THE STABILITY OF MONEY DEMAND FUNCTION: RENEWED EVIDENCE FROM NIGERIA

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Abstract

This paper empirically analyzed the stability of money demand function in Nigeria using annual time series data on broad money, real GDP growth rate, inflation rate and interest rate from 1992 to 2014. The study employed the use of multiple regression analysis, stationarity test and stability test. The study found out that the plot of the cumulative sum of recursive residuals (CUSUM) provided evidence of stability, the plot of the cumulative sum of squares of recursive residuals (CUSUMSQ), on the other hand, revealed instability of some parameters between 2000 and 2005, and the parameters are stable after the periods. The study concludes that M₂ (broad) money demand function is stable in Nigeria for the study period and stood the Nigerian monetary authority in good stead for monetary policy deployment during the study period.

Keywords: Money demand, Broad money, Stationarity, Stability test.

1. INTRODUCTION

The Nigerian economy has had a checkered history, in which the country arguably squandered her benefits from the oil boom of the 1970s that led to a bout of political and economic policies designed to stabilize the economy. Most notably, Nigeria instituted the International Monetary Fund’s Structural Adjustment program in 1986. The attendant changes in fiscal and monetary policies have sought to put the economy on the path to sustainable development.

As reported by Imimole and Uniamikogbo (2014), Nigerian economy has witnessed some significant structural and institutional changes. These include the liberalization of external trade and payment system, consolidation of the banking sector, the adoption of a managed float exchange rate regime, the elimination of price and interest rate controls. These developments may have altered the relationship between money, income, prices and other key macroeconomic variables, which may have caused the money demand function to become structurally unstable.

Indeed, the search for a viable and sustainable monetary policy framework for Nigeria has been on since the creation of the Central Bank of Nigeria in 1959. This Nigerian apex bank, has utilized the money demand function as an indispensable tool by Central Banks world-wide in the design and implementation of monetary policy (Owoye & Onafowora, 2007). The estimations of money demand guide the monetary authority on which of the policy options to be deployed depending on the immediate and expected economic conditions. A stable demand function for money, in the postulation of Goldfeld & Sichel (1990) serves as a prerequisite for the use of monetary aggregates in the conduct of policy.

As noted by Owoye and Onafowora (2007), it is useful for identifying growth targets for money supply, manipulating interest rates and reserve money for the control of liquidity and managing inflation. Its stability has implications for the choice of monetary policy targets. In the opinion of Essien, Onwioduokit

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and Osho (1996), the stability of the demand for money is considered crucial in understanding the behaviour of critical macro-economic variables given that monetary policy will only be effective if the demand for money function is stable.

Therefore, the stability issue in money demand function becomes an interesting research area for researchers to test the effectiveness of a given monetary programme (Halicioglu and Ugur, 2005). The key questions to be answered is whether the policies engendering stable demand for money function stable in Nigeria has been beneficial and whether the broad money (M2) has been more suitable as monetary policy instrument in Nigeria? The broad objective of this paper is to analyze the stability of money demand function in Nigeria from 1992 to 2014. This study will also test if the stability of money demand function supports the choice of M2 as suitable instrument for policy formulation, planning and implementation in Nigeria.

The rest of the paper is arranged as follows: The next section covers the review of related literature of previous studies and the theoretical framework. In section three, the methodology of the research is presented. The findings, analysis and discussions on the findings are presented in section four while in the concluding section, the summary and recommendations are presented.

2. REVIEW OF RELEVANT LITERATURE

This section is in two parts: the review of related literature and theoretical framework.

2.1 Review of Related Literature

The search for a stable money demand function has generated interest amongst researchers. This has led to the re-specification of hitherto settled models (Carpenter and Lange, 2002). Empirical evidence from developed countries showed mixed results. The analysis of the stability of M3 money demand function for Germany following the monetary unification by Bahamani-Oskooee and Bohl (2000) reported unstable money demand function. Further exploration of M2 stability by Bahamani-Oskooee (2001) in Japan and found that M2 money demand function was stable. Indeed, real income and interest rate were cointegrated. However, although the investigation by Bahamani-Oskooee and Barry (2000) of the stability of M2 money demand function in Russia found evidence of cointegration between the series in the system, the plot of the CUSUMSQ, on the other hand, revealed that M2 money demand function was not stable. Real money demand M2 and its economics determinants were found to be weakly cointegrated by Al-Samara (2011) in his study in the analysis of money demand function in Syria. However, error correction model provided a support for the instability in the money demand due to structural changes in the function. These findings support the choice of exchange rate as a nominal anchor for Syrian monetary policy to tie down the price level and achieve its stability. Similar finding was reported by Hussin, Ali and Hylmee (2010) who re-examined the demand for money in ASEAN-5 countries (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) by utilizing the autoregressive distributed lag (ARDL) approach to cointegration analysis. A unique cointegrated and stable long-run relationship among, income, interest rate, exchange rate, broad monetary aggregate foreign interest rate, and inflation was reported. The income elasticity and the exchange rate coefficient were positive while the inflation elasticity was negative.

The stability of money demand function in Turkey between 1989 and 2010 was examined by Dritsaki and Dritsaki (2012) by estimating the demand for narrow money, its stability and robustness using cointegration and error correction models. The result revealed the existence of unstable money. The impulse response functions also showed that interest rate causes the largest shift in money demand and industrial production.
In Kenya, Adam (1992) established a series of single equation demand for money functions ($M_0$, $M_1$, $M_2$ and $M_3$) for the Kenyan economy from 1973 to 1989. His application of the Johansen technique suggested that income elasticities of money demand were around unity for $M_0$ and slightly lower at around 0.8 for the other monetary aggregates. The demand for broad money ($M_1$) was found to be stable. The adoption of money market-oriented monetary policy measures by South Africa Reserve Bank in 1980 was the structural break examined by Nell (1999) in the empirical evaluation of the stable long-run demand for money function in South Africa over the period 1965-1997. The results suggest that $M_3$ was stable while $M_1$ and $M_2$ display parameter instability. This suggests that $M_3$ money stock could serve as an indicator for monetary policy for South Africa.

Early attempt at determining the stability of money demand function in Nigeria can be traced back to the “TATOO Debate” initiated in 1972 by Tomori. This initial postulation of Tomori (1972) was that income, interest rate and real income are the major determinants of demand for money in Nigeria. Owing to perceived shortcomings of Tomori’s work, Ajayi (1974), Teriba (1974), Ojo (1974) and Odama (1974) reacted to the findings. The debate centered around the significance of income in money demand function for Nigeria, the stability of the function, and the choice of appropriate definition of money in Nigeria. On the issue of income, in line with Tomori’s assertion, Teriba and almost all the other scholars agreed that income is the most significant determinant of money demand in Nigeria. On interest rate, Teriba contrasted Tomori’s view by arguing that long term interest rate is significant (unstable demand for money) but short term rates are insignificant (stable demand for money function). The heat generated by the deliberation consequently led to further empirical investigations on the issue.

Anoruo (2002) explored the stability of the $M_2$ money demand function in Nigeria in the post Structural Adjustment Programme (SAP) period. The results from the Johansen and Juselius (1990) cointegration test suggested that real discount rate, economic activity and real $M_2$, are cointegrated. His cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) stability test results indicated that the $M_2$ money demand function in Nigeria is stable for the study period. Nwaobi (2002) examined the stability of money demand for Nigeria using vector auto regression approach. His results confirmed a stable money demand function for Nigeria. Similar result was recorded by Akinlo (2006) who using an autoregressive distributed lag (ARDL) technique combined with CUSUM and CUSUMSQ tests, showed broad money to be cointegrated with income, interest rate and exchange rate. The CUSUM test weakly reported a stable money demand for Nigeria.

The empirical results obtained by Owoye and Onafowora (2007) indicated the existence of long-run relationship between the real broad money aggregate, real income, inflation rate, interest rate, and expected exchange rate. The researchers had employed the cointegration and vector error correction analysis to test the stability of the demand for real broad money in Nigeria over the quarterly period 1986:1 to 2001:4. The CUSUM and CUSUMSQ tests confirmed the stability of the short- and long run parameters of the real money demand function in Nigeria.

Ditimi, Wosa and Olaiya (2011) appraised monetary policy development in Nigeria and also examined the effect of monetary policy on macroeconomic variables for the period 1986 to 2009. The study adopted a simplified Ordinary Least Square technique and the findings of the study showed that monetary policy had a significant effect on exchange rate and money supply and an insignificant influence on price instability.

The autoregressive distributed lag bounds testing approach was adopted by Iyoboyi and Pedro (2013) in the evaluation of the demand for money in Nigeria from 1970 to 2010. The results found cointegration relationship among real expected exchange rate, real income, narrow money demand, short term interest rate, foreign real interest rate and expected inflation rate. Indeed, the real income and interest rate were significant variables explaining the demand for narrow money. However, real income was the more
significant variable in both the short and long term. The real expected exchange rate (REER) and expected inflation rate (EIR), and foreign real interest rate results confirm the interconnectedness of the Nigerian economy with the global scene.

The summary of literature across the climes shows conflicting findings. Before the presentation of the methodology, it is important that the theoretical underpinning of the study be presented first in order to aid fuller understanding of the matters at stake.

2.2 Theoretical framework
The position taken by the classical theory is that money was held for transaction purposes or as a medium of exchange. The supply of money is defined as the sum of notes and coins and the demand deposits. The quantity theory of money is predicated on the assumptions that money supply is exogenous and the income velocity of money is stable. If the velocity is stable, then the demand for money is stable. Hence, there is a tight link between the amount of money and the level of nominal income. In addition, this theory postulates that the economy moves to a long run full-employment equilibrium. In the long run, the price level depends upon the quantity of money in the economy. Equation of the quantity theory of money;

$$MV=PY$$  
(1)

Where:

$M$ is the stock of money,

$V$ is its velocity (how many times a unit of money turns over during a period of time),

$P$ is the price level and

$Y$ is real income.

The rearrangement of the above identity in equation (2) provides a behavioral interpretation of demand for money in terms of demand for real balances, prices and income, as long as its velocity is constant:

$$\frac{M}{P} = \frac{Y}{V}$$  
(2)

Where:

$M$ represents money demand

The monetarist approach to the quantity theory however differs from the conventional quantity theory in explaining the link between the money supply and the level of income. The monetarists postulate a direct transmission mechanism from monetary to real sector through the real balance effect.

The Friedman's modern quantity theory of money posits that money demand, like the demand for any other asset, should be a function of wealth and the returns of other assets relative to money. His money demand function is as follows:

$$\left[ \frac{M_d}{P} \right] = f(Y_p, rb - rm, re - rm, \pi - r_m)$$  
(3)

Where:

$Y_p$ = permanent income (the expected long-run average of current and future income)

$rb$ = the expected return on bonds

$rm$ = the expected return on money

$re$ = the expected return on stocks

$\pi$ = the expected inflation rate (the expected return on goods, since inflation is the increase in the price (value) of goods)

Money demand is positively related to permanent income. However, permanent income, since it is a long-run average, is more stable than current income, so this will not be the source of a lot of fluctuation in money demand. The other terms in Friedman's money demand function are the expected returns on bonds, stocks and goods relative to the expected return on money. These items are negatively related to money demand: the higher the returns of bonds, equity and goods relative to the return on money, the lower the quantity of money demanded. Friedman did not assume the return on money to be zero. The return on
money depended on the services provided on bank deposits (check cashing, bill paying, etc.) and the interest on some checkable deposits.

The framework of this study is premised on Keynes’ liquidity preference theory which was developed in 1936. The theory explicitly highlights the transaction, precautionary and speculative motives for holding money. In the Keynesian approach there is a link between the quantity of money and the level of income in an economy, but this approach does not postulate that economy moves to a long run full-employment equilibrium. It is assumed that the interest rate has an important effect on the money demand and the income velocity of money is not stable. The level of demand for money not only determines the rate of interest but also prices and national income of the economy. Therefore, Keynes emphasized on speculative motive for holding money.

Keynes had a great impact on the theory of demand for money function. Using his speculative demand for money, Keynes extended another function of money i.e., store of value property. According to the speculative demand, an expectation on the future price of bonds is the major factor in deciding between money and financial assets (bonds). Anyone who thought that the value of non-money assets was likely to increase would seek to economize on the holding of money balances in order to increase the capital gains available to the holders of non-money assets. It is this motive for varying the money balances that people hold which Keynes called the speculative demand. The speculative demand equation can be seen thus:

\[ M^d = L_1(Y) + L(r). \]  
Where:
- \( M^d \) represents money demand
- \( L_1(Y) \) represents the transactions and precautionary demand for money. Keynes made both an increasing function of the level of money income.
- \( L_2(r) \) represents the speculative demand for money, which, as shown above, Keynes argued to be a declining function of \( r \).

Having established the theoretical basis for the study, the methodology employed in the study is presented in the next section.

3. METHODOLOGY

3.1: Model Specification
It established in literature that the determinants of money demand \( (M_2) \) are real GDP Growth rate \( (RGDPG) \), inflation rate \( (INFR) \) and interest rate \( (INTR) \). The nature of the relationship between money demand and its determinants can be stated in functional forms by indicating the mathematical form of the model thus:

\[ M_2 = F (RGDPG, INFR, INTR,) \]  
\[ LM_2 = \beta_0 + \beta_1 RGDPG + \beta_2 INFR + \beta_3 INTR + u_t \]  
Where:
- \( LM_2 \) = Logged demand for money (broad money)
- \( RGDPG \) = Real GDP Growth rate
- \( INFR \) = Inflation Rate
- \( INTR \) = Interest Rate
- \( \beta_0, \beta_1, \beta_2, \) and \( \beta_3 \) = Constants
- \( u_t \) = Stochastic error term
3.2: Data Source and Description
Secondary data on broad money (M₂), real GDP Growth rate (RGDPG), inflation rate (INFR) and interest rate (INTR) used in this paper are annual time series figures covering the period of 1992 to 2014. They are obtained from Central Bank of Nigeria Statistical Bulletin (2014). The study covered the period between 1992 and 2014.

3.3 Estimation Procedure
The study employs four-prong procedural steps. The first step, descriptive statistics is employed in the analysis of the data in order to help show, describe and summarize the data in a meaningful way and also to know if the data are normally distributed through their averages and Jarque-Bera values.

The second step is the test for stationarity. This is a safe test especially with respect to time series data in order to avoid spurious regression results in the event that the variables concerned are stable over time. This requires that the Augmented Dickey-Fuller Unit Root test be deployed. The third step in the event of non stationarity is the estimation of the model using the regression technique Ordinary Least Squares (OLS) technique. The post estimation test requires the examination of the stability of the dependent variable - broad money supply (M₂) through the use of Cumulative sum of recursive residuals (CUSUM) and Cumulative sum of squares of recursive residual (CUSUM of squares). The test of the presence or otherwise of parameter instability during the period, will be established depending on whether the recursive residual of the estimated money demand function is beyond or below the boundaries of the critical significant lines (in this case 5%). The estimation of the models is with the use of E-Views™ (version 7).

4.0: RESULTS AND DISCUSSIONS
As earlier stated in the previous section, this study involves time series data from 1982 to 2014 using the Ordinary Least Squares (OLS) technique. The result of the precursor Unit Root test the results regression is offered for discussion in the subsequent sub-section.

4.1 Unit Root Tests
The result of the Augmented Dickey-Fuller (ADF) test to establish the stationarity status of the series, as shown in Table 1 indicates that all the variables are I(0).

Table 1: Augmented Dickey-Fuller (ADF) Unit Root Tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>Intercept</th>
<th>Trend &amp; Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM2</td>
<td>-1.5547 (0)</td>
<td>-1.9349 (1)</td>
</tr>
<tr>
<td>RGDPG</td>
<td>-2.9615 (0)</td>
<td>-2.9517 (0)</td>
</tr>
<tr>
<td>INFR</td>
<td>-1.7399(0)</td>
<td>-10.7996 (3) **</td>
</tr>
<tr>
<td>INTR</td>
<td>-3.5254 (0) **</td>
<td>-3.2983 (0)</td>
</tr>
<tr>
<td><strong>First Difference</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔLM2</td>
<td>-3.002 (0)**</td>
<td>-3.0671 (0)**</td>
</tr>
<tr>
<td>ΔRGDPG</td>
<td>-4.426 (2) **</td>
<td>-4.7714 (2) **</td>
</tr>
<tr>
<td>ΔINFR</td>
<td>-4.5262 (0) **</td>
<td>-4.5578 (0) **</td>
</tr>
<tr>
<td>ΔINTR</td>
<td>-6.4408 (0) **</td>
<td>-4.9270 (1) **</td>
</tr>
</tbody>
</table>
Key: *** Stationary @ 1%; ** Stationary @ 5%; * Stationary @ 10%
Source: Computed by the Authors

From Table 1 above some of the variables are stationary at level I(0) and the rest at first difference I(1) i.e. the variables are integrated in the same order. Having established the stationarity property of the series, equation (6) then qualifies for estimation using the Ordinary Least Squares technique.

4.2 Estimation Results
The results are presented in two parts. These are the estimated model and the stability test results.

4.2.1 Estimated Model
The estimated model is presented in equation (7):

\[
LM_2 = -0.03 - 0.01RGDPG - 0.003INFR - 0.01INTR
\]

\[
(-0.05) \quad (-0.01) \quad (-0.004) \quad (-0.01)
\]

\[
R^2 = 0.661 \quad \overline{R^2} = 0.436 \quad SE = 0.7126
\]

The estimation results of the study shows that the regressors provides explanations for about 44 percent (\(R^2 = 0.44\)) of the broad money supply. Indeed, the elasticity of money with respect to income is not in line with the economic theory for broad money, because according to Keynes (1936), there exists a positive relationship between the demand for money and income. The results obtained suggest that income is not a significant determinant of money demand in Nigeria.

Furthermore, the result shows that the demand for money elasticity with respect to inflation is negatively signed this implies that inflationary tendencies deplete the value of money thereby reducing the desire to hold money (cash). And thus the coefficient of elasticity for broad money is insignificant. This is due to the fact that incomes are at subsistence level hence individuals need to hold cash to finance daily transactions even when inflation expectations are high. Interest rate came out with the expected sign even though statistically insignificant. This may be as a result of the fact that interest rate works through the financial system and with the underdeveloped nature of Nigeria’s financial system, the effectiveness of interest rate as a monetary policy instrument is challenged.

4.2.2 Stability Test Result
In order to test the stability of the dependent variable - broad money supply (\(M_2\)) in Nigeria the use of cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residual (CUSUM of squares) are employed. When the recursive residual of the estimated money demand function goes outside the boundaries of the critical 5% significant lines, then there is presence of parameter instability in that period. The result of the test is presented below:

The CUSUM test shows that the money demand function (\(M_2\)) is stable for the period of study since it is within the boundaries of the two critical lines i.e. the critical 5% significant lines.
While the CUSUMSQ test indicates instability of the parameters for $M_2$ between 2000 and 2005, and the parameters are stable after the periods. This is in line with the findings of Bahamani-Oskooee and Barry (2000).

5. CONCLUSIONS

This study has empirically examined the stability of money demand using stationarity and stability test to analyze money demand function in Nigeria. $M_2$ was used as dependent variable and RGDPG, INFR and INTR as the independent variables. Data used covered the sample period of 23 years (1992-2014).

The results obtained were satisfactory to some extent in the sense that most of the variables are in line with the apriori expectation. Income (RGDPG) turned out to be negative and insignificant while interest rate came out with the right sign (negative) but not statistically significant. Inflation was also negative.

However, the implications of the empirical evidence found in this study are quite expected but not in all cases. Because according to Keynes income is the most significant determinant of the demand for money. Therefore, any policy aimed at changing the level of income will influence the demand for money in the same direction. If policy makers aimed at mopping liquidity, the authorities should implement policies that will reduce disposable income in the economy.

The CUSUMSQ stability test provides evidence of an unstable money demand function for some of the period. On the other hand, the CUSUM test shows that the money demand function ($M_2$) is stable for the
period of study since it is within the boundaries of the two critical lines i.e. the critical 5% significant lines. The paper infers that the estimated money demand model provides important foundations for monetary policy setting in Nigeria.

The empirical finding with respect to income suggest that monetary authorities should implement policies that will reduce disposable income in the economy, that is if they aimed at mopping liquidity. However, for inflation monetary authorities can use more effective policies such as monetary targeting as a tool for the control of inflation. Monetary targeting which was among the complementary policies will be an effective tool for the control of inflationary pressures in Nigeria. More so, the empirical finding with respect to the interest rate, monetary authorities should try as much as possible to introduce policies aimed at developing the financial system of the country.

Innovations from the monetary policy rate and exchange rate do not significantly explain the variations in output. The study therefore recommends that the monetary authority should provide some measure of support for specific sectors adversely affected by unanticipated monetary policy shocks.

REFERENCES


