ASSESSING INFLATION TARGETING IN NIGERIA: AN APPLICATION OF BAYESIAN ESTIMATED MODEL

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Abstract
Inflation targeting (IT) is the band at which consumer price index is permitted to fluctuate, ensures price stability and economic growth sustainability. This paper concentrates mainly on the IT aspects of the Dynamic Stochastic General Equilibrium Model (DSGEM) using Bayesian estimation technique, to evaluate the effectiveness of Inflation targeting of the Bank (CBN), at both the theoretical and empirical levels and as policy ingredient. The question of whether adopting IT makes a difference in the fight against inflation was addressed. The results of the analyses show that domestic and foreign demand shocks are the most influential factor in affecting domestic variables in Nigeria. Nigerian inflation, however, appears to be most sensitive to domestic supply, money supply, interest rate shocks and nominal exchange rate shocks. Lastly, the findings indicate that the impact of domestic monetary policy shocks appears to be moderate.
Key words: Dynamic stochastic general equilibrium, Inflation targeting, Bayesian Analysis.

JEL codes: C32, E30, C11

1. Introduction

Inflation targeting (IT) framework is the band at which consumer price index is permitted to fluctuate. It ensures price stability, control inflation, sustainable economic growth and increased transparency of the monetary policy strategy. Price stability is however a common goal for Central Bank with some inflation targets set by governments and Central Bank. This is a main target of monetary policy in a lot of countries, be it developed or emerging economies of the world. IT policy flexibility of the Central Bank depends on the band of the consumer price index frame, option to narrow or expand the band of inflation frame, gyration frequency of inflation, the severity of economic shocks and credibility of the Central Bank. If consumer price frame is too wide, this will make inflation expectations and the commitment of the Bank uncertain. In order to provide certain guidance regarding inflation expectations and overcome the disadvantage of a range of the IT index, most of the country's Bank either just set the target point or both set the target point and allow fluctuations to be +/- 2% or less (Riksbank, 1993).

Since the 1980s, inflationary developments in Nigeria created fundamental challenges to the task of monetary management via monetary policy applications. Different strategies in the

past have failed to arrive at the objective of price stability due to various reasons such as ineffectiveness of the transmission mechanism to bring about changes in the ultimate target-that is when the operating and average targets are altered. Adenekan and Nwanna (2004) indicated that by 1988 and 1989, inflation had skyrocketed to more than 50 per cent in Nigeria. Furthermore, Bawa and Abdullahi (2012) stated that in spite of the fact that inflation declined to about 7.5 per cent in 1990, it rose to 44.8, 57.2 and 57.0 per cent, respectively, in 1992, 1993 and 1994. It reached an all-time high of 72.8 per cent in 1995. The headline inflation in the country has constantly moved around double digit figures. (See CBN various annual financial reports; 2008; 2010; 2011 and 2013). The National Bureau of Statistics (various publications) points that in 2018, Nigeria inflation rate was 12.09 percent, a 4.43 decline from 2017, but in 2017, it was 16.52 percent, a 0.85 percent increase from 2016, same inflation rate in 2016 was 15.68 per cent, a 6.67 increase from 2015. It can be deduced that, incessant fluctuations in inflation was as a result of the current economic recession and recent dollar restrictions. However, since late 1990s, the CBN has persistently expressed its commitment to low inflation and also set annual inflation targets.

To date, various monetary policy strategies of the Bank (Central Bank of Nigeria- CBN) were not very effective in containing the upward trending inflation. At the macroeconomic level the very high volatility recorded in price inflation, real exchange rate, and terms of trade shocks resulting from currency overvaluation etc. closely reflect the pattern of Nigeria's external economic shocks. Presently, the CBN is now seriously targeting the implication of rising inflation on the efficacy of monetary policy and thus, begin to rethink the direct approach to monetary management. That is, appropriate quantity of money supply, asset prices, exchange rates, consumption and investment at suitable levels in order to achieve stable price.

The monetary policy of IT takes into consideration the fact that monetary policy decisions on a forecasted rate of inflation shows clearly the expected trend of inflation. That is, the central bank forecasts the future path of inflation, which is compared with a specified inflation target. If expected inflation deviates from the target, the need arises for a change of policy and instrument(s) used to achieve the objective. This led to the development of Dynamic Stochastic General Equilibrium Model (DSGEM), which Bayesian technique becomes one of the estimation techniques very popular as a veritable tool for monetary policy analysis in a large number of Central Banks with the adoption of inflation targeting as a monetary policy framework since the 1990s. This development is often credited with having brought about substantial reductions in both the level and variability in the inflation-targeting countries, and is sometimes argued to have improved the stability of the real economy as well. (see, Leiderman and Svenson (1995) and Bernanke et al. (1999).

Despite the increasing adoption of DSGEM, which Bayesian technique is workhorse in both developed and emerging economies, there have been very few studies focusing on Nigeria.

Existing studies on Nigeria inflation dynamics have neither employed IT monetary policy framework Dynamic Stochastic General Equilibrium Model nor estimate their model with Bayesian technique. Adebiyi and Mordi (2008), attempt to develop a small scale macro econometric model for the Nigerian economy, using dynamic stochastic general equilibrium (DSGE). This model incorporates expectation as an anchor in the forward looking monetary policy objective of the CBN. It captures most of the channels through which policy makers believe monetary policy can influence a small open economy with a managed floating exchange rate. Their model, only captures reduced-form parameters and does not consider inflation targeting as a monetary policy framework in Nigeria. Bernanke and Miskin (1997) suggested that if IT can be used as a framework for making monetary policy, rather than as a rigid rule, it has a number of advantages, including more transparent and coherent policy, making and increased accountability. In Mishkin (2000) suggestion, IT is not a panacea, but it can be a highly useful monetary policy tool for some emerging market economies. This paper concentrates mainly on the IT aspects of the Dynamic Stochastic General Equilibrium Model (DSGEM) using Bayesian estimation technique, to evaluate the effectiveness of Inflation targeting of the Bank (CBN), at both the theoretical and empirical levels and as policy ingredient. The question of whether adopting IT makes a difference in the fight against inflation was addressed. The study would assist monetary authority in formulating policies and forecasting policy implications - if inflation targeting needs to be modified in the light of present inflation crisis in Nigeria?

The paper is organized as follows; following the introduction which presents background of the study. The remainder of the paper is organized as follows. The next section surveys the theoretical and empirical literature review, section 3 describes the data and methodology, while section 4 presents empirical results and discussion of findings. Section 5 provides the conclusion and policy recommendations.

2. Review of Empirical and Theoretical Literature

'Inflation targeting' is an economic policy in which the central bank of a country estimates and makes public a projected or 'target' inflation rate. A more robust advantages of inflation targeting characteristics are; it meet the challenge of keeping the inflation expectations stable in the period of external shocks, also helps countries achieve lower inflation in the long run and bring inflation outcomes closer to desired levels. It strength monetary policy independence and improve monetary policy efficiency. In addition stabilizes both inflation and the real economy. IT is a monetary policy framework whereby public announcement of official inflation targets (or target ranges) is undertaken along with explicit acknowledgement that price stability (meaning low and stable inflation) is monetary policy's primary long-term objective (King 2002). Monetary policy as a mechanism for openness, transparency, and accountability should be in place with respect to monetary policy formulation. For major central banks in the world irrespective of the structure the economy

in place – developed and emerging economies, IT have become the operational monetary framework of choice to achieve price stability.

An added role of IT is to ‘’lock in’’ the gains from ‘’taming’’ inflation. Bernanke, Gertler, and Gilchrist (1999) are explicit on this issue when they argue that ‘’one of the main benefits of inflation targets is that they may help to ‘lock in’ earlier disinflationary gains, particularly in the face of one-time inflationary shocks”. Therefore, in the case of inflation targeting in an open economy, exchange rate considerations are of crucial importance. It transmits the effects of changes in the policy instrument, interest rates, and various foreign shocks. Given the critical role of the exchange rate in the transmission process of monetary policy, excessive fluctuations in interest rates can produce excessive variability in output by inducing significant changes in exchange rates. Mish Kin (2000), suggests that in the medium term ‘’ in contrast to an exchange rate peg, inflation targeting enables monetary policy to focus on domestic considerations and to respond to shocks to the domestic economy’’

A large number of studies in the past, in the area of small open economy DSGE framework empirically evaluated through calibrations and estimation using the Bayesian approach-utilizing information from the previous studies. But all these studies concentrated on DSGE framework empirical evaluation without been specific on inflation targeting as a monetary policy framework. Da Silveira (2006) presents DSGE model of a small open Brazillian economy with special reference to monetary policy analysis. Variables utilized are real GDP, CPI Inflation, 3 month Treasury Bills rate, Real exchange rate as a proxy of short term interest rates, Terms of trade, U.S. real per capita GDP and U.S., CPI Inflation. This is similar to that of Kolassa (2008), presented a two-country model linking Poland and euro area. The model used GDP growth, consumption CPI Inflation, real wages, investment, nominal exchange rates and interest rates variables. These open economies DSGE framework is empirically evaluated through calibrations and estimated by the Bayesian approach utilizing information from the previous studies as priors. Overall, results of the model can be seen as rather inconclusive about the differences in parameters describing agent’s decision making in Poland and in the Euro-area.

Furthermore, Liu (2006) designs DSGE based New Keynesian framework to describe the key features of a small open economy. Particularly, the model focuses on the transmission mechanism of monetary policy to provide a tool for basic policy simulations for New Zealand were used. Key variables include GDP, overall inflation, import inflation, nominal interest rate, competitive price index, real exchange rate, foreign output, and foreign real interest rate. In this study, the Bayesian estimation technique provides comparison between non-nested models and parameter uncertainty explicitly. The Bayesian inferences are in terms of probabilistic statements rather than the notional repeated samples of classical hypothesis testing procedures.

Moreover, Hamann, Perez and Rodriguez (2006) develop a DSGE model for small open economy of Colombia. The model used take into account two main sectors that are categorized as tradable and non-tradable sectors with three agents; households, firms and government sector. The variables used are inflation, nominal interest rate, and real output and exchange rate. Methods used in the analysis are, Calibration, minimum Distance Spectral Analysis and the Bayesian technique. The results show that the policy shocks explain only 3-7 percent variation in inflation, 2.2 percent in real exchange rate and just 0.1 percent in output. The largest source of variation comes from the shocks in Total Factor Productivity (TFP) of the non-traded sector. Buncic and Melecky (2007) reviewed an open economy New Keynesian policy model for Australian economy. The study focuses on the importance of external shocks on macroeconomic fluctuations comparing this to the impact of domestic shocks for Australian economy. Variables employed, are foreign interest rate, foreign inflation, foreign output gap, domestic interest rate, domestic inflation, domestic output gap, real exchange rate and nominal exchange rate series. They prefer to estimate the model New Keynesian Policy Model (NKPM) in Bayesian framework. The empirical estimates from the study suggest that domestic and foreign demand shocks and to some extent the domestic supply shocks are the most influential in Australian business cycle. The effect of real exchange rate on output revealed in the study is somewhat moderate. Inflation appears very sensitive to the domestic supply shocks. The impact of domestic monetary policy on inflation is moderate.

The studies by, Adebiyi and Mordi (2008), Garcia (2009) developed a simple dynamic general equilibrium New Keynesian macro econometric model for forecasting and policy analysis for the Nigerian economy. The model, focused nominal interest rate and money supply, incorporates inflation expectation, thereby anchoring a forward looking monetary policy objective of the CBN. Estimating with the Nigerian quarterly data from 1995 to 2007, the results justify the current policy actions of the CBN to control inflation. The review above shows that the empirical findings, using DSGE Bayesian technique determination of inflation domestically and foreign is uniform.

Existing studies on Nigeria have neither employed IT as a monetary policy framework of DSGE model nor estimate their model with Bayesian technique for the Nigerian economy. This study, however focus the issue of the use of a more dynamic model that shows the exact policy and model statement. It employ a data point observation to investigate the IT and monetary policy of CBN in Nigeria during the period 1986-2018, using the Bayesian estimation technique. This study, is therefore an extension overall the studies reviewed and result is expected to differ from previous varied studies that were carried out before this time.

3. Methodology

While some models are built specifically to validate theoretical consistencies, others are constructed for policy evaluation, impact analysis and forecasting purposes. In order to

improve the forecasting ability of the DSGE models, Tovar (2009) suggests the improvement in the structure of the model, the empirical validation and the effective communication of the model output to policy makers and the public. This study mainly used Calibration method of analysis based on Bayesian DSGE models. Calibration means that most of the values of the parameters of the model are chosen from ‘’findings in other applied areas of economics……’’(Kydland & Prescott, 1996). That is to evaluate the operating mechanism of monetary policy, and simultaneously analyze the applicability of monetary policy framework of inflation targeting in Nigeria. This section extensively examines the method and procedure adopted to conduct and advance the study.

Bayesian estimation

The estimation technique that is fast gaining popularity in this IT operational framework is the Bayesian estimation. This approach can be seen as the consolidating aspects of calibration and more formal econometric techniques. What sets this estimation technique apart from other estimation techniques is that it entails the specification of some priors for the parameters that are being estimated. These priors could be obtained from the same sources that are utilized in the calibration exercise. The degree of confidence surrounding the prior is measured through the probability distribution of the parameter in question (Kremer *et al.,* 2006). IT requires the setting up of a model that can provide information on future inflation, issue that relates to the necessity of forecasting inflation. The researcher then allows the data to tilt his/her belief surrounding the prior in one or the other direction.

Theoretical Model Set Up:

The model is based on the open-economy DSGE outlined in Gali (2008) and Glenn (2009). It shares the essential features of Buncic and Melecky (2007) New Keynesian policy Model (NKPM) in Bayesian framework. Such that from the results of their model estimates, domestic and foreign demand shocks and to some extent the domestic supply shocks are the most influential, while inflation appears highly sensitive to the domestic supply shocks. The basic structure of the model captures many of the rigidities that previous studies have found are important to describe the dynamics in the model and serves as a useful starting point for developing a DSGE model for Nigeria.

Consumption, exports, imports and the CPI index

To start with, the small open economy trade with the rest of the world and foreign currency is needed to do so. The nominal exchange rate is denoted by *E* and is defined as the amount of domestic currency needed to buy one unit of foreign currency, implying that a rise in *E* corresponds to a depreciation in the domestic currency and vice versa. Terms of trade is the foreign price level expressed in domestic currency divided by the price of domestic goods,

$$S_t = \frac{E_t P_t^*}{P_{H,t}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \qquad (1)$$

The * subscript is used to denote the foreign variables, making p^*_t the foreign consumer price index (CPI) and $P_{H,,t}$ is the price of domestically produced goods. Terms of trade can be referred to as the relative price between foreign and domestic goods. In log linear form

$$s_t = e_t + P_t^* - P_{H,t} \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Therefore, the domestic consumer can buy foreign goods consumption, consists of both domestically produced goods and foreign goods according to a composite consumption index defined by the following equation (3):

$$C_t = \left[(1-\delta)\frac{1}{\eta} C_{H,t}^{\frac{\eta-1}{\eta}} + \delta \frac{1}{\eta} C_{F,t}^{\frac{\eta-1}{\eta}}\right]^{\frac{n}{n-1}} \quad (3)$$

Domestic and foreign consumption use the subscripts *H* and *F* respectively and δ is the share spent on foreign goods and hence a measure of openness. η is the elasticity of substitution between home and foreign goods.

The log linearized version of (3) is

$$c_t = (1-\delta)c_{H,t} + \delta c_{F.t} \quad (4)$$

Deriving an optimal expression for $c_{H,t}$and $c_{F,t}$ respectively we get

$$C_{H,t} = (1-\delta)\left(\frac{P_t}{P_{H.t}}\right)^n C_t \quad (5)$$

$$C_{F,t} = \delta\left(\frac{P_t}{E_t P_t^*}\right)^n C_t \quad (6)$$

(6) is the import function. Inserting equations (5) and (6) into (3) we get the domestic consumer price index (CPI).

$$P_t = \left[(1-\delta)P_{H,t}^{1-n} + \delta(E_t P_t^*)^{1-n}\right]^{\frac{1}{1-n}} \quad (7)$$

The log linearized versions of (5) and (6) are:

$$C_{H,t} = \eta\delta s_t + c_t \quad (8)$$

and $$im_t = c_t - \eta(1-\delta)s_t \quad (9)$$

The export function depends on market shares together with a sticky component as in Gottfries (2002).

$$\frac{EX_t}{Y_t^*} = \left[\delta^* S_t^{\eta^*}\right]^{\mu} \left(\frac{EX_{t-1}}{Y_{t-1}^*}\right)^{(1-\mu)} \quad (10)$$

Where μ∈[0,1] decides how the individual value between the lagged term and the rest of the right hand side as in (10).

In log linearised form (10) takes the form

$$ex_t = y_t^* + \mu\eta^* s_t + (1-\mu)(\mathrm{ex}_{t-1} - \mathrm{y}_{t-1}^*) \quad (11)$$

The net export

Net export is exports minus imports, (12).

$$NX_t = EX_t - IM_t \quad (12)$$

Divided by steady state production, *Y*, and use $X_t \approx X(1+x_t)$ gives

$nx_t = \frac{EX(1+ex_t) - IM\,(1+im_t)}{Y}$, where $nx_t = \frac{NX_t}{Y}$. In steady state we have

$EX = IM$ and $\frac{IM}{Y} = \delta$ which gives the log linear expression (4.13)

$$nx_t = \delta(ex_t - im_t) \quad (13)$$

Consumer Inflation and the Real Exchange Rate

Inflation consists of price changes from both domestic and foreign goods, whose weights depend on the CPI index which in turn depends in the consumer index (3).
Making a Taylor approximation of the CPI index gives

$p_t = (1-\delta)P_{H,t} + \delta(e_t + p_t^*) = p_{H,t} + \delta(e_t + p_t^* - p_{H,t})$ where the terms of trade definition can be used to get

$$p_t = p_{H,t} + \delta s_t \ \ldots\ldots \quad (14)$$

Taking the first time difference of (14) we get the CPI inflation (consumer inflation)

$$\pi_t = \pi_{H,t} + \delta \Delta s_t \quad \ldots\ldots\ldots (15)$$

(15) is the inflation that the consumer faces when which is why it is called consumer inflation, $\pi_{H,t}$ Is of interest to firms which will be discussed below. From (16) it can be seen that inflation in the open economy is different from that of closed economy due to price inequalities between foreign and domestic goods, which happens. When $s \neq 0$, this effect is

increasing with the openness (δ). When adding domestic and foreign price levels to the nominal exchange rate *e*, we get the real exchange rate (16)

$$Q_t = \frac{E_t P_t^*}{P_t} \qquad \ldots\ldots\ldots\ldots \qquad (16)$$

Log linearizing Q_t and rewrite e as $q_t = e_t + p_t^* - p_t = s_t - \left(p_t - p_{H,t}\right) = s_t - \delta s_t$ lead to equation (17)

$$q_t = (1-\delta)s_i$$

Our attention will now focus on statement of inflation targeting using Bayesian approach of DSGE structural macroeconomic models, based on a single equation technique. The model applied the Bayesian technique and followed (An and Schorfheide, 2005). The technique was based on maximization of the likelihood function derived from the rational-expectations solution by the Kalman-filter, combined with prior distributions. The posterior density function of the estimated parameters was characterized by the random-walk Metropolis-Hastings (MH) algorithm. Bayesian techniques were used to fit Nigerian economy case data for the period 1986Q1 to 2018 Q4. We postulate that the economics of IT are firmly embedded in equations (1) to (3) NOTE. This third equation entails an important aspect for IT, namely the role of 'expected inflation'. The inflation target itself and the forecasts of Bank are thought of as providing a strong steer to the perception of expected inflation. Consequently, inflation forecasting is a key element of IT; it can actually be thought of as the intermediate target of monetary policy in this framework (Svensson, 1997). It creates avenue for total evaluation and captures instability characteristics of the data, while equally allows for a fully structural approach to analyze the sources of price fluctuations in the Nigerian economy.

Equations to be Estimated

$\pi_t = \rho_\pi E_t\pi_{t+1} + (1-\rho_\pi)\pi_{t-1} + \lambda_1 y_t + \lambda_2 q_t + \epsilon_\pi,$ …….(17)

$$\pi_t^* = \rho_\pi^* E_t\pi_{t+1}^* + (1-\rho_\pi^*))\pi_{t-1}^* + \lambda^* y_t^* + \epsilon_{y,t}^*$$

…….(18)

The model is already in log-linear form: Formally, the solution of the log-linearized system can be written as: The model analyzed consists of a set of linearized equations so that each variable in the model is in percentage deviation from its steady state value. That is $x_1 = (X_1 - X)/X$ is in log-deviation and X is the steady state value. The variables with asterisks are the foreign variables. The open economy model we shall be estimating for Nigeria is derived from Buncic and Melecky (2007). This has become a standard method of analyzing inflation dynamics. Equations, (17&18) is an open economy New Keynesian Phillips Curve (NKPC).

This curve is derived from the profit maximization decision of the domestic firms under the monopolistic competition and sticky prices. The NK Phillips curve is forward looking, as expectations about future inflation influence the current inflation. It also comprises a backward looking element in inflation, so that past inflation matters for current inflation. This extension due to Gali and Gertler (1999) improves the inertia of the inflation. Since it is an open economy Phillips curve, the exchange rate also enters the equation.

Data Description and Sources of Data

The overall domestic inflation is the annual growth rates in consumer price index (CPI) for Nigeria. Data source of this variable is CBN statistical bulletin (various publications). Real exchange rate is calculated by multiplying nominal exchange rate with Nigeria-US price ratios where the CPI of both countries is a suitable proxy of respected prices. Domestic nominal interest rate i.e. short term money market rate is taken as the proxy of nominal interest rate. The data source for this variable is the Statistical Bulletins of the CBN. Foreign real interest rate is calculated by subtracting nominal US money market rates from expected inflation. This is obtained from the IFS-CD 2011.

4. Results and Discussion of Findings

This section presents the estimated results of the models specified in the previous section. The relationship between macroeconomic policy, (IT), economic shocks are examined with the aid of Bayesian estimation technique. The estimated results for DSGE models using the above stated techniques are then presented and analyzed as follows. According to Schorfhiede (2000), prior values can emanate from the following: personal introspection to reflect strongly held beliefs about the validity of economic theories: researcher confidence about the likely location of structural parameters of the model and observation, facts and existing empirical literature. Against this background, the prior values were obtained from the DSGE model for the Nigerian economy by Ayeni (2010), Adebiyi and Mordi (2010), expert judgment (JVI/IMF, 2010) and DYNARE specification.

In practical perspective, for this study to fit its referenced model, which consists in placing a prior distribution $\rho(\Gamma)$ on structural parameters Γ, the estimate of which are then updated using the data $У^T$ according to the Bayes rule:

$$\rho(\Gamma/У) = \frac{\rho(У^T/\Gamma)}{\rho(У^T)} \propto L(\Gamma/У^T)\rho(\Gamma) \quad \ldots\ldots \quad (19)$$

Where $\rho(\Gamma/У) = L(\Gamma/У^T)$ is the likelihood function $\rho(\underline{У^T/\Gamma})$ is the posterior distribution of parameters and $\rho(У^T)$ is the marginal likelihood defined as:

$$\rho(У^T) = \int \rho(У^T/\Gamma)\rho(\Gamma)\, d\Gamma \quad \ldots\ldots \quad (20)$$

Any DSGE model forms a linear system with rational expectations, the solution to which is of the form:

$$R_t = B_t(\Gamma)R_{t-1} + B_2(\Gamma)U_t \quad \ldots\ldots (21)$$

$U_t = B_3(\Gamma)U_{t-1} + B_4(\Gamma)\varepsilon_t$ …… (22)

Where Rt is a vector of endogenous variables, U_t is a vector of stochastic disturbances and ε_t is a vector of innovations to stochastic shocks and coefficient matrices Ai depending on the parameters of the model. Equations (20) and (21) linked observable variables used in the estimation with endogenous variables.

The Estimated Model Parameters

It is apparent from the results in Table 1 that our Bayesian estimates fall in the range of values reported in Caraiani Petre (2007). The entries show the parameters of interest and the priors imposed on them. The Bayesian Posterior mean and 95% confidence intervals are shown.

Table1: Results of the Structural parameters prior and posterior distribution

Parameter	Prior mean	Posterior mean	Con. Interval	Prior distribution	Standard deviation
Rho_pie (coefficient of forward looking inflation rate in domestic inflation equation)	0.880	0.9685	0.9563	0.9819 beta	0.1100
Psi-pie (coefficient of inflation in domestic interest rate equation)	1.200	1.0140	1.0000	1.0296norm	0.3500
Lam1(coefficient of output in domestic inflation equation)	1.200	1.2009	1.1413	1.2575 norm	0.3500
Lam2(coefficient of real exchange rate in domestic inflation equation)	1.200	1.3004	1.1535	1.4479 norm	0.3500

Source: Author's computations, (2018)

An estimate of the domestic Phillips curve shows a very significant coefficient for the exchange rate. The impact of the exchange rate on domestic inflation (λ_2=1.30) is very close to the prior value (1.20), indicating a high exchange rate pass through into prices (that is, about 130 percent). For monetary policy to have an impact on inflation, the coefficient of output and exchange rate gaps must be less than one. This is confirmed from the results, where output value is (λ_1=1.20) and exchange rate is (λ_2=1.30). The posterior estimate of the output gap (λ_1=1.20) is the same as the prior (1.20), which provides an important tool for monetary authorities (particularly the Central Bank of Nigeria) to control inflation through output gap. The effect of inflation rate posterior value (p=0.97) when compared to prior value (0.88) is a clear indicator that both fiscal and monetary authorities should both

target inflation policy, since inflation rate affects all the stated macroeconomic variables significantly, whether they are sourced from output gap, exchange rate or nominal interest rate. The exchange rate movements thus are confirmed to have an important influence on the domestic inflation changes. The estimate of the domestic Phillips curve also shows a very significant coefficient for the exchange rate. Openness exposes the economy to disturbances that emanate from exchange rate fluctuations that cause pass-through inflation. The New Keynesian Phillips curve suggests we should observe falling aggregate prices and negative rates of inflation (in terms of a deviation from the steady-state inflation).

5. Conclusion and Policy Recommendations

This paper has examined, the IT aspects of the Dynamic Stochastic General Equilibrium Model (DSGEM) using Bayesian estimation technique, mainly to see the effectiveness of Inflation targeting of the Bank (CBN), at both the theoretical and empirical levels and as policy ingredient. The results of the analyses show that domestic and foreign demand shocks are the most influential in affecting domestic variables in Nigeria. Nigerian inflation, however, appears to be most sensitive to domestic supply and exchange rate shocks, while the impact of domestic monetary policy shocks appears to be moderate. Regarding foreign economic shocks' in general, the study revealed that world demand shocks and exchange rate shocks have the largest impact on the Nigerian economy, noticeably larger than domestic monetary policy shocks. Foreign supply shocks do not appear to significantly affect domestic variables. The estimation of the open economy Phillips curve showed that the exchange rate has a considerable influence on the domestic current inflation. This specification considered a hybrid NK Phillips curve, allowing for both expected inflation and past inflation to influence current inflation. At the same time, the results above showed how by introducing nonlinearities in the Phillip's curves, one obtains complex dynamics that are not possible within the linear Phillip's curves. Actually the future DSGE models for Nigeria should allow for such nonlinearities. The estimation of the Taylor rule confirmed that the Central Bank of Nigeria pursued first of all the prices stabilization. The set inflation rate must be in the target frame or, it can be lower. Countries implementing the inflation targeting monetary policy framework operate macroeconomic better than before the implement of it.

Therefore, CBN should select in controlling the volume of money as well as controlling interest rate as the operating objectives, in which the intermediate target was controlling growth rate of Broad money supply (M2), credit and interest rate. Based on the experience of many countries the CBN also has to choose an interest rate instrument as the primary one. That is, the primary interest rates which is market-oriented and its basis forming market interest rates. The results suggest that the economy could benefit if the CBN targets inflation aggressively and at the same time, intervenes on foreign exchange markets moderately to smooth out excessive exchange rate fluctuations. It must be equally ensured that the CBN is

really the last lender of the Banks. The inflation targeting band of CBN should not be narrower than +/-2% for the first 5-year period and +/-1 for the next years because actual inflation changes to divert the set band. IT Countries usually specify their inflation targets over a medium to long term period.

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