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CENTRAL BANK OF NIGERIA

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Abstract

This study explored the continued relevance of inflation targeting in an imperative growth focused monetary policy after the Great Recession. Using Nigerian data for the period 1996 to 2014, this study employed a Vector Autoregression (VAR) model based on the New Keynesian theory to simulate the estimated outcomes for the economy on key macroeconomic variables under two alternative policy frameworks: Inflation targeting and Nominal GDP targeting. The results showed that full-fledged Inflation targeting may not be relevant in the new normal as it would not adequately address exchange rate variability, economic growth as well as employment objectives of the Nigerian economy. However, the alternative scenario of Nominal GDP targeting is more amenable to a multiple-objective monetary policy, as it generates higher economic growth, higher exchange rate stability as well as lower inflation rate.

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1.0 INTRODUCTION

There has been widespread consensus in the literature about the role of inflation and the reaction of monetary theory. First, the experiences of developed countries during the 1970s and 1980s showed that a high rate of inflation does not lead to high growth and employment. High and volatile inflation deters productive investment and employment generation, and may worsen inequality. Second, there is increasing recognition of the benefits of low and stable inflation as well as the cost of high and volatile inflation; to the extent that low inflation has become a public good. In addition, the literature has increasingly stressed the importance of inflation expectations in monetary policy. Inflation targeting has been considered in the literature as most suitable approach for effectively anchoring inflation expectations (Sivak, 2013).

Simply, inflation targeting encompasses a monetary policy framework in which the central bank sets an explicit target for future inflation (usually low inflation rate) and work towards achieving this goal (Agenor and Pereira da Silva, 2014). Consequently, the inflation rate serves as the nominal anchor on which the central bank relies to maintain price stability. Typically, inflation targeting requires five key elements including a (Sivak, 2013): Public announcement of medium-term numerical targets for inflation; an institutional commitment to price stability as the primary, long-run goal of monetary policy and a commitment to achieve the inflation goal; an information-inclusive approach in which many variables are used in making decisions about monetary policy; increased transparency of the monetary policy strategy through communication with the public; and increased accountability of the central bank for achieving its inflation objectives.

Indeed, since the first adoption of inflation targeting by the New Zealand in 1990, several countries from developed and emerging market economies as well as developing countries have adopted the framework. The policy framework proved to be quite successful in the previous two decades.

However, the recent global financial and economic crisis has put a severe dent to this monetary policy framework. During the crisis, most central banks fell into the liquidity trap as the target interest rates were cut to the zero bound to stimulate the economy. When there was no incentive for a further lowering of the nominal interest rate, unconventional monetary policy was adopted evidenced by several rounds of quantitative easing followed.

Yet, unemployment remained very high indicating that the steps taken were not sufficient to reverse the recessionary trend. In spite of the persisting unemployment and low growth, inflation rates in most advanced economies such as the US remained very low. It was obvious that the achievement of the low inflation target, with low interest rate and low volatility, did not guarantee favourable growth and improved employment. At this point, economists began to question the wisdom in the inflation targeting framework. Under this abnormal environment, termed by some analyst as the *new normal*, unconventional monetary policy appeared more successful in addressing the imbalances in the economy.

In the new normal, central banks have the additional mandate of maintaining financial system stability and economic growth in addition to the price stability objective of monetary policy. In the particular case of developing economies with substantial output gap, we query the continued relevance of the conventional focus of monetary policy. What is the continued relevance of inflation targeting as opposed to growth focused monetary policy on price stability? Is inflation targeting still relevant in a growth focused monetary policy?

This study attempts to explore the continued relevance of inflation targeting by central banks in developing countries as opposed to embracing medium to long term growth targeting. We thus examine a countercyclical monetary policy stabilization focus is more appropriate in the post global financial crises era than a medium to long term growth objective**.**

The rest of the paper is organized as follows. Section one introduces the paper and presents a brief review of basic concepts. Section two reviews the conceptual as well as theoretical and empirical literature, while, section three looks at the methodology and estimation technique. Section four analyzes and discusses the data. Conclusion and policy recommendations are presented in section five.

1.1 Inflation targeting

Conceptually, an inflation target is a nominal anchor that is expected to constrain price movement to a particular point or within a pre-agreed band. More specifically, inflation targeting as a means of operationalizing the price stability objective focuses solely on inflation stability as opposed to targeting the other prices within the price stability framework such as exchange rate and interest rate or money supply target (Batini et al

2005). Inflation targeting as a monetary policy framework has various benefits and downsides. The key benefit is improved credibility of the central bank, built around increased communication, leading to improved market expectations. However, the major shortfall of the framework is that central banks become obsessive over inflation objectives/targets in the wake of more pressing macroeconomic problems that could be addressed using available policy instruments (Bernanke and Mishkin, 1997).

In the wake of the 2007/2008 financial and economic crisis, many central banks were faced with the more pressing financial stability issues than monitoring gradual creeps in inflation. The Bank of England (BoE) and The United States of America Federal Reserve Bank (US Fed) who have the dual mandate of maintaining an inflation objective and low unemployment were observed to have relaxed their rein on inflation in favor of maintaining low unemployment. In Europe, however, the European Central Bank (ECB) stuck dogmatically to its inflation target even when the high policy rate applied to stave off inflation was hurting the recovery and pushing most European economies into double deep recession. The ECB, however, subjectively relaxed its inflation target in favor of growth and recovery, by lowering its policy rate to an all-time low of 0.15% in June 2014 and its overnight rate to -0.1%. This implied that commercial banks had to pay for their overnight deposits rather than earn a spread. This is a policy initiative directed at forcing commercial banks to lend directly into the economy in order to jump start economic activities.

Evidence from the literature suggests that an inflation targeting framework is likely to be most successful when certain prerequisites are met; central bank independence, adopting price stability as the sole objective of monetary policy and the existence of a well-developed technical infrastructure. In addition, the impact of fiscal dominance as well as financial, structural and external sector dominance should be kept at the barest minimum.

The independence of a central bank is guaranteed when its monetary policy decisions are not subjected to review by any governmental authority. Such level of independence allows central banks to always have the free will to deploy their policy instruments to target inflation in order to keep it within the agreed band or on the specific target. The new normal paradigm thrusts monetary policy with additional objectives that will require more instruments to enable policy makers cope with policy implementation (Bayoumi *et al*, 2014).

Under the new normal paradigm, with central banks saddled with additional mandates, the expanded function of central banks may conflict with the pristine role of some governmental agencies who may, as a result, question the continued relevance of central bank independence (Bayoumi *et al*, 2014). Can central banks still pursue inflation targeting if independence is curtailed or lost entirely?

In general, a central bank that adopts inflation targeting as a framework of monetary policy would pursue an independent monetary policy and an open capital account while allowing the exchange rate to float. In the new normal, there is the likelihood that central banks may attempt to pursue an independent monetary policy, maintain an open capital account and manage exchange rate through interventions in the foreign exchange market. Focusing solely on a price stability objective may, however, lead to some short run losses in employment and output goals (Mishkin, 2001).

A robust forecasting skill is required for inflation targeting central banks to engage in a high degree of accuracy in forecasting inflation in the short to medium term (Mishkin 2001, Batini *et al,* 2005). Most developing countries' central banks have weak financial, fiscal and monetary institutions, thus making the application of inflation targeting in these countries considerably difficult. Weak institutional structures can also amplify the susceptibility of an economy to external shocks (Mishra and Mishra, 2013).

The above prerequisites will ultimately address some of the conditions listed below such as fiscal dominance, financial dominance, structural dominance and external sector dominance.

1.2 Fiscal Dominance

For inflation targeting to be successful, a strong level of coordination must be established between the monetary and fiscal authorities. Fiscal authorities must buy into the price stability objective of the monetary authorities and behave in such a manner as to minimize the fiscal dominance of monetary policy. Fiscal dominance is defined as a situation whereby the fiscal authorities, due to a high level of irresponsibility, incur high levels of debt such that the monetary authorities are forced to monetize the debt, leading to increased money supply and inflation.

In an open economy, government debt becomes more attractive when a central bank increases the real rate of interest. This is applicable as the appreciation in the real rate causes aggregate demand and output to decrease, thus lowering the level of inflation. The

reverse reaction is however applicable if the increase in the real rate is as a result of an increase in the government default premium, resulting normally from a perception of the financial markets that government debt is too high. This will lead ultimately to a depreciation in the real rate and subsequent rise in inflation as government debt becomes less attractive.

In the second scenario, considering that the initial increase in interest rate was a response to rising inflation in an inflation targeting environment, the depreciation in real rate due to the high propensity of default by government will cause a further rise in inflation. Under this circumstance, monetary policy under an inflation targeting framework will continue to exert an upward pressure on inflation. Fiscal policy is, therefore the most feasible approach to deal with rising inflation (Woodford 2003, Blanchard 2004).

1.3 Financial Dominance

Financial dominance is characterized by a weak financial system constituting an obstacle to the effective deployment of short term interest rate as a policy instrument to target inflation. A robust financial and banking system is therefore strategic to effective inflation targeting (Mishkin, 2004). In the event that the monetary authorities attempt to use the policy rate to target inflation in a financially weak economy, the resulting effect could range from a financial crisis to a collapse of the financial system and even the currency (Fraga *et al* 2003).

1.4 Structural Dominance

Structural dominance is a common phenomenon in developing countries. The situation arises where the economy is characterized by poor infrastructure and structural weaknesses which prevent the smooth transmission of the monetary policy to the real economy. The economy is, therefore, said to be susceptible to supply side shocks which the monetary authorities have to take into consideration before raising interest rates to target rising inflation. The central bank will normally take these shocks into consideration by adjusting money supply upwards thus accommodating a higher level of inflation than earlier anticipated (Mishra and Mishra, 2013).

1.5 External Sector Dominance

In an open economy, the relevance of the external sector cannot be overlooked as various transmission mechanisms could create a pass-through of external shocks to the domestic economy. Significant variables of impact include the exchange rate, the interest rate and

the inflation rate. External dominance is, therefore, defined as the propensity of external shocks to derail the monetary authorities from the achievement of their inflation target due to large external shocks impacting on the domestic economy (Mishkin, 2004). A movement in the exchange rate is, therefore, considered to be an external shock and the percentage change in the interest rate and the rate of inflation is considered to be a measure of external dominance (Fraga *et al,* 2003).

1.6 The New Normal

Prior to the 2007-2008 financial and economic crisis, there was a robust asset price bubble, fuelled primarily by an overheating housing market across the United States of America (USA) and most European Union (EU) countries. Following the standard focus of monetary policy which is price stability with an underlying assumption that growth will occur under a low inflation environment, policy makers in the USA and the EU moved to curtail the rise in price levels (inflation) by raising policy rates. Over time, inflation was stabilized by the high policy rates and economic activity slowed to near equilibrium levels.

In the wake of the crisis, a severe credit crunch was experienced across most economies, thus leading to a major economic crisis. Policy rates reduced to an all-time low in the USA and EU, causing the build-up in a new asset price bubble driven primarily by the portfolio market. Raising policy rates to stabilize this emerging bubble would only lead to the twin problem of deflation (because of the already too low inflation rate) and a double deep recession (due to the fragile recovery). From this development, policy makers in the developed economies learnt that apart from the regular price stability focus of monetary policy, a financial stability focus was required to address stability issues with the financial system. This twin monetary policy objectives, was tagged ***the new normal***. In the emerging economies, the growth sub-objective linked directly to low inflation was decoupled from the price stability objective to stand as a sole objective of monetary policy. This invariably gives three broad objectives of monetary policy in the new normal.

The proposed instruments for the financial stability objective would be macro-prudential measures and guidelines. These guidelines will serve to ensure that the flow of credit is supplied only to prime borrowers who will channel these funds to productive economic activities (Bayoumi *et al* 2014). Subbarao (2010) amongst others argue however that the central bank may not be well equipped with the appropriate instruments to address

financial stability issues which cut across two broad areas of interest rate and exchange rate volatility and financial system illiquidity.

The current *'lender of last resort'* instrument was adopted in the wake of the last financial crisis to ease the credit crunch facing financial institutions globally but these institutions hung on to the liquidity without passing it on to the financial and capital markets. Subbarao therefore is of the view that the central bank should develop an additional instrument '*purchaser of last resort'* to enable it mop up toxic assets within the system.

2.0 THEORETICAL AND EMPIRICAL LITERATURE

The foundation of inflation targeting is rooted in the expectations theory. The theory posits that a higher level of expected inflation in the future tends to create incentives for larger price increases now. Thus, people's expectations about inflationary trend matter and play a critical role in shaping the impact of monetary policy decisions on the economy (Woodford, 2012). The New Keynesian theory also shows the conditions where inflation targeting can perform optimally. It states that incompleteness of financial markets generates distortions which make full-fledged inflation targeting inefficient and non-optimal with severe impact on economic welfare. In other words, the presence of financial frictions greatly magnifies the incentives to deviate from price stability (Kolasa and Lombardo, 2011).

Hence, the option of the preferred monetary policy framework by central banks must reflect the frictions or market failures which monetary policy strives to moderate. Inflation targeting is more appropriate to pricing frictions in the goods market, as it is able to subdue frictions created by nominal price stickiness (Woodford 2003). However, this type of frictions may not be the most serious friction that monetary policy worries about. Alternatively, nominal GDP targeting as a monetary policy framework has been identified as a veritable option in the absence of perfect financial markets (Sheedy, 2014)[3].

Empirical work on inflation targeting is wide and varied in its coverage. Some studies are focused on the relevance of inflation targeting in delivering sustainable growth and macroeconomic stability (Bernanke *et al,* 1999). In some other studies, substantial effort is devoted to establishing the desirability of an inflation tolerance corridor over an inflation tolerance limit as a basis for monitoring inflation creep. Evidence is emerging that the connection between inflation and unemployment (the Phillips curve) appears to have waned as the curve is flattering (IMF, 2013). This evidence tends to question the existing monetary policy framework of placing excessive emphasis on the price stability objective. This argument however, depends on whether the source of flattening of the Philip curve is crisis driven or structural in nature. If the source is structural in nature, then more focus should be on flexible inflation targeting rather than strict inflation targeting (Bayoumi *et al*, 2014). In all, the consensus in the literature suggests that inflation targeting is not a rigid

policy rule for central banks, but one that accommodates discretionary use of policy in times of dire need (Friedman and Kutter, 1996; Bernanke and Mishkin, 1997).

2.1 Theoretical Foundation

In recent years, the basic New Keynesian model has become the workhorse framework for the analysis of monetary policy, fluctuations and welfare (Gali, 2006). This sticky price model differs from the traditional classical economic models in two important ways. First, it assumed imperfection in the goods market. Second, it imposes some limitations on price adjustments, by assuming that only a fraction of the firms can adjust their prices at a given time. There has been several modifications to this basic model. For instance, Woodford (2003) developed a version of the New Keynesian model that is commonly adopted as a theoretical foundation for inflation-targeting using a model of the monetary policy transmission mechanism that abstracts altogether from financial frictions. This model assumes that there is a single interest rate that serves as the policy rate and operating target of the central bank. It is also the rate of return which households and firms receive on savings and can borrow against future income. However, this model omits an important feature of most economies; even in the most sophisticated financial system, sizeable spreads exist between lending and deposit rates. Moreover, this spread is not constant, especially during periods of financial stress.

Curdia and Woodford's (2009) extension of the New Keynesian Model captures the spread between the interest rates available to savers and borrowers, that can vary for either exogenous or endogenous reasons. They posit that the variation in spreads over time is of great significance and have implications for both the equilibrium relation between the policy rate and aggregate expenditure on one hand, and the relation between real activity and inflation, on the other hand.

Kolasa and Lombardo (2011) analyzed and quantified the impact of financial frictions on the optimal conduct of monetary policy in a two-country DSGE model. In accordance with prior literature using a simple closed-economy model, they found that financial market imperfections breed distortions which alter the equilibrium condition and render explicit inflation targeting sub-optimal. They demonstrated that loss in economic welfare associated with the distortions is substantial. Simply put, financial frictions greatly amplify the stimulus to shelf off the goal of price stability if allowance is made for non-tradable

goods in the model. However, the literature has also posited that the mere existence of an important credit channel does not in itself render inflation targeting suboptimal unless new types of financial shock are introduced (Faia and Monacelli, 2007; Carlstrom, Fuerst and Paustian, 2010; De Fiore and Tristani, 2012). It has also been argued that the choice of a monetary strategy should depend on the most important frictions or market failures which monetary policy sought to mitigate. As Woodford (2003) posited, inflation targeting is the appropriate policy response to pricing frictions in the goods market because it can move the economy closer to optimality or even replicate the optimality condition under flexible prices. In other words, inflation targeting is able to subdue frictions created by nominal price stickiness.

On the other hand, Sheedy (2014) argued that nominal price stickiness may not be the most serious friction that monetary policy has to contend with. He argued that in the same manner that menu costs contribute to price stickiness, transaction costs can make financial markets incomplete. Using a model of optimal monetary policy with incomplete-markets economy and heterogenous households who are risk averse and exposed to the same labour income risk, he examined analytically the choice between inflation targeting and nominal GDP targeting. In his conclusion the combination of incomplete markets and strict inflation targeting implies a particularly inefficient distribution of risk when households are risk averse. If complete financial markets are available, borrowers would issue state-contingent debt where the contractual repayment is lower in a recession and higher in a boom. These securities would resemble equity shares in GDP, and they would have the effect of reducing the leverage of borrowers and hence distributing risk more evenly. In the absence of such financial markets, Sheedy (2014) affirmed that a monetary policy of nominal GDP targeting by stabilizing the debt-to-GDP ratio could effectively complete financial markets. A key implication of this model is that during recession often marked with stagflation, if stagnation cannot be immediately remedied, some inflation might be a good idea to compensate for the inefficiency of incomplete financial markets.

Before the global financial crisis of 2007-2009, 27 countries had adopted full fledge inflation targeting as a monetary policy framework. The diversity of countries that have adopted the framework, evidence the adaptability of the framework to different

macroeconomic structures. Some studies have argued that the choice of an explicit inflation target could be explained by economic structure and history of these countries [Carare and Stone (2003), Gerlach (1999), Mishkin and Schmidt-Hebbel (2001) and Truman (2003)]. In general, their findings show that inflation targeting countries have lower holding of public debt although Amato and Gerlach (2002) show that the level of government debt was high prior to adopting inflation targeting by some countries. Findings also show that most of the inflation targeting countries had advanced institutional infrastructural and financial systems. Truman (2003) found that economies that have encountered a currency crisis and dissatisfactory economic performance in the past, expressed high propensity to the adoption of an inflation targeting framework.

The main reasons for adopting inflation targeting are summarized in Table A1 in the Appendix and varied across countries. In some countries, the central banks were compelled by market forces to jettison their previous regimes to adopt inflation targeting framework (Brazil, UK, Czech Republic and Sweden). Others adopted inflation targeting framework as a result of increasing dissatisfaction with their previous regimes and persisting discrepancy between the price stability goal of the central and the formal nominal anchor (Columbia, Iceland, Israel, Hungary, Mexico, New Zealand and Switzerland). Finally, other countries adopted inflation targeting as a natural process of evolution of monetary policy over time (Australia, Canada, Chile, Korea, Peru, South Africa, Poland, Norway, the Philippines, Thailand etc.)

During the recent global financial crisis, most central banks cut interest rates to near the zero lower thus pushing their economies into a liquidity trap. At the zero lower bound, policy space was substantially constrained leading to the adoption of unconventional tools such as quantitative easing to support monetary policy. In spite of theses policy measures, unemployment remained very high indicating that the steps taken were not sufficient to reverse the recessionary trend. Inflation in most advanced economies remained low coupled with declining unemployment and slow growth. This emerging situation brought to light the fact that low and stable inflation does not necessarily guarantee growth and improved employment. Economists thus began to question the continued relevance of the inflation targeting framework.

Scholars have criticized the insufficiency of the responses of some central banks to the economic slump and the asset price bubbles. Sumner (2012) reasons that due to the fear

of increased inflation, the US Fed did not provide enough monetary stimulus in late 2008, allowing the largest decline in nominal spending since the great depression. This aggravated the financial crisis and led to high unemployment. Obviously the problem with inflation targeting is that it can react well to demand shocks but cannot address supply shocks. Suppose there is an adverse supply shocks, the central bank can respond with an expansionary monetary policy or contractionary policy. If it carries out an expansionary policy, it would move out of the recession but inflation would increase further. On the other hand, it can adopt a contractionary policy which would lower inflation rate but only at the expense of further exacerbating the recession. Thus, under an inflation targeting regime, adverse supply shocks put the economy into more severe recession, just because the central bank does not allow inflation to rise.

The crisis also exposed the weakness of inflation targeting framework during episodes of asset price bubbles and other unpleasant financial developments. By neglecting these financial frictions, inflation targeting creates serious danger to economic stability.

3.0 METHODOLOGY AND DESIGN

3.1 Estimation techniques

Most recent studies involving the monetary policy transmission mechanism have relied on the DSGE modelling technique. The DSGE model attempts to explain aggregate economic phenomena on the basis of macroeconomic models derived from microeconomic principles. The main advantage of this micro-foundation approach is that it overcomes the *Lucas critique* which traditional macroeconometric models are vulnerable to (Woodford, 2003). Moreover, the microfoundation modeling is based on the economic agent's preference thus making the DSGE a natural framework for assessing the welfare effects of policy changes (Tovar, 2008). However, given the difficulty of constructing an accurate DSGE model, a Vector Autoregression (VAR) based simulation model became a credible alternative to the DSGE model (Epstein, 2008; Galindo and Ros, 2006). The VAR model has gained widespread use in empirical analysis because it is a tractable and flexible way to analyze economic time series. Specifically, a VAR models have been capable of describing the rich dynamic structure of the relationships between economic variables (Bjornland, 2000) and is easy to estimate. Lastly, VAR usually gives a good fit to macroeconomic data; has the ability to combine long-term and short-term information in the data by exploiting the cointegration property of the series (Juselius, 2009). Despite the distinctive features of the VAR model, it is important to state that it has some drawbacks. The real economy usually embodies more complexity than VAR models can capture. In addition, in situations where there are either short data series or a large amount of structural changes, the VAR model may not generate sufficiently accurate estimates of economic relationships. However, the VAR approach is a prominent policy model which provides some approximate idea of the impact of alternative policies.

In this study our first step was the estimation of a VAR model to analyze the impact of the policy variable on key macroeconomic indicators of concerns such as inflation rate, exchange rate change and economic growth. Secondly, the VAR model was transformed into a simulation model to be used for monetary policy experiments. The primary aim of this simulation exercise was to estimate the impact of a medium to long-term decline in the policy instrument on exchange rate variability, inflation rate and economic growth. The basic idea was to generate estimates of the likely impacts of tight monetary policy by the

CBN to achieve a targeted inflation rate (inflation targeting) against the probable effects of a looser monetary policy to expand real GDP growth in order to generate more employment as part of an alternative to the inflation targeting policy. VAR based simulation models are widely used in similar monetary policy analysis (Aron and Muellbauer, 2002; Bernanke *et al,* 1999; Galindo and Ros, 2006; Epstein, 2008).

3.2 *VAR Model Estimation and Data*

We set up a 5-variable VAR model with prime lending rate, exchange rate, inflation, GDP growth and external reserves as endogenous variables:

$$A(L)y_t + B(L)x_t = u_t$$

Where y_t is a column vector of the endogenous variables consisting of prime lending rate (PLR), exchange rate (EXC), inflation rate (INF), external reserves (RES), and nominal gross domestic product (GDP). A(L) is a 5x5 matrix polynomial in the lag operator L, B(L) is a 2x2 matrix, x_t is a column vector of exogenous variables consisting of US Treasury bill rate and net credit to government; and u_t is a column vector of serially independent errors.

To generate the structural shocks of interest rate on exchange rate, external reserves, inflation and nominal GDP growth, we use the Cholesky decomposition. The reduced form VAR residuals (μ_t) and the structural disturbances (ε_t) relates as follows:

$$\begin{bmatrix} \mu_{plr} \\ \mu_{exc} \\ \mu_{res} \\ \mu_{\inf} \\ \mu_{gdp} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha & 1 & 0 & 0 & 0 \\ \beta & \delta & 1 & 0 & 0 \\ \tau & \omega & \gamma & 1 & 0 \\ \sigma & \pi & \rho & \lambda & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{plr} \\ \varepsilon_{exc} \\ \varepsilon_{res} \\ \varepsilon_{\inf} \\ \varepsilon_{gdp} \end{bmatrix}$$

where ε_{plr} denotes prime lending rate shocks; ε_{exc} the exchange rate volatility shock; ε_{res} the change in external reserves position; ε_{inf} the inflation shock; and ε_{gdp} the output shock. To ensure that the structural VAR model is identified, ten restrictions (zeros) were imposed on the matrix of the coefficient of the structural disturbances, such that the upper diagonal elements are all zero. Given the ordering of the endogenous variables in the matrix S, the implication is that some structural shocks have no contemporaneous effects on some endogenous variables. The policy variable, PLR was ordered first on the assumption that it

is not determined by the other five endogenous variables. Exchange rate volatility was ordered second on the assumption that interest rate affects capital flows and therefore, the exchange rate. External reserve was ordered third, on the assumption that both interest rate and the exchange rate affect the volume of external reserves. Inflation was ordered fourth on the assumption that inflation shock is contemporaneously affected by all the first three shocks. Output was ordered last on the assumption that output shock is contemporaneously affected by all the other shocks while the output shock has no contemporaneous impact on the other variables.

All the data used for the estimation were obtained from the CBN statistical database, with the exception of US Treasury bill rate which was downloaded from the Board of Governors of the Federal Reserve System web page. Quarterly data was used for the period 1996 to 2014. The key variables include: prime lending rate, interbank exchange rate, external reserves, inflation rate, nominal and real gross domestic product (GDP). The results of the Augmented Dickey Fuller Test for unit roots for the variables are presented in Table 1. All the variables were stationary at level. We included constant and trends in the ADF test for some variables and none for others (example USTBR). Given that the endogenous variables are integrated of order zero, unrestricted VAR offers a plausible estimation method. It should be noted that our choice of prime lending rate as the interest rate is informed by the fact that a large proportion of loans and credits are usually granted to the prime borrowers (about 80 per cent). Therefore, it is the rate that drives economic activities in the country.

Table 2: Stationary Tests

Variable	**Stationary (Significance Level)**	**Intercept**	**Intercept and trend**
Exchange rate change (EXC)	Yes (1%)	Yes	No
Change in External reserves	Yes (1%)	Yes	No
Growth rate (NGDPG)	Yes (5%)	Yes	No
Inflation rate (INF)	Yes (1%)	Yes	No
Prime lending rate (PLR)	Yes (1%)	Yes	No
US 3mth Treasury bill rate (USTBR)	Yes; (1%)	No	No
Net Domestic Credit to Government (NDCG)	Yes (1%)	Yes	No

4.0 EMPIRICAL RESULTS

Following the approach of Galindo and Ros (2006) and Epstein (2008), the estimation adopted an unrestricted VAR model with five endogenous variables consisting of prime lending rate as the policy variable, inter-bank foreign exchange rate change, changes in external reserves and consumer price index (proxy for inflation rate) and de-trended GDP growth rate (at current prices). Two exogenous variables, US 3-month Treasury bill rate (UStbr) and net domestic credit to government (NDCG), for the period 1996, quarter one (1996q1) to 2014, quarter one (2004q4), with two quarter lags were used as control variables. 1996q1 was chosen based on data availability for major variables of interest. USTBR captures external development while NDCG is the control for fiscal dominance. Figure 1 presents the impulse response functions using the Choleski de-composition with the ordering: prime lending rate, inter-bank foreign exchange rate, changes in external reserves and consumer price index and de-trended GDP growth rate. The results appeared insensitive to the ordering of the variables as the analysis was further attempted with random orderings.

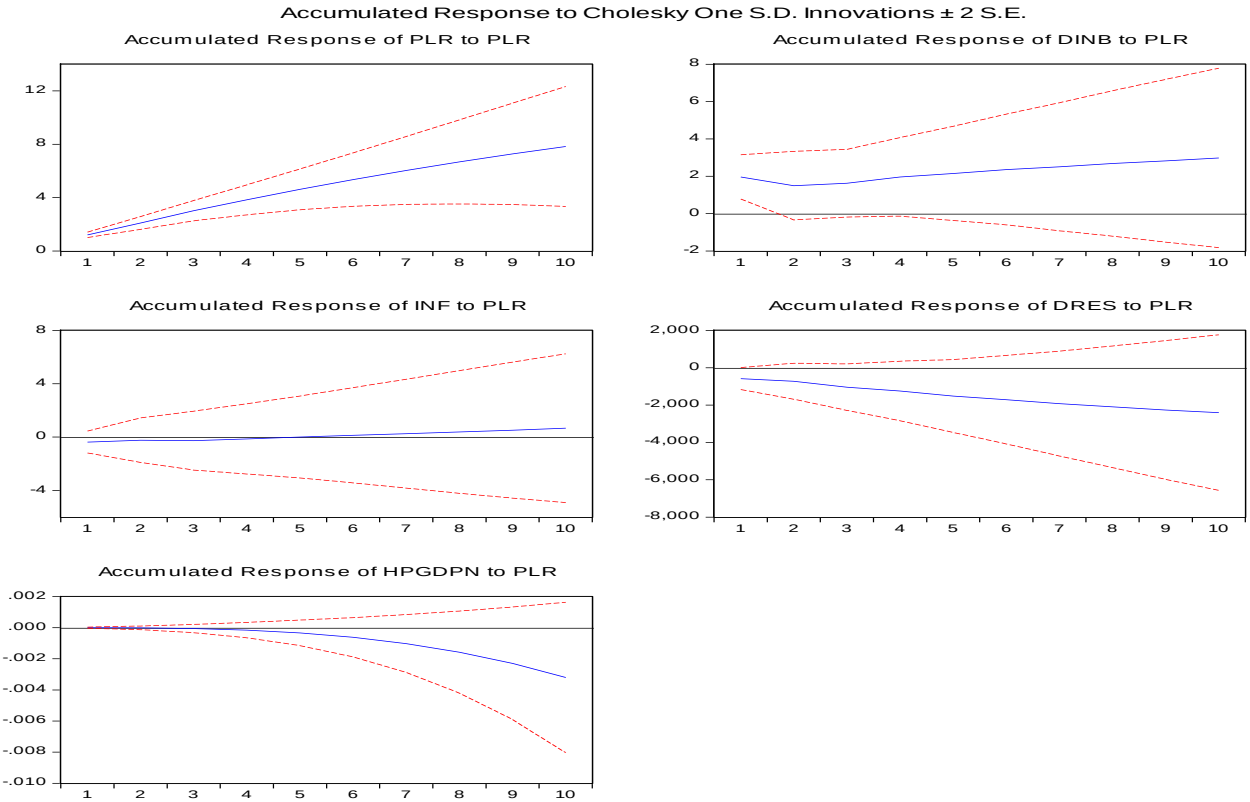

Figure 1: Impulse Response Functions

A critical examination of Figure 1 reveals that a positive shock in prime lending rate has initial mild negative impact on inflation till third quarter after which the impact turns positive persistently till the end of the tenth quarter.

This points to the fact that higher interest rates may be inflationary in nature though initially seemingly un-harmful. This result is in line with Epstein (2008) for South Africa. In terms of economic growth, external reserves and exchange rate, a positive shock in prime lending rate has an adverse impact on growth and external reserves and is accompanied by rising instability in exchange rate.

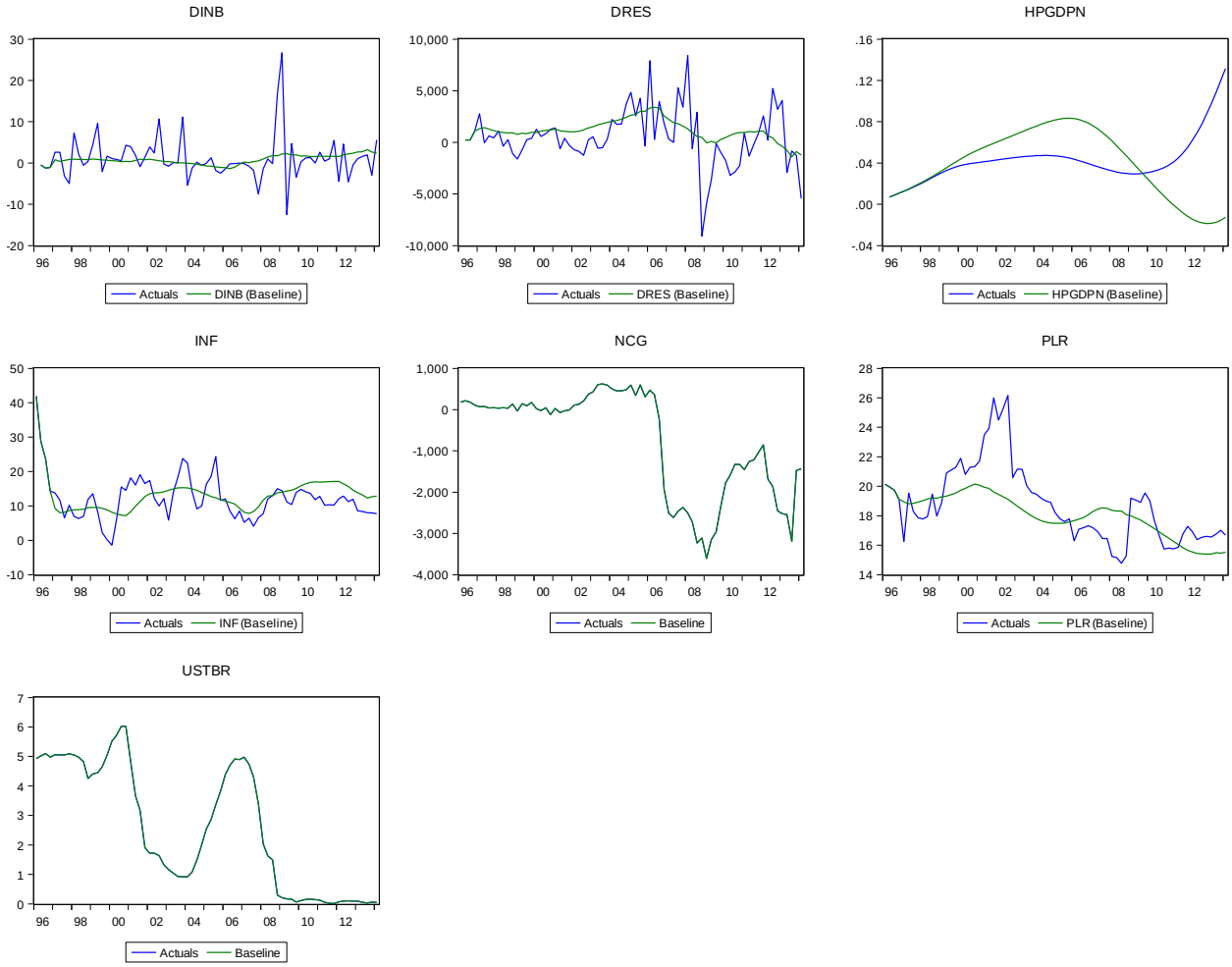

Figure 2: Baseline Estimate Vs. Actual, 1996q1-2014q1

The VAR model was transformed into a dynamic simulation model and solved over the period 1996q1 to 2014q1. The baseline estimates obtained were compared with actuals. The result is presented in Figure 2. From the figure, the baseline estimates depict all the basic trends in the actual data. However, the baseline estimates did not fully track all the

turning points in the actual data. This is one of the known limitations of forecasting approaches.

Following the objective of the study, alternative scenarios were created in which the prime lending rate was used as the policy variable. Two of the scenarios are reported: Full-fledged Inflation targeting scenario (Scenario 1) and Nominal GDP targeting (Scenario 2). The actual captures the outcome of the existing framework, monetary targeting. For the purpose of the simulation, the period 2007q1 to 2014q1 was chosen. This period marks a critical era in monetary policy management in Nigeria. This period has been assumed to be a transitional period particularly with the passage of the CBN Act of 2007, which gave instrument autonomy to the CBN (Ojo, 2013). The actual and simulated results of the various policy frameworks are presented in Tables A2 and A3 in the appendix, but summarized in Table 3.[4]

Under scenario 1, the prime lending rate was adjusted to reflect the inflation targeting oriented monetary policy. Subsequently, the prime lending rate was increased by 5 percent and assumed to be persistently higher than the actual by that margin from 2007q1 to 2014q1. Under this Scenario, exchange rate variability rose by 6.90 per cent relative to actual variability. Both simulated economic growth and inflation rates worsen relative to their actual values with growth deviating by 4.67 per cent from actual growth rate while the inflation rate rose by 0.75 per cent relative to the actual rate (see Table 3). On average during the simulation period, mean decline in external reserves amounted to US$358.71 per annum for the period 2007 to 2014. This was 112.34 per cent higher than the actual decline in external reserves of US$168.93 per annum for the same period.

Under the alternative scenario of Nominal GDP targeting (NGDPT), the prime lending rate was adjusted to reflect the real targeting oriented monetary policy. The prime lending rate was reduced 5 percent below the actual rate and assumed to remain low for the simulated period (2007q1-2014q1). The actual and simulated results of this proposed policy action are presented in Table A3 in the appendix. Under this Scenario, exchange rate variability reduced drastically by 12.08 per cent relative to the actual. In the same vein, both simulated economic growth and inflation rates performed considerably much better than they did under both the actual value and inflation targeting scenario, with growth rising by

[4] Note that before arriving at 5 percent other percentages were examined but 5 percent offered a more plausible margin.

0.67 per cent while inflation rate declined by 0.23 per cent relative to actual for the simulation period (see Table 3).

Table 3: Summary of Simulation Results

	Simulated Vs. Actual				% Deviation from Actual			
	Exchange rate change (N/US$)	**Growth rate (%)**	**Inflation rate (%)**	**External Reserves change (US$ million)**	**Exchange rate change**	**Growth rate**	**Inflation rate**	**External Reserves change**
Actual (Monetary targeting)	1.24	5.17%	10.60	-168.93				
Inflation Targeting	1.33	4.93%	10.68	-358.71	6.90	-4.67	0.75	112.34
Nominal GDP Targeting	1.09	5.21%	10.58	148.19	-12.08	0.67	-0.23	-187.72

* The values are averages for the period, 2007-2014.

5.0 CONCLUSION AND RECOMMENDATION

From the analysis above, it appears that a full-fledged Inflation targeting framework (scenario 1) may not be too relevant in the new normal as it may not address the exchange rate and foreign reserves variability, economic growth as well as employment objectives of the Nigerian economy. However, the alternative scenario of Nominal GDP targeting framework seems more plausible, as it generates higher economic growth, increment in foreign reserves, more stable exchange rate as well as lower inflation rate. This result is consistent with the new Keynesian theory, which posits that an economy with huge output gap could boost economic growth and employment through a low interest rate policy. Furthermore, the theory argues that with financial frictions in place, strict inflation targeting may be suboptimal under conditions of financial market imperfection as is common in most developing economies.

The outcome of this study demonstrates that in post crisis Nigeria, under the new normal paradigm, strict inflation targeting would not be a suitable framework to address the key macroeconomic issues confronting the economy, such as inclusive economic growth, price instability and exchange rate stability. The dynamic VAR simulation model adopted in this study demonstrates that nominal GDP targeting could be more suitable than inflation targeting in pursuit of the broader set of objectives highlighted under the new normal paradigm. Inflation targeting however still remains a relevant policy approach but is considered weak in its ability to deal with financial and economic crisis if deployed solely. Other instruments therefore need to be developed to enable central banks address inherent instabilities in the financial system while pursuing inclusive growth objectives. Given the likely costs of a sudden change in the policy framework (such as possible loss of central bank independence etc.), it is recommended that the expanded mandate be deployed cautiously. In the interim, an augmented or integrated inflation targeting framework could be adopted to address price stability, access to credit, output gap and exchange rate instability (Agenor and Pereira da Silva, 2013).

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Appendix

Table A1: List of Inflation Targeting Countries

Country	Inflation Target adoption date	Previous Anchor	Target inflation rate	Inflation Rate at adoption date	2009 average inflation rate	Main reason for IT adoption
New Zealand	1990	None	1-3	3.3	0.8	Part of extensive reforms; dissatisfaction with earlier outcomes; provide a new nominal anchor
Canada	1991	None	2+/-1	6.9	0.3	Provide a new nominal anchor and bring down inflation
UK	1992	Exchange rate	2+/-1	4.0	2.2	Forced off a fixed exchange regime; search for a new anchor to rebuild credibility
Sweden	1993	Exchange rate	2+/-1	1.8	-0.3	Forced off a fixed exchange regime; search for a new anchor to secure price stability
Australia	1993	None	2-3	2.0	1.9	Provide a new monetary anchor and lock in disinflation
Czech Rep	1997	Exchange rate and money supply	3+/-1	6.8	1.0	Forced off a fixed exchange regime; force down inflation with EU member in view
Israel	1997	Exchange rate	2+/-1	8.1	3.3	Lock in disinflation and define the slope of the exchange rate crawling peg
Poland	1998	Exchange rate	2.5+/-1	10.6	3.8	Considered the most effective way to bring down inflation preparatory to EU membership
Brazil	1999	Exchange rate	4.5+/-1	3.3	4.9	Forced off a fixed exchange regime;search for a new anchor with the IMF programme
Chile	1999	Exchange rate	3+/-1	3.2	1.5	Provide a new monetary anchor; gradual disinflation
Colombia	1999	Exchange rate	2-4	9.3	4.2	Dissatisfaction with earlier framework, search for a new nominal anchor within the IMF programme
South Africa	2000	Money supply	3-6	2.6	7.1	Formalization of earlier policy; greater transparency of policy
Thailand	2000	Money supply	0.5-3	0.8	-0.9	IT considered more appropriate with floating exchange rate than money supply targeting
South Korea	2001	Money supply	3+/-1	2.9	2.8	Part of extensive reforms following the Asian crisis; price stability set as the sole monetary policy objective
Mexico	2001	Money	3+/-1	9.0	5.3	Problem with earlier fixed

		supply				exchange rate and monetary target; provide a new nominal anchor
Iceland	2001	Exchange rate	2.5+/-1.5	4.1	12.0	Dissatisfaction with fixed exchange rate regime; preparatory to EU/EMU membership
Norway	2001	Exchange rate	2.5+/-1	3.6	2.2	Final phase in the movement towards flexible exchange regime and stronger emphasis on price stability
Hungary	2001	Exchange rate	3+/-1	10.8	4.2	Increasing Incompatibility with fixed exchange regime and disinflation; preparatory to EU membership
Peru	2002	Money supply	2+/-1	-0.1	2.9	Formalization of earlier policy; greater transparency of policy
Phillipines	2002	Exchange rate and money supply	4.5+/-1	4.5	1.6	Formalization and simplification of earlier policy; greater transparency and focus on price stability
Guatemala	2005		5+/-1	9.2	1.8	
Indonesia	2005	Money supply	4-6	7.4	4.6	
Romania	2005	Money supply	3.5+/-1	9.3	5.6	
Turkey	2006	Exchange rate	6.5+/-1	7.7	6.3	
Serbia	2006		4-8	10.8	7.8	
Armenia	2006		4+/-1			
Ghana	2007	Money supply	14.5+/-1	10.5	19.3	

Source: Scott Rogers (2010), Hammond (2012) Monetary Bulletin

Table A2: Scenario 1: Full-Fledged Inflation Targeting

	Exchange rate change (N/US$)		External reserves change (US$ Million)		Growth (%)		Inflation rate (%)	
	S	**A**	**S**	**A**	**S**	**A**	**S**	**A**
2007Q1	3.77	-0.10	1,157.80	335.80	4.00	4.00	5.30	5.30
2007Q2	-2.68	-0.80	647.80	-7.70	4.00	4.00	5.00	6.40
2007Q3	-5.99	-1.80	5,771.50	5,304.00	4.00	3.00	4.50	4.10
2007Q4	-7.04	-7.50	4,618.40	3,402.90	3.00	3.00	6.90	6.60
2008Q1	0.37	-1.40	3,856.90	8,423.40	3.00	3.00	10.20	7.80
2008Q2	2.29	0.90	560.00	-599.40	3.00	3.00	11.90	12.10
2008Q3	6.24	-0.10	-1,622.40	2,924.70	3.00	3.00	12.00	13.00
2008Q4	8.02	16.70	-4,523.60	-9,081.50	3.00	3.00	13.40	15.10
2009Q1	9.19	26.70	-3,669.30	-5,918.50	3.00	3.00	13.10	14.40
2009Q2	3.27	-12.50	-4,338.40	-3,619.20	3.00	3.00	13.00	11.20
2009Q3	3.89	4.70	-2,469.50	-119.40	3.00	3.00	12.70	10.40
2009Q4	1.24	-3.40	-2,781.10	-960.80	3.00	3.00	13.10	13.90
2010Q1	1.35	0.30	-1,846.10	-1,715.50	3.00	3.00	13.00	14.80
2010Q2	2.04	1.20	-2,438.20	-3,198.60	3.00	3.00	13.00	14.10
2010Q3	2.30	1.30	-2,064.50	-2,879.40	3.00	3.00	12.80	13.70
2010Q4	2.17	0.00	-1,813.80	-2,249.80	3.00	4.00	12.50	11.80
2011Q1	2.06	2.60	-1,059.80	882.60	4.00	4.00	12.30	12.80
2011Q2	0.24	0.40	-362.10	-1,330.90	4.00	4.00	12.20	10.20
2011Q3	0.23	1.00	354.00	-150.70	4.00	4.00	12.00	10.30
2011Q4	-0.41	5.50	571.00	899.50	5.00	5.00	11.90	10.30
2012Q1	-0.67	-4.40	939.10	2,557.70	5.00	6.00	11.50	12.10
2012Q2	2.40	4.60	1,099.80	215.10	6.00	6.00	11.20	12.90
2012Q3	-0.02	-4.60	1,491.30	5,227.90	7.00	7.00	10.80	11.30
2012Q4	0.59	-0.40	2,136.20	3,190.00	7.00	8.00	10.20	12.00
2013Q1	-0.69	1.00	1,829.60	4,053.70	8.00	9.00	10.00	8.60
2013Q2	-0.12	1.60	1,424.00	-2,927.10	9.00	10.00	9.60	8.40
2013Q3	3.11	1.90	-160.30	-848.50	10.00	11.00	9.30	8.00
2013Q4	-3.06	-2.90	-2,404.80	-1,261.20	11.00	12.00	8.60	8.00
2014Q1	4.50	5.60	-5,306.00	-5,448.10	12.00	13.00	7.70	7.80
Average	**1.33**	**1.24**	**-358.71**	**-168.93**	**4.93**	**5.17**	**10.68**	**10.60**

Where A= Actual
S= Simulated
Source: VAR-based Simulation Results

Table A3: Scenario 2: Nominal GDP Targeting

	Exchange rate change (N/US$)		External reserves change (US$ Million)		Growth (%)		Inflation rate (%)	
	A	**S**	**A**	**S**	**A**	**S**	**A**	**S**
2007Q1	-0.1	-6.80	335.8	2,566.80	4.00	4.00	5.30	5.20
2007Q2	-0.8	0.03	-7.7	627.90	4.00	4.00	6.40	6.10
2007Q3	-1.8	1.40	5,304.00	4,516.60	3.00	3.00	4.10	5.20
2007Q4	-7.5	-3.98	3,402.90	2,821.40	3.00	3.00	6.60	6.30
2008Q1	-1.4	1.52	8,423.40	2,847.60	3.00	3.00	7.80	9.30
2008Q2	0.9	2.87	-599.4	979.70	3.00	3.00	12.10	11.30
2008Q3	-0.1	6.18	2,924.70	-458.60	3.00	3.00	13.00	11.40
2008Q4	16.7	4.82	-9,081.50	-3,526.20	3.00	3.00	15.10	13.50
2009Q1	26.7	7.93	-5,918.50	-2,087.00	3.00	3.00	14.40	13.50
2009Q2	-12.5	2.77	-3,619.20	-3,949.10	3.00	3.00	11.20	13.30
2009Q3	4.7	4.63	-119.4	-2,793.70	3.00	3.00	10.40	13.10
2009Q4	-3.4	1.17	-960.8	-3,117.30	3.00	3.00	13.90	13.50
2010Q1	0.3	1.90	-1,715.50	-2,406.60	3.00	3.00	14.80	13.30
2010Q2	1.2	1.72	-3,198.60	-2,586.90	3.00	3.00	14.10	13.40
2010Q3	1.3	1.79	-2,879.40	-1,693.00	3.00	3.00	13.70	12.90
2010Q4	0	0.96	-2,249.80	-1,147.20	4.00	3.00	11.80	12.60
2011Q1	2.6	0.81	882.6	230.00	4.00	4.00	12.80	12.20
2011Q2	0.4	-0.95	-1,330.90	687.40	4.00	4.00	10.20	12.10
2011Q3	1	-0.33	-150.7	1,520.80	4.00	4.00	10.30	12.00
2011Q4	5.5	-0.92	899.5	1,616.50	5.00	5.00	10.30	11.90
2012Q1	-4.4	-0.53	2,557.70	1,988.10	6.00	6.00	12.10	11.30
2012Q2	4.6	0.71	215.1	2,935.60	6.00	6.00	12.90	10.80
2012Q3	-4.6	-1.38	5,227.90	3,577.10	7.00	7.00	11.30	9.90
2012Q4	-0.4	-0.92	3,190.00	4,024.60	8.00	8.00	12.00	9.60
2013Q1	1	-1.51	4,053.70	3,714.90	9.00	9.00	8.60	9.30
2013Q2	1.6	-0.53	-2,927.10	2,291.50	10.00	10.00	8.40	9.20
2013Q3	1.9	2.54	-848.5	804.60	11.00	11.00	8.00	9.00
2013Q4	-2.9	-0.27	-1,261.20	-3,288.10	12.00	13.00	8.00	8.00
2014Q1	5.6	6.11	-5,448.10	-6,400.00	13.00	14.00	7.80	7.50
Average	**1.24**	**1.09**	**-168.93**	**148.19**	**5.17**	**5.21**	**10.60**	**10.58**

Where A= Actual
S= Simulated
Source: VAR-based Simulation Results