THE PRIMARY LINK IN THE KEYNESIAN TRANSMISSION MECHANISM IN NIGERIA: AN EMPIRICAL INVESTIGATION.

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ABSTRACT

Keynesians theoretical postulations have availed that interest rate which is the primary channel in the Transmission mechanism of Money supply on the stability of prices in the economy has been immersed in economic discourse. This relationship which is indirect and negative has been the discourse amongst economist and it is inconclusive. This study seeks to complement literature in this area given evidence for Nigeria between 1975-2011. The use of Vector Error Correction Model (VECM) within the framework of Vector Auto Regression (VAR) methodology was adopted for analysis. Variables such as Inflationary Rate (INF), Total Liquidity of Money(M_2) proxied as total quantity of money supplied(MS), the Minimum Rediscount Rate(MRR) proxied as interest Rate, where sourced from Central Bank of Nigeria Bulletin and used as data set for analysis. The study revealed a negative and unidirectional long- run equilibrium relationship between interest rate and money supply, with the interest rate serving as the signal to variations in money supply. It was also noted that money supply is not a major determinant of interest rate as substantiated by the insignificant values of the t-statistics and the low R^2 value of 37% variations explained by the model specified and 63% variations not captured by the model. Worthy to note also is that the short run relationship between money supply and interest Rate alternated between negative and positive relationships. Reasons for such behaivour reveal the combination of the Keynesian -effect and the expectation factor effect. Against this background, it is recommended that government should apply caution in the use of these two important tools of monetary policy to achieve price stability, as well as the need to consider other factors to augment the efficacy of the use of these tools. It is also worthy to note that the continuous use of interest rate as the key driver of the quantum of money to be supplied by monetary authorities, is a signal in the right direction.

Keywords: Money Supply, Interest Rate, Vector Auto Regression

1. INTRODUCTION

Economists overtime have been bedeviled with the problem of precipitating positive movements along axis that will lead to the reduction of gaps seen as disequilibrium in the economy. The Keynesians, though agreed that the effect of money supply towards precipitating changes in the real sector is limited, especially against the background of the economic scenario as witnessed in the great depressions of the 1930s, when the Supremacy of money's argument by the Classicals that "money

and only money matters" was seen as a negation towards the evolvement of economic growth. This thinking engendered the concept of the liquidity trap as posited by Keynes that people are unwilling to place funds in loanable terms due to low interest rate, instead they prefer to hold money in liquid form.

It was in the light of this argument, that the Keynesian which has metamorphosed into the Fiscalist school of thought posited that, interest rates as a primary link will be affected by money supply first which will in turn affect investment, and consumption decisions, that will transcend to the real sector of the economy. This thought as countered by the Classicals opined that money supply is directly proportional to prices as elaborated by the quantity theory of money.

Studies such as Ajayi(1974),Iyoha(1969),Saidu(2007) Odedokun(1996),Ebiringa(2012)relating interest rates to money supply in Nigeria, though limited in scope and fraught with methodological problems, are inconclusive. Most of such studies use nominal interest rates as against ex-ante real interest rates, which in theory affect savings and investment decisions. Of particular importance is the quality of data used in the studies, as most of these studies do not examine the issues of the macro statistics properties of the data. The syllogistic reasoning here is that there is the problem of spurious regressions, when non-stationary series are used in regression analysis.

The main objective of this paper is to empirically investigate the effect of money supply on the primary link in the Keynesian transmission mechanism using time series data of 1975-2011 taking hindsight of the quality of data used, since past studies had likely produced spurious regressions. The strength of this relationship which also forms the fulcrum of our analysis is the specific objective of the study.

Reliance was made on secondary sources of data which was mainly generated from Central Bank of Nigeria's publications, Federal office of Statistics as well as other published works.

The rest of the paper is organized as follows; section2 examines the review of literature, theoretical and conceptual issues; section 3 deals with data presentation, model specification, empirical examinations and discussions; finally section 4 concludes the paper.

2.0 CONCEPTUAL, THEORETICAL AND EMPIRICAL REVIEW

2.1 Conceptual issues

This paper has adopted the 1994 series of the CBN briefs definition of money supply. Money stock refers to the total value of the total stock of money in the economy and this consists of currency (notes and coins) and deposits with the commercial and merchant banks. There are two variants of money supply in Nigeria, namely:

M_1 = is the narrow measure of money supply which includes currency in circulation with the non-bank i.e. Public and demand deposits (current account) at the commercial banks.

M_2 = is the broad measure of money supply and includes M_1 and savings and time deposits (quasi-money) at the commercial and merchant banks. M_2 measures total liquidity in the economy.

From the foregoing, the variant of money supply used in this work is synonymous to the M_2 since it measures the total money supply in the economy at certain periods.

A review of the money supply policy and the interest rate policy in Nigeria is discussed within the framework of the period before the 1986 Structural Adjustment Program (SAP) reforms and the Post 1986 SAP reform periods, which relied on the dynamics of the market.

Adewuyi (2000) while writing on the absorptive capacity and macroeconomic policy in Nigeria reviewed that in the area of monetary policy, money supply grew from 25.79% in the pre-reform period to 31.2% in the post reform period. The expansionary monetary policy coupled with the rapid growth of government expenditure aggravated the rate of inflation. He further stated that the observed increase in money supply growth cannot be unconnected with the monetization of foreign exchange receipts, capital inflow and the liberalization of the financial sector.

2.2 **Determinants of Money Supply**

The general assumption as ascribed by Anyanwu (1993) is that nominal money supply is exogenously determined, that is, the monetary authority or the Central Bank supplies it. But he asserts that the real money supply is endogenously determined since the price level variation cannot be fixed. In other words, money supply is determined by the central bank behaviour, the behaviour of the non-bank public and the behaviour of the commercial banks.

Specifically, he posits that, money supply is influenced by the factors depicted by the following equation:

$$Ms = \frac{1 + C}{rd + r_t + t + e} R \quad \ldots\ldots (1)$$

Where Ms = Money Supply

C = is the desired currency ratio determined by the non-bank

Public. If the non-bank public increases its demand for currency, money supply with increase.

rd = Is the reserve requirement percentage against demand

Deposits and is set by the central bank. If the reserve requirement is high, money supply will be low.

rt = is the reserve requirement percentage against commercial bank time deposits and is also set by the central bank. If this percentage is high – money supply will be low.

e = is the desired excess reserve ratio, determined by the commercial banking system. If commercial bank demand for excess reserves increases, money supply increases.

t = is the desired time deposit ratio which is determined by the non-bank public. If the non-bank public increases its demand for time deposits, money supply increases.

R = is the quantity of total reserves supplied to the commercial banking system by central bank. If the total reserves supplied by the Central Bank are high money supply will be high

Others are;

r = is the interest rates. There exist a positive relationship between money supply and interest rates. When interest rates are high, money supply is also high.

rb = The Bank rate typifies the rate at which commercial bank borrow from the central bank or discount bills. When this rate rises then money supply falls.

2.3 **Interest Rate**

Interest rates are quite many and are often referred to as the interest rate structure. Interest rates differ from bank to bank in Nigeria due largely to their been deregulated. Each bank has interest rates for its ordinary saver, fixed depositor, as well as a price-lending rate offered to its first class customers and a maximum lending rate charged to its other customers. There is also an inter-bank rate, which applies to very short-term loan transactions among the banks themselves.

The rediscount rate is the minimum rate at which the CBN is prepared to lend to the commercial and merchant banks either in the form of rediscounting or direct loans.

The use of the minimum rediscount rate (MRR) is adopted for this work, premised on the argument that, the adoption of the indirect mechanism requires that interest rate policy will become the most important instrument of monetary management, aimed at regulating the cost of credit from deposit money of banks, as the MRR becomes the nominal anchor of all money market interest rates.

Adewuyi (2000) assertions on interest rate policy availed that before 1986 the Central Bank of Nigeria (CBN) with a view to encouraging savings and investment, and hence economic growth regulated the structure and levels of interest rates. This regulated interest rates regime was characterized by the demand for credit exceeding the savings rate, government borrowing being financed by the CBN and the negative real interest rates. The real deposit and real lending rates were -12.28 and -8.66% in the period of 1975-85. This was as a result of the prevalent nominal interest rates which could not keep pace with inflation rates.

With the adoption of the Structural Adjustment Program (SAP) in 1986, there was a policy shift from a regulated regime of setting various interest rates to a market determined interest rate regime. Following this, interest rates were 'guided-deregulated' and the minimum rates on savings and time deposits were at 12 and 11% respectively in 1987. The maximum lending rate was also raised from 13% to 15% while the Minimum Rediscounting Rate (MRR) was equilibrated at 11%. In August 1987, monetary authorities completely deregulated the interest rates by removing the minimum interest rates on savings deposits and the maximum lending rates. This action further raised the MRR from 11% to 15%.

Despite the complaints from producers and pressure from the Manufacturing Association of Nigeria (MAN), which saw the CBN reduce the MRR from 15 to 12.75% in December 1987, market forces still accounted for the rise in MRR to18.5% and this led to the high lending rate.

Given this scenario, the spread between the lending and the deposit rates continued to widen. It increased from 4.11% in the period 1975-1985 to 7.33% in the period 1986-1993, despite the moral suasion by the CBN against such trend. The reason was as a result of the combined effects of high inflation rate due to continuous devaluation and continuous depreciation of the naira. This trend continued unabated in the period 1994-97 and when it became obvious that government efforts at controlling the interest rates spread were inadequate, the government decided to fix the minimum lending rate at 21% without tampering with the rate on deposits. In order to complement this policy, the MRR was reduced from 18.5 to 15.5%. Since the inflation rate increased astronomically over this period, the real interest rates also recorded larger negative growth values from -21.2% in the Pre reform period to -29.4% in the Post reform period, while the interest rate spread also maintained an upward trend by increasing from 7.33% in previous period to 8.23% in the Post reform period.

Sanusi (2000) assets that, the objective of varying the interest rate is to alter the demand for and supply of financial assets in the direction that is consistent with the overall objectives of monetary policy including output growth and inflation. That is, a change in monetary policy stance initiated by a change of the MRR is initially transmitted to the nominal short-term interest rates, which feeds into the real interest rates and finally affects the consumption and investment decisions of economic agents. While these transactions are going on in the financial sector, the effect of the change is being transmitted to the real sector through its effect on aggregate demand and changes in the price level. Therefore, through changes in interest rates, the effect of monetary policy can be readily transmitted to the larger economy. Literature has substantiated a number of factors affecting interest rate to include monetary policy orientation (i.e. liberal or control regime); Financial structure (i.e. its development level, banking sector concentration, banking size, the degree of openness of the financial market); asymmetric information; menu cost; size of the informal market. This reasons are well documented in Sanusi(2000), Chizea(2001), Nnanna(2002), Ebiringa(2012) who cited works of Gambacorta(2008), Aydin(2007), Hofmann(2006), Hulsewig et al (2009), De Bondt(2005), Burgstaller(2003), Baugnet et al(2009), Chionis and Leon(2006), Kaketsis and Sarantis(2006). It is worthy to note that factors affecting interest rate vary across, as well as within country, based on the ever changing financial environment. These variations provide necessary background for the evolvement of a monetary policy as revealed by Kwapol and Scharter(2009).

2.4 Theoretical Framework

John Maynard Keynes in 1936 made one of the most important criticisms of the validity of the assumptions underlying the quantity theory of money. He used his **Liquidity Preference Theory** to propose a more complex theoretical framework for analyzing aggregate economic relationships. Anyanwu (1993) reviews on this highlighted that to Keynes, money is held to finance expenditures, other than transactions and precautionary events. That is money is held for purposes other than as a medium of exchange but also for speculative reasons, which depends on the 'liquidity preference' of asset holder rather than on his expenditures. In essence, the amount of money held in speculative balances depends on the anticipated direction and magnitude of prospective changes in market interest rates. Thus, if individuals believe that market interest rates are likely to increase in the future, they have an incentive to hold their wealth in the form of liquid assets in order to avoid the capital losses on long-term assets that would accompany the expected increase in interest rates. Those who hold money because they expect the return on money balances to exceed the yield on alternative assets, are said to exhibit liquidity preferences. Keynes was of the view that more individuals expect a future increase in market interest rates when the current level of interest rates is low than when the current level of interest rates is high. Therefore, liquidity preferences and the speculative demand for money are opined to be inversely related, to the current level of interest rates. Liquidity preference as seen here is the degree of risk aversion and the expected yield on alternative financial assets.

Keynes thus expanded upon the Classical quantity theory by introducing the interest rate as a major determinant of the demand for money, made explicit through his analysis of speculative motive. Empirical studies have shown that the response of the demand for money to the rate of interest is stable and inverse, but also that the response is relatively inelastic (except in the Keynesian liquidity trap' where it is infinitely interest-elastic at low-level interest rates)

The other extreme case of the demand for money in Keynes terms called **the liquidity Trap** avails that the speculative segment becomes infinitely elastic when the rate of interest assumes the lower value of its 'normal' range. Keynes reasoned that the interest rate might be so low during a period of severe unemployment that it would be impossible to lower it further through an increase in the money supply.

2.5 Empirical Literature

An empirical review of literature on the subject matter has revealed studies like Lastrapes and Selgin (1995) while studying money supply shocks and its effects on interest rate given the USA economy,

found out via cointegration techniques that a permanent money supply shock generates a temporary fall in interest rate.

Gbenedio, Ayadi, Okpala and Amon(1999) applying cointegration techniques to investigate the long run equilibrium relationship between Money supply variability and interest rate spread in Nigeria between 1985-1992, discovered that subsequent to the introduction of SAP, there existed no long run equilibrium relationship between these variables, however further investigation revealed evidence for the Pairwise Granger Causality test that support Friedman's Hypothesis that money growth variability impact on the term structure of interest rates. They concluded that these results have implications for developing economies especially those that share similar characteristics with Nigeria.

Lynch and Ewing(1995) using a group of developing countries as sample data and the cointegration methodology for analysis did submit that money growth variability has a positive relationship with spread between short and long term interest.

The results of Monnet and Weber (2001) on their work on Money and interest rates, are no different, while using the regression analysis to determine the correlation coefficients of the variables amongst the sample of 31 countries for the period 1961-1998, they availed that a positive relationship exist, but it is higher for the group of developing countries as against the developed economies.

A study by the West Africa Monetary Agency (WAMA) for countries under the umbrella of Economic Community for West African Countries (ECOWAS) while using correlation analysis found out conflicting results, which stated positive relationship for UEMOA Countries (i.e. Benni, Burkina-Fasso, Cote 'd' ivoire, Guinea-Bissau, Togo, Senegal, Mali, Niger), Gambia, Ghana, Guinea and Cape Verde; and negative relationship for Nigeria, Sierra Leone; with no relationship for Liberia, since the traditional instruments of Monetary policy such as Open Market Operations and Interest rate policy are not being operated. The study recommended for effective functioning of the financial market to support the maintenance of equilibrium interest rates which will assist in avoiding the prevalence of low interest rate.

Blejer(1978) while writing on money and the nominal interest rate in an inflationary economy like Argentina and using the VAR methodology, revealed that the changes in money supply are expected to affect the nominal rate of interest in opposite directions. That is the liquidity and credit effect tend to depress the rate of interest, while higher inflationary expectations work in the opposite direction. Theoretical studies suggest that although liquidity and credit effects initially dominate, the dominance effect is eventually eroded by the expectation effect. These results are confirmed in countries with mild inflation as against those obtained for a highly inflationary country like Argentina, which indicates that the expectation effect is dominant and that any change in the rate of monetary disequilibrium was fully transmitted to the nominal interest rate.

Huizinga and Leiderman (1985) works on interest rates, money supply announcements and monetary base announcements for USA via econometric techniques, found out unexpected increases in the announced monetary base and money supply did have a significant positive effect on interest rates during the period 1979-1982.

Engel and Frankel (1984) adopted the combination of Calgan- type Money Demand Equation and the Dorbush's Money Supply Equation to develop an ARIMA model to study why interest rates react to money announcements in USA for the period 1977-1982. They revealed that when money supply grows more rapidly than had been expected, the market assumes that the Federal Reserve will reverse the error in the future. The expectation of future tightening causes the interest rate to rise and the exchange rate to fall. The positive correlation of money announcements and interest rate changes rationalizes the flexible price model that unanticipated money growth raises expected future interest rate and expected inflation.

Case and Fair (1999) developed a money market model for the USA economy to investigate the transmission effect of money supply. It findings were consistent with the Keynesian preposition that

an increasing money supply at equilibrium causes a decrease of the interest rate because more money is supplied than needed since households tend to deposit their exceeding money at the bank, trying to benefit from the high interest rate of interest bearing bonds. Following this increasing supply of money, pressure is put upon the interest rate, which drops to the equilibrium level. As interest rate is the price of borrowed funds, it causes capital to be available at cheaper conditions. Mankiw and Taylor (2006) also substantiate this finding in stating that interest rate decreases causes the demand for loanable funds to be higher.

In a study by Jimoh (1990) on the demand for money and the channels of monetary shocks transmission in Nigeria while reviewing the demand for money literature in Nigeria, which have been variously examined before 1990 by Tomori (1972), Teriba (1974) Ajayi (1974), and Ojo (1974) Odama (1974) made a major conclusion that the demand for money in Nigeria was interest rate insensitive, irrespective of which definition of money and interest rate that was employed. This was not difficult to explain deducing from the underdeveloped nature of the Nigeria money and financial markets. These writers however arrived at certain conclusions that the transaction component of money demand could still be sensitive to interest rate once there are some assets which are interest-bearing, that are not classified as money, virtually risk less and close to money.

In using the two-stage least squares approach in his study, Jimoh (1990) demonstrated that if the demand for money in Nigeria was at any time insensitive to interest rate changes, that situation no longer holds true today. This further suggested that there exists substitution between money and other financial assets in the portfolios of wealth holders in Nigeria, though the level of significance in terms of substitutability of money and other financial assets (in particular) variables like consumption and investment functions was quite low. This implied that it would be safe to interpret the presence of a significant inflation rate variable in the demand function of money, implying that wealth holders suffer some form of money illusion.

The foregoing has policy implications for the government as for effective monetary policy to be attained; both the interest rate and the level of money supply are adjusted in such a manner that ensures that one reinforces the other. That is, for an expansionary monetary policy of increase in money supply, there should be a corresponding reduction in the administered interest rate; this will pave way for substitution of other financial assets, for money.

3.0 Methodology Issues and Empirical Evidence

This study used secondary data, which were obtained from the 2011 Central Bank of Nigeria's (CBN) Statistical Bulletin. Readjustment procedure was done by deflating the nominal values of MRR and MS with inflation to obtain the real values, thereafter logarithms were taken on these real values for ease of computation and interpretation in elasticities. Operationally the study employed the econometric method of simple regression analysis as the main tool to ascertain and estimate the relationship between money supply and interest rates, using the e-views 7 computer software.

Table 1: Table Showing 1975-2011 Summary Computations of the Relevant Variables used in the Study.

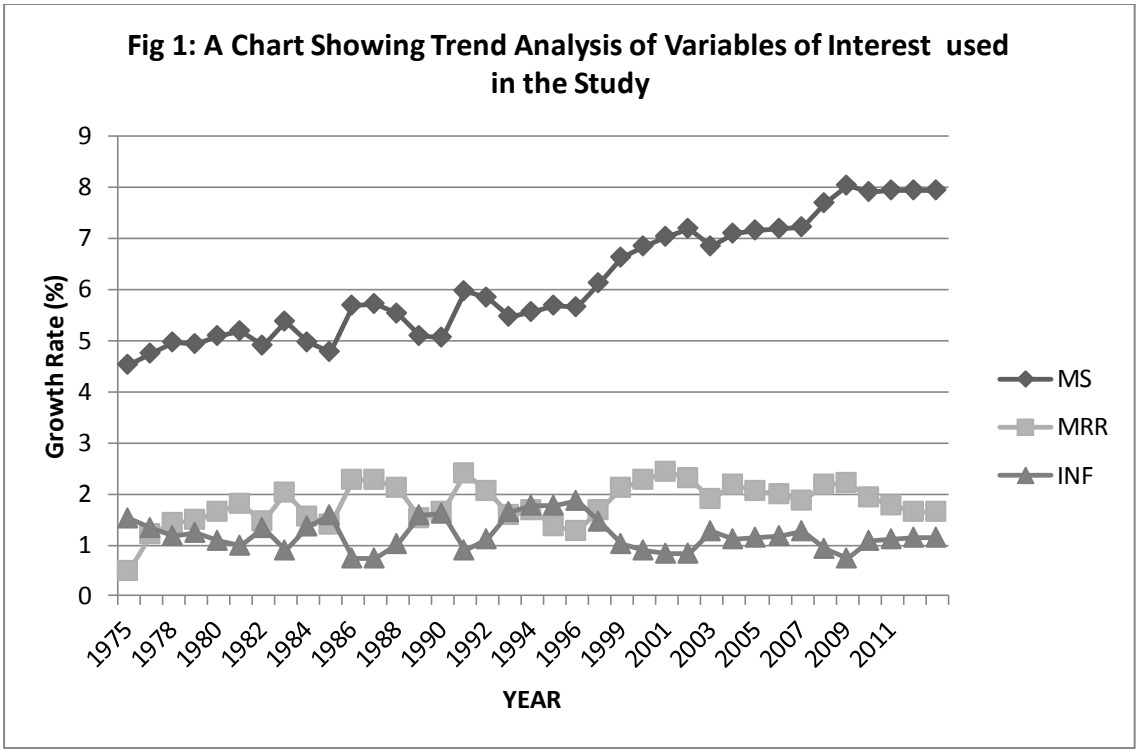
	INF (%)	MRR (%)	MS(N,m)
Mean	20.47568	11.47297	1833676.
Median	13.90000	12.75000	198479.2
Maximum	72.80000	18.50000	12023983
Minimum	5.400000	1.000000	10896.00
Std. Dev.	16.58656	5.306748	3447850.
Skewness	1.534849	0.283890	2.084931
Kurtosis	4.623175	2.996572	5.954228
Jarque-Bera	18.58902	0.497012	40.26094
Probability	0.000092	0.779965	0.000000
Sum	757.6000	424.5000	67846011
Sum Sq. Dev.	9904.108	1013.817	4.28E+14
Observations	37	37	37

Source: Researcher's Computation from Appendix 1 using e-views 7

A cursory look at the 37 observations on table 1 above has revealed that between 1975 to 2011 the inflationary rate (used as a deflator in the study), Minimum Rediscount Rate and Money Supply has averaged about 20.5%, 11.5% and N1,833,676, 000 and the maximum values of inflationary rate, Minimum Rediscount Rate and Money Supply recorded in 1995, (1989&1990) and 2011 of 72.8%, 18.5% and N12,023,983,000 respectively, with their corresponding minimum values of 5.4%, 1% and N10,896,000 been captured in 1986,1975 and 1975 respectively. The deviation of inflationary rate, Minimum Rediscount Rate and Money Supply, from the expected showed 16.6%, 5.3% and N3, 447,850,000 respectively. However the inflationary rate, Minimum Rediscount Rate and Money Supply that would have been considered ideal for stability of prices was estimated at 13.9%, 12.8% and N198, 479,200.

It is worthy to note that the total units of inflationary rate, Minimum Rediscount Rate and Money supply over the time of study was computed at (757.6) (424.5) percentage units and N67, 846,011,000 respectively.

The Jarque- Bera test of normality of the inflationary rate, Minimum Rediscount Rate and Money Supply series revealed slight bias, high bias and no bias respectively as reported by the low and high probability values, as well as low and high skewness (i.e. distribution of the series along its mean) and Kurtosis (i.e. the peakness and flatness of a normal curve) Statistics as the case might be. A trend analysis of the 37 observations on the variables of interest in this work is revealed on Fig.1 below;



Source: Researcher's Computation from Appendix 1 using e-views 7

A look at Fig 1 above shows that money supply has consistently grown given an average growth rate of less than 5% to 8%. This has led to a corresponding growth in interest rate that has hovered around 2%, while noting that the spread between growth in money supply and interest rate has increased consistently from about 3% to 6%. The growth rate of inflation is also at about 1.5%.

3.1 Choice of Variables and tools of analysis

The analytical framework was modeled using Vector Auto Regression (VAR) methodology of the Ordinary Least Squares regression.

(a) The regression equation formatted after the Dickey-Fuller (DF) class of unit root test for stationarity will be used to ascertain the stationarity of the variables used in the Time series. This is done to test the stationarity of the time property of the series. That is to determine whether shocks in a system could cause oscillatory changes in the variables so considered to persist indefinitely or whether the effects of such shocks tend to cause these variables to oscillate to zero as time passes.

(b) The test for co-integration is done i.e. to ascertain whether a long run relationship exist between the variables understudy. The Johansen and Juselius (1990) cointegration procedure will be adopted.

(c) The test for the direction of causation between the variables will also be modeled using the Granger Causality Format.

(d) The rate of interest will be regressed on the broad money supply (M2) within the period 1975-2011. This is premised on trying to evaluate the strength and the relationship between the variables money supply and interest rates, which Keynes said, was a weak relationship and is an inversely related phenomenon. The model will be structured using the Engle and Granger (1987) general format of the Vector Error Correction Model (VECM) so that short-run dynamics could be captured by the error correction mechanism, which tends to correct the disequilibrium error. This short run dynamics preposition serve as detections of short run disequilibrium error whenever they exist and provide information on how long it would take to correct them.

3.2 Apriori Decision

It is expected that the money supply has an inverse relationship with interest rates. That is increases in money supply would lead to a fall in interest rate.

3.3 Model specification

The explicit forms of the models to be analyzed are;

(i) **Unit Root Test**

(a) $\Delta MRR=\alpha +(\beta-1)MRR_{t-1} + U$ (2)

(b) $\Delta MS=\alpha+(\beta-1)MS_{t-1} + U$ (3)

Where; ΔMRR= the first differenced of Minimum rate of rediscount
MRR_{t-1} = the one year lagged estimate of Minimum rate of rediscount
ΔMS= the first differenced of money supply
MS_{t-1}= the one year lagged value of money supply.
α= the autonomous estimate.
$(\beta-1)= \phi$ = parameter of the independent variable.
ε_t or U= disturbance term at time t

Here the null hypothesis is that Ho:$\beta=0$. This implies the non-stationarity of the series.
The alternative hypothesis is that H1:$\beta\neq0$ or $\Phi<0$. This implies that the series is stationary.
Note: That the test involve testing the negativity of Φ in the OLS regression, with the t-ratio given as Φ/SE_β,; SE_β given to be the standard error of β. The t-calculated statistics are compared with the Dickey-Fuller t-simulated tables computed at $\beta=0$ to serve as decision rule.

(ii) **Cointegration Test**

Co-integration tests are conducted by using the reduced rank procedure developed by Johansen (1988) and Johansen and Juselius (1990). Johansen method detects a number of cointegrating vectors in non-stationary time series. It allows for hypothesis testing regarding the elements of co-integration vectors and loading matrix. Johansen procedure is used to determine the rank r or the number of co-integrating vectors, which identifies the existence of the long-run relationship.

The cointegrating equation is of the form:

$MRR_t = \forall + \triangle MS_t + \varepsilon_t$.....(4)

Where)MRR_t , $\triangle MS_t$, and ε_t are as earlier defined.

(iii) **Causality Test**

The test for Granger causality is performed by estimating

equations of the following bi-variate form.

$$\Delta MRR_t = \alpha_0 + \sum_{i=1}^{m} \beta^{1,i} + \sum_{i=0}^{m} \beta^{2,1} \Delta MS_{t-1} + \delta ECM_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta MS_t = \beta_0 + \sum_{i=1}^{m} \alpha^{1,i} + \sum_{i=0}^{m} \alpha^{2,1} \Delta MRR_{t-1} + \gamma ECM_{t-1} + \mu_t \quad (6)$$

Note: Where ε_t and μ_t are white noise disturbance items (normally and independently distributed), m are the number of lags necessary to induce white noise in the residual, and $ECM_{t-1}$is the error correction term from the long run relationship. MS_t is said to Granger-cause MRR_t if one or more $\alpha_{2,1}$ (i = 1,…m) and δ are statistically different from zero. Similarly, MRR_t is said to Granger-cause MS_t if one or more $\beta_{2,i}$ (i=1,…m) and γ are statistically different from zero. A feedback or bi-directional causality is said to exist if at least $\alpha_{2,i}$ and $\beta_{2,0}$ are statistically significance of the t-statistic of the lagged error correction term or the significance of F-statistics of the sum of lags on each right hand side variable.

(iv) **The Vector Error Correction Model**

The model specified to investigate the phenomenon in this study is stated below;

$$MRR = f(MS) \quad (7)$$

$$MRR=\alpha + b_1 MRR_{t-1} + b_2 MS \square\square b_3 \Delta MRR_{t-1} + b_4 \Delta MS_{t-1} + \lambda U_{t-1} + \varepsilon \quad (8)$$

Where; Error Correction Term (ECT) = λU_{t-1}= this captures the short term dynamics, while the other variables are as earlier defined.

3.4 The Results and their Discussions

Table 2 below reveal results of the unit root test of all the variables used for the work.

Table 2: Results for Unit Root Test for Stationarity.

Null Hypothesis: RMRR has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.431625	0.0012
Test critical values:	1% level		-3.626784	
	5% level		-2.945842	
	10% level		-2.611531	
*MacKinnon (1996) one-sided p-values.				
Null Hypothesis: D(RMS) has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.379519	0.0000
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	
*MacKinnon (1996) one-sided p-values.				

Source: Researcher's Computation using e-views 7

Table 2 above reflects the Stationarity of the time series used in this work, which are tested for Unit Root using Dickey-Fuller statistics. This to a large extent minimizes the spuriousness of results. The negativity sufficiency of the t- calculated further buttress our argument of stationarity, which is achieved at levels or integrated at order zero {i.e. I (0)} for the MRR series and at first difference {i.e. I(1)} or integrated at order one for the MS series.

Table 3 below shows the results of the long run cointegration test between money supply and interest rate in Nigeria between 1975 to 2011.

Table 3: Cointegration Results between Money Supply and Interest rate

Sample (adjusted): 1976 2011				
Included observations: 36 after adjustments				
Trend assumption: Linear deterministic trend				
Series: RMRR RMS				
Lags interval (in first differences):				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.537137	28.79175	15.49471	0.0003
At most 1	0.029017	1.060051	3.841466	0.3032
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.537137	27.73170	14.26460	0.0002
At most 1	0.029017	1.060051	3.841466	0.3032
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Researcher's Computation using e-views 7

Results on table 3 show that there exist a long run relationship between money supply and interest rate, since the Max-eigenvalue and the Trace tests at 5% level of significance indicate the existence of one cointegrating equation. That is when there exists any shock which causes these variables to oscillate apart in the short run, there is the tendency for them to return to equilibrium in the long-run.

Table 4: Table shows the causal direction between money supply and Interest Rate (1975-2011)

Pairwise Granger Causality Tests			
Sample: 1975 2011			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
RMS does not Granger Cause RMRR	35	0.38112	0.6864
RMRR does not Granger Cause RMS		4.20513	0.0246

Source: Researcher's Computation using e-views 7

Table 4 above shows there exist a unidirectional causal relationship between interest rate to money supply given that the F-calculated at 5% level of significance falls in the acceptance region, which necessitate the acceptance of the alternative hypothesis and the rejection of the null hypothesis as stated above in table 4. This means that the minimum rate of rediscount serve as an indicator to movements in money supply flows.

Table 5: Results of the Long- run Model and Its accompanying Short run Dynamics

Model Relationship	Variable	Coefficient	Std Error	t-Stats
Long Run relationship	RMRR(-1)			
	C	-1.66		
	RMS(-1)	-0.03	0.1	-0.32
Short Run Relationship	C	0.04	0.07	0.52
	D(RMRR(-1))	0.69	0.46	1.51
	D(RMRR(-2))	-0.32	0.34	-0.94
	D(RMS(-1))	-0.54	0.47	-1.15
	D(RMS(-2))	0.26	0.41	0.63
	ecm	-0.6	0.21	-2.83
R^2 = 0.37; F-statistics= 3.3; AIC= -1.02; S.E Eqn= 0.3				

Source: Researcher's Computation using e-views 7

Table 5 above has reported the long run relationship and its accompanying short run relationship. In the long-run relationship, which has met the a priori shows a negative relationship between Money supply and the minimum rediscount rate with the degree of impact captured at 0.03%. This means a 1% positive change in money supply will lead to about a 0.03% decline in interest rate. However, the t-statistics of -0.32 falls within the acceptance region, as such accepting the null hypothesis that money supply does not significantly affect the fluctuations in Minimum rediscount rate. This is collaborated with the low correlation coefficient (R^2) of about 37% with other factors not captured in the model accounting for the remaining 63%.

In the short run disequilibrium relationship, the immediate response of interest rate or minimum rediscount rate to its own preceding first and second year lag values shows inelastic positive and negative relationship respectively. The interest rate inelastic values of 0.7% and -0.32% as indicated in the short-run disequilibrium model are not statistically significant, which means the first and second year lag values of interest rate are not strong enough in explaining variations in interest rate. This explanation is no different from the effect that the short run first and second year lag values of money supply have on the interest rate, which are negative (0.54%) and positive (0.26%) respectively.
The F=Statistics of 3.3 shows that the model is statistically significant, that means the model is good enough in providing information about variations in interest rate been explained by variations in money supply. In simple terms, the explanatory power of the model is strong. The low value of the standard error of 0.3 has further substantiated this claim.
The Akaike information Criteria or AIC reveals the maximum number of lags in use for the model as well as ensures the elimination of autocorrelation or non-serial independence of the disturbance term. The -1.02 value in this case shows the lowest value, which the AIC has attained to reduce to the barest minimum or eliminate autocorrelation.
The error correction model (ECM) has an adjustment parameter or coefficient of -0.6 which signifies that about 60% of the disequilibrium in the preceding period is compensated for or corrected in the current period. In this case the time period within which the variables studied can equilibrate in an event of a shock is about two and half years.

4.0 Conclusion

This study tries to estimate the relationship between interest rates or minimum rate of rediscount and money supply. Unit root test for stationarity was done to check the time property of the variables used in this work, which were I(1) so as to avoid spuriousness of results. Test for cointegration is done to check whether the variables have a long term relationship. The parameter of the error term as well as the time for equilibration between the variables whenever distortions exist was estimated for the model specified.

It was discovered that a long run and inelastic negative relationship of 0.03% exist between the interest rates and money supply, suggesting a weak relationship. This is reinforced by the estimated low R-square of 37% variations in money supply been responsible for variations in interest rates, with the remaining 63% explained by other factors not specified in the model. A one- way causation exists from interest rate to money supply as revealed in the Granger Pairwise Causality Test. These results are not far fetched from empirical works associated with Monnet and Weber(2001)Sanusi(2000) Gbenedio et al(1999).

However, in the short- run dynamics, the lag values of D(RMRR (-1)), D(RMS(-2)) have conflicting relationships that do not agree with the study's a priori expectation of negative relationship. This can be attributed to the expectation factor, Blejer(1978),Engel and Frankel(1984) suggests that when businessmen suspect that money is to be injected into the system, which is likely going to cause inflation that has the propensity to decimate their profits, they are likely to review their interest rates upward to cover for the shortfall in profits, causing an upward concomitant movement with money supply.
The ECM revealed that if their exist any shock in the system this variables would random walk to equilibrium in two and half years.

Based on the results above it is recommended that financial managers in Nigeria should be cautious in applying these two important tools of monetary policy. That is other factors need to be considered to enable effective use of these monetary policy tools for policy implementation in Nigeria. It is also worthy to note that the continuous use of interest rate as the key driver of the quantum of money to be supplied by monetary authorities, is a policy in the right direction.

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Appendix 1: DATA SHOWING SOME SELECTED ECONOMIC INDICATORS USED IN THE WORK

Year	MS(Nm)	MRR(%)	INF(%)
1975	10,896.00	1	33.9
1976	11,286.00	3.5	21.2
1977	13,878.00	4	15.4
1978	14,001.00	5	16.6
1979	14,278.00	5	11.8
1980	14,397.00	6	9.9
1981	16,161.70	6	20.9
1982	18,093.60	8	7.7
1983	20,879.10	8	23.2
1984	23,370.00	10	39.3
1985	26,277.60	10	5.5
1986	27,389.80	10	5.4
1987	33,667.40	12.75	10.2
1988	45,446.90	12.75	38.3
1989	47,055.00	18.5	40.9
1990	68,662.50	18.5	7.5
1991	87,499.80	14.5	13
1992	129,085.50	17.5	44.5
1993	198,479.20	26	57.2
1994	266,944.90	13.5	57
1995	318,763.50	13.5	72.8
1996	370,333.50	13.5	29.3
1997	429,731.30	13.5	10.7
1998	525,637.80	14.31	7.9
1999	699,733.70	18	6.6
2000	1,036,079.50	13.5	6.9
2001	1,315,869.10	14.31	18.9
2002	1,599,494.60	19	12.9
2003	1,985,191.80	15.75	14
2004	2,263,587.90	15	15
2005	2,814,846.10	13	17.9
2006	4,027,901.70	12.25	8.2
2007	5,832,488.50	8.75	5.4
2008	9,208,462.60	9.81	11.6
2009	10,780,627.10	7.44	12.5
2010	11,525,530.30	6.13	13.7
2011	12,023,983.40	6.25	13.9

Source: From Various Years of CBN Statistical Bulletins