

# MACROECONOMIC STABILIZATION AND MONETARY POLICY NEXUS IN NIGERIA

E. B. UDAH

(Received 25, April 2007; Revision Accepted 3, July 2007)

## ABSTRACT

This paper develops the Central Bank reaction function and investigates the extent to which the Central Bank of Nigeria in recent years has been successful in addressing adverse changes in prices and the naira exchange rate. The result indicates that the CBN was successful in controlling inflation and depreciation of the naira in foreign exchange market. However, there was a large lag in the responsiveness of the monetary authorities to adverse changes in the economic environment. The study recommends among others that the current autonomy status granted the CBN should be strengthened and sustained.

## INTRODUCTION

Adverse changes in key macroeconomic aggregates (inflation, balance of payments, GDP, exchange rate and unemployment) have been a source of worry to policy-makers especially the Central Bank of Nigeria. This is because of the possible effects instability of these aggregates will have on the overall business cycle. This is also why different regimes of monetary policy have been put in place to address this instability. It is argued that monetary policy is one of the most potent tools for transforming depressed economies from recession to recovery in recent times. Changes in money supply can have immediate impact on output, balance of payments, exchange rate, and employment. Given the importance of stability in these macroeconomic aggregates, it is useful to investigate whether or not monetary policy is capable of ameliorating adverse changes in these aggregates.

This paper attempts to contribute to the evaluation of Central Bank performance in Nigeria. In specific terms the paper applies the quadratic social preference function on the Central Bank of Nigeria and test three hypotheses. (i) The Central Bank of Nigeria is successful in maintaining price stability; (ii) The CBN is effective in exchange rate management and (iii) The lag response of CBN to adverse changes in macroeconomic aggregates are strong. A measure of Central Bank performance is its ability to adopt a particular monetary policy and use it effectively to regulate macroeconomic aggregates to the desired level. To the best of our knowledge previous attempts to measure central bank performance using the reaction function did not focus on Nigeria (Nyong 1995; Havrilesky 1967; Wood 1967; Friedlaender 1973; Froyen 1974; Barro 1980; Mc Millin 1981).

Following the above introduction, the rest of the paper is organized into five sections. Section two examines the conduct of monetary policy in Nigeria, section three discourses the transmission mechanism of monetary policy in Nigeria. In section four, we present the model and analytical framework. Section five presents the results and some discussions, and the paper concludes in section six with relevant remarks.

### 11.0 Monetary Policy in Nigeria

The central thesis of monetary policy is to influence the availability, cost and direction of credit in order to pursue specific economic goals. Monetary policy is not only a part of overall economic policy that regulates the level and growth of money stock and credit in the economy; it is also part of an adjustment policy to stimulate sustainable growth and development. In other words, monetary policy is a major economic stabilization tool, which involves measures taken to regulate and control the volume, cost, availability and direction of money and credit in an economy to achieve some specified macroeconomic objectives and to counter all undesirable trends in the economy (Okowa, 1995; Gbosi, 1998 and

Anyanwu, 1993). These undesirable trends include sluggish economic growth, inflationary pressures, unemployment and instability in the external sector

In Nigeria as in other developing countries, the objectives of monetary policy include attainment of domestic price stability, full employment, adequate economic growth and external sector stability. Since independence monetary policy has undergone profound changes. Before the advent of the Structural Adjustment Programme (SAP), which started in 1986, monetary management depended mainly on the direct instruments such as credit ceilings, selective credit, exchange rate, interest rate; cash reserve requirements and specific deposit. During this period, market based instruments were not widely used. The reasons for this were because of the narrowness and under developed nature of the Nigerian financial markets and the inadequate supply of debt instruments and the deliberate restraint on interest rates (Gbosi, 1998).

By the end of 1975, the inflation rate which stood at 33.9 per cent had become the most serious macroeconomic problem that faced the nation. The disruption of productive activities as a result of the civil war as well as the unrealistic wage increases awarded by Adebo and Udoji commissions of 1971 and 1974 respectively contributed to the observed inflationary pressures. To address this problem the monetary authorities encouraged the commercial banks to direct a greater percentage of their credit to the productive sectors. This reduced the liquidity of the commercial banks through the issuance of stabilization securities. These instruments could be repurchased or sold by the CBN from any banking institution (CBN, 1975).

Under SAP monetary policy objectives include the stimulation of output and employment as well as the promotion of both domestic and external stability (CBN, 1993). The excess liquidity experienced in the 1990s makes the achievement of these objectives increasingly difficult. To address this problem, the CBN adopted several monetary measures. These measures include reduction in credit growth by banks, special deposit requirements against outstanding external payment areas, abolition of foreign exchange guarantees cum currency deposits as naira collaterals for naira loans and the withdrawal of public sector deposit from banks (CBN, 1988).

In 1988 there was major policy shifts from the regime of direct credit control to a system of indirect credit control. This was necessary because of the continued problem of inflation and disequilibrium in the balance of payments. The major objective of this shift in policy direction was to strengthen the effectiveness of monetary policy and the overall efficiency of the financial markets. Thus, in September 1992, in pursuit of the new monetary framework, the ceiling imposed on the individual bank's credit was removed (Odozi, 1992). The main instrument of monetary control was open market

operation (OMO). As argued by Ojo (1993), OMO involves the CBN discretionary power to purchase or sell securities in the financial market in order to influence the volume of credit and subsequently interest rate that consequently affect money supply. Specifically the stance of monetary policy was restrictive in nature. This was designed to ensure stability in key macroeconomic variables to prevent deviations from prescribed targets. To this end, the objectives of credit and credit policies in 1993 were: to reduce inflationary pressures in the economy; to eliminate pressures on the balance of payments in order to boost external reserves and stabilize the exchange rate of the domestic currency; and support the government efforts in solving the problem of low productivity and decreased capacity utilization and output (CBN, 1988).

The post SAP monetary policy was aimed at drastic reduction in the rate of inflation; stabilize the naira exchange rate; and reduction of pressure on the BOP. To realize this, the post SAP monetary policy since 1994 centered on a high growth rate of GDP, single digit inflation and accumulation of external reserves (CBN, 1993, p.12-15).

### 111. How Does Monetary Policy Affect Economic Activity

There are various theoretical arguments about the transmission mechanism of monetary policy. We shall examine four theoretical arguments within the context of the classical theory, the Keynesian theory, the monetarist theory and the neo-Keynesian theory.

In the classical transmission mechanism, a change in the money supply does not affect real variables such as output, employment and income. The classical economists assume that money is neutral in its effect on the economy. They based their analysis on a direct and mechanical relationship between money and prices. The analysis of the relationship between money and prices is, based on the quantity theory of money.

In the classical theory, money plays a crucial role, which implies that changes in money supply cause changes in absolute price level, and in nominal income. To make this clear the classicist specified two channels through which monetary changes are transmitted to the real sector of the economy. These are the direct mechanism and the indirect mechanism. The direct mechanism assumes long run equilibrium between the demand for and the supply of money. The argument is straight-forward. Suppose the monetary authorities increase money supply. This leads to the increase in supply of actual money balances of the public, and exceeds the demand for them, since the actual money holdings of agent, is greater than the desired relative to their expenditure and wealth, there exists the tendency for them to exceed their money holdings by buying consumer goods and financial assets. This action will increase the demand for goods and services and in turn, the price level will rise. The increase in the general price level leads to a reduction in supply of real cash balances. This will continue until equilibrium is restored in the money market.

The indirect mechanism operates through money rate of interest and involves the banking system. Assuming the monetary authorities make open market purchase of government securities, which increase the reserves of banks, with excess reserves, the banks can create more money. This lowers the money rate of interest. This reduction in interest rate creates a disparity between the actual and desired stock of real capital. Investors and entrepreneurs will take advantage of this reduction in interest rate to invest more in capital goods. This increase in investment raises the aggregate demand for money, which is financed by the banking sector by creating more credit money.

In the Keynesian transmission mechanism, changes in money supply affect aggregate expenditure, output, employment and income indirectly via changes in interest rate. The argument is simple. If income level remains unchanged, the increase in money supply causes agents to spend their excess holdings of money on bonds. This implies an increase in the demand for bonds and a rise in their prices. A rise in the

prices of bonds brings down the money interest rate. This, in turn, increases the speculative demand for money. This is the liquidity trap effect, and constitutes the first stage in the Keynesian transmission mechanism. In the second stage, this fall in interest rate and the implied increase in the speculative demand for money stimulate investment. Economic agents would rather invest in capital goods than hold money in cash for speculative purposes. In the third stage however, the increase in investment raises the level of income and employment through the multiplier. The increased output and employment generates additional savings equal to the increase in investment and equilibrium is restored in the commodity market. Nevertheless, the rise in real income brings diminishing returns to labour, causing per unit labour cost and the price level to rise.

The monetarists argue that the transmission mechanism by which changes in money supply causes changes in aggregate demand, prices, interest and other macroeconomic aggregates is essentially a portfolio adjustment process. The monetarists assert that money being one of the assets in which wealth can be held is generally substituted for other assets. If equilibrium position is disturbed by a change in the stock of one of the assets, then portfolio adjustment will occur, which changes assets price and their rate of return. This in turn affects the level of and composition of aggregate demand. For instance, if government increases the stock of money supply, say, by open market purchase of securities, it sets off a series of portfolio adjustment. As the increase in money supply lowers the yield (Marginal rate of return) on money, assets holders switch to other assets offering higher yield.

According to the Monetarist, the next step in the transmission process is the attempt of holders of money to restore or retain a desired balance in their portfolios after an unexpected increase in the money supply. This increase in money supply will affect interest rate in three distinct ways. First, is the liquidity effect, which causes a short run reduction in the cost of capital. The short run reduction in interest rate causes portfolio holders to sell of their securities, and this results in an increase in their holdings of money, and hence a rise in liquid money with them. Second, they will spend their excess money holdings on financial and non financial assets. This increase in aggregate expenditure on assets, goods and services will tend to cause output, employment and income to rise. This is the output effect. This will lead to a rise in prices, because of the rise in output and demand for money resulting from the liquidity effect. Finally, there is the price expectations effect, which occurs because of expectations of lenders that inflation, will continue. This causes them to demand for higher rate of interest as a premium in the expected inflation rate. It follows from the foregone that the short run liquidity effect brings a reduction in interest rates and both the output and price expectation effects increase the interest rates. This increase in interest rate, will, in turn, discourage investment and hence a reduction in output and employment.

The neo Keynesians discuss monetary transmission mechanism through the portfolio adjustment process. They identify three channels of monetary transmission mechanism- the wealth effect, substitution effect and the credit availability effect.

Whereas in the Keynesian analyses, there is no direct wealth when the Central Bank engages in open market purchase of bonds or securities, in the neo Keynesian analysis, changes in the money supply affect the economy via wealth effect channels. The wealth effect occurs because the increase in money supply lowers the relative returns of money, which leads to a generalized increase in demand for other assets whose price rises in responds to demand. The increase in price leads to a capital gain by those who held those assets. Capital gains stimulate consumption, and through the multiplier, it affects investment, output and employment.

The substitution effect includes not only government bonds but also individual bonds, equities, savings, mortgages, among others. Given this type of portfolio, assuming the

Central Bank engages in open market purchase of securities, this increases the prices of securities, thereby reducing the yield on them. Investors soon realize that they hold more money than desired, and this causes them to readjust the structure of their portfolio to reduce their money holdings. Now, assuming they substitute bonds for their excess money balances. This increases the demand for bonds, thereby leading to an increase in their market price and a reduction in their current yield, as interest rate falls. As a consequent, the demand for the assets such as equities, consumer durables etc. increases. Moreover, when agents with excess money balances purchase equities, their prices rise and the value of capital of such firms rises above the supply price of such new capital. With more capital, the firms are induced to increase their demand for more capital equipment. This raises output in the capital goods industries. This, will, in turn, spread to other sectors of the economy via the multiplier.

The credit availability argument shows the effect a fall in interest would have on banks and other financial institutions. The supply of bank credit depends on the prevailing market rate of interest and on non-price credit rationing. The non-price credit rationing is essentially due to the absence of a market clearing interest rate, and therefore banks issue loans to investors based on their status, credit worthiness and wealth. So that when the Central Bank increases money supply, say, through the purchase of government securities, the increased money supply leads to a fall in interest rate. The reserves of banks will increase and they will reduce credit rationing and make more credit available to their customers. However, with a fall in interest rate banks will adjust their portfolio of assets holding and sell off some of their securities. This result in capital gain, and this additional funds are use to advance more loans. If the interest rate charged on bank loans is very low relative to interest rate earned by banks on other assets in their portfolios, the banks may continue with credit rationing (Taylor, 1995; Ojo, 1999; Nyong, 2001)

**IV.0 MODEL SPECIFICATION**

The model specification is based on the maximization of quadratic social preference function similar to those used by Nyong (1995). The Central Bank is assumed to face a constrained utility problem. That is, the CBN attempts to maximize a quadratic social utility function or preference function subject to its perception of what the structure of the economy is (Nyong 1995; Havrilesky 1967; Wood 1967; Friedlaender 1973; Froyen 1974; Barro 1980; Mc Millin 1981; Abrams, Richard K. et al 1980). If policy instruments are truly under the control of monetary authorities, then reaction function coefficient will show how policy responded to movement in the target variables. The loss function is given by:

$$Mst = a_1 (y_t - y_t^*) + a_2 (p_t - p_t^*) + a_3 (BoP_t - BoP_t^*) + a_4 (unp_t - unp_t^*) + a_5 (i_t - i_t^*) \dots \dots \dots (1)$$

- Where Mst = money supply (M<sub>1</sub> and M<sub>2</sub>)
- Y<sub>t</sub> = domestic output or gross domestic product
- P<sub>t</sub> = general price level (CPI)
- BoP<sub>t</sub> = the balance of payments
- UNP<sub>t</sub> = unemployment level
- i<sub>t</sub> = domestic interest rate.
- Y<sub>t</sub><sup>\*</sup> = the desired levels of output
- P<sub>t</sub><sup>\*</sup> = the desired price level
- BoP<sub>t</sub><sup>\*</sup> = desired balance of payments positions
- UNP<sub>t</sub><sup>\*</sup> = desired unemployment level
- i<sub>t</sub><sup>\*</sup> = the desired domestic interest rate.

The above equation contains as an argument the weighted squared deviations of actual from desired, indicated by the \*. The first four arguments (income or productivity, price

level, balance of payments, unemployment) are measures of macro-economic stabilization goals. However, the last argument expresses the monetary authorities concern for financial market stability.

Moreover, reaction functions are the output of a constrained maximization, where the constraints are the reduced - form equations that characterize the economy. Therefore, equation one is minimized, subject to the structure of the Nigerian economy.

The Nigerian economy is monolithic and structured into the real sector, service sector or monetary sector and the price sector.

**IV.1 The Real Sector:**

$$GNP = C_t + I_t + G_t + X_t - M_t \dots \dots \dots (2)$$

Exports are exogenously determined while imports are influenced by income and external reserves. The price and quantity of Nigeria's major exports, crude petroleum is controlled by the Organization of Petroleum Exporting Countries (OPEC).

$$C_t = a_0 + a_1 y_t + a_2 z_t + a_3 c_{t-1} + U_t \dots \dots \dots (3)$$

The following are assumptions as to sign of coefficient.

$$a_1, a_2, a_3 > 0$$

According to the Keynesian economists the level of consumer expenditure is a stable function of disposable income (yd). Therefore, consumption is positively related to disposable income, wealth and the previous levels of consumption. This explains why the coefficient a<sub>1</sub>, a<sub>2</sub>, and a<sub>3</sub> are positive.

$$I_t = b_0 + b_1 y_t + b_2 c_t + b_3 i_t + b_4 i_{t-1} + U_t \dots \dots \dots (4)$$

The following are assumptions to coefficient b<sub>1</sub>, c<sub>t</sub> and i<sub>t-1</sub> > 0, i<sub>t</sub> < 0.

From the Keynesian's theory, investment is a function of income, consumption, interest rate and previous levels of investment. Thus, a positive relationship exists between investment, income, present level of consumption and the previous level of investment, and inversely related to interest rate.

**IV.2 The Price Sector:**

$$P_t = C_0 + C_1 W_t + C_2 y_t + C_3 Mst + C_4 Pm_t + C_5 EX\Delta R_t + C_6 P_{t-1} + U_t \dots \dots \dots (5)$$

The following are assumptions to coefficient C<sub>1</sub>, C<sub>3</sub>, C<sub>4</sub>, C<sub>5</sub>, C<sub>6</sub> > 0 C<sub>2</sub> < 0

From the structuralist, monetarist and Keynesian explanation for inflation, we can infer that an increase in wage rate, Money supply, import prices as well as exchange rate is inflationary. This explains the positive sign attached to their coefficients. However, an increase in productivity will be successful in bringing down prices and hence the negative relationship between prices and productivity.

But the wage rate is influenced by past values of the price level, changes in disposable income (yd), the unemployment rate (U<sub>t</sub>), and the past levels of the wage rate shown thus:

$$W_t = w(p_t, y_d, u_t, W_{t-1}) \dots \dots \dots (6)$$

**IV.3 Monetary Sector:**

$$M_{2t} = \alpha_0 + \alpha_1 y_t + \alpha_2 p_t + \alpha_3 i_t + \alpha_4 M_{2t-1} + U_t \dots \dots \dots (7)$$

The following are assumptions as to sign of coefficients α<sub>1</sub>, α<sub>4</sub> > 0, α<sub>2</sub>, α<sub>3</sub> < 0

From Monetarists and Keynesians theory of demand for money, the demand for nominal cash balances is positively related to income and the previous levels of demand for nominal cash balances and negatively related to the price levels and interest rate.

That is, the demand for nominal cash balances increases as income increases. As disposable income increases, households desire to hold more nominal cash balance for transaction, precautionary and speculative motives. However, according to the monetarists, changes in

prices affect the purchasing power of money. When prices rise, the Naira buys less; when prices fall, it buys more. Thus, rising price level causes money holdings to decline in value. This explains the negative sign attached to the price coefficient. Furthermore, the Keynesians believe that a rise in interest rate will lead to a decline in household's demand for nominal cash balances because the opportunity cost of holding money will be high.

The money supply equation is of the form  $M_{st} = \beta_0 + \beta_1 C_t + \beta_2 r_t + \beta_3 d_t + \beta_4 q_t + \beta_5 r_d + \beta_6 r_t + \beta_7 R + U_t \dots (8)$

The following are assumptions as to sign of coefficient.

$\beta_1, \beta_2, \beta_3$  and  $\beta_4 > 0$   $\beta_5, \beta_6$  and  $\beta_7 < 0$

- Where  $M_{st}$  = Money supply
- $C_t$  = currency as demanded by non bank public
- $r_t$  = market rate of interest
- $d_t$  = the discount rate
- $q_t$  = time deposit rate
- $r_d$  = reserve requirement on demand deposit
- $r_t$  = reserve requirement on time deposit
- $R$  = quantity of total reserves supplied by central bank.

Therefore, we say that money supply is determined jointly by the behaviour of non bank public, central bank authority and the commercial banking system.

For the money market to clear, the demand for real cash balances ( $M_{2t}$ ) must be equal to the money supply ( $M_{st}$ ).

Therefore at equilibrium  $M_{2t} = M_{st} \dots (9)$

- Where GNP = Gross National Product
- $C_t$  = Consumption Expenditure
- $I_t$  = Total Investment Expenditure
- $G_t$  = Government Expenditure
- $X_t$  = Total Exports
- $M_t$  = Total Imports
- $Y_d$  = Disposable Income
- $Z_t$  = Nominal Wealth
- $P_t$  = Price Level
- $W_t$  = Nominal Wage Rate
- $Pm_t$  = Price of Imports
- $M_{st}$  = Total Money Supply ( $M_2$ )
- $EX\Delta R_t$  = Exchange Rate (nominal) in terms of US dollars
- $U_t$  = Unemployment Rate
- $I_t$  = Interest Rate
- $M_{2t}$  = Nominal money demand.
- $Y_t$  = Full employment output

Thus, the minimisation of the static quadratic loss or preference function (equation one) subject to the constraints imposed by the structure of the economy as seen in equations 2 to 9, leads to the specification of monetary policy reaction function that relates money supply ( $M_{st}$ ) as the dependent variable to the lagged exogenous and endogenous variables of the model which include fiscal policy variable and to the argument of loss function, (Nyong 1995; Anyanwu 1993; Wood 1967; Havrilesky 1967; Friedlaender 1973; Richard K. Abrams

et al 1980; Froyen 1974; Barro 1977; Potts and Luckett 1978; McMillian and Beard 1980).

Consequently, the monetary policy reaction function to be estimated is a reduced form equation and is presented thus:

$$M_{st} = \alpha_0 + \alpha_1 Gov_t + \alpha_2 Y_t + \alpha_3 Bop_t + \alpha_4 P_t + \alpha_5 EX\Delta R_t + \alpha_6 M_{st-1} + U_t \dots (10)$$

where  $U_t$  is the stochastic error term.

The following are assumptions as to sign of coefficient:

$\alpha_1, \alpha_2, \alpha_6 \geq 0$  and  $\alpha_3, \alpha_4, \alpha_5 \leq 0$

The sign attached to the coefficients of these variables reflects these utility weights and a proxy to measuring Central Bank's performance.

**V.0 Analytical Framework**

In this paper we explore the cointegration theory/ error correction mechanism. Given data instability in Nigeria occasioned by policy instability, political cum economic disruptions etc, it becomes increasingly useful to test the time series property of the variables for meaningful economic results. It is clear that OLS regression estimates with non stationary time series data often produce unacceptable results, even though the overall results may indicate a high degree of fit (as measured by coefficient of multiple correlation,  $R^2$  or adjusted coefficient of  $R^2$ , high auto correlated residuals and low standard significance as measured by the usual t-statistics (Gurujarati, 1995). Moreover, many economic variables have a strong tendency to trend over time, such that the levels of these variables can be characterize as non stationary, since they do not have a constant mean over time. Yet many analyses of unadjusted non stationary series have been carried out on the assumption that non-stationary series do not matter. Difficulties may arise while performing regression with clearly non stationary series, thus leading to the so called 'spurious' regression (Granger and Newbold, 1974). Given two completely unrelated but integrated series, regression of one on the other will tend to produce an apparently significant relationship when, in fact, they are not related.

This study therefore, adopts the cointegration/ error correction methodology to estimate equation 10. This selection is based on the premise that if the variables are non stationary, the desirable properties of consistency, efficiency, and unbiasedness will be lost if Ordinary Least Squares (OLS) technique is used to estimate the equation, which could lead to spurious results and inference, hence, inaccurate predictions. Cointegration and error correction is used because it adds richness, flexibility and versatility to the econometric modeling and integrates short-run dynamics with long equilibrium. Hence accurate predictions can be more confidently made on the economic relationship between the variables.

**V.2 EMPIRICAL RESULTS AND DISCUSSION**

**V.2.1 Result from Stationarity Test (Unit Root Test)**

Before estimating the model, we first examine the characteristics of the data used. The essence of the unit test root is to determine whether the data is stationary and the order of integration. In this respect the study utilizes the ADF and PP tests. The results of the unit root test are presented in table 1

**Table 1.0 Augmented Dickey Fuller Test Philip Peron Test**

Variables	Levels	1 <sup>st</sup> difference	2 <sup>nd</sup> diff	Lag length	Order of integration	Levels	1 <sup>st</sup> diff	Order Of integration
Ms	2.378211	-2.934496**		2	I(1)	1.467884	-2.94631**	I(1)
Gexp	5.26930*			2	I(0)	3.860645		I(0)
GDP	-0.750778		9.147459*	2	I(1)	-0.978103	-5.63712*	I(0)
Exchr	1.160058	-6.097316*		2	I(1)	1.450564	-6.08888*	I(1)
Pt	1.780374		-7.013876*	2	I(2)	5.43837*		I(0)

Critical values for ADF at

1% = -3.653730

5% = -2.957110

10% = -2.617434

\*\* indicate significance at 10%

\* indicate significance at 1%,5%,10%

Critical values for PP at

1% = -3.639407

5% = -2.951125

10% = -2.614300

The result of the unit root test indicates that the variables attend stationarity at different levels. Based on the ADF test money supply attends stationary at first difference.

Whereas government expenditure and balance of payments are stationary in their levels, exchange rate and the consumer price index are stationary in the first difference.

**Table 2.0 Result from Cointegration Test**

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesis No. of CE(s)
0.978361	372.1584	94.15	103.18	None**
0.958499	245.6607	68.52	76.07	At most 1**
0.895335	140.6532	47.21	54.46	At most 2**
0.762012	66.17258	29.68	35.65	At most 3**
0.370881	18.79988	15.41	20.04	At most 4*
0.100808	3.506534	3.76	6.65	At most 5

Table 2.0 shows the eigenvalues, trace test for the significant eigen vectors. The result indicates that we have four significant vectors. This suggests the presence of cointegration in time series variables implying that normalized cointegration coefficient gives the long run relationship in the variables.

**Solved Long Run Static Solution**

$$Ms = 7.384 - 0.286 + 0.675LExchr - 0.653LGDP + 1.070BOP + 0.722LGexp$$

This result agrees with the long run solution of our model from static regression.

The presence of cointegration makes it possible to estimate error correction mechanism (ECM), which is a solution to the problem of spurious result associated with estimating equations involving time series variables, and to capture dynamic adjustment to the long run (Patterson, 1990).

Adopting the general to specific framework, we proceeded to estimate over-parametised error correction model of money supply from where a parsimonious (preferred) error correction model would be obtained. The novelty of ECM is that it provides a framework for establishing the links between the long run and short run approaches to economic modeling. Thus with ECM no information associated with the variable first differencing is lost because the modeling technique incorporates both the short run dynamics and long run information through error correction term. The over-parametised error correction model of money supply is presented in table 3.0. The equation include ECM term lagged one period, representing the past value of the error correction factor whose coefficient should be negative and statistically significant to support the existence of cointegration.

**Table 3.0: The Over-Parameterized Error Correction Model of Money Supply in Nigeria.**

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	-5501.434	24210.64	-0.227232	0.8223
D(GEXP)	-0.478358	0.455641	-1.049859	0.3047
GEXP	1.206921	0.500951	2.409258	0.0244
D(GDP)-2	1.950822	2.987236	0.653052	0.5202
D(BOP)-1	-0.318781	0.521133	-0.611708	0.5467
BOP	0.386451	0.487900	0.792070	0.4364
D(EXCHR)-1	-8631.156	4819.613	-1.790840	0.0865
EXCHR	12659.46	6823.432	1.855292	0.0764
D(PT)-2	607.4759	245.8255	2.471168	0.0213
PT	-569.2947	239.1781	-2.380212	0.0260
ECM(-1)	-172820.2	170041.2	-1.604436	0.1223

R<sup>2</sup>-Adjusted = 0.28, DW = 2.34

Based on the result in table 3.0, the over-parametised model was further estimated using the general to specific approach and the summary of the parsimonious (preferred) model is presented in table 4.0. We arrive at the parsimonious model in

table 3.0 by eliminating the jointly insignificant variables such as GDP and BOP. A careful examination of the parsimonious results show that the error correction term is well specified as it has the expected a priori sign and is statistically significant.



Table 4.0: Parsimonious Error Correction Results of Money supply in Nigeria

Variable	Coefficient	Std Error	t-statistic	Prob.
GEXP	0.747930	0.330351	2.262812	0.0319
D(EXCHR)	-6269.071	2915.704	-2.150105	0.0407
EXCHR	6409.099	3566.167	1.797195	0.0835
D(PT)-2	609.2853	230.8352	2.639482	0.0136
PT	-341.5496	124.9192	-2.734164	0.0109
ECM(-1)	-305499.7	150615.9	-2.028337	0.0525

$R^2$ -Adjusted = 0.31, DW = 2.06

Examination of the parsimonious model shows that the error correction term is statistically significant and has the correct a priori sign. The nature of the distribution of the error term indicates that it is stationary. This means that the combination of dependent and the explanatory variables is cointegrated. The existence of cointegration provides further validity of the regression results (Nyong, 1995; Engle and Granger, 1987; Domowitz and Elbadawi, 1987). A priori expectations about the signs of the parameters were met in all the variables and were also statistically significant at 5 and 10 per cent levels. There were no indications of serial correlation as shown by the value of DW.

The negative sign on the coefficient of the price variable is consistent with a priori expectation. This suggests that the monetary authority responded to adverse changes in the aggregate price level by reducing money supply, in line with the monetarist explanation of inflation. The exchange rate variable has the expected a priori sign and is statistically significant at 5 per cent levels. This indicates that monetary authorities reacted to depreciation in the domestic currency in the foreign exchange market by adopting restrictive credit expansion. The fiscal policy variable has the correct sign and is statistically significant. The findings suggest that expansionary fiscal policy was used to stimulate employment, along with tight monetary policy to address price instability.

#### VI.0 CONCLUSION

This paper develops a central reaction function and tries to investigate the extent CBN was able to carry out its core objective of price stability and exchange rate stability. The results show that the current autonomy granted the CBN is yielding result. This is because the Central Bank of Nigeria as shown by the result was successful in addressing adverse changes in prices and the naira exchange rate vis-a-vis other major currencies. Thus, this paper strongly advocates that the current autonomy granted the CBN should be sustained and even strengthened. This is because it is only an independent Central Bank that can pursue the objective of price stability at the cost of other objectives of importance to the political authorities.

#### REFERENCES

- Abrams, K. Richard, Froyen, Richard, Waud, Roger., 1980. Monetary Policy Reaction Function, Consistent Expectation and Burns Era. *Journal of Money, Credit and Banking*. Xiii, 30-41
- Adams, C., 1992. Recent Development in Econometrics Methods: An Application to the Demand for Money in Kenya. AERC Special paper 15.
- Anyanwu, J. C., 1993. Monetary Economics Theory, Policy and Institutions, Hybrid Publishers Ltd, Onitsha.
- Brro, Robert., 1978. Unanticipated Money Growth and Unemployment in the United States. *American Economic Review*. 4, 101-115.
- CBN- Central Bank of Nigeria, 1995. Monetary and Credit Policy for Fiscal Year 1995. CBN, Lagos.
- CBN, 1998. Annual Reports and Statement of Account, Lagos.
- CBN, 1993. Perspectives of Economic Policy Reforms in Nigeria. Research Department CBN, Lagos.
- Domowitz, I. and Elbadawi, I., 1987. 'An Error Correction Approach to Money Demand: the case of Sudan', *Journal of Economic Development*, 26, 257-275.
- Friedlaender, A. F., 1973. Macro-Policy Goals in Post War Period: A study in Revealed Preference. *Quarterly Journal of Economics*. 87, 25-43.
- Froyen, R. T., 1974. A test of Endogeneity of Monetary Policy. *Journal of Econometrics*. Vol.2 pp. 175-188.
- Granger, C W. J. and Newbold P., 1974. 'Spurious Regression in Econometrics'. *Journal of Econometrics*. 2, 111-20.
- Gujarati, N. Damodar, 1995. Basic Econometrics. McGraw-Hill, Inc.
- Havrilesky, T., 1967. A test of Monetary Policy Action. *Journal of Political Economy*. 299-304.
- McMillin, Douglas, 1981. A Dynamic Analysis of the Impact of Fiscal Policy on Money Supply. *Journal of Money, Credit and banking* 13, 221-226.
- Nyong, M. O., 1995. Economic Development and Monetary Policy in two Neighbouring African Countries: Gambia and Senegal. *Journal of Economic and Social Studies*. 37, 111-125.
- Nyong, M. O., 2001. Public Policy, Public Sector Economics and Management in Nigeria. A & A Communications Ltd, Calabar
- Ojo, M. O., 1993. A Review and Appraisal of Nigeria's Experience with Financial Sector Reforms. CBN, Lagos.
- Okowa, W. J., 1995. Macroeconomics for Universities. Pam Unique Publishing Co. Ltd, Port Harcourt, Nigeria.
- Odozi, V. A., 1992. 'Recent Monetary Policy Development and Measures to Attract Foreign Investment in Nigeria', CBN Bullion, Lagos.
- Patterson, K., 1990. An Introduction to Applied Econometrics. Palgrave Publishing, New York.
- Taylor, J. B., 1995. Economics. Houghton Mifflin Company, New Jersey.
- Wood, J., 1967. A Model of Federal Reserve Behaviour. In *Monetary Process and Policy*, G. Horwitch, ed. Richard Irwin, Homewood, Illinois. 135-66.