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M2 Targeting, Money Demand, and Real GDP Growth in Nigeria: Do Rules Apply?[1]

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Abstract

This paper examines M2 money targeting, the stability of real M2 money demand, and the effects of deviations of actual real M2 growth rates from targets on real GDP growth and inflation rate on the Nigerian economy since the introduction of the Structural Adjustment Program (SAP) in 1986. We employ cointegration vector error correction methodology using quarterly data from 1986:1 to 2001:4. Our results indicate that a long-run relationship exists between the real broad money supply, real GDP, inflation rate, domestic interest rate, foreign interest rate, and expected exchange rate. Furthermore, both the CUSUM and CUSUMSQ tests confirm the stability of the short- and long run parameters of the real money demand function. The stability of the real money demand function supports the choice of M2 as an intermediate target as Central Bank of Nigeria (CBN) attempts to manage inflation and stimulate economic activity in Nigeria. Our empirical analysis showed that the CBN was not strongly committed to its annual M2 money growth targets, but more importantly, the deviations from M2 target growth rates impacted real GDP growth rate and inflation rate adversely during the period.

1. Introduction

In the late 1970s and early 1980s, a number of central banks world-wide adopted monetary targets as a guide for monetary policy. Monetary targeting is an attempt by central banks to describe or determine the optimum money stock that will yield the desired macroeconomic objectives. Theoretically, the choice of target is normally between the stock of monetary aggregates and interest rates. Whenever the money demand function is unstable, interest rate is generally the preferred target; otherwise, the money stock is the appropriate target (see Poole, 1970, 1971; and McCallum, 1989)[2]. In the early 1990s, some central banks adopted numerical inflation or nominal GDP targets as guides for monetary policy in contrast to the conventional choice of interest rate or money stock. Economists and analysts attribute this departure to the unreliability of monetary aggregates as guides for monetary policy.

For the Central Bank of Nigeria (CBN), the primary objective in its conduct of monetary policy is to maintain a stable price level that supports sustainable economic growth and employment[3]. While other central banks adopted numerical inflation or nominal GDP targets as guides for monetary policy since the 1980s and 1990s because financial market innovations and deregulations rendered monetary aggregates less reliable policy guides, the CBN did not deviate from the conventional monetary aggregate as the appropriate intermediate target. An implicit assumption with respect to this choice is that the intermediate target chosen is measurable, controllable, and predictable[4]. In addition, it is assumed that the money demand function is stable in the conduct and implementation of monetary policy. This is very important because the money demand function is used both as a means of identifying medium term growth targets for money supply and as a way of manipulating the interest rate and reserve money for the purpose of controlling the total liquidity in the economy and for controlling inflation rate.

[1] We acknowledge the useful comments and suggestions of the anonymous referees. The usual disclaimer applies.
[2] For a detailed analysis, see Bennett T. McCallum, Monetary Economics: Theory and Policy, 1989, Chapters 3 and 4.
[3] By definition, price stability in Nigeria refers to the attainment of single-digit inflation rate on an annual basis.
[4] See Frederic S. Mishkin, The Economics of Money Banking and Financial Markets, 2004, Chapter 18.

The purpose of this study is to examine whether the CBN's choice of M2 as an intermediate target was the appropriate one by examining the underlying assumption of the stability of M2 money demand function since the implementation of the Structural Adjustment Program (SAP) in 1986. The objective to investigate the long-run stability of the real money demand function is based on the fact that the stability of the money demand function has important implications for the conduct and implementation of monetary policy. In other words, these are some of the important issues for empirical analyses because it is possible that the implementation of SAP in 1986 may have altered the stability of real money demand function. With respect to the choice of intermediate targets by monetary authorities, economic theory suggests that the success or failure of such policy stance depends on the level of commitment to targets, therefore, this raises a fundamental question as to level of commitment by the CBN to its annual growth targets set for M2, and if it deviated from its annual growth targets for M2 during the period, how did this impact real GDP growth and inflation rate? This is at the core in terms of the linkage between target achievement, or lack thereof, and the overall objectives of monetary policy[5]. To shed some light on this issue, we examined not only the level of success or failure of the CBN in keeping with its annual target set for M2 growth but also the effects of the deviations of actual M2 growth rates from targets on real output growth and inflation rate during the period.

After the implementation of SAP in 1986, the Nigerian economy went through some significant structural and institutional changes. These changes included the liberalization of the external trade and payment systems, substantial degree of financial deepening and innovations in the banking sector, the adoption of a managed float exchange rate system, the elimination of price and interest rate controls, changes in monetary policy, and the emphasis on market determined indirect instruments of monetary policy. It is conceivable that these developments may have altered the relationship between money, income, prices, and other key economic variables; and this may have caused the money demand function to become structurally unstable. Consequently, determining whether the financial reforms undertaken under the SAP impacted the money demand relationship is important to the effective formulation and implementation of monetary policy in Nigeria. This is so because issues or factors that affect the behavior and stability of the money demand relationship assume greater urgency when the broad monetary aggregate became the official intermediate target for monetary policy [see the CBN (Amendment) Decree Number 37 of 1998].

In order to ensure that our results are robust, we adopted the Johansen/Juselius (1990) multivariate cointegration method to find the appropriate real money demand function and to analyze its behavior both in the short-run and long-run. Even though the Johansen/Juselius cointegration technique is not informative relative to the stability of the parameters in the model [Bahmani-Oskooee and Shin (2002, p.86)], however, one cannot overlook its usefulness for empirical modeling in industrialized and developing countries. To test for the stability of the parameter estimates in this study, we employed the CUSUM and CUSUMSQ tests which Brown, et al. (1975) developed in order to examine the stability of short-run dynamics and long-run coefficients of the money demand function. From the CUSUM and CUSUMSQ test results, we found the real money M2 demand function to be stable during the sample period. In addition, from the visual inspection of the M2 money growth data, we observed that the actual from M2 growth rates deviated from the target growth rates, therefore, one can easily conclude that the CBN was not strongly committed to the annual M2 growth targets. More importantly, our test results showed that these deviations from targets growth rates impacted real GDP growth and inflation rate adversely in Nigeria.

The rest of the paper is organized as follows. In Section 2, we examine the current monetary policy framework in Nigeria. We devote Section 3 to the empirical methodology where we specify the real money demand function. This will be followed by Section 4 where we report our estimated empirical results, and Section 5 is devoted to the summary and conclusions of the study.

[5] The CBN (Amendment) Decree Number 37 also defines price stability as the central bank's major policy objective.

2. Monetary Policy Framework in Nigeria

In Nigeria, the overriding objective of monetary policy is price and exchange rate stability[6]. The monetary authority's strategy for inflation management is based on the view that inflation is essentially a monetary phenomenon. Because targeting money supply growth is considered as an appropriate method of targeting inflation in the Nigerian economy, the Central Bank of Nigeria (CBN) chose a monetary targeting policy framework to achieve its objective of price stability. With the broad measure of money (M2) as the intermediate target, and the monetary base as the operating target, the CBN utilized a mix of indirect (market-determined) instruments to achieve it monetary objectives. These instruments included reserve requirements, open market operations on Nigerian Treasury Bills (NTBs), liquid asset ratios and the discount window (see IMF Country Report No. 03/60, 2003).

The CBN's focus on the price stability objective was a major departure from past objectives in which the emphasis was on the promotion of rapid and sustainable economic growth and employment. Prior to 1986, the CBN relied on the use of direct (non-market) monetary instruments such as credit ceilings on the deposit money of banks, administered interest and exchange rates, as well as the prescription of cash reserves requirements in order to achieve its objective of sustainable growth and employment. During this period, the most popular instruments of monetary policy involved the setting of targets for aggregate credit to the domestic economy and the prescription of low interest rates. With these instruments, the CBN hoped to direct the flow of loanable funds with a view to promoting rapid economic development through the provision of finance to the preferred sectors of the economy such as the agricultural sector, manufacturing, and residential housing.

During the 1970s, the Nigerian economy experienced major structural changes that made it increasingly difficult to achieve the aims of monetary policy. The dominance of oil in the country's export basket began in the 1970s. For example, in 1970, the share of oil revenue in total export value was about 58 percent, and this increased to over 95 percent during the 1980s. The increased revenue from oil to the government led to a rapid increase in Nigeria's external reserves in the 1970s. Furthermore, the rapid monetization of the increased crude oil receipts resulted in large injections of liquidity into the economy, which induced rapid monetary growth. Between 1970 and 1973, government spending averaged about 13 percent of gross domestic product (GDP), and this increased to 25 percent between 1974 and 1980. This rapid growth in government spending came not from increased tax revenues but the absorption of oil earnings into the fiscal sector, which moved the fiscal balance from a surplus to a deficit that averaged about 2.5% of GDP a year. This new era of deficit spending led the government to borrow from the banking system in order to finance the domestic deficits. At the same time, the government was saddled with foreign deficits, which had to be financed through massive foreign borrowing and the drawing down of external reserves. To reverse the deteriorating macroeconomic imbalances (declining GDP growth, worsening balance of payment conditions, high inflation, debilitating debt burden, increasing fiscal deficits, rising unemployment rate, and high incidence of poverty), the government embarked on austerity measures in 1982. The austerity measures was successful judging by the fall in inflation rate to a single digit, the significant improvement in the external current account to positions of balance, and the 9.5 percent growth in real GDP in 1985. However, these improvements were transitory because the economy did not establish a strong base for sustained economic growth.

To put the Nigerian economy back on a sustainable growth path, the government adopted the comprehensive Structural Adjustment Program (SAP) sponsored by the International Monetary Fund (IMF) in June 1986. The SAP was a structural and sectoral macroeconomic policy reform whose main strategies were (a) the liberalization of the external trade and payment systems, (b) the adoption of a market-based exchange rate for the domestic currency ─ Naira, (c) the elimination of price and interest rate controls, and (d) the reliance on market forces as the major determinants of economic activity. According Nnanna (2001), the adoption of SAP marked the beginning of reforms in the financial sector as the banking system witnessed free entry and exit, and the use of indirect but market-based monetary control instruments for implementing monetary policy in Nigeria.

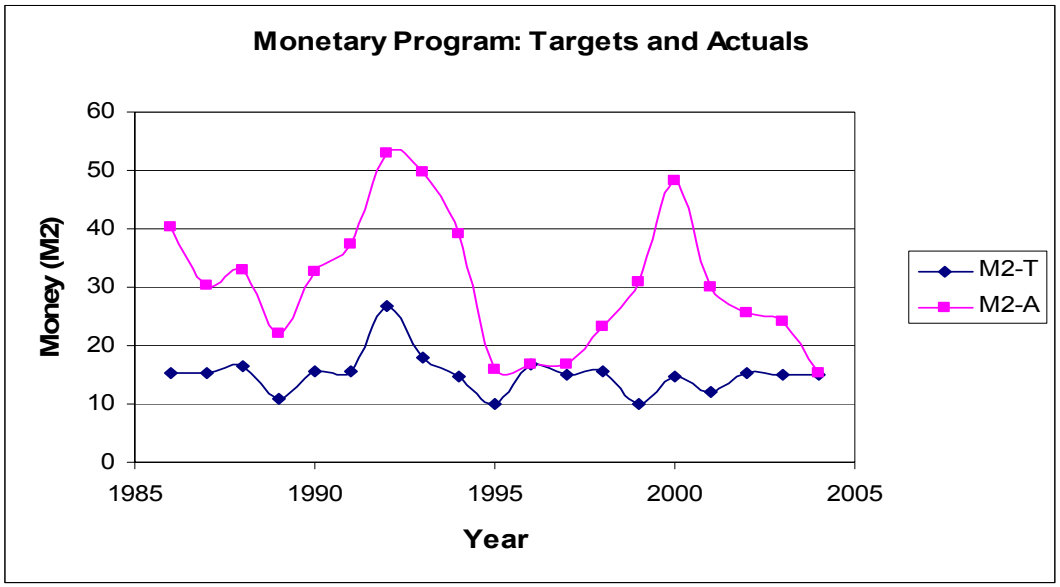
[6] See the CBN's "Monetary, Credit, Foreign Trade and Exchange Policy Guidelines" (CBN, 2001).

The CBN reached an important milestone in 1986 when it decided to adopt M2 as an intermediate target for monetary policy. While this choice raises a key question in terms of why the CBN considered M2 as the appropriate intermediate target instead of interest rate or nominal GDP or inflation targeting, however, the more important questions and issues for empirical analyses are: (1) the commitment of the CBN to its annually announced M2 target growth rates and whether or not rules apply, (2) was the real M2 money demand function stable to warrant the choice of M2 money stock as an intermediate target?, (3) what are the macroeconomic outcomes from the targets in terms of the overall objectives (lower inflation rate and real GDP growth) of monetary policy?

Given the fact that interest rates and prices were controlled pre-SAP, it is not difficult to see why the CBN ruled out interest rate targeting or inflation targeting as viable policy options. Furthermore, the structure of the financial markets in less developed countries renders interest rate targeting ineffective. As Taylor (2004) pointed out, "if financial markets are weak, the effectiveness of transmitting policy through interest rates will be limited." With these controls and the constraints due to weak financial markets, nominal GDP targeting may not have succeeded.[7] As for the commitment to rules, many countries apply rules because policy rules may aid in focusing policy discussions in terms of intermediate and operating targets. Over the past decade, many countries adopted the Taylor rule, which Taylor (1993) developed for the United States. According to Taylor (2004), these rules can also be part of the monetary policy strategy in emerging market economies. More recently, Batini (2004) argued that for Taylor rule to be applicable to emerging market economy like Nigeria, modifications have to be made because of the specific features of the emerging market economies.[8] If one examines the modifications suggested by Batini (2004) and the fact that rules assume that policymakers seek to stabilize output and prices along paths that are considered to be optimal, then one can conclude that the CBN's M2 growth rate target can (and was meant to) influence output and prices if there is commitment to announced rules. The key issue with the application of Taylor rule to monetary policy making in Nigeria is commitment to target rules.

To shed some light on the commitment to policy rules, Figure 1 plots the annual M2 growth targets and the actual growth rates of M2 from 1986 to 2004. From the visual inspection of this diagram, one can see:

Figure 1



[7] See, Judd and Motley (1992, 1993), and Taylor (2004).

[8] Batini (2004) identified six aspects: (i) the feedback parameter on inflation must be set to a larger value than that commonly used for developed countries……, and (vi) in emerging market economies, it may on occasion be sensible to consider policy rules based on money rather than interest rates as instruments.

(a) what appeared to be upper and lower bounds for M2 growth targets, and (b) deviations in two sub-periods: 1986-1996 and 1997-2004. The CBN kept M2 growth targets within bounds, except for 1992 when it exceeded the upper bound. Based on these bounds, we conclude that the CBN followed a policy rule that allowed for feedbacks from the economy. As Handa (2000) pointed out, "the credibility of policy rule usually requires that the policy function be a simple and transparent rule so that the public can easily judge the policy maker's adherent to or deviations from it." As for deviations, the diagram shows that the CBN's monetary policy appeared to be excessively expansionary compared to what its policy rules prescribed between 1986 and 1996. In 1996, the actual M2 growth rate was exactly the 16.8% that the CBN targeted. In 1997, the CBN exceeded its target of 15.0% by 1.9% (actual M2 growth was 16.9%). Since 1997, monetary conditions seemed excessively expansionary contrary to policy rule prescriptions. Finally, in 2004, the actual M2 growth rate of 15.2% exceeded the target level by 0.2% (see Figure1). The annual reports and speeches of the Governor of the CBN alluded to these deviations from targets. From the visual inspection, one can conclude that the CBN was not strongly committed to its annual M2 targets, but more significantly, the lack of commitment to rules calls to question the issue of credibility of the CBN[9].

3. Empirical Methodology

To answer the question raised in the previous section regarding the stability of M2 real money demand, we employed an econometric analysis based on an open economy portfolio balance model of real money demand function (see, Thomas, 1985). The underlying assumption of this model is that economic agents may hold money either as an inventory to smooth differences between income and expenditures, or for its yield as an asset in a portfolio. Either motive suggests a specification in which the demand for money depends on a scale variable such as real income or wealth and the rates of returns to money and to alternative assets. In open economy macroeconomics, money is considered as part of portfolio, which consists of domestic financial assets, real assets, and foreign assets. The return on the domestic money is the "own" rate of interest. The return on real assets is the expected rate of inflation. According to Friedman (1956), the purchasing power of money erodes quickly under high inflation, while the value of real assets is maintained, and as result, economic agents may wish to switch into real assets when the inflationary expectations are strong.

The opening up of the Nigerian economy since 1986, which included a significant degree of trade liberalization as well as financial deepening, suggests that the domestic demand for money cannot be realistically estimated without considering the impact of foreign monetary developments. If the residents change their money holdings due to foreign monetary developments, then the exclusion of foreign effects could lead not only to model misspecification, but it could lead to a restrictive interpretation of the characteristics of the money demand function. To capture the effects of foreign factors, some studies of money demand have considered the impact of foreign interest rates and the expected rate of depreciation of the domestic currency (see, for example, Arango and Nadiri, 1981; Thomas, 1985; Arize et al., 1990; Bahmani-Oskooee, 1991; Chowdhury, 1997; Ibrahim, 2001; Bahmani-Oskooee and Shin, 2002; Civcir, 2003). The inclusion of the foreign interest rate in the money demand function is to capture the effects of capital mobility. Studies suggest that an increase in the foreign interest rate that increases the return on foreign assets relative to those on domestic assets may cause agents to decrease their demand for domestic money holdings (see, McKinnon, 1983).

The expected exchange rate captures the substitution between domestic and foreign currencies. Its impact on the domestic demand for money is ambiguous because it can be either positive or negative. In the studies by Arango and Nadiri (1981), Bahmani-Oskooee and Pourheydarian (1990), and Bahmani-Oskooee and Rhee (1994), they argued that if residents evaluate their asset portfolio in terms of the domestic currency, a depreciation of the exchange rate that increases the value of their foreign holdings would enhance wealth. To maintain a fixed share of the wealth invested in domestic assets, residents will shift parts of their foreign holdings to domestic assets, including domestic currency. The increase in the share of wealth held in domestic assets, including domestic currency, suggests a rise in the demand for

[9] For the literature of credibility, dynamic inconsistency, rules versus discretion, see Kydland and Prescott (1977), Stanley Fischer (1990), Benjamin Friedman (1990), Bennett McCallum (1987, 1988, 1993).

the domestic currency. Studies have argued that the depreciation of the domestic currency leads residents to anticipate further depreciation, then as a hedge against the exchange rate risk, they may adjust their portfolio towards holding more of the foreign currency and less of the riskier domestic currency. The shift in portfolio away from the domestic currency to foreign currencies amounts to a decline in the demand for the domestic currency (i.e., the currency substitution effect).

Following this discussion, the theoretical literature, and Handa's (2000, p. 210) specification, the standard long-run real money demand function modified to take account of foreign currencies and foreign assets as alternatives to domestic money can be written in (semi) log-linear form as:

$$\Delta \ln\left(\frac{M}{P}\right)_t = \beta_0 + \beta_1 \Delta InY_t + \beta_2 DIR_t + \beta_3 In\pi_t + \beta_4 \Delta InEER_t + \beta_5 FIR_t + \varepsilon_t \qquad (1)$$

where, *ln* is natural logarithm, *M* is the nominal *M2* money stock, *P* is the domestic price level, hence *M2/P* is the real *M2* money balances, Y_t is the real *GDP*, DIR_t is the domestic interest rate (the "own" rate of return), π_t is the inflation rate, EER_t is a measure of the expected exchange rate depreciation, FIR_t is the foreign interest rate, and ε_t is a white noise disturbance term.

According to Handa's (2000, p. 210), the domestic rate of interest and the expected exchange rate depreciation are two important variables to include in the modified long-run real money demand function, and the failure to include foreign interest rate[10] "would make it difficult to capture the substitution between domestic currency and foreign bonds, which is an element of capital mobility rather than of the substitution of the liquidity services of the foreign currency for the domestic one". Furthermore, it is important to point out that it is not unusual to include inflation rate as an explanatory variable in the money demand function. Some studies use current inflation rate and others use expected inflation rate as explanatory variable[11]. This is so because the inflation generating process is not universal, but more importantly, the expectations of inflation vary across developed and developing countries. With respect to developing countries, monetary and non-monetary factors contribute to the inflation process. For example, in a study of money demand and the inflation process in Brazil, Calomiris and Domowitz (1989, p. 82) argued that expected inflation is determined simultaneously with equilibrium real balances and real government debt. In addition, Calomiris and Domowitz (1989, p. 87) found that changes in money do not predict changes in the price level whereas changes in the price level do predict changes in money. In many other developing countries, studies show that one of the dominant predictors of inflation is the growth of money (see Owoye, 1997: Table 2, p. 490). In the case of Nigeria, monetary factors and macro-monetary policy announcements are major determinants of the inflation generating process. With every policy announcements, economic agents form their expectations about prices accordingly. In other words, in economies such as Nigeria where prices adjust almost instantaneously due to policy announcements, one can therefore assume that there is no difference between current inflation and expected inflation (that is, $\pi = \pi^e$). To summarize, the prior expectations for the coefficients are as follows: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 < 0$, and $\beta_5 \gtrless 0$.

The money demand model specified above is estimated using quarterly data from 1986:1 to 2001:4 gathered from the IMF's International Financial Statistics 2002 CD-ROM. The real *M2* money demand is measured as the nominal *M2* money stock divided by the consumer price index (*CPI)*. Real income as a measured scale variable is proxied by the real industrial production because quarterly data on real *GDP* for Nigeria for the entire sample period are not available. A crude approximation would have been the use of an interpolated quarterly *GDP*.[12] The domestic interest rate ("own" rate of return) is proxied by the

[10] Note that DIR_t, FIR_t, and EER_t are the standard theoretical variables in the uncovered interest parity condition.

[11] See Calomiris and Domowitz (1989), Goldfeld and Sichel (1990), and more recently, Muscatelli and Spinelli (2000), and Brissimis, et al. (2003).

[12] The use of industrial production as a proxy for gross domestic product is consistent with the literature. In the study of money demand in Brazil, Calomiris and Domowitz (1989, p. 86) used industrial production as proxy for GDP.

three-month interbank rate[13]. The inflation rate is the quarterly rate of inflation, which is derived as the quarterly percentage change in the *CPI*. Since well over 40% of Nigeria's international trade is conducted with the United States, the US three-month Treasury bill rates and the Nigerian naira/US dollar exchange rates are used as the foreign interest rate and the nominal exchange rate, respectively.

Empirical studies have shown that it is difficult to measure the expected exchange rate depreciation, and because of this, studies use different measurement methods, but most studies commonly use the forward exchange rate data to capture market expectations. In addition, forward exchange rate data for the Naira-US dollar is not available. Given this, we measure the expected rate of depreciation of the domestic currency by fitting a first order autoregressive time series model to the first difference of the logarithm of the exchange rate and then use the fitted values from this equation as a series of one-step-ahead forecasts for the depreciation rate. The estimated autoregressive model (AR (1)) takes the form:

$$\Delta ln\, EER_t = \underset{(2.774)}{0.058} + \underset{(7.225)}{0.892}\, \Delta\, ln\, EER_{t-1} + u_t \qquad (2)$$

$$R^2 = 0.313 \quad SER = 0.194 \quad DW = 2.019 \quad LB = 4.91\ (p = 0.23)$$

where the number in parentheses below the coefficients are t-ratios, R^2 is the coefficient of determination, *SER* is the standard error of the regression, *DW* is the Durbin Watson statistics, and *LB* is Ljung-Box Q statistic test for a fourth order serial correlation process in the errors, and *p* is the probability value.

4. Estimated Results

In modeling the money demand function, we examined each series entering the model to determine whether it is stationary and its order of integration. The results of the augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) unit roots test procedure are reported in Table 1. Studies have shown that these

Table 1: ADF and PP Unit Root Test Results

	Levels				First Differences			
Variables	**ADF1**	**PP1**	**ADF2**	**PP2**	**ADF1**	**PP1**	**ADF2**	**PP2**
lnM2	-3.144	-2.464	-0.681	-0.559	-3.939*	-7.558*	-3.979*	-7.532*
lnY	-1.243	-1.138	-0.817	-0.659	-6.084*	-6.056*	-6.051*	-6.084*
$ln\,\pi$	-2.597	-4.872*	-2.518	-4.883*	-9.718*	-15.114*	-9.710*	-14.217*
DIR	-2.610	-2.674	-2.479	-2.526	-7.949*	-7.966*	-8.011*	-8.031*
FIR	-2.499	-1.865	-1.531	-1.388	-3.566†	-3.398‡	-3.229†	-3.319†
lnEER	-1.992	-2.158	-1.907	-2.089	-7.025*	-6.988*	-6.997*	-7.029*
DTG	-5.383*	-6.208*	-7.273*	-5.818				

Notes: ADF and PP1 = unit root tests with constant and trend; and ADF2 and PP2 = unit root tests with constant.
*, †, and ‡ indicate statistical significance at the 1%, 5%, and 10% level respectively.
With constant and trend: McKinnon (1991) critical values are: -4.108 (1%), -3.482 (5%), and -3.169 (10%).
With constant only: McKinnon (1991) critical values are: -3.536 (1%), -2.907 (5%), and -2.591 (10%)

[13] The importance of interest rate in money demand has been firmly established in the literature, but considerable disagreement exists as to which interest rate (e.g. long-term or short-term) should be used as the opportunity cost of holding money. According to Wong (1977), most people in developing country live near subsistence level and hold money for precautionary purpose over shorter periods. As such, the short-term interest rate is more appropriate in the case of Nigeria.

tests lack power in small samples; however, studies give more credence to the PP test because of its validity even if the disturbances are serially correlated and heterogeneous while the ADF tests require that the error term be serially uncorrelated and homogeneous. Despite the shortcomings of these tests, we cannot over-emphasize their importance for empirical modeling because they show the order of integration among variables. Given the unit-root properties of the variables, we proceeded to establish whether or not there is a long-run cointegrating relationship among the variables in equation (1) by using the Johansen full information maximum likelihood method[14] (Johansen 1988; Johansen/Juselius 1990).

The results of the cointegration tests are presented in Panel A of Table 2. The results reported for the trace and maximum eigenvalue statistics show that the null-hypothesis of no-cointegrating vector linking real *M2* and its economic determinants is rejected at the 5% level of significance. The trace test statistics reveal that there is one cointegrating relationship. The maximal eigenvalue statistics suggests at most two cointegrating relationships among real *M2* and its economic determinants. Since the trace statistics takes into account all of the smallest eigenvalues, it possesses more power than the maximal eigenvalue statistic (see Serletis and King, 1997; and Kasa, 1992). Furthermore, Johansen and Juselius (1990) recommend the use of the trace statistics when there is a conflict between the two statistics. The conclusion drawn from this result is that there exists a unique long-run relationship between *M2, Y, DIR, π, ΔEER* and *FIR*. Since there is one cointegrating vector, an economic interpretation of the long-run broad money demand function can be obtained by normalizing the estimates of the unconstrained cointegrating vector on the real *M2*. The parameters (i.e., long-run elasticities) of the cointegrating vector for the long-run broad money demand function are presented in Panel B of Table 2. The results in Panel B of Table 2 show a positive and statistically significant relationship between the demand for real broad money and real income during this period. This result is consistent with the prediction of economic theory, and it suggests that people held more money as their income increased.

The coefficient on the real income variable indicates that the long-run income elasticity for real broad money is 2.067. The high coefficient of the long-run income elasticity may appear to contradict the hypothesis of economies of scale in money holding predicted by the transactions and precautionary theories; however, as we may recall, we use a broader definition of money (*M2*), which includes some assets such as savings balances and time deposits because they provide liquidity service after the deregulation of the Nigerian economy in 1986. These asset components of *M2* reflect portfolio demand than for M1, which is dominated by current transaction needs, therefore, the portfolio demand components of *M2* could make them a 'superior good' for households for whom these assets are viable. In addition, our result with respect to high income elasticity for *M2* is supported by Laidler (1993, p. 169) that "broader definitions of money demand produce higher estimates of the income/wealth elasticity than the narrow ones" (see Fair, 1987; Goldfeld and Sichel, 1990). It is important to point out here that income elasticity greater than one is an unresolved empirical issue in the literature for both developed and developing countries even though several studies have argued that financial development and liberalization, technological improvements in payment systems, creation of money substitutes, and improved economic stability should decrease the income elasticity of money demand. For example, studies by Papadopoulos and Zis (1997), Ericsson and Sharma (1998), Brissimis et al. (2003) found higher long-run income elasticity in their analyses of money demand in Greece. More recently, Mark and Sul (2003) found income elasticity greater than one in 10 of the 19 advanced countries they examined in their study [see Table 7, p. 678]. It is important to point out that these results are for countries with structures and attributes that should yield lower income elasticity.

The domestic "own" interest rate and inflation rate variables enter the long-run real money demand model with different and predicted signs. The "own" interest rate variable is positively related to real money demand. This indicates that the higher the own rate of return, the higher the demand for broad money. On the other hand, inflation is negatively related to real money demand, which means that the higher the rate

[14] The Johansen/Juselius approach produces asymptotically optimal estimates because it incorporates a parametric correction for serial correlation (which comes from the underlying vector autoregression (VAR)) and the system nature of the estimator means that the estimates are robust to simultaneity bias. Moreover, the Johansen method is capable of detecting multiple cointegrating relationships (if they exist) and it does not suffer from problems associated with normalization.

Table 2: Johansen Maximum Likelihood Cointegration Test Results
(*lnM2, lnY*, *DIR*, *ln*π, Δ*lnEER*, *FIR*)

Panel A: Maximum Eigenvalue and Trace Tests for real M2 Money Demand Function

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	Trace Statistic	5 Percent Critical Value
None	0.693	75.63*	67.08	104.69*	95.75
At most 1	0.476	47.98*	47.87	67.06	69.82
At most 2	0.355	24.06	27.58	46.67	47.86
At most 3	0.282	18.27	21.13	29.61	29.80
At most 4	0.122	8.36	14.26	8.42	15.49
At most 5	0.001	0.05	3.84	0.05	3.84

Panel B: Normalized cointegrating coefficients of the real *M2* demand equation[15]

$$ln\,(M/P)_t = -36.376 + \underset{(5.351)^*}{2.067\,lnY_t} + \underset{(8.191)^*}{0.306 DIR_t} - \underset{(5.046)^*}{0.041\,ln\,\pi_t} - \underset{(3.908)^*}{0.371\,\Delta\,lnEER_t} - \underset{(4.317)^*}{0.207\,FIR_t}$$

Note: * indicates rejection of the null hypothesis at 5% significance level.
t-statistics are in the parentheses below the coefficients.

of return on the alternative asset, the lower the demand for money. The coefficients of the foreign interest rate and the expected exchange rate depreciation are both negative and statistically significant. These results highlight the importance of foreign effects in explaining the demand for money holdings in Nigeria during the sample period. The statistically significant negative coefficient of the foreign interest rate variable supports the argument of capital mobility effect with respect to the portfolio balance, but more importantly, the statistically significant negative coefficient of the expected exchange rate depreciation indicates the existence of the currency substitution in Nigeria.

4a: *Dynamic Specification of Real M2 Money Demand*

So far, the results show that the variables in the real broad money demand model in equation (1) tend to move together in the long-run as predicted by economic theory. In the short-run, deviations from this relationship could occur due to shocks to any of the variables. In addition, the dynamics governing the short-run behavior of real broad money demand are different from those in the long-run. Due to this difference, the short-run interactions and the adjustments to long-run equilibrium are important because of the policy implications. According to Engle and Granger (1987), if cointegration exists between non-stationary variables, then an error-correction representation of the type specified by equation (3) below exists for these variables. Given the fact that the variables of the money demand equation are cointegrated, the next step is the analysis of the short-run dynamics within a Vector Error Correction Model (VECM). The VECM takes the form:

[15] The statistical significance of DIR_t, FIR_t, and EER_t is indicative of the absence of collinearity or multicollinearity in the specified real money demand model given in equation (1). This is further confirmed by our correlation matrix of these variables (DIR_t, FIR_t, EER_t and π_t) not reported here in order to conserve on space. The table of correlation matrix is available upon request from the authors.

$$\Delta In\left(\frac{M}{P}\right)_t = \delta_0 + \sum_{i=1}^{k-1}\delta_1\Delta In\left(\frac{M}{P}\right)_{t-i} + \sum_{i=0}^{k-1}\delta_2\Delta InY_{t-i} + \sum_{i=0}^{k-1}\delta_3\Delta DIR_{t-i} + \sum_{i=0}^{k-1}\delta_4\Delta In\pi_{t-i} + \sum_{i=0}^{k-1}\delta_5\Delta InEER_{t-i} + \sum_{i=0}^{k-1}\delta_6\Delta FIR_{t-i} + \delta_7 ECT_{t-1} + \mu_t \quad (3).$$

The coefficients of equation (3) have the same signs as those in equation (1), and the meanings are as we discussed earlier. ECT_{t-1} is the lagged error correction term, that is, the fitted residuals from the cointegrating equation (1), and μ_t is a white noise error term.

The VECM shows how the system adjusts to the long-run equilibrium implied by the cointegrating equation (1). A crucial question concerning the VECM is the optimal lag for the right-hand-side variables. We employed Hendry's (1987) methodology of "general-to-specific" to eliminate all insignificant lags. Accordingly, we initially estimated a VECM with four lagged differences of the explanatory variables, a constant term and one error correction (ECT_{t-1}) term. The dimensions of the parameter space were then reduced to a parsimonious VECM specification by using sequential F-tests to exclude the statistically insignificant lags. The results of the reduced short-run dynamic real broad (*M2*) money demand model and the various diagnostic tests are presented in Table 3. As expected, the error-correction term (ECT_{t-1}) is of the expected negative sign and highly significant in the real money demand function. This result substantiates the finding of cointegration among the variables reported earlier, but more importantly, it suggests that one cannot overlook the cointegrating relationship among variables in the model; otherwise, this could introduce misspecification in the underlying dynamic structure. The absolute value of the coefficient of the error-correction term indicates that about 6 percent of the disequilibrium in the real *M2* demand is offset by short-run adjustment in each quarter. This means that excess money is followed in the next period by a reduction in the level of money balances, which people would desire to hold. Thus, to maintain long-run equilibrium, it is important to reduce the existing disequilibrium over time.

In addition to the disequilibrium effect, the results in Table 3 show that the quantity of money demanded is influenced by changes in real income, inflation rate, domestic and foreign interest rates, and the expected depreciation of the domestic currency. The estimated coefficients of the error correction money demand equation have the expected signs and are of magnitude similar to what is found in other studies of money demand in Nigeria and for other developing countries. For example, in related study, Arize et al. (1990) employed a partial adjustment setup to examine the demand for narrow money (M1) in seven African countries, including Nigeria, over the annual period 1960-1987. For Nigeria, they reported real total income elasticity estimates of 0.28 in the short-run and 2.03 in the long-run.[16] The diagnostic tests presented in the lower panel of Table 3 show that there is no evidence of diagnostic problem with the model. The coefficient of determination (adjusted R^2), used to measure the goodness-of-fit of the estimated model, indicates that the model is reasonably accurate in prediction. If we look at the probability value of the Jarque-Bera (JB) LM test, which is given in the squared bracket, the null hypothesis of normally distributed residuals cannot be rejected. The Lagrange Multiplier (LM) test of no error autocorrelation against autocorrelation of at most order k = 4 suggests that the residuals are not serially correlated. The Breusch-Pagan (BP) and Engel's autoregressive conditional heteroscedasticity tests [ARCH (4)] suggest that the disturbance term in the equation is homoskedastic. The Ramsey RESET test result shows that the calculated F-value is less than the critical value at the five percent level of significance. This is an indication that there is no specification error.

[16] See studies by Nwaobi (2002) which analyzed the *M1* money demand in Nigeria over the period 1960-1995 within a closed economy money demand framework where he employed the vector error-correction procedure. He reported a short-run income elasticity estimate of 0.639. Anoruo's (2002) investigation of the Nigerian broad money (*M2*) demand over the quarterly period: 1986.2 to 2000:1 with a closed economy money demand model and cointegration procedure found long-run income elasticity to be 5.44.

Table 3: Estimates of the Error-Correction Model of Real M2 Money Demand

Variable	Coefficient	t-statistic	t-Probability
Constant	-0.7247	-3.6881	0.0006
$\Delta \ln M_{t-1}$	0.1257	1.9604	0.0537
$\Delta \ln M_{t-3}$	0.1993	2.7054	0.0092
$\Delta \ln M_{t-4}$	0.1895	2.5051	0.0154
$\Delta \ln Y_t$	0.2679	6.0648	0.0001
$\Delta \ln Y_{t-1}$	0.1577	3.9242	0.0004
ΔDIR_t	0.1128	2.6551	0.0105
ΔDIR_{t-4}	0.1187	2.5742	0.0129
$\Delta \ln \pi_t$	-0.0094	-9.6799	0.0000
$\Delta \ln \pi_{t-3}$	-0.0028	-3.1831	0.0025
$\Delta \ln EER_{t-2}$	-0.0362	-1.7983	00779
$\Delta \ln EER_{t-3}$	-0.0275	-1.9764	0.0502
ΔFIR_{t-2}	-0.1533	-2.2660	0.0276
ΔFIR_{t-4}	-0.1637	-3.6433	0.0006
ECT_{t-1}	-0.0622	-5.2987	0.0002

Diagnostic Statistics:

Adj. R^2 =0.7433; F-statistic=17.5721 [0.000]; SSE = 0.0877; ARCH (4) = 1.4031 [0.7704]; BG = 0.5265 [0.3180]; JB [χ^2 (2)] = 0.5181 [0.9770]; and RESET = 1.3357 [0.7883].

Notes:

SSE: Sums of Squared Errors; ARCH: Engle's test for conditional heteroskedasticity;
BG: Breusch-Godfrey LM (4) test for serial correlation; JB: Jarque-Bera test for normality of residuals;
RESET: Ramsey's test for specification error. [Probability values are in the squared brackets].

4b: *Test for Structural Stability*

In this section, the central issue for empirical analysis is the stability of the parameters of the real *M2* money demand equation, which we reported in Table 2. It is now a standard practice to incorporate short-run dynamics in testing for stability of the long-run parameters of a money demand equation. To this end, we follow Bahmani-Oskooee and Shin (2002) and apply the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests developed by Brown

Figure 2: Plot of Cumulative Sum of Recursive Residuals

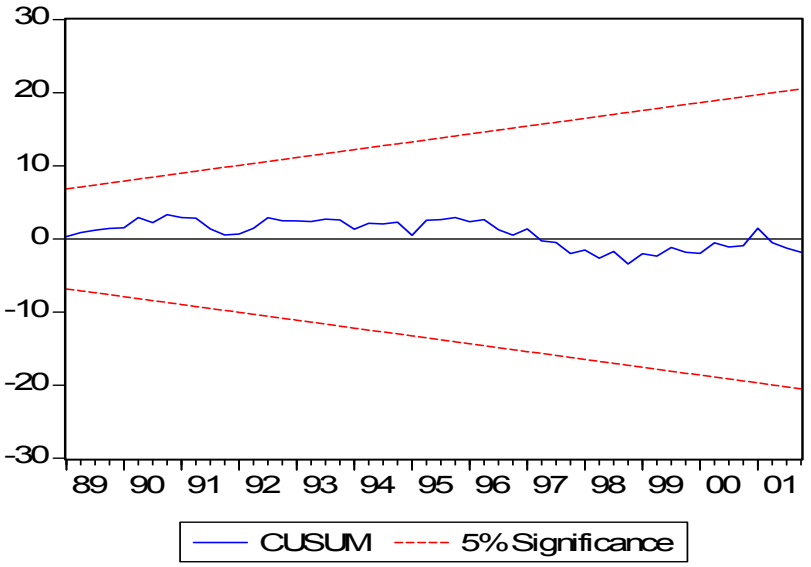
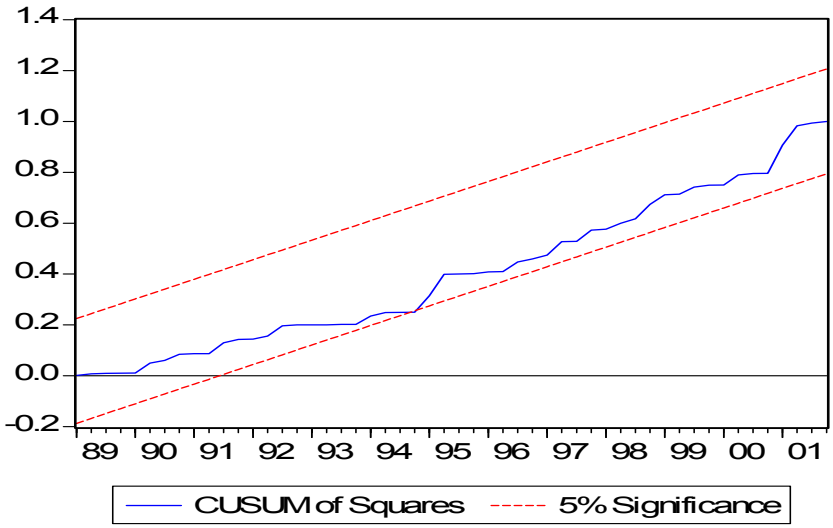


Figure 3: Plot of Cumulative Sum of Squares of Recursive Residuals



et al. (1975) to the residuals of equation (3). The CUSUM and CUSUMSQ test statistics are updated recursively and plotted against break points in the data. For stability of the short-run dynamics and the long-run parameters of the real broad money demand function, it is important that the CUSUM and CUSUMSQ statistics stay within the 5% critical bound (represented by two straight lines whose equations are detailed in Brown et al., 1975, Section 2.3). As we can see from Figures 2 and 3, neither the CUSUM nor CUSUMSQ plots cross the 5% critical lines, therefore, we can safely conclude that the estimated parameters for the short-dynamics and long-run of the real *M2* money demand function are stable. In other words, a stable real *M2* demand function exists over the entire sample period. These empirical results support the CBN in its choice of *M2* as an intermediate target for monetary policy.

4c*: Dynamic Specification of the Real Output Equation*

As the empirical results above indicate, the CBN made the right choice of an intermediate target, but this raises an important issue with respect to how this appropriate intermediate target impacted its objectives of sustained real output growth with single digit inflation rate over the entire period. Given the deviations we observed in Figure 1, therefore, our objective in this section is to examine the effects of the deviations of *M2*'s growth from target rates on real output growth and inflation rate. Economic theory suggests that when central banks are not committed to rules and are time-inconsistent with respect to monetary policy, or can be made to deviate from announced targets under pressure, there are losses that follow from such lack of commitment to the target rules. To begin, we measure the deviations of actual *M2* money growth from the target levels by employing the GARCH specification of the form:

$$InDTG_t = \lambda_0 + \lambda_1 InDTG_{t-1} + \lambda_2 D86_t + e_t, \qquad e_t \sim N(0, h_t) \tag{4}$$

$$h_t = \alpha + \theta e_{t-1}^2 + \gamma h_{t-1} + \eta D86_t + \mu_t \tag{5}$$

where *DTG* is the deviation from money target growth rates, μ_t is a white noise process with $E(\mu_t) = 0$, and *D86* is a dummy variable that we have included to capture the shift in monetary policy or the focus that commenced in 1986 following the adoption of SAP.

The conditional variance equation (5) is a function of three terms: the mean, α; the news about the variability from the previous period, measured as the lag of the squared residual from the mean equation, e_{t-1}^2 (the ARCH term); and the last period's forecast error variance, h_{t-1} (the GARCH term). The estimated results for equation (5) are reported in equation (5′) below:

$$\underset{}{h_t} = \underset{(0.0002)^*}{0.0015} + \underset{(0.1612)^*}{0.7438 e_{t-1}^2} + \underset{(0.1092)^*}{0.3921 h_{t-1}} + \underset{(0.0018)^*}{0.0048 D86_t} + \mu_t \tag{5′}.$$

R^2 = 0.304; *SER* = 0.156; *DW* = 2.118

The number in parentheses below the coefficients are the standard errors, R^2 is the coefficient of determination, *SER* is the standard error of the regression, and *DW* is the Durbin-Watson statistics. All coefficients are positive, but more importantly, they are statistically significant at the conventional level. The statistical significance of the lagged GARCH (h_{t-1}) term and $D86_t$ shows the presence of variability around target money growth since the adoption of SAP.

Before we proceeded to show the impact of deviations of actual real *M2* money supply growth from targets on real output growth and inflation rate, we re-examined the long-run cointegrating relationship which now includes *DTG* along with other macroeconomic variables. The results of the trace and maximum eigenvalue tests for cointegration reported in Table 4 show that a long-run relationship exists between *Y, DIR, π, EER, FIR*, and *DTG*. There is evidence of one cointegrating vector which suggests that an economic interpretation of the long-run real output function can be obtained by normalizing the estimates of the unconstrained cointegrating vector on real output growth. The sign on the coefficient on *DTG* is negative and statistically significant. This result suggests that the deviations of actual *M2* growth from target rates have adverse effects on real output growth. Based on the negative and statistically significant coefficient on *DTG,* one can draw the conclusion that the CBN contributed to Nigeria's economic quagmire since the adoption of SAP in 1986 because it accommodated excessive variability in actual *M2* growth rates in comparison to its annual target rates.

Table 4: Johansen Maximum Likelihood Cointegration Test Results
(*lnY*, *DIR*, *lnπ*, *ΔlnEER*, *FIR*, *DTG*)

Panel A: Maximum Eigenvalue and Trace Test for real output growth (*Y*) equation

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	Trace Statistic	5 Percent Critical Value
None	0.508	43.26*	40.08	93.64*	85.75
At most 1	0.389	30.13	33.88	64.38	69.82
At most 2	0.330	24.44	27.58	43.25	47.86
At most 3	0.184	12.37	21.13	25.81	29.79
At most 4	0.156	10.38	14.27	13.44	15.49
At most 5	0.049	3.06	3.84	3.06	3.84

Panel B: Normalized cointegrating coefficients of the real output growth (Y) equation

$$\ln Y = 6.981 - 0.072DIR + 0.169\ln\pi + 0.0694\Delta 1nEER - 0.912FIR - 0.629DTG$$
$$(3.182)* \quad (2.521)* \quad (5.434)* \quad (2.312)* \quad (7.607)*$$

To show the effects of these deviations on real output growth and inflation rate in Nigeria, we postulate a dynamic real output equation within a VECM of the form:

$$\Delta \ln Y_t = \varphi_0 + \sum_{i=1}^{n-1}\varphi_1\Delta InY_{t-i} + \sum_{i=0}^{n-1}\varphi_2\Delta DIR_{t-i} + \sum_{i=0}^{n-1}\varphi_3\Delta In\pi_{t-i} + \sum_{i=0}^{n-1}\varphi_4\Delta InEER_{t-i} + \sum_{i=0}^{n-1}\varphi_5\Delta FIR_{t-i} + \sum_{i=0}^{n-1}\varphi_6\Delta InDTG_{t-i} + \varphi_7 ECT_{t-1} + \eta_t \quad (6)$$

where the variables are as defined earlier. The results of this reduced short-run dynamics of real output growth and the necessary diagnostic tests are reported in Table 5. The sign of the coefficient on the error-correction term is expectedly negative and statistically significant. The coefficient on ECT_{t-1} term suggests that about three percent of the disequilibrium in real output growth is offset by short-run adjustment in each quarter. In addition, the coefficients of the lagged *DTG* terms are negative and statistically significant. This further lends credence to the results obtained from the normalized cointegrating coefficients reported in Table 4.

In our final analysis, we investigated the extent to which *DTG* affected macroeconomic outcomes. To accomplish this, we employed the forecast error variance decompositions to examine the effects of innovations from *DTG* on the two important objectives (real output growth, Y_t; and inflation rate, π_t) of the CBN. Here, our goal is to examine the proportions of the variance in real output growth and inflation rate that are explained by the innovations or shocks to *DTG*. If the innovations to *DTG* explain significant portions of the variance in Y_t and π_t , then we can conclude that the CBN contributed to the post-SAP economic malaise in Nigeria by not committing strongly to its policy rules. On the other hand, if the innovations to *DTG* cannot explain significant portions of the forecast error variance of real output growth

Table 5: Estimates of the Error Correction Model of Real Output Growth

Variable	Coefficient	t-statistics	t-Probability
Constant	-0.0704	-4.0667	0.0004
Δ *ln* Y_{t-1}	0.3164	3.6323	0.0007
Δ *ln* Y_{t-3}	0.6363	7.4397	0.0000
Δ DIR_t	0.0652	1.7125	0.0940
Δ DIR_{t-1}	0.0693	1.6770	0.1008
Δ DIR_{t-3}	0.1009	2.5065	0.0161
Δ *ln* π_t	0.0127	6.8800	0.0000
Δ *ln* π_{t-1}	0.0061	5.0163	0.0000
Δ *ln* π_{t-2}	0.0072	5.1133	0.0000
Δ *ln* EER_{t-1}	0.0531	2.7608	0.0084
Δ FIR_{t-2}	-0.2189	-2.3864	0.0215
Δ FIR_{t-3}	-0.1271	-1.9803	0.0468
Δ $lnDTG_{t-1}$	-0.0258	-3.3267	0.0018
Δ $lnDTG_{t-3}$	-0.0172	-1.9022	0.0639
ECT_{t-1}	-0.0381	-6.4402	0.0000

Diagnostic Statistics:

Adj. R^2 = 0.7085; F-statistic = 21.0396 [0.0000]; SSE = 0.0484; ARCH (4) = 1.7094 [0.7807]; BG = 0.7611 [0.4448]; JB [χ^2 (2)] = 0.5181 [0.7655]; RESET = 1.4921 [0.6826].

Notes:

SSE: Sums of Squared Errors; ARCH: Engle's test for conditional Heteroskedasticity; BG: Breusch-Godfrey LM (4) test for serial correlation; JB: Jarque-Bera test for normality of residuals; RESET: Ramsey's test for specification error. [Probability values are in the squared brackets].

and inflation rate, then one can view the deviations of *M2* from target growth rates as insignificant and therefore conclude that there are no adverse effects from CBN's failure to stick to target money growth.

In Table 6, we report the forecast error variance decompositions at 1, 2, 4, 6, 8, and 10 horizons in order to highlight the dynamics of the system. The variance decomposition of real output growth (Y_t) indicates that π_t accounts for 66.87% of the forecast error variance of real output in the first period of estimation

Table 6: Generalized Forecast Error Variance Decompositions of *Y*, π , and *DTG* at Various Horizons

		← percent of forecast variance explained by shocks to →					
Variance	Horizon	ΔlnY	ΔDIR	$\Delta ln\pi$	$\Delta lnEER$	ΔFIR	$\Delta lnDTG$
ΔY	1	20.07	0.22	66.87	1.61	0.21	11.01
	2	9.69	0.08	79.93	0.85	0.10	9.35
	4	6.25	1.75	80.50	3.15	0.05	8.30
	6	4.97	3.03	82.28	2.98	0.53	6.19
	8	4.07	4.29	82.80	3.31	0.91	4.62
	10	3.36	5.05	83.47	3.35	1.27	3.50
π	1	0.00	1.29	98.71	0.00	0.00	0.00
	2	1.65	1.09	96.15	0.46	0.02	0.61
	4	2.07	2.97	86.83	1.35	1.85	4.93
	6	2.95	2.45	78.84	1.37	5.03	9.31
	8	2.96	2.31	75.18	1.50	5.91	12.13
	10	3.38	2.19	72.23	1.44	6.67	14.09

and rises to 83.47% in the tenth period. On the one hand, the variance decomposition of Y_t indicates that 20.07% of the forecast error variance is explained by its own innovations in the first period and decreased gradually to 3.36% in the tenth period. On the other hand, innovations to *DTG* accounts for 11.01% of the forecast error variance of Y_t in the initial period and declines to 3.50% in the final period. Apart from the innovations to π_t , which dominate in explaining the forecast error variance of Y_t through all horizons and the first two horizons for Y_t where own innovations explained 20.07% and 9.69%; the innovations to *DTG* explain the forecast error variance of Y_t in the fourth, sixth, eighth, and tenth horizons more than the own innovations of Y_t (see Table 6). As expected, the forecast error variance of π_t is largely explained by its own innovations beginning with 98.71% in the first estimation period and gradually decreasing to 72.23% in the final period. In the initial estimation period, *DTG* has no impact in explaining the forecast error variance of π_t , but it picked up considerably beginning with 0.61% in the second year and rose to 4.93%, 9.31%, 12.13%, and 14.09% in the fourth, sixth, eighth, and tenth year, respectively. This finding, therefore, suggests a relatively strong long-run impact of *DTG* on inflation rate (π_t) in Nigeria. These results show that whenever actual *M2* growth rates deviate significantly from their prescribed target levels, this would have adverse effects on CBN's desired objectives of maintaining a stable price level and achieving a sustainable economic growth in Nigeria.

5: Summary and Conclusions

This paper examined the validity of the choice of *M2* as an intermediate target by modeling and tested for the stability of the broad money demand function in Nigeria during the structural adjustment period 1986:1-2001:4. In our empirical analysis, we employed Johansen maximum likelihood cointegration procedure to show that there is a long-run relationship between real broad money (*M2*), real income, domestic interest rate, inflation rate, foreign interest rate, and expected depreciation rate of the domestic currency. The statistical significance of the expected exchange rate in the money demand equation suggests that currency substitution exists in Nigeria. Also, by introducing foreign effects into the real money demand function, the results reveal that the Nigerian economy is susceptible to external shocks through capital mobility/flight. Despite all the structural changes that occurred during the period, the parameters of the real *M2* demand equation remained stable over the entire period of the analysis.

The stability of the broad money demand validates CBN's choice of *M2* as an intermediate target for monetary policy. However, it is important to note that the existence of currency substitution introduces a different monetary policy dynamics because it exposes the Nigerian economy to external and internal shocks. This is due to the fact that currency substitution exerts tremendous pressure on the exchange rate, and this may hinder the CBN's ability to assert control over money supply. Furthermore, this paper reveals that the CBN chose *M2* as the appropriate intermediate target for monetary policy during the SAP period, but it was not strongly committed to its annual growth targets. The inability to stick to targets resulted in severe deviations which impacted the real GDP growth and inflation rate adversely. Based on these findings, we conclude that the broad money (*M2*) as an intermediate target was the right choice; however, the monetary policy rules of the CBN exacerbate macroeconomic outcomes due to its inability to commit to target levels post-1986.

This study shows that a simple monetary policy rule can be effective in emerging market economies like Nigeria if the central bank commits to the rule-prescribed growth targets and minimize the deviations from target levels. For Nigeria, it is conceivable that the CBN might have succeeded in achieving its monetary policy objectives if it had not accommodated excessive monetary expansions, which allowed the actual *M2* growth rates to exceed the prescribed target levels during the period analyzed.

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