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Abstract

This work dealt on the effectiveness of the exogenous and endogenous variables as determinants of money supply in Nigeria. It is a contribution to the existing debate on money supply exogeniety/endogeneity concepts. To examine these issues, this work adopted two models and used annual time-series data for the period 1980 to 2019. It employed the ordinary least square (OLS) technique, the unit root test, the Johansson co-integration procedure and the error correction mechanism (ECM) to analyse the data

Index terms—

1 Introduction

n a bid to control the monetary aggregates or to determine the quantity of money in the economy (for achieving macroeconomic objectives), Nigeria through its central bank (CBN) has adopted different approaches of monetary policy. From inception in 1959, the CBN has adopted two broad monetary policy frameworks. These are exchange rate targeting **??**1959) **??**1960) **??**1961) **??**1962) **??**1963) **??**1964) **??**1965) **??**1966) **??**1967) **??**1968) **??**1969) **??**1970) **??**1971) **??**1972) **??**1973) designed to provide a sound basis for the national currency introduced soon after independence and the other is monetary targeting adopted since 1974. Monetary targeting involves the use of direct control or market based (indirect) instruments. Consequently, the major focus of monetary policy was on controlling monetary aggregates, a policy based on the belief that inflation is essentially a monetary phenomenon. The ability to control money supply relative to the required level of output would all things being equal control inflation. The monetary targeting was used both under the direct monetary control and the indirect monetary control era, as well as in the short-term (annual) and medium-term policy framework. During the direct monetary control era the major objective of the monetary policy was to promote rapid and sustainable economic growth. To achieve this, the monetary authorities imposed differential quantitative ceilings on all sectors of the economy, given more of such ceiling to the preferred sectors of the economy. Agriculture, Manufacturing and Construction were the preferred sectors with respect to credit allocation below market lending rate. The post-1986 considered as the era of indirect control ushered in a new era of monetary policy implementation with market-friendly techniques in Nigeria. Using this technique the CBN indirectly influences economic parameters through its Open Market Operation (OMO), which is complimented with the use of reserve requirements; the Cash Reserve Ratio (CRR) and the Liquidity Ratio (LQ). These set of instruments are used to influence the quantity-based nominal anchor (monetary aggregate) used for monetary programming **??**Uchendu, 2009 and **??**BN 2016).

Monetary policy since 1986 (the Structural Adjustment Programme-SAP was adopted in July 1986 against the crash in the international oil market and the resultant deteriorating economic conditions in the country) was designed to achieve fiscal balance and balance of payments viability by altering and restructuring the production and consumption patterns of the economy, eliminating price distortions, reducing the heavy dependence on crude oil exports and consumer goods imports, enhancing the non-oil export base and achieving sustainable growth. Other aims were to rationalize the role of the public sector and accelerate the growth potentials of the private sector. The main strategies of the programme were the deregulation of external trade and payments arrangements, the adoption of a market-determined exchange rate for the Naira, substantial reduction in complex price and administrative controls and more reliance on market forces as a major determinant of economic activity.

The objectives of monetary policy since 1986 have remained the same as in the earlier period. In line with the general philosophy of economic management under SAP, monetary policy was aimed at inducing the emergence of a market -oriented financial system for effective mobilization of financial savings and efficient resource allocation. The main instrument of the market based operations was OMO. This is complemented by reserve requirements and discount window operations. The adoption of a market-based framework, such as OMO in an economy that had been under direct control for long, required substantial improvement in the macroeconomic, legal and regulatory environment. In order to improve macroeconomic stability, efforts were directed at the management

of excess liquidity, thus a number of measures were introduced to reduce liquidity in the system. These included the reduction in the maximum ceiling on credit growth allowed for banks, the recall of the special deposits requirements against outstanding external payment arrears to CBN from banks, abolition of the use of foreign guarantees/currency deposits as collaterals for naira loans and the withdrawal of public sector deposits from banks to the CBN. Money is considered exogenous or endogenous depending on its relationship to the economy. If its existence and quantity are determined by economic activities and production, money is considered endogenous. Conversely, if the existence and quantity of money are determined by forces outside economic activity -most often by the state (or monetary authority), money is considered exogenous. Since the inception of recorded monetary thinking, there has been an ongoing debate about whether money should be treated as endogenous or exogenous (Palley 2008).

As Nayan and chik (2010) put it in many of the mainstream macroeconomic literature money supply is assumed to be exogenously determined by the Central Bank. This view is forward by a group of economists known as the monetarists based on the argument that money supply equals the money multiplier times the monetary base. Since the central bank can manipulate the base money, it can control the supply of money in the economy exogenously. On the other side of the debate, another group of economists known as the post Keynesian economists maintained that money supply is endogenous in nature. Whereas there are a number of different views of the concept of money supply endogeniety, the core argument of the post Keynesian school of thought is that economic activities determine the level of money supply.

In Nigeria the CBN uses M 2 (Broad money supply) as monetary aggregate and policy decision are based on the same. The Broad money comprises narrow money (M 1) and Quasi money (QM); which the Nigerian monetary authority manipulates in order to control the money supply. The fact remains that the stability of the economy depends much on the ability of the CBN to control the components of 'M 1 ' and 'QM'. As a developing nation the control of these variables may become more problematic due to economic and structural changes in the economy, ranging from liberalization of the economy to recent banking reforms and also the advent of Automated Teller Machines (ATM), mobile banking, interest banking, debit and credit cards, and money market funds which exert pressures on money supply.

Our focus in this study therefore is to examine how effective the CBN instruments of monetary policy may be in controlling money supply in the face of economic and structural changes in the economy and also how effective economic activities may be in controlling the money supply.

2 II.

3 Review of Related Literature a) Conceptual Framework

A conceptual framework as suggested by Kothari and Garg (2014) forms a simplified familiar structure which is meant to help gain insight into a phenomenon that one needs to explain. To **??**rodho (2009) Conceptual research is that which relates to some abstract ideas or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. The conceptual literature concerns the concept and theories and explains how the variables relate. One of the controversial issues in monetary economics is the debate over the concept of exogenous and endogenous money. The debate has been going on since the 17the century and has its theoretical roots as well as its policy implication. Exogenous money supply along with the stable money demand function is an important element in the monetarists' model that asserts the effectiveness of monetary policy. On the other hand post-Keynesian advocate the concept of endogneity of money supply since the ultimate good of the economic activity is to create money. According to the post Keynesians the main function of commercial banks in the modern economy is to finance the business sector which would in turn determine the quantity of money. Therefore money supply has no impact on real variables such as investment, employment and national income (Minsky 1977).

4 c) The neo-classical Approach To Money Supply Determination

The idea of an exogenous money supply is a fundamental tenet of the neo-classical economics. The quantity theory of money, MV= PY, frames the approach clearly. The theory assumes, at least in the short-run, that the velocity of money (V) and real output (Y) will be constant, either in levels or growth rates. It then assumes that causation runs from the left to the right hand side of the equation; meaning that variation in money growth (M) determines fluctuations in the price level (P) -that is, the rate of inflation or deflation. The quantity theory finally assumes that the central bank, on its own has the capacity to determine 'M', through discount-window lending and dynamic open market operations (Friedman 1968).

Combining these elements, the conclusion emerges that the central bank exogenously determines the growth rate of the money supply and through this capacity, will also control an economy's inflation rate and business cycle fluctuations.

5 d) THE Post-Keynesian Approach To Money Supply Determination

Endogenous money supply theory is one of the main cornerstones of the post-Keynesian (PK) economics. In post-keynesian economics money is endogenously determined. Analytically, it provides a critical link connecting the financial and the real sectors of the economy (George and Pasche, 2010).

This approach is considered appealing because it provides a link not only to the impact of financial sector (the central bank and commercial banks) on the money supply but also brings to the fore the impact on money supply of the non-bank public and activities in the real sector, (Ali and Islam, 2010).

6 e) Empirical Literature Review i. Empirical evidence of Exogenous Money Supply

A monetary sector model of India had been estimated by Khetan (1973). The model consisted of three sectors, namely, the commercial banking, the private non-bank and the government sectors and comprises eight (8) behavioral equations. The demand and supply of six principal financial assets in the Indian money market include bank credit, currency with the public, demand deposits, excess reserves, government securities and time deposits. The theory he found useful for his analysis was the orthodox money multiplier theory. He found that money supply is exogenous in Indian economy. This orthodox model is illuminating both for what it includes and what it omits. First the model emphasizes the supply of base as a constraint on the money supply. Fractional reserve banking means that base is needed to support deposit, so that the supply of base restricts the quantity of deposits that can be created. Second, bank lending creates inside balances and in equilibrium, these balances must be willingly held, or else agents will seek to spend them causing interest rate, output or price level adjustments. Thus, equilibrium outcomes must lie on the money demand schedule. Third, the money supply depends on the portfolio choices of agents through the demand for currency, time deposits, and excess reserves. Shifts in Monetary or government authority.

Banks and non-bank private sector activities.

Real economic/noneconomic activities.

7 Exogenous process

Exogenous/ Endogenous process

8 Endogenous process Money supply

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any of these assets demands will change the money supply: thus, even the orthodox model exhibits some money supply endogeneity (Palley 1993). Other works that gave support to exogenous money supply are: **??**eltzer (1958), who investgated the France economy; Pollin (2008) and Cerueira (2009), who examined the extent of the exogeneity of money supply in Brazel .

10 ii. Empirical evidence of Endogenous Money Supply

In what they termed a review work, Sabri et'al (2015), embarked on the process of reviewing the post Keynssian theory and evidence of money supply endogeneity. They demonstrated and declared that money is endogenous through credit and production transmission mechanism. The method they used is historical and theoretical analyses. The lack of empirical evidence made the validity of their work questionable.

Nell (1999), using the ordinary least square (OLS) method found that irrespective of the monetary system at anytime, the money supply process in South Africa is endogenously determined. The empirical analysis that took 1966-1997 as investigation period further showed that the inability of the South Africa Reserve Bank (SARB) to control money growth rate within this investigation period confirms the presence of an endogenous money supply process in South Africa. Nell found the structuralist approach to money supply which is part of the post-Keynesian theory of money supply appropriate for carrying out his analysis. He supported the structuralist argument that commercial banks respond to an increase in credit demand with structural changes of their portfolio on the asset and liability side. This is because, for the structuralist, liquidity pressures matter and the supply price of finance to banks can increase endogenously. Other works for endogenous money supply are: Bakara (2011), Cling (2011), Nayan and Chik (2010), Elhendway (2015). Others are Arkadiusz (2019), Falah and Ahmed (2017), Elhendway (2016), Kaplan, F. and Gungor, S. (2015).

11 III.

12 Methodology

This study sets up an econometric model to test the long run relationship between money supply and some exogenous and endogenous variables in Nigeria with a view to ascertain their effectiveness. In this study the exogenous variables are those variables that the central Bank can manipulate or set their values through its polices to control the growth of money supply. In this sense money is exogenous according to Brunner (1968) if it can be manipulated by the monetary authorities. And the endogenous variables are variables that their values are determined by economic activities; meaning that money supply is endogenously determined if its changes are caused by economic activities and production **??**Tobin, 1971). We used annual time series data from 1980-2019. The sources of the data are; Central Bank of Nigeria (CBN) Statistical Bulletin (2016-2019), CBN Annual report and statements of account for various years, National Bureau for statistics (NBS)-2017-2019. Most time series data are characterized by a unit root so that their first difference are stationary (Engel and **??**ranger, 1987, Granger, 1969). According to Wadud (2000), if a statistical test like co integration establishes co-movements in the time series data, then the residual from the regression can be used as an error correction term in the dynamic first difference equation. Therefore after estimating the multiple regression models, the study shall conduct tests for stationarity, cointegration and error correction models, so as to know the long run reliability of the models. Granger causality test will also be carried out to determine the direction of causality between money supply and the exogenous/endogenoue variables. The theoretical framework adopted in 'model 1' is the exogeneity approach of the monetarists to money supply determination. This approach suggests that the Central Bank has powers to control the growth of money supply through its instruments. Given that the Nigerian economy is similar to many other economies this research work adopted the model developed by Cerqueira (2009). In testing the exogeneity of money supply in Brazil, Cerqueira related money supply to other instruments of monetary policy. Model 2 adopted the idea of endogeneity theory of money supply advocated by the post Keynesians (PK) economists. In line with this theory the study adopts the economic model developed by **??**ry (1985) in Turkish economy which was adopted by Bakara (2011) in the Nigerian economy. According to Bakara, a change in money supply is determined by the activities of the commercial banks and in real economic sectors of the economy. From the regression result on Table IV.1, we observed that, Treasury bill rate (TBR), monetary policy Rate (MPR) and Liquidity Ratio (LQR) were statistically significant at 5 percent level. The coefficient of determination and F-statistic were also significant but the Durbin-Watson statistic is below 1.5 which suggests the presence of serial autocorrelation. Given this result, it is necessary to test its reliability, that is, whether it is not a spurious regression. This is because most time series data are characterized by unit root. We therefore subject the variables to a unit root test. The result of table IV.2 above shows that the variables are non-stationary at level form since their ADF values are less than their critical values at 5% level of significance, for this reason, the null hypothesis of a unit root was accepted for all the variables but was rejected at first difference. Thus, we conclude that the variables under investigation are stationary at first difference or integrated of order one 1 (1).

Given the unit root properties of the variables, we proceed to implement the Johanson Co-Integration Test. This test is shown on table IV.3. The result of table IV.3 indicates that the trace statistic of 125.78 and 76.66 are greater than 5 percent critical value of 95.75 and 69.82 respectively, which means that at least there are two co-integrating equations, hence, the "At most 1*" hypothesis was rejected. This suggests the existence of a long-run equilibrium relationship between explanatory variable and money supply. Consequently, we adopt the Error Correction Model (ECM) which was specified in case Co-integration is established among the variables. It tests for long run relationship between the dependent variable and the explanatory variables. The Granger Causality Test suggests that there is bidirectional causality between Money supply (MSP) and Open Market Operation (OMO) while independent causality exists between money supply and Treasury Bill Rate (TBR), Monetary Policy Rate (MPR), Cash Reserve Ratio (CRR) and Liquidity Ratio (LQR). This means that OMO Granger cause money supply though it was not significant at 5 percent level in the regression analysis. It also revealed the importance of OMO in the model.

13 b) Multiple Regression (Endogeneity Model -Model 2)

This empirical analysis shows the relationship between National Income (RIC), Interest Rate (RIR), Price Level (PRL), Currency outside Banks (COB), Reserves of the Banking System (RBS) and Money Supply (MSP). The short run result from model 2 indicates that National Income (RIC), Price level (PRL), Currency outside Banks (COB) and Reserves of the Baking System (RBS) are all significant at 5 percent level. The coefficient of determination (R 2) and the F-statistic were also significant. But the Durbin-Watson statistic of 1.3 is low and suggests the existence of serial autocorrelation in the Model. It is therefore necessary to test its reliability, that is, whether it is not a spurious regression. This was carried out through the unit root test using the Augumented Dickey -Fuller (ADF) stationarity test. The result on table IV.6 above shows that money supply (MSP) and price level (PRL) were non stationary at level form since their ADF values are less than their critical values at 5 percent; for this reason the null hypotheses of a unit root was accepted for these variables but was rejected at first difference (when ADF value > critical value). The other variables, National Income (RIC), Interest Rate (RIR), Currency Outside Banks (COB) and Reserves of the Banking System (RBS) were stationary at level form, hence, their ADF values are greater than their respective critical values at 5 percent under level form. We

therefore maintain that the variables under investigation are integrated of order 1(0) and 1(1). This could be also confirmed using the probability of the ADF statistic as depicted on the computer result.

According to Akpan (2008), the presence of 1(1) and 1(0) variables does not constitute any hindrance as it is not necessary for all the variables in the multi-variables regression to have the same order of integratebility. As the dependent variable was stationary at first difference, 1(1); we envisage co-integration in the model. We therefore adopted the Johanson Co-Integration procedure to test for co-integration in the model. From table IV.8, it is observed that the trace statistic of 470.9720 is greater than the 0.05 critical value of 95.75366, depicting that there is at least one cointegrating equation, we therefore reject the null hypothesis of none co-integrating equation. The test found about 4 co-integrating equations which is confirmed from the table as we reject the sixth hypothesis (At most 5*). This suggests a robust long run equilibrium relationship between the endogenous variables and money supply in Nigeria. Consequently, we adopt the error correction model which was specified in case co-integration was established among the variables. This is achieved by adding the residual of the model as explanatory variable which is captioned Ecm (1) to test the long run relationship. The estimated model can be shown as: ?(Log(MSP)) t = 0.344 + 0.275LOG(RIC) t -0.006RIR t -0.164(PRL) t + (0.2582) (0.1105) (0.0056) (0.2083) 0.301LOG (COB) t + 0.201LOG(RBS) t -0.561ECM(-1) ?? (eq.IV.4).(0.0471) (0.0425) (0.1814) Furthermore, it is appropriate to know the direction of causality between money supply and the explanatory variables. The Granger Causality Test result on table IV.10 explains this. there are independent causality between Interest Rate (RIR) and Money Supply (MSP), this means that RIR does not granger cause MSP, neither does MSP granger RIR. It also revealed that there is unidirectional causality from (MSP) to Currency outside Banks (COB); meaning that it is MSP that granger cause COB and not the other way round. Interestingly, there is bidirectional causality between National Income (RIC), Price Level (PRL), Reserves of the Baking System (RBS) and MSP. Meaning that as RIC, PRL, and RBS granger cause MSP, so does MSP granger cause them. This test shows how robust and important the relationship between the endogenous variables and money supply is.

V.

14 Discussion of Findings

15 Model 1

The parsimonious result on Table IV.4 is a longrun regression analysis of model 1 which took into account the stationarity of the variables. From this result we found that Treasury Bill Rate (TBR) has positive significant effect on money supply. It was observed that one unit increase in reserve money will increase money supply by 0.12 units. This supports the monetarist believe that the monetary authorities can control the money supply stock through the base money. The other variables (Monetary policy Rate-MPR, Open market Operation-OMO, Cash Reserve ratio -CRR and Liquidity Ratio-LQR) were insignificant. This may suggest that these variables are more useful in the short run.

The Adjusted R-squared of about 38.4 percent which represents the collective impact of the explanatory variables is low though the F-statistics is significant at 5% level of significant. It suggests that about 38.4 percent of changes in Money supply were accounted for by the explanatory variables in the exogenous model.

It is worthy of note that the expected signs (A Pirion expectations) of all the explanatory variables except Cash Reserve Ratio (CRR) were in line with economic theory. That the CRR failed to maintain the expected sign could be attributed to inability of the regulatory authorities to enforce laws. This is because most times, the CBN as a regulatory body does compromise and allow the commercial banks to use deposits above the required level thereby reducing the CRR contrary to law.

Interestingly, the model is valid, the coefficient of the Error correction Mechanism (ECM) is negative and significant which means that the model is useful for policy formulation and forecasting. However, the speed of adjustment given by-0.0000027 is relatively slow. This means that in case of any shock in the economy, the return to equilibrium would be very slow. It implies that about 0.00027 percent of any past deviation will be corrected in the current period. Thus it will take a long time for any disequilibrium in money supply stock to be corrected using the exogenous model.

The Durbin-Watson statistics of about 1.80 (which approaches 2) with a low probability of Fstatistics means that, the model is devoid of first order serial autocorrelation **??**Akpan 2oo8, Woodredge, 2006).

On Table IV.5, the results of Granger causality test show that there is bidirectional causality from OMO to MSP and from MSP to OMO. That is, OMO MSP. This means that both Open market operation (OMO) and Money Supply (MSP) granger cause each other. That OMO granger cause MSP (though it was not statistically significant in the long-run) depicts how important it is in the Model.

However, there is independent causality among Treasury Bill Rate (TBR), Monetary Policy Rate (MPR), Cash Reserve Ratio (CRR), Liquidity Ratio (LQR) and MSP. This indicates that as MSP does not granger cause TBR, MPR, LQR and CRR, none of these variables granger cause MSP.

16 Model 2

The parsimonious result on Table IV.9 showed the long run relationship of the endogenous model. The result indicated that, National income (RIC), Currency outside Bank (COB) and Reserves of the Banking System (RBS) were statistically significant at 5 percent level, while Interest Rate (RIR) and Price Level (PRL) were

found to be insignificant. A unit increase in National income will increase money supply by 0.27 units, while a unit increase in Currency outside Banks or Credit to the Private Sector will increase money supply by 0.30 or 0.20 units respectively. This result supports the post-Keynesians augment that activities of the commercial banks and production are the main forces that drive the Money Supply stock.

Furthermore, the apiriori expectations of all the variables included in the model were in line with economic theory. It also has good explanatory powers as shown by the value of the adjusted R-squared (?0.77) and F-statistic of about 208.530. This shows that the impact of the joint effect of the explanatory variables is not only significant but can really explain the reasons for changes in the level of Money Supply in Nigeria. It means that about 77 percent of the changes in the level of Money supply in Nigeria are explain by the endogenous variables, that is activities of the commercial banks and the non-banking sector of the economy. This supports the work of Barkara, 2011. The result also shows that the Error correction mechanism (ECM) is statistically significant and negative. Thus it will rightly act to correct any deviation from long-run equilibrium. In deed if the actual equilibrium values were too high the ECM will reduce it; while if it is too low the ECM will rise it **??**Kareem, 2009). The Coefficient of the ECM which is about -0.5613 denotes that about 56.1 percent of any past deviation will be corrected in the current period. The implication is that it will take a The implication of our results or the inference one may draw from the results is that the forces that move the money supply aggregates in Nigeria is more of endogenous in nature. And therefore, the money supply will behave better if commercial banks are provided with enabling environment and needed infrastructures provided for the real sector of the economy to perform at its best.

17 VI.

18 Conclusion and Policy Recommendation a) Conclusion

This work examined the determinants of money supply in Nigeria. The analyses carried out show that the determination of money supply in Nigeria has been strongly endogenous and weakly exogenous. As the endogenous variables are market driven and beyond the control of monetary authorities, the money supply in Nigeria has been largely endogenous.

The Nigerian monetary authority has tried to use conventional instruments such as to increase or reduce cash requirement ratio; increase or reduce monetary policy rate (MPR) and unconventional instruments such as to issue CBN bills and notes in the effort in curtailing the growth of money supply. But these CBN's efforts could only have played a marginal role. Ultimately, it is those market driven variables which have played the deterministic role in pushing the money supply growth in Nigeria.

It is arguably that the monetary policies implemented by the monetary authority in Nigeria, if by any means to be effective and meaningful could have only followed the money growth path required by the market forces. It is the Nigerian economic growth model, the evolving financial system and the process of financial deepening which have fundamentally contributed to the changes of money supply aggregates in Nigeria. Thus, subject to the market-driven endogenous money supply growth, the monetary policies implemented by the Nigerian monetary authority could at most marginally affect the money supply growth part in the short-term but could hardly alter the long-run money supply growth part. This was clearly shown in the parsimonious ECM results. This means that any substantial actions from the Nigerian monetary authority to treat money as exogenous should be understood as being short-term in nature and not as being a deterministic initiative to set certain long-run monetary target for the market to follow.

This conclusion supports Ching (2011) who wrote that "in a modern open economy with a sophisticated profit maximizing banking system, a nonbanking financial sector, dynamic currency in circulation affecting the supply of bank reserves and rapid international capital flows, it is at least questionable whether money is exogenously determined.

19 b) Policy Recommendation

On the basis of the findings of this work, the following recommendations are suggested; -Nigerian monetary authority should reduce the dependence on the use of monetary instruments as a major means of managing or controlling the money supply growth and consider a policy mix as an option. This policy mix entails using monetary instruments without neglecting the market forces, the Nigeria economic growth model and the evolving financial system. -For a more effective policy formulation that may moderate the growth of money supply, the government and the CBN should improve the activities of the money market to be more efficient in dealing with the issue of Treasury bill rate as such will ensure or moderate the growth of money supply. -For the real sector of the economy to have its full impact in determining the growth of money supply in the Nigerian economy, there is need for adequate provision of financial and physical infrastructural facilities to enhance competition through increase production of goods and services. -Lastly it is also necessary to strengthen policies that will discourage the holding of cash by the public. This will enable the banks to have enough cash at their disposal for credit delivery which will promote economic activities and enhance moderate money supply growth.

Where; y	=	the dependent variable i= 1
? o	=	n the intercept (that is the value of
? i	=	Parameters to be estimated
x i	=	the explanatory variables
t	=	Subscript depicting time or period.
U	=	iid stochastic error term

Year n i Specifically, each model with its peculiarities could be developed econometrically from equation 3

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Volume Parameter estimates Expected signs The implication Source: Author's analysis Note: Table III.1: Expression of expected signs (Model 1) ? 11 ? 12 ? 13 ?0 ?0 <o

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Model 2. Note IV. Table III.2: Expression for expected signs (Model 2) Paran

a) Multiple Regression (Exogeneity Model -Model 1)

This empirical analysis shows the degree or association between treasury bill rate (TBR), open market operation (OMO), monetary policy rate (MPR), cash reserve ratio (CRR), liquidity ratio (LQR) and money supply (MSP).

[Note: :Implies that increase in the explanatory variable leads to an increase in the dependent variable. :Implies that increase in the explanatory variable leads to a decrease in the dependent variable. t .....???????????(Eq III.5)Where: ? 0 = the intercept; ? 21? 25 = parameters to be estimated and U t = error term.Based on a priori reasoning the expected signs for the parameter estimates are as shown on table (III.2).]

Figure 1:)

IV1

				Dependent Variable LOG (MSP)		
Variable C		Coefficient	Std. Error	t.	Prob.	R-squared (R 2) 0.9
		2.707671	0.614233	statistic	0.0001	
				4.408216		
(TBR)	Log(OMO)	-0.772570	- 0.073061	-	0.0000	F-statistic = 225.802
MPR		0.177287	- 0.088912	S10.57438	0.0563	
		0.048524	0.020165	-	0.0232	
				1.993937		
				-		
				2.406318		
CRR		-0.017498	0.016869	-	0.3033	
				1.037273		
LQR		0.023967	0.007503	3.194505	0.0033	

Source: Extraction from E-View (Computer) Result

The estimated model can be shown as

LOG (MSP) t = 2.708 + 0.773 (TBR) t -0.177 Log (OMO) t -0.049 MPR t (0.614) (0.073) (0
(0.020)-0.017CRR t + 0.024LQR t ???????????? (eq, IV.1).(0.028) (0.008)

Figure 2: Table IV . 1 :

IV2

Variables	ADF Statistic	At Level 5% Critical Value	Probability	ADF Statistic	At 1 st Difference 5% Critical Value	Probability	Order of Integration
(Log)MSP	-2.913609	-2.957110	0.0548	-8.829645	-2.960411	0.0000	1(1)
TBR	2.526266	-2.957110	1.0000	-3.363907	-2.960411	0.0203	1(1)
(Log)OMO	-1.708340	-2.971853	0.4163	-9.311849	-2.971853	0.0000	1(1)
MPR	-2.777594	2.957110	0.0728	-5.850592	-2.963972	0.0000	1(1)
CRR	-1.942212	-2.957110	0.3097	-4.490656	-2.960411	0.0012	1(1)
LQR	-2.897793	-2.957110	0.0567	-5.374798	-2.96411	0.0000	1(1)

Figure 3: Table IV . 2 :

IV3

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Probability **
None *	0.794944	125.7829	95.75366	0.0001
At most 1*	0.612104	76.66419	69.81889	0.0128
At most 2	0.540739	47.30662	47.85613	0.0563
At most 3	0.393970	23.18436	29.79707	0.2371
At most 4	0.134194	7.658777	15.49471	0.5026
At most 5	0.097839	3.191842	3.841471	0.0740

*[Note: Trace test indicates 2 Co-Integrating equ(s) at the 0.05 level. * denotes rejection of the hypothesis at 0.05 level * * Mackinnon -Hang -Michelis (1999) P.value. Source: Extraction from E-view (Computer) Result .]*

Figure 4: Table IV . 3 :

IV

4: Parsimonious ECM Result (Model 1)
Dependent variable ? (log (MSP))

Variables	Coefficient	Std. Error	t-statistic	Prob.	R-squared = 0.502939
C	0.183847	0.023251	7.906996	0.0000	Adjusted R-Squared =
?(TBR) ?(LOG(OMO))	- 0.122704	0.051447 0.125961	- 2.384946	0.0250 0.6482	0.383645 f-stat=4.2159
	- 0.058170		- 0.461812		
?(MPR)	- 0.010234	0.026922	- 0.380134	0.7071	Durbin -Watson stat
?(CRR)	0.025801	0.043108	0.598522	0.5541	= 1.797899
?(LQR)	- 0.007266	0.010215	- 0.711336	0.4855	
ECM(-1)	- 2.67E-06	6.73E-07	- 3.371032	0.0005	

The estimated model can be shown as:
?(LOG(MSP)) t =0.184+0.123?(TBR) t -0.058?(Log(OMO) t -0.010?(MPR) t (0.0233) (0.1906) (0.1260) (0.
+ 0.026? (CRR)) Table IV.5: Pairwise Granger Causality Test (Model 1)

Null hypothesis	Obs	f-statistic	Prob.	Decision	Direction
TBR does not Granger Cause MSP	34	0.19050	0.8277	Accept	No causality
MSP does not Granger Cause TBR		0.66722	0.5217	Accept	No causality
OMO does not Granger Cause MSP	34	16.9056	2 E-05	Reject	Causality
MSP does not Granger Cause OMO		10.5159	0.0004	Reject	Causality
MPR does not Granger Cause MSP	34	1.04182	0.3671	Accept	No causality
MSP does not Granger Cause MRP		1.13659	0.3348	Accept	No causality
CRR does not Granger Cause MSP	34	0.41932	0.6619	Accept	No causality
MSP does not Granger Cause CRR		1.54731	0.2318	Accept	No causality
LQR does not Granger Cause MSP	34	1.24884	0.3035	Accept	No causality
MSP does not Granger Cause LQR		1.75721	0.1924	Accept	No causality

[Note: t -0.007?(LQR)) t -2.67E-06ECM(-1) ???. (Eqn.IV.2) (0.0431) (0.0102) (6.73E-07)]

Figure 5: Table IV .

IV

6: Multiple Regression Result (Model 2)
Dependent Variable LOG (MSP)

Variables	Coefficient	Std. Error	t-statistic	Prob.	R-squared = 0.993344
C	-2.393622	0.970213	-2.596703	0.0151	Adjusted R-Squared =
LOG (RIC) RIR	0.687505	0.255303	3.668720	0.0018	0.992196 f-stat=1062.687
	-0.003933	0.008274	-0.475373	0.6381	Prob(f-stat)=0.00000
PRL LOG(COB)	-0.301713	0.148234	-2.565391	0.0271	Durbin - Watson stat
	0.736431	0.200772	3.667993	0.0010	= 1.357493
LOG(RBS)	0.402688	0.063374	6.354134	0.0000	

The estimated model can be shown as:
LOG(MSP)) t = -2.394 + 0.688LOG(RIC) t -0.004RIR t +0.302PRL t + 0.736LOG(COB) t (0.970) (0.255) (0.148) (0.201)+ 0.403LOG(RBS) ??????????????????.equ.(IV.3) (0.063

Figure 6: Table IV .

IV7

Variables	At Level 5% Critical Statistic ADF Value		At 1 st Difference ADF 5% Critical Statistic Value	
(Log)MSP	-2.913609	-2.957110	-8.829645	-2.960411
(Log)RIC	-5.020830	-2.957110	-	-
RIR	-3.025803	-2.957110	-	-
PRL	-0.726740	-2.957110	-5.012580	-2.951125
(Log)COB	-4.178677	-2.986225	-	-
(Log)RBS	-4.208076	-2.957110	-	-

Figure 7: Table IV . 7 :

IV8

At most 3*	0.558766	36.89816	29.79707	0.0064
At most 4	0.213028	12.35274	15.49471	0.1408
At most 5*	0.138480	4.471722	3.841466	0.0345

Trace test indicates 4 Co-Integrating equ(s) at the 0.05 level.
* denotes rejection of the hypothesis at 0.05 level
* * Mackinnon -Hang -Michelis (1999) P.value.
Source: Extraction from E-view (Computer) Result.
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Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob**
None *	0.999948	470.9720	95.75366	0.0001
At most 1*	0.944434	174.7796	69.81889	0.0000
At most 2*	0.818383	88.07382	47.85513	0.0000

Figure 8: Table IV . 8 :

IV

9: Parsimonious ECM Result (Model 2)
Dependent variable ? (LOG (MSP))

Variables	Coefficient	Std. Error	t-statistic	Prob.	
C	0.344128	0.258164	1.000976	0.2992	R-squared = 0.833977
LOG (RIC)	0.275047	0.110532	2.488403	0.0395	Adjusted R-Squared =
RIR ? (PRL)	-0.005978	0.005627 0.208267	-1.062530	0.5141	0.767471 f-
	-0.164473		-0.789724	0.3429	stat=208.5795 Prob(f-
LOG(COB)	0.300766	0.047073	2.318119	0.0293	stat)=0.0000 Durbin -Watson stat
LOG (RBS)	0.201037	0.042519	3.270767	0.0199	= 1.91769
ECM(-1)	-0.561322	0.181422	-3.094019	0.0000	

Source: Extraction from E-view (Computer) Result.

Figure 9: Table IV .

IV10

Null hypothesis	Obs	f-statistic	Prob.	Decision	Year 2021) C (Direction
RIC does not Granger Cause MSP	34	5.65147	0.0085	Reject	causality
MSP does not Granger Cause RIC		3.42904	0.0531	Reject	causality
RIR does not Granger Cause MSP	34	0.02551	0.9748	Accept	
MSP does not Granger Cause RIR		0.14024	0.8698	Accept	No causality
PRL does not Granger Cause MSP	34	5.11215	0.0134	Reject	Causality
MSP does not Granger Cause PRL		3.43418	0.0475	Reject	Causality
COB does not Granger Cause MSP	34	0.95041	0.4012	Accept	No causality
MSP does not Granger Cause COB		10.0084	0.0007	Reject	Causality
RBS does not Granger Cause MSP	34	10.0437	0.0006	Reject	Causality
MSP does not Granger Cause RBS		24.1088	7E-07	Reject	Causality

Source: Extraction from E-view (Computer) Result

Figure 10: Table IV . 10 :

.1 Source: Extraction from E-View (Computer) Result

Source: Extraction from E-View (Computer) Result

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