Taylor's Rule and Monetary Policy in Nigeria

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Abstract- ***Taylor's Rule is a monetary policy framework used by the Central bank to stabilize the pace of economic activities through interest rates mechanism. There are three key indicators to the rule. These include; Federal fund rate, Price level and changes in real income. Taylor's Rule posits that the benchmark interest rate that drives economic stability and growth is determined by inflation and growth of national output. It was proposed by John Taylor in 1993 to US Federal Reserve Bank. This study investigated the applicability potential and suitability of the 'Rule' for monetary management in Nigeria by employing the Structural Vector Auto-Regression (SVAR). Empirical findings from the study established that growth of real National Output and Inflation do not have contemporaneous effects on Monetary Policy Rate (MPR) in Nigeria. It also indicates that shocks to growth of real National Output and inflation do not account for changes in MPR in Nigeria and vice-versa. Further findings from the study suggested that Taylor's Rule to monetary policy framework may not be practically potent for monetary policy management in Nigeria. This study recommended that the Central bank of Nigeria should continue to explore and fine-tune Inflation Targeting as a monetary anchor; maintain optimum quantum of base money that would moderate the CPI and engender the growth of the economy; entrench policy consistency; and promote monetary and fiscal policy fusion in the Nigeria.***

Index Terms- ***Taylors' Rule, Monetary Policy, SVAR***

I. INTRODUCTION

The history of monetary policy in Nigeria dates back to the colonial era when the colonial Government dominated the country's currency and monetary system. Following independence in 1960, the central Bank of Nigeria (CBN) was established in 1958 to manage the country's monetary policy and regulate the financial sector. Over the years, the CBN has implemented various monetary policy measures to address economic challenges and promote economic growth. These measures included setting interest rates, conducting open market operations, adjusting reserve requirements, and managing the exchange rate. Monetary policy refers to the measures taken by a country's central bank to regulate the supply of money, interest rates, and credit conditions in order to achieve macroeconomic objectives such as price stability, economic growth, employment generation, and exchange rate stability.

Monetary policy plays a central role in stabilizing economies by managing inflation, influencing output, and safeguarding financial stability. In Nigeria, the Central Bank of Nigeria (CBN) has often faced the challenge of balancing price stability with economic growth amid structural bottlenecks. While discretionary policy has historically dominated, economists argue that rule-based frameworks, such as Taylor's Rule, can provide predictability, transparency, and credibility. Taylor's Rule is a monetary policy framework used by the Central bank to stabilize the pace of economic activities through interest rates mechanism.There are three key indicators to the rule. These include; Federal fund rate, Price level and changes in real income. The rule suggests how central banks should set short-term interest rates in response to inflation and output fluctuations. There are three key indicators to the rule. These include; Federal fund rate, Price level and changes in real income. Taylor's Rule posits that the benchmark interest rate that drives economic stability and growth is determined by inflation and growth of national output. It was proposed by John Taylor in 1993 to US Federal Reserve Bank. In advanced economies, such as the United States, the rule has served as a benchmark for evaluating monetary policy decisions. Woodford (2001) observed the rule has since been given significant consideration for

monetary policy anchor in the United States of America and other countries across the globe. However, its applicability to developing economies like Nigeria where structural shocks, fiscal imbalances, and supply-side constraints prevail is less clear. This study therefore examines the implication and applicability of Taylor Rule in Nigeria as a monetary policy framework with the global objective of maintaining macroeconomic stability and growth in the economy.

MONETARY PERFORMANCE IN NIGERIA

The fundamental objectives of monetary policy in Nigeria over the years have been price stability and the growth of the economy. The monetary authority has variously anchored its policy framework on base money and inflation targeting since the Structural Adjustment Programme (SAP) when the Nigeria's monetary system was deregulated. However, evidence from the Central Bank of Nigeria indicates that the actual performance of monetary and macroeconomic indicators show recognizable disparity between the actual performances and the corresponding targets.

Figure1: Broad Money Supply (M2)

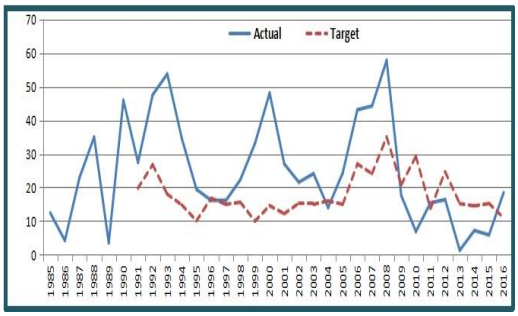


Figure 1 above presents the performance of broad money supply (M2) covering the period of the Structural Adjustment Programme (SAP); from 1991-2009, actual base money in the economy outstripped the targeted money supply during the period. However from 2010-2015, the target base money remained greater than the actual performance. The actual base money in the economy was 27.43 percent in 1991 while the CBN target growth for the same years was 19.8 percent. Actual monetary base grew by 47.53 percent (target=26.8 percent) in 1992; 53.76 percent (target=18 percent) in 1993; reaching 57.78 percent (target= 35 percent) in 2008. The high growth of monetary base in the economy underpins the expansionary monetary policy stance in the period.

However, the period 2013 to 2015 presents contrary picture as policy stance became tighter. Actual growth of base-money fell to 1.32 percent (target=15.2 percent) in 2013; 7 percent (target=14.52 percent) in 2015; and 5.9 percent (target=15.24) in 2015, before reaching 18.45 percent (target=18.98 percent) in 2016. The tight money policy stance of the CBN since 2014 has proven relatively more effective in moderating the explosion in the Consumer Price Index (CPI) brought about by erosion in the Naira value following the plummet of the prices of crude petroleum oil in the international market in that year.

The Nigerian economic performance during the period 1981-2016 was a response of the behaviours of monetary indicators such as inflation rate and MPR/MRR. In real term, between 1981-1989, Gross Domestic Product (GDP) averaged a lowly N15,204.22 billion while inflation and MRP/MRR averaged24.4 percent and 10.7 percent during the period respectively. The period 1990-1998 also presents a low output averaged of N20,409.45 billion while inflation and MPR/MRR presents a higher average of 33.3 percent and 16.1 percent respectively in the period. However, by 2009-2016, real GDP averaged N59, 472.05 billion just as inflation rate and MPR/MRR averaged 11.7 percent and 10.7 percent respectively during the period. Following the performances of the indicators within the context of the data paoint, it is obvious that higher national output (N59.472.05) was achieved the at the lowest inflation rate (11.7 percent) and MPR (10.7 percent) corresponding to 2009-2016 respectively. It is therefore important that CBN should continue to pay closer attention to inflationary behaviour in the economy.

Table 1: Aggregate Performances

YEAR	REAL GDP (N Billion)	INFLATION RATE (%)	MRR/MPR (%)	Remark
1981-1989	15204.22	24.4	10.7	Low output, high inflation, low MPR/MRR
1990-1998	20409.45	33.3	16.1	Low output, high inflation, high MPR/MRR
1999-2007	31942.87	11.7	14.4	High output, low inflation, high MPR/MRR
2009-2016	59472.05	11.7	10.7	High output, low inflation, low MPR/MRR

*Computed from Data provided in CBN Statistical Bulletins

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Theoretical Framework

In 1993, Stanford University economist, John Taylor developed a monetary policy management mechanism which targets interest rate as an anchor for price stability and economic growth. This mechanism has come to be known as Taylor's Rule or Principle.

The traditional Taylor's Rule is given with the following function:

$$i_t = i_t^* + \phi_{\prod}(\prod_t - \prod_t^*) + \phi_y(y_t - y_t^*) \quad (1)$$

The forecast function of the Rule is given as follows:

$$i_t = 0.4 + 1.5(\prod_t - 0.02) + 0.5(y_t - y_t^*) \quad (2)$$

Where i= Federal Fund Rate, ∏=actual Inflation, y=real output growth, ∏*=target inflation and y*= potential output is empirically ascertained using a linear trend.

Taylor's Principle being a recommendation to the US Federal Reserve Bank was principally anchored on three economic variables – US Ffederal Funds Rate, Inflation Rate and Real GDP growth rate (Woodford: 2001). Both inflation and real GDP Growth are proposed to determine interest rate as follows:

i. where actual inflation is relative to the targeted level of inflation
ii. how far actual output is above or below its potential output; and
iii. The level of the short-term interest rate that would be consistent with full employment.

Taylor's rule recommends a high interest rate to usher in contractionary monetary policy when actual inflation is greater than the target level or actual output is greater than potential output and the other way round. Sometimes these goals are in conflict: for example, inflation may be above its target when the economy is below full employment. In such situation, the rule provides guidance to policy makers on how to balance these competing considerations in setting an appropriate level for the interest rate.

2.2 Literature Review

A growing body of literature has evaluated the relevance of Taylor's Rule to Nigeria's monetary

policy, with findings that are often mixed. Scholars differ on whether the rule adequately captures Nigeria's economic realities, especially given the dominance of exchange rate shocks and fiscal constraints. Obi, Ukeje, & Anayochukwu (2009) One of the pioneering studies on Nigeria applied Taylor's Rule to CBN's policy decisions between 1980 and 2006. Their results showed significant deviations from Taylor-prescribed rates, with CBN often prioritizing exchange rate stabilization over inflation targeting. The authors concluded that monetary policy in Nigeria has been more discretionary than rule-based.

Mbutor (2015) examined the interaction between exchange rates and Taylor's Rule, arguing that a "modified Taylor Rule" incorporating exchange rate movements better explains Nigeria's monetary policy. His findings showed that inflation alone was insufficient to drive policy decisions, as CBN frequently intervened to stabilize the naira.

Using SVAR models, Adewuyi & Akande (2017) assessed the responsiveness of Nigeria's interest rates to output and inflation shocks. Their results suggested that while inflation was a major driver of monetary policy, output gaps had less explanatory power, partly due to poor measurement of potential GDP in Nigeria.

Recently, Adebayo & Olufemi (2019) analyzed Nigeria's monetary policy stance between 2000 and 2017. They found partial compliance with Taylor's Rule, noting that CBN set lower-than-prescribed interest rates during recessions to support growth. Their study recommended adopting Taylor's Rule as a "guideline" rather than a rigid framework.

Acha & Ikechukwu (2021) Compared CBN's MPR to Taylor's Rule-implied rates during periods of oil price shocks. They observed that Taylor's Rule consistently prescribed higher interest rates than those actually set by CBN, especially during inflationary surges (e.g., 2016 recession). Their conclusion was that Nigeria's monetary policy framework is influenced more by political and social considerations than strict rule adherence.

Onyele & Nwankwo (2022) explored the effectiveness of Taylor's Rule under fiscal dominance conditions. They concluded that the government's fiscal stance—high borrowing and deficit financing—limits the rule's applicability. The authors emphasized the need for coordination between fiscal and monetary policy to enhance effectiveness.

III. METHODOLOGY

The traditional Taylor's Rule is based on the following function:

$$i = \phi [y, \Pi] \quad (3)$$

Where: i=Federal Reserve Fund Rate (Monitory Policy Rate), y=growth rate of Real GDP and $\prod$=Inflation Rate.

This study investigated the applicability potential and suitability of the Taylor's Rule for monetary management in Nigeria by employing the Structural Vector Auto-Regression (SVAR). In the specification of SVAR model, the relevant variables are annual time series of Growth Rate of Real GDP (gdp), Inflation Rate ($\prod$) and Monetary Policy Rate (MPR). Based on the scope of the study, the time series covered the period 1981-2016. The Structural VA

The Structural VAR model of the study is defined with the dynamic equation below.

$$A_oZ_t=A_1Z_{t-1}+\varepsilon_t \quad (4)$$

Where: Z_t= [gdp, $\prod$, i] = vector of endogenous variables; A_o=matrix of coefficient of endogenous variables; $A_1(L)$ an autoregressive polynomial in the lag operator L, ε_t= vector of reduced form shocks which are assumed to be normally distributed with constant variance-covariance matrix. Equation '2' is trans formed as follows:

$$A_oZ_t=A_1Z_{t-1}+\varepsilon_t$$
$$(A_o-A_1L)\ Zt=\varepsilon_t$$
$$B_1Z_t=\varepsilon_t \text{ ----------} (A_o-A_1L)=B_1$$
$$Z_t=B^{-1}{}_1\varepsilon_t \quad (5)$$

$$Z_t = B^{-1}{}_1\varepsilon_t \;\Rightarrow\; \begin{bmatrix} gpg \\ \Pi \\ i \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ b & c & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{dgp} \\ \varepsilon_t^{\Pi} \\ \varepsilon_t^{i} \end{bmatrix} \quad (6)$$

Identification

In identifying the model, there is the need to impose some restriction which is governed by economic theories (Agu: 2011). Given that there are three (3) variables in system, at least 3 restrictions (assumptions) should be made considering the limitation criterion of n(n-1)/2. Consequently, we make the following assumption on the behaviour of the variables:

i. Inflation is expected to be affected contemporaneously by Real GDP shock;
ii. MPR is expected to be affected contemporaneously by Real GDP shock; and
iii. MPR is expected to be affected contemporaneously by Inflation shock

Optimum Lag Selection

The Maximum Lag lengths for endogenous variables in the system was selected based on the information provided by five penalty criteria which include Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ).

IV. EMPIRICAL ANALYSIS

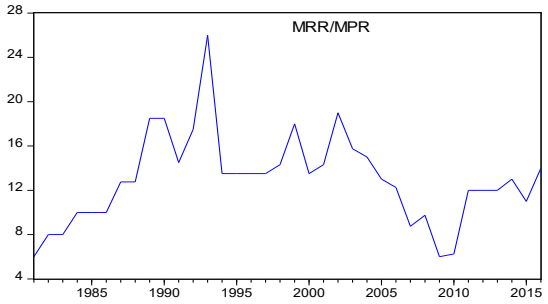
The underpinning methodology of this study is the Structural Vector Auto Regression (SVAR) with recursive orthogonal restrictions. However, given that the research time series were stationary at their first differences, SVAR-D version was applied in the analysis to measure the contemporaneous effects of Growth on Real GDP on Inflation and Monetary Policy rate on one and contemporaneous effect of inflation on MPR on the other hand.

4.1 Time Series Growth Trends

Monetary Policy Rate (MPR)/Minimum Rediscount Rate (MRR)

The Central Bank of Nigeria (CBN) changed its Minimum Rediscount Rate (MRR) policy rate in 2006 to the current Monetary Policy Rate (MPR). The MRR and MPR is the benchmark for interest rate in the economy. MPR is the minimum interest rate CBN can lend to the banks in the short-term. At the inception of the new MPR in 2016, the benchmark interest rate was set at 10 percent and it remained relatively stable and low over a decade reaching 14 percent in 2014. The upward review and retention of MPR to 14 percent in 2016 from 11 percent of 2015 was intended to create a positive real interest rate that would encourage investment and economic growth given escalation in consumer prices index and high exchange rate variability in that period.

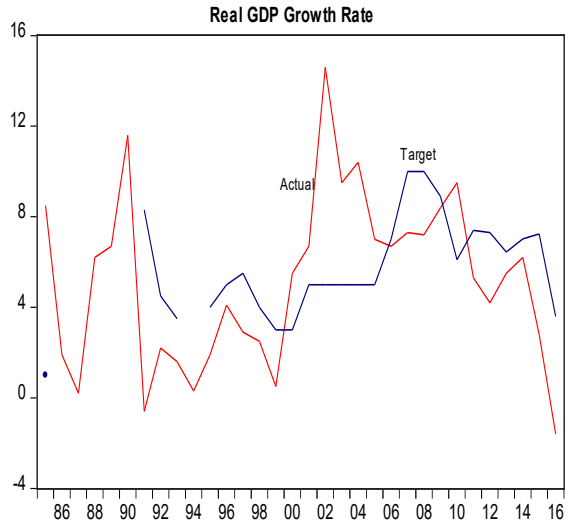
Figure 2. Movement in MPR/MRR (1981-2016)



Real Gross Domestic Product (GDP)

A primary objective of monetary policy in Nigeria is to engender the growth of National Output of the country. The CBN at the beginning of any fiscal period sets an economic growth target for the country. Figure2 shows the trend of both the actual and target growth of the economy from 1985 to 2016. Although the trends indicates a mixed-bag of period where the actual is greater than the target and the other way round, since 2011, actual performance has consistently fallen below target growth rate reaching a negative growth in 2016 when the economy fell into recession. The year 2016 was characterized with high exchange rate variability, making it extremely difficult for economic activities to take place.

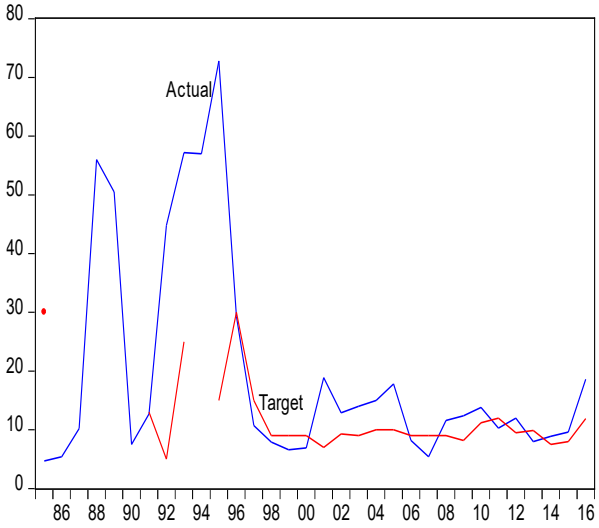
Figure 3: Movement in Real GDP



Inflation

Since 2002 when the CBN began experimenting Inflation Targeting monetary policy framework, inflation in the country has stayed low compared with the regimes of exchange rate and monetary targeting periods. Figure 3 shows that since 2002, the gap between actual inflation and target rate have narrowed significantly. However. from 2014 to 2016, actual inflation rate has remained above the target rate, a movement that can be ascribed to the depreciation of the national currency due to the plummet of crude oil prices in that period.

Figure 4: Movement in Inflation



4.2 Diagnostics Analysis

Unit Root

Table 2: Augmented Dickey-Fuller Result

Variable	Order of integration	T (Tau)	MacKinnon Critical Values	
Log Real GDP	1	**-3.22936	-3.559407 -2.061125 -2.614300	1% 5% 10%
Inflation Rate (INF)	1	**-5.576457	-3.559407 -2.061125 -2.614300	1% 5% 10%
Monetary Policy Rate (MPR)	1	**-6.175493	-3.648342 -2.954021 -2.615817	1% 5% 10%

**Significant at all Mackinnon levels significance (1%, 5% and 10%) – See Appendices

The ADF result in table 2 shows that all the variables, Real GDP, Inflation rate and Monetary Policy Rate are stationary at their first differences; that they are integrated at Order one (1) respectively. The integrated version of the variables is deployed into the analysis of the study using the SVAR-D methodology.

Optimum Lag Length in the VEC System

Table 3 : Maximum Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-151.1584	NA	5.833790	10.27722	10.41734*	10.32205
1	-140.1399	19.09868*	5.123409	10.14266	10.70314	10.32196*
2	-130.4822	14.80841	5.010097	10.09882	11.07965	10.41259
3	-118.8344	15.53038	4.428702*	[9.922296*]	11.32349	10.37055
4	-112.5365	7.137695	5.887085	10.10243	11.92399	10.68516
5	-107.3826	4.810321	9.151872	10.35884	12.60075	11.07605

Note: FPE=Final prediction error; AIC=Akaike information criterion; SIC=Schwarz information criterion; HQ=Hannan-Quinn information criterion;

From the optimum lag length result in table 3, lag length three (3) as presented by AIC was selected as the maximum length of the variables and was used in the SVAR analysis.

4.3 STRUCTURAL VAR ESTIAMTION

Figure 5: AR Test for Stability of the Model

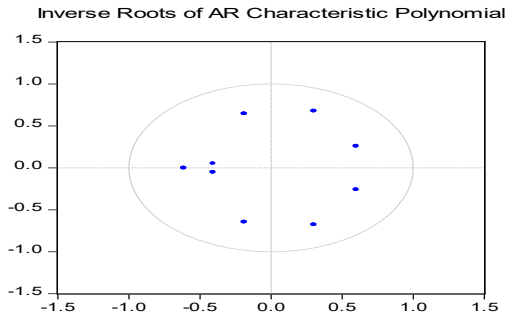


Figure 5 above shows that all the unit roots are positioned within the unity circle, thus indicating that the SVAR model is stable.

Table 4: Estimate of Contemporaneous Effects

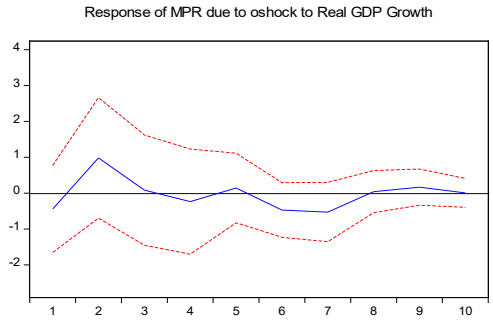
	Real GDP Growth	Inflation	MPR
Real GDP Growth	-	-	-
Inflation	121.23782 (0.1071)	-	-
MPR	17.40344 (0.3606)	0.032346 (0.4522)	

Note: Probability Value (p-Vs) of coefficient estimates are in parentheses

The focus of the SVAR analysis is to measure the effect of Real GDP and Inflation on Monetary Policy Rate in Nigeria on one hand, an how Real GDP affects Inflation Rate on the other hand. Table 4 therefore presents the estimates of the contemporaneous effects in the system. The result shows that Real GDP has no contemporaneous effects on Inflation (β=121.23782; p-V=0.1071) and Monetary Policy Rate (β=17.40344; p-V=0.3606) respectively. Also Inflation has no contemporaneous effect on MPR Rate (β=0.032346; p-V=0.4522).

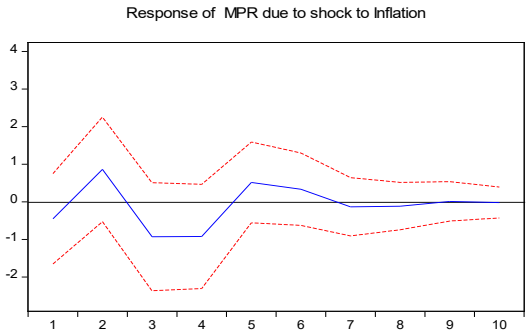
Impulse Response Functions (IRFs)

Figure 5: IRF OF MPR due to shock to Real GDP



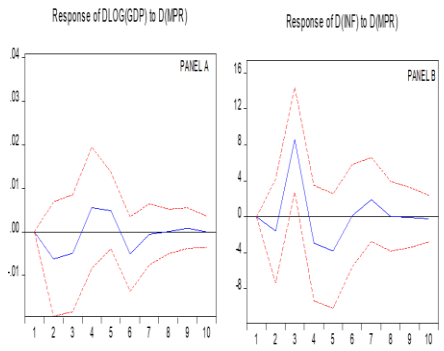
Real GDP growth does not determine MPR in Nigeria over the period.

Figure 6: IRF OF MPR due to shock to Inflation



From the Impulse Response Function (IRF) of figure 6 it was observed that MPR responded negatively and positively across all periods due to shock to inflation which died on the 7th periods. Inflation therefore is not a good determinant of MPR in Nigeria over the periods.

Figure 7: IRF of MPR Real GDP and Inflation due to shock to MPR



Variance Decomposition (VDs)

Table 5 Variance Decomposition of MPR

Variance Decomposition of D(MPR)				
Period	S.E.	DLOG(GDP)	D(INF)	D(MPR)
1	3.442884	1.637870	1.707190	96.65494
2	3.969039	7.359730	6.030989	86.60928
3	4.079522	7.008835	10.88817	82.10299
4	4.275644	6.686528	14.57059	78.74288
5	4.353280	6.558680	15.45699	77.98433
6	4.411803	7.519844	15.62542	76.85474
7	4.475347	8.698155	15.27254	76.02931
8	4.479579	8.689884	15.30946	76.00066
9	4.486545	8.802361	15.26265	75.93499
10	4.486975	8.800893	15.26163	75.93747

VI. SUMMARY CONCLUSION AND RECOMMENDATION

Taylor's Rule posits a monetary policy framework where the Monetary Policy Rate is targeted as an anchor to drive stability and growth in an economy which was recommendation to the US Federal Reserve Bank for the management of the US economy in 1993 (Taylor: 1993). However, since it was recommended no country including the US has explicitly adopted the framework which target monetary policy benchmark interest rates.Monetary policy anchors adopted by CBN over the years were exchange rate and monetary targeting as well the current exploration of inflation targeting in the economy. Interestingly, since the CBN embraced inflation targeting experimentation, inflationary pressures has been significantly kept low except since

2015 when the crude oil prices crashed in the international market leading to erosion in the value of Naira which by extension caused the Consumer Price Index to explode.This study revealed that Real GDP and Inflation are not good enough in determining the level of MPR that will in turn drive economic stability and growth in the economy and this may underpin the reason why no country has explicitly adopted Interest Rate Targeting as a monetary anchor. Taylor's Rule appears not to be ideal for usage in Nigeria as monetary policy framework by the CBN. Therefore, it is recommended that the CBN continues to explore and fine-tune Inflation Targeting as an anchor; maintain an optimum quantum of base money in the economy; entrench monetary policy consistency; and promote monetary and fiscal policy synthesis in the economy.

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