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**A Further Empirical Investigation to the
Concept of Money Demand in Nigeria:
A Case for Currency Substitution**

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Abstract

The paper investigated the empirical relationship between broad definition of money, real income, interest rates, expected inflation and expected exchange rate and examined the constancy of this relationship in the light of economic reforms that had taken place in Nigeria since 1987. The study confirms a long-run relationship between real balances, income, interest rates, and inflation. The significance of foreign interest rate and expected exchange rate indicates the presence of currency substitution.

1 INTRODUCTION

A lot of policy changes have taken place since Nigeria embarked on Structural Adjustment Programmes (SAP) in 1986. SAP was engendered as a result of the downturn in the international oil market which impacted negatively on foreign exchange revenue accruing to the Nigerian government in the early 1980s creating serious balance of payments problem. To correct for these defects, SAP was introduced with the aim of restructuring production and consumption patterns of the economy, through measures that include; elimination of price distortions and reduction of the over-dependence of the economy on the export of crude oil and imports of raw materials and consumer goods. The three primary policy instruments designed to achieve these objectives include: the adoption of a realistic exchange rate policy and the associated external trade and payments systems liberalization; price deregulation policies with greater emphasis on market forces; and rationalization and restructuring of public expenditure and customs tariffs.

Against the background of economic reforms, Nigerian monetary authorities have been focusing on monetary targeting in recent times with the aim of achieving price level stability, growth and stable exchange rate for the domestic currency. However, evidence has revealed persistent inflation and increasing devaluation of naira. Ineffectiveness of monetary policy could then result from instability in money demand function usually constrained by phenomenon like currency substitution. Currency substitution is usually engendered by instability in the system and in turn creates unstable money demand function (Mckinnon, 1982).

A lot of studies have been carried out on demand for money in Nigeria; starting with pioneering study conducted by Tomori (1972) with the ensuing discussion known as "TATOO" in literature, and other follow-up studies to demonstrate the determinants and stability of money. However, there is a need to revisit the issue of determinants and stability of money demand function owing to economic reforms being pursued by the government. In this paper, we provide further evidence on the issues of demand for money

and the currency substitution phenomenon by modeling the empirical relationship between broad money, income, interest rates, expected inflation, expected exchange rate and foreign interest rate. We also examine the constancy of this relationship, especially in the light of financial reforms, deregulation of financial markets and financial crises. This phenomenon to our knowledge has not been investigated in the case of Nigeria. Besides, the paper utilizes an error correction technique to test for the existence of long-run relationship.

The paper is divided into five sections. Section one introduces the paper, while section two contains literature review. Section three discusses methodological issues and estimation of the specified model. Results and conclusion are dealt with in sections four and five respectively.

2. Literature Review

2.1 Financial and Monetary Policy Reforms and the Nigerian Economy

In the pursuit of economic growth as well as macroeconomic stability as monetary and fiscal objectives, Nigerian economic managers embraced financial and foreign exchange rate liberalization policy. The deregulation of the financial markets was based on McKinnon-Shaw financial intermediation hypothesis which postulates that interest rates positively respond to savings and economic growth (McKinnon, 1973; Shaw, 1973). While the financial liberalization would free interest rate from the government ceiling and credit control, exchange rate liberalization entails devaluation of the national currency against the currencies of major trading partners.

The financial sector reforms thus centred around expansion of the financial sector through the encouragement of new institutions. This has led to increase in the number of commercial banks from 28 in 1985 to 66 with over 2358 branches and merchant banks from 12 to 53 with 124 branches at the end of 1993. Measures taken also include deepening the banks capital base as a measure against insolvency in the system along with prudential guideline to ensure sound banking practices.

The monetary policy component of the reform involved deregulation of interest rates and credit control since 1985. Consequently, interest rates have been mainly determined by the market forces, hence the upward trend of the variable. Likewise, the former 18 sectors in the sectoral credit allocation scheme classification were reduced to only two sectors of agriculture and manufacturing receiving 50% of credit allocation while the remaining 50% goes to other sectors. Under the foreign exchange market liberalization, the fixed exchange regime has been abolished. This is reflected on the naira/dollar exchange rate. For instance, the official average exchange rate (naira/the US dollar) rose from 1.1999 in 1985 to 36.2166 in 1998, while parallel or black market stood at 113 in 2001 (CBN, 2001).

But like in other developing countries with similar economic background that have also embarked on structural adjustment reform, the Nigerian economy had been dogged by inflation and instabilities in the financial markets. For example, inflation rate rose from 5.8 percent in 1985 to the all-high 72.8 percent in 1995.

2.2 Theoretical and Empirical Literature

Evidences from theories and empirical analysis have shown that currency substitution, a phenomenon known as the use of foreign money along with the domestic currency in transactions usually results from instability in the system following the implementation of financial reforms, especially if the process is not preceded by attainment of macroeconomic stability (Van Aarle and Budina, (1996); (Cuthbertson and Bredin, (2000)). By a country adopting financial and exchange rate deregulation and the attendant currency devaluation, most researchers claim that it is like the economy losing a nominal anchor that could control inflation. This is because of the link between exchange rate and money and the price level (exchange rate and money supply are indexed to the price level) (Edward, 1993). For an optimum and beneficial financial and foreign exchange liberalization that would not engender problems like currency substitution, it has been argued that this process should be preceded by attainment of macroeconomic stability (Dornbusch and Reynoso (1993);

Mirakhor and Villaueva (1993); Mntiel (1995) Ikhide; and Alawode (2001). When such process is not optimized the stability of money demand function and by implication, effectiveness of monetary policy may be questioned.

It was therefore, posited that a finding of currency substitution in an economy indicates a lack of credibility of programme to control inflation (Clements and Schwart, 1993 and Guidotti and Rodriguex, 1992). Its presence in an economy creates unstable money demand function (Mckinnon, 1982); and confounds monetary policy when money demand is predicted ignoring its existence (Tullock, 1975).

According to Adam (1999), demand for money lies at the heart of macroeconomic policy making in Africa. This is because money either as cash or interest-bearing deposit remains the single most important financial asset held by the non-bank private sector. But this could be constrained by the phenomenon of currency substitution emanating from economic reforms.

The implication of a stable money demand function for monetary policy is that changing the growth of domestic money stock can influence the path of income and price level. This can definitely become complicated if there is an influence of external variables on the domestic demand for money. For instance, if domestic and foreign currencies become close substitutes, this will lead to reallocation of agents' portfolio (Batten and Hafer, 1985). This adjustment will definitely have a bearing on domestic demand for money and consequently on effectiveness of policy in bringing about desired changes in the economy.

Economic theories and empirical analysis posit a close relationship between money balances, income and opportunity cost variables. According to Friedman (1970), demand for money is a function of interest rate, income and the general utility of holding money. Other studies like Cagan (1956); Frenkel (1977); Aghevli and Khan (1980); Adekunle (1980: 255-278) have not only emphasised expected inflation rate as a determinant of

demand for money but also variables like real income. This position is summarised in Khan (1980: 307-326). This postulates that, an increase in the cost of holding money, through the interest or the declining purchasing power of money because of inflation leads to a decline in money demand. This demand is treated as the demand for real money balances; implying that the function is homogeneous of degree one in the level of prices.

In an inflationary economy, money as a financial asset loses its store of value role, thus demand increases for low inflation currency. Hence, it is suggested by Civcir (2003) that portfolio theory may be more appropriate in the analysis of money demand in high inflation economies.

Originally developed by McKinnon and Oates (1996), but variously extended to include the possibility of currency substitution by Girton and Roper (1981), Cuddington (1983), Branson and Henderson (1985) and Zervoyianni (1982, 1992), portfolio approach assumes that economic agents seek to maximise the return to their wealth subject to given level of risk. They hold diverse assets and switch among them as the case may be. These diverse assets include domestic and foreign currencies as well as domestic and foreign stocks and bonds.

Hence, based on the portfolio theories, in addition to the traditional variables, there appeared to be some influences on money from the interest rate in the international market, foreign exchange risk and exchange rate expectations (Arize (1994); Civcir (2003); Bahmani-Oskooee and Rhee (1994)). Studies by Daniel and Fried (1983), Bahmani-Oskooee and Rhee (1994), Van Aarle and Budina (1996), Cuthbertson and Bredin (2001), Yildirm (2003), and Civcir (2003) have provided strong evidences of presence of currency substitution with mixed results on the stability of money demand function for various periods of economic processes.

3 MODEL SPECIFICATION

Demand for domestic money is usually specified for the test of currency substitution. In a portfolio approach that emphasizes the store of value role of money, demand for money is a function of return on money itself, rate of returns on alternative assets and income.

It is generally given thus:

$$m = f(y,R) \dots\dots\dots 1$$

Where; m is real money balances, y is a scale variable and R is the vector of rates of returns on various assets. In this specification, money demand is directly related to the scale variable and elements of R included in m and inversely related to elements of R excluded from m .

Since the portfolio approach include money as part of the portfolio of assets held by economic agents, the return on money is its own rate; and this is inversely related to money. On the other hand, assets alternatives to money include government securities, real assets, foreign currencies, domestic and foreign stocks and bonds. The return on the real assets is the expected rate of inflation; given that while money value depreciates under inflation, the value on real assets remains the same. This variable is inversely related to money. According to currency substitution theory, return on foreign currency is represented by expected depreciation of the domestic currency; and this is inversely related to money balances as well. However, Cuddington and Mckinnon have criticised the use of expected rate of exchange in currency substitution literature on the ground that a model without expected exchange rate corrected for foreign interest rate can not separate currency substitution from capital flow. Hence Civcir (2003) added interest rate on foreign assets to separate the effect of capital flow from currency substitution but later found this variable to be collinear with the expected rate of exchange. Foreign interest rate is included as a variable in this model and it is expected to be inversely related to money balances.

Specifically and in semi log form then the model is given thus:

$$lrm2_t = b_0 + b_1 lrgdp_t + b_2 plm_t + b_3 ecpin_t + b_4 leer_t + b_5 fr_t + m_t \dots \dots \dots 2$$

Data and Sources

The data used in this study are as follows: Lrm2 is the log real broad money (M2). This includes Nigerian naira currency denominated in circulation plus demands and time deposits deflated by the appropriate consumer price deflator. Lrgdp is real GDP at 1995 constant prices deflated by the appropriate deflator . Plrn is the prime lending rate. Ecpin the expected inflation rate. It is the consumer price index using 1995 as the base year. Eer is the expected exchange rate depreciation of naira. The Exchange rate is the nominal exchange rate naira/1US\$. Fr is the US federal fund rate. All the data were obtained from the International Monetary Fund International Financial Statistics (IFS), 1987.

Estimation Techniques

The paper employs co-integration and error correction techniques. These methods are believed to overcome the problem of spurious regression while at same time provide consistent and good estimates of both long-run and short-run elasticities that satisfy the properties of the classical regression method; given the fact that all variables in the Error Correction Model (ECM) are integrated of order zero, I(0). The techniques are also unique and preferred to the traditional Adaptive Expectation and Partial Adjustment models because the latter are associated with problems of spurious regression, inconsistent and indistinct short-run and long-run elasticity estimates. Among the works done on demand for money and currency substitution using ECM include (Bahmani-Oskooee and Rhee (1994); Bose and Rahman (19996); Jonsson (2001); Yuldirim (2003); Civcir (2003); Cuthbertson and Bredin, (2001).

The aim of the cointegration analysis is to establish long run equilibrium relationship between variables. In the Engle-Granger cointegration analysis, variables of consideration are said to be cointegrated or have long run equilibrium relationship if in the OLS regression of one variable on the others, their residuals; as the proxy for their combination are integrated less than original variable. For instance, if the variables are integrated of order one, I(1), then their residuals should be integrated of order zero, I(0). Such as the residuals are stationary; I(0). Alternatively, cointegration exists among the variables if they are integrated of the same level. The implication of this analysis is that deviation or drift may occur between the variables, but this is temporary as equilibrium holds in the long run for them.

The Error Correction model represents an alternative way of presenting long run equilibrium relationship between variables. It shows the dynamic error analysis of the cointegrated variables. As such in this paper, the first step to the ECM analysis is the estimation of a static money demand function given by equation 2. Upon rejection of the null hypothesis of no cointegration the lagged residuals from the cointegration equation are imposed as the error correction term in an error correction equation. This is given thus:

$$\Delta lrm2 = \mathbf{d}_0 + \mathbf{d}_1 \Delta lrgdp + \mathbf{d}_2 \Delta plrn + \mathbf{d}_3 \Delta ecpin + \mathbf{d}_4 \Delta leer + \mathbf{d}_5 \Delta fr + EC_{t-1} + \mathbf{m}_t \dots 3$$

Where Δ is the difference operator, EC_{t-1} is the vector of stationary residuals from the cointegration equation 2, μ is the error term. All variables in equation 3 are I(0) or stationary; this implies that the t-ratio can now be applied to test for the significance of error correction term or any of the explanatory variables.

The error term in the equation represents the speed of adjustment from one period to another. If it is significant carrying with it a negative sign and that all other variables in

equation 3 are jointly significant, then the variables jointly are said to have significant effect on the dependent variable.

The first stage of cointegration and error correction techniques is the test for unit root. The whole analysis then proceeds from it. The followings are the methods people use in testing for the stationarity of economic variables: the Dickey Fuller (DF) test; the Augmented Dickey Fuller (ADF) test; Phillip-Peron (PP) test; and the Sargan-Bhargara Cointegrating Regression Durbin-Watson (CDRW) test. This study uses the ADF.

4 RESULTS AND DISCUSSION

In this section, we start by discussing the order of integration of the series as the first step in the cointegration analysis. It is important as an integrated series accumulates past effects; which means that a disturbance to the series does not return to any mean value, hence non-stationary. The order of such a series is then determined by the number of times it must be differenced to make it stationary. If two or more series are integrated of the same order, then a linear relationship can be estimated. When we examine the order of integration of the linear relationship it is similar to testing for the null hypothesis that there is no cointegration against the alternative that there is cointegration. The results of the order of integration are presented thus.

In Table 1 we have the results for real broad money, real gross domestic product, prime lending rate, inflation, exchange rate and foreign interest rate. The tests were carried out in level and first difference and were performed by including both a constant and a deterministic trend in the regression. The critical values for ADF tests at 1 and 5 percent confidence levels are -2.60 and -1.95 respectively.

Table 1 Unit Roots
Augmented Dickey-Fuller (ADF)

	Level	First diff
LM2	1.397304	-3.557912*
LGDP	0.270664	-4.335052**
PLRN	0.3522048	-5.020411**
ECPIN	2.307418	-4.7849965**
EER	6.704183	-3.850161*
FR	-0.407620	-3.781376*

Notes: **, * signify that the statistics are significant at 1% and 5% levels of significance respectively.

From Table 1 it can be seen that the hypothesis of non-stationarity is rejected for real gross domestic product, prime lending rate and inflation at 1% confidence level while it is at 5% for real broad money, exchange rate and foreign interest rate. This shows that all the series are integrated of order one I(1). By implication, it follows that we can proceed to the second stage of testing for cointegration relationship between real broad money and its explanatory variables as given in this paper.

4.2 Co-integration Analysis

The main objective is to test for the stationarity of the linear relationship of the variables whose order of integration were determined in section 4.1 or to determine whether the variables are integrated of order zero; such as they are co-integrated. If co-integration of these variables is confirmed, it portends that a non-spurious long-run relationship exists. When this is combined with error correction model (ECM), whose variables are I(0) in the next section, consistent estimates of both long-run and short elasticities is evident.

For co-integration analysis, the Engle & Granger (1987) residual-based procedure was employed. While the residual-based test is suitable for a single equation, hence it is called the single equation approach, the Johansen reduced rank approach is a system approach in that it tests for the existence of more than one co-integration relationship. In the application of the Johansen procedure, the constant and the trend variables are set unrestricted; such as they are not forced to lie in the co-integration space only. The Engle & Granger (1987) residual-based approach is applied in this paper.

Having found out that the variables of interest are integrated of order one, we proceeded to the second stage of estimating the co-integration model for broad money. The results are given in Table 2. The result of the ADF statistics of the residuals rejects the null hypothesis of no co-integration between broad money and the chosen explanatory variables. This implies that there exists a stable long-run equilibrium relationship between the series.

Table 2: Long -run Regression Results

Constant	LGDP	PLRN	ECPIN	EER	FR
0.0096	0.897	-0.004	-0.001	0.002	-0.014
(0.5064)	(26.8)**	(4.22)**	-(4.46)	(11.8)**	(-4.1)**

Note: Figures in parentheses are the t-statistics

**= significant at 1%; *= significant at 5%

The 1 and 5 percent critical values of ADF are -2.62 and -1.95 respectively.

$R^2 = 0.998$, $\text{Adj } R^2 = 0.997$, $\text{ADF} = -3.37$, $\text{F-Value} = 4459.36$

The estimated coefficients of LGDP, ECPIN, PLRN and FR all have the expected signs and are all significant at 1% confidence level. Only exchange rate has the wrong expected sign yet significant at 1% confidence level. The income elasticity of money is 0.89, suggesting

that incomes remains the main determinant of money demand. The significance of the coefficients of explanatory variables is that they all influence demand for money. To be noted is that the coefficient of rate of inflation as an opportunity cost variable was significant with the right sign. This means that inflation has exerted a substantial pressure on money demand.

4.3 The Error-Correction Model

Following the estimation of the long-run relationship between broad money, the results of the error correction model are presented in Table 3. Here the model was regressed on the first differenced of all variables plus the lagged value of the error term. The coefficient of the error term of about 0.4451 is significant at 10% confidence level with the expected negative sign. A significant error term with the right sign indicates a strong feed back effect of deviation of money demand from its long –run growth path. The value of the coefficient of the error term represents the speed of adjustment. Here the coefficient of the error term is 0.4451; meaning that 44.5 percent of the discrepancy between actual and equilibrium value of money demand is corrected in each period.

Table 3: Error-Correction Regression

Constant	?LGDP	?PLRN	?ECPIN	?EER	?FR	? (EC) ₋₁
0.0.017	0.195	0.00004	-0.0047	-0.0003	-0.017	-0.45
(3.423)*	(1.602)*	(0.364)**	(-1.082)*	(0.783)*	(-2.61)*	(-2.86)*

Note: Figures in parentheses are the t-statistics

**= significant at 1%; *= significant at 10%

$R^2 = -.487$, $DW = 1.99$, $F\text{-Value} = 5.11$

4.3 Structural Stability Test

Nigeria commenced a structural adjustment programme in 1986. The adjustment programme encompassed a whole range of deregulation, privatization and commercialization with implications for developments in the financial sector of the economy, the economy as a whole and money demand function in particular. It is therefore one of the objectives of this study to examine whether these development has altered the stability of the money demand function. To do this, the Chow's Breakpoint and Forecast tests were employed.

In the Chow's breakpoint test, the sample is divided into two sub-samples; such as T_1 and T_2 . Separate equations are then fitted for the two sub-samples to see whether there are significant differences in the estimated equations. The Forecast test on the other hand estimates the model for a sub-sample of T_1 and then uses it to predict the values of the dependent variable in the remaining sub-sample T_2 data points. An evidence of instability in the estimated relation over the two sub-samples is given if there is a large difference between the actual and predicted. The Chow's breakpoint and forecast were applied to 1993 period in Nigeria. The 1993 period corresponds to the period of political instability resulting from the annulment of the June 12, 1993 presidential election. The results are presented in Table 4 .

Table 4: Chow Tests

	Chow Breakpoint Test		Chow Forecast Test	
	F-Statistic	LL Ratio	F-Statistic	LL Ratio
1993:3-1999:4	1.1103280	18.03727	1.220553	36.95268
	(0.480023)	(0.053007)	(0.243012)	(0.075490)

Note: The probability values are in parenthesis.

The tests feature a low value of F-statistic and LR for the rejection of the null hypothesis of structural break; while at the same time expect that LR value will be higher than that of the F-statistic. The results as presented in Table 4 above reject the null hypothesis of structural break for the period coinciding with political instability, leading to the conclusion of stability of money demand during the period under investigation.

5 Conclusion

This paper estimated money demand function for Nigeria for the period of 1987:1-1999:4 using the error correction frame. The period is very unique in many senses as it was characterized by financial liberalization, inflation and political instability.

Empirical results showed that there is a long run relationship between broad money balances, income, prime lending rate, expected inflation and foreign interest rate. The significance of both expected exchange rate depreciation, though with a wrong sign and that of foreign interest rate indicate currency substitution in Nigeria.

We also find evidence of stability of both long-run and short-run money demand during the investigated period. The implication of this from the stand point of policy is that monetary targeting is feasible in Nigeria. However, this may be complicated by the existence of currency substitution. This means that with the continuous liberalization of the economy, the stability of demand for money must be periodically reviewed.

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