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Monetary Policy Manipulation by the Central Bank of Nigeria and its implication in Achieving Sustainable Economic Development in Nigeria by the year 2030.

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Abstract

The objective of this paper is to discuss inflation target policy thrust using Taylor's rule to analyze the impact of interest rate fluctuation on the actualization of Sustainable Economic Development goal in Nigeria by the year 2030. The writers used the Generalized Method of Moments (GMM) estimator to estimate the forward looking Taylor rule with interest rate smoothening. Data covering quarters 1 – 4 between 2006 and 2013 were obtained with 32 observations in total. The model for the study is the forward looking Taylor's rule. The findings of the study shows that, the inflation co-efficient (β=0.47) is statistically significant while the co-efficient of the out-put gap (ϒ=-0.10) is negative but statistically insignificant for backward – looking reaction function. while for forward looking reaction function inflation co-efficient (β = 0.47) shows that a one percent point (p.p) rise in expected annual inflation induces the CBN to raise interest rate by less than half p.p Meaning that CBN do accommodate inflation shocks. This does not follow the Taylor's rule. It is thus recommended that; government should ensure that there are constant changes in exogenous variables on the demand side of the economy; keep inflation close to its target rate and avoid large output gap; Nigerians at large need to imbibe consumption smoothening behavior.

Keywords: ***monetary policy, interest rate, Taylor Rule, price stability, Sustainable Economic Development, year 2030.***

Introduction

Monetary policy is the central tool for maintaining price stability and a key tool in managing the business cycle. Inflation Targeting is the monetary policy that the Central Banks and monetary authorities do use to stabilize rate of inflation in order to provide good footings for the economy through the use of short-term interest rate. In Nigeria, the Central Bank of Nigeria adopted inflation targeting as its monetary policy framework in 2012. The CBN primary objective then was price stability (Arto, 2016). CBN also responded to other variables such as output and exchange rate in addition to inflation rate. The framework has been increasingly viewed as a good monetary policy framework and widely applauded by many economists and policymakers.

Monetary policy outcomes vary greatly; depending on both the target and instrument in use. The implication is that, monetary policy should not only be conducted on the basis of opinion polls, but rather, policy makers are expected to have clear and quantifiable reaction functions for inter-temporal instrument variations (Chukwuma, 2011). Such reaction functions identifies a set of variables that combined with monetary policy rules to give a good approximation for the process by which interest rates are determined.

A cursory look at the Nigerian economy today has shown that there has been little systematic or empirical analysis of how monetary policy has been set in by the monetary authority in the country. Due to different proposals on how interest rate should be set for a number of years, there have been large deviations between the targets and the actual performance of major macro-economic aggregates.

This paper examines the reactions function(s) of the Central Bank of Nigeria in setting interest rates. It is aimed to answer some questions such as: in setting interest rates, has the CBN acted as if it was following a 'rule'? Does it respond systematically to variables other than inflation and output? How has the introduction of inflation targeting affected monetary policy? Is there an evidence of interest rate smoothing? And, will the manipulation of interest rate in this nature be able to help the country in achieving sustained economic development by the 2030?

As a point of departure, this paper is country and economic specific as it is presented from economic dimension. It premise on how the Nigerian government uses its monetary policy tools through interest rates manipulations, whether these manipulations could help in achieving the targeted sustainable growth and development . the rest of the paper is presented as follows.....

Literature Review

Theoretical Review on the Taylor Rule

Since 1990s, interest rate, by replacing the money supply, has gradually become the intermediate target of monetary policy in the western countries and it has played more and more important role in the conduct of monetary policy. Taylor rule, firstly proposed by Taylor (1993), characterizes Central Banks' behaviour through a linear function of interest rate to inflation gap (the deviation of inflation rate from its target) and output gap (the deviation of real output from its potential value). Now it is an important reference for Central banks when implementing monetary policy to stabilize price level and smooth output fluctuations. Taylor rule not only performs well in empirical study, but also has fundamental economic theory. Given a quadratic Central Bank loss function and linear aggregate demand and supply curves in the dynamic structure of economy, we can obtain Taylor rule by minimizing the loss function (Zheng, Wang and Guo, 2011).

In its original form, the Taylor rule assumes that Central banks use past or current values of inflation and output gap to set up the interest rate. However, in practice, they tend to rely on all available information-concerning the expected evolution of prices-when defining the interest rate. For that reason, Clarida, Galf and Gertler, (1999, 2000) suggest the use of a forward-looking version of the Taylor rule where Central Bank's target expected inflation and output gap instead of past or current values of these variables. That practice allows the Central Bank to take various relevant variables into account when forming its forecasts.

Taylor's rule has two elements. The first is for the nominal interest rate to rise more than one-for-one with inflation, so that the real rate increases when inflation rises. The second is for the interest rate to rise when output is above normal and fall when output is below normal. Taylor's proposed rule is linear in inflation and in the percentage departure of output from its natural rate (Romer, 2012).

Inflation Target Rules

There have also been proposed simple rules for targeting inflation as opposed to instruments. Of these proposed policies, inflation targeting has received by far the most attention (Clarida et al. 1999). Inflation Targeting is the monetary policy that the Central Banks try to stabilize inflation in order to provide a good sentiment for the economy by using the short-term interest rate as the policy instrument. The rationale for inflation targeting is in twofold (Clarida et al. 1999).

The first is simple to guarantee that monetary policy avoids the mistakes of the pre-Volcker era by identifying a clear nominal anchor for policy. Note that in the pre-Volcker

years, the United State monetary Authority allowed real short-term interest rates to drift lower even as anticipated inflation rose. True, the monetary authority did hike nominal interest rates, but often by less than expected inflation. Thus, the policy did not act to stabilize the economy which would have required real interest rates to rise in response to expected inflation (Farrell, 2019). The inflation target is in effect the nominal anchor. Since the anchor is directly in terms of inflation, it avoids the potentially instability problems associated with alternatives such as money growth that are only indirectly linked to inflation. For example, if there are large shocks of money demand, then a money growth target may fail precisely to pin down the equilibrium inflation rate.

The second rationale has to do with credibility and commitment. We have seen that it is in general optimal for policy-makers to place a higher weight on the costs of inflation than the true social loss function suggests. The focus on inflation targets may be viewed as a way to instil a higher effective weight on inflation in the policy choice.

Empirical Evidence

There are a number of empirical studies devoted to find the reaction(s) of Central Bank of different Countries in setting interest rates. Two recent papers were reviewed in this study. These papers were chosen based on the similarities between the method and subject of their investigation and the purpose of this paper.

Aimed at advancing our understanding of monetary policy in emerging market economies, Sanchez-Fung and José (2011) investigated Brazil's economy. The central objective was to assess whether the Taylor rule reaction functions is practical for understanding how monetary authorities in Brazil behave following inflation targeting adoption and switching to a floating exchange rate regime. Monthly economic time series data was used. Nominal Select (overnight) interest rate was used as proxy for nominal interest rate; inflation rate was measured using CPI; output was proxy by industrial production index, while Hodrick-Prescot (HP) filter was used to obtain the output gab and nominal exchange rate was expressed in units of domestic currency per units of US$. The method of estimation was by Autoregressive Distributed Lag-General Unrestricted Model (ADL-GUM). The benchmark reaction function reveals that the Central Bank behaves according to the Taylor principle by raising the overnight Selic policy interest rate more than the amount by which expected inflation exceeds the target but it does not systematically react to exchange rate developments. (Precisely Banco Central do Brasil, Selic rate is the weighted average interest rate of the overnight interbank operations—collateralized by federal government securities—carried out at the Special System for Settlement and Custody -

Selic). The excess policy response carries a positive and significant coefficient in the reaction function including only an inflation gap variable.

Also Chukwuma (2011) using error correction (ECM) estimation approach estimated the monetary policy reaction function for Nigeria. Empirical estimates could not confirm interest rate smoothing but Central Bank of Nigeria acts consistent with it price stability and private sector-led growth objectives, but accommodates discrepancies in its goals and outcomes, possibly without intending to do so. This study also follows the Taylor rules.

Methodology

Model Specification

Simple Interest Rate Rules

The basic formulation of the simple reaction function used in the monetary policy literature is the Taylor rule, proposed by Taylor (1993) for U.S. His rule has two elements. The first is for the nominal interest rate to rise more than one-for-one with inflation, so that the real rate increases when inflation rises. The second is for the interest rate to rise when output is above normal and fall when output is below normal. Taylor's proposed rule is linear in inflation and in the percentage departure of output from its natural rate. That is, his takes the form

$$i_t+\beta(\pi-\pi^*) \; +=r^n\gamma(\ln yt-\ln yt^*) \qquad \beta > 0,\ \gamma > 0 \ldots\ldots\ldots\ldots\ldots\ldots 1$$

where: i_t= *desired short-term nominal interest rate* r^n=*real interest rate*

π_t=inflation rate π^*_t=targeted inflation

y_t= real output y^*_t= potential output

In Eq. (1), the parameter------- indicates the sensitivity of interest rate policy to the deviation of inflation rate from its target and the parameter ------ indicates the sensitivity of interest rate policy to the output gap. CBN has a secondary objective of exchange rate stabilization. Therefore Eq. (1) is modified to appreciate the effect of exchange rate. This takes the form;

$$i_t=r^n+\beta(\pi-\pi^*) \; +\gamma(\ln yt-\ln yt^*) \; +\theta e_t-\varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots 2$$

where e_t is the real exchange rate (that is, the price of foreign goods in terms of domestic goods). Eq. (2) gives simple backward-looking reaction function version of the Taylor rule.

Forward-looking Taylor Rule

In the traditional Taylor rule, the reaction of interest rate to inflation and output gap is contemporary or backward-looking. However, in practice, Central Banks do not tend to take the past or actual inflation as the target but the expected inflation. Therefore, Clarida et al. (1998) suggested introducing the expectation to construct a forward-looking version

of Taylor rule, which assume that the Central Bank regards the nominal interest rate ----- as the instrumental target and the rate depends on both expected output gap and expected inflation. Specifically:

$i^*_t = r^n + \beta(E_t[\pi_{t+k}] - \pi^*) + \gamma E_t(lny_{t+m} - lny^*_{t+m})$ 3

where E_t is the conditional expectation operator. We also assume that the Central Bank adjusts interest rates in a cautious way through smoothing in the form of partial adjustment as follows:

$i_t = \rho i_{t-1} + (1-\rho) i^*_t + v_t \quad 0 \leq \rho < 1$ 4

Letting $\alpha \equiv r^n - (\beta - 1)\pi^*$ and $\hat{y} \equiv y_t - y^*_t$ *and substituting Eq. 3 into Eq.2*

Rearranging, gives the following simplified forward –looking monetary policy function:

$i_t = (1-\rho)\{[\beta\pi_{t+k}] - \pi^*) + \gamma[(\hat{y}_{t+m} - E_t(\hat{y}_{t+m})]\} + (\rho i_{t-1}) + \mathcal{E}_t$ 5

where : $\mathcal{E}_t = -(1-\rho)\{[\beta\pi_{t+k} - E_t[\pi_{t+k}] - \pi^*) + \gamma[(\hat{y}_{t+m} - E_t(\hat{y}_{t+m})]\} + v_t$

Clarida et al. (1998, 2000), among others, estimate the parameters of the model (1) by GMM.

Eq. (5) is a linear GMM regression, with orthogonal conditions of the form:

$E_t\{i_t - (1-\rho)\{[\alpha + \beta\pi_{t+k}] - + \gamma\hat{y}_{t+m}\} + \rho i_{t-1} | z_t\} = 0$

Where z_t is a vector of instrument variable that are orthogonal to $\mathcal{E}_t$

GMM Regression Techniques

A generalized method of moments (GMM) estimator is used to estimate the forward-looking Taylor rule with interest rate smoothing. the first task of model selection is to determine the appropriate numbers of ***k*** and ***m*** for the linear forward-looking rule. The forecast horizon parameters ***k*** and ***q*** are set at 4 and 1, respectively, following the suggestion of Clarida et al. (2000) that these horizons are roughly in line with the conventional wisdom regarding the lags after which monetary policy affects these variables.

The set of instrumental variables used in this study includes the lags 1-4 and 8 of inflation rate and output gap, as well as exchange rate and constant.

Due to the overlapping observation structure, the error term $\mathcal{E}_t$ is expected to be serially correlated. In estimating GMM, a heteroscedasticity and serial correlation consistent (HAC) estimator is therefore required. Following Clarida et al. (1998), among others, standard errors are calculated by using Newey and west (1987) heteroskedasticity and autocorrelation consistent (HAC) standard errors. The quadratic spectral kernel with Newey-West's fixed bandwidth selection in this regard was used in this study. The base case is used, because it yields smaller standard errors for the estimating equation than other methods.

Data specification

In this study, the data series employed are quarterly data for Nigeria covering the period 2006:Q1 - 2013:Q4 with 32 observations in total. The detail of data selection, processing and description is given as follows:

1. *Short-term Nominal Interest rate:* Since the inception of business of the Bank, the key rate announced by the Bank of Nigeria has undergone various transformations and changes. First the name ***rediscount*** was used, then the ***bank rate,*** then the ***prime rate*** and now known as the ***monetary policy rate.*** The monetary policy rate (MPR) is chosen as a proxy variable of interest rate. The rate is a signaling rate which is supposed to serve as a reference cap for all other rate in the Nigerian economy. This data is available at the official website of CBN

2. *Inflation Rate:* The CPI inflation rate available at CBN official website was use in this study.

3. *Output Gap:* The third variable in the reaction function is the output gap, which the difference between potential output, an unobservable variable and actual gap. The gross domestic product (GDP) is selected as a measure of actual output. Quarterly GDP at constant 2006 prices was used. The data is available from Nigeria Statistical Service quarterly bulletins 2011q4, 2013q4. CBN does not publish an estimate of potential output, so the Hodrick-Prescott (HP) trend of GDP, which is the standard technique, used in US monetary policy analysis to estimate potential output, with smoothing parameter equal to 1,600 (Hodrick and Prescott, 1997).

4. *Exchange rate:* The inter-Bank Exchange rate (₦... US$) is used as proxy for real exchange rate.

Analysis of Results

This section of the paper presents and discusses empirical findings based on monetary policy reaction function of CBN. First result of simple backward-looking version of the Taylor rule is discussed, followed by GMM estimation of forward-looking Taylor rule with interest rate smoothing.

The estimation results of simple backward-looking version of the Taylor rule without allowing for either a forward-looking behaviour of the Central Bank or interest rate smoothing are shown in Table 1. The inflation coefficient (β.=0.47) is statistically significant and less than one. This indicates an accommodative behaviour of interest rate of inflation, which may generate self-fulfilling burst of inflation and output (Zheng, et al. 2011). The coefficient of the output gap (r=-0.10) is negative but statistically insignificant.

A negative coefficient on output gap means that if real output is below its potential level, a rise in the interest rate will have a stabilizing influence on the economy. By including the effect of exchange rate into the model, the exchange rate (inter-Bank Exchange Rate (₦..../US$) coefficient is positive and statistically significant.

Following the result of the backward-looking rule CBN does not follow the Taylor principle, but respond systematically to variables other than inflation and output.

Table 1.Backward-looking reaction estimation table

Parameter		Coefficient	Std. Error	p>|t|
Constant		2.67	0.01	0.00
Inflation reaction	ρ	0.47	0.04	0.00
Output gap reaction	β	- 0.10	0.29	0.30
Exchange rate reaction	Υ	0.89	0.01	0.00

The actual result from the computer is shown in appendix (result 1)

The benefit of a simple representation of monetary policy is that it makes policy setting easy to understand and provides a simple rule of thumb for evaluating policy. But its downside is that it may be too simple. By ignoring lags, it compresses potentially long-lived influences into variables at just one point in time. By focusing on inflation and the output gap, it ignores other potentially important information variable, like the exchange rate, world interest rates and financial stability. The exclusion of potentially valuable information may affect the predictive accuracy and stability of the rule.

Table 2.Forward-looking reaction estimation table

Parameter		Coefficient	Std. Error	p>|t|
Constant		**2.19**	**0.029**	**0.00**
Inflation reaction	ρ	**0.19**	**0.010**	**0.00**
Output gap reaction	β	**0.48**	**0.002**	**0.30**
Exchange rate reaction	Υ	**- 0.02**	**0.005**	**0.02**

The actual result from the computer is shown in appendix (result 2)

Table 2 reports the estimation result of the forward-looking reaction function for CBN. As shown in the table, all parameter estimates are statistically significant under 5% level. The inflation coefficient (β=0.47) means that; a one percentage point (pp) rise in expected annual inflation induces the CBN to rise the interest rate by less half p.p. Therefore, as the coefficient on inflation is less than unity, the real interest rate decrease as well in response to higher inflation and this will exert the undesired stabilizing effect on inflation. The inflation coefficient been less than one indicates that the CBN do not reacts aggressively to expected inflation pressures, hence CBN accommodate inflation shocks. Figure 1 in the appendix showing the relationship between inflation and real interest rate is consistent with this result: starting from the third quarter in 2007, high inflation periods have lower real interest rate while low inflation periods have higher real rate of interest.

Independently of its main concern about inflation, the CBN is also responding to the business cycle: a 1pp. Increase in the output gap generates an interest rate decrease of about 0.2pp. Also the significance of $\boldsymbol{\rho}$ in the reaction function confirms interest rate smoothing.

The forward-looking equations explain the MPR better than the backward-looking equations. This is so in the sense that the standard errors of the estimated are smaller. The standard errors of the estimate reported in Table 1 are much higher than those reported in Table 2.

With regards to whether other variables be included explicitly in the reaction function, exchange rate (Inter-Bank Exchange Rate (₦..../US$) was considered because exchange rate stability is a secondary objective of CBN and also in emerging market economies (like Nigeria) exchange rate has may impacts on the domestic economy through expenditure switching effect. The change in exchange rate is significant and positively signed indicating that a 10% change the Inter-Bank Exchange Rate (₦.../US$) over the past year is associated with a 16 basis points change in the policy rate. *The result is show in Appendix (Result 3).*

Testing for Misspecification and Validity of Instruments.

Some applications of GMM have what is known as "weak instruments" or "weak identification"; that is, instruments that are only weakly correlated with the included endogenous variables. If instruments are weak, then the sampling distributions of GMM are in general non-normal and standard GMM point estimates, hypothesis test and confidence intervals are unreliable. Therefore, Empirical researchers need to check whether or not the instruments are weak. Researchers have considered that specification works well in the sense that the model is correctly specified and the instruments $\mathbf{z}_t$are asymptotically uncorrelated with the error term, ε_t. Using Hasen's J statistic, the J statistics is not significant (P=0.9838) at 5% significance level, so we conclude that our model is correctly specified and hence the validity of the instruments. {*see Appendix Result 4 for the detail}*

Conclusion

This paper estimates the CBN's monetary policy reactions function(s) (response to deviations of inflation and output from their target values) in setting interest monetary policy rate (MPR) using the Taylor rule. Three important issues were the central focus.

First, it to understand the way CBN sets monetary policy. Second, it asks whether Central Banks, besides targeting inflation and the output gap, are also reacting to the information contained in the exchange rate. Lastly, to access whether there is evidence of interest rate smoothing. Related to the first point, this study also considers whether CBN has acted as if it was following a rule in setting interest rates.

To answer the first question, monetary policy reaction functions of CBN was estimated. The results indicate that CBN do not reacts aggressively to inflation pressures, hence CBN accommodated inflationary shocks. CBN does not boost the real interest rate when inflation has increased which is in contradiction with the Taylor's rule. Also with regard to output gap, the negative coefficient on output gap means that if real output is below its potential level, CBN increase the interest rate to have a stabilizing influence on the economy which is just the opposite of the Taylor's rule. Therefore, CBN does not follow the Taylor principle for conducting monetary policy using both backward and forward looking reaction function hence this might hamper on the government thrust of achieving sustainable economic development.

Also, the results indicate that CBN is reacting to changes in exchange rate in order to avoid inflationary pressures from imbalances in the asset and financial markets. Finally, the reaction function of CBN confirms interest rate smoothing.

From the results it is cannot be concretely established whether or not monetary policy in Nigeria in the period from March 2006 to December 2018 is good enough to ensure sustainable economic development. Calrida et al. (1999) argued that the implicit inflation targeting feature is a crucial feature of a good monetary policy management. On the other hand, Nakagawa (2005) showed that the central bank should respond to output more strongly if the financial market is markedly imperfect. This is beyond the scope of this paper, but it is worthy of future research work.

Policy recommendations

1. The Federal government should in order to generate sustained economic growth and development of the country; government should ensure that there are constant changes in exogenous variables on the demand side of the economy such as government spending, tax schedule and transitionary demand for money. These changes will spring ball the economy.

2. The federal government should as a matter of necessity, increase aggregate demands through increases in national output. This will bring about a rise in the real interest rate which reduces the interest rate sensitivity component of demand.

3. All effort should be made to keep inflation close to its target rate and avoid large output gap so as to account for any permanent demand shock(s) arising. This will go a long way to help the government to achieve its macroeconomic goals.

4. Nigerians at large need to imbibe consumption smoothening behavior. This behavior means using one income justifiably to cater for present and future consumption in line with the present value.

5. As a policy alternation to the Taylor's rule, the Federal Government can imbibe the Friedman "constant money growth rule" as a monetary policy. This means that the Central Bank can constantly adjust its short term interest rate to ensure that the fort coming money demand result in constant growth rate of the nominal money base. With this, investment will trigger-off and, unemployment reduces and sustainable development ensured. This analysis is a base for future research.

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