

**What Does the Central Bank of Nigeria Target?
An Analysis of Monetary Policy Reaction Function in Nigeria**

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**A Draft Final Report Presented at the Biannual Research Workshop of the African
Economic Research Consortium, Arusha Tanzania**

October 2007

Abstract

Current literature is not as much concerned about the relative efficiency of rules and discretion in monetary policymaking as much as it is on monetary policy reaction function. This is based on the understanding that even when monetary policy has no long run real effects, temporary instability and/or wrong policies have the potential of leading to loss in productivity – at least in the short run. Thus, over the last decade, models have been developed to explain the behavior of Central Banks in respect of what informs the formulation of monetary policy. Much of the work in this area has gone to determine the relative efficiency of simple vis-à-vis complex monetary policy rules, historical vis-à-vis idealistic rules, normative vis-à-vis positive rules, etc (Taylor 1999a). Of these, the Taylor rule has almost come to be accepted as a benchmark. The attraction to the rule lies in its simplicity, efficiency and insight in tracking historical monetary policy in the United States and some other developed countries. However, it is accepted in the literature that some of the peculiarities of developing countries make a rigid application of the Taylor rule improper (see Batini 2003b). In other words, the specific policy reaction function in each economy needs to be tracked. This is particularly so in Nigeria. With abnormally high differential between deposit and lending rates, high disparity between desired and actual inflation rates, the unsettled questions of fiscal dominance and exchange rate influence on monetary policy, the question is asked again, ‘what really do monetary policy makers in Nigeria react to? ... and how? To answer this, this paper specifies two simple models – the first (model 1) is based on the historical processes of the Central Bank of Nigeria while the second (model 2) follows more closely the Taylor rule. Model 2 also incorporates target inflation as opposed to actual inflation. The intention is to compare outcomes of the two models with the aim of providing a description of the Central Bank of Nigeria reaction function as well as prescribing realistic reaction functions that incorporate international best practices and appreciates local peculiarities. The results confirm the primacy of inflation in monetary policy reaction in Nigeria consistent with recommendations in the literature. Ex-ante pronounced policy targets of the Central Bank however differ from ex-post outcomes. Interest rate smoothing behaviour could not be confirmed leaving indications that the Central Bank has not been critically concerned with costs associated with interest rate variability or that such costs have been swamped by other (probably heavier) challenges of policy. Finally, government influence on monetary policy (particularly the thorny issue of fiscal dominance) could not be confirmed nor could we find any indications of significant impact of oil prices on policy framework.

I. Introduction – The Problem

Debates over targets and structure of monetary policies are as old as the economic systems that engender them. Thoughts have varied on the framework for conducting monetary policy (the rules versus discretion debate), structure of institutions supporting them, nature of policy instruments as well as the stability or otherwise of the target variables. For several decades up to the 1990s, many countries adopted base-money targeting and fixed their exchange rates. However, questions about stability of money demand, multiplier and velocity have tended to force countries to rethink monetary policy frameworks. Such rethinking led to the emergence of inflation targeting as a framework for monetary policy. The framework has won many ‘converts’ since its introduction in the early 1990s.

Monetary policy outcomes vary greatly depending on both the target and instrument in use. Conventional wisdom indicates that constraints are imposed on results depending on the number of targets and available instruments. In a typical economy, the effectiveness of monetary policy as a nominal anchor depends on what is targeted and how, as well as what support parameters are available to aid the conduct of such policy. Taylor (2000) showed that the broad option here is between exchange rate targeting and inflation targeting (explicitly targeting domestic price level).

In adopting inflation targeting regime, the choice of instrument matters in the final outcome. Interest rate and base money targeting are two major instruments available to a country choosing to target inflation. Interest rate targets are often perceived to be more transparent and provide preferred options in cases of proven high volatility of velocity of money. On the other hand, short term interest rate can be misleading in time of crisis (particularly in times of deflation or hyper inflation). For some countries too, there is high correlation between money growth and inflation, in which case, targeting base money becomes an effective means of tackling such money-driven inflation (Batini 2003 a).

The major policy instrument for monetary policy in Nigeria is the minimum rediscount rate (MRR) of the Central Bank. While both interest and inflation rates are high, a worrisome problem in observed response to these macroeconomic imbalances is lack of policy consistency and coherence. This could be on account of inadequate information on the nature and size of impact of the MRR on key macroeconomic aggregates. Specifically, the Central Bank, with massive support from the Presidency made a series of efforts to reduce this ‘high’ rate. Thus, between 2000 and 2004, the MRR has been reduced by more than 400 basis points to less than 16%, ostensibly in response to public pressure. However, much of this reduction is not based on any known formulae or systematic understanding of the relationship between MRR (the key policy instrument) and other monetary or macroeconomic aggregates. Besides, different segments of the organized private sector have different proposals as to how low interest rates should be. These also, are not based on any known estimates of the size of the reaction of targets macroeconomic variables to changes in the minimum rediscount rate. The consequence over time has been large variations between monetary targets and outcomes as shown in table 1 in the appendix.

But monetary policy is not supposed to be conducted on the basis of opinion polls. Rather, policymakers are expected to have clear and quantifiable reaction functions with regards to the

inter-temporal instrument variation. Such reaction functions identify a set of variables that, combined with a monetary policy rule, offer a good approximation to the process through which interest rates are determined (Torres, 2002). Indeed, the debate in policymaking is not only about the broad instrument choice but more so about the inter-temporal instrument variation. Having chosen the interest rate as a key instrument of monetary policy in a liberalized regime, what determines how policymakers vary the instrument over time? For example, the monetary policy reaction function could set the MRR to adjust to close any observed disequilibrium relationship between the target and actual inflation rate, exchange rate, or output/employment. Surprisingly, the nature of the monetary policy reaction function with regard to the MRR is not known; nor are precise parameters of such reaction function. So, when the Central Bank adjusts the MRR, by how much does it expect the major macroeconomic aggregates to move?

The goal of this paper is therefore to model Central Bank of Nigeria monetary policy reaction function. In particular, the paper aims to estimate alternative reaction functions with a view to informing on the size of the parameters and effectiveness of such functions; and to illustrate the methodological issues involved in the specification and estimation of policy reaction functions especially in line with recent developments in monetary policy reaction function formulation and estimation.

Specifically, the paper seeks to:

- a) Specify and estimate a model of monetary policy reaction in Nigeria
- b) Highlight theoretical and methodological developments in the literature in respect of monetary policy reaction function formulation and estimation and use the benchmark in the literature to assess the performance of the Nigerian reaction function

The paper consists of six sections. The next section reviews the literature on monetary policy reaction function while section III evaluates the trend in monetary policy in Nigeria. Equations of the model are specified and discussed in IV, while sections V and VI discuss the estimation results and preliminary policy implications respectively.

II. The Literature

It seems axiomatic that Central banks should focus on the control of price level in an economy, but that is only as far as theoretical conclusions go. Despite the expansive literature on what the Central Bank should target, there are no clear cut conclusions on the focus of policy. This is for two reasons. First, the literature is still inconclusive on the trade off between inflation and output (the standard Philips curve). Even the most dogmatic inflation targeting framework still provides for output growth. Despite the recommendations and the ‘near agreement’ that Central Banks should focus explicitly on maintaining price stability, the inclusion of output gap still indicates (somewhat more than just implicit) mandate to output growth. Second, the practice could be quite different from the theory. Often, even the most ‘independent’ Central Banks get mired in the broad policy environment and so get involved in growth policy design. The Central Bank provides technical assistance to other institutions and collaborates with such institutions to achieve improved growth. Central Bank reports often show supports to real sector development programmes. The scope of such programmes depends on the configuration of power and politics as well as the collaboration of other institutions that ought to spearhead such policies.

The basic framework for the perceived trade off between inflation and output growth started with the Phillips (1958) curve which established an empirical negative relationship between inflation rate and level of employment. At the time of its publication, Phillips did not intend his curve to be a policy tool, but Samuelson and Solow (1960) later serialized the policy implications of the relationship establishing it as one. The reasoning behind the trade-off seemed to complement the classical Keynesian structure that prevailed at the time and so was widely accepted. Seven years later, Friedman and Phelps tried to prove that Phillips curve showed a short term relationship and that in the long term, there is a natural rate of unemployment which can combine with any rate of inflation. They claimed that stagflation illustrates this stance. In no time, this view also became widely accepted. Taylor came into the picture in 1979 incorporating rational expectations in a simple general equilibrium model of the US economy. Taylor concluded that “there is no long-run tradeoff between the level of output and the level of inflation in the model—the Phillips curve is vertical in the long run. However, there is a long run tradeoff between fluctuations in output and fluctuations in inflation. In other words, there is a ‘second order’ Phillips curve which is not vertical in the long run”(Taylor, 1979). His conclusion also kicked off a new perspective in the relationship between inflation and output. He followed up on this with his work in 1993 on inflation targeting which has formed the core of analysis on inflation and output. The central conclusion of this latter work is that the Central Bank seeks to minimize a loss function that is a weighted average of two terms: one based on deviations from the inflation target and the other based on deviations from the output target. According to Friedman, the tradeoff in Taylor curve is not an inference from experience; rather an implication of a policy choice. A zero weight on the output term reduces the bank’s objective to inflation alone while a zero weight on the inflation term reduces the bank’s objectives to output alone. As the weight varies between these two extremes the bank’s objective shifts and corresponding to each weight is a policy rule that is optimal for the Taylor economic model. This policy rule will in turn imply for that model a variance of inflation and a variance of output.

For many years, under the reign of monetarist perspectives to macroeconomic management led by Friedman (1959)¹, the thrust of monetary policy in many countries has been the control of inflation. Indeed, the success of monetary policies in different economies is often measured in terms of the ability of such policies to curtail inflation. The traditional literature on monetary policy reaction function has therefore been defined in terms of inflation and output gap². Therefore, the systematic component of monetary policy, with inflation as the major policy goal and the rediscount rate as the instrument, is the essence of the specification of a reaction function (Zha, 1997:30).

But it is not clear that there is a simple (direct) linkage between the rediscount rate and broad money or between broad money and domestic price level in the very short run. Price level for

¹ Friedman (1959) showed that changes in money supply can cause changes not only in nominal variables but sometimes too in real ones like output and unemployment. The main instrument of Friedman’s exposition is the quantity theory of money which viewed real balances as an asset with money stock, bonds and physical assets being alternative forms of holding wealth thus making its demand a function of the yield on other assets.

² This leaning was influenced by two factors. First, the experiences of many developed countries especially in the late 1980s and 1990s raised serious questions on the authenticity of the trade off between inflation and output as contained in the Philip’s curve proposition. Secondly, there seems to be some measure of consensus in the literature that where monetary policy matters, it does so in the short run. This has left the control of employment principally within the purview of fiscal policy

example is affected by a number of variables like broad money, output and even its own past values and many of these variables change simultaneously. Over time though, a somewhat consistent form of the relationship between rediscount rate of central banks and other macroeconomic variables has been in use as follows:

$$R = \beta_1 M + \beta_2 R + \beta_3 X + eM_s$$

Where R is the funds (rediscount rate), M is a monetary indicator, R is the Treasury Bill rate (a summary representation of other interest rates in the economy), X is a set of other variables that are used to predict fluctuations in the general price level and eM_s is money supply shock. Indeed, the dynamic relationship reflected in the systematic component of the equation above is complicated and the trade off between output and inflation for example could be substantial and uncertain especially in the short run. As such policies could falter in the short run from exactly reflecting the relationship.

But do we really need a rule to run monetary policy or should policymakers be left to their discretion? This has been the subject of intense debate over the decades. The possibility of faltering in policymaking and organizing monetary policy around rigid rules is the major anchor for arguments in favour of the use of discretion. It might not be entirely wrong to see the rules versus discretion debate to be one between practitioners on the one hand and academics on the other. Central Bankers seem to be perpetually afraid of leaving monetary policy to some pre-determined formula. In the words of McCallum and Nelson (2000: 274),

When central bankers object to the use of a policy rule, they typically refer to alleged constraints on policy flexibility. Evidently, the conception that they have in mind—at least in many cases—is a regime in which the central bank “has turned policy decisions over to a clerk armed with a simple formula and a hand calculator” or possibly “to a team of PhD economists armed with computers and Matlab programs

On the other hand, advocates of rules cite arbitrariness, time-inconsistency of political processes, among others for favouring rule-based monetary policy regimes. In the words of Christ (1953) quoted in Hutzler (2004)

Debates about which of the alternative regimes is to be preferred must take place. But, prior to this discussion, we should try to attain consensus on the need for some alternative regimes that will embody greater predictability than the unconstrained monetary authority that exists. The familiar analogy is with traffic chaos that would exist if there were no rules. The first requirement is that there be rules of the road. Whether or not these rules require driving on the left or the right is of secondary importance to the requirement that there be a rule

Since 1993, the literature on monetary policy reaction has been largely influenced by the work of John Taylor. Taylor's (1993) monetary policy rule specifies the Federal Reserve as aiming to close a specified output gap and a (pre-determined) inflation target. It is a monetary policy rule that sets the Central Bank as particularly concerned with the rate of domestic inflation. In his rule, he showed that the Federal funds rate is determined as a function of the economy's real rate

of interest at a zero rate of inflation plus target inflation, deviation of inflation from its target rate, and deviations of output from its desired level (termed the output gap). The rule is summarized thus

$$i_t = \bar{r} + \Pi_{t-1} + \beta_1(\Pi_{t-1} - \Pi^T) + \beta_2(y_{t-1} - \tilde{y}_{t-1})$$

Where i_t is federal fund rate at time t , \bar{r} is real rate of interest at a zero rate of inflation, Π_{t-1} is average inflation rate over the last four quarters, Π^T is target inflation, Y_{t-1} is the real output in previous period and \tilde{Y}_{t-1} is potential output. Taylor specifically defined his rule for the US economy as a weighted average of inflation and output gap in a simple relationship given as follows

$$R_t = (r^* + \beta^*) + 1.5(\beta_{4pt} - \beta^*) + 0.5 y \sim t$$

Where R_t is the nominal interest rate, β_{4pt} is the annual inflation rate (the fourth difference of the log price level pt), and $y \sim t$ is the output gap (defined as $y \sim t = y_t - \tilde{y}_t$, where y_t is log real GDP and \tilde{y}_t its potential level). β^* is the target for annual inflation, and r^* is the steady-state value of the real interest rate (Nelson 2000). In implementation, the rule involves comparing the real rate with its long run equilibrium value and adjusting the rate to reflect deviations from its equilibrium value. In reality too, the coefficients 1.5 and 0.5 are simply economy-specific approximations of the United States Federal Funds rate and is not a generalization of a strict relationship between Central Bank discount rate and its determinants (indeed, empirical studies have consistently supported higher values of one or both feedback coefficients). From a policy standpoint though, it is desirable to have a (long-run) coefficient on inflation in the rule exceeding one. This ensures that the Taylor rule delivers inflation equal to its target value (β^*) on average (Nelson 2000; Taylor 1999b). Taylor's rule is a characterization of the processes of systematic policymaking that was both descriptive and prescriptive based on what has worked elsewhere and not just an ideal based on abstract model (Hetzel 2000).

Some research has also been conducted to ascertain the timing of actions by monetary authorities that would help maintain effective controls on inflation. Taylor believes the superior inflation performance of the 1980s in the US is attributable to effective reactionary response from the Federal Open Market Committee (FOMC). But Orphanides (2001) posits that it is not principally what the monetary policy committee does with observed inflation but its preemptory action on expected inflation that makes the difference. Orphanides' model is part of a larger family of models involving forward looking specification of policy reaction by the FOMC. According to his model, it is not weak policy response that called forth observed inflation of the past but activist policies that may have proved overambitious. Mehra (1999) also found that part of the great omission of conventional Taylor rule models is the part played by activist policies that 'anticipate' reaction and incorporate feedback from agents to the FOMC. His model therefore incorporated movements in long term inflationary expectations as evidenced by the behaviour of bond rate, which following Goodfriend (1993), he used to proxy reactionary expectations.

Whether they be backward-looking models like Ball (1999), Svensson (1997), and Rudebusch and Svensson (1997) or forward looking models in the class of Clarida et al (2000), most

reaction models simply extend the Taylor rule and predict movements in the policy rate of interest as a function of macroeconomic variables without incorporating feedback from the latter. Hetzel (2000) argues that this is only based on the observed correlations between the funds rate and economic activity and has little information content on what really defines the behaviour of the funds rate itself or reaction function of the FOMC. In view of the joint behaviour of the public and the feedback to the monetary committee (Bernanke and Blinder 1992), Hetzel (2000) proposes a rule that allows for a specification of the structural form of the relationship between the FOMC and the public which distills the behaviour of the public from the reaction of the FOMC. More so, the modeling of inflation as exogenous to monetary policy actions raises questions on the reality and coverage of the models. For instance, inflation for the most part is a function of monetary policy. Therefore portraying the Central Bank as primarily concerned with fighting inflation and not being responsible for inflation itself, though gratifying to monetary authorities may be a skewed representation of actual monetary policy behaviour.

An interesting finding of forward and backward looking specifications of the Taylor rule is the high significance of the coefficient of the lag of the dependent variable. This has been interpreted to mean an interest rate 'smoothing' reaction of monetary authorities. Indeed, investigating the interest rate smoothing behaviour of Central Banks now form the bulk of a growing literature and expectedly, arguments deepen as to the nature of such smoothing behaviour if at all it exists. Ellis and Lowe (1997) examined the effects of interest rate smoothing on the Taylor rule in Australia. To do so, they introduce a cost for interest rate changes to the Central Bank's loss function. When the cost is varied, it was found out that moderate degrees of smoothing do not often increase the variability of inflation and output in any appreciable degree. This they explain as being as a result of monetary policy transmission lags which increase the impact of previous interest rates on current output. Smoothing in this sense leads to longer cycles in output and inflation. However, while Ellis and Lowe (1997) model is backward-looking, Clarida et al (1998) present a forward-looking model to assess the smoothing behaviour of the German, United States and Japanese Central Banks. The results showed that the Central Banks apparently raised the anchor rates in reaction to a rise in expected inflation and lowered the rates when output is below a target range.

Closely tied to discussions on reaction functions and their specification are assumptions about the money demand function of a country. The literature on money demand in Nigeria is long and vast. The long string of research, however, shows that money demand in Nigeria has been fairly stable over time. Ajayi (1977) for example examined the period 1960 through 1970 and finds that real income and interest rate have significant impact on M2. This, in his view, was an indication that money demand function is stable for the study period. His work relied on the OLS methodology. On the other hand, Darrat (1986) explored the demand for money in three OPEC members namely Libya, Nigeria and Saudi Arabia. Applying the Chow, Gupta and Farley and Hinich stability tests he concludes that the money demand function is stable in the three countries. Anoruo (2002) examined the stability of money demand function in the Structural Adjustment (SAP) period. Also using the Johansen and Juselius cointegration test and other stability test procedures (the CUSUM and CUSUMQ tests), he found that M2 demand function in Nigeria was stable for the period. In his view, this implies that M2 is a viable monetary policy tool and can be used to stimulate economic activity in Nigeria. Arize and Lott (1985) also examined money demand in Nigeria. They find that real income and expected inflation are

important determinants of money demand, explaining over 80% of variation in real cash balance in Nigeria. They show that given low per capita income of the country, permanent income and measure income are largely the same. In addition, given the near-exogenous determination of major prices (particularly oil prices), monetary authorities in the country should be more desirous of following the constant growth rate rule as international inflation can be easily transmitted to domestic prices. Nwaobi (2002) using data from 1960 through 1995 examines the stability of the demand for money in Nigeria. With a model specifying a vector valued autoregressive process (VAR) and the Johansen co-integration framework, he finds that money supply, real GDP, inflation and interest rate are co-integrated. This suggests that the money demand function is stable. In addition, evidence gathered from his non-nested tests suggests that income is the more appropriate scale variable in the estimation of money demand function in Nigeria. Fielding (1994) employs quarterly data of four African countries (Nigeria, Cameroon, Kenya and Cote d'Ivoire) to construct money demand functions. He finds that money demand depends not only on income, inflation and interest rates, but also inversely on the variability of inflation and interest rates. The central policy implication of this finding is that calculations of the seignorage-maximizing rate of inflation which ignores the variability effect of inflation and interest rates will overestimate the optimal rate of inflation given that high inflation tends to be associated with highly variable inflation. The estimated functions were quite heterogeneous though and so while he recommends membership of monetary unions for higher stability, he warns against the four countries being members of the same monetary union.

III. Monetary Policy in Nigeria

The responsibility for monetary policy formulation rests with the Central Bank of Nigeria (CBN). Monetary policy objective is couched in terms of maintaining price stability and promoting non-inflationary growth. The primary means adopted to achieve this objective is to set aggregate money supply targets and to rely on the open market operations (OMO) and other policy instruments to achieve the target.

Monetary policy in Nigeria has relied more on indirect transmission mechanisms. Over time, the practice is to target the monetary base. However, the practice of targeting base money is based on the assumption that there is a stable money demand function in the economy. The minimum rediscount rate is central to monetary policymaking and analysis. This reliance on indirect transmission processes anchored on instruments which exact impact are not known makes monetary policymaking in Nigeria a very challenging responsibility. A resultant of this has been large observed discrepancies between policy targets and outcomes over time (as shown in appendix table 1). Sometimes, it is difficult to relate targets to outcomes in much meaningful ways. The magnitude and persistence of the variations are quite high. For example, target growth of M1 and M2 were overshoot by 121% and 554% respectively in 2001 while target reserves were overshoot by 792% in 2000. The Central Bank regularly blames this on fiscal dominance, but it needs to be empirically proven that even the nature of monetary policy is not in itself a factor in this anomaly.

The fiscal stance of the Central government is particularly very important in understanding and analyzing monetary policy in the country. With a provision for a financing of one-eighth of all central government fiscal deficits by the monetary authorities (often through ways and means), concerns about fiscal dominance often dominate discussions about monetary policy making.

Indeed, fiscal dominance is often blamed for much of the poor performance of monetary aggregates. Besides, the provision of deficit financing, fiscal stance affects monetary policy also through its unbridled borrowing from the commercial banking system. This way, the Central Bank perpetually remains a fire-fighting agency in charge of mopping up excess liquidity created by fiscal authorities. It also probably contributes to the short term nature of monetary policy focus³.

Following liberalization of the financial sector, interest rate became market-determined and soon soared above repression-regime values. Despite high inflation rates, real interest rate as at 2000 was over 20%. The spread of lending and deposit rates also constitutes a disincentive to effective financial intermediation. Part of the factors identified by the Central Bank as being responsible for this is the oligopolistic nature of the banking industry in Nigeria⁴. More worrisome however is the high premium placed on foreign exchange transactions which is in turn a function of the distorted incentive system and breakdown of traditional control mechanism in the industry. The persistent high interest rate reduces returns on investment in the real sector and perpetuates trading in financial instruments.

Policy direction at the Central Bank of Nigeria has continued to present a mix of attention between inflation management and the maximization of output growth. As part of its programmes to shore up output growth, the Central Bank of Nigeria manages a number of programmes aimed at facilitating credit and resource flows to areas of the real sector that it considers critical. The rationale given by the Bank is that part of its mandates is not just the design and management of monetary policy but also involvement in development programmes that ultimately yield growth of output. Importantly, it instituted the Agricultural Credit Guarantee Scheme Fund (ACGSF) with authorized called-up share capital standing at N3 billion (about US\$24 million). Beginning at the inception of the programme in 1978 to June 2005, a total of 403,886 loans valued at N7.9 billion (about US\$63.2 million) have been guaranteed, while a total of 293, 141 loans, valued N5.3 billion (about US\$42.4 million) had been fully repaid, representing a repayment rate of 72.6%. The Bank also has an interest drawback programme for banks lending to the real sector. The Bank also maintains the small and medium enterprise equity investment scheme (SMEEIS). The new SMEEIS guideline developed in March 2005 expanded the scope of the scheme to include non-industrial enterprises. As at end-June 2005, the total amount set aside by eighty three (83) banks under SMEEIS was N31.0 billion. The cumulative investment at end June 2005 was N10.3 billion in 192 projects by 83 banks. The Central Bank of Nigeria also started a micro finance scheme with the aim of encouraging the start up of micro finance institutions.

In 2005 also, the Central Bank launched a new monetary policy framework. The policy kicked off from a point of strength as the Bank achieved a greater proportion of its targets for the 2004 fiscal year for the first time. The objectives of the policy include continued drive to achieve

³ Monetary policy focus of the Central Bank became medium term in outlook for the first time in 2002. Before then, policy time horizon hardly (if ever) exceeded one year (Nnanna 2002).

⁴ By end 2001, the financial sector in Nigeria consisted of 90 Deposit Money Banks, 747 Community Banks, 6 Development Finance Institutions, 1 Stock Exchange, 1 Commodity Exchange, 5 Discount Houses, 74 Primary Mortgage Institutions, 98 Finance Companies, 118 Insurance Companies and 80 Bureaux de Change. However, only 10 banks control about 53% of total deposits, 46.5% of total credits and 50.8% of total assets in the industry.

lower (single digit) inflation rate, gradual reduction in the cost of borrowing, particularly for private sector investors by reducing interest rates, maintenance of monetary stability and sustaining exchange rate stability. The thrusts of the policy include commitment to exchange rate stability through commitment to a 3% band with the US Dollar, maintenance of positive real interest rates while also minimizing the spreads in the term structure of rates, and ensuring lower cost of capital for investors and consolidation of the banking system. Others are continued institutional reform of the CBN to play more challenging roles in the economy, quarterly review of the MRR, reform of the Payments system, setting ways and means advances to Government strictly to Zero and the gradual withdrawal and re-injection of public sector deposits with commercial banks for liquidity management (CBN 2005)

On the 28th of November, 2006, the Monetary Policy Committee of the Central Bank adopted a new monetary policy framework that took effect from December 11, 2006. The framework introduced a new Monetary Policy Rate (MPR) to replace the Minimum Rediscount Rate (MRR). The MPR will determine the lower and upper band of the CBN standing facility and is expected to have the capability of acting as the nominal anchor for other rates. It is also expected to discontinue outright rediscounting of bills in the CBN to encourage trading among market operators; ensure the full deployment of information technology infrastructure for the effective implementation of the new framework as a follow up to the banking consolidation. The Monetary Policy Committee would meet every other month to review developments in the economy. The new framework became necessary as the MRR has not been sufficiently responsive to CBN's policy initiatives, especially in tackling the problem of excess liquidity in the system. The new monetary policy framework, which hinges on an interest rate corridor, provides for the CBN lending facility as well as the acceptance of overnight deposit from operators at specified rates. Under the new initiative, the CBN discount window could be accessed by market operators (Discount Houses and Deposit Money Banks), that are in need of funds to meet liquidity shortages and those with excess liquidity could deposit the funds overnight. The utilization of the standing facility is expected to bring about orderly market operations in the banking system by ensuring that interest rate volatility is reduced to the barest minimum and stability in market rates could be guaranteed. Potential challenges to the new system are expected to come from defining the policy setting rules (the response function), the frequency of changes for the policy rate, the significance of inflation rate in determining the policy rate and the problem of price, credit and operational risks. There is also the continual challenge of poor sensitization of operators and other stakeholders as well as regular training for implementers.

IV. The Model

1. A Descriptive Representation of CBN Policy Reaction

Monetary policy management in Nigeria has historically followed base money targeting framework (see CBN 2002, Nnanna 2002 among others). Such monetary policymaking relies on targeting one or two definitions of money and then adjusting the key monetary instruments to meet the target broad money. The framework assumes a stable money demand function, which simplified specification is as given as

$$M_t = P_t + kY_t - \eta i_t + v_t \quad (1)$$

Where M_t is the money supply (as defined at any particular time t), Y_t is t -period aggregate income, i_t is the interest rate at time t , and v_t is a white noise error term. If however, this equation is rewritten to endogenize interest rate and normalize base money impact on interest rate to unity, the above function becomes

$$i_t = \frac{P_t}{\eta} - \frac{M_t}{\eta} + \frac{k}{\eta}(Y_t) + v_t \quad (2)$$

Equation 2 is same as equation 1 except that endogenizing interest rate implies dividing all variables with the coefficient of interest rate η . In that case, interest rate becomes the target variable while trends in money supply and income determine its value. The coefficient, k/n could be thought of as the feedback indicator of the upward pressure on the interest rate given output expansion.

Tracking the history of monetary policy formulation in Nigeria will be incomplete without reference to the delineation of regime periods. So far, two policy regime shifts could be noted; the pre- and post-liberalization regimes. However, the results obtained from tracking interest rate reaction function under the pre-liberalization (or command) regime may not be very informative. In the literature, a common practice is to capture such regimes using dummy variables after testing for structural shifts⁵. However, the approach here is rather to assume that given that policy interest rates were kept low and almost constant, and that many of the policy instruments and outcomes were literally manipulated by executive fiat in the pre-SAP era, tracking post-liberalization monetary policy behaviour may be more informative. As such, the study will be concerned with post-liberalization reaction function of the Central Bank. In particular, attention will be focused on the period of the new civilian regime between 1999 and 2005.

Following Flores et al (2000), it is assumed that interest rates are adjusted to defend exchange rate. This is consistent with revealed goals of monetary policy in Nigeria. According to Nnanna (2002), interest rate was high for the greater part of sample period and beginning immediately from the financial liberalization. The Minimum rediscount rate was used to defend a number of other macroeconomic variables. The overvalued exchange rate was sustained by high interest rates. Thus, 'ensuring exchange rate stability' implied for the greater part, manipulating monetary instruments to keep the exchange rate at pre-determined values. Post-liberalization, reserves serve two purposes: they are indicators of movements in the balance of payments and they also are used to stabilize the exchange rate. Thus, the inclusion of reserves captures adjustments made to ensure favourable balance of payments.

Theoretically and given the history of (at least partial) exchange rate targeting in Nigeria, the deviation of exchange rate from target ($e - e^*$), is an important target of monetary policy. But the idea of a quantified exchange rate target is not very clearly specified in monetary policy documents in Nigeria. While the exchange rate may be targeted in practice, it is not explicitly

⁵ In the Nigerian case, the case of structural shift in 1986 is taken as given in the literature given that the introduction of structural adjustment policy and the consequent liberalization of the monetary sector provided a major departure from the structure of monetary policy pre-1986

declared in published policy documents of the Central Bank. Therefore, modeling exchange rate behavior could be a bit tricky. The parallel exchange rate premium could be an apt variable for tracking changes in exchange rate being a particularly pervasive indicator of distortion. The only snag is that while the size of the premium has been large over the years, the theoretical implication of including it in a model is not very clear except to assume that policymakers are interested in reducing its size as an indicator of distortion in the economy. Arguably and given the peculiarity of the Nigerian monetary climate, the parallel market premium might be more useful to experiment with as it could be more easily captured than the differential of exchange rate from targets. Equation 2 is therefore extended to include the impact of foreign exchange premium and foreign reserves.

$$i_t = \frac{P_t}{n} - \frac{M_t}{n} + \frac{k}{n}(Y_t) + \alpha PREM + \beta \log\left(\frac{RES_t}{RES^*_t}\right) \quad (3)$$

$$\text{Where } PREM_t = \left[\left\{ \frac{(off_e - par_e)}{par_e} \right\} * 100 \right]$$

Where i_t is the policy interest rate (in this case the minimum rediscount rate – MRR), P_t is the price level, M_t is broad money supply, $PREM_t$ is the premium of the parallel market exchange rate and RES_t is foreign exchange reserves.

$$i_t = \frac{P_t}{n} - \frac{M_t}{n} + \frac{k}{n}(Y_t) + \alpha PREM + \beta \log\left(\frac{RES_t}{RES^*_t}\right) + \mu_t \quad (4)$$

While output growth is one of the broad objectives of the Central Bank monetary policy, instrument variation with respect to output is not properly defined and as such, it often remains no more than an implicit target variable. Besides, this research shall use high frequency (quarterly or monthly) data and output data exist only in annual series. It is feared that interpolation at this stage may introduce some form of systematization of the data and which may affect the results obtained. Bleaney and Lisenda (2001) recommend the use of private sector credit growth or the share of credit to the private sector in total credit in the economy. But this needs not be the only reason for the use of credit to the private sector. As part of its developmental role, the Central Bank of Nigeria supports the growth of the private sector and engages in a number of activities aimed at enhancing growth and development. These go beyond the setting of monetary policy rates and extend to providing credit (through specialized banks and special interest rates) for target sectors of the economy. The Central Bank continuously works to increase private sector share of total credit as well as minimize constraints to its access to such credit. Under the current reforms in the country and as part of its developmental responsibilities, the Central Bank works with other agencies at repositioning the private sector as the engine of growth. This partly implies paying attention to the volume and share of private sector credit. Neither much of these responsibilities nor their impacts can be completely captured through the use of quantitative indicators. But outcomes in the form of access to credit by the private sector are likely informative indicators of their success. So output is dropped from the above equation and growth of credit to the private sector is used.

A critical part of the economy that needs to be captured is government. The continual reference to fiscal dominance portrays very active role of government in setting monetary policy directions and outcomes – whether proactively or passively. Given a weak tax system and the oil-based nature of the Nigerian economy, prominent influences on and indicators of government activity include oil prices and the consequent income, as well as government expenditure. Among these three, it was not possible to lay hands on monthly government income or expenditure. While income data were agglomerated for some years, expenditure data were the more difficult to get. As such, capturing government impact is limited to the use of oil prices, which is considered somewhat indirect though. Also, monetary policy no matter the targeting framework is more concerned with the rate of growth of (or changes in) the price level and not really the level itself. Effectively then, price level is replaced by inflation rate while growth of credit to the private and public sectors are brought into the equation and output dropped. Every other variable remains the same as follows:

$$i_t = \lambda\pi_t + \eta CPG + \alpha PREM + \beta \log\left(\frac{RES_t}{RES^*_t}\right) + \delta(CGG)_t + \mu_t \quad (5)$$

Where π is the inflation rate and CPG is the share of private credit in total credit. For target reserves, it is observed that the Central Bank of Nigeria does not explicitly target reserves in its monetary policy. However, there is both the West African Monetary Zone (WAMZ) and IMF target protocols to which the country is signatory. This is given as a minimum of six months imports cover for the former and three months imports cover for the latter. Operationally, the WAMZ protocol reflects reserves targeting in Nigeria more than the IMF specification⁶. As such, this work takes the WAMZ target as the target for use in the work.

2. An Alternate Model of Central Bank Reaction

The previous section gave a summary view of a model based on the expressed goals and targets of the Central Bank. Specification of prescriptive monetary policy reaction models, on the other hand, goes beyond merely tracking history to using outcomes to judge history. This is done by incorporating optimality rules, implications of commitments in monetary policy reaction, non-linear responses in macroeconomic variables, etc (Evans and Honkapohja 2003, Moessner and Gravelle 2001; Cook et al 1997). However, reasoning with Ndekwu (1997:31), part of the view held in this analysis is that targeting monetary aggregates contributes to the continual missing of targets by monetary authorities. As such, while the previous section attempts to track historical monetary policy using conventional targeting framework, there may also be need to compare this with the outcome from a contemporaneous model of inflation targeting given historical data. As such, this section presents a model of an open economy with inflation targeting as the monetary policy framework, using basic Taylor rule. It begins with a Central Bank loss function that minimizes the difference between desired and actual inflation as well as between desired and actual output. The specification consists of a standard IS curve (relating output gap to real interest rate), a Philips curve (relating inflation to the output gap) and an interest rate response function. The output gap, xt , is the percentage deviation of real GDP from a trend line measuring potential output as shown in the relationships below.

⁶ Indeed, the Central bank starts showing the red alert whenever reserves get to as low as seven months of imports cover.

$$x_t = -(i_t - \pi_t - r) + u_t \quad (6)$$

$$\pi_t = \pi_{t,1} + \lambda x_{t,1} + e_t \quad (7)$$

$$i_t = g_0 + g_\pi \pi_t + g_x x_t \quad (8)$$

All variables are as earlier defined except inflation which is defined in current period and r is the long run average rate of interest (Orphanides, 2001; Hetzel 2000). The above three conditions are captured by an optimal rule that minimizes the variance of output and inflation as in the equation below:

$$i_t = \bar{r} + \Pi_{t-1} + \beta_1(\Pi_{t-1} - \Pi^T) + \beta_2(y_{t-1} - \tilde{y}_{t-1}) \quad (9)$$

Where i_t is policy interest rate at time t , \bar{r} is real rate of interest at a zero rate of inflation, Π_{t-1} is average inflation rate over the last four quarters, Π^T is target inflation, Y_{t-1} is actual output in previous period and \tilde{Y}_{t-1} is potential output.

While it is the intention here to estimate a function as close to the Taylor rule as possible, the reality of data constraints and policy relevance of the rule in Nigeria forces some modification. First, given the data constraints on output outlined earlier, there will be need to de-emphasize output even in this 'optimal' model. In addition, it is obviously more difficult tracking potential output at high frequencies in an environment where data on actual output are not available. Besides, there are a number of conceptual difficulties associated with measuring potential output. So the last indicator in equation (9) will be completely dropped. In its stead, as in the tracking model, growth of credit to the private sector (CPG) will be used. The Central bank of Nigeria does not explicitly set monthly inflation targets in its monetary policy framework within sample. Available data are annual but it is assumed that these annual targets do not necessarily change at lower intervals. In the previous equation, actual inflation is used in the place of target, but the model in this section will use the deviation between actual and target inflation. To bridge the consistency gap between annual targets and monthly actuals, the annual targets shall be assumed constant for each year leaving the size of the deviations for all the months in any particular year dependent on the size of the actual inflation for each month. Finally, the first term in equation (9) is often regarded in the literature as a measure of interest rate smoothing. The present analysis shall retain both the concept and the measurement and it will be investigated using the lag of the dependent variable. Thus, the alternate model presented in equation 9 becomes;

$$i_t = \lambda(\pi - \pi^*)_t + \eta CPG_t + i_{t-1} + \mu_t \quad (10)$$

All variables are as earlier defined. Relative weights of both output and inflation (as espoused in the Taylor rule) shall be implicitly determined in the estimations and not assigned apriori. The alternative model (equation 10) captures the development role of the Central Bank of Nigeria through the incorporation of private credit. However, additional attempts will be made to capture the impact of Central Bank's monetary policy on the real sector by evaluating the impact of the real exchange rate (REER) in monetary policy reaction in Nigeria.

This work shall use monthly data between 1999 and 2005 (covering mainly the period of the current democracy in Nigeria). Interest rate, exchange rate, credit and reserves data shall be sourced from the Central Bank of Nigeria publications. Additional data on inflation data shall be sourced from the Federal Office of Statistics. Estimation shall be with the PC Give Econometric software.

V. Findings

This section presents a summary of the outcome of the estimations of the different representations made in the previous section and outlines their implications for both policy and further studies.

Table 3 in the appendix summarizes the time series characteristics of most of the data used in the estimations in the models. Most of the variables are integrated of order 1 (i.e. I (1) series). Only five of the variables, made up of mainly the growth rates (of M2, private credit, reserves and total credit) and average savings rate are stationary at level values. Most of the others (including exchange rate, inflation, inflation gap⁷, broad money, minimum rediscount rate, nominal and real effective exchange rates, prime lending rates, parallel market exchange rate and its premium, reserves and target inflation) are not stationary at level forms.

Bleaney and Lisenda (2001) are quite apt when they noted that ‘few developing countries satisfy the criteria necessary for estimating a Central Bank reaction function in the way that has been done for industrial countries because of a combination of lack of monetary independence, instability of the policy regime, speculative exchange rate pressures, and paucity of data’. Expectedly therefore, there was some challenges with data. For example, while the data for this work were in monthly series, it was observed that the Central Bank of Nigeria has limited data on target inflation... mainly annual. The assumption was therefore made that the monthly targets may not altogether differ from annual target rates. Of course, this might not be wholly representative of the processes at the Bank, but it could not be confirmed otherwise. The annual targets therefore had to be assumed constant for each year and the difference between the targets and the actual for each month is taken as inflation gap. In addition, while the idea of reaction of policy rate to private sector credit as a measure of its reaction to overall economic growth seems inadequate, estimations using high frequency data of the sort in this study seem to preclude the use of GDP growth rates as these are not available in higher frequencies. It is feared that interpolations might increase overall interdependence of errors in the estimations. Indeed, the approach here follows largely the recommendation by Orphanides (2001) and Batini (2003 b) that in situations where the values of the output gap are uncertain either due to data paucity or poor quality of the data, it is better to de-emphasize the output gap and proceed with only inflation and other more certain (identified) variables. The challenges emanating from the rest of the problems (monetary independence and instability of policy regime) have significantly dropped within the sample period relative to Nigeria’s own history and so constitute less of problems than that of data availability and quality.

⁷ This was obtained as the difference between actual and target inflation, though with the latter found in annual series only.

Given the differences in the time series properties of the different variables in the models, attempts were first made to establish co integration among the key variables. This should make it possible for the estimation of long run relationships through the introduction of error correction factors. As could be seen from table 5 however, it was not possible to establish co integration among these variables. Table 4 in the appendix summarizes the estimates of the reaction functions using monthly data covering 1999:1 to 2005:12. Following the data, relationships expressed by the equations are mainly short run. The functional form of the equations used is log-linear.

Much against a priori expectations, a number of the variables in the original models did not seem to reflect the history of monetary policy reaction function in Nigeria. Of the variables in the original tracking model for Central Bank reaction function, the premium of the foreign exchange rate (the difference between official and parallel market exchange rates) and reserves are central. These were based on the revealed preferences of the Central Bank⁸. However, empirical estimates could not establish that these variables matter for the core monetary policy instrument of the Bank, the Minimum Rediscount Rate (MRR). Earlier estimations including these variables showed they are very insignificant in explaining changes in the MRR.

Given the history of foreign exchange in Nigeria, one of the core means of tackling instability in the foreign exchange market has been programmes to reduce the gap between official and parallel market exchange rates. The centrality of exchange rate in the formulation of monetary policy derives from the fact that for most countries, the overriding objective of monetary policy is price stability. Consequently, volatility in the exchange rate is generally counter-productive to the goals of price stability. This also explains the political sensitivity of exchange rate regimes in both developing and developed economies (Nnanna 2002b). Nigeria's monetary policy is anchored on the monetary targeting framework and like most other countries in recent years, price stability represents the overriding objective of monetary policy. Foreign exchange premia translate to high incentive for speculative transactions in the market and this often destabilizes the market. As such a core mandate, which the Central Bank has historically set itself to, is the reduction of the uncertainty in the foreign exchange market. However, the estimated equations could not establish that the setting of the core instrument for Central Bank direct influence on the money and foreign exchange market (the MRR) is directly impacted by movements in the premium of the foreign exchange market.

An enduring challenge for Central Banks is the size of external reserves. Developments in global financing system seem to continually task the capacity of nations (particularly developing ones) to raise their reserves, almost in the spirit of unilateral insurance mechanism. Conceptually, reserves are raised from surplus of Central Bank operations. The latter in turn depends on the gamut of policies that the Central Bank adopts, including its position on the policy interest rate. However, it was not possible to establish any significant relationship between reserves and the MRR. In the course of the work, it was deemed fit to consider the growth of reserves as all targets can only be met with growing reserves. A positive, significant relationship should

⁸ The Central Bank of Nigeria Annual Report and Statement of Accounts, 2003 states as follows: "Specifically, the policy measures were designed to achieve a non-inflationary growth of 5% through the mobilization and prudent use of resources; achieve a single digit inflation; sustain stability in the exchange rate; promote financial sector soundness and achieve external reserve stock that could support at least 6 months of current import cover.

therefore be established between reserves and the minimum rediscount rate. However, the results showed that this was not so. Indeed, as in the case of the premium of the exchange rate, this was the case whether at the level form or at the difference level. None of the lags of the variable seem to significantly impact on the MRR.

In both the tracking model and the alternate model, we tried to investigate interest rate smoothening using the lag of the dependent variable. Given the time series properties of the variable, it could only enter the model in first difference form. However, in all the equations ran, this did not show much significance. A possible explanation for this may be the short run nature of the equations estimated, in which case, efforts at smoothening the interest rate may neither be necessary nor significant in the short run. The inability of the work to confirm interest rate smoothening partly implies that the Central Bank does not seem to attach great weights to costs arising from interest rate variability. Such costs could be macroeconomic or agency-specific and could to a large extent (and depending on the nature of structure of the economy) determine the persistence with which a monetary authority follows the inflation-output variability rule (see for example Lowe and Ellis 1997 on Australia).

A major factor for many developing countries in the tracking of monetary policy reaction is the differential of the market interest rates, particularly where these are market driven. However, instead of viewing this differential in terms of 'desired' and actual rates of interest as suggested by some work in the literature (see Flores et al, 2000 for example), this work used the difference between the prime lending rate and the average savings rate. This is more reflective of the actions and intentions of the Central Bank given that a central issue for many years has been knowing what options exist for reducing the persistently high difference between lending and deposit rates and promote real sector growth⁹. However, contrary to expectations also, it could not be proven from the estimates that this variable significantly impacts on the outcomes of the MRR. Estimates in both the level form and first difference yielded the same results.

The estimations incorporate the lagged and current values of changes in the price level. The results showed that only the one year lagged value of inflation rate affects the minimum rediscount rate. This result remained consistent and significant in most of the estimations indicating that the Central Bank's policy objective of price stability actually influences the setting of the policy interest rate. The one-period lag in the estimation results seems to indicate that the Central Bank raises the anchor rates in reaction to previous year's inflation rates – a form of reactionary policymaking. This is quite in contrast to both recommendations in the literature and the practice of more advanced Central Banks which is to take proactive stance towards future inflation rates and set policy interest rates to achieve these rates.

Two measures of impact of fundamentals of economic activity on monetary policy were experimented with. Our proposal earlier suggested the use of share of credit to the private sector

⁹ Indeed, a number of policy programmes were designed in terms of reducing the spread between lending and deposit rates. One major reason offered for this extraordinarily high differential is the risk associated with real sector banking in the economy. Evidence abound that the apex bank uses a number of other 'instruments' like moral suasion to prevail on banks to lower the lending rates. Once in a while, as in the celebrated bankers' committee case of 2002, this works, but in many other times, the central bank has to increase the incentive towards this optimal behaviour using the policy rate of interest.

partly reflecting the developmental roles of the Central Bank. However, it was feared that this might not capture the whole story underlying the relationship between monetary policy and economic fundamentals even as it affects the private sector alone. An immediate complementation was therefore sought using shifts in the real exchange rate following Hinkle and Nsengiyumva (1999); Elbadawi and Soto (1994); and Baffes et al (1997). Interestingly, the results showed that growth of credit to the private sector significantly influences the setting of the policy interest rate, the MRR. This result remained consistent even in the estimation of the alternate model. In effect, whether as a reflection of the desire of monetary policymakers to impact on the growth of the real sector or just for its own sake, there is evidence that it remained a major factor in monetary policy formulation. In contrast, the real exchange rate was only marginally significant in its impact on monetary policy for the sample period. Table 4 contains two equations for each of the model forms – the essence of the second equation being mainly to bring out the impact of the real exchange rate as a complement to private sector credit growth in influencing the setting of the MRR.

In representing historical monetary policy (using the tracking model), it was proposed to extend the analysis to wider areas of macroeconomic factors that could have impact on the setting of monetary policy targets. Specifically, given Nigeria's history of high share of government in total output and the oil-driven nature of its income and expenditure patterns, three indicators – public income and expenditure as well as oil price – were to be incorporated. However, data could not be obtained for government income and expenditure beyond published and annual data. Attempts at both the Federal Ministry of Finance and the Office of the Accountant General of the Federation which hold such unpublished data did not yield much fruits. As such, the growth of credit to the public sector and oil price (both of which data were obtained from the Central Bank) were used to reflect trends in government finances and the impact of oil respectively. Estimations however show that oil price does not have significant impact on the monetary policy target setting and that the impact of changes in public sector credit is only marginal (shown in table 4).

One of the major differences between the Taylor Rule and the observed reaction function in Nigeria as captured in the proposed equations is the targeting of inflation. While the Central Bank's expressed intention is to target inflation, the Taylor rule recommends the targeting of inflation gap. This was captured in the specification of the alternate model where inflation gap was used in the place of target and/or actual inflation. Output estimates showed that the impact of inflation gap could be quite important on the MRR. However, it has to be noted that this has not been explicit in Central Bank's policymaking, but might have implicitly been so. Attempts were made to incorporate broader macroeconomic fundamentals of the Nigerian economy (particularly the pervasive government and oil sector) in the tracking equation. The aim was to provide deviations from the traditional and strict Taylor specification and give Nigeria-specific flair to the model for tracking monetary policy history.

VI. Conclusions and Policy Implications

One major observation of the outcome of our model efforts seems to be that ex-post the outcomes of the targeting framework for monetary policy in Nigeria does not seem to differ much from expected results in a Taylor rule. Indeed, there are quite important similarities between the outcomes of the tracking and the alternate equations. But interestingly, this suggests

that a number of variables which the Central Bank ex-ante notifies as targeting do not really seem to impact on the ex-post setting of the monetary policy instrument – the MRR. However, this could be more of a coincidence than design. For one, it is possible that the bank uses other instruments other than the MRR to achieve these other targets in which case, the MRR is not able to capture the outcomes of the targets set in those areas. On the other hand, it is also not very clear that the central bank explicitly quantifies the impact of these other variables and takes all of them into account either in the setting of the MRR ex-ante or restructuring of the outcomes ex-post. If these be the case, then this close tracking of the observed relationship with the Taylor rule is no more than a coincidence.

In some sense, the ‘coincidence’ viewpoint seems to be more credible. While there is good enough evidence to show that the Central Bank uses other instruments, its publications are explicit on the primacy of the MRR (now replaced with the monetary policy rate – MPR) as policy instrument. However, the huge discrepancies between targets and outcomes of monetary policy and other macroeconomic aggregates (as shown in appendix table 1) indicate that the ex-ante quantification of target variables and the impact of instruments on such targets are, mildly speaking, very weak. Besides, a number of the variables that seem to matter in the tracking model are not explicitly targeted in CBN pronouncements. Put simply, the variables that are targeted are missed (with large variations) while those that are not targeted turn out to be significant in their impact. As such, there is reason to believe that such outcomes may be no more than coincidence – the persistent reference to fiscal dominance as a cause notwithstanding. Even though it may not be right to make strong conclusions on the impact of the public sector owing to the inability to explicitly incorporate all indicators of government fiscal stance, evidence points to weak ex-post influence on monetary policy.

The Taylor rule however, specifies reaction function in terms of deviations of output and inflation. Presently, data on output does not exist except as annual series. This implies that in our models, output deviations could not effectively be captured, whether in the tracking or the alternate models. This raises the immediate challenge of improvement in the data collection process. The National Bureau of Statistics is presently working with other agencies to generate higher frequency output growth series. This has intrinsic value both for policy and research. Given that most of the targets of the Central Bank are quite within short intervals, it is important that such important variable as output growth that the Central Bank also targets could be obtained in short interval series. The use of growth in private and public sector credits, the real exchange rate and oil prices can in no way substitute for the relevance of output in a monetary policy reaction function, given both the trends in the literature as well as mandates of Central Banks, not the least those of developing countries where growth is a critical variable. Indeed, it is no big surprise that the real exchange rate and oil prices did not show appreciable impact on the dependent variable as they are vaguer in capturing either the explicit targets of monetary policy or tangible handle on practical economic activities that affect day-to-day living in the economy under study.

It is interesting to note that inflation rates and inflation gaps (between target and actual rates) seem to ‘coincide’ in the estimates such that one equation could easily stand in for the other. This means that it is possible for the Central Bank to use the same set of instruments for reducing inflation to also reduce the gap between desired and actual inflation. However, evidence (as in

table 1 in the appendix) shows that inflation targets have not been very closely met in the past. It may then be the case that explicit targeting of the inflation gap may point to some other (probably more effective) combination of policy instruments to reduce both inflation rates and gaps between desired and actual inflation.

Both the co-integration tests and the estimation results point to the lack of long run relationships even among monetary variables and less so between monetary and real sector variables. This may not be unconnected with the pronounced short run stance of monetary policy for a large part of the sample period. The Central Bank did not have medium term policy framework until 2002. For an economy with long term trends in many important macroeconomic variables, this is a major setback to building strong linkages in the economy.

While the results are fairly consistent with the pronounced policy of tackling inflation as a priority of the Central Bank of Nigeria, there are other questions regarding the optimality or otherwise of the Central Bank targeting framework. In particular, it will be interesting and worth investigating to find out whether the targeting framework is optimal and whether the values set by – and consequently obtained from – monetary policy stance are the best for rapid economic growth. Put otherwise, while the evaluation so far is concerned with the question of what monetary authorities in Nigeria target there are other (equally fundamental) questions like determining the optimal targets consistent with fast growth and comparing these with the targets set by monetary authorities in Nigeria.

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Appendix

Table 1: Monetary Targets and performance (2000 – 2005)

Variable	2000		2001		2002		2003		2004		2005	
	Tar get	Act ual	Tar get	Act ual	Tar get	Act ual	Tar get	Act ual	Tar get	Act ual	Tar get	Act ual
M2	14.6	48.1	12.2	27	15.2	21.6	15	24.1	15	14	15	16.03
M1	9.8	62.2	4.3	28.1	12.4	15.9	13.8	29.5	10.8	8.6	11.4	15.5
Aggregate Bank Credit	27.8	-23.1	15.8	75.8	57.9	64.6	25.7	29.1	22.5	12	22.5	14.5
Credit (net) to Fed Government	37.8	-162.3	2.6	79.7	96.6	6320.6	-150.3	58.4	29.9	-17.9	-10.9	-37
Credit to private sector	21.9	30.9	22.8	43.5	34.9	11.8	32.3	27.1	22	26.6	22	30.8
Inflation rate (%)	9	6.9	7	18.9	9.3	12.2	9	23.8	10	10	10	11.6
GDP	3	3.8	5	3.9	5	3.5	5	10.2	5	6.5	5	6.2

Note: All values in % growth except where otherwise specified

Source: CBN Annual Report and Statement of Accounts, Various Issues

Table 2: Correlation of selected financial variables in Nigeria

	MRR	ASR	MLR	PLR	EXTR	NER	CPI12
MRR	1						
ASR	.40	1					
MLR	.51	.21	1				
PLR	.53	-.02	.55	1			
EXTR	-.07	-.18	-.16	.55	1		
NER	.012	-.39	.12	.61	.57	1	
CPI12	.21	-.33	.24	.67	.50	.94	1

Source: Authors' calculations

MRR – Minimum Rediscount Rate

ASR – Average Savings Rate

MLR – Maximum Lending Rate

PLR – Prime Lending Rate

EXTR – External Reserves

NER – Nominal Exchange Rate

CPI12 – Annual Consumer Price Index

Table 3: Unit root tests of key variables

	Variable	Description	T-ADF	Level of Stationarity	Lag Length
1.	ASR	Average Savings Rate	-4.8882	0	0
2.	CPI	Consumer price index	-6.8538	1	0
3.	EXRATE	Exchange Rate	-6.5059	1	0
4.	INF	Inflation Rate	-7.7901	1	0
5.	INFGAP	Inflation Gap	-4.2899	1	0
6.	M2	Broad Money	-10.619	1	0
7.	M2G	Growth in M2	-11.505	0	0
8.	MRR	Minimum Rediscount Rate	-8.9651	1	0
9.	NEER	Nominal Effective Exchange Rate	-6.8404	1	0
10.	PLR	Average Savings Rate	-7.3393	1	0
11.	PMER	Parallel Market Exchange Rate	-5.5908	1	0
12.	PREM	Exchange Rate Premium	-5.2744	1	0
13.	PRIVCREDG	Growth of Private credit	-7.2649	0	0
14.	REER	Real Effective Exchange Rate	-6.692	1	0
15.	RES	Reserves	-9.3044	1	0
16.	RESG	Growth in reserves	-6.6242	0	0
17.	TCREDG	Growth of total credit	-9.4786	0	0

18.	TINF	Target Inflation Rate	-5.0454	1	0
19.	OILPRICE	Oil Prices	-5.7844	1	0
20.	PUBCREDG	Growth in Credit to the Public Sector	-6.7253	0	0

Table 4: Summary of the Estimation Outputs

Model Form	Const	Inflation /a		Inflation gap		Private Credit Growth /b		REER /a		Public Credit Growth /b		D. W.
		Lag/ Diff	Coeff	Lag/ Diff	Coef	Lag /Diff	Coeff	Lag /Diff	Co eff	Lag/ Diff	Co eff	
Tracking	-0.0280 (-3.58)	1, 1	-0.0032 (-2.07)	-	-	0, 0	0.0246 (3.72)	-	-	0, 0	-1.36e-05 (-1.46)	1.89
”	-0.0299 (-3.78)	1, 1	-0.0047 (-2.48)	-	-	0, 0	0.0233 (3.52)	1, 1	0.2768 (1.34)	0, 0	-1.10e-05 (-1.17)	1.81
Alternate	-0.0276 (-3.49)	-	-	1, 1	-0.0032 (-2.04)	0, 0	0.0243 (3.64)	-	-	-	-	1.83
”	-0.0300 (-3.78)	-	-	1, 1	-0.0049 (-2.60)	0, 0	0.0230 (3.46)	1, 1	0.3197 (1.59)	-	-	1.73

Notes: /a – Log forms of variables used in estimation; /b – Variables not in log forms

Table 5: Co integration Test

Sample: 1999:01 2005:12

Included observations: 81

Test assumption: Linear deterministic trend in the data

Series: MRR INF PREM REER

	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.201281	40.64462	47.21	54.46	None
0.166543	22.44019	29.68	35.65	At most 1
0.090503	7.684187	15.41	20.04	At most 2
2.64E-06	0.000214	3.76	6.65	At most 3

****** denotes rejection of the hypothesis at 5%(1%) significance level
L.R. rejects any cointegration at 5% significance level

Unnormalized Cointegrating Coefficients:

MRR	INF	PREM	REER
0.059421	-0.014470	0.001858	0.005000
0.065250	0.031548	0.046941	-0.001760
0.027310	-0.000895	-0.026139	0.002991
-0.014242	-0.003236	-0.004173	0.003285