

# IMPACT OF COMMODITY PRICE FLUCTUATIONS ON THE STABILITY OF NIGERIAN MONEY DEMAND FUNCTION

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## ABSTRACT

*This study examined the impact of commodity price fluctuations on the stability of Nigerian money demand functions between 1970-2008. The data series employed were gathered from various sources such as the Central Bank of Nigeria statistical Bulletin, Economic and Financial Review, monthly and Annual reports and statement of Accounts for various years. The study employed co-integration methods by Johansen (1988) Johansen and Juselius (1990). The time series property of quarterly data employed were first investigated. The result showed that a long-run relationship exists among the variables in the model. The coefficient of the long-run relationship was then deductively along the general to specific approach. From the findings it was discovered that the sign of the coefficient of the explanatory variables were impressive and robust. Therefore, in line with the findings of this study, we recommend that monetary aggregate should be one of the tools in controlling inflation in Nigeria.*

## 1. INTRODUCTION

The issue of long run relationship between money and its determinant have always been in the center of conduct of the monetary policy and this has gained currency due to increasing in financial innovations, financial sector reforms, shift in exchange rate policy worldwide and also increasing in financial integration. However theoretical and empirical approaches on this particular topic (money demand function and its determinants) have been complex and multi-dimensional Darrat (2009). In Nigeria context too, this issue is quite comprehensive and relatively studied by many researchers. Folorunsho and Akinlo (1999), Emmanuel (2001), Nwaobi, (2004), Busari (2005) Gbedebo and Adedapo, (2008).

The usefulness of money demand function in the conduct of monetary policy depends crucially on its stability. A stable money demand function forms the core in the formulation and conduct of monetary policy. It enables a policy driven change in monetary aggregates to have forecastable influence on output, interest rates and prices (Sriresun 1999). The issue of the stability of the demand for money is also crucial because a stable demand for money is also crucial for the understand of the monetary policy transmission mechanism (Laumas and Mehru (1976). It is crucial because a stable demand for money function means that the quantity of money is predictable related to a set of key variables linking money to the real sector of the economy. Therefore, this helps monetary authority to ensure an effective control of the monetary base Treichel (1997). The absence of a stable money demand function can lead to monetary policies which are

inconsistent with the development in the real sector of the economy and wrong interest rate targets. The targeted monetary aggregate might not then be an appropriate reflection of the liquidity in the economy. Therefore, it is important to have knowledge of those factors that affect the demand for money in order to ascertain that a stable relationship exist between these factors and the money stock. Money demand function also serves as a conduit in the transmission mechanism for monetary policy. Hence, the stability of the money demand function is very essential if monetary policy is to have predictable effect on inflation and real output Treichel, (1997), Thapelo, (2006).

The search for stable money demand function has been a very contentious issue since the great intellectual debates between the Keynesian and monetarist of the 1960's and 1970's as no demand for money model set forth by any of these two schools of thought as well as their contemporaries had able to stand the test of time. However, empirical studies on the demand for money function started in the 1950's through 1990's in both developed and less developed nations. It actually started in Nigeria in the early 1970's among a group of scholars within Lagos, Ibadan, Ife axis and was particularly called the TATOO debate, an acronym carries from the initials of the major debaters of those days (Tomori, 1972, Ajayi 1974, 1977, Odama 1974 and Terriba 1977). As lively as the dabate was the issue is still inconclusive Busari (2004). In the literature, two events were discovered to have led to inconclusiveness of these debates. The first is the array of estimation technique and test procedures available to researchers since the debate started in the early 1970s. the second is the development in the financial sector since the mid-1980's which might have resulted to some instability in the demand for money function in Nigeria. However, the first event has led to the re-examination of the nature and stability of the demand for money function using error method Terriba (1992) and Nwaobi (2004) and the second event led to incorporating the significant variables in the financial sector reforms.

In the literature, there are disputes on whether a stable long-run money demand function actually exists, while some authors argued that money demand function was stable. (Hamori and Hamori, 1973; Ajayi, 1977; Hansen and Kim, 1995; Akinlo and Folorunso 1999; Oskooee, 2000; Nwaobi, 2002; Busari, 2004; Gbadebo and Adedapo, 2008) and many others, some authors were of the opinion that money demand function was not stable (Gold Feld, 1973, Buhmani, 2000). In Nigeria, the aggregate money demand function often revealed its stability (Tomori, 1972, Ojo, 1974, Iyoha, 1976). But in recent years, the public demand for money has grown significantly more than how it was predicted by existing money demand regression equations. Indeed, the actual money balances that Nigerians prepare to hold now are much higher than the predicted by existing money demand regression equations. The question is, why have Nigerians prepared to hold more money balances than what was predicted by existing money demand regression equation? An attempt to answer this question introduces us to the factors that influence Money Demand Function in Nigeria.

In Nigeria, some of the studies conducted confirmed that Money Demand Functions have been stable over time (Tomori, 1972; Ojo, 1974; Iyoha, 1976) However, financial markets in most emerging economies including those of developing nations (Nigeria inclusive) have witnessed rapid expansion and reforms. Nigerian economy had gone through several financial reforms in the last two decades, including facilitating the new entry of many domestic banks, ₦25billion recapitalization of commercial banks, the gradual deregulation of lending deposit interest rate; facilitating the use of updating payment technologies like ATM and electronic transfer of deposits also included in this reform are, the expansion of a variety of internet banking service like e-banking and mobile banking technology, enhancement of telecommunication

infrastructure, and many others. While these fast financial developments could promote economic growth, such developments may also hamper the effectiveness of monetary policy. For instance, financial development and the proliferation of these new financial products and deposit substitutes could cause instability in the underlying money demand relationship with important consequences for the conduct and efficacy of monetary policy. It has also been discovered by researchers (Gurley and Shaw, 1995; Darrat, 2009) that the emergence of new interest bearing money substitute resulting from financing developments may unexpectedly increase the interest rate sensitivity of money holdings. Such elasticity shift in the money demand relations could weaken the presumed stable relations between monetary aggregates and ultimate policy objectives of price stability. If this arises, it casts serious doubt on the efficacy of monetary policy and calls into question the common use of monetary targeting in the conduct of monetary policy.

The paper is divided into five sections. Following the introductory chapter is empirical survey that covers the theoretical literature and empirical literature, section three deals with theoretical framework and model specification, chapter four covers data presentation and data analysis while section five concluded the work with policy implementation and conclusion

## **2. EMPIRICAL SURVEY**

### **Theoretical Literature**

#### **Commodity Price and Economic Development in Nigeria**

Commodity price development in Nigeria since the late 1990's has been tremendous. It followed an upward trend with prices of metals and crude oil showing the most pronounced increase. Although booms in commodity price could be observed previously, the magnitude of the increase, its duration and its breadth are unestimated. Price developments for agricultural products have been more subdued. And even though prices for agricultural raw materials, food and beverages have been following an upward trend since late 2001, their respective gains around 30%, 50% and 70% are relatively moderate compared with non agricultural commodity.

Fatusi (1999) explains that commodity price plays an important role in the economy of Nigeria which derives the majority of their merchandise export revenues from one single commodity or several commodities. Nigeria with a dominant share of oil in their export revenue also appears to be highly dependent on oil regarding government revenue and Gross Domestic product (GDP) with contribution of around 50% or above. By contrast, the direct contribution of agricultural products and their non-oil commodities to GDP and government revenues is considerably smaller. Thus, the significance of these commodities for respective economies stems mainly from their importance as a source of foreign exchange revenue and their being responsible for the employment of large parts of the labour force, particularly in Nigeria with mainly agricultural produce.

#### **Inflationary impact of oil price development in Nigeria**

Inflationary trends of oil price developments pass through effects from international to domestic energy prices were significant in all countries. Notable, oil importers and oil exporters experienced a comparably lower degree pass through, possibly reflecting the more widespread use of oil price subsidies while this first round effect on increased energy price in

Nigeria can be quantified as substantial. The limited availability of more detailed economic data makes it difficult to analyze possible second-round effects. However, a relatively contained inflation rate suggests that the impact of such second-round effects on the overall price seems limited.

At the same time, governments of oil-rich countries reacted quite prudently to the windfall revenues from higher oil prices. Although spending increased substantially, the budget position improved markedly in several countries with some countries running sizeable fiscal surpluses, moreover, the response of domestic supply to the rise in private and public spending was favourable while global markets were easily able to provide goods and services as showed in the rapid rise of imports on money demand.

Cross-country difference in exposure to certain commodities and in terms of price developments imply that terms of trade changes have varied substantially for the countries under review. Net oil exporters stand out as the main beneficiaries of the commodity boom, where as the terms of trade of exporters of agricultural produce and, to a lesser extent of non-oil commodities have deteriorated. This reflects the fact that rise in oil prices has been substantially stronger compared with most other commodities produced in the region.

Indeed, oil trade balances for the net oil importers have worsened significantly since 1999. Correspondingly most countries are spending a considerably higher amount of their import bill on oil than they did in 1999. Against this background, it is useful to distinguish between net oil exporters and importers when accessing the impact of commodity price fluctuations on the respective economies. The recently established oil produces like Equatorial Guinea and Chad have displayed the highest growth rates in the region, with average annual GDP rising by 25% and 10.5% respectively between 1999 and 2005.

The growth performance of several counties was heavily influenced by wars and civil strife. Exporters of agricultural and other non-oil commodities recorded growth rate between 0.1% and 5.5% (Burkina Faso) (and other carrying inventories storage costs plus any risk premium) only then, when expected returns are in balance are firm willing to hold the inventories despite the high cost. In the long run, the general price level adjusts to the change in the money, as a result, the real money supply, real interest rate and real commodity price return to where they were.

The relationship between commodity price and money demand determinant can be derived from two simple assumptions:

The first assumption relates to the tendency for the spot price of the commodity to move back toward long run equilibrium.

The second assumption concerns the decision as to whether it holds the commodity for another period either leaving it in the ground or on the top. These are perceived to be sufficiently below their future equilibria which will then make the arbitrage component to be net.

### **Effects of Monetary Policy on commodity prices**

Commodity price are back. In the 1970's macro economic discussion were dominated by oil price shocks and other rises in agricultural and mineral products were thought to play a big role in the stagflation of that decade.

In Nigeria, commodity price fell out of favour in the late 1980's and 1990's. During this period, commodity prices generally declined. Nkeji (2003) indicates that the effect of monetary policy on real commodity price is that high real commodity prices can be a signal that monetary policy is loose. According to him, the real oil price may have given rise to wealth effects that appreciates the money demand aggregate. The trade able sector gave rise to the "Dutch-Disease Syndrome in Nigeria".

### **Commodity price shock and Macroeconomic Activities In Nigeria**

A development in the global economy passing a great challenge to policy makers across country is the increasing rate fluctuations in oil prices.

The oil price oscillating between \$17 and \$20 in 2002 hovered around \$73 per barrel by October 2004. In fact, the price of oil has profound fluctuation since 1974. Persistent oil shock could have severe macroeconomic effect thus inducing challenges for policy makers in both the oil exporting and importing countries over the past three decades.

(Caruth, Hooker and Oswald 1996; Hamilton 1996; and Castil 2000) did a lot of studies and concluded that the price in oil prices reduced output and increased inflation in 1970's and early 1980's and falling oil prices boosted output and lowered inflation particularly in United States in the mid to late 1980's.

The transmission mechanism through which oil prices has impact on real economic variable includes both supply and demand channel. The supply side effects are related to the fact that it is an input to production and consequently an increase in oil price that lead to a rise in produce costs that included firms to lower output. Oil prices changes also entails demand-side effect (i.e consumption and investment). Consumption is affected indirectly through its positive relation disposable income. Oil price rises reduces the consumer's spending power or purchasing power. Investment movement is affected if the oil price shock encourages producers to substitute less intensive energy to intensive capital. The magnitude of this effect is in turn stronger than the speculative perceived long last reasons.

The theoretical literature has been of a generate nature, with different authors assigning different weights on the supply and demand changes. Few studies exist yet; the effect of oil prices has heavy effect on microeconomic variables for an oil exporting country like Nigeria.

### **Review of Empirical Literature**

Going by economic literature, the differences in the specification of the variables in the money demand function and commodity price have produced important differences in implications or results, hence the following empirical literatures:-

Gilbert (1990) stated that commodity price is a fact of life for commodities exporters and importers. If causes are manifold and for most commodities economic, activity in industrial countries is often the most important determinant. The study shows that 1% increase in industrial countries production, other things remaining unchanged raises the non-oil commodity prices by 2%. In real terms for good and beverages, demand is relatively stable but changes in weather often lead to variations in supply and unstable prices. Collier and Gunning (1989) compared other countries commodity price to that of Nigeria boom is as a result of some factors. He argued that:- Even though government initially tried to save windfalls, they finally invest far in excess of single currency. During an age of fluctuating exchange rates, if primary commodity prices are affected by the aggregate demand of the industrial countries, fluctuations in the value of the dollar relative to a basket of other countries currencies will cause fluctuations in dollar price of commodities even when the price is constant in terms of all currencies together.

Gilbert (1990) shows that the causes of commodity price fluctuations are manifold and for most commodities, economics activity in industrial countries is often the most important determinant. Collier and Gunning (1989) compared other countries commodity price to that of Nigeria boom and concluded that they

are based on some factors like heavy investment on simple currency, inability of the government to save windfalls.

Sriram (1999) estimates the Demand for Money Function in Malaysia, a small open economy, initially by applying a closed economy model framework, and later an open economy model by allowing for possibilities of currency substitution. Based on the cointegration and weak exogeneity tests, the study finds that the long-run income elasticity is close to one and the opportunity cost variables were negatively (interest rates on alternative assets and inflation) related to money as expected. However own rate of money was positive. These results are therefore, consistent with theory.

Ajayi (2000) explains that nominal price exhibit upward trends, they are typically insufficient even to match inflations so that real price have been constant or falling. According to Ajayi, commodity price has increased about five folds since the mid 1950's. By contrast, a pound of cocoa or coffee fetched the same price in nominal dollar in the early 1900's as it did in 1955, although copper and cotton prices approximately tripled.

The present day study of commodity price is motivated by the findings that it was not the oil price shocks that monetary policy responds to that caused fluctuation in aggregate money demand function.

Ajayi (2000) explained that nominal price exhibit upward trends and Bola (2002) analyzed the possibility that economic recession in Nigeria context may have been the consequence of the federal government policy in response to inflation that triggered the oil price shocks. Ojo (2001) presented growth rate price for twelve countries and Edor (2002) pointed out that money supply, domestic output, real exchange rate, captures the cost punch effect of rising prices of production.

Ojo (2001) presented growth rates of export prices for twelve (12) African countries from 1980 to 1990 together with two measures of their coefficient of variation. From 1975 to 1980, all of these countries benefited from export-price growth. An experience that was reversed in the following quinquennium. From 1980 to 1990, Nigeria and Ghana, two countries usually thought to have performed poorly experienced large fluctuation in export prices according to both the measures. Zaire and Zambia both largely dependent on copper also experienced high variability. The experience of Tanzania which experienced low variability demonstrates only that absence of commodity price fluctuation is no guarantee of success.

Bala (2002) analyzed the possibility that economic recession in the Nigeria context may have been the consequence of the federal government policy in response to inflation that triggered the oil price shocks. The study found that domestic output arose due to the Federal Reserve's policy of monetary tightening of industries sparked by the oil price shock.

Bossogo-Egoume (2002), in the study of demand for money in Guyana, finds that there are three co-integration relationships, but chooses the theoretically consistent relation. The price variable has unit elasticity as expected and the income elasticity was close to one. The interest on deposits is positively related to money whereas interest rates on alternative assets negatively affected money demand. Nominal exchange rate depreciation and inflation had an insignificant role. The parameter constancy is a key feature that a money demand model has to exhibit. The coefficients of variables estimated were found to be stable indicating that the model was well-specified. Thus events that were capable of creating outliers or structural breaks were captured appropriately.

Edor (2002) pointed out that money supply, domestic output, real exchange rate captures the cost push effects of rising prices of production while the quantity of money appears due to its effect on the cost of capital.

Aktham (2004) studied impact of financial liberalization on the stability of money demand function in Jordan using ECM, the result shows that quarterly time series data confirms that the broad demand for money in Jordan was stable during the period under investigation. The result also shows that the inflation rate is the most important variable that explains the demand for money in the Jordanian economy.

Lesotho and Aziakpono (2004) examined money demand function in South Africa between 1981 and 2000 and employed ECM as estimation techniques. The variables used were GDP, rate of inflation, domestic interest rate represented by nominal savings deposit rate, foreign interest rate represented by the South African Treasury bill rate and the exchange rate as represented by the Rand/Loti to US dollar, their result shows that money demand function was stable during the study period.

Busari, (2004) using cointegration and error correction approach on annual data for the period 1970-2002 to examine Nigerian money demand function in this study, he observed that demand for money in Nigeria this period was stable and that reforms measures introduced. Since the mid 1980s seems not to have significantly altered the demand function for money in Nigeria.

Adebiyi (2006) examined broad money demand, financial liberalization and currency substitution in Nigeria using Error Correction Model (ECM). His results showed that long-run demand for real balances in Nigeria depends upon real income on its own interest rate, interest rates on government securities, inflation and expected exchange rates. He finally concludes that money demand function in Nigeria was stable despite the economic reforms and financial crises.

Gbadepo and Adedapo, (2008) examined the impact of financial innovation on the stability of Nigeria money demand function using Johansen ECM and they found that financial innovation has no significant impact on the stability of Nigerian Money demand function.

Azam (2010) examined M2 money demand function in Indonesia using vector error correction model (VECM) for the period of 1990-2008. The result indicates that the demand for real M2 money aggregate is co-integrated with real income and interest rate. The real income has positive relationship with real money demand, both in the long-run and short-run. On the other hand, interest rate has a negative influence on M2 in the short-run, but has no statistically significant relationship in the long run. Furthermore, we find that the ARDL model is more appropriate in predicting stable money demand functions of Indonesia compare to VECM.

In Nigeria, the price is relatively stable, punctuated by shorter periods of extreme volatility when prices flare upward in peaks that typically last several years. Volatility has usually been greater. Since 1970, although some of the increase reflects largely mechanical effect of determining the price in a price of commodities and real exchange rate affects the money demand through the balance of payment effects on reserves. In the aggregate demand equation, output depends on domestic money while net exports depend on the relative price of commodities.

The research works of various researchers or theorist were reviewed and they made the following contributions to the relationship between commodity price fluctuation and money demand.

### **THEORETICAL FRAMEWORK AND MODEL SPECIFICATION**

The conventional textbook formulation of the demand for money typically relates the demand for real money balances ( $m = M/P$ ), to the interest rate,  $r$ , and some measure of economic activity such as real GNP ( $y = Y/P$ ), where  $M$  = money holdings,  $P$  = the price level, and  $Y$  = gross national product. Thus,  
 $m = f(r, y)$

Several theories have been put forward to explain the equation above. Perhaps the most satisfying are those of the transactions view, in which the demand for money evolves from a lack of synchronization between receipts and payments and the existence of a transactions cost in exchanging money for interest-bearing assets (usually taken to be short term (Goldfold, 1973). Of relevance to this research project's model will be a select few. This will serve as a base for the model to be specified. Keynes formulated his theory of demand in his well known book, "The General Theory of Employment, Interest and Money" in 1936. According to him, the demand for money arises out of its liquidity; liquidity refers to the convertibility of an asset into cash. He then identified three motives for holding money.

#### **Transaction motive**

This arises out of money's medium of exchange role and arises out of the need for bridging the gap between periodic receipts and payments. Keynes recognized both the income motive for households and business motives for firms. Given the society's basic institutional and technical customs and practices which govern income receipt and the flow of expenditures, the transactions demand depends on personal income and business turnover. It thus varies in direct proportion to changes in money income. Symbolically it is written as:

$$L_t = k_t(Y)$$

Where;

$L_t$  : Transactions demand for money

$K_t$  : The fraction of money income society desires to hold as transaction balances.

$Y$ : money income

#### **Precautionary motive**

This arises out of unforeseen circumstances or expectations regarding the uncertain future by economic agents. Keynes posited that households sometimes keep money for unexpected contingencies such as medical emergencies or events while firms held balances above transactionary balances based on expectations about the economy e.g. a boom or depression. Keynes held that the level of precautionary balances varied with income and not interest rate changes. Symbolically:

$$L_p = k_p(Y)$$

Where;

$L_p$ : Precautionary demand for money

$K_p$ : The fraction of money income society desires to hold as precautionary balances.

Keynes usually lumped both motives together as they were both affected by the same institutional factors which he assumed given and fairly stable in the short run adding to the fact that they were both interest inelastic. Mathematically,

$$L_1 = L_t + L_p = k_t (Y) = k(Y)$$

**Where;**

$L_1$ : Demand for active balances

**Speculative motive**

This falls under the idle balances held by economic agents according to Keynes. He posited that people hold or hoard money above their active balances for the purpose of being able to earn some form of gains by speculating on bond prices. Since individuals knew that an inverse relationship exists between bond prices and interest rate, they held money for the opportunity to partake in such speculative activities so as to earn some form of interest.

According to Keynes, there thus existed an inverse relationship between speculative demand for money and interest rates. Functionally, this is expressed as:

$$L_2 = f(i)$$

Where;

$L_2$  : Speculative demand for money

$i$  : interest rate

Keynes concluded by positing that the total demand for money consists of demand for active balances ( $L_1$ ) and that of idle balances ( $L_2$ ). Thus,

$$L = L_1 + L_2$$

$$L = k(Y) + f(i)$$

However, Keynes demand for money theory has been criticized for unnecessarily bifurcating aggregate demand for money into transactions and speculative demand. The transactions demand for money depended on income level (but Keynes had assumed a constant relation between money holdings and income). His speculative demand was based on portfolio approach which considered the yields of assets viz-a-viz their competition with money held in individuals' portfolio. Again, he further limited his analysis to two assets; money and bonds. The combination of demand motives with two different approaches is inconsistent (Paul, 2004).

Furthermore on the theory of the demand for money, Baumol-Tobin Portfolio Formulation of the Demand for Money is perhaps most widely taught demand for money theory which seeks to explain the demand for money as a function of income and interest rates. It arose as a defence by Keynesians to the inconsistencies of Keynes liquidity theory. Its simplest version is the so-called square root of money holdings and it was put forward by two economists. Tobin (February 1958), looked at the demand for money from the risk angle in his "Liquidity Preference as Behavior towards Risk" paper while Baumol (1952) in his "Transactions Demand for Cash: An inventory Theoretic Approach".

His equation is:

$$M = \left[ \frac{kY}{2r} \right]^{1/2}$$

This implies that nominal money holdings for cost minimizing individuals vary directly with the square root of planned nominal expenditures and inversely with the square root of market interest rate. It could also be expressed in real terms by deflating each nominal variable above with the price index.

Most empirical validations of the above theory use the narrow money stock (currency plus demand deposits, (M1) as the dependent variable often deflated by the implicit GNP deflator. Income is defined as real GNP or GDP and the interest rate is usually measured in two ways: by the rate on commercial paper and by the rate on time deposits.

Several authors' regression specifications base their regressions using this style. E.g. (Hafer and Hein, 1984), (Judd and Scadding, 1982) etc.

Their explicit specification usually is:

$$M_t = \beta_0 + \beta_1 y_t + \beta_2 r_t^c + \beta_4 r_t^d + U_t$$

Where;

Y: income

$r^c$  : Rate of commercial paper (variable used as a measure of financial innovation.)

$r^d$  : Rate on time deposits.

M: monetary aggregate.

t: time

Usually the growth rate of money supply is used; alternative specifications use a lagged value of money supply as one of the regressors which necessitates the use of auto-correlation corrective techniques.

$$\ln M_t = \beta_0 + \beta_1 \ln y_t + \beta_2 \ln r_t^c + \beta_4 \ln r_t^d + \beta_5 \ln M_{t-1} + U_t$$

The resulting inference from their theory is that the demand for money is positively related to income and inversely related to interest rate.

### MODEL SPECIFICATION

To successfully examine the impact of commodity price fluctuation on the stability of Nigerian money demand function, and in line with the above theoretical framework we now specify the following models.

$$M2/P = F(RGDP, INF, EX, FR, SDR, TDR, DSAP, U)$$

In a more explicit and econometric form

$$M2/P = \beta_0 + \beta_1 RGDP_t + \beta_2 INF_t + \beta_3 EX_t + \beta_4 FR_t + \beta_5 SDR_t + \beta_6 TDR_t + \beta_7 DSAP_t + U_t$$

Representing the above equation in a log-linear form

$$\begin{aligned} \text{Log } M2/P_t = & \alpha_0 + \alpha_1 \text{Log } RGDP_t + \alpha_2 \text{Log } INF_t + \alpha_3 \text{Log } EX_t + \alpha_4 \text{Log } FR_t + \alpha_5 \text{Log } SDR_t + \\ & \alpha_6 \text{Log } TDR_t + \alpha_7 DSAP + U \end{aligned}$$

M/p = Real Money stock

RGDP = Real Gross Domestic Product

INF = Domestic Inflation Rate

EX = Exchange Rate

FR = Foreign Interest Rate

SDR = Saving Deposit Rate

TDR = Treasury Bill Rate

DSAP = Dummy variable to capture the financial reform policy that have taken place since the sweeping reforms of the structural adjustment programme (SAP) embarked upon by Nigeria in 1986 which led to changes in the financial system.

A model of demand for money should establish a stable relationship between demand for money and the factors influencing it theoretically. The demand for money is hypothesized to be an increasing function of some measure of income or wealth.

$B_1$  should be positive since real income demanded rises with level or value of transactions. The coefficient, 'B<sub>2</sub>' that represents  $INF_t$  is expected to be either positive or negative, if it is negative, goods are an alternative to money, therefore it enters as level (Ericsson, 1998, Haumas and Mehra, 1976 Srirum, 1999) inflation rate may also have a positive relationship with demand for money because when it is expected to rise, economic agents could increase the money holdings expecting their planned nominal expenditures to move up (Sriram 1999). Therefore, it is merely an empirical issue; but we prefer a negative relationship as explained earlier  $\beta_3$  (Exchange Rate) is either positive or negative but preferably negative.

$\beta_4$  (Foreign Interest Rate) is expected to be negative.

$\beta_5$  and  $\beta_6$  (Savings deposit rate and Treasury bill rate) are expected to be negative.

### Sources of Data

The data to be used in this research work shall be quarterly observations on gross domestic product (GDP), money stock [which shall be deflated by CCPI (Composite consumer price index) to get real money supply], domestic interest rates e.g. Treasury bill rate and savings deposit rate, inflation rate. Treasury bill rate, and savings deposit rate had no quarterly series (1970-1980) due to the regulation of prices. To resolve this problem of non-availability of quarterly data on those variables mentioned, decomposing annual series to quarterly series using cubic spline function by Asogu, (1992) was employed.

## SECTION 4

### Unit Root Tests

Since correct inference will depend on the statistical properties of the data. Particularly, a unit root test is conducted on the relevant series. The Augmented Dickey-Fuller (ADF) with intercept but no trend and with intercept and trend. Table 4.1 displays the result of the Augmented Dickey Fuller Tests for the variables in levels.

**Table 4.1 Unit root test for variables in levels**

Variables	Untrended	Trended
LRM2	1.956568	-2.053431
LRM1	1.8725	-1.95625
LGDP	-2.221540	-2.263249
INF	-2.56486	-2.536110
EX	-0.8014171	2.314022
TBR	-1.562881	-1.218628
FR	-2.25008	-2.910997
SDR	-1.348129	-1.198838

Mckinnon critical values for respectively of hypothesis of a unit root at 5% = -2.8806 trended and 3.4403 for untrended formulated from the table, it is obvious that none of the variables is stationary at levels. Therefore we proceed to unit of the variables at first difference.

**Table 4.2 Unit root test for the variables at first difference**

Variables	Untrended	Trended
$\Delta$ LRM2	-4.959304	-5.059079
$\Delta$ LRM1	-4.87253	-5.03456
$\Delta$ RGDP	-4.972948	-5.16667
$\Delta$ INF	-5.140943	-5.134229

$\Delta EX$	-8.453799	-8.466849
$\Delta FR$	-4.034007	-4.081913
$\Delta TBR$	-5.733820	-5.788950
$\Delta SDR$	-6.856816	-7.056206

Mckinnon critical values for rejection of hypothesis of a unit root at 5% level of significant -2.8807 untrended and -3.4403 for untrended formulated.

From results in table 4.2, after taking the first differences, all variables became stationary. Therefore we can conclude that all the variables in our cointegration regression are first difference stationary. That is, each series is characterized as integrated of order I(1). The result of formal unit root test confirm that a standard regression model is not appropriate for estimating the relationship between broad money and the other variables specified in the model. Hence, the need for cointegration technique (Islam and Ahmed, 1999). The non-stationarity of the data and the notion that none of the variable a priori can be regarded as exogenous suggest that an appropriate methodology would start with a non-structural vector autoregression model (VAR), and use cointegration tests to examine any long-run relationship that exists among the variables (Jonsson, 1999).

### Cointegration Test Results

Following our findings in section 4.2 that all variables of interest are of I(1) we, therefore, test for possible cointegration among the variables. The cointegration technique helps to clarify the long-run relationship between integrated variables. The methods developed by Johansen and Juselius (1990) are applied to the data.

**Table 4.3 Co-integration results**

Series: LM2 LRGDP RF SDR TDR INF ER DUMMY

Lags interval: 1 to 4

Eigenvalue	Ratio	Likelihood		Hypothesized	No. of CE(s)
		5 Percent Critical Value	1 Percent Critical Value		
0.338937	206.6476	156.00	168.36	None	**
0.290088	144.1478	124.24	133.57	At most 1	**
0.187899	92.41312	94.15	103.18	At most 2	
0.160190	60.98535	68.52	76.07	At most 3	
0.098607	34.62391	47.21	54.46	At most 4	
0.094160	18.94798	29.68	35.65	At most 5	
0.024309	4.015127	15.41	20.04	At most 6	
0.001979	0.299085	3.76	6.65	At most 7	

### Discussion of co-integration results

Co-integration results for the model is reported in table 4.3. The results from the co-integration test reject the null hypothesis of no co-integration in favour of at least two cointegrating relationship. The Eigen value associated with the first vector is indeed dominant over those corresponding to other vectors, thus confirming that there exists a unique cointegrating vector in the model. As regards the behaviours of the

variables in the model, all the variables are significant at various levels of significant and correctly signed. Also, the long-run gross domestic product elasticity is relatively high but not that much close to one. The lower than unitary income elasticity suggest that money demand has been rising at a rate lower than the changes in total transactions in the economy.

The coefficient of inflation rate was expected either negative or positive if it turned out to be negative and this means that when inflation decreases agents reduce their money holding with expectation that their planned nominal expenditure will move down therefore this confirms our assertion that coefficient of inflation is mere an empirical issue. The INF variable is also statistically significant, hence it plays a major role in the demand for money. The negative and statistically insignificant of exchange rate variable (ER) results show that in the case of depreciation, peoples expectation will be high or rise so that the domestic currency would rebound and this makes people hold more domestic money. the other opportunity cost variables shown in the results behave and do not behave in the manner suggested by theory. The coefficient of the savings deposit rate is negative, and foreign interest rate is equally negative which implies they behave in the manner suggested by economic theory however, the coefficient of Treasury bill rate is positive which contradicts economic theory. It worth nothing that these variables are statistically significant in the long-run hence play vital role in the long-run demand for real money.

### Error Correction Presentation

This is the last stage in the cointegration process and it involves estimating our previous equations. However this time with error correction factor as a dependent variable. This involves regressing the first difference of each variable in the cointegration equation onto lagged values of the first differences of all of the variables plus the lagged value of the error-correction term. All the variables are lagged equally in 4 lags.

**Table 4.4 Unrestricted ECM Result**

Included observations: 151 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.100606	0.054544	1.844490	0.0678
D(LM2(-1))	-0.326577	0.141803	-2.303038	0.0232
D(LM2(-2))	-0.276022	0.137954	-2.000831	0.0479
D(LM2(-3))	-0.166679	0.123644	-1.348061	0.1804
D(LM2(-4))	-0.049049	0.111109	-0.441453	0.6598
D(INF)	0.001526	0.023857	0.063945	0.9491
D(INF(-1))	-0.006224	0.022234	-0.279955	0.7800
D(INF(-2))	-0.023357	0.022469	-1.039542	0.3008
D(INF(-3))	-0.012233	0.022754	-0.537624	0.5919
D(INF(-4))	-0.004045	0.023436	-0.172592	0.8633
D(RF)	0.096691	0.077861	1.241837	0.2169
D(RF(-1))	-0.098512	0.083324	-1.182279	0.2396
D(RF(-2))	0.080267	0.083970	0.955905	0.3412
D(RF(-3))	-0.181032	0.084725	-2.136702	0.0348
D(RF(-4))	0.086908	0.083858	1.036371	0.3023
D(TDR)	-0.038067	0.080540	-0.472651	0.6374
D(TDR(-1))	0.027828	0.095358	0.291823	0.7710

D(TDR(-2))	0.019555	0.093003	0.210257	0.8339
D(TDR(-3))	0.052041	0.081166	0.641165	0.5227
D(TDR(-4))	0.027881	0.067827	0.411054	0.6818
D(SDR)	0.028981	0.089714	0.323041	0.7473
D(SDR(-1))	-0.100532	0.121326	-0.828608	0.4091
D(SDR(-2))	-0.057497	0.120119	-0.478669	0.6331
D(SDR(-3))	-0.091030	0.107132	-0.849695	0.3973
D(SDR(-4))	-0.079292	0.096228	-0.823997	0.4117
D(LRGDP)	-0.103509	0.308124	-0.335933	0.7376
D(LRGDP(-1))	-0.243928	0.308994	-0.789427	0.4316
D(LRGDP(-2))	-0.133637	0.311837	-0.428548	0.6691
D(LRGDP(-3))	0.158343	0.302468	0.523503	0.6017
D(LRGDP(-4))	0.194521	0.280310	0.693950	0.4892
D(ER)	-0.038699	0.065579	-0.590110	0.5563
D(ER(-1))	-0.001713	0.049150	-0.034850	0.9723
D(ER(-2))	0.011727	0.055973	0.209513	0.8344
D(ER(-3))	0.035102	0.057134	0.614383	0.5402
D(ER(-4))	0.024162	0.066973	0.360767	0.7190
D(DUMMY)	0.361493	0.494335	0.731271	0.4662
D(DUMMY(-1))	0.085382	0.465045	0.183599	0.8547
D(DUMMY(-2))	0.028629	0.463849	0.061720	0.9509
D(DUMMY(-3))	-0.019071	0.462308	-0.041252	0.9672
D(DUMMY(-4))	0.184779	0.468781	0.394169	0.6942
ECM(-1)	-0.538027	0.148339	-3.627008	0.0004

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R-squared	0.481777	Mean dependent var	0.046853
Adjusted R-squared	0.293332	S.D. dependent var	0.539578
S.E. of regression	0.453588	Akaike info criterion	1.482992
Sum squared resid	22.63163	Schwarz criterion	2.302254
Log likelihood	-70.96591	F-statistic	2.556596

### The Unrestricted Model

All variables are as defined previously. The ECM result for broad money is presented in table 4.4. This shows that that  $\Delta RF$  and  $RESEM_{t-1}$  are significant, whereas all other variables are insignificant. This shows that short-run real broad money demand is affected by its first lag and the second lag of the foreign interest rate. The ECM which is the error correcting term in the model, indicates the speed of adjustment from short-run equilibrium to the long-run equilibrium state. The greater the co-efficient of the parameter (the higher the speed of adjustment of the model). From the short-run to the long-run in the model, one would notice that the ECM (EC above) is statistically at 5 percent. This shows that there is dynamic adjustment from short-run to long-run. The coefficient of the ECM is 0.54, this indicates that 54 percent of the errors in the short-run are corrected in the long-run. The negative and significant error correction term is of particular importance as it validates the significant of the co-integration relationship.

From statistical point of view, the unrestricted model performed reasonably well in that Durbin-Watson (DW) statistic indicates the absence of auto correlation since 1.97945. We equally observed that about 47 percent of the short-run variation in the real balance is explained by the included fundamentals.

**Table 4.5 Parsimonious model**

Included observations: 151 after adjusting endpoints

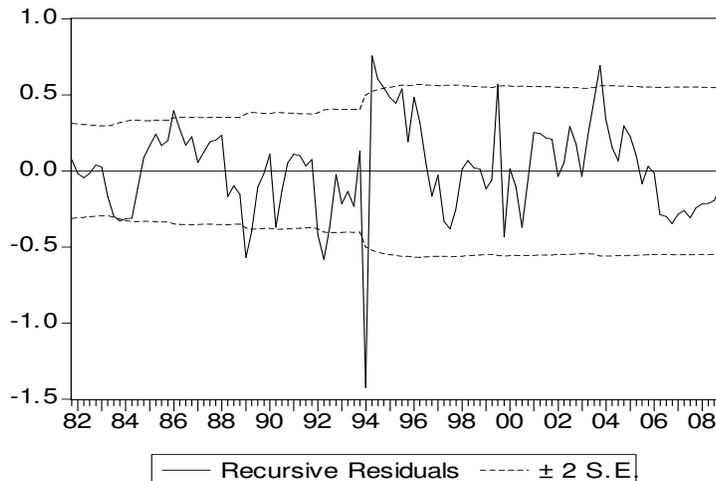
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.073810	0.039211	1.882361	0.0620
D(LM2(-1))	-0.277323	0.103114	-2.689492	0.0081
D(LM2(-2))	-0.151311	0.085867	-1.762152	0.0803
D(INF(-2))	-0.018454	0.020189	-0.914078	0.3623
D(INF(-3))	-0.013724	0.019938	-0.688363	0.4924
D(RF)	0.070480	0.066678	1.057033	0.2924
D(RF(-3))	-0.113920	0.067912	-1.677460	0.0958
D(TDR)	-0.011505	0.032700	-0.351831	0.7255
D(TDR(-3))	0.011384	0.051964	0.219082	0.8269
D(SDR(-1))	-0.072253	0.046268	-1.561633	0.1208
D(SDR(-3))	-0.051270	0.069409	-0.738662	0.4614
D(LRGDP(-1))	-0.256248	0.251928	-1.017147	0.3109
D(LRGDP(-4))	0.227988	0.226264	1.007619	0.3155
D(ER)	0.005759	0.039978	0.144050	0.8857
D(ER(-3))	0.023407	0.042310	0.553218	0.5810
D(DUMMY)	0.082265	0.434941	0.189142	0.8503
D(DUMMY(-4))	0.148019	0.430283	0.344003	0.7314
ECM(-1)	-0.567247	0.109095	-5.199549	0.0000
R-squared	0.441377	Mean dependent var		0.046853
Adjusted R-squared	0.369974	S.D. dependent var		0.539578
S.E. of regression	0.428285	Akaike info criterion		1.253426
Sum squared resid	24.39598	Schwarz criterion		1.613102
Log likelihood	-76.63369	F-statistic		6.181489
Durbin-Watson stat	2.057968	Prob(F-statistic)		0.000000

### The Parsimonious Model

The unrestricted model equation is reduced to a parsimonious one by one following the general to specific principles. This parsimonious model is attained by the sequential removal of those variable exerting no influence in the model. After removing all variables found insignificant in unrestricted model, the  $\Delta LM2_{t-1}$ ,  $\Delta LM2_{t-2}$ ,  $\Delta RF_{t-1}$ , and  $RESM2$  now significant

The results of this parsimonious model supplement those of the unrestricted model is that two more variables are found to be significant that appeared insignificant in the unrestricted model. The result from parsimonious model shows that the Durbin-Watson statistic value (2.058550). Since it is above 2, we conclude that the model does not suffer serial correlation. Also, the speed of adjustment to short-run equilibrium is about 57 percent. The 36 percent of the variation in the money stock is explained by the included fundamentals.

**Figure 4.1: Structural Stability Test (Recursive Stability Test Approach For the Combinations of all the series in the Model)**



In order to test whether a structural break occurred, we estimated recursive model based on the parsimonious model. The recursive parameter estimates obtained are plotted against time to get a graphical representation. The visual inspection of the graphical representation of recursive model estimates enables us to trace the time path of each parameter, thus showing when structural break occurred in each variable included in the model. If the coefficient plots show dramatic jumps, it is a sign of the potential structural break.

The recursive estimations reported in figure 4.1 shows a generally stable money demand function with only a break or parametric instability in the years 1986 to 1999. This is the period when government and the central bank of Nigeria introduced several policies (SAP) and policies by the central bank to liberalize the financial system in Nigeria to be more market oriented.

As shown in figure 4.1, the structural break is evident in all parameters. However, from 1999 onwards all the graphical representation show virtually constant parameters and this is a strong indication of the stability of the model.

## 5. SUMMARY AND CONCLUSION

The economic findings presented in this study demonstrated that commodity price do not directly affect output, consumer price index and exchange rate in Nigeria over the period covered.

However, the findings showed that the fluctuation in the price of commodities affect the real exchange rates in Nigeria. Also, it found out that it is not, the price itself but rather it's manifestation in real exchange rate and money supply in precious years value that affect the fluctuation of aggregate economic activity proxy of money demand (md) in the current year value.

The monetary authority have been encouraging adverse economic in balance through its various policies. This has resulted in economic fluctuation and hardship among the people through contractionary adjustments. This research has showed that commodity prices are high influenced by monetary aggregates in Nigeria.

Based on the findings, the following recommendations are made;

The monetary authorities should adopt a monetary policy that maintains a stable exchange rate to encourage foreign investors in the country. The central bank of Nigeria should maintain a monetary policy that will reduce interest rate to attract investment in the country to facilitate an increase in production of locally made foods, especially in the manufacturing sub-sector, there by increasing output and employment, redirecting the economy towards growth and development. The monetary authorities should reduce money supply by controlling base money, that is, the central bank of Nigeria should sell financial securities to banks and non-bank public so as to reduces the ability of deposit money banks to create new money. Also, this can be achieved by raising the cash reserve deposit that banks are required to hold with the central bank. The larger the deposit balances on the bank balance sheet, the high their stability to create more money. The central bank therefore, should target the growth in those deposit balance in order to control the expansion in money supply which could precipitate commodity price distorts.

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