregory Hansen residual which forms the basis for co-integration

test at 1% level of significance. The tested money demand model gives important basis for the monetary policy formation in Nigeria as there exists fairly long run relationship among the variable as the study infers.

In a study of the cointegrating properties and stability of money demand in Nigeria, Nwaobi (2002) examined the stability of money demand in Nigeria using vector auto regression. The result confirms that there is stable money demand function in Nigeria within the period of the study. Again, Anono (2002) undertook an exploration on broad money demand stability in Nigeria within the period of structural adjustment programme (SAP). In the course of the study, he used broad money demand function and discovered that it is only a sound monetary policy instrument can be used to carryout economic transactions in Nigeria.

In summary, it is noteworthy that there are a number of limitations which can be observed. For example, prominent among these limitations is the fact that most of the studies went straight in the application of Ordinary least square technique to estimate the parameters of their model without paying prior attention to the stationarity status of the data employed. The implication is that there are possibilities that the outcome of their results may not be reliable since some of the data may be non-stationary. Secondly, among the reviewed studies, some focused separately on the stability of money demand while others focused separately on the determinants of money demand. This is an improvement in knowledge as it sets out towards filling some of the observed gaps in the extant literature.

3.0 METHODOLOGY

Given that this study attempts to study the effect of one variable on another variable, the *ex-post facto* research design was adopted in the study. This design was adopted because the researcher does not have direct control of the independent variables given that their manifestations have already occurred.

3.1 Specification of Research Models

In econometric model, economic theories form its foundation. To specify the model that captured money demand function in Nigeria, this study adopted the model of Teriba (1992) who

specified broad money demand against income rate of interest and inflation rate. Hence the model will be specified below.

MD= f (GDP, INT, INF)

The model is transformed statistically as follows:

$MD = b_0+B_1GDP + B_2INT + B_3 INF + U$

Where: GDP = Gross domestic product at current price, MD = Broad Money Demand, INT = Interest Rates, INF = Inflation rate, U = Error term (stochastic term), b_0 = Constant term, b_1-b_3 =Parameters to be estimated

3.2 Economic Criteria (A priori expectation)

b_1 is expected to be positive because in macroeconomic theory, money demand is expected to grow and fall with an increase or decrease respectively in income.

b_2 is expected to be negative because in macroeconomic theory, interest rates has a negative relationship with money demand according to Keynes.

b_3 will be expected to be positive as inflation reduces the value of money and makes people want to hold more money to satisfy their needs.

In summary,

b_1 and $b_3>0$, $b_2< 0$

3.3 Estimation Procedure

3.3.1 Akaike Information Criterion (AIC) Model Selection

Exploratory model building is often used within the context of multiple regression (MR) analysis. As noted by Draper & Smith (1998), these undertakings are usually motivated by the contradictory goals of maximizing predictive efficiency and minimizing data collection/monitoring costs. A popular compromise has been to adopt some strategy for selecting a "best" subset of predictors. All-possible subsets does choose a "best" model for a fixed number of predictors but not necessarily an overall "best" model. For example, for the m^{th} model based

on p_m out of a total of p independent parameters, Mallows C_P utilizes a criterion of the form: $SS_m / \hat{\sigma}_e^2 - [n - 2(p_m + 1)]$

where $\hat{\sigma}_e^2$ is the residual variance estimate based on the full model (i. e., the model with all *p* predictors). Models with values close to $p_m + 1$ are "best" in a final prediction error (FPE) sense. Thus, a "best" model can be identified for fixed values of p_m but there is no general method for selecting an overall "best" model.

The purpose of this study is also to evaluate the use of information criteria, such as Akaike's (1973, 1974) AIC, for selecting "best" models using an all-possible subsets MR approach. An advantage of information statistics is that "best" can be defined for both a fixed number of predictors as well as across prediction sets of varying sizes. Akaike (1973) adopted the Kullback-Leibler definition of information, $I(f;g)$, as a natural measure of discrepancy, or asymmetrical distance, between a "true" model, $f(y)$, and a proposed model, $g(y|\beta)$, where β is a vector of parameters. Based on large-sample theory, Akaike derived an estimator for $I(f;g)$ of the general form

$$AIC_m = -2Ln(L_m) + 2 \cdot k_m$$

where L_m is the sample log-likelihood for the m^{th} of M alternative models and k_m is the number of independent parameters estimated for the m^{th} model. The term, $2 \cdot k_m$, may be viewed as a penalty for over-parameterization. The derivation of AIC involves the notion of loss of information that results from replacing the true parametric values for a model by their maximum likelihood estimates (MLE's) from a sample. In addition, Akaike (1978) has provided a Bayesian interpretation of AIC. A min(AIC) strategy is used for selecting among two or more competing models. In a general sense, the model for which AIC_m is smallest represents the "best" approximation to the true model. That is, it is the model with the smallest expected loss of information when MLE's replace true parametric values in the model.

3.4 Toda and Yamamoto Approach

The conventional Granger causality tests in an unrestricted Vector Auto-regression (VAR) framework is conditional on the assumption that the underlying variables are stationary, or integrated of order zero in nature. If the time series are non-stationary, the stability condition of the VAR is supposed to be violated. This implies that the $\chi 2$ (Wald) test statistics for Granger causality that are used to test the joint significance of each of the other lagged endogenous variables in VAR equations becomes invalid. In the case of non-stationary time series, one must investigate cointegration and if that exists, one must proceed with vector error correction model instead of unrestricted VAR. If the series are not integrated of order $I(1)$ or are integrated of different orders no test for long run relationship is employed.

On the other hand employment of unit root and cointegration tests may suffer from low power against the alternative, therefore they can be misplaced and may suffer from pre-testing bias (Toda and Yamamoto, 1995; Pesaran, Smith and Shin (2001). To obviate some of these problems Toda &Yamamoto (1995) and Dolado and Lutkepohl (1996) employ a modified Wald test for restriction on the parameters of the VAR (k) with k being the lag length of the VAR system. In their approach, the correct order of the system (k) is augmented by the maximal order of integration (d_{max}) then the VAR ($k + d_{max}$) is estimated with the coefficients of the last lagged d_{max} vector being ignored. Toda and Yamamoto (1995) confirm that the Wald statistic converges in distribution to a chi-square random variable with degrees of freedom equal to the number of the excluded lagged variables regardless of whether the process is stationary, possibly around a linear trend or whether it is cointegrated.

The TY procedure avoids the bias associated with unit roots and cointegration tests as it does not require pre-testing of cointegrating properties of the system (Zapata & Rambaldi, 1997 and Clark & Mizra, 2006). The method proposes an augmented level VAR modeling and hence causality testing with a possibly integrated and cointegrated system (of arbitrary orders) unlike the general VAR modeling where the long-run information of the system is often sacrificed in the mandatory process of first differencing and pre-whitening (Clark & Mirza, 2006; Rambaldi and Doran, 2006). The test (MWALD) statistic is valid as long as the order of integration of the process does not exceed the true lag length of the model (Toda & Yamamoto, 1995).

A VAR of order p can be represented by

$$y_t = a_0 + a_1 t + \sum_{i=1}^{p} \Phi_i y_{t-i} + \Psi w_t + u_t \ldots\ldots(1)$$

where y_t is a (n × 1) vector of endogenous variables, t is the linear time trend, a_0 and a_1 are (n × 1) vectors, w_t is a (q × 1) vector of exogenous variables and u_t is a (n × 1) vector of unobserved disturbances where $u_t \sim N(0, \Omega)$, t = 1 2…..T.

In our case, TY version of VAR($k + d_{max}$) can be written as

$$\begin{bmatrix} md_t \\ gdp_t \\ \text{int}_t \\ \text{inf}_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} + \begin{bmatrix} A_{11,1} A_{12,1} A_{13,1} A_{14} \\ A_{21,1} A_{22,1} A_{23,1} A_{24} \\ A_{31,1} A_{32,1} A_{33,1} A_{34} \\ A_{41,1} A_{42,1} A_{43,1} A_{44,} \end{bmatrix} \begin{bmatrix} md_{t-1} \\ gdp_{t-1} \\ \text{int}_{t-1} \\ \text{inf}_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} A_{11,k} A_{12,k} A_{13,k} A_{14,} \\ A_{21,k} A_{22,k} A_{23,k} A_{24,} \\ A_{31,k} A_{32,k} A_{33,k} A_{34,} \\ A_{41,k} A_{42,k} A_{43,k} A_{44} \end{bmatrix}$$

$$\begin{bmatrix} md_{t-k} \\ gdp_{t-k} \\ \text{int}_{t-k} \\ \text{inf}_{t-k} \end{bmatrix} + \begin{bmatrix} A_{11,p} A_{12,p} A_{13,p} A_{14,} \\ A_{21,p} A_{22,p} A_{23,p} A_{24,} \\ A_{31,p} A_{32,p} A_{33,p} A_{34,} \\ A_{41,p} A_{42,p} A_{43,p} A_{44,} \end{bmatrix} + \begin{bmatrix} md_{t-p} \\ gdp_{t-p} \\ \text{int}_{t-p} \\ \text{inf}_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \ldots\ldots\ldots\ldots(2)$$

where *d* is the first-difference operator and the order of p represents ($k + d_{max}$). Directions of Granger causality can be detected by applying standard Wald tests to the first '*k*' VAR coefficient matrix. For example,

H_{01}: $A_{12,1} = A_{12,2} = \ldots\ldots = A_{12,k} = 0$, implies that *gdp* does not Granger cause *md*

H_{02}: $A_{21,1} = A_{21,2} = \ldots\ldots = A_{21,k} = 0$, implies that *md* does not Granger cause *gdp*

H_{03}: $A_{13,1} = A_{13,2} = \ldots\ldots = A_{13,k} = 0$, implies that *int* does not Granger cause *md*

H_{04}: $A_{31,1} = A_{31,2} = \ldots\ldots = A_{31,k} = 0$, implies that *md* does not Granger cause *int* and so on.

3.5 Data Sources

This study made use of time series data on broad money supply, gross domestic product at constant price, interest rate and inflation rate for the period spanning between 1980 and 2019 sourced mainly from central Bank of Nigeria statistical bulletins of various years.

4.0 EMPIRICAL RESULTS AND DISCUSSION

4.1 Unit Root Test

The Augmented Dickey-Fuller (ADF) statistics were employed to test for the existence of unit root in the data using trend and intercept. The results are presented in table one below.

Table 1: Augmented Dickey Fuller Unit Root Test

Trend and Intercept @ Levels

Series	ADF Test Statistic	5% critical values	P-value	Remarks
LMD	-2.036039	-3.548490	0.5614	Not Stationary
LGDP	-2.187274	-3.548490	0.4811	Not Stationary
INT	-2.717750	-3.548490	0.2362	Not Stationary
INF	-3.067046	-3.548490	0.1301	Not Stationary

Sources: Researcher's compilation from E-view.

In table 1, it was observed that LMD, LGDP, INT and INF were not stationary at level. This is confirmed by their respective P-values such as 0.5614, 0.4811, 0.2362 and 0.1301. At level, the null hypotheses of the mentioned series cannot be rejected. This implies that the series have a unit root.

Table 2: Augmented Dickey Fuller Unit Root Test

Trend and Intercept @ 1st Difference

Series	ADF Test Statistic	5% critical values	P-value	Remarks
LMD	-3.185047	-3.552973	0.1048	Not Stationary
LGDP	-6.023589	-3.552973	0.0001	Stationary $I(1)$
INT	-6.742067	-3.552973	0.0000	Stationary $I(1)$
INF	-5.572634	-3.552973	0.0004	Stationary $I(1)$

Sources: Researcher's compilation from E-view (version 7.0)

In table 2, it was observed as LMD was stationary at level as confirmed by the P-value (0.1048). However, LGDP, INT and INF became stationary at 1st difference. This is confirmed by their respective P-values such as 0.0001, 0.0000 and 0.0004. At 1st difference, the null hypotheses of the mentioned series (i.e. LGDP, INT and INF) were rejected. This implies that the series apart from LMD do not have a unit root.

Table 3: Augmented Dickey Fuller Unit Root Test

Trend and Intercept @ 1st Difference

Series	ADF Test Statistic	5% critical values	P-value	Remarks	
LMD	-7.196306	-3.557759	0.0000	Stationary	*I*(2)
LGDP	-6.023589	-3.552973	0.0001	Stationary	*I*(1)
INT	-6.742067	-3.552973	0.0000	Stationary	*I*(1)
INF	-5.572634	-3.552973	0.0004	Stationary	*I*(1)

Sources: Researcher's compilation from E-view (version 7.0)

In table 3, it was observed as LGDP, INT and INF became stationary at 1st difference as confirmed by their respective P-values such as 0.0001, 0.0000 and 0.0004, the null hypothesis of the LMD was rejected at 2nd difference. This implies that the series (LMD) do not have a unit root at second difference.

Table 4: Levels of Integration

Series	Remarks
LMD	*I*(2)
LGDP	*I*(1)
INT	*I*(1)
INF	*I*(1)

Sources: Researcher's compilation

To investigate the stationarity issue and possible presence of unit roots in series, univariate analysis of each of the time series (i.e. LMD, LGDP, INT and INF) was carried out. Augmented Dickey–Fuller (ADF) t-tests (Dickey and Fuller, 1979) for the individual time series and their differences were used. ADF tests computed indicated that these tests are individually significant at the 5% level. Thus, table 4 shows that the series are *I*(2), *I*(1), *I*(1), and *I*(1). The result hereby reveals the stability or predictability of the time series. Since the series do not have unit root, that means the series are stable and predictable and therefore valid for prediction or forecasting.

According to Toda and Yamamoto (1995), economic series could be either integrated of the different orders or non-cointegrated or both. In these cases, the ECM cannot be applied for Granger causality tests. Hence, they developed an alternative test, irrespective of whether Y_t and X_t are *I*(0), *I*(1) or *I*(2), non-cointegrated or cointegrated of an arbitrary order. This is widely known as the Toda and Yamamoto (1995) Augmented Granger Causality. This procedure provides the possibility of testing for causality between integrated variables based on asymptotic theory.

4.3 Lag Length Selection Criteria of the Model

The choice of the lag length is empirically determined. The various criteria are considered while Akaike information criterion (AIC) is adopted.

Table 5: Lag Length Selection Criteria of the Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-288.0240	NA	1787.972	18.84026	19.02529	18.90057
1	-158.1073	217.9248	1.162591	11.49079	12.41595*	11.79237
2	-137.2603	29.58931*	0.900631*	11.17808*	12.84336	11.72092*
3	-127.1230	11.77235	1.529964	11.55632	13.96172	12.34042
4	-113.1030	12.66319	2.396559	11.68406	14.82958	12.70943

Sources: Researcher's compilation from E-view (version 7.0)

* indicates lag order selected by the criterion

Note: LR: sequential modified LR test statistic (each test at 5% level)**,** FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion. Judging by the AIC, the lowest value is 23.49574 as marked by asterisk (*). Thus, it indicates the optimum lag length. Therefore, lag length two (2) is chosen for the model.

4.4 Vector Autoregressive (VAR) Result

As stated below, the result reveals the elasticities of the parameters.

LMD = -0.069 + 1.365 LMD(-1) - 0.439 LMD(-2) - 0.095 LGDP(-1) – 0.020 LGDP(-2) + 0.003 INT(-1) 0.005 INT(-2) – 0.002 INF (-1) - 0.001 INF(-2)

t- statistics = [-0.4106] [7.0805] [-2.2998] [0.8884] [-0.1921] [0.6435] [1.1753] [-1.2758]

P-value = (0.6850) (0.0000) (0.0305) (0.3831) (0.8493) (0.5260) (0.2560) (0.2142) (0.4869)

R-squared = 0.9987, F-statistics = 2458.88 P-value [F-statistics] = 0.0000, Breusch-Godfrey Serial Correlation LM test = 1.63 P-value = 0.4437

Considering the coefficients of the estimated parameters, it was observed that a year period lag of variables that 1% increase in LRGDP will bring about 0.3% increase in the current value of LRGDP. It is also estimated from the result that 1% increase in LMD will bring about 1.4% increase in current value of LMD. The result revealed that 1% increase in LGDP will bring about 0.1% increase in LMD while 1% increase in INT, on the average bring about 0.0003% increase in LMD. The coefficients of INF have a negative relationship with LMD. It shows that rise in the general price level by 1% will bring about decrease by 0.02% in money demand. The joint influence of the explanatory variables on the dependent variable revealed that the entire regression plane is statistically significant. This is confirmed by the P-value of the F-statistics [0.00000] which is less than 0.05. The model is free from serial correlation as there is no presence of autocorrelation in the model. This is supported by the P-value of the LM test [0.4437]. The model shows that 99.87% of the total variation in the dependent variable is explained by the changes in the explanatory variables such as LGDP, INT and INF.

Table 6: VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: LMD

Excluded	Chi-sq	df	Prob.
LGDP	1.140827	1	0.2855
INT	0.054768	1	0.8150
INF	4.984745	1	0.0256
All	5.580133	3	0.1339

The P-values of the parameters are 0.2855, 0.8150, and 0.0256. It is observed from the result that none of the variables causes each other except INF. These are evident from their respective P-values. Thus LGDP=> does not cause LMD significantly, INT => does not cause LMD significantly, while INF => granger cause LMD significantly.

4.5 Test of Research Hypotheses

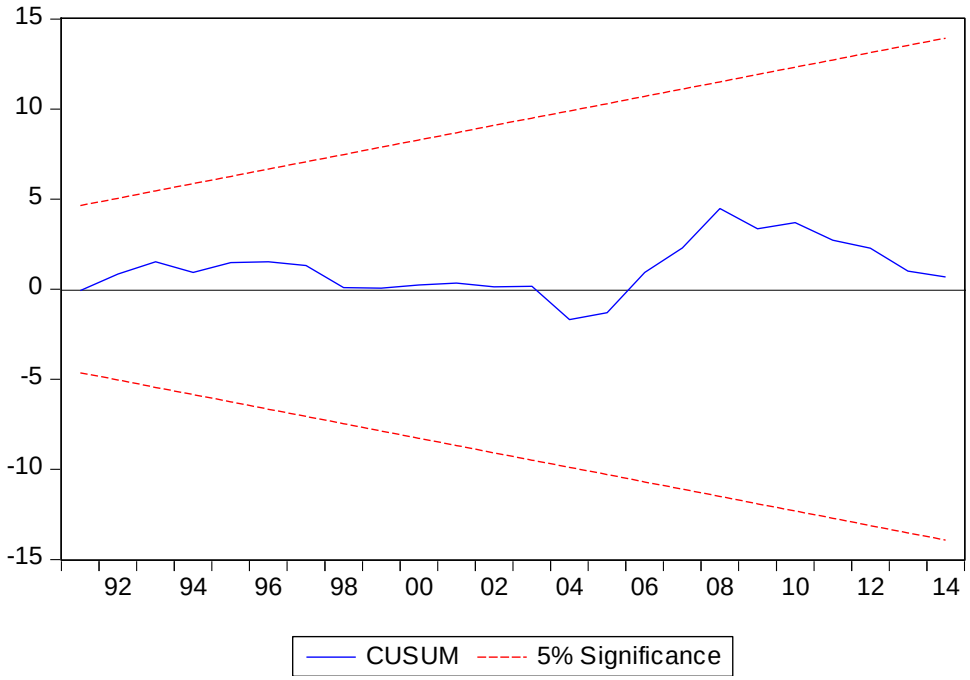
In order to take a decision on the hypotheses stated, test of hypotheses is conducted. In testing the all the hypotheses, the F-statistic and its P-value was used and considering the second hypothesis, CUSUM test was used. The hypotheses are expressed below in their null form as follows:

1. Keynes liquidity preference theory does not hold in Nigeria.

The computed F-statistics from the regression equation above is 2458.88 while its associated P-value is 0.0000. Since the level of significance (0.05) is greater than the P-value (0.0000), the null hypothesis is rejected and it is concluded that Keynes liquidity preference theory holds in Nigeria.

2. Money demand function is not stable in Nigeria.

The stability of money demand function in Nigeria is tested with the aid of CUSSUM test, the result of which is contained in the diagram below.



From the CUSUM plot given above, it can be seen that the blue line does not cross the 5 percent critical region lines represented by the red lines, hence, this indicates that there is stability in money demand function in Nigeria over the period considered. Therefore, the null hypothesis of no stability is rejected while it is concluded that money demand function is stable in Nigeria.

5.0 DISCUSSION OF RESULTS

To determine the stability of the demand for narrow money in Nigeria, a test known as cumulative sum of recursive (CUSUM) was conducted. It can be concluded that the result is suggestive that the money demand function for Nigeria is stable over the study period. It is instructive to note that the stability test results are in contrast to several investigations conducted for both developed and developing countries, the primary purpose of which were to justify the appropriateness of existing money targeting frameworks, using various specifications and approaches and reporting unstable money demand function, occasioned largely by structural changes in the economy (Lee TH, Chung KJ, 1995). However, application

of Toda-Yamamoto approach revealed that inflation rate as of the determinants of demand for money significantly granger cause money demand in Nigeria within the period under study.

A priori, the demand for money is expected to be positively correlated with real income (GDP) as there is a positive income effect on real cash balances. However, the magnitude of the income coefficient reflects the theoretical underpinning. Real money demand is expected to be negatively correlated to interest rates (short or long term) because of the higher opportunity cost of holding money for example, when the interest rate becomes higher. In other words, if the interest rate becomes higher, ceteris paribus, less of money would be held and vice versa. Real money demand is inversely related to expected inflation rate, as expected rise in inflation increases the cost of holding money. Consequently, expected inflation has a lot of impact on the return of financial assets, since it imposes greater risks in saving money. Hence, ceteris paribus, if the inflation rate is anticipated to rise, the demand for real money tends to decrease and vice versa. In essence, the coefficient of anticipated inflation rate is expected to have a negative sign, implying that the demand for real cash balances will tend to decrease if there are expectations that the price level will rise. The aim of incorporating the expected inflation rate in the money demand function is to measure the return on holdings of goods which are an alternative to domestic currency.

5.1 Implications of Results

The results of estimated money demand function was presented in the regression equation . It was found that considering a year period lag, there is a positive relationship between money demand and real income during the period of study. It implies that increase in real income (LGDP) leads to increase in the demand for money, as predicted by economic theory. The real income (LGDP) coefficient is 0.09 which is less than unity and is consistent with the transactions and precautionary theories as well as the Baumol–Tobin, inventory–theoretic approach because for M1, it is dominated by current transaction and precautionary needs. Consequently, the estimated income elasticity is supportive of the hypothesis of economies of scale in the demand for money, in line with transactions and precautionary theories.

The interest rate (INT) has incorrect sign and is positively related to money demand, indicating the lower opportunity cost of holding money. This is confirmed by the interest rate (INT) coefficient of 0.003 at one year period lag. However, the inflation rate both at a year and two years period lags have a negative sign, and is consistent with a priori expectations. Studies have found that changes in price level predict changes in the demand for money. The coefficient of –0.002 and -0.001 respectively show that the demand for narrow money in Nigeria will decrease by about 0.2% or 0.1% when the inflation rate (at a year or two year lag) rises by 1%. If the intention of incorporating the expected inflation rate in the money demand function is to measure the return on items such as equity holdings (shares), investment in land and real estate, which are an alternative to holding domestic currency, the result indicates that the higher the rate of expected inflation (i.e., higher returns on the alternative assets), ceteris paribus, the lower is the demand for narrow money in Nigeria. Hence, people would tend to switch to other money alternatives when inflation is anticipated, because they promise higher rates of returns.

6.0 CONCLUSION

The paper aimed at empirically estimating the money demand functions in Nigeria within the period 1980 to 2014. The study sought to examine the applicability of Keynes demand for money function and equally to determine the stability status of demand for money function in Nigeria for the studies period. It was found that Keynes liquidity preference theory holds in Nigeria. The test of stability showed that the estimated parameters for the study are stable within the period under study. Thus, money demand function is stable in Nigeria. The explanatory variables [Gross Domestic Product (RGDP), Interest Rate (INT) and Inflation Rate (INF)] are true parameters/determinants for money demand function in Nigeria within 1980-2014.

6.1 POLICY RECOMMENDATIONS

Based on the above findings, the following recommendations are made.

- To achieve important stable growth in the economy, real money demand function in Nigeria must be stable. Therefore, CBN should pursue policy aimed at changing the level

of income which will influence the demand for money in the same direction. If policy makers aim at moping liquidity, the authorities should implement policies that will reduce disposable income in the economy. Again, the empirical finding with respect to the interest rate, calls for policies aimed at developing the financial system, increasing its depth and reaches within the economy. A highly developed financial system increase competition and awareness about the level and changes in interest rate thereby making it an effective tool of policy. This is imperative against the background of the fact that the demand for money is stable with respect to interest rate hence stability suggests effectiveness of monetary policy in Nigeria.

- Finally, the empirical evidence implies, also, that the monetary authorities in Nigeria should introduce the right monetary policy together with an improved monetary policy discipline. This implies policies towards redistributing income, financial development, good interest rate and a stable and growing money market.

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