

**DOES MONETARY POLICY CURB INFLATION IN NIGERIA?  
AN EMPIRICAL SUPPORT**

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**ABSTRACT**

This paper considered the effects of treasury bill rate(TBR), one-month deposit rate(IMDR), three months deposit rate(IIIMDR), six month deposit rate(VIMDR), twelve months deposit rate(XIIMDR) and prime lending rate(PLR) on inflation in Nigeria. The data sets cover the period of 2006M1 to 2017M4. Ordinary least squares(OLS) and maximum likelihood methods of estimation were applied to the generalized linear models (GLM) specified. The results indicate the following; among all the money market indicators considered, only IIIMDR exerts right directional (negative) effect on inflation, significant at 10% level while XIIMDR and PLR have positive (unexpected directional effect) on inflation, significant at 1% and 5% respectively. TBR at lag 2 exerts right directional (negative) effect on current inflation significant at 1% level. It is observed that among all the predictors considered in this study, three months' deposit rate has direct effect in controlling inflation towards the right direction while treasury bill rate influences inflation toward the right direction in short-run. Hence, there is the need for CBN and MPC to re-evaluate the monetary policy frameworks in order to achieve price stability and economic growth.

**Keywords:** Money market indicators, inflation, Lagged predictors and GLM

**1. Introduction**

The Monetary Policy Committee (MPC) has the responsibility within the Bank to regulate monetary and credit policy in order to facilitate the attainment of price stability and to support the economic policy of the Federal Government. So whether the monetary policy is expansionary or contractionary, the primary aim is to maintain a non-inflationary economy and price stability. In the recent years, interest rate has been raised so as to curtail the growing rate of inflation yet, year on year inflation has risen up to about 18.72% in January, 2017. Hence, it has become a national concern whether our monetary policy rates are curbing inflation significantly.

The current economic recession and the urgent need to come out of it have necessitated diverse empirical research on different aspects of our national economy. The sudden economic shock due to the latest growth figures showing the economy contracted 2.06%, two consecutive quarters of declining growth, and the realization that the income generated from the current crude oil sales which account for over 70% of total income cannot service our internal and

external debt levels, recurrent expenditures and finance some capital projects, hence, diversification of the economy has become not only necessary but also, a means to economic recovery.

According to Emefiele (2016) the domestic output in Q2, 2016 contracted by 2.06%. This represented a decline of 1.70 percentage points in output from the -0.36% recorded in Q1, and 4.41 percentage points lower than the 2.35% growth in the corresponding period of 2015. Also, headline inflation (year-on-year) rose again in August to 17.6%, from 17.1% in July 2016, thus maintaining the upward trend since January 2016. The increase in headline inflation in August reflected increases in both food and core components of inflation. Core and food inflation have increased from 16.93 and 15.80% in July to 17.2 and 16.43%, respectively, in August 2016. The question is how has the monetary policy help to curb the rising inflationary pressure? This is the thrust of this research.

Amaefula(2016,"a") investigated the effects of inflation and its risk on interest rate in Nigeria, with data set spanning from 1995:M1 to 2014:M12. ARCH(1) and GARCH(1, 1) were used to measure inflation risk and the result indicated that GARCH(1, 1) measured inflation risk better than ARCH(1) model based on Schwarz Information Criterion (SIC), and adopting multiple regression method, the result reveals that inflation and inflation risk exact negative and positive impacts on interest rate respectively, but none is significant. This result implies that the direction of this interest rate by monetary policy rate (MPR) is not proactive enough to curb the rising inflationary pressure in Nigeria.

Some earlier studies have shown that inflation uncertainty have positive relationship with interest rate. Many researchers like Fama and Schwert (1977); Mishkin (1981); Fama and Gibbons (1982) and Chan (1994) have provided empirical evidence for the positive relationship between expected inflation variation and the t-bill rates under different specifications such as asset pricing models. Fave and Auray (2002) have confirmed a relationship between interest rate and inflation rate in the long-run. Amaefula (2016,"b") also examines whether long-run equilibrium relationship exist between interest rate and inflation in Nigeria, using frame work of Johansen cointegration test vector error correction model (VECM) of granger causality test and his results show evidence of long-run equilibrium relationship between the two variables with strong evidence of unidirectional granger causality flow from interest rate to inflation at the long-run.

The present paper differs from previous studies on the subject matter in some perspectives; firstly, it examines the current effects of seven different money market indicators on inflation. Secondly, it considers the lagged effects of these predictors on inflation. The idea is to observe the previous policy on these money market indicators on current inflation. Thirdly, to identify which of these explanatory variables have a significant right dimensional influence (expected effect) or unexpected influence on inflation. This is necessary for a better appraisal of our monetary policies in the present economic challenge. Moreover, the plots of individual predictor effect on inflation were added in one image to explicate the third concept of this paper.

The rest of the paper is organised as follows; section (2) presents the materials and method,

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section (3) deals with the data analysis, results and discussion and section (4) present the conclusion.

### 3. Materials and Method

This section provides information on source of data collection, variable measurement and definition, model specification and estimation and method of unit root test.

#### 3.1. Source of Data Collection

The data sets on monetary policy rates and inflation were obtained from published Central Bank of Nigeria (CBN) statistical bulletin of 2016 and April 2015. The data sets cover the period of 2006:M1 to 2017:M4.

#### 3.2. Variable Measurement

This paper used all item year on year inflation to measure inflation and interest rates are measured using money market indicators such as Treasury bill rate (TBR), saving deposit rate (SDR), one month deposit rate (IMDR), three months deposit rate (IIIMDR), six months deposit rate (VIMDR), twelve month deposit rate (XIIMDR) and prime lending rate (PLR).

#### 3.3 Model specification and method of estimation

Equation (1) is a multiple regression model showing the direct effects of TBR, SDR, IMDR, IIIMDR, VIMDR, XIIMDR and PLR on inflation and it is given as;

VIMDR, XIIMDR and PLR on inflation and it is given as;

$$IFR_t = \beta_0 + \beta_1 TBR_t + \beta_2 SDR_t + \beta_3 IMDR_t + \beta_4 IIIMDR_t + \beta_5 VIMDR_t + \beta_6 XIIMDR_t + \beta_7 PLR_t + e_t \quad (1)$$

Where  $\beta_0$  is constant term,  $\beta_i, i = 1, \dots, 7$  are parameter coefficients and the error term  $e_t$  is assumed to be normally distributed with mean zero and variance  $\sigma^2$ . Equation (1) regression model will be estimated using least squares method.

Equation (2) presents multiple regression model showing one month lagged effects of monetary policy rates on inflation (previous month monetary policy rates on current inflation) and it is given as;

$$IFR_t = \beta_0 + \beta_1 TBR_{t-1} + \beta_2 SDR_{t-1} + \beta_3 IMDR_{t-1} + \beta_4 IIIMDR_{t-1} + \beta_5 VIMDR_{t-1} + \beta_6 XIIMDR_{t-1} + \beta_7 PLR_{t-1} + e_{t1} \quad (2)$$

Where  $\beta_0$  is constant term,  $\beta_i, i=1, \Lambda, 7$  are parameter coefficients and the error term  $e_{i1} \sim N(0, \sigma^2)$ .

Equation (3) shows two months lagged effects of monetary policy rates on inflation and it is given as;

$$IFR_t = \beta_0 + \beta_1 TBR_{t-2} + \beta_2 SDR_{t-2} + \beta_3 IMDR_{t-2} + \beta_4 IIIMDR_{t-2} + \beta_5 VIMDR_{t-2} + \beta_6 XIIMDR_{t-2} + \beta_7 PLR_{t-2} + e_{t2} \quad (3)$$

Where  $\beta_0$  is constant term,  $\beta_i, i=1, \Lambda, 7$  are parameter coefficients and the error term  $e_{t2}$  is assumed to be normally distributed with mean zero and variance  $\sigma^2$ .

### 3.4 Unit Root Test

The unit root test is based on Augmented Dickey Fuller (ADF) test and is of the form

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta_t + \sum_{i=1}^k \xi_i \Delta y_{t-i} + a_i \quad (4)$$

Where k is the number of lag variables. The non-constant option removes the constant term and the above regression, and the trend option includes the time trend  $\delta_t$ . ADF unit root test  $H_0 : \beta = 0$  and  $H_0 : \beta < 0$ . If the ADF test statistic is greater than 1%, 5% and 10% critical values, the null hypothesis of a unit root test is accepted.

## 4. Data Analysis, Results and Discussion

This section presents the summary results of all the variables under consideration, analysis of ADF unit root test, and the estimates of equations (1), (2) and (3) models. Some graphical analyses were also presented.

**Table 1.** Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IFR	136	10.75456	3.483356	3	18.72
TBR	136	8.850074	3.488598	1.04	15
SDR	136	2.803824	.8652861	1.39	4.5
IMDR	136	8.552574	2.446521	3.49	15.01
IIIMDR	136	9.062941	2.284772	4.13	14.65
VIMDR	136	8.812941	2.545456	3.5	15.84
XIIMDR	136	8.106691	2.833444	3.53	16.47
PLR	136	16.87154	1.043639	14.58	19.66

The summary statistics in Table1. shows that treasury bill rate has the highest standard deviation and saving deposit rate has the least standard deviation. This indicates that TBR as a measure of money market indicator is the most dispersed variable among all other variables while SDR is the least dispersed money market indicator considered in this paper. The summary statistics in the above table clearly indicates that year on year inflation (IFR) attained its peak when the value rose to 18.72% and that occurred in January, 2017.

**Table 2.** Result of ADF test for unit root

Variable	Deterministic Terms	Lags	Test values	Critical values			p-values
				1%	5%	10%	
IFR	C, trend	9	-4.195	-4.031	-3.447	-3.147	0.0046
	C, drift	13	-2.405	-2.362	-1.659	-1.290	0.0089
TBR	C, trend	11	-4.324	-4.031	-3.447	-3.147	0.0029
	C, drift	16	-2.443	-2.364	-1.660	-1.290	0.0081
SDR	C, trend	14	-4.127	-4.031	-3.447	-3.147	0.0058
	C, drift	17	-2.748	-2.364	-1.660	-1.290	0.0036
IMDR	C, trend	17	-4.488	-4.031	-3.448	-3.148	0.0016
	C, drift	24	-3.076	-2.371	-1.663	-1.292	0.0014
IIIMDR	C, trend	16	-4.438	-4.034	-3.447	-3.147	0.0019
	C, drift	24	-3.046	-2.371	-1.663	-1.292	0.0015
VIMDR	C, trend	15	-5.280	-4.033	-3.447	-3.147	0.0001
	C, drift	24	-2.376	-2.371	-1.663	-1.292	0.0099
XIIMDR	C, trend	17	-4.704	-4.034	-3.448	-3.148	0.0007
	C, drift	24	-2.691	-2.371	-1.663	-1.292	0.0043
PLR	C, trend	11	-4.300	-4.034	-3.447	-3.147	0.0031
	C, drift	19	-2.381	-2.366	-1.661	-1.291	0.0096

The ADF unit root test result of Table 2 above indicates that all the variables under consideration have no unit root in level series that is, all are integrated of order zero ( I(0)) up to

certain number of lags as reported in Table 2 and need not to be differenced to achieve stationary. Specifically, for the two options of deterministic terms considered (constant trend and constant drift respectively) and the p-values are all significant at 1%. Hence, the null hypothesis of a unit root is rejected against the alternative.

#### 4.1 Estimates of Regression Models

The summary estimates of the multiple regression models specified in Equation (1) to (3) are presented below;

Estimates of equation (1) are presented below;

$$IFR_t = 0.6866 + 0.1042TBR_t - 0.0693SDR_t - 0.0510IMDR_t - 1.3748IIIMDR_t$$

<i>p</i> – values	[0.899]	[0.253]	[0.854]	[0.930]	[0.067]
<i>t</i> – values	(0.13)	(1.15)	(-0.18)	(-0.09)	(-1.85)

$$+ 0.2985VIMDR_t + 0.8118XIIMDR_t + 0.0772PLR_t + e_t$$

<i>p</i> – values	[0.012]	[0.006]	[0.012]
<i>t</i> – values	(0.61)	(2.77)	(2.54)

F(7,128) = 3.64, Prob > F = 0.0013, R - Squared = 0.1661, Adj. R - Squared = 0.1205,  
Durbin - Watson statistic = 2.1873

Estimates of equation (2) are presented below;

$$IFR_t = 14.1958 + 0.1823TBR_{t-1} + 0.2326SDR_{t-1} - 0.5285IMDR_{t-1} + 0.0656IIIMDR_{t-1} - 0.3597VIMDR_{t-1}$$

<i>p</i> – values	[0.011]	[0.053]	[0.554]	[0.383]	[0.932]	[0.217]
<i>z</i> – values	(2.55)	(1.94)	(0.59)	(-0.87)	(0.09)	(1.23)

$$- 0.3597XIIMDR_{t-1} - 0.2647PLR_{t-1} + e_{1t}$$

<i>p</i> – values	[0.235]	[0.399]	log likelihood = -351.76314 ,	AIC = 5.329824
<i>t</i> – values	(-1.19)	(-0.84)		

Estimates of equation (3) are presented below;

$$IFR_t = 22.6266 - 0.3251TBR_{t-2} + 0.3052SDR_{t-2} + 0.3856IMDR_{t-2} - 0.4573IIIMDR_{t-2}$$

<i>p</i> – values	[0.000]	[0.001]	[0.441]	[0.533]	[0.557]
<i>z</i> – values	(4.02)	(-3.36)	(0.77)	(-0.62)	(-0.59)

$$- 0.1498VIMDR_{t-2} + 0.0272XIIMDR_{t-2} - 0.4688PLR_{t-2} + e_{13}$$

<i>p</i> – values	[0.776]	[0.931]	[0.140]	log likelihood = -349.9481636
<i>t</i> – values	(-0.28)	(0.09)	(-4.48)	AIC = 5.34251

#### 4.2 Discussion of Empirical Findings

The result of equation (1) shows that SDR, IMDR and IIIMDR have negative effects (right directional effect) on inflation but only IIIMDR is significant at 10% level. The result also indicates TBR, VIMDR, XIIMDR and PLR have positive effects (unexpected dimensional effect) on IFR, but only XIIMDR and PLR are significant at 1% and 5% respectively. The idea is that monetary policy is expected to reduce inflation since Nigerian experience is that of a rising inflation pressure. The

positive effect of TBR on IFR is similar with some earlier findings like that of Fama and Schwert (1977); Mishkin (1981); Fama and Gibbons (1982) and Chan (1994) who provided empirical evidence for the positive relationship between expected inflation variation and the t-bill rates.

The outcome of equation (2) reveals the one month lagged effect of all the predictor variables exact no significant effect on inflation except TBR which exact a positive impact on current inflation (IFR) and it is significant at 10% level. Permit me to say that this outcome is not the anticipated directional influence MPC may intend, since it implies that a unit rise in TBR will result to about 18.2% rise in inflation, especially now that the economy drift into recession, characterized by naira loosing against dollar, high cost of goods and services, back log of salary arrears in many states and local governments etc.

The outcome of equation (3) reveals that the two months lagged effect of all the predictor variables exact no significant effect on inflation except TBR which exacts a negative impact on current inflation (IFR) and it is significant at 1% level. Let me also say that this outcome is the right directional influence, since it implies that a unit rise in TBR will result to about 30.5% reduction in inflation. Without overstatement, TBR seems not to have direct influence on inflation but a kind of indirect and delay mode of effect on inflation on a short-run.

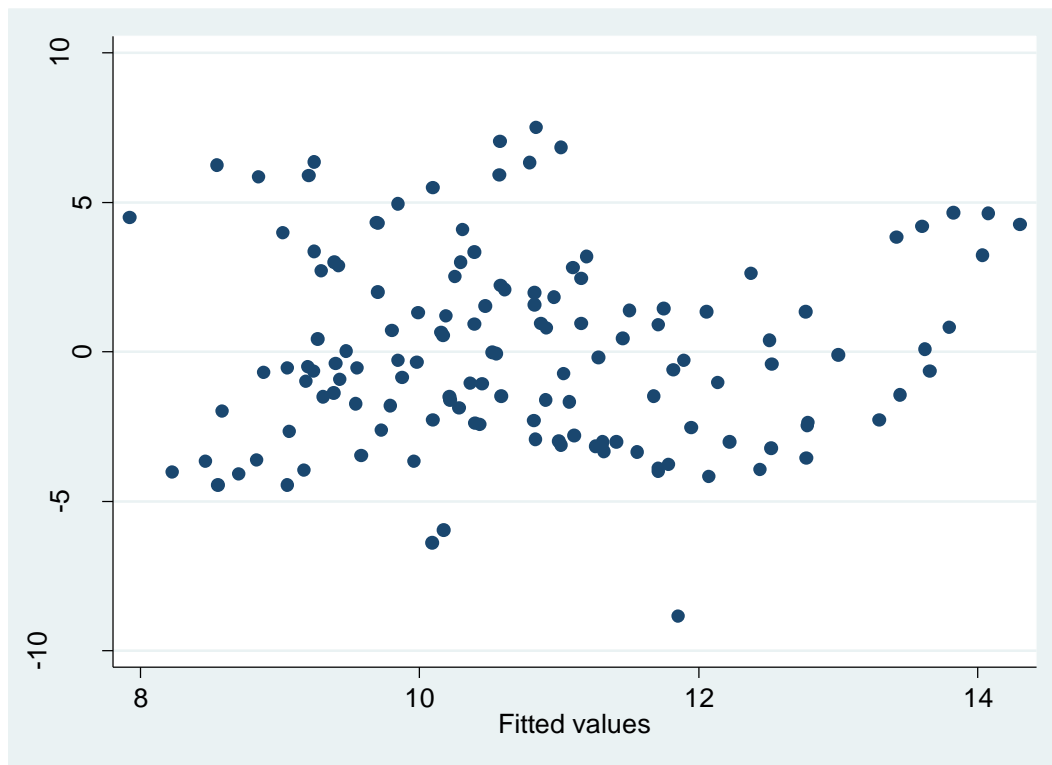


Figure1. Plot of residual  $\hat{\varepsilon}_i$  against the fitted values  $\hat{Y}_i$

The result of Fig.1 shows that the residual is normal and since there is no pattern in the magnitude of the dispersion about zero associated with changing  $\hat{Y}_i$  suggests absence heterogeneous variances of  $\varepsilon_i$ . Hence, the model is adequate.

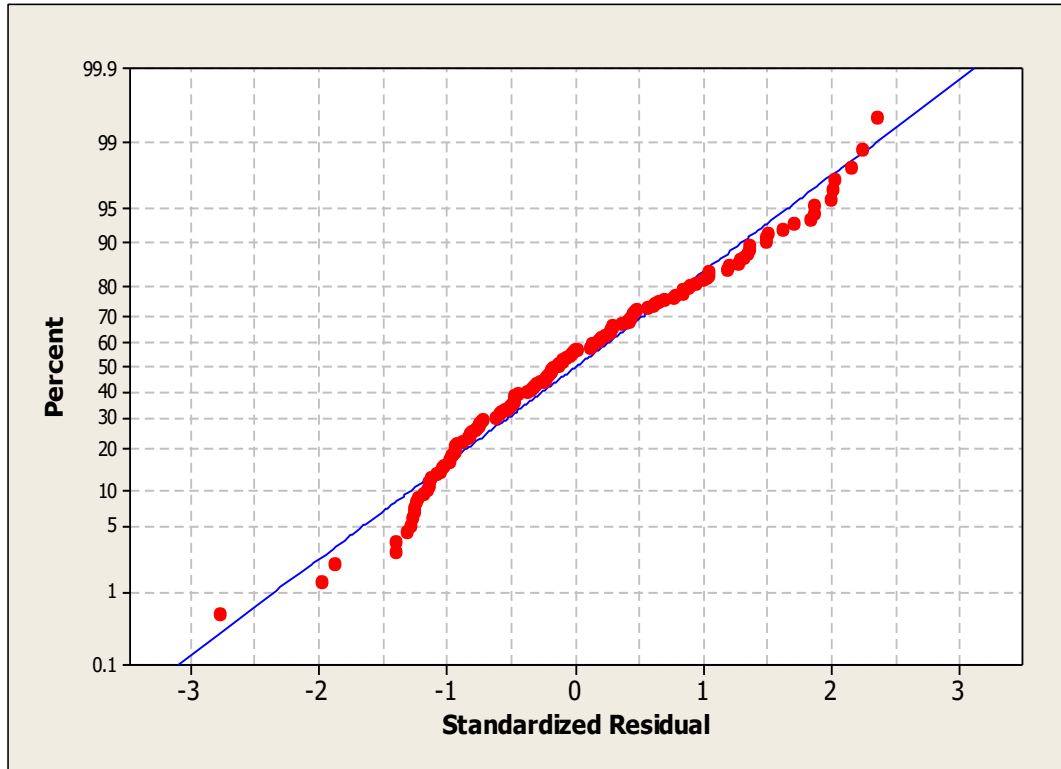


Figure2. Probability plot of standardized residual

The result of Figure 2 shows that the assumption of normality condition of the error term is satisfied

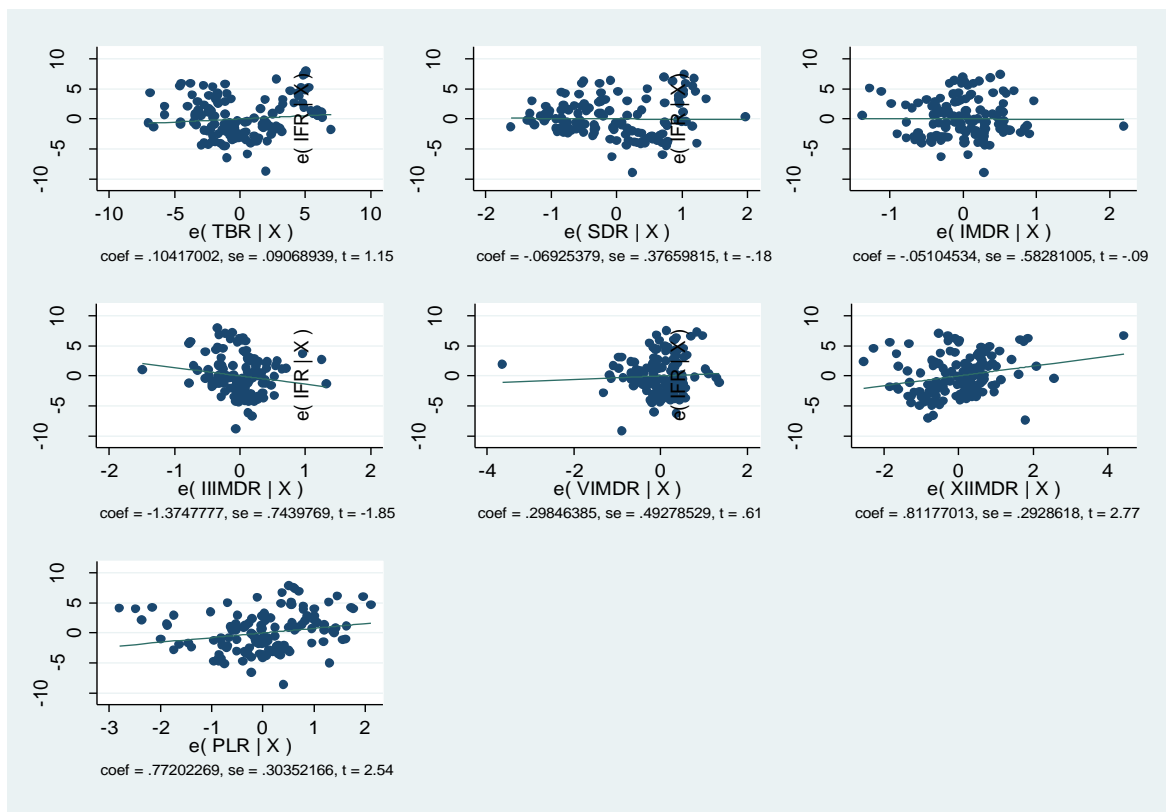


Figure3. Plot of individual predictor effect on inflation in one image



The essence of Fig.3 is to clarify the dimensional relationship between inflation as it relates individual predictor's effect. Fig 3 indicates that among all the predictors, only three month deposit rate has negative dimensional influence on inflation. Six month deposit rate and prime lending rate have positive dimensional influence each on inflation.

## 5. Conclusion and Policy Implications

The paper is focused on the effects of monetary policy on inflation in Nigeria. Variables of interest are money market indicators such as TBR, SDR, IMDR, IIIMDR, VIMDR, XIIMDR and PLR and year on year inflation (IFR). The unit root test were done using the ADF unit root test and the results indicated that all the variables considered are integrated order zero  $I(0)$ , hence are considered stationary for the reported number of lags. Multiple linear regression was employed with OLS method of estimation for equation (1), generalized linear model was employed to examine the effects of lagged predictor variation on inflation . hence, equation (2) and (3) were estimated using maximum likelihood method

The results of equation (1) showed that none of the predictor variable has a right directional effect on inflation except IIIMDR and it is significant at 10% level. The result also indicates TBR, VIMDR, XIIMDR and PLR have positive effects (unexpected dimensional effect) on IFR, but only XIIMDR and PLR are significant at 1% and 5% respectively. The result implication is that except IIIMDR, all other interest rates policy considered in this study are not proactive enough to curb inflation in Nigeria. Equation (2) results showed that none of the predictor variables at one month lag exact a right directional significant effect on inflation, though TBR at lag 1 exacts a positive impact on current inflation at 10% level. Equation (3) reveals that none of the predictor variables at lag 2 exact significant right directional effect on current inflation except TBR and it is significant at 1% level. This implies that TBR seems to be practical in curtailing inflation in a short-run rather than directly.

However, it is observed that among all the money market indicators used in measuring monetary policy considered in this study, three months deposit rate (IIIMDR) has direct effect in controlling inflation towards the right direction while treasury bill rate (TBR) influences inflation towards the right direction in shot-run.. Hence, there is the need for CBN and MPC to re-evaluate the monetary policy framework in order to achieve price stability and economic growth.

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