



Determinants and Stability of Money Demand in Nigeria

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ABSTRACT

This study examines the determinants of broad money demand and its stability in Nigeria over the quarterly period 1991:Q1 to 2014:Q4. With ordinary least squares and other statistical methods the results indicate that a long-run relationship exists between the real broad money aggregate and real income, domestic interest rate, inflation rate, exchange rate and foreign interest rate. Real income and exchange rate are directly related to the real broad money balances while domestic interest rate, inflation rate and foreign interest rate are inversely related to the demand for broad money.

Keywords: Broad Money Demand, Autoregressive Distributed Lag, Monetary Policy, Stability, Nigeria

JEL Classifications: C32, E31, E37, F31, O52

1. INTRODUCTION

A sound monetary policy formulation presupposes theoretically coherent and empirically robust model of money demand. To monetary authorities, the stability of the money demand function is necessary for understanding how the formulation and implementation of an effective monetary policy is crucial in offsetting the fluctuations that may arise from the real sector of the economy. If the relationship between the demand for money and its determinants shift around unpredictably, the central bank loses the ability to derive results from the implementation of its policies (Bhatta, 2013. p. 1).

In the conduct and implementation of monetary policy, the assumption that the money demand function is stable is very important, because, the money demand function is used both as a means of identifying medium term growth targets for money supply and as a way of manipulating the interest rate and reserve money for the purpose of controlling both the inflation rate and the total liquidity in the economy (Owoye and Onafowora, 2007. p. 1). The stability of money demand is crucial for the understanding of the monetary policy transmission mechanism. It enables a policy driven change in monetary aggregates so that the desired values of targeted macroeconomic variables such as fiscal policy, exchange rate, stock market, consumption expenditure, savings

and investments, imports, exports, inflation and interest rates are ensured (Sober, 2013. p. 32).

The recent instability of the money demand function calls into question whether our theories and empirical analyses are adequate. It casts doubt on setting rigid money supply targets in order to control aggregate spending in the economy as this may not be an effective way to conduct monetary policy (Mishkin, 2010. p. 516).

This concern has been triggered further by the abandonment of monetary targeting strategy by many developed countries such as Australia, Brazil, Canada, New Zealand, Norway and Turkey, as they switched to inflation targeting strategy arguing that the money demand function is tending to become unstable (Bhatta, 2013. p. 2). Unpredictability of velocity caused by the volatility of interest rate is the key reason policymakers have given for abandoning monetary targeting (Omer, 2010. p. 5). The recent developments in the Nigerian monetary system and the impact of financial liberalization may have caused the instability of the money demand function and rendered the monetary policy ineffective (Nduka et al., 2013. p. 4). In other words, the choice of M2 as an intermediate target portends serious economic problem for the Central Bank of Nigeria (CBN) if M2's demand function is found to be unstable. Therefore, the stability issues of the money

demand function needs an intense focus for justifying the working of the monetary targeting strategy (Bhatta, 2013. p. 2).

The purpose of this study is to examine the determinants of money demand and to determine its stability in Nigeria. The aim of this paper is to:

1. Evaluate how income, interest rate, inflation rate, exchange rate and foreign interest rate affect the quantity of money demand in Nigeria.
2. Examine the money demand function and to understand its long-run cointegrating relationship with the selected macroeconomic variables - real income, interest rate, inflation rate, exchange rate and foreign interest rate.
3. Determine the stability of the M2 money demand function for the conduct of optimal monetary policy in Nigeria.

The rest of the paper is organized as follows: Section 2 presents the review of some international and national studies and justifies the relevance of the study. Section 3 discusses the methodology. Section 4 presents the empirical results and section 5 provides the concluding remarks.

2. LITERATURE REVIEW

The following section presents a review of the empirical studies on money demand at international and national levels.

2.1. Review of International Empirical Studies

Dagher and Kovanen (2011) adopted the bounds testing procedure to test the stability of the long-run money demand for Ghana. The results provided strong evidence for the presence of a stable, well-identified long-run money demand during a period of substantial changes in the financial markets and any deviation from the equilibrium are rather short-lived. Suliman and Dafaalla (2011) applied cointegration and error correction models on time series data (annually observations) to examine the behavior of money demand in Sudan during the period, 1960–2010. Co-integration results revealed there is a long-run relationship between real money balances and the explanatory variables and the stability tests showed that the money demand function is stable between 1960 and 2010. The study concluded that it is possible to use the narrow money aggregate as target of monetary policy in Sudan. Dritsaki and Dritsaki (2012) applied cointegration and error correction models to examine the stability of money demand function in Turkey from January 1989 to May 2010 under the economic reforms and financial crises and found there existed a well-determined instability for the demand for narrow money and its dynamics and concludes from the estimation of the impulse response functions that interest rate caused the largest shift in money demand as well as in the industrial production.

Lungu et al. (2012) analyzed the money demand function for Malawi during the period of 1985–2010 using monthly data. Cointegration test results indicated a long – run relationship amongst real money balances, prices, income, exchange rate, treasury bill rate and financial innovation. While all variables significantly influenced money demand in the long-run, short-run policy must be directed at increasing financial innovation, open

market activities and improving the productivity of the economy to provide higher returns on alternative investments. Mansaray and Swaray (2012) examined the rate at which changes in the financial markets in Sierra Leone affected money demand behaviour and sought to draw the implications for monetary policy using annual data for the period 1981–2010. Employing the autoregressive distributed lag (ARDL) approach to cointegration, the short-run dynamics and the long-run results showed that real gross domestic product (GDP), inflation, real exchange rate and foreign interest rate have significant impact on real money balances in Sierra Leone. The Granger causality test results identified uni-directional causality running from real balances to inflation and real effective exchange rate respectively. The results suggested a stable money demand and that the monetary authorities should continue to pursue real money balances as an intermediate target in setting their monetary policy framework. Bhatta (2013) with ARDL modeling to cointegration, examined the long-run stability issue of money demand function in Nepal using the annual data set of 1975–2009. The bounds test showed that there existed the long-run cointegrating relationship among demand for real money balances, real GDP and interest rate in case of both narrow and broad monetary aggregates. The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) test revealed that both the long-run narrow and broad money demand functions were stable. The results showed that demand for money balance in Nepal is a predictable function of a few variables and that the central bank can rely on the monetary aggregates as intermediate targets for achieving the broad economic objectives.

Dharmadasa and Nakanishi (2013) investigated the long run money demand function for Sri Lanka using error correction version of ARDL approach while giving special attention to the effect of international financial crisis on money demand. Findings emphasized that M1 money demand in Sri Lanka is highly co-integrated with the real income, real exchange rate and short-term domestic and foreign interest rates. The overall test result showed that Sri Lanka maintained a stable money demand function despite the economic uncertainty that arose due to international financial crisis. Sheefeni (2013) examined the demand for money in Namibia. Time series techniques such as unit root test, cointegration and ARDL approach were utilized on quarterly data for the period 2000:Q1 to 2012:Q4. The bounds testing approach to cointegration revealed no cointegration among real money aggregates (M1 and M2), real income, inflation, and interest rate. Therefore, the stability of demand for money function could not be established. Kapingura (2014) examined the stability of the money demand function in South Africa using quarterly data from 1994 to 2012. The Johansen co-integration tests and the vector error correction model were used to analyze the long-run and short–run interaction between the variables. The Johansen co-integration test proved that there exists a long-term relationship between the money demand function and its determinants in South Africa. However, the CUSUM and CUSUMSQ proved that the South African money demand function was unstable over the period from 2003 to 2007.

Kiptui (2014) used bounds testing techniques and error correction model to examine the stability of the demand for money in Kenya and found that demand for broad monetary aggregates is stable

meant that monetary targeting remained relevant in the Kenyan context. Özcalik (2014) used ARDL on Monthly data between 1995:Q4-2013:Q3 to examine the long run and short run dynamics of M_2 money demand and macroeconomic factors (M2, interest rate and GDP). CUSUM and CUSUMSQ tests indicated that money demand function is stable in the first step, while it is not stable in the second test even in the long run and short run.

2.2. Review of National Empirical Studies

Akinlo (2006) using the ARDL approach combined with CUSUM and CUSUMSQ tests on quarterly data showed that M2 was co-integrated with income, interest rate and exchange rate over the period 1970:1–2002:4. Owoye and Onafowora (2007) using cointegration and vector error correction on quarterly data from 1986:1 to 2001:4 examined M2 money targeting, the stability of real M2 money demand and the effects of deviations of actual real M2 growth rates from targets on real GDP growth and inflation rate on the Nigerian economy since the introduction of the Structural Adjustment Programme in 1986. The results indicated that a long-run relationship existed between the real broad money supply, real GDP, inflation rate, domestic interest rate, foreign interest rate and expected exchange rate. The CUSUM and CUSUMSQ tests confirmed the stability of the parameters of the real money demand function. The stability of the real money demand function supported the choice of M2 as an intermediate target. The deviations from M2 target growth rates impacted real GDP growth rate and inflation rate adversely during the period. Kumar et al. (2010) investigated the level and stability of money demand (M1) in Nigeria between 1960 and 2008 and found that money demand was stable and that Nigeria could effectively use the supply of money as an instrument of monetary policy. Iyoboyi and Pedro (2013) using ARDL bounds test approach to cointegration estimated a narrow money demand function of Nigeria from 1970 to 2010 and found cointegration relations among narrow money demand, real income, short term interest rate, real expected exchange rate, expected inflation rate and foreign real interest rate. Achsani (2010) employed error correction and ARDL model in investigating the stability of money demand in an emerging market economy, Indonesia and concluded that it is possible to use the narrow money aggregate as target of monetary policy in Indonesia. Doguwa et al. (2014) found a stable long-run demand for money function during the period 1991:Q1–2013:Q4, while accounting for the possibility of structural breaks using the Gregory-Hansen residual based test for co-integration. The CUSUMSQ test provided evidence of a stable money demand function before and after the crisis which provided important foundations for monetary policy setting in Nigeria. Imimole and Uniamikogbo (2014) established a long run relationship exists between M_2 money aggregate and its determinants using ARDL bounds testing procedure in Nigeria for the period 1986 Q1–2010 Q4. The CUSUM and CUSUMSQ test conducted confirm that the short and long run parameters of the real broad money demand function are robust, and exhibit remarkable stability. It was therefore recommended that monetary authority should target M_2 monetary aggregate in regulating domestic prices and stimulating economic activity in Nigeria.

The general observation from the international and national literature is that most studies on the determinants and stability of the money

demand function have been focused on the advanced economies and few industrialized economies. Only a few empirical studies are focused on the demand for money in Nigeria, differing by time period, monetary aggregate, data frequency and model specification. There is the need to fill this gap in the literature by extending the data set from 1991 to 2014 and by ARDL modeling to co-integration analysis to get rid of the phenomenon of spurious regression.

3. METHODOLOGY

3.1. Model Specification

The general specification takes the following functional relationship for the long-term demand for money:

$$M/P = (Y, i) \quad (1)$$

Where the demand for real balances M/P is a function of the chosen scale variable (Y) to represent economic activity and the opportunity cost of holding money (i). M stands for selected monetary aggregates in nominal term. P stands for the price level. Following Owoye and Onafowora (2007); Nduka et al. (2013); Imimole and Uniamikogbo (2014), the model (in a log-linear form) of money demand in Nigeria is as adopted:

$$\text{Log } M/P = \alpha_0 + \alpha_1 \text{LogRGDP}_t + \alpha_2 \text{LogDIR}_t + \alpha_3 \text{LogINF}_t + \alpha_4 \text{LogEX}_t + \alpha_5 \text{LogFIR}_t + U_t \quad (2)$$

Where Log = natural logarithm, α_0 = intercept term, M = nominal M2 money stock, P = domestic price level proxied by implicit price deflator, M2/P = real M2 money balances, RGDP_t = real income as a measured scale variable proxied by real GDP, DIR_t = domestic interest rate proxied by the monetary policy rate (MPR). The “operating” target rate i.e “MPR” serves as an indicative rate for transaction in the money market as well as other deposit money banks retail interest rate, INF_t = inflation rate, EX_t = expected exchange rate proxied by the Nigerian naira/US dollar exchange rates, FIR_t = foreign interest rate proxied by US 3-month treasury bill rates, U_t = error term.

In applying the cointegration technique, we determined the order of cointegration of each variable. The error correction version of the ARDL model pertaining to the variables in Equation. (2) is stated below, following Akinlo (2006), Dritsakis (2011), Mansaray and Swaray (2012):

$$\begin{aligned} \Delta \text{Log } M2/P_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta \text{Log } M2/P_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta \text{Log } \text{RGDP}_{t-i} \\ & + \sum_{i=0}^n \alpha_{3i} \Delta \text{Log } \text{DIR}_{t-i} + \sum_{i=0}^n \alpha_{4i} \Delta \text{Log } \text{INF}_{t-i} \\ & + \sum_{i=0}^n \alpha_{5i} \Delta \text{Log } \text{EX}_{t-i} + \sum_{i=0}^n \alpha_{6i} \Delta \text{Log } \text{FIR}_{t-i} \end{aligned} \quad (3)$$

Where Δ = first difference operator, parameters α_1 – α_6 = short-run dynamics of the model, parameters β_1 – β_6 = long-run relationship, all other variables are as defined above.

To investigate the presence of long-run relationships among the variables, bounds testing under Pesaran et al. (2001) procedure were used. The bounds testing procedure is based on the F-test. The F-test is a test of the hypothesis of no co-integration among the variables against the existence of co-integration among the variables (Dritsakis, 2011. p. 5). This is denoted as:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ i.e there is no cointegration among these variables.

$H_a: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 = 0$ i.e there is cointegration among these variables.

The ARDL bound test is based on the Wald-test (F-statistic). The asymptotic distribution of the Wald-test is non-standard under the null hypothesis of no cointegration among the variables. Two critical values are given by Pesaran et al. (2001) for the cointegration test. The lower critical bound assumes all the variables are 1(0) meaning that there is no cointegration relationship between the examined variable. The upper bound assumes that all variables are 1(1) meaning that there is cointegration among the variables. When the computed F-statistic is greater than the upper bound critical value, then the H_0 is rejected (the variables are cointegrated). If the F-statistic is below the lower bound critical value, then the H_0 cannot be rejected (there is no cointegration among the variables). When the computed F-statistic falls between the lower and upper bounds, then the results are inconclusive. According to Kremers, Ericsson and Dolado (as cited in Kiptui, 2014. p. 852), the F-test is considered a stage one test-the more powerful test is the significance of the lagged error correction term in the short-run model.

Next step is the estimation of the long-run relationship based on the appropriate lag selection criterion. The model based on Schwarz Bayesian Criterion (SBC) was selected since it uses the smallest possible lag length which makes it the parsimonious model (Mansaray and Swaray, 2012). Based on the long-run coefficients, the estimation of dynamic error correction was carried out using formulation of Equation (4).

The error correction model is thus defined as:

$$\begin{aligned} \Delta \text{Log M2} / P_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta \text{Log M2} / P_{t-1} \\ & + \sum_{i=1}^n \alpha_{2i} \Delta \text{Log RGDP}_{t-1} + \sum_{i=1}^n \alpha_{3i} \Delta \text{Log DIR}_{t-1} \\ & + \sum_{i=1}^n \alpha_{4i} \Delta \text{Log INF}_{t-1} + \sum_{i=1}^n \alpha_{5i} \Delta \text{Log EX}_{t-1} \\ & + \sum_{i=1}^n \alpha_{6i} \Delta \text{Log FIR}_{t-1} + EC_{t-1} + U_t \end{aligned} \quad (4)$$

Where λ is the speed of adjustment parameter.

EC is the residuals that are obtained from the estimated cointegration model of Equation (3).

3.2. Stability Test

Laidler; Bahmani-Oskooee (as cited in Akinlo, 2006. p. 448) pointed out that some of the problems of instability could stem from inadequate modeling of the short-run dynamics characterizing departures from the long-run relationship. Hence, it is expedient to incorporate the short-run dynamics in testing for constancy of long-run parameters. In view of this, the CUSUM and CUSUMSQ tests proposed by Brown et al. (1975) was applied. Specifically, the CUSUM test makes use of the CUSUM based on the first set of n observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5% significance level represented by a pair of straight lines, the null hypothesis of coefficient constancy cannot be rejected. If either of the lines is crossed, the null hypothesis that all coefficients in the error correction model are stable can be rejected at the 5% level of significance. A similar procedure is used to carry out the CUSUMSQ test, which is based on the squared recursive residuals (Bhatta, 2013. p. 19). These tests are commonly used by researchers who explore the demand for money (Akinlo, 2006; Dritsakis, 2011; Mansaray and Swaray, 2012; Bhatta, 2013).

3.3. Data Sources and Techniques of Analysis

This study employed quarterly time series data from 1991:Q1 to 2014:Q4. Secondary data was sourced from statistics portal of the CBN which is available at <http://statistics.cbn.gov.ng/cbn-onlinestatsand> retrieved on November 2, 2015, the CBN's statistical bulletins and the International Financial Statistics website. The statistical technique employed in the study is the ARDL modeling to cointegration. This deals with single cointegration and is applicable on small-sized samples. The bounds testing procedure has certain econometric advantages in comparison to other methods of cointegration which are the following: (a) All variables of the model are assumed to be endogenous. (b) This procedure is being applied irrespective of whether the variables are stationary or integrated of order 1. (c) The short-run and long-run coefficients of the model are estimated simultaneously. (d) The procedure allows that the variables may have different optimal lags, while it is impossible with conventional cointegration procedures. (e) This procedure employs only a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system of equations (Bhatta, 2013. p. 10).

Given these features, the bounds testing procedure was selected to identify the determinants of money demand in Nigeria, then, the stability tests were adopted to see if the demand for money remains stable over time. The cumulative sum test is useful for detecting systematic changes in the regression coefficients whereas the cumulative sum of squares test is useful in situation where the departure from the constancy of regression coefficients is abrupt and sudden. Among the prominent works that used the ARDL modeling to cointegration are: Akinlo (2006) for Nigeria, Dagher and Kovanen (2011) for Ghana, Dritsakis (2011) for Hungary, Mansaray and Swaray (2012) for Sierra Leone, Bhatta (2013) for Nepal, Imimole and Uniamikogbo (2014) for Nigeria, Kiptui (2014) for Kenya and Özcalik (2014) for Turkey.

4. EMPIRICAL RESULTS

The quantum values and the logged values of the selected variables are shown in appendix A1 and appendix A2 respectively. Correlation matrix and the heteroscedasticity test for the first hypothesis are indicated in appendix A3 and A4 respectively while the autocorrelation test is displayed in appendix A5. The unit root test for M2 money demand function is shown in appendix A6.

We conducted stationarity tests to ensure that none of the variables are integrated of order higher than one. We thus begin by testing for the presence of unit roots in the variables. The ADF unit root test is used to determine the order of integration. The results are presented in the Table 1.

The unit root test is conducted on the log values of the dependent and independent variables. The results show that all the variables were stationary at first difference except real money demand and real GDP that are stationary at level. Our dataset thus comprehend a mixture of 1 (0) and 1 (1) processes, which provides necessary theoretical support for the use of the ARDL methodology and guarantees the suitability of the ARDL approach. Table 2 provides the result of the multiple regressions.

The coefficient on the real income variable indicates that the long run income elasticity for real broad money is 0.2111. This means that a 1% increase in real income increases the demand for real money balances by 0.21%. The long run income elasticity of less than one supports the argument of several studies that financial development

and liberalization, technological improvements in payment system, creation of money substitutes and improved economic stability should decrease the income elasticity of money demand (Owoye and Onafowora, 2007; p.8). This result is in conformity with the findings of Nduka et al. (2013), Iyoboyi and Pedro (2013) for Nigeria and Mansaray and Swaray (2012) for Sierra Leone.

The results show that the interest rate coefficient carries a negative sign and is statistically significant. This implies that in the long run, the demand for broad money balances remain dependent on the domestic interest rate. Thus, the interest rate is a good proxy of the opportunity cost of holding money and has a significant effect on the demand for broad money in Nigeria. The coefficient of the domestic interest rate follows Friedman’s quantity theory of money and is consistent with the contributions of Nduka et al. (2013) and Akinlo (2006) for Nigeria. This result is in contrast to Imimole and Uniamikogbo (2014), Onafowora and Owoye (2008) for Nigeria, Kapingura (2014) for South Africa and Abdulkheir (2013) for Saudi Arabia whose empirical results showed that the coefficient of domestic interest rate is positively related to real money demand.

The inflation rate elasticity is negative (−0.0218) and significant, supporting Friedman’s theoretical expectations. This means that the higher the inflation rate, the lower the demand for broad money in Nigeria i.e a 1% increase in inflation decreases demand for real money balances by 0.02% in the long run. Inflation growth will lead to increased return on alternative forms of assets such as equity holding (shares), investment in land and real estate and commodities, which will reduce demand for naira. This suggest that

Table 1: ADF unit root tests from M2 money demand function

| Variables | At level with constant, no trend | | At first difference with constant, no trend | |
|-----------|----------------------------------|-------------------|---|-------------------|
| | ADF statistics | 5% critical value | ADF statistics | 5% critical value |
| LOGM2P | -3.83 | -2.9980 | -1.0429 | -3.0048 |
| LOGRGDP | -3.13 | -2.9980 | -0.7476 | -3.0048 |
| LOGDIR | -2.02 | -2.9980 | -5.3786 | -3.0048 |
| LOGINF | -2.38 | -3.0048 | -4.6004 | -3.0048 |
| LOGEX | -2.06 | -2.9980 | -4.6551 | -3.0048 |
| LOGFIR | 2.44 | -3.0299 | -3.3833 | -3.0048 |

Source: Researcher’s Eview result. ADF: Augmented Dickey Fuller

Table 2: Regression result

| Dependent variable: M2P | | | | |
|---------------------------|-------------|-----------------------|-------------|----------|
| Method: Least squares | | | | |
| Sample: 1991Q1–2014Q4 | | | | |
| Included observations: 96 | | | | |
| Variable | Coefficient | Std. error | t-statistic | Prob. |
| C | 176.5896 | 55.76911 | 3.166441 | 0.0053 |
| RGDP | 0.211143 | 0.000565 | 373.7244 | 0.0000 |
| DIR | -6.334513 | 2.079549 | -3.046099 | 0.0070 |
| INF | -0.021800 | 0.528999 | -0.041210 | 0.0476 |
| EX | 0.015178 | 0.256238 | 0.059235 | 0.0134 |
| FIR | -23.02143 | 5.587963 | -4.119825 | 0.0006 |
| R ² | 0.899885 | Mean dependent var | | 725.0583 |
| Adjusted R ² | 0.869853 | SD dependent var | | 2887.932 |
| S.E. of regression | 35.00580 | Akaike info criterion | | 10.16122 |
| Sum squared resid | 22057.31 | Schwarz criterion | | 10.45574 |
| Log likelihood | -115.9347 | F-statistic | | 31304.14 |
| Durbin-Watson stat | 1.901229 | Prob (F-statistic) | | 0.000000 |

Source: Researcher’s Eview result

the hedging effect of inflation on money demand is greater than the investment effect. This finding is in consonance with many studies like Mansaray and Swaray (2012) for Sierra Leone, Imimole and Uniamikogbo (2014) for Nigeria, Kjosevski (2013) for Macedonia, Dritsakis (2012) for Hungary and Sharifi-Renani (2007) for Iran. The result is at variance with Abdulkheir (2013) for Saudi Arabia whose findings indicated a positive and statistically significant long run relation between the inflation rate and money demand.

There is also a positive and statistically significant effect of exchange rate on real broad money demand supporting the wealth effect argument in the literature. This is consistent with theory that predicts that an increase in exchange rate can be perceived as an increase in wealth, leading to a rise in the demand for domestic money. Depreciation of the exchange rate increases the external value of the domestic currency in foreign assets. Thus, wealth holders who perceive this as an increase in their wealth tend to convert a portion of their foreign assets to domestic assets in a bid to maintain a fixed share of their wealth that are invested in domestic currency (Mansaray and Swaray, 2012. p. 81). The positive coefficient of exchange rate in Nigeria is in conformity with the findings of Akinlo (2006), Imimole and Uniamikogbo (2014) for Nigeria, Sharifi-Renani (2007) for Iran and Mansaray and Swaray (2012) for Sierra Leone. It also contradicts the findings of Kapingura (2014) for South Africa, Onafowara and Owoye (2004), and Nduka et al. (2013) for Nigeria as they attributed the negative coefficient of the exchange rate depreciation to the existence of currency substitution in Nigeria.

The foreign interest rate coefficient is negative and statistically significant. A 1% rise in foreign interest rate may lead to 23.02% fall in the demand for real money balances. This result is supportive of the portfolio balance argument of capital mobility and highlights the importance of foreign effects in explaining the demand for real broad money in Nigeria during the sample period. This finding is in consonance with the studies of Onafowora and Owoye (2008) and Imimole and Uniamikogbo (2014) for Nigeria. The result is in contrast to Nduka et al. (2013) who did not support the argument of capital mobility because the coefficient of foreign interest rate was positively related to real money demand for the period of 1986–2011 in Nigeria.

To investigate the presence of long run relationship among the variables, bounds testing procedure was used (Table 3).

The value of our F-statistic is 4.44 and we have $(K+1) = 6$ variables (M2/P, RGDP, DIR, INF, EX and FIR) in our model. The lower and upper bounds for the F-test statistic at 5% significance levels are 2.81 and 3.76 respectively (Pesaran et al., 2001. p. 300). We did not constrain the intercept of our model and there is linear trend term included.

As the F-statistic value of 4.44 exceeds the upper bound of 3.76 at the 5% significance level, we can conclude that there is cointegrating relationship between real money demand, real GDP, domestic interest rate, inflation rate, exchange rate and foreign interest rate in Nigeria. The calculated F-statistics clearly rejects null hypothesis of no cointegration at 5% level of significance. This is consistent with several studies like Bhatta (2013) for Nepal and Dritsakis (2011) for Hungary. This findings is at variance with Akinlo (2006) over the period 1970:1–2002:4 for Nigeria whose result showed that there is no strong evidence of cointegration and Sheefeni (2013) who found that there is no cointegration between real money balances and the selected macroeconomic variables in Namibia. Table 4 shows the ARDL error correction model.

The presence of a cointegrating relationship among real money balances and its explanatory variables validates the estimation of a short run dynamic model. The coefficient of the error correction term, ECT_{t-1} is negative and significant. The ECT measures the speed of adjustment towards equilibrium. The coefficient of the feedback parameter is -0.3669 . This means reversion speed is relatively high. This implies that if there are departures from equilibrium in the previous period, the departures are reduced by about 36% in the current period. When real broad money balances deviate in the short run from real income, domestic interest rate, inflation rate, exchange rate and foreign interest rate, its speed of adjustment to long run equilibrium is about 36% per quarter and is statistically significant.

This correction speed of adjustment is comparatively more consistent than the findings in other studies such as: 31% in Vietnam, 16% in Iran (Sharifi-Renani, 2007), 13% in Greece (Dritsakis, 2011), 6% in Nigeria (Owoye and Onafowora, 2007) and 4.9% in Cambodia.

The goodness of fit for the short run ARDL model is 68% and the adjusted R^2 is 44%. The adjusted R^2 of the error correction model is rather low but it does not significantly affect our results since

Table 3: Wald test for cointegration

| Test statistic | Value | df | Probability |
|--|-----------|-----------|-------------|
| F-statistic | 4.448360 | (6, 50) | 0.0011 |
| Chi-square | 26.69016 | 6 | 0.0002 |
| Null Hypothesis: $C(32) = C(33) = C(34) = C(35) = C(36) = C(37) = 0$ | | | |
| Null hypothesis summary: | | | |
| Normalized restriction (=0) | Value | Std. Err. | |
| C(32) | -0.187774 | 0.112056 | |
| C(33) | 1.517708 | 0.554523 | |
| C(34) | 0.049145 | 0.080016 | |
| C(35) | -0.110713 | 0.037096 | |
| C(36) | 0.107764 | 0.071908 | |
| C(37) | 0.020125 | 0.017424 | |

Source: Researcher's Eview result

Table 4: Error correction model result

| Dependent variable: D(M2P) | | | | |
|---|-------------|-----------------------|-------------|-----------|
| Method: Least squares | | | | |
| Sample (adjusted): 1992Q3–2014Q4 | | | | |
| Included observations: 86 after adjustments | | | | |
| Variable | Coefficient | Std. error | t-statistic | Prob. |
| C | -2.803392 | 1.093712 | -2.563191 | 0.0136 |
| @TREND | -0.008966 | 0.003658 | -2.450996 | 0.0179 |
| D(RGDP) | 0.333423 | 0.455225 | 0.732436 | 0.4675 |
| D(DIR) | 0.116207 | 0.105407 | 1.102451 | 0.2758 |
| D(INF) | -0.058979 | 0.050908 | -1.158547 | 0.2524 |
| D(EX) | 0.037015 | 0.090408 | 0.409418 | 0.6841 |
| D(FIR) | -0.052366 | 0.035685 | -1.467463 | 0.1488 |
| D(M2P(-1)) | -0.282641 | 0.218390 | -1.294200 | 0.2018 |
| D(RGDP(-1)) | -1.067328 | 0.750953 | -1.421297 | 0.1617 |
| D(DIR(-1)) | -0.014691 | 0.102648 | -0.143116 | 0.8868 |
| D(INF(-1)) | 0.031540 | 0.035265 | 0.894364 | 0.3756 |
| D(EX(-1)) | -0.131470 | 0.084338 | -1.558852 | 0.1256 |
| D(FIR(-1)) | -0.000131 | 0.040327 | -0.003237 | 0.9974 |
| D(M2P(-2)) | -0.140406 | 0.156290 | -0.898370 | 0.3735 |
| D(RGDP(-2)) | -0.832480 | 0.713168 | -1.167298 | 0.2489 |
| D(DIR(-2)) | -0.073428 | 0.104087 | -0.705446 | 0.4839 |
| D(INF(-2)) | 0.066014 | 0.036124 | 1.827406 | 0.0739 |
| D(EX(-2)) | -0.242753 | 0.103751 | -2.339755 | 0.0235 |
| D(FIR(-2)) | -0.040243 | 0.040214 | -1.000713 | 0.3220 |
| D(M2P(-3)) | -0.162527 | 0.143134 | -1.135492 | 0.2618 |
| D(RGDP(-3)) | -0.402507 | 0.612308 | -0.657361 | 0.5141 |
| D(DIR(-3)) | -0.075225 | 0.105636 | -0.712115 | 0.4798 |
| D(INF(-3)) | 0.062082 | 0.037498 | 1.655632 | 0.1043 |
| D(EX(-3)) | -0.202955 | 0.129347 | -1.569068 | 0.1232 |
| D(FIR(-3)) | -0.038980 | 0.039076 | -0.997541 | 0.3235 |
| D(M2P(-4)) | 0.127876 | 0.135116 | 0.946415 | 0.3487 |
| D(RGDP(-4)) | -0.046899 | 0.522875 | -0.089695 | 0.9289 |
| D(DIR(-4)) | 0.281096 | 0.101316 | 2.774434 | 0.0079 |
| D(INF(-4)) | 0.081807 | 0.035341 | 2.314803 | 0.0249 |
| D(EX(-4)) | -0.290660 | 0.121404 | -2.394144 | 0.0206 |
| D(FIR(-4)) | -0.039823 | 0.041665 | -0.955796 | 0.3440 |
| M2P(-1) | -0.170285 | 0.116019 | -1.467741 | 0.0487 |
| RGDP(-1) | 1.659446 | 0.623052 | 2.663414 | 0.0105 |
| DIR(-1) | 0.042550 | 0.086098 | 0.494207 | 0.6234 |
| INF(-1) | -0.129451 | 0.043463 | -2.978427 | 0.0045 |
| EX(-1) | 0.120151 | 0.073791 | 1.628248 | 0.1100 |
| FIR(-1) | 0.018468 | 0.018081 | 1.021355 | 0.0122 |
| ECT(-1) | -0.366896 | 0.273263 | -1.333805 | 0.0077 |
| R ² | 0.688847 | Mean dependent var | | 0.010937 |
| Adjusted R ² | 0.448999 | S.D. dependent var | | 0.054407 |
| S.E. of regression | 0.040386 | Akaike info criterion | | -3.280080 |
| Sum squared resid | 0.078290 | Schwarz criterion | | -2.195601 |
| Log likelihood | 179.0435 | Hannan-Quinn criter. | | -2.843628 |
| F-statistic | 2.872021 | Durbin-Watson stat | | 2.030615 |
| Prob (F-statistic) | 0.000333 | | | |

Source: Reseacher's Eviews result

the variables are in the difference form. Durbin Watson statistic of 2.03 is indicative of the absence of autocorrelation.

This model with 4 period lags based on SBC was selected since the SBC is parsimonious as it uses minimum acceptable lag while selecting the lag length and avoids unnecessary loss of degrees of freedom (Bhatta, 2013. p. 14). The lag selection result is displayed Table 5.

Finally, the stability of the long run coefficients together with the short run dynamics was examined. The CUSUM and the CUSUMSQ tests were applied (Figures 1 and 2).

Finally, the CUSUM and CUSUMSQ indicate that the estimated short run dynamics and long run parameters of the money demand function are stable, since the plots of these graphs are confined within the 5% critical bounds of parameter stability. Thus, a stable real broad money demand function exists in Nigeria over the entire period of the analysis.

5. CONCLUSIONS

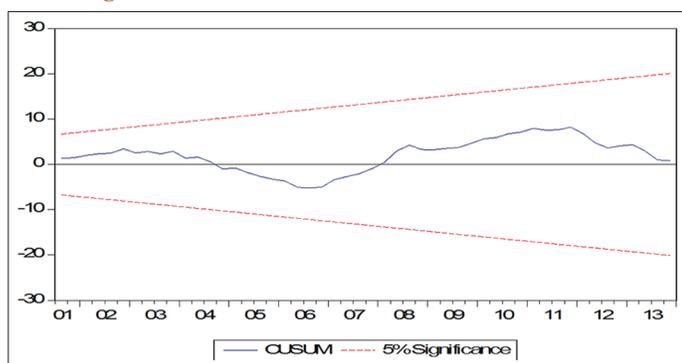
Given the importance attached to money demand and its stability in the success or failure of monetary policy the results of this study reveal that a cointegrating relationship exist between the

Table 5: Lag selection result

| VAR lag order selection criteria | | | | | | |
|---|----------|-----------|-----------|------------|------------|------------|
| Endogenous variables: D(M2P) | | | | | | |
| Exogenous variables: C (M2P(-1)) D(RGDP(-1)) D(DIR(-1)) D(INF(-1)) D(EX(-1)) D(FIR(-1)) | | | | | | |
| Sample: 1991Q1–2014Q4 | | | | | | |
| Included observations: 79 | | | | | | |
| Lag | LogL | LR | FPE | AIC | SC | HQ |
| 0 | 116.7427 | NA | 0.003640 | -2.778295 | -2.568344 | -2.694182 |
| 1 | 118.2558 | 2.719806 | 0.003594 | -2.791286 | -2.551342 | -2.695157 |
| 2 | 119.6633 | 2.494376 | 0.003558 | -2.801603 | -2.531666 | -2.693458 |
| 3 | 120.3597 | 1.216365 | 0.003587 | -2.793915 | -2.493985 | -2.673754 |
| 4 | 126.7108 | 10.93367* | 0.003134* | -2.929388* | -2.599465* | -2.797211* |
| 5 | 127.0553 | 0.584226 | 0.003188 | -2.912792 | -2.552875 | -2.768598 |
| 6 | 127.6435 | 0.982796 | 0.003224 | -2.902366 | -2.512457 | -2.746156 |
| 7 | 127.6793 | 0.058933 | 0.003306 | -2.877956 | -2.458054 | -2.709730 |
| 8 | 128.9018 | 1.980733 | 0.003290 | -2.883589 | -2.433693 | -2.703347 |
| 9 | 129.2756 | 0.596219 | 0.003346 | -2.867736 | -2.387848 | -2.675478 |
| 10 | 129.5565 | 0.440897 | 0.003412 | -2.849531 | -2.339650 | -2.645257 |
| 11 | 130.1028 | 0.843740 | 0.003456 | -2.838046 | -2.298172 | -2.621756 |
| 12 | 130.2465 | 0.218179 | 0.003536 | -2.816366 | -2.246499 | -2.588060 |

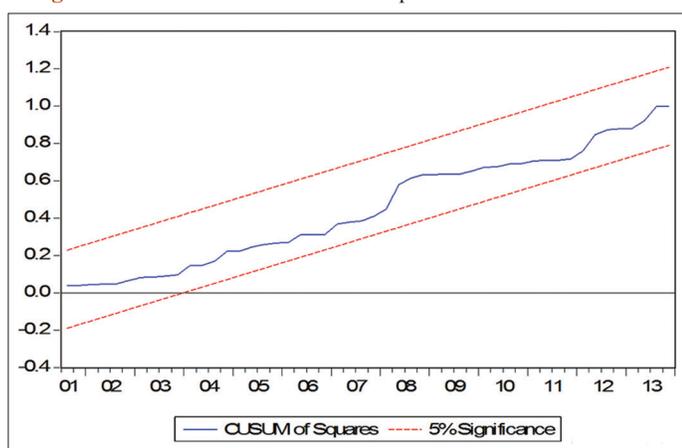
*Indicates lag order selected by the criterion. LR: Sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion. Source: Researcher’s Eview result

Figure 1: Plot of cumulative sum of recursive residuals



Source: Researcher’s Eview result

Figure 2: Plot of cumulative sum of squares of recursive residuals



Source: Researcher’s Eview result

real broad money, real income, domestic interest rate, inflation rate, exchange rate and foreign interest rate. Furthermore, the CUSUM and CUSUMSQ test also confirmed the stability of the long-run money demand function. However, monetary targeting is still relevant in setting monetary policy framework in Nigeria.

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APPENDIX

Table A1: Quantum values of selected variables

| Year | M2 | P | M2/P | RGDP | DIR | INF | EX | FIR |
|--------|---------|----------|--------|--------|-------|-------|--------|------|
| 1991-1 | 71.0 | 146.34 | 48.52 | 82.9 | 14.5 | 6 | 9.42 | 6.02 |
| 1991-2 | 80.1 | 165.90 | 48.28 | 82.03 | 12.5 | 10.1 | 9.47 | 5.56 |
| 1991-3 | 81.2 | 165.13 | 49.17 | 81.7 | 13.5 | 14.5 | 10.87 | 5.38 |
| 1991-4 | 87.5 | 186.64 | 46.88 | 82.73 | 17.5 | 20.1 | 9.87 | 4.54 |
| 1992-1 | 102.7 | 234.31 | 43.83 | 84.53 | 17.5 | 29.2 | 12.47 | 3.89 |
| 1992-2 | 114.9 | 259.30 | 44.31 | 84.12 | 17.5 | 42.7 | 18.48 | 3.68 |
| 1992-3 | 121.6 | 256.27 | 47.45 | 83.97 | 17.5 | 53.9 | 18.76 | 3.08 |
| 1992-4 | 129.1 | 288.14 | 44.80 | 84.68 | 17.5 | 51.2 | 19.5 | 3.07 |
| 1993-1 | 146.6 | 282.33 | 51.93 | 85.92 | 24.5 | 53.5 | 22.33 | 2.96 |
| 1993-2 | 159.5 | 318.34 | 50.10 | 85.42 | 28.5 | 57.6 | 22.09 | 2.97 |
| 1993-3 | 176.1 | 319.33 | 55.15 | 85.35 | 25 | 56.5 | 21.87 | 3 |
| 1993-4 | 198.5 | 352.51 | 56.31 | 85.84 | 26 | 60.2 | 21.87 | 3.06 |
| 1994-1 | 208.2 | 349.73 | 59.53 | 86.36 | 13.5 | 55.4 | 21.87 | 3.24 |
| 1994-2 | 228.3 | 405.65 | 56.28 | 86.15 | 13.5 | 45 | 21.87 | 3.99 |
| 1994-3 | 242.8 | 412.31 | 58.89 | 86.19 | 13.5 | 54.4 | 21.87 | 4.48 |
| 1994-4 | 266.9 | 454.00 | 58.79 | 86.53 | 13.5 | 71 | 21.87 | 5.28 |
| 1995-1 | 254.5 | 771.47 | 32.99 | 88.34 | 13.5 | 79.2 | 21.87 | 5.74 |
| 1995-2 | 290.7 | 823.67 | 35.29 | 88.06 | 13.5 | 87.9 | 21.87 | 5.6 |
| 1995-3 | 301.9 | 824.84 | 36.60 | 88.11 | 13.5 | 75.2 | 21.87 | 5.37 |
| 1995-4 | 318.8 | 877.90 | 36.31 | 88.14 | 13.5 | 55.7 | 21.87 | 5.26 |
| 1996-1 | 328.7 | 1,045.19 | 31.45 | 92.12 | 13.5 | 44.3 | 21.87 | 4.93 |
| 1996-2 | 354.0 | 1,096.84 | 32.27 | 91.73 | 13.5 | 30.5 | 21.87 | 5.02 |
| 1996-3 | 351.9 | 1,095.85 | 32.11 | 91.73 | 13.5 | 26.6 | 21.87 | 5.1 |
| 1996-4 | 370.3 | 1,154.68 | 32.07 | 91.63 | 13.5 | 19.8 | 21.87 | 4.98 |
| 1997-1 | 409.9 | 1,039.73 | 39.42 | 94.72 | 13.5 | 13.8 | 21.87 | 5.06 |
| 1997-2 | 410.6 | 1,107.59 | 37.07 | 94.44 | 13.5 | 13.8 | 21.87 | 5.05 |
| 1997-3 | 425.5 | 1,113.14 | 38.23 | 94.45 | 13.5 | 7.5 | 21.87 | 5.05 |
| 1997-4 | 4 429 | 1,174.94 | 36.57 | 94.22 | 13.5 | 8.2 | 21.87 | 5.09 |
| 1998-1 | 468.0 | 930.82 | 50.28 | 97.53 | 13.5 | 8 | 21.87 | 5.05 |
| 1998-2 | 477.3 | 930.82 | 46.46 | 97.12 | 14.58 | 5.3 | 21.87 | 4.98 |
| 1998-3 | 527.0 | 1,045.36 | 50.41 | 97.13 | 15 | 7.6 | 21.87 | 4.82 |
| 1998-4 | 525.0 | 1,105.20 | 47.56 | 96.69 | 14.56 | 10.6 | 21.87 | 4.25 |
| 1999-1 | 609.0 | 1,108.99 | 54.91 | 98.1 | 18 | 14.1 | 86.32 | 4.41 |
| 1999-2 | 634.9 | 1,188.39 | 53.43 | 98.39 | 18 | 10.4 | 93.25 | 4.45 |
| 1999-3 | 655.6 | 1,198.41 | 54.71 | 98.55 | 19 | 2.3 | 94.88 | 4.65 |
| 1999-4 | 699.7 | 1,265.47 | 55.29 | 98.07 | 17 | 0.5 | 96.32 | 5.04 |
| 2000-1 | 795.5 | 1,602.57 | 49.64 | 103.2 | 13.5 | -1.9 | 99.87 | 5.52 |
| 2000-2 | 904.2 | 1,623.01 | 55.71 | 103.18 | 13.5 | 2.7 | 101.12 | 5.71 |
| 2000-3 | 962.7 | 1,602.90 | 60.06 | 103.23 | 13.5 | 11.7 | 103.52 | 6.02 |
| 2000-4 | 1,036.1 | 1,684.57 | 61.51 | 102.71 | 13.5 | 15.7 | 103.9 | 6.02 |
| 2001-1 | 1,274.0 | 1,514.05 | 84.15 | 108.1 | 13.5 | 18.1 | 110.62 | 4.82 |
| 2001-2 | 1,263.2 | 1,594.28 | 79.23 | 108.09 | 15 | 20.7 | 113.25 | 3.66 |
| 2001-3 | 1,327.6 | 1,602.70 | 82.84 | 108.08 | 14.56 | 18.9 | 111.72 | 3.17 |
| 2001-4 | 1,315.9 | 1,677.06 | 78.46 | 107.5 | 14.58 | 17.8 | 112.18 | 1.91 |
| 2002-1 | 1,423.3 | 1,651.66 | 86.17 | 112.63 | 20.5 | 18 | 114.76 | 1.72 |
| 2002-2 | 1,502.1 | 1,720.62 | 87.30 | 113.33 | 20.5 | 11.7 | 117.06 | 1.72 |
| 2002-3 | 1,605.4 | 1,737.85 | 92.38 | 113.1 | 18.5 | 12.6 | 125.31 | 1.64 |
| 2002-4 | 1,599.5 | 1,791.97 | 89.26 | 112.73 | 16.5 | 9.8 | 126.76 | 1.33 |
| 2003-1 | 1,918.9 | 1,968.68 | 97.47 | 124.04 | 16.5 | 7.9 | 127.18 | 1.16 |
| 2003-2 | 2,124.3 | 1,999.36 | 106.25 | 123.93 | 16.5 | 10.3 | 127.62 | 1.04 |
| 2003-3 | 1,981.1 | 2,000.26 | 99.04 | 123.78 | 15 | 14.5 | 128.08 | 0.93 |
| 2003-4 | 1,985.2 | 2,042.75 | 97.18 | 123.26 | 15 | 22.9 | 134.54 | 0.92 |
| 2004-1 | 2,106.2 | 2,295.68 | 91.75 | 114.62 | 15 | 23.2 | 135.22 | 0.92 |
| 2004-2 | 2,113.3 | 2,095.56 | 100.85 | 123.7 | 15 | 17.1 | 133.09 | 1.08 |
| 2004-3 | 2,156.8 | 2,096.98 | 102.85 | 142.37 | 15 | 10.9 | 132.82 | 1.49 |
| 2004-4 | 2,263.6 | 2,179.98 | 103.84 | 146.88 | 15 | 10.3 | 132.86 | 2.01 |
| 2005-1 | 2,568.1 | 2,640.27 | 97.27 | 120.05 | 13.00 | 12.30 | 132.85 | 2.54 |
| 2005-2 | 2,691.3 | 2,640.16 | 101.94 | 126.78 | 13.00 | 17.80 | 132.85 | 2.86 |
| 2005-3 | 2,773.0 | 2,549.65 | 108.76 | 153.93 | 13.00 | 26.20 | 132.30 | 3.36 |
| 2005-4 | 2,814.8 | 2,561.98 | 109.87 | 159.19 | 13.00 | 15.00 | 130.59 | 3.83 |
| 2006-1 | 3,307.7 | 3,100.24 | 106.69 | 128.58 | 13.00 | 11.20 | 129.53 | 4.39 |
| 2006-2 | 3,911.8 | 3,267.96 | 119.70 | 135.44 | 14.00 | 10.50 | 128.46 | 4.70 |

(Contd...)

Table A1: (Continued)

| Year | M2 | P | M2/P | RGDP | DIR | INF | EX | FIR |
|--------|----------|----------|-----------|----------|-------|-------|--------|------|
| 2006-3 | 4,320.7 | 3,068.63 | 140.80 | 162.50 | 14.00 | 4.30 | 128.33 | 4.91 |
| 2006-4 | 4,027.9 | 3,051.16 | 132.01 | 169.30 | 10.00 | 7.50 | 128.29 | 4.90 |
| 2007-1 | 4,798.3 | 3,491.67 | 137.42 | 135.77 | 10.00 | 6.70 | 128.23 | 4.98 |
| 2007-2 | 5,116.2 | 3,399.92 | 150.48 | 142.76 | 8.00 | 5.10 | 127.65 | 4.74 |
| 2007-3 | 5,672.6 | 3,192.04 | 177.71 | 173.07 | 8.00 | 4.40 | 126.58 | 4.30 |
| 2007-4 | 5,809.8 | 3,032.71 | 191.57 | 182.62 | 9.00 | 5.40 | 120.87 | 3.39 |
| 2008-1 | 7,998.2 | 3,896.61 | 205.26 | 142.07 | 9.50 | 8.10 | 118.04 | 2.04 |
| 2008-2 | 7,948.4 | 3,791.71 | 209.63 | 150.86 | 10.25 | 10.00 | 117.84 | 1.63 |
| 2008-3 | 8,960.3 | 3,518.04 | 254.70 | 183.68 | 9.75 | 13.10 | 117.75 | 1.49 |
| 2008-4 | 9,166.8 | 3,363.27 | 272.56 | 195.59 | 9.75 | 14.80 | 120.65 | 0.30 |
| 2009-1 | 8,997.8 | 3,660.24 | 245.83 | 149.19 | 9.75 | 14.30 | 146.88 | 0.21 |
| 2009-2 | 9,077.0 | 3,622.86 | 250.55 | 162.10 | 8.00 | 12.50 | 147.76 | 0.17 |
| 2009-3 | 9,458.5 | 3,353.10 | 282.08 | 197.08 | 6.00 | 10.80 | 150.90 | 0.16 |
| 2009-4 | 10,780.6 | 3,253.72 | 331.33 | 210.60 | 6.00 | 12.60 | 149.97 | 0.06 |
| 2010-1 | 11,023.3 | 4,638.18 | 237.66 | 160.12 | 6.00 | 14.90 | 149.94 | 0.11 |
| 2010-2 | 10,845.5 | 4,603.11 | 235.61 | 174.73 | 6.00 | 14.00 | 150.13 | 0.15 |
| 2010-3 | 11,224.8 | 4,256.03 | 263.74 | 212.77 | 6.25 | 13.40 | 150.47 | 0.16 |
| 2010-4 | 11,525.5 | 4,135.99 | 278.66 | 228.71 | 6.25 | 12.60 | 150.65 | 0.14 |
| 2011-1 | 11,653.6 | 4,994.57 | 233.33 | 171.27 | 7.50 | 12.00 | 152.00 | 0.13 |
| 2011-2 | 12,172.1 | 5,028.32 | 242.07 | 187.83 | 8.00 | 11.30 | 154.42 | 0.05 |
| 2011-3 | 12,618.1 | 4,314.28 | 292.47 | 228.45 | 9.25 | 9.60 | 153.28 | 0.02 |
| 2011-4 | 13,303.5 | 3,877.04 | 343.14 | 246.45 | 12.00 | 10.40 | 155.75 | 0.01 |
| 2012-1 | 13,271.0 | 5,020.25 | 264.35 | 181.12 | 12 | 12.2 | 157.95 | 0.07 |
| 2012-2 | 13,483.1 | 4,924.26 | 273.81 | 199.83 | 12.00 | 12.8 | 157.35 | 0.09 |
| 2012-3 | 14,065.3 | 4,508.40 | 311.98 | 243.26 | 12.00 | 11.9 | 157.38 | 0.1 |
| 2012-4 | 15,483.8 | 4,017.67 | 385.39 | 263.68 | 12.00 | 12 | 157.32 | 0.09 |
| 2013-1 | 15,669.2 | 4,892.10 | 320.30 | 194.06 | 12.00 | 9 | 157.3 | 0.09 |
| 2013-2 | 15,593.2 | 4,809.46 | 324.22 | 212.18 | 12.00 | 8.8 | 157.31 | 0.05 |
| 2013-3 | 14,362.5 | 4,297.28 | 334.22 | 259.84 | 12.00 | 8.3 | 157.32 | 0.03 |
| 2013-4 | 15,689.0 | 4,060.20 | 386.41 | 284.03 | 12.00 | 7.9 | 157.32 | 0.06 |
| 2014-1 | 17,732.9 | 130.64 | 13,573.87 | 15438.68 | 12.00 | 7.8 | 157.3 | 0.05 |
| 2014-2 | 16,171.6 | 135.13 | 11,967.44 | 16084.62 | 12.00 | 8 | 157.29 | 0.03 |
| 2014-3 | 16,814.5 | 131.20 | 12,815.93 | 17479.13 | 12.00 | 8.3 | 157.29 | 0.03 |
| 2014-4 | 18,927.8 | 133.36 | 14,193.01 | 18150.36 | 13 | 8 | 162.33 | 0.02 |

Sources: Central Bank of Nigeria Statistical Bulletin, December, 2014. IMF World Economic Outlook Database, April, 2015 and Researcher's Computations. M2: Nominal M2 money stock, P: Implicit price deflator, M2/P: Real M2 money balances (N' Billion) is the dependent variable, RGDP: Real income (N' Billion), DIR: Domestic interest rate (%), INF: Inflation rate (%), EX: Expected exchange rate (N/\$1.00), FIR: Foreign interest rate (%) are the independent variables. 2014 rebased gross domestic product and implicit price deflator figures at 2010 constant basic prices

Table A2: Logged values of selected variables

| Year | LOGM2P | LOGRGDP | LOG(DIR) | LOGINF | LOGEX | LOGFIR |
|--------|--------|---------|----------|--------|-------|--------|
| 1991-1 | 1.69 | 1.92 | 1.16 | 0.78 | 0.97 | 0.78 |
| 1991-2 | 1.68 | 1.91 | 1.10 | 1.00 | 0.98 | 0.75 |
| 1991-3 | 1.69 | 1.91 | 1.13 | 1.16 | 1.04 | 0.73 |
| 1991-4 | 1.67 | 1.92 | 1.24 | 1.30 | 0.99 | 0.66 |
| 1992-1 | 1.64 | 1.93 | 1.24 | 1.47 | 1.10 | 0.59 |
| 1992-2 | 1.65 | 1.92 | 1.24 | 1.63 | 1.27 | 0.57 |
| 1992-3 | 1.68 | 1.92 | 1.24 | 1.73 | 1.27 | 0.49 |
| 1992-4 | 1.65 | 1.93 | 1.24 | 1.71 | 1.29 | 0.49 |
| 1993-1 | 1.72 | 1.93 | 1.39 | 1.73 | 1.35 | 0.47 |
| 1993-2 | 1.70 | 1.93 | 1.45 | 1.76 | 1.34 | 0.47 |
| 1993-3 | 1.74 | 1.93 | 1.40 | 1.75 | 1.34 | 0.48 |
| 1993-4 | 1.75 | 1.93 | 1.41 | 1.78 | 1.34 | 0.49 |
| 1994-1 | 1.77 | 1.94 | 1.13 | 1.74 | 1.34 | 0.51 |
| 1994-2 | 1.75 | 1.94 | 1.13 | 1.65 | 1.34 | 0.60 |
| 1994-3 | 1.77 | 1.94 | 1.13 | 1.74 | 1.34 | 0.65 |
| 1994-4 | 1.77 | 1.94 | 1.13 | 1.85 | 1.34 | 0.72 |
| 1995-1 | 1.52 | 1.95 | 1.13 | 1.90 | 1.34 | 0.76 |
| 1995-2 | 1.55 | 1.94 | 1.13 | 1.94 | 1.34 | 0.75 |
| 1995-3 | 1.56 | 1.95 | 1.13 | 1.88 | 1.34 | 0.73 |
| 1995-4 | 1.56 | 1.95 | 1.13 | 1.75 | 1.34 | 0.72 |
| 1996-1 | 1.50 | 1.96 | 1.13 | 1.65 | 1.34 | 0.69 |
| 1996-2 | 1.51 | 1.96 | 1.13 | 1.48 | 1.34 | 0.70 |
| 1996-3 | 1.51 | 1.96 | 1.13 | 1.42 | 1.34 | 0.71 |
| 1996-4 | 1.51 | 1.96 | 1.13 | 1.30 | 1.34 | 0.70 |
| 1997-1 | 1.60 | 1.98 | 1.13 | 1.14 | 1.34 | 0.70 |
| 1997-2 | 1.57 | 1.98 | 1.13 | 1.14 | 1.34 | 0.70 |
| 1997-3 | 1.58 | 1.98 | 1.13 | 0.88 | 1.34 | 0.70 |
| 1997-4 | 1.56 | 1.97 | 1.13 | 0.91 | 1.34 | 0.71 |
| 1998-1 | 1.70 | 1.99 | 1.13 | 0.90 | 1.34 | 0.70 |
| 1998-2 | 1.67 | 1.99 | 1.16 | 0.72 | 1.34 | 0.70 |
| 1998-3 | 1.70 | 1.99 | 1.18 | 0.88 | 1.34 | 0.68 |
| 1998-4 | 1.68 | 1.99 | 1.16 | 1.03 | 1.34 | 0.63 |
| 1999-1 | 1.74 | 1.99 | 1.26 | 1.15 | 1.94 | 0.64 |
| 1999-2 | 1.73 | 1.99 | 1.26 | 1.02 | 1.97 | 0.65 |
| 1999-3 | 1.74 | 1.99 | 1.28 | 0.36 | 1.98 | 0.67 |
| 1999-4 | 1.74 | 1.99 | 1.23 | -0.30 | 1.98 | 0.70 |
| 2000-1 | 1.70 | 2.01 | 1.13 | 0.28 | 2.00 | 0.74 |
| 2000-2 | 1.75 | 2.01 | 1.13 | 0.43 | 2.00 | 0.76 |
| 2000-3 | 1.78 | 2.01 | 1.13 | 1.07 | 2.02 | 0.78 |
| 2000-4 | 1.79 | 2.01 | 1.13 | 1.20 | 2.02 | 0.78 |
| 2001-1 | 1.93 | 2.03 | 1.13 | 1.26 | 2.04 | 0.68 |
| 2001-2 | 1.90 | 2.03 | 1.18 | 1.32 | 2.05 | 0.56 |
| 2001-3 | 1.92 | 2.03 | 1.16 | 1.28 | 2.05 | 0.50 |
| 2001-4 | 1.89 | 2.03 | 1.16 | 1.25 | 2.05 | 0.28 |
| 2002-1 | 1.94 | 2.05 | 1.31 | 1.26 | 2.06 | 0.24 |
| 2002-2 | 1.94 | 2.05 | 1.31 | 1.07 | 2.07 | 0.24 |
| 2002-3 | 1.97 | 2.05 | 1.27 | 1.10 | 2.10 | 0.21 |
| 2002-4 | 1.95 | 2.05 | 1.22 | 0.99 | 2.10 | 0.12 |
| 2003-1 | 1.99 | 2.09 | 1.22 | 0.90 | 2.10 | 0.06 |
| 2003-2 | 2.03 | 2.09 | 1.22 | 1.01 | 2.11 | 0.02 |
| 2003-3 | 2.00 | 2.09 | 1.18 | 1.16 | 2.11 | -0.03 |
| 2003-4 | 1.99 | 2.09 | 1.18 | 1.36 | 2.13 | -0.04 |
| 2004-1 | 1.96 | 2.06 | 1.18 | 1.37 | 2.13 | -0.04 |
| 2004-2 | 2.00 | 2.09 | 1.18 | 1.23 | 2.12 | 0.03 |
| 2004-3 | 2.01 | 2.15 | 1.18 | 1.04 | 2.12 | 0.17 |
| 2004-4 | 2.02 | 2.17 | 1.18 | 1.01 | 2.12 | 0.30 |
| 2005-1 | 1.99 | 2.08 | 1.11 | 1.09 | 2.12 | 0.40 |
| 2005-2 | 2.01 | 2.10 | 1.11 | 1.25 | 2.12 | 0.46 |
| 2005-3 | 2.04 | 2.19 | 1.11 | 1.42 | 2.12 | 0.53 |
| 2005-4 | 2.04 | 2.20 | 1.11 | 1.18 | 2.12 | 0.58 |
| 2006-1 | 2.03 | 2.11 | 1.11 | 1.05 | 2.11 | 0.64 |
| 2006-2 | 2.08 | 2.13 | 1.15 | 1.02 | 2.11 | 0.67 |
| 2006-3 | 2.15 | 2.21 | 1.15 | 0.63 | 2.11 | 0.69 |
| 2006-4 | 2.12 | 2.23 | 1.00 | 0.88 | 2.11 | 0.69 |
| 2007-1 | 2.14 | 2.13 | 1.00 | 0.83 | 2.11 | 0.70 |

(Contd...)

Table A2: (Continued)

| Year | LOGM2P | LOGRGDP | LOG(DIR) | LOGINF | LOGEX | LOGFIR |
|--------|--------|---------|----------|--------|-------|--------|
| 2007-2 | 2.18 | 2.15 | 0.90 | 0.71 | 2.11 | 0.68 |
| 2007-3 | 2.25 | 2.24 | 0.90 | 0.64 | 2.10 | 0.63 |
| 2007-4 | 2.28 | 2.26 | 0.95 | 0.73 | 2.08 | 0.53 |
| 2008-1 | 2.31 | 2.15 | 0.98 | 0.91 | 2.07 | 0.31 |
| 2008-2 | 2.32 | 2.18 | 1.01 | 1.00 | 2.07 | 0.21 |
| 2008-3 | 2.41 | 2.26 | 0.99 | 1.12 | 2.07 | 0.17 |
| 2008-4 | 2.44 | 2.29 | 0.99 | 1.17 | 2.08 | -0.52 |
| 2009-1 | 2.39 | 2.17 | 0.99 | 1.16 | 2.17 | -0.68 |
| 2009-2 | 2.40 | 2.21 | 0.90 | 1.10 | 2.17 | -0.77 |
| 2009-3 | 2.45 | 2.29 | 0.78 | 1.03 | 2.18 | -0.80 |
| 2009-4 | 2.52 | 2.32 | 0.78 | 1.10 | 2.18 | -1.22 |
| 2010-1 | 2.38 | 2.20 | 0.78 | 1.17 | 2.18 | -0.96 |
| 2010-2 | 2.37 | 2.24 | 0.78 | 1.15 | 2.18 | -0.82 |
| 2010-3 | 2.42 | 2.33 | 0.80 | 1.13 | 2.18 | -0.80 |
| 2010-4 | 2.45 | 2.36 | 0.80 | 1.10 | 2.18 | -0.85 |
| 2011-1 | 2.37 | 2.23 | 0.88 | 1.08 | 2.18 | -0.89 |
| 2011-2 | 2.38 | 2.27 | 0.90 | 1.05 | 2.19 | -1.30 |
| 2011-3 | 2.47 | 2.36 | 0.97 | 0.98 | 2.19 | -1.70 |
| 2011-4 | 2.54 | 2.39 | 1.08 | 1.02 | 2.19 | -2.00 |
| 2012-1 | 2.42 | 2.26 | 1.08 | 1.09 | 2.20 | -1.15 |
| 2012-2 | 2.44 | 2.30 | 1.08 | 1.11 | 2.20 | -1.05 |
| 2012-3 | 2.49 | 2.39 | 1.08 | 1.08 | 2.20 | -1.00 |
| 2012-4 | 2.59 | 2.42 | 1.08 | 1.08 | 2.20 | -1.05 |
| 2013-1 | 2.51 | 2.29 | 1.08 | 0.95 | 2.20 | -1.05 |
| 2013-2 | 2.51 | 2.33 | 1.08 | 0.94 | 2.20 | -1.30 |
| 2013-3 | 2.52 | 2.41 | 1.08 | 0.92 | 2.20 | -1.52 |
| 2013-4 | 2.59 | 2.45 | 1.08 | 0.90 | 2.20 | -1.22 |
| 2014-1 | 4.13 | 4.19 | 1.08 | 0.89 | 2.20 | -1.30 |
| 2014-2 | 4.08 | 4.21 | 1.08 | 0.90 | 2.20 | -1.52 |
| 2014-3 | 4.11 | 4.24 | 1.08 | 0.92 | 2.20 | -1.52 |
| 2014-4 | 4.15 | 4.26 | 1.11 | 0.90 | 2.21 | -1.70 |

Source: Researcher's computations

Table A3: Correlation matrix

| | M2P | RGDP | DIR | INF | EX | FIR |
|------|-----------|-----------|-----------|-----------|-----------|----------|
| M2P | 1.000000 | | | | | |
| RGDP | 0.941963 | 1.000000 | | | | |
| DIR | -0.412069 | -0.243983 | 1.000000 | | | |
| INF | -0.325986 | -0.262345 | 0.269213 | 1.000000 | | |
| EX | 0.623110 | 0.429846 | -0.436834 | -0.477309 | 1.000000 | |
| FIR | -0.796329 | -0.645755 | 0.470939 | 0.196478 | -0.595517 | 1.000000 |

Source: Researcher's Eview result

Table A4: Heteroscedasticity test for the first hypothesis

| White heteroskedasticity test | | | |
|-------------------------------|----------|-------------|----------|
| F-statistic | 0.929882 | Probability | 0.618034 |
| Obs*R ² | 20.66630 | Probability | 0.417002 |

Source: Researcher's Eview result

Table A5: Autocorrelation test

| Breusch-Godfrey serial correlation LM test | | | |
|--|----------|-------------|----------|
| F-statistic | 2.953030 | Probability | 0.080993 |
| Obs*R ² | 6.470604 | Probability | 0.113480 |
| Durbin-Watson stat | 1.901229 | | |

Source: Researcher's Eview result

Table A6: ADF unit root tests from M2 money demand function

| Variables | At level with constant, no trend | | At first difference with constant, no trend | |
|-----------|----------------------------------|-------------------|---|-------------------|
| | ADF statistics | 5% critical value | ADF statistics | 5% critical value |
| LOGM2P | -3.83 | -2.9980 | -1.0429 | -3.0048 |
| LOGRGDP | -3.13 | -2.9980 | -0.7476 | -3.0048 |
| LOGDIR | -2.02 | -2.9980 | -5.3786 | -3.0048 |
| LOGINF | -2.38 | -3.0048 | -4.6004 | -3.0048 |
| LOGEX | -2.06 | -2.9980 | -4.6551 | -3.0048 |
| LOGFIR | 2.44 | -3.0299 | -3.3833 | -3.0048 |

Source: Researcher's Eview result. ADF: Augmented Dickey Fuller

Author Queries???

AQ1:Kindly provide author details in the reference list