CENTRAL BANK OF NIGERIA

MODELING THE REAL SECTOR OF THE NIGERIAN ECONOMY

RESEARCH DEPARTMENT

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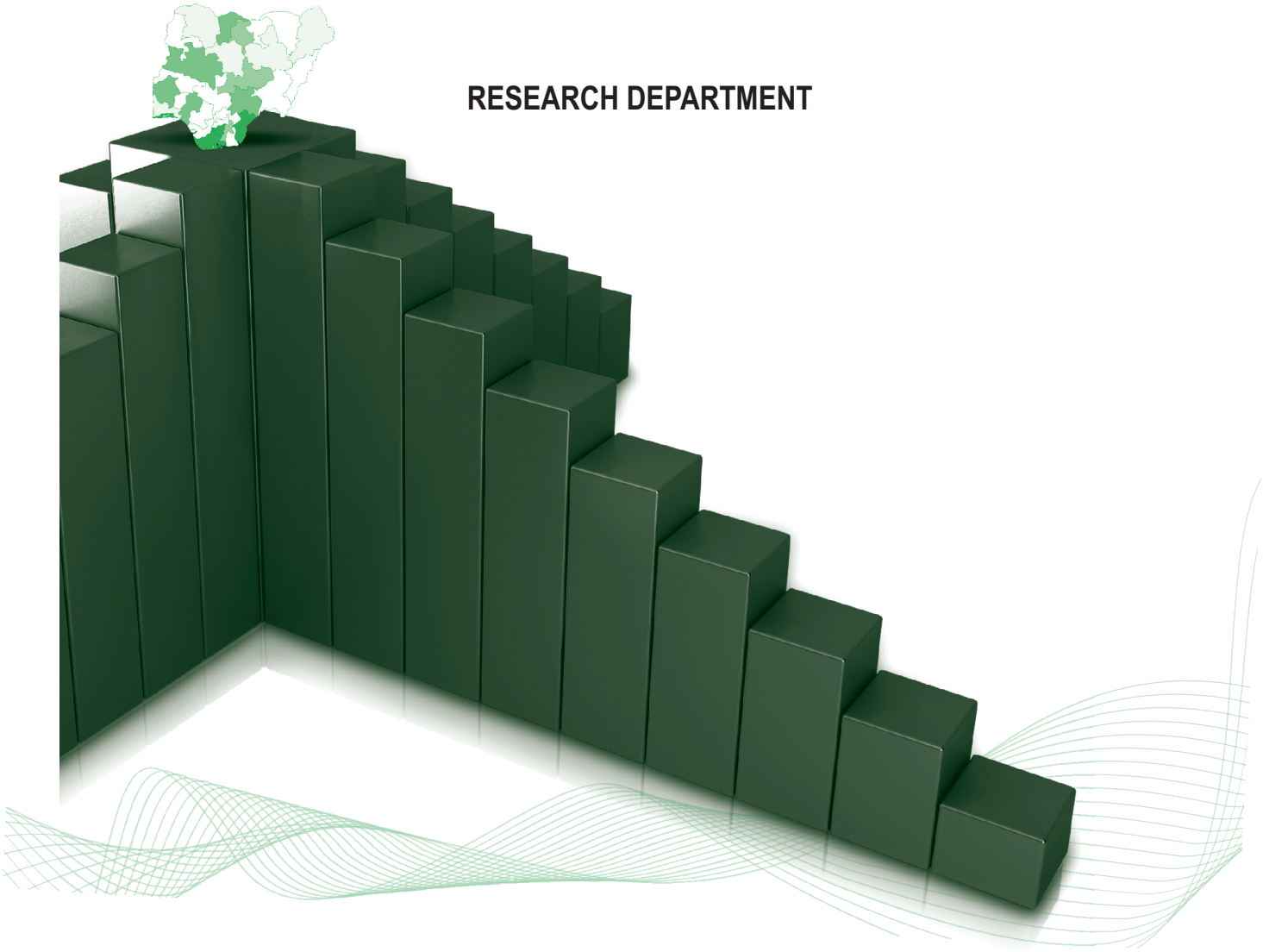

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Executive Summary

1. *The real sector of the Nigerian economy has over the years metamorphosed into an emerging industrial workhorse, arguably being the engine of the country's economic transformation. Hence, the government has continued to play a catalytic role through various policy initiatives to elevate the sector to levels that would make Nigeria an economic hub and driver of Africa's economic renaissance.*

2. *In Nigeria, issues of real sector development are intricate and reflect a mix of both domestic and international characteristics. On the domestic front, the sector comprises agriculture, industry, building and construction, wholesale and retail and the services sectors, while activities in the international oil market are intertwined with global economic developments. Consequently, sectoral policy must adequately address issues related to enhancing the capacity of the private sector to drive real sector activities and hence, achieve higher levels of growth.*

3. *Dating back to the work of Carter in 1960, several models have been developed in Nigeria to assist policy formulation and implementation. In 2008, the Central Bank of Nigeria developed a macroeconometric model of Nigeria to assist the Bank in policy analysis. The model, which was an aggregated, sparsely captures all the interplay in the real sector due to the complexity in the workings of the economy. Hence, the need for real sector model to complement the CBN Macroeconometric model of the Nigerian economy.*

4. *The modeling framework follows the Keynesian paradigm with structuralist modifications to reflect peculiarities of the Nigerian economy. Government fiscal activities are captured under a different block to fully account for its relevance as an enabler of growth especially since it constitutes a significant part of gross national output.*

5. *The model consists of fifteen behavioural equations and thirteen identities.*

6. *The findings of the study include amongst others:*

    - *The estimates in the consumption equation reveals that price changes do not significantly impact consumption, all other things being equal. On the other hand, there is an evidence to show that*

output growth and a robust financial market are important in the determination of consumption in Nigeria.

- *From the inflation equation, proxied by headline consumer price index, the results indicate that the explanatory variables conform to a-priori expectations. It is evident from the result that inflation in Nigeria is not only backward looking and persistent but also driven by agricultural output.*

- *The major drivers of investment in the oil sector are output in the oil sector and foreign direct investment flows into the sector. Some level of inflation is also an elixir for investment. In terms of investment in the non-oil sector, industry economic activity, government capital expenditure and change in the capital stock are the drivers of investment in the sector.*

- *Exports of goods (oil) depend on foreign income, nominal exchange rate, crude oil prices and crude oil output. The results indicate that all the explanatory variables are statistically significant. Non-oil export is determined by nominal exchange rate and the previous values of agricultural output, as well as the output of wholesale and retail trade. All the variables in the estimation output have the required signs and are statistically significant, except for agricultural output.*

- *On imports of good (non-oil), the results reveal that government capital expenditure, industrial output and agricultural output are positively related to imports of non-oil goods, supporting the view that government's capital disbursements are directed towards the importation of capital goods for investment in public infrastructure such as roads and power. Also, import of services are positively influenced by output and foreign direct investment (FDI). Considering the import-dependent nature of the Nigerian economy, an increase in income will result in increased import of services since aggregate imports account for a large proportion of consumption.*

- *Agricultural output is driven primarily by crop production, livestock, forestry and fishing. The estimation result shows that rainfall, credit to the private sector, government capital expenditure and the previous value of agriculture output significantly impact on agricultural production in Nigeria. The response of industrial output*

to nominal exchange rate significant except for credit to the private sector even though it met the apriori expectation.

- *The major driver of building and construction output are its lag value, government capital expenditure, the nominal exchange rate and the maximum lending rate. Similarly, wholesale and retail output are significantly influenced by the fourth lag of nominal exchange rate, government capital expenditure, industrial output and its one period lagged value. Output in the services sub-sector is determined by private consumption, government capital expenditure, output of building and construction and its one period lagged value.*

7. *Model Simulation and Scenarios Analysis*
   For policy analysis, we conduct in-sample and out-of-sample forecast. The in-sample simulation shows that the model performs reasonably well. The out-of-sample simulation is conducted based on the following scenerios:

   - *Scenario 01:- A depreciation in the nominal exchange rate from N155/$ to N158/$;*
   - *Scenario 02:- An appreciation in the nominal exchange rate from N155/$ to N152/$;*
   - *Scenario 03:- A decline in the maximum lending rate by 200 basis points;*
   - *Scenario 04:- An increase in the maximum lending rate by 200 basis points;*
   - *Scenario 05:- Depreciation in nominal exchange rate (from N155/$1 to N158/$1) and increase in MLR (by 200 basis points); and.*
   - *Scenario 06:- Appreciation in nominal exchange rate (from N155/$1 to N152/$1) and reduction in MLR (by 200 basis points).*

Results of the simulations suggest that a depreciation of the exchange rate from N155/US$ to N158.0/US$ do not substantially impact on output. An appreciation of the nominal exchange rate subdues inflation rate initially for the first four quarters, before trending upward thereafter. Concomitantly, a steady increase in the growth of output owing to a rise in imports of production inputs as well as reduced cost of production is observed.
A decline in the prime lending rate of 200 basis points shrinks output marginally, but consistently by about 0.06 per cent in the first four quarters. The impact

subsists over the next four quarters at an average of 0.19 per cent and subsequently drops to 0.12 per cent. An increase in the prime lending rate would immediately impact on output growth by 0.06 percentage point in the first four quarters and thereafter decline by 0.2 and 0.12 percentage points, respectively, for 2013 and 2014.

Also, a combination of a 1.4 per cent depreciation in the nominal exchange rate (within band) and 200 basis points increase in the prime lending rate retards oil investment and non-oil investment and hence, total output. But a reversal of the policy mix, buoys output growth substantially.

Chapter One: Introduction

1.0 Introduction

The real sector of Nigeria's economy has arguably been the engine of the country's economic transformation over the years. Importantly, the sector has metamorphosed into an emerging industrial workhorse from a hitherto rudimentary agrarian economy that can hardly be ignored. A plethora of factors, including infrastructural gaps, inefficiencies in the public sector project management and service delivery, the resource curse of oil exploration, dysfunctional macroeconomic policy environment, among others have obviously truncated the real sector revolution.

Nevertheless, government has continued to play a catalytic role through the enunciation of policies and provisioning of financing havens to elevate the sector to levels that can make Nigeria an economic hub and a driver of Africa's economic renaissance. Although, recent numbers suggest resilient growth (especially at the heels of recent trepidations in the global economy), it is incontrovertible to see that currently, most countries that were at the same or even lower stage of development decades ago such as Malaysia have transformed their real sectors beyond mean proportions.

The issues of real sector development in Nigeria remain intricate and reflect a mix of both domestic and international characteristics. The real sector comprises agriculture, industry, building and construction, wholesale and retail and the services sectors, while from the international front, developments in the international oil market and the oil and gas sector are influenced by global financial activities. Thus, the policy environment must be adequately focused towards enhancing the capacity of the private sector to drive real sector activities and hence, achieve desirable levels of growth. There is no gainsaying the fact that the complex interactions of agents and economic activities pose the challenge of clearly understanding the adjustment mechanisms required to attain optimal levels of output. Although not exhaustive, econometric models are helpful tools that could be used in the determination of quantitative signposts to assists policy makers in formulating and implementing sound policies. Formulation and implementation of sound economic policies had made differences between developed, emerging and developing economies, and econometric models have played a part in these differences.

In Nigeria, several models have been developed to assist policy formulation and implementation. Economic model could be dated back to the work of Cater in 1960, who constructed input-output table to aid the formulation and

implementation of first National Development Plan. Several other models have been developed in order to assist in policy formulation, implementation and analysis including; the World Bank, 1974; NISER, 1983, and Olofin, 1985).

In 2008, the Central Bank of Nigeria developed a macroeconometric model of Nigeria to assist the Bank in policy analysis. The model, which was an aggregated model might not be able to capture all the sectoral interplay in the real sector due to the complexity in the workings of the economy. This study, therefore, set out to develop a disaggregated model of the real sector of the Nigerian economy. The model is not to compete with the aggregated macroeconomic model but to complement it and serve as input to the maintenance of the macro model.

Following this introduction, the next section focuses on the theoretical and empirical framework for the study. Section 3 periscopes into the real sector activities in Nigeria. Section 4 examines the methodology to be adopted for the study and discuss the empirical results in section 5. Section 6 undertakes model simulation and scenario analysis, while section 7 presents the summary and conclusion.

Chapter Two: Review of Relevant Literature

2.0 Theoretical Framework and Literature Review

2.1 Theoretical Framework

The framework provides a structure for understanding the key variables that drives the sector, and the linkages among the key macroeconomic variables as well as other sectors of the economy. Theoretically, models of the real sector largely transcend demand side approaches as in the traditional closed economy Keynesian framework to the Mundell-Flemming open economy macroeconomic models and supply side based production and cost function approaches. Several modifications in recent times have resulted in the widespread applications of the real business cycle and new Keynesian models with microfoundations. Quite importantly, the overriding structure of these models leads to the reflection of supply, demand price evolution processes within the real sector model. The characterisation of these processes has been in the context of several theoretical underpinnings and intuition.

2.1.1 Aggregate Supply

The theoretical foundation of the aggregate supply embodies the view that the accumulation of savings is pertinent to enhancing capital formation that can boost productivity and economic growth. According to Meiselman (1982) the fiscal operations of government alters investment incentives, allocative efficiency and growth through adjustments to relative prices. In other words, Matlanyane (2005) underscores that the analysis of factor supply decisions can be useful in the evaluation of policies that are meant to bring about higher levels of capital formation. In the context of the neo-classical flexible accelerator model, investment decisions are determined mainly by the cost of capital, influenced by the tax policy and other incentives that may include a favourable macroeconomic environment. However, public and private investment demand must be accompanied by a concomitant supply of financial capital; otherwise, as noted by Boskin (1982), interest rates will go up to levels that will undermine further investment.

In the literature, modelling the supply side output determination process depends on two approaches, namely, the production and the cost structure approaches. A typical specification of the production function follows a Cobb-Douglas production function of the form:

$$y = Ak^{\alpha}l^{1-\alpha}$$

Where *y* is output, *k* and *l* are the capital stock and the level of employment, respectively. *A* represents the level of factor efficiency or technological progress, while α and $1-\alpha$ are the relative factor contributions of the stock of capital and employment, respectively. Although the Cobb-Douglas production function has widespread applications, the constant elasticity of substitution (CES) production function has been introduced to allow for a discretional degree of factor substitution (Matlanyane, 2005). The transcendental logarithmic function has also been applied recently to permit relative flexibility in technology and relax the assumptions of homotheticity and quasi-additiveness in the CES.

To address the difficulty of consistency between factor demands and the price setting behaviour, the cost function approach to the supply side has also received relative application. It involves minimizing the cost function subject to production constraint and it takes the form:

$$C = wK + rL$$

Where C, K and L are the cost, capital stock and employment respectively, while w and r are respectively, the wage rate and the cost of capital. This approach provides an opportunity to derive the price equation within a consistent framework alongside factor demands but generally lacks the capacity to derive a measure of capacity utilisation, as observed in many macro-based models (Matlanyane, 2005).

2.1.2 Aggregate Demand

On the demand side, the open economy Keynesian income-framework has been the benchmark model in the output determination process. It underscores four main economic agents, namely, household, businesses, government and the rest of the world. The aggregate demand, therefore, sums up consumption, investment, government expenditure and trade balance associated with these economic agents and is represented by:

$$Y_t = C_t + I_t + G_t + (X_t - M_t)$$

Where Y_t represents the real GDP, C_t represents the real private consumption expenditure. It represents the real gross domestic investment, G_t represents the real government expenditure on domestic goods, X_t represents the real exports and M_t represents the real imports.

2.1.3 Consumption

According to economic theory, consumption behaviour is explained by four theories with microfoundations. The first of the theories is Keynes absolute income hypothesis (Keynes, 1936), which postulated that consumption is positively related to the current level of disposable income. The other is the relative income hypothesis later developed by Duesenberry (1946) and Modigliani (1949), which predicted that an individual's consumption depends on his income relative to that of the society. Later extensions on theory of consumer behaviour were the life cycle (Modigliani-Brumber, 1954; and Ando-Modigliani, 1963) and permanent income (Friedman, 1957) hypotheses. The life cycle hypothesis tied consumption to life-time income rather than the individuals current income, while the permanent income hypothesis presupposed that consumption was dependent on permanent income – which in simple terms is the average of contemporaneous and expected income.

Several works have extended these basic theoretical approaches to analyse consumptions in the context of uncertainty, multiple assets and risk, liquidity constraints and buffer stock models. Other variables such as interest rate, alternative measures of wealth, taxation, financial intermediation and demographic factors have also been included to determine consumption behaviour. Inflation has also been incorporated in the consumption function to capture the inflation loss on liquid assets (Whitley and Bai, 1997). Deaton (1978) supported the inclusion of the rate of inflation as a measure of uncertainty. From the above theoretical proposition, private consumption could take a form such as:

$$C_t = f(Y_t^d, r_t, \pi_t, w_t)$$

The variables in the above specification are defined thus: Y_t^d = disposable income, r_t = the deposit rate, π_t = the inflation rate and w_t = the real wealth of households.

2.1.4 Investment

As in the case of consumption behaviour, four theoretical models have been developed to explain investment demand. These included the Keynesian present value and marginal efficiency of investment, Jorgenson's (1971) accelerator principle, the user cost of capital and the Tobin Q theory (Brainard and James 1968; Tobin, 1969). The accelerator theory and the Tobin Q theory are considered the most suitable for modelling investment behaviour in a supply-constrained economy (Matlanyane, 2005). The preference stemmed in the flexibility of the

inclusion of policy instruments which the government can manipulate to enhance aggregate supply. The choice of the accelerator theory over the Tobin Q is mainly associated with measurement issues associated with the unobservable marginal Q, inaacurate measurement of the financial firm by financial markets (Blundell, et al. 1992) and the rudimentary stage of capital markets (Geda, et al., 2001).

2.1.5 Price Level

The price level in a developing economy is influenced by supply and demand through the interplay of aggregate supply and aggregate demand. New Keynesian class of models allowed for nominal rigidities and market imperfections with largely similar structure to traditional models of policy analysis typical of the IS/LM model. They are characterized by two main equations, namely, an aggregate demand equation and the New Keynesian Phillips Curve (NKPC). The former relates the output gap negatively to the real interest rate and positively to future output gap. The NKPC on the other hand linked domestic inflation to the output gap and a supply shock. Calvo (1983) developed the baseline NKPC model in a staggered price setting framework. In this model, a proportion of firms were assumed to be able to choose new prices every period whereas the remaining firms had to keep their prices fixed.

The absence of the source of inflation persistence in the NKPC was viewed as producing misleading forecasts relating to monetary policy effects (Ball, Mankiw and Reis, 2003). Alternative application of the NKPC was found in the traditional accelerationist Phillips curve. This approach assumed backward-looking expectations and proved to be consistent with the usual effects of monetary policy and standard empirical analyses of inflation. This model, however, ignored the Lucas critique and therefore a suspect tool for monetary policy analysis even though the model permitted expectations to adjust. The observed weaknesses in the new Keynesian and the accelerationist Phillips curves led to the intuition that a "hybrid" Phillips curve that incorporated backward-looking inflation expectations as well as rational expectations was appealing (see Gali and Gertler, 1999).

2.2 Literature Review

Real sector activity is commonly disaggregated in a number of models into various value-added sectors. The level of disaggregation in these models usually depends upon the estimation approach and availability of data which may have placed some limitation on the depth of such studies in the developing economies. While a Cobb-Douglas production function is commonly used and found to be appropriate in most estimation, Klien (1983) proposed the use of

input-output (IO) approach to modelling the real sector highlighting the relationship between value added and components of final demand. The approach specified value added as a function of various components of final demand, emphasizing the responsiveness of output to changes in aggregate demand conditions. As applied in Musila and Rao (2002), Elliot et al. (1986) and Randakuwa *et al*. (1990) the approach was used to varying sectoral outputs for the Kenyan and Sri Lankan economies.

Similarly, El-Sheikh (1992) and Marzouk (1975) used a less disaggregated model classified into agriculture and urban value added and further cascaded into manufacturing, construction and other sectors. Both specifications and classifications had gained reasonable support empirically. A slightly different approach was used by Ghartey and Rao (1990) by estimating three equations for the production sector. These were aggregate output, agricultural output and manufacturing output. From the model GDP responded well to changes in total employment as well as aggregate capital stock while exhibiting increasing returns to scale for the equations. On the other hand, industrial output increased with GDP while agricultural output increased with industrial output.

Another approach that captured market imperfections to modelling the labour market was implemented by DU Toit and Koekmoer (2003) for the economy of South Africa. Demands for unskilled and skilled labour were specified in the paper. They revealed that labour market was significantly influenced by factors which included government interventionist policy, union powers, structure of the labour force, inappropriate production technologies and low productivity.

Drachman and Zilberfrab (1987) built a small annual econometric model of the real sector in Israel for the purpose of forecasting key real macrovariables and policy analysis by the relevant Economic Planning Authority. It employed data spanning 1965 – 1983 and the Ordinary Least Square (OLS) technique in estimating the equations. The model comprised five equations namely, private consumption, private investment, exports, imports and output. The distinction between this model and previous models relating to the Isreali economy, like Litvin and Meridor, 1977; Arstein *et al*, 1982; and Zilberfarb, 1980, was the inclusion of the crowding effect of government expenditure on private investment. The study discovered that structural changes had occurred in the last decade, making extrapolations of previous estimates less reliable. In addition, the analysis of the response of the model to fiscal policy revealed low multipliers owing to the crowding out of exports by government expenditure.

In his study, Matlanyane (2005) developed a small model for the national account sector in South Africa. The sector was divided into five sub sectors, namely: the agricultural sector, the construction sector, the manufacturing sector, electricity and water sector and the net indirect taxes as a function of some components of real aggregate demand. Using this technique, he estimated four equations comprising consumption, investment, exports and imports. Consumption, investment as well as agricultural and manufacturing output were made to determine the import of goods and services in the model.

Musila (2007) estimated a small-open economy macroeconomic model for Malawi. Given that the economy had followed an export oriented agricultural based development strategy since independence, the model was structured to consist of production, expenditure, government, monetary, employment sectors and prices. The model employed data spanning 1967 – 1996 and had 37 endogenous variables of which 23 were explained by stochastic equations and identities and bridge equations, which closed the model. There were 15 exogenous variables, 4 of which were dummy variables (intended to capture structural shifts in the economy that might have resulted from the oil-crisis of 1972 – 1974 and the economic reforms that were launched in 1981). The short-run version of the model was estimated using the cointegration estimation technique. The estimated parameters of the long version of the model were used to perform dynamic simulation experiments, which indicated that a sustained devaluation of the Malawi kwacha improved the real trade balance, but led to higher inflation and reduced real GDP growth.

Chapter Three

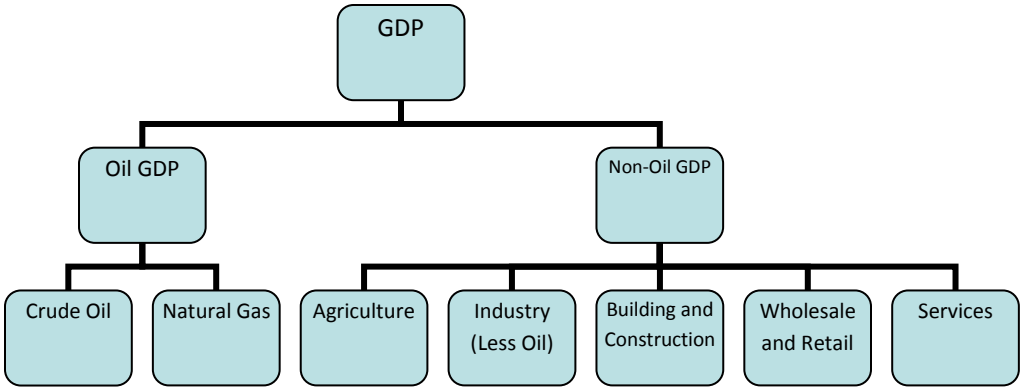
3.0 Overview of Real Sector Developments in Nigeria

3.1 Real Sector Activities in Nigeria

3.1.1 Nature and structure

Structurally, Nigeria's economy can be classified into three major sectors – primary, secondary and tertiary. The primary sector consists of agriculture and natural resources; the secondary sector is mainly industry, which is made up of processing and manufacturing, as well as building and construction; while services and wholesale & retail trade make up the tertiary sector. The real sector is also classified into oil and non-oil sector. While the oil sector is made up of the crude petroleum and gas production, the non-oil sector is made up of agriculture, industry, wholesale and retail and services.

Figure 1: Components of Gross Domestic Product

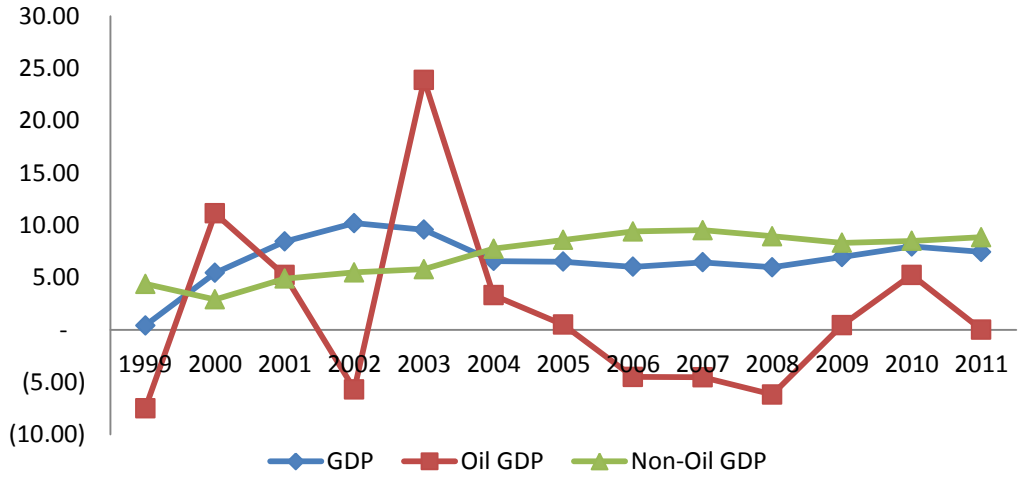


Source: National Bureau of Statistics (NBS)

The oil sector has been the dominant sector in terms of foreign exchange earnings. However, its contribution to GDP has been on the decline since the turn of the millennium. The oil sector contributed about 30.8 per cent of GDP in 1999, which rose to 32.5 per cent in 2000 declined to 31.5 per cent in 2001 and fell consistently to 14.8 per cent in 2011. For the period 1999 to 2011, oil sector contributed an average of 23.3 per cent. While the contribution to the GDP has been on the decline, its growth performance has been mixed. The oil sector growth rate declined by 7.5 per cent in 1999, but grew by 11.1 per cent in 2000, reaching its peak in 2003 with 23.9 per cent growth. On the average, the oil sector grew by 1.6 per cent for the period 1999 to 2011.

The percentage share of non-oil GDP during the period 1999-2011averaged 76.7, increasing from 69.2 per cent in 1999 to 85.2 per cent in 2011. Its growth performance also followed the same trend. It grew by 4.4 per cent in 1999 and peaked at 9.4 per cent in 2006 and by 2011 it grew by 8.9 per cent, averaging 7.2 per cent during the period.

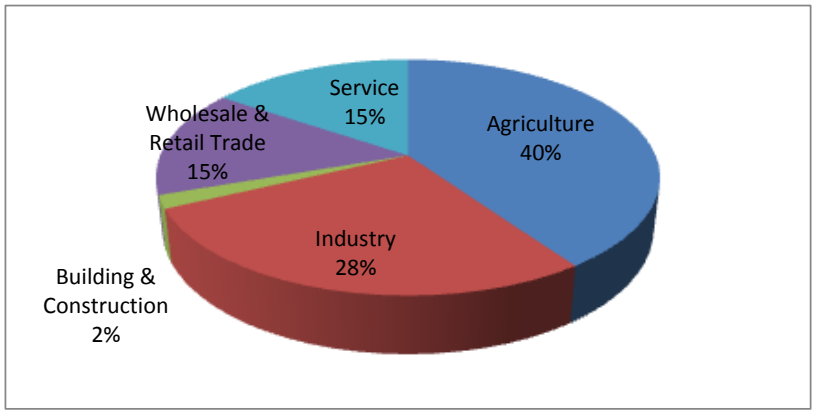
Figure 2: GDP Growth Rate



Source: Central Bank of Nigeria (CBN)

An analysis of the sectoral contributions to GDP (as shown in Figure 3) revealed that the share of agriculture in GDP averaged 40.3 per cent during the period 1999-2011. It was 36.7 per cent in 1999; peaked at 43.9 per cent in 200 and stabilized at 40.2 per cent in 2011. The agricultural sector is expected to play its traditional roles of meeting the food needs of the teeming population, providing the required raw material needs of the industrial sector and providing the envisaged surplus for exports and thereby generating foreign exchange to improve the balance of payments position. The subsistence nature of farming characterized by low adoption of technology, inadequate use of fertilizers and improved seeds accounted for low productivity of the sector. Also, lack of access to adequate funds to invest in the sector had been identified as a major hindrance to improved productivity.

Figure 3: Average Sectoral Contribution (1999 - 2011)



Source: Central Bank of Nigeria (CBN)

The industrial sector consists of manufacturing and mining (including crude petroleum, gas and solid minerals). The manufacturing sector in Nigeria consists of large, medium, small and micro scale enterprises. On attainment of independence, government embarked on transforming the country from its predominantly agrarian nature, into an industrialized economy through various policies and programmes as encapsulated in the development plans. The share of the industrial sector averaged 27.9 per cent during the period of analysis, with its sectoral contribution declining from 35.4 per cent in 1999 to 19.3 per cent in 2011. The decline in the sectoral contribution of the industrial sector to GDP is attributed to various factors including policy inconsistencies and reversals, as well as infrastructural bottlenecks. The share of manufacturing sector averaged 4.0 per cent during the period of analysis. The declining share of the industrial sector, especially manufacturing sector is worrisome as this has exacerbated the unemployment situation in the country.

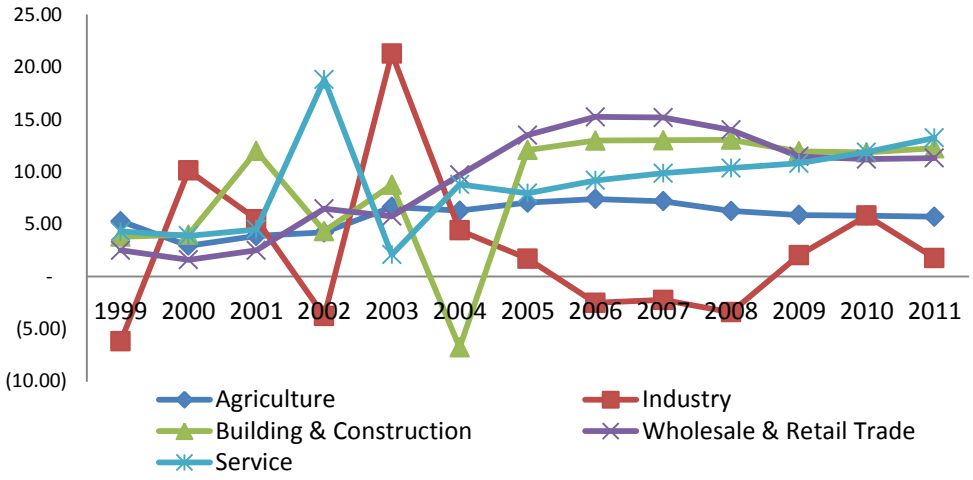
The mining sub-sector is made up of crude petroleum, gas and solid minerals. Solid minerals such as coal and tin used to be the main mining activity and export items for Nigeria prior to the discovery of crude oil. However, this changed following the discovery of petroleum, which has dominated activity in the mining sector, and constituted the major source of government revenue and export earnings. The crude petroleum & natural gas sector accounted for 23.3 per cent of the share of total GDP during the period under review, which showed a similar declining pattern with the industrial sector falling from 30.8 per cent in 1999 to 14.8 per cent in 2011.

The share of building and construction in the GDP fluctuated around 1.8 per cent during the period of analysis. As a percentage of GDP, the share of wholesale & retail trade averaged 14.8 per cent during the period 1999-2011. The share of the sector increased during the period of analysis from 13.6 per cent in 1999 to 19.4 per cent in 2011. Similarly, the share of services in GDP averaged 15.5 per cent during the review period, increasing from 12.3 per cent in 1999 to 19.1 per cent in 2011.

3.2 The Growth Drivers

Generally, the real sector had witnessed some fluctuations in fortune looking at the economic history of Nigeria over the years. Since return to democratic governance, the economy maintained an impressive average growth of 7.9 per cent following governments resolve and commitment to grow the economy reflecting the improved macroeconomic reforms and policies embarked upon, especially the National Economic Empowerment and Developments Strategy (NEEDS). During the period of analysis, the economy grew at 0.4 per cent in 1999; peaked at 10.5 per cent in 2004 before moderating to 7.5 per cent in 2011. The robust growth rate of GDP during the period 1999-2011 was attributed largely to the development in the non-oil sector.

Figure 4: Sectoral Growth Rate (Per cent)



Source: Central Bank of Nigeria (CBN)

The non-oil (GDP) growth averaged 8.9 per cent in the period 2006 – 2010, which grew from 4.4 per cent in 1999 to 8.9 per cent in 2011. The performance of the non-oil sector was driven by the agricultural sub-sector, given its contribution to the GDP, which was over 40 per cent, followed by the services and wholesale &

retail trade sectors. Sectoral analyses showed that growth in the agricultural sector stabilized around 6.0 per cent during the period of analysis. Agriculture accounted on the average for about half (3.7 percentage points) of the growth in non-oil sector GDP (7.9 percentage point) in the period 1999 – 2011.

In agriculture, evidence suggested that yields were falling and that productivity had declined for both cash and food crops over the past decades. For the cash crops, production levels had also tumbled. However, production levels for foods crops had risen, and the development had been attributed largely to steady and considerable expansion in area under cultivation as productivity, measured by yields per hectare had declined. Other significant sub-sectoral growth drivers during this period included the services, wholesale & retail trade, and building and construction sectors, with recorded growth rates of 4.3 per cent to 13.3 per cent, 2.5 per cent to 11.3 per cent, and 3.8 per cent to 12.3 per cent in 1999 and 2011, respectively. In the services subsector, communications recorded the highest growth rate of about 73.0 per cent on the average over the period. The growth rate in this sector was buoyed by the sustained liberalization and expansion of telecommunications services.

Chapter Four

4.1 Data Requirement

The data used in this study are obtained from two main sources, namely: the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN). The quarterly data employed for model estimation and simulation span 1990 – 2011. In the study, nominal data sets are utilized for estimation and in-sample simulations. The use of quarterly series is premised on two crucial factors. Firstly, sufficient degrees of freedom relating to number of observations is critical, especially when estimating the over-parameterized models. Secondly, for monetary policy purposes, annual data results could hardly hold sway for a model conceived to track economic developments which, invariably, affect the real sector.

4.2 Model Specification

The modeling agenda follows the Keynesian paradigm with structuralist modifications reflecting peculiar characteristics of the Nigerian economy. Modelling the real sector captures private consumption, domestic investment, income, and prices. Government fiscal activities are captured as exogenous variables to fully account for its relevance as an enabler of growth especially since it constitutes a significant part of gross output. The five major components of output – agriculture, industry, building and construction, wholesale and retail trade and services – were modeled to aid the forecasting of the real sector variables.

4.2.1 Private Consumption

The economy depends significantly on imported goods and the price of imported consumption products are influenced by the exchange rate. Recently, remittances from abroad have been on the increase and are now a major alternate household income which can influence private consumption. Therefore, private consumption (CON) is specified as a function of income (NY), change in the consumer price index (CPI), all share index as a proxy for wealth, real interest rate, remittances (RMT) and real exchange rate (RER).

$$con = \beta_{0,1} + \beta_{1,1} ny - \beta_{2,1}((cpi_t - cpi_{t-4}) / cpi_{t-4}) * 100 + \beta_{3,1} rir + \beta_{4,1} asi + \beta_{5,1} rmt + \beta_{6,1} rer + \mu_1 \qquad (1)$$

4.2.2 Consumer Price Index

Price determination in Nigeria follows a structuralist approach obviously reflecting the institutional and market rigidities which are characterized by the interplay of both domestic and international factors. Given Nigeria's high import-

dependency and the probable exchange rate pass-through, the exchange rate is considered an important variable in the determination of the headline consumer price index. The contribution of Government to GDP is relatively high and so is the impact of its expenditure on consumer prices. The impact of such pressure fuels the domestic money supply. Activities of DMBs in the setting of the lending rate similarly influence money supply and liquidity and therefore consumer prices. Thus headline CPI is specified as a function of nominal exchange rate (NER), domestic prime lending rate (PLR), private consumption (CON), agricultural output (NYG), money supply (m2), and all-share index (ASI).

$$cpi = \beta_{0,2} + \beta_{1,2} ner + \beta_{2,2} plr + \beta_{3,2} m_2 + \beta_{4,2} asi + \beta_{5,2} con + \beta_{6,2} nyg + \mu_2 \quad (2)$$

4.2.3 Oil Investment

The oil sector in Nigeria is funded through a public-private partnership (PPP) arrangement, which encompasses contributions from both parties. Government contributes its portion through the joint venture cash calls (JVCs). Private sector contribution mostly comes from foreign direct investment (FDI). Thus, investment in the oil sector (inv_o) is specified as a function of oil, inflation (π), real oil output (*roy*), oil FDI (fdi_o) and crude oil price (p_o).

$$ninv_{\text{o}} = \beta_{0,3} - \beta_{1,3} y_{\text{vo}} - \beta_{2,3} \pi + \beta_{3,3} roy + \beta_{4,3} fdi_{\text{o}} + \beta_{5,3} p_{\text{o}} + \mu_3 \quad (3)$$

4.2.4 Non-Oil Investment

In the non-oil sector, investment is influenced by government through the action of the monetary authority to influence the cost of capital and price level in the economy. In addition, government expenditure via intervention in infrastructure complements private investment. Therefore, investment in the non-oil sector (inv_n) is specified as a function of change in total capital formation over its lag (Δk_{t-i}), real non-oil output (rny), real interest rate (rir), inflation (π) and government total expenditure (gte). Thus, the behavioural form of this relationship is specified as:

$$ninv_{\text{n}} = \beta_{0,4} - \beta_{1,4} \Delta k_{\text{t-i}} + \beta_{2,4} y_{\text{n}} + \beta_{3,4} rir + \beta_{4,4} \pi + \beta_{5,4} tge + \mu_4 \quad (4)$$

4.2.5 Exports of Goods (Oil)

Nigerian exports are classified into tangible and intangible. The tangible goods i.e export can be further disaggregated into oil and non-oil exports in line with dual

nature of the Nigerian economy. Oil export is exogenously determined and is influenced by the world crude oil prices, the level of economic growth in the major industrial countries. Domestic social and economic environments also influence the level of oil production and export.

Oil export is one of the major exports for the country. The country's oil export depends on foreign countries' income *(fny)* (proxied by OECD output), real exchange rate *(rer),* crude oil prices *(po)* and world oil output *(opn)*.

$$x_{go} = \beta_{0,5} + \beta_{1,5}\text{fny} + \beta_{2,5}rer + \beta_{3,5}po + \beta_{4,5}opn + \mu_5 \quad (5)$$

4.2.6 Exports of Goods (Non-Oil)

Non-oil exports, which comprises industrial and agricultural products is influenced by ability of local producers to meet international standards and the demand by foreign consumers. Despite increase in non-oil export in recent times, non-oil export is still being hindered by inadequate infrastructural support and inconsistency of government policies.

Recently, Nigeria's export has been driven by non-oil exports. The non-oil export is determined by foreign income *(fny),* real exchange rate *(rer),* agricultural output *(nyg)* and industrial output *(nyi),* and is specified as follows:

$$x_{gn} = \beta_{0,6} + \beta_{1,6}fny + \beta_{2,6}\text{rer} + \beta_{3,6}nyg + \beta_{4,6}nyi + \mu_6 \quad (6)$$

4.2.7 Exports of Services

Given that exports are primarily driven by domestic production and output, export of services is explained by output of services (nys)

$$x_s = \beta_{0,7} + \beta_{1,7}nys + \mu_7 \quad (7)$$

4.2.8 Imports of goods (oil)

Import in Nigeria is generally decomposed into imports of goods and services and is further disaggregated into oil and non-oil goods. Import has been identified as the major driver of both domestic production and final consumption. In this model, therefore, oil import is traditionally specified as a function of oil output *(roy),* index of energy consumption *(iec)* and real exchange rate *(rer)*.

$$m_{go} = \beta_{0,8} + \beta_{1,8} roy + \beta_{2,8} iec + \beta_{3,8} rer + \mu_8 \quad (8)$$

4.2.9 Imports of goods (Non-oil)

In line with economic theory and literature, non-oil import is determined by non-oil output *(nny)*, aggregate consumption *(con)*, non-oil foreign direct investment *(fdi_n)* and government capital expenditure *(gce)*.

$$m_{gn} = \beta_{0,9} + \beta_{1,9} nny + \beta_{2,9} con + \beta_{3,9} fdi_n + \beta_{4,9} gce + \mu_9 \quad (9)$$

4.2.10 Imports of Services (oil)

Import of services is determined by output of services (nys) and non-oil foreign direct investment (fdi_n).

$$m_s = \beta_{0,10} - \beta_{1,10} nys + \beta_{1,10} fdi_n + \mu_{10} \quad (10)$$

4.2.11 Agricultural Output

The agricultural sector consists of crop production, livestock, forestry and fishing. Agriculture remains the foremost employer of labour and also a major driver of output growth in the Nigerian economy. However, production in the sector remains mainly rain-fed and subsistent, leaving the sector highly susceptible to the vagaries of weather and other natural developments. Over the last three decades, various concessionary arrangements have been made in an effort to provide finance to the sector in order to boost production through the use of more capital-intensive and mechanized methods. Production in this sector is specified in the model as the function of an autoregressive lag of agricultural output ($nyg_{(-1)}$), rainfall (*rf*), credit to the private sector (*cps*) and government capital expenditure (*gce*).

$$nyg = \beta_{0,11} + \beta_{1,11} rf + \beta_{2,11} nyg_{(t-1)} + \beta_{3,11} cps + \beta_{4,11} gce + \mu_{11} \quad (11)$$

4.2.12 Industrial Output

Key components of this sector are oil and gas, manufacturing, building and construction, wholesale and retail, and services. Activity in the sector is highly capital-intensive, technologically advanced and import dependent. A key component in the production process across the sector is energy, without which production activities may be hampered. Thus, the index of electricity consumption is used as a proxy for energy requirement. The quantum of credit

available to this sector (represented by credit to the private sector) determines to a great extent the production activities. The level of investment in the economy, particularly in infrastructure, acts as a catalyst to production activities. In recent years, production activity in the oil sector was disrupted by Niger-Delta crisis but has improved. Production in the industrial sector is thus driven by energy consumption (iec), credit to the private sector (cps), overall output, investment and nominal exchange rate.

$$nyi = \beta_{0,12} + \beta_{1,12} iec + \beta_{2,12} cps + \beta_{3,12} y + \beta_{4,12} inv + \beta_{5,12} ner + \mu_{12} \quad (12)$$

4.2.13 Building and Construction Output

Government spending has an overbearing influence in determining the output of building and construction in Nigeria. Given the urgent need to develop the economy, government overtime had embarked on providing the requisite infrastructure such as roads, buildings, bridges, drainages, etc to foster economic activities. The output of building and construction *(nyb)* is determined mainly by government capital expenditure *(gce),* nominal exchange rate *(ner),* and prime lending rate *(plr),* which measures the cost of funds. Government capital expenditure is expected to have a positive influence on output of building and construction, while the nominal exchange rate and prime lending rate is expected to have a negative impact on building and construction output.

$$nyb = \beta_{0,13} + \beta_{1,13} gce + \beta_{2,13} ner + \beta_{3,13} plr + \mu_{13} \quad (13)$$

4.2.14 Wholesale and Retail Trade Output

In recent times, commerce has begun to have significant impact on economic activities in the Nigerian economy, as its share in the GDP remained at 14.8 per cent since the return to democratic governance. Given the declining share of manufacturing in its sectoral contribution to GDP and the burgeoning population of Nigeria, wholesale and retail trade has come to the fore in providing the required goods and services through heavy importation and contributing more to GDP. The output of wholesale & retail trade *(nyw)* is specified to be determined by nominal exchange rate *(ner),* government recurrent expenditure *(gre)* and income *(y)*. Government recurrent expenditure and income is expected to exert positive influence on wholesale & retail trade output, while nominal exchange rate is expected to have a negative influence on the dependent variable.

$$nyw = \beta_{0,14} + \beta_{1,14} ner + \beta_{2,14} gre + \beta_{3,14} y + \mu_{14} \quad (14)$$

4.2.15 Output of Services

Output of services sector is determined by private consumption *(con),* prime lending rate (PLR), total government expenditure *(tge),* and building and construction output *(nyb)*. All the explanatory variables are expected to lead to increase in services output, except for prime lending rate.

$$y_s = \beta_{0,15} + \beta_{1,15}con - \beta_{2,15}plr + \beta_{3,15}tge + \beta_{4,15}nyb + \mu_{15} \quad (15)$$

4.2.16 Identities

$$y^a = nyg + nyi + nyb + nyw + nys \quad (16)$$

$$y^e = con + inv + tge + x - m \quad (17)$$

$$y^e = y^a \quad (18)$$

$$inv = invo + invn \quad (19)$$

$$k_t = inv_t + \Delta inv_{t-1} \quad (20)$$

$$\Delta k_t = k_t - k_{t-1} \quad (21)$$

$$\pi = ((cpi_t - cpi_{t-4}) / cpi_{t-4}) * 100 \quad (22)$$

$$rir = plr - \pi \quad (23)$$

$$tge = gce + gre \quad (24)$$

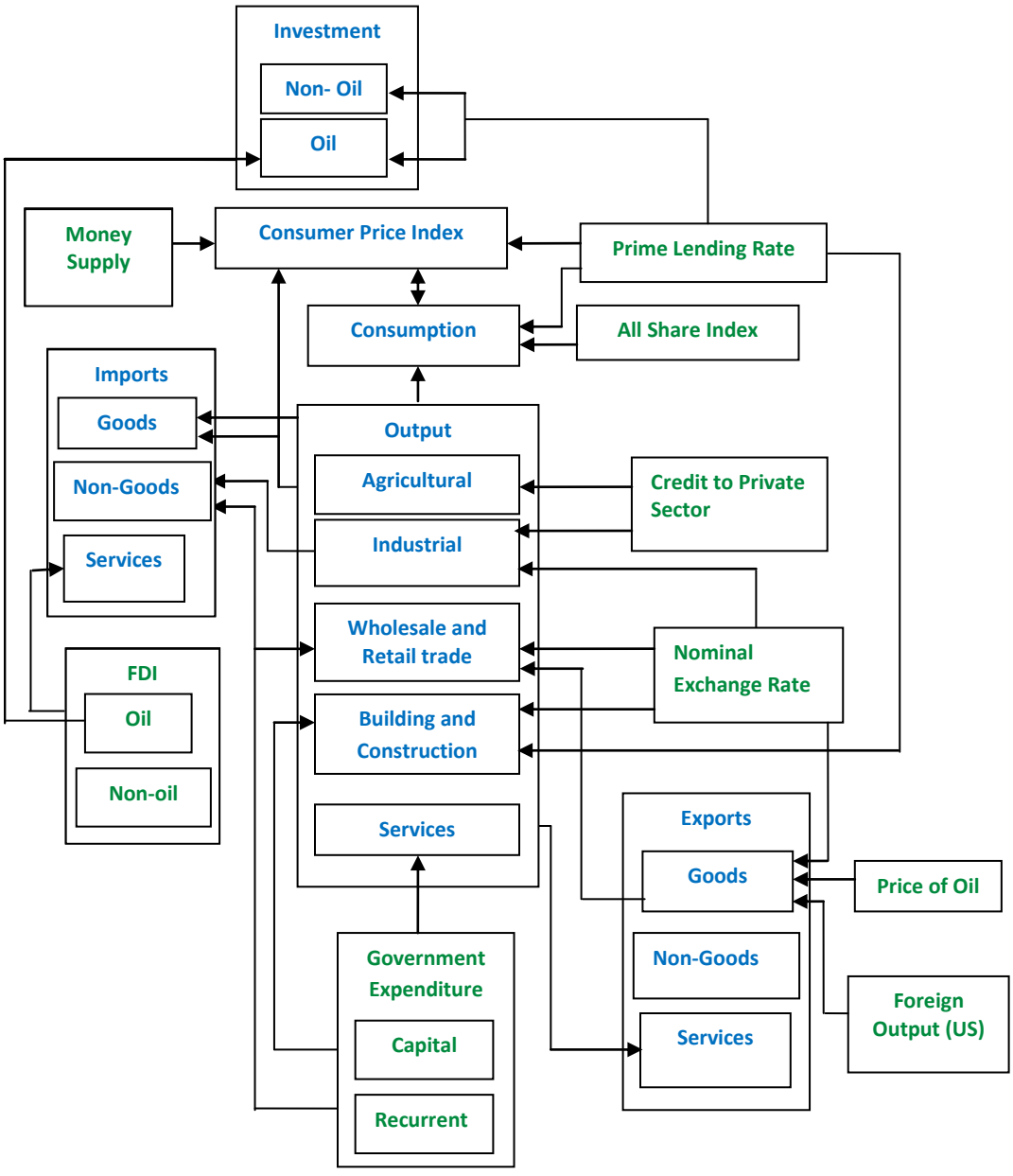
$$x = x_g + x_s \quad (25)$$

$$x_g = x_{go} + x_{gn} \quad (26)$$

$$m = m_g + m_s \quad (27)$$

$$m_g = m_{go} + m_{gn} \quad (28)$$

Figure 5: Flowchart of the Real Sector Model



Chapter Five

5.0 Model Estimation, Interpretations and Appraisal

5.1 Model Estimation and Interpretations

The real sector model consists of 15 equations and 13 identities. The equation are private consumption, consumer price index, oil investment, non-oil investment, export of goods (oil), export of goods (non-oil) export of services, import of goods (oil), import of goods (non-oil), import of services (oil), agricultural output, industrial output, building and construction, wholesale and retail trade and services. The last five equations cumulatively form the total domestic output of the economy. This disaggregation is meant to show the linkages among the endogenous variables and to provide more useful information to the MPC members.

5.1.1 Consumption

In most of the empirical literature, output and prices appear to be the dominant determinants of consumption. Also, from the estimation result in table 1, price has a marginal impact on consumption. The results suggest that price, income, prime lending rate and all-share index have the correct signs and are all significant at 1.0 per cent. In the long-run, 100 per cent increase in price culminates to 0.4 per cent rise in consumption. This is an indication that price changes do not significantly impact consumption, all other things being equal. In the case of output, 1 per cent rise in output lead to 0.48 per cent in consumption. In the same vein, 1 per cent increase in all-share index lead to a rise of 0.72 per cent in consumption while a 1 unit change in prime lending rate made an impact of 5 unit change in consumption. This is an indication that the developments in the financial market, with respect to lending, are important in the determination of consumption in Nigeria.

Table 1: OLS Estimation – Consumption

Dependent Variable: LOG(NCON)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CPI)-LOG(CPI(-4))*100	0.003493	0.000540	6.466997	0.0000
LOG(NY)	0.472936	0.059184	7.990952	0.0000
MLR	0.032033	0.006894	4.646661	0.0000
LOG(ASI)	0.808756	0.091625	8.826812	0.0000
R-squared	0.955937	Durbin-Watson stat		0.380612

5.1.2 Consumer Price Index

The results in Table 2 indicated that all the explanatory variables conformed to a-priori expectations. The first order autoregressive level of agriculture output, broad money supply, consumer price index and the contemporaneous consumption were all significant at 1.0 per cent level, except the one period lag of the prime lending rate. The result indicated that inflation was backward looking and persistent. A 1 per cent increase in cpi lagged by one quarter would induce a 0.98 per cent rise in the contemporaneous consumer price level while a 1 per cent increase in agricultural output led to a decline of 0.09 per cent in the price level in the long-run. In the case of broad money supply, the relationship with consumer prices was positive. A 1 per cent rise in money supply would induce 0.06 per cent increase in consumer price index. The result supported the fact that price level changes were driven by monetary phenomenon. With a 1 per cent increase in consumption, consumer price index increased by 0.03 per cent in the long-run.

Table 2: OLS Estimation - Consumer Price Index

Dependent Variable: LOG(CPI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MLR(-1)	-0.001036	0.001228	-0.843884	0.4012
LOG(NYG(-1))	-0.089710	0.027734	-3.234681	0.0018
LOG(NM2(-1))	0.058345	0.017229	3.386523	0.0011
LOG(NCON)	0.036018	0.013585	2.651330	0.0096
LOG(CPI(-1))	0.978155	0.010835	90.27635	0.0000
R-squared	0.998284	Durbin-Watson stat		1.289536

5.1.3 Oil Investment

The major driver of investment in the oil sector was output in the oil sector with output elasticity of approximately 0.8 per cent. This was followed by foreign direct investment flows into the oil sector with an elasticity of 0.27 per cent. Inflation with an elasticity coefficient of 0.007 per cent showed that investment in the oil sector was insensitive to price change in Nigeria.

Table 3: OLS Estimation - Oil Investment

Dependent Variable: LOG[OINV]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NY)	0.807816	0.130148	6.206900	0.0000
LOG(FDIO(-4))	0.243879	0.116193	2.098915	0.0390
LOG(CPI)-LOG(CPI(-4))*100	0.005572	0.002370	2.350942	0.0212
MLR	-0.072127	0.045031	-1.601722	0.1132
R-squared	0.747332	Durbin-Watson stat		0.526356

5.1.4 Non-oil Investment

In terms of investment in the non-oil sector, industry economic activity accounted for 0.75 per cent of the elasticity. Government capital expenditure and change in the capital stock were the other drivers of investment in the non-oil sector. Similarly, as it is in the case of the investment in the oil sector, inflation was positive, while interest rate was inversely related to non-oil investment.

Table 4: OLS Estimation - Non-Oil Investment

Dependent Variable: LOG(NINVN)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(K)-LOG(K(-4))	0.256932	0.153566	1.673106	0.0983
MLR	-0.078152	0.040406	-1.934171	0.0567
LOG(GCE)	0.484602	0.264038	1.835353	0.0702
LOG(NYI)	0.646310	0.221529	2.917492	0.0046
LOG(CPI)-LOG(CPI(-4))*100	0.003521	0.002065	1.705302	0.0921
R-squared	0.857857	Durbin-Watson stat		0.230983

5.1.5 Exports of Goods (Oil)

Exports of goods (oil) depended on foreign income, nominal exchange rate, crude oil prices and crude oil output. The results from the estimation output showed that all the explanatory variables and/or the right hand side variables were statistically significant and met their *apriori* conditions. A 1 unit increase in the US income would cause exports of goods (oil) to increase by 0.32 per cent, and vice versa. Developments in the foreign exchange market had a toll on exports of goods (oil) in the Nigerian economy. A 1 unit increase (depreciation) in the nominal exchange rate would lead to an increase in the value of nominal exports of goods (oil) by 0.76 per cent. Similarly, developments at the

international oil market had bearing on the price of crude oil, which tended to influence oil exports in the long-run. A 1 unit increase in oil prices at the international market would lead to a 0.79 per cent increase in oil exports. Lastly, crude oil production had a strong impact on oil export. A 1 per cent unit increase in crude oil production would impact positively on exports of goods (oil) by 0.83 per cent and vice versa.

Table 5: OLS Estimation - Exports of Goods (Oil)

Dependent Variable: LOG(XGO)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(USNY)	0.322715	0.045237	7.133811	0.0000
LOG(NER)	0.756995	0.091025	8.316367	0.0000
LOG(PO)	0.799638	0.115578	6.918609	0.0000
OPN	0.832156	0.392437	2.120484	0.0369
R-squared	0.894129	Durbin-Watson stat		0.195410

5.1.6 Exports of Goods (Non-Oil)

Non-oil export was determined by nominal exchange rate and the previous values of agricultural output, as well as the output of wholesale and retail trade. All the variables in the estimation output had the required signs and statistically significant, except for agricultural output. A 1 per cent increase in the nominal exchange rate would increase non-oil exports by 0.27 per cent. Similarly, a unit increase in the previous values of agricultural output and wholesale & retail trade output would increase non-oil exports by 0.13 and 0.54 per cent, respectively.

Table 6: OLS Estimation - Exports of Goods (Non-Oil)

Dependent Variable: LOG(XGN)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NER)	0.273629	0.132541	2.064493	0.0421
LOG(NYG(-2))	0.132548	0.196179	0.675650	0.5011
LOG(NYW(-2))	0.540360	0.206568	2.615900	0.0106
R-squared	0.904899	Durbin-Watson stat		0.257822

5.1.7 Exports of Services

The above estimation revealed that changes in the period lag of export of services as well as the contemporaneous output from services substantially

explained 98.0 per cent variation in the dependent variable (export of services). Moreso, both explanatory variables were found to conform to economic theory and also were found to be statistically significant at 1.0 per cent. Therefore, a 1 per cent increase in the first quarter lag of export of services and output of services result to a 0.89 per cent and 0.09 per cent increase in the contemporaneous export of services, respectively. The intuition behind this economic phenomenon rests on the fact that increased exports in the previous quarter would bring about increased foreign earnings which would feed into the economy as investment resulting therefore into more output for exports.

Table 7: OLS Estimation - Exports of Services

Dependent Variable: LOG(XS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(XS(-1))	0.896688	0.041280	21.72219	0.0000
LOG(NYS)	0.097825	0.036969	2.646111	0.0097
R-squared	0.982004	Durbin-Watson stat		1.744153

5.1.8 Imports of Goods (Oil)

The estimated model revealed that industrial output, which was driven mainly by domestic aggregate demand had significant impact on the level oil imported for consumption. Secondly, importation of oil was also highly correlated with developments in the foreign exchange market as reflected in the coefficient for NER. A 1 per cent increase in nominal industrial output raised imports of goods in oil by about 0.72 per cent.

Table 8: OLS Estimation - Imports of Goods (Oil)

Dependent Variable: LOG(MGO)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NYI)	0.716684	0.053585	13.37470	0.0000
LOG(NER)	0.384232	0.160836	2.388962	0.0191
R-squared	0.929866	Durbin-Watson stat		0.348859

5.1.9 Imports of Goods (Non-Oil)

The results revealed that government capital expenditure, nominal industrial output and nominal agricultural output were positively related to imports of non-

oil goods confirming a priori expectations. The result supported the view that government's capital disbursements were directed towards the importation of capital goods for investment in public infrastructure such as roads and power. In addition, the pace of economic activities characterised by industrial output significantly influenced the level of importation of non-oil goods as production in the sector was highly dependent on imported raw materials.

Table 9: OLS Estimation - Imports of Goods (Non-Oil)

Dependent Variable: LOG(MGN)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GCE(-1))	0.255056	0.166443	1.532393	0.1292
LOG(NYI(-1))	0.411742	0.087354	4.713490	0.0000
LOG(NYG(-1))	0.298037	0.125727	2.370515	0.0201
R-squared	0.962388	Durbin-Watson stat		0.709497

5.1.10 Imports of Services (Oil)

The estimation result showed that nominal output and foreign direct investment (FDI) positively influenced the dependent variable (import of services) considerably. This was reflected by the R^2 statistics which indicated that about 87 per cent of the variation in the dependent variable was explained by the changes in the independent variables. In addition, output and foreign direct investment conformed to a priori expectations and were found to be statistically significant at 5.0 per cent and 1.0 per cent, respectively. From an optimistic perspective, the estimation result also revealed that an increase in output by one per cent would raise the import of services by 0.17 per cent. This phenomenon was substantiated by economy theory which clearly explained that an increase in the income would lead to a corresponding increase in consumption. Coupled with the import dependent nature of the Nigerian economy, an increase in income would result in an increase in import of services given that aggregate imports accounted for a large proportion of commodities consumed in the economy.

Furthermore, an increase in foreign direct investment by one per cent led to an increase in import of services by 0.72 per cent. This is based on economic reasoning that imports constituted a significant share of inputs for both domestic production and final consumption. Therefore, an increase in the inflow of foreign direct investment warranted an increase in input (goods and services) for production which led to an increase in the demand for imported services.

Table 10: OLS Estimation - Imports of Services

Dependent Variable: LOG(MS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NY)	0.217701	0.064495	3.375463	0.0011
LOG(FDIO)	0.691833	0.088763	7.794159	0.0000
R-squared	0.873255	Durbin-Watson stat		0.664698

5.1.11 Agricultural Output

Agricultural output was driven primarily by crop production, livestock, forestry and fishing. The sector was the major employer of labour and engine of economic growth, contributing an average of 6.5 per cent in the growth of GDP in Nigeria. The long-run estimation result of the agricultural sector showed that all the included explanatory variables (rainfall, credit to the private sector, government capital expenditure and the previous value of agriculture output) were not only statistically significant but also rightly signed in line with economic theory. The result suggested that, holding all other variables constant, a 1.0 per cent increase in the amount of rainfall would increase agricultural output by 0.07 per cent while credit to the private sector and government capital expenditure induced agricultural output growth by 11.0 and 13.0 per cent, respectively. The previous value of agricultural output explained as much as 72.0 per cent of the movement in the contemporaneous value. This finding was in tandem with theory and fundamentals of the Nigerian economy. For example, agricultural sector output, over the years, had been driven primarily by favourable weather conditions coupled with the various salutary government agricultural policies. Credit to the private sector fed into agriculture output through expanded availability of funds for investment in the sector.

Table 11: OLS Estimation - Agriculture Output

Dependent Variable: LOG(NYG)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RF(-4))	0.066554	0.014524	4.582353	0.0000
LOG(NYG(-4))	0.713535	0.083055	8.591132	0.0000
LOG(CPS)	0.125085	0.057652	2.169662	0.0330
LOG(GCE)	0.132938	0.091311	1.455874	0.1493
R-squared	0.985444	Durbin-Watson stat		0.488188

5.1.12 Industrial Output

With its contribution to GDP swinging from negative between 2006 and 2008 to a positive position in 2010, the industrial sector was modelled as a function of domestic output, credit to the private sector, investment and nominal exchange rate. The response of industrial output to the explanatory variable was significant except for credit to the private sector even though it met the *a priori* expectation. A 1.0 per cent decline in credit to the private sector decelerated industrial output by 0.06 per cent, while investment and exchange rate stimulated industrial output by 13.0 and 11.0 per cent, respectively, with a 1.0 percentage increase. Similarly, a 1.0 per cent increase in the lag of domestic income raised total industrial output by as much as 86.0 per cent. The huge contribution of income to industrial output was not unconnected with the Keynesian view that in consumption invariably increased with income. This intuitively implied that a higher marginal propensity to consume raised the demand for industrial good, given Nigeria's high import propensity and dependency. Test statistics for the model confirmed the robustness of the estimates as about 98.0 per cent variations in industrial output was explained by the independent variables. However, there was evidence of autocorrelation as indicated by the Durbin-Watson autocorrelation coefficient of 1.34.

Table 12: OLS Estimation - Industrial Output

Dependent Variable: LOG(NYI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CPS(-4))	0.001236	0.114536	0.010794	0.9914
LOG(NY(-4))	0.915727	0.097731	9.369872	0.0000
LOG(NINV(-4))	0.029623	0.036412	0.813561	0.4183
LOG(NER(-4))	0.032306	0.092766	0.348248	0.7286
R-squared	0.962849	Durbin-Watson stat		0.613010

5.1.13 Building and Construction Output

The major driver of building and construction output were the previous value of output of the dependent variable, government capital expenditure, the nominal exchange rate and the maximum lending rate with output elasticities of approximately 0.82, 0.15, 0.08 and -0.007 per cent, respectively. All the variables were statistically significant, with the exception of the interest rate.

Table 13: OLS Estimation - Building and Construction Output

Dependent Variable: LOG(NYB)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NYB(-4))	0.818960	0.052918	15.47594	0.0000
LOG(GCE)	0.146483	0.044232	3.311730	0.0014
LOG(NER)	0.079446	0.042321	1.877217	0.0641
MLR	-0.007024	0.004831	-1.453798	0.1499
R-squared	0.984460	Durbin-Watson stat		0.524010

5.1.14 Wholesale and Retail Output

The estimated model showed that the fourth lag of nominal exchange rate, government capital expenditure, nominal industrial output and the one period lagged value of the dependent variable significantly drove wholesale and retail trade. The output elasticity of these variables were approximately 0.03, 0.13, 0.27 and 0.57 per cent, respectively. All the estimated variables were statistically significant, with the exception of the fourth lag of the nominal exchange rate. The variables were properly signed and met *a priori* expectation.

Table 14: OLS Estimation - Wholesale and Retail Trade Output

Dependent Variable: LOG(NYW)
Sample (adjusted): 1991Q1 2011Q4
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NER(-4))	0.033374	0.028464	1.172489	0.2445
LOG(GCE)	0.126224	0.074016	1.705364	0.0920
LOG(NYI)	0.274055	0.055230	4.962104	0.0000
LOG(NYW(-1))	0.570326	0.079056	7.214245	0.0000
R-squared	0.988060	Durbin-Watson stat		2.006631

5.1.15 Service Output

The estimated model of the services sub-sector revealed that nominal private consumption, government capital expenditure, nominal GDP of building and construction and the one period lagged value of the dependent variable were

the main drivers of the subsector. The variables were all statistically significant with output elasticity of approximately 0.10, 0.18, 0.25 and 0.50 per cent, respectively.

Table 15: OLS Estimation - Services Output

Dependent Variable: LOG(NYS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NCON)	0.153002	0.015719	9.733489	0.0000
LOG(GCE)	0.096041	0.041468	2.316021	0.0231
LOG(NYB)	0.177513	0.030018	5.913633	0.0000
LOG(NYS(-4))	0.596429	0.053880	11.06966	0.0000
R-squared	0.997683	Durbin-Watson stat		0.601190

Chapter Six

6.0 Model Simulation and Scenarios Analysis

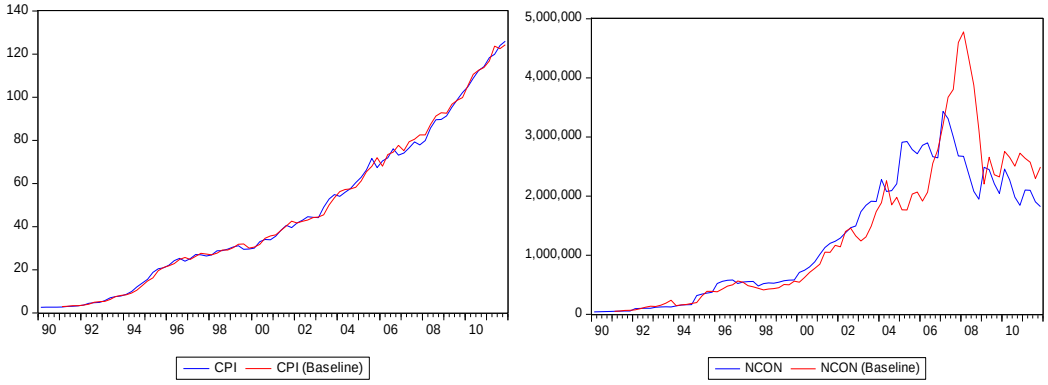
The essence of model building was to aid decision making, particularly of the MPC of the CBN. The MPC needed qualitative input that enabled them make informed decisions on monetary policy rate that determined other market rates. Consequently, model evaluation was performed for both in-sample (ex-post) and out-of sample (ex- ante) simulations.

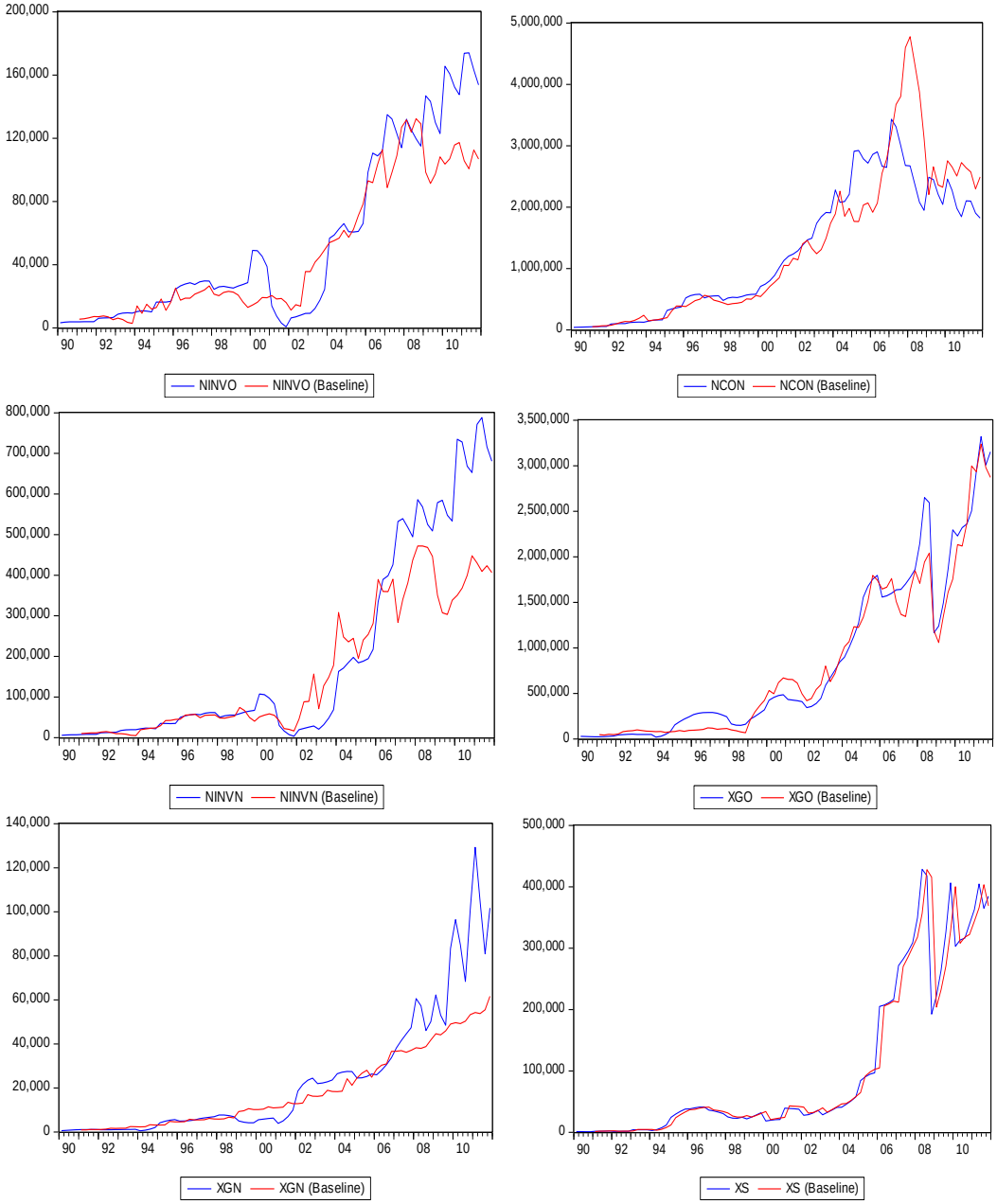
6.1 In-sample Simulation

To test the reliability of the endogenous variables, a simulation of endogenous variables with in-sample (ex-post) was conducted. The tracking of the actual endogenous variables by their simulated values depended significantly on the data quality, the block structure of the model (inter-linkages of behavioural equations) and the level of significance of the parameters of economic variables.

A cursory examination of the charts in figure 6 showed well the model tracked the endogenous variables in terms of the time path and turning points. This suggested the reasonable performance of the model given the behaviour of the variables of interest, as well as their suitability and reliability for policy simulation and forecasting.

Figure 6: Actual and Simulated Values of Endogenous Variables




200,000
160,000
120,000
80,000
40,000
0
90 92 94 96 98 00 02 04 06 08 10
NINVO
NINVO (Baseline)
5,000,000
4,000,000
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1,000,000
0
90 92 94 96 98 00 02 04 06 08 10
NCON
NCON (Baseline)
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
90 92 94 96 98 00 02 04 06 08 10
NINVN
NINVN (Baseline)
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3,000,000
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500,000
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90 92 94 96 98 00 02 04 06 08 10
XGO
XGO (Baseline)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
90 92 94 96 98 00 02 04 06 08 10
XGN
XGN (Baseline)
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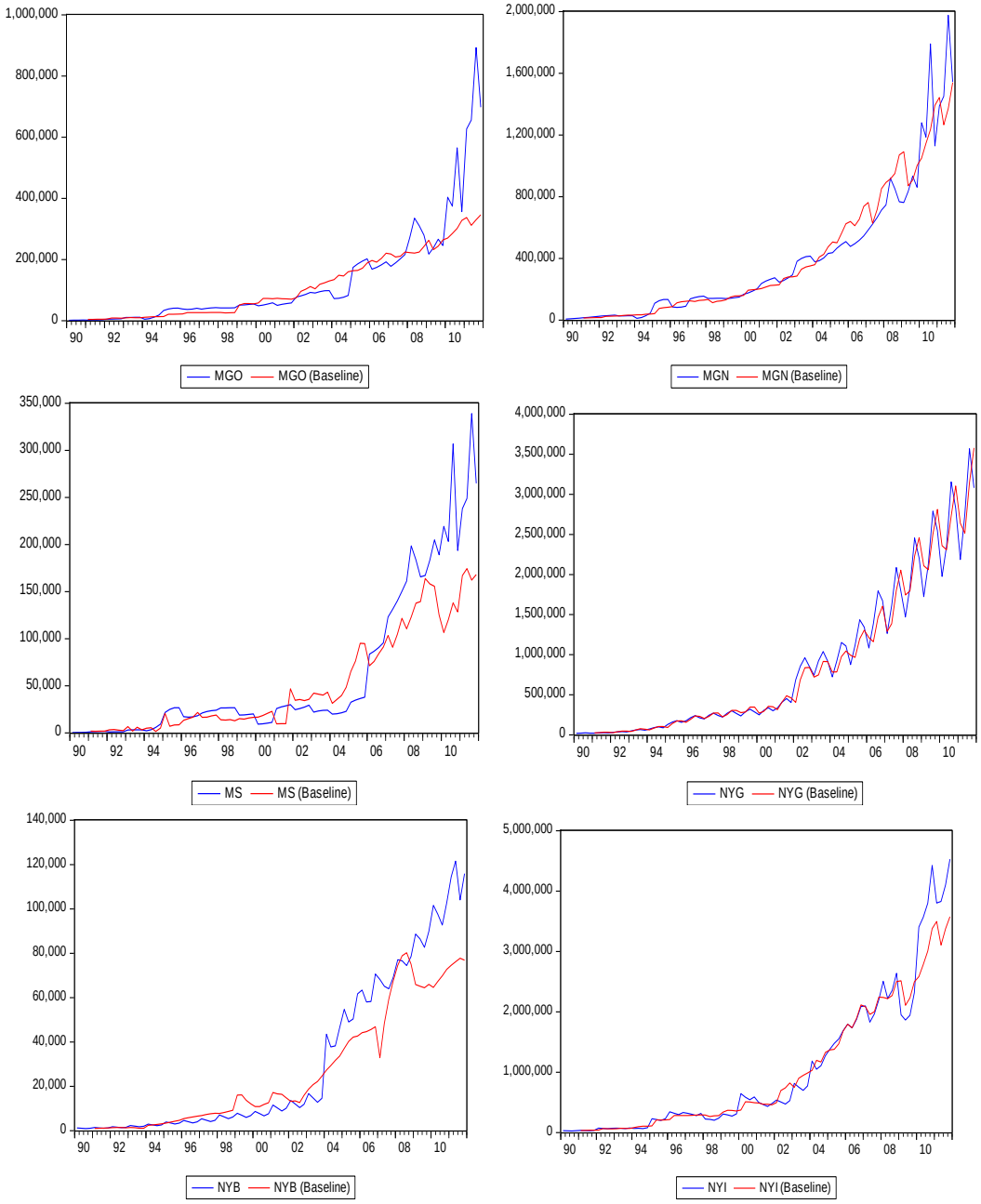
300,000
200,000
100,000
0
90 92 94 96 98 00 02 04 06 08 10
XS
XS (Baseline)


1,000,000
800,000
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400,000
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90 92 94 96 98 00 02 04 06 08 10
MGO MGO (Baseline)
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400,000
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90 92 94 96 98 00 02 04 06 08 10
MGN MGN (Baseline)
350,000
300,000
250,000
200,000
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50,000
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90 92 94 96 98 00 02 04 06 08 10
MS MS (Baseline)
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90 92 94 96 98 00 02 04 06 08 10
NYG NYG (Baseline)
140,000
120,000
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80,000
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40,000
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90 92 94 96 98 00 02 04 06 08 10
NYB NYB (Baseline)
5,000,000
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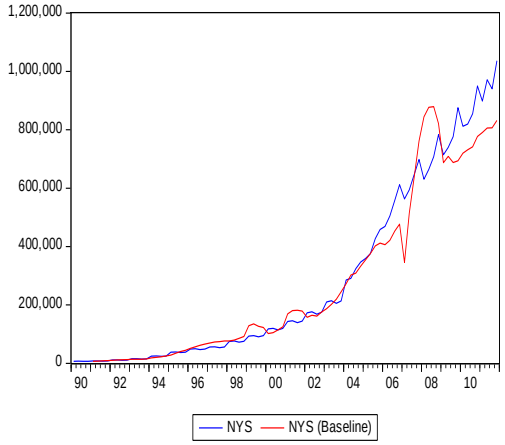
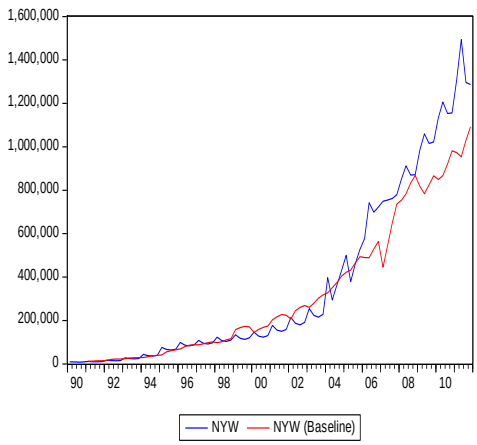
90 92 94 96 98 00 02 04 06 08 10
NYI NYI (Baseline)





6.2 Out-of-Sample Simulation and Scenarios Analysis

From the in-sample, it was observed that the simulated values of the endogenous variables tracked the actual reasonably well. This provided the basis for conducting out-of-sample simulations. Some selected variables were shocked and their impact traced given the interrelationship and inter-linkages.

From the baseline simulation, it was assumed that the present condition would continue. With the alternative scenarios, it was assumed that the present condition would alter based on the changes in the economy. Some of the issues for which some alternative scenarios were considered include:

- The effect of depreciation in nominal exchange rate (from N155/$1 to N158/$1) on selected real sector variables;
- The response of selected real sector variables to an appreciation in exchange rate (from N155/$1 to N152/$1);
- The response of selected real sector variables to a decline in MLR by 200 basis points;
- The response of selected real sector variables to a rise in MLR by 200 basis points;
- The combined effect of depreciation in nominal exchange rate (from N155/$1 to N158/$1) and increase in MLR (by 200 basis points)on selected real sector variables; and

- The response of selected real sector variables to the combined effect of an appreciation in nominal exchange rate (from N155/$1 to N152/$1) and reduction in MLR (by 200 basis points).

6.2.1 Baseline Scenarios

From the baseline scenarios, it was assumed that all the policy variables would remain unchanged for the forecast period.

6.2.2 Alternative Scenarios

- Scenario 01:- A depreciation in the exchange rate from N155/$ to N158/$.
- Scenario 02:- An appreciation in the exchange rate from N155/$ to N152/$.
- Scenario 03:- An increase in monetary policy rate (MPR) by 200 basis points
- Scenario 04:-A reduction in MPR by 200 basis points.
- Scenario 05:- A depreciation in nominal exchange rate (from N155/$1 to N158/$1) and an increase in MLR by 200 basis points); and
- Scenario 06:- An appreciation in nominal exchange rate from N155/$1 to N152/$1) and reduction in MLR by 200 basis points.

6.2.3 Simulation Results

Two variables were shocked for the simulation. These included the MPR and nominal exchange. The results of the scenarios were reported in tables 16 to 22.

Scenario 01: Nominal exchange rate depreciates to ₦158.0/US$

Depreciation of the exchange rate from N155/US$ to ₦158.0/US$ resulted in a minimal improvement in output growth arising from expansion in building and construction, industrial and service activity sectors. While the impact on building and construction and services sectors was instantaneous, there was delayed response of industrial output of about 4 quarters. The eventual growth in industry output was consistent with the inertia associated with the expansion in investment oil and non-oil investments.

Table 16: Scenario 01 - Nominal Exchange Rate Depreciates to ₦158.0/US$

obs	Building and Construction Growth Rate		Agricultural Growth Rate		Industrial Growth Rate		Service Growth Rate		Wholesale and Retail Trade Growth Rate		Total Output Growth Rate	
	Baseline	GRB	Baseline	GRG	Baseline	GRI	Baseline	GRS	Baseline	GRW	Baseline	YGRW_1
2012Q1	11.29	11.42	24.55	24.55	0.30	0.30	8.97	8.99	-3.32	-3.32	7.20	7.20
2012Q2	5.63	5.75	24.72	24.72	4.63	4.63	4.46	4.48	-16.02	-16.02	7.30	7.30
2012Q3	6.66	6.78	17.00	17.00	3.62	3.62	2.07	2.09	-1.20	-1.20	7.65	7.66
2012Q4	11.10	11.23	19.27	19.27	-0.06	-0.06	6.54	6.56	8.22	8.22	7.74	7.74
2013Q1	6.76	6.86	14.28	14.28	2.78	2.83	8.08	8.11	3.71	3.77	7.07	7.10
2013Q2	3.31	3.41	14.87	14.87	4.47	4.52	3.22	3.25	0.89	0.99	7.50	7.54
2013Q3	6.22	6.32	11.72	11.72	7.68	7.73	2.85	2.89	1.89	2.01	8.11	8.15
2013Q4	9.15	9.26	13.34	13.34	6.50	6.55	5.96	5.99	5.07	5.21	8.61	8.66
2014Q1	8.43	8.51	12.72	12.72	10.10	10.13	7.86	7.89	6.16	6.24	10.14	10.17
2014Q2	5.75	5.83	12.90	12.90	10.97	11.01	6.71	6.75	4.96	5.02	10.48	10.51
2014Q3	9.53	9.62	12.10	12.10	12.82	12.86	10.60	10.64	7.08	7.12	11.67	11.69
2014Q4	11.42	11.51	13.26	13.26	12.18	12.22	10.28	10.32	9.51	9.55	12.03	12.06

The depreciation in the exchange rate tipped prices upward following an increase in consumption. As Keynes (1936) showed, the increase in consumption was influenced by the rise in income.

obs	Inflation		Consumption		Investment		Non-Oil Investment		Oil Investment	
	Baseline	Change	Baseline	Δ%	Baseline	Δ%	Baseline	Δ%	Baseline	Δ%
2012Q1	8.01	0.0001	2258971	0.002	519702.9	0.001	404374	0.0000	115329	0.0031
2012Q2	9.70	0.0001	2611572	0.002	564363.7	0.001	433483	0.0000	130881	0.0029
2012Q3	6.79	0.0002	2694575	0.001	618853.3	0.001	483303	0.0000	135550	0.0024
2012Q4	4.09	0.0002	2809842	0.002	605940.3	0.001	476763	0.0000	129178	0.0028
2013Q1	3.65	0.0008	2843315	0.018	557258.4	0.032	437112	0.0323	120147	0.0305
2013Q2	2.97	0.0014	2883471	0.018	607006.1	0.032	471242	0.0321	135764	0.0315
2013Q3	1.79	0.0020	2794822	0.018	650476.5	0.032	502258	0.0318	148218	0.0314
2013Q4	0.93	0.0026	2910942	0.021	625791.9	0.033	487493	0.0320	138299	0.0354
2014Q1	0.11	0.0030	2766205	0.031	590855.6	0.053	461648	0.0527	129207	0.0530
2014Q2	-0.05	0.0033	3230181	0.029	656211.3	0.052	507187	0.0532	149024	0.0493
2014Q3	0.11	0.0036	3592483	0.028	705863.4	0.052	542871	0.0529	162992	0.0472
2014Q4	-0.08	0.0039	3225514	0.031	665888.7	0.055	516378	0.0557	149510	0.0530

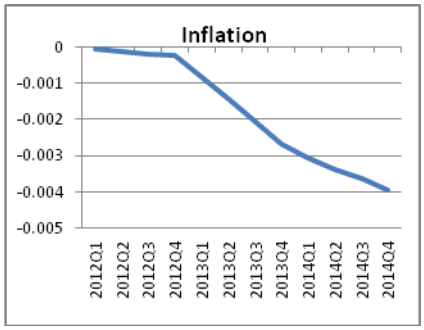
Scenario 02: Appreciation of nominal Exchange Rate from N155/US$ to ₦152/$1

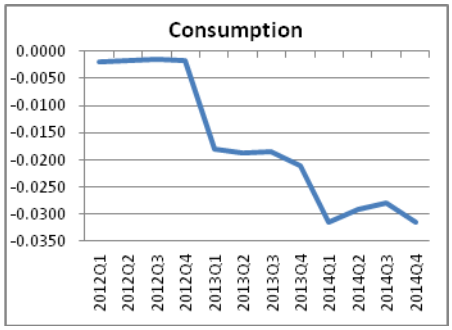
The out of sample simulation of an appreciation of the nominal exchange rate showed that strengthening of the domestic currency would result to slight deceleration of the inflation rate initially for the first four quarters, before plummeting thereafter. The simulation also indicated that an appreciation in the value of the naira would lead to a steady decline in the growth rate of output. In addition, the import- dependent nature of the economy caused consumption and investment to decline in similar patterns owing to the shock. Explicitly, an appreciation in the value of the domestic currency made foreign goods (consumer and intermediate) more attractive thereby increasing their demand and reducing the demand for domestically produced goods. In this vein, the combined effects of lower prices and greater demand for foreign goods relative to domestically produced goods would bring about reduced consumption and investment.

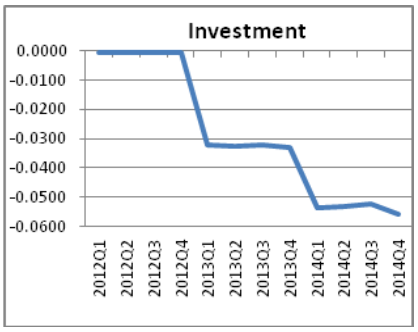
Table 17: Scenario 02 - Appreciation of Nominal Exchange Rate to N152/US$1

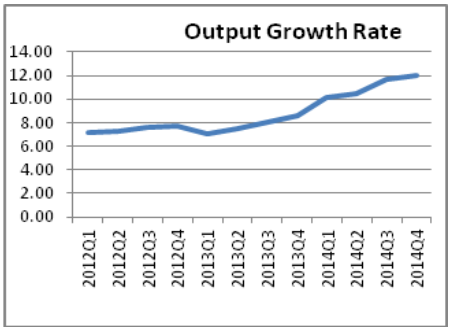
obs	Building and Construction Growth Rate		Agricultural Growth Rate		Industrial Growth Rate		Services Growth Rate		Wholesale and Retail Trade Growth Rate	
	Baseline	GRB	Baseline	GRG	Baseline	GRI	Baseline	GRS	Baseline	GRW
2012Q1	11.29	11.17	24.55	24.55	0.30	0.30	8.97	8.94	-3.32	-3.32
2012Q2	5.63	5.51	24.72	24.72	4.63	4.63	4.46	4.44	-16.02	-16.02
2012Q3	6.66	6.53	17.00	17.00	3.62	3.62	2.07	2.05	-1.20	-1.20
2012Q4	11.10	10.97	19.27	19.27	-0.06	-0.06	6.54	6.52	8.22	8.22
2013Q1	6.76	6.66	14.28	14.28	2.78	2.73	8.08	8.05	3.71	3.64
2013Q2	3.31	3.22	14.87	14.87	4.47	4.42	3.22	3.18	0.89	0.79
2013Q3	6.22	6.12	11.72	11.72	7.68	7.63	2.85	2.82	1.89	1.77
2013Q4	9.15	9.05	13.34	13.34	6.50	6.44	5.96	5.93	5.07	4.94
2014Q1	8.43	8.34	12.72	12.72	10.10	10.06	7.86	7.82	6.16	6.07
2014Q2	5.75	5.67	12.90	12.90	10.97	10.94	6.71	6.68	4.96	4.90
2014Q3	9.53	9.45	12.10	12.10	12.82	12.78	10.60	10.56	7.08	7.03
2014Q4	11.42	11.34	13.26	13.26	12.18	12.14	10.28	10.24	9.51	9.47

obs	Inflation		Consumption		Investment		Non - Oil Investment		Oil Investment		Output		Output Growth Rate	
	Baseline	Δ	Baseline	Δ(%)	Baseline	Δ(%)	Baseline	Δ(%)	Baseline	Δ(%)	Baseline	Δ(%)	Baseline	YGRW_2
2012Q1	8.007473	-7.2E-05	2258971	-0.0019	519703	-0.0007	404374	0.0000	115329	-0.0032	9146011	-0.00395	7.20	7.19
2012Q2	9.701585	-0.000141	2611572	-0.0018	564364	-0.0007	433483	0.0000	130881	-0.0030	10527860	-0.00370	7.30	7.29
2012Q3	6.786492	-0.000189	2694575	-0.0014	618853	-0.0005	483303	0.0000	135550	-0.0024	11750370	-0.00306	7.65	7.65
2012Q4	4.094981	-0.000243	2809842	-0.0016	605940	-0.0006	476763	0.0000	129178	-0.0029	11109750	-0.00351	7.74	7.73
2013Q1	3.648896	-0.000842	2843315	-0.0181	557258	-0.0324	437112	-0.0328	120147	-0.0309	10229860	-0.03832	7.07	7.03
2013Q2	2.969114	-0.001447	2883471	-0.0187	607006	-0.0324	471242	-0.0326	135764	-0.0320	12109550	-0.03956	7.50	7.46
2013Q3	1.794103	-0.002028	2794822	-0.0186	650477	-0.0321	502258	-0.0322	148218	-0.0317	13529310	-0.03947	8.11	8.07
2013Q4	0.930493	-0.002671	2910942	-0.0210	625792	-0.0332	487493	-0.0325	138299	-0.0359	12307940	-0.04461	8.61	8.57
2014Q1	0.108331	-0.003071	2766205	-0.0314	590856	-0.0535	461648	-0.0534	129207	-0.0536	11362420	-0.06698	10.14	10.11
2014Q2	-0.04796	-0.003379	3230181	-0.0292	656211	-0.0531	507187	-0.0540	149024	-0.0499	13734510	-0.06291	10.48	10.46
2014Q3	0.106615	-0.003648	3592483	-0.0280	705863	-0.0523	542871	-0.0536	162992	-0.0479	15259140	-0.06068	11.67	11.65
2014Q4	-0.08144	-0.003936	3225514	-0.0314	665889	-0.0559	516378	-0.0565	149510	-0.0537	13512960	-0.06845	12.03	12.00









Scenarios 03 – A 200 basis point decline in the Maximum Lending Rate

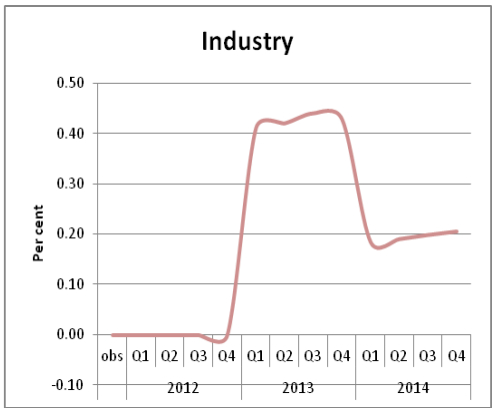
From scenario 03, a decline in the maximum lending rate of 200 basis point retarded output growth marginally, decreasing it consistently by about 0.06 per cent in the first four quarters of 2012. The impact increased over the next four quarters in 2013 at an average of 0.19 per cent and subsequently dropped to 0.12 per cent in the last quarter of 2014. Similarly, the decline in MLR had minimal

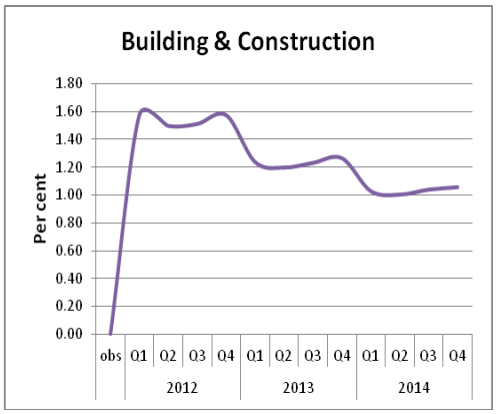
effects on other components of GDP, with exception of building and construction where there was a considerable increase in the sector averaging 1.27 per cent over the 12 forecast quarters.

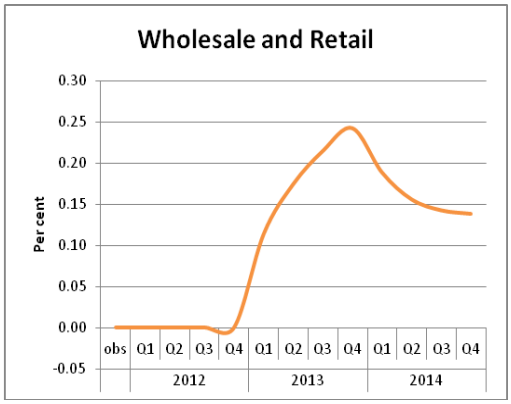
From the scenario, the liquidity expansion as a result of improved credit conditions in the economy increased the level of investment significantly. Consequently, the increase in MLR, on the average, increased nominal investment by 16.91 per cent over the forecast period. Nominal investment increased steadily from 16.59 in 2012 Q1 to 17.15 per cent in 2014 Q4. The impact of the reduced interest rates was almost identical for both investments in non-oil and oil sectors.

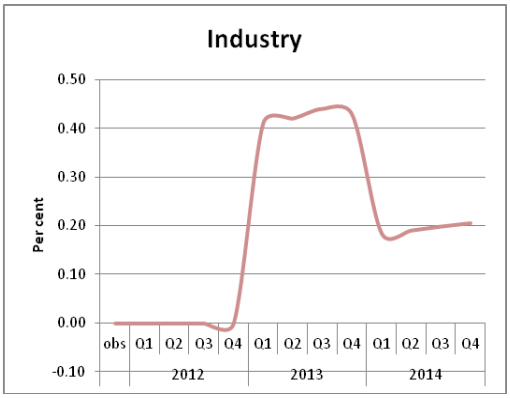
Table 18: Scenario 03 - Maximum Lending Rate (MLR) declines by 200 basis points

		Output Growth		Building & Const		Industry		Services		Wholesale & Retail	
	obs	*Baseline*		*Baseline*	*Δ*	*Baseline*	*Δ*	*Baseline*	*Δ*	*Baseline*	*Δ*
2012	Q1	7.20	-0.06	11.29	1.57	0.30	0.00	8.97	-0.80	-3.32	0.00
	Q2	7.30	-0.06	5.63	1.49	4.63	0.00	4.46	-0.77	-16.02	0.00
	Q3	7.65	-0.05	6.66	1.51	3.62	0.00	2.07	-0.75	-1.20	0.00
	Q4	7.74	-0.06	11.10	1.57	-0.06	0.00	6.54	-0.78	8.22	0.00
2013	Q1	7.07	0.18	6.76	1.24	2.78	0.41	8.08	-0.23	3.71	0.11
	Q2	7.50	0.19	3.31	1.20	4.47	0.42	3.22	-0.21	0.89	0.17
	Q3	8.11	0.20	6.22	1.23	7.68	0.44	2.85	-0.21	1.89	0.21
	Q4	8.61	0.21	9.15	1.26	6.50	0.43	5.96	-0.22	5.07	0.24
2014	Q1	10.14	0.12	8.43	1.03	10.10	0.18	7.86	0.06	6.16	0.19
	Q2	10.48	0.11	5.75	1.00	10.97	0.19	6.71	0.06	4.96	0.16
	Q3	11.67	0.11	9.53	1.04	12.82	0.20	10.60	0.06	7.08	0.14
	Q4	12.03	0.12	11.42	1.05	12.18	0.21	10.28	0.06	9.51	0.14









Scenario 4 – Increase of maximum lending rate (MLR)

The result of the out-of-sample forecast showed that an increase in the maximum lending rate would had an immediate impact on total output growth, as output was expected to increase by 0.06 percentage basis point in 2012 and thereafter to decline by 0.2 and 0.12 percentage basis point in 2013 and 2014, respectively. The growth in total output would be driven by growth in the services sector, which was forecasted to increase by 79 and 22 percentage basis points in 2012 and 2013, respectively, and declined by 6 percentage basis points in 2014. The increase in maximum lending rate would have no impact on agricultural growth rate throughout the forecast horizon. The positive shock on the maximum lending rate would have no immediate impact on the industrial and wholesale & retail trade sector growth until after 2012.

Table 19: Scenario 04 - Increase in Maximum Lending Rate

obs	Building & Construction Growth Rate		Agricultural Growth Rate		Industrial Growth Rate		Services Growth Rate		Wholesale & Retail Trade Growth Rate		Total Output Growth Rate	
	Baseline	GRB	Baseline	GRG	Baseline	GRI	Baseline	GRS	Baseline	GRW	Baseline	TGRW_1
2012Q1	11.29	9.74	24.55	24.55	0.30	0.30	8.97	9.77	-3.32	-3.32	7.20	7.26
2012Q2	5.63	4.16	24.72	24.72	4.63	4.63	4.46	5.23	-16.02	-16.02	7.30	7.36
2012Q3	6.66	5.17	17.00	17.00	3.62	3.62	2.07	2.83	-1.20	-1.20	7.65	7.71
2012Q4	11.10	9.55	19.27	19.27	-0.06	-0.06	6.54	7.33	8.22	8.22	7.74	7.80
2013Q1	6.76	5.54	14.28	14.28	2.78	2.37	8.08	8.31	3.71	3.59	7.07	6.88
2013Q2	3.31	2.13	14.87	14.87	4.47	4.05	3.22	3.43	0.89	0.71	7.50	7.31
2013Q3	6.22	5.01	11.72	11.72	7.68	7.24	2.85	3.07	1.89	1.68	8.11	7.92
2013Q4	9.15	7.91	13.34	13.34	6.50	6.07	5.96	6.18	5.07	4.83	8.61	8.41
2014Q1	8.43	7.41	12.72	12.72	10.10	9.91	7.86	7.80	6.16	5.97	10.14	10.02
2014Q2	5.75	4.76	12.90	12.90	10.97	10.78	6.71	6.66	4.96	4.80	10.48	10.37
2014Q3	9.53	8.51	12.10	12.10	12.82	12.62	10.60	10.54	7.08	6.94	11.67	11.56
2014Q4	11.42	10.38	13.26	13.26	12.18	11.98	10.28	10.22	9.51	9.37	12.03	11.91

The increase in the maximum lending rate would lead to increases in inflation rate and consumption in the forecast horizon, while causing a decline in investment and imports.

Table 20: Increase in Maximum Lending Rate (MLR)

obs	Inflation		Consumption		Investment		Imports	
	Baseline	Δ	Baseline	%Δ	Baseline	%Δ	Baseline	%Δ
2012Q1	8.01	0.25	2,258,971	6.65	519,702.9	-14.23	2,087,871	0.001
2012Q2	9.70	0.28	2,611,572	6.65	564,363.7	-14.22	1,987,076	0.001
2012Q3	6.79	0.29	2,694,575	6.64	618,853.3	-14.23	2,194,088	0.001
2012Q4	4.09	0.30	2,809,842	6.65	605,940.3	-14.24	2,354,347	0.001
2013Q1	3.65	0.07	2,843,315	6.48	557,258.4	-14.51	2,228,706	-0.052
2013Q2	2.97	0.06	2,883,471	6.47	607,006.1	-14.51	2,150,612	-0.18
2013Q3	1.79	0.06	2,794,822	6.45	650,476.5	-14.52	2,427,794	-0.18
2013Q4	0.93	0.05	2,910,942	6.45	625,791.9	-14.53	2,588,765	-0.18
2014Q1	0.11	0.04	2,766,205	6.39	590,855.6	-14.62	2,400,655	-0.20
2014Q2	-0.05	0.04	3,230,181	6.39	656,211.3	-14.62	2,331,973	-0.25
2014Q3	0.11	0.04	3,592,483	6.38	705,863.4	-14.62	2,664,478	-0.26
2014Q4	-0.08	0.03	3,225,514	6.37	665,888.7	-14.64	2,813,932	-0.26

Scenario 05: Depreciation of nominal exchange rate and an increase in maximum lending rate.

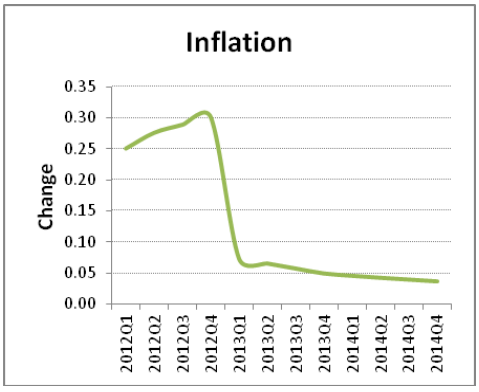
The mixed effect of depreciation in nominal exchange rate by 1.4 per cent and an increase in the maximum lending rate by 200 basis points in the out-of-sample

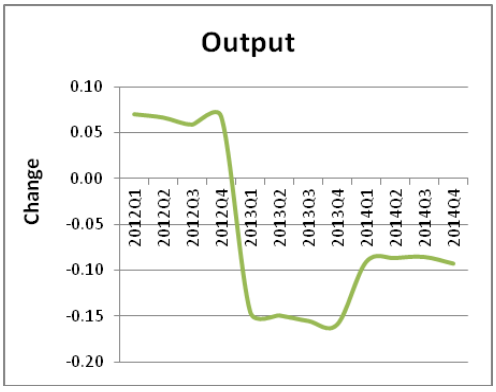
forecast indicated a negative effect on non-oil investment, oil investment and total output, as shown in the table and chart above. The magnitude of the combined effect of the depreciation in nominal exchange rate and an increase in the maximum lending rate surpassed 14.0 per cent. It also had a dampening effect on output growth particularly from 2013Q1 at 0.15 per cent down to 2014Q4 at 0.09 per cent. The increase in the maximum lending rate increased the cost of fund required for investment and production, while the depreciation of the nominal exchange rate reduced the value of the Naira. This tended to marginally reduce consumption. The dampening effect of this policy action could also be seen in the rest of the subsectors, with the major impact of the effect felt in building and construction, agriculture and industry. The effect started appearing in 2013Q1 for wholesale and retail and in 2014Q1 for services. On the contrary, the combined effect of depreciation in nominal exchange rate and an increase in the maximum lending rate had a salutary effect on inflation as it tended to pull down prices.

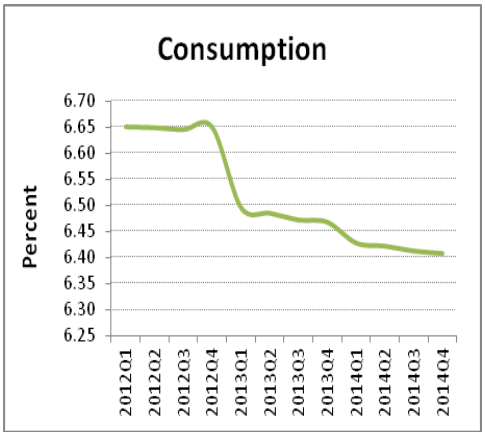
Table 21: Scenario 05 - Depreciation of nominal exchange rate and an increase in maximum lending rate.

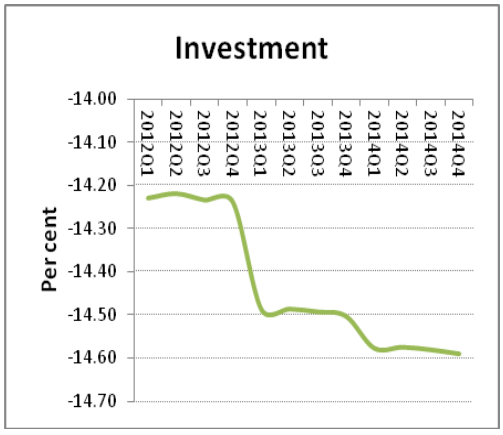
	Building & Construction		Agriculture		Industry		Services		Wholesale & Retail Trade		Inflation	
Obs	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ
2012Q1	11.29	-1.43	24.55	0.00	0.30	0.00	8.97	0.83	-3.32	0.00	8.01	0.25
2012Q2	5.63	-1.35	24.72	0.00	4.63	0.00	4.46	0.79	-16.02	0.00	9.70	0.28
2012Q3	6.66	-1.37	17.00	0.00	3.62	0.00	2.07	0.77	-1.20	0.00	6.79	0.29
2012Q4	11.10	-1.42	19.27	0.00	-0.06	0.00	6.54	0.81	8.22	0.00	4.09	0.30
2013Q1	6.76	-1.12	14.28	0.00	2.78	-0.36	8.08	0.26	3.71	-0.05	3.65	0.07
2013Q2	3.31	-1.09	14.87	0.00	4.47	-0.37	3.22	0.25	0.89	-0.08	2.97	0.07
2013Q3	6.22	-1.12	11.72	0.00	7.68	-0.39	2.85	0.25	1.89	-0.10	1.79	0.06
2013Q4	9.15	-1.15	13.34	0.00	6.50	-0.37	5.96	0.25	5.07	-0.11	0.93	0.05
2014Q1	8.43	-0.93	12.72	0.00	10.10	-0.15	7.86	-0.02	6.16	-0.10	0.11	0.05
2014Q2	5.75	-0.91	12.90	0.00	10.97	-0.15	6.71	-0.02	4.96	-0.10	-0.05	0.04
2014Q3	9.53	-0.94	12.10	0.00	12.82	-0.16	10.60	-0.02	7.08	-0.10	0.11	0.04
2014Q4	11.42	-0.96	13.26	0.00	12.18	-0.16	10.28	-0.02	9.51	-0.10	-0.08	0.04

Obs	Consumption		Total Investment		Non-Oil Investment		Oil Investment		Output	
	Baseline	%Δ	Baseline	%Δ	Baseline	%Δ	Baseline	%Δ	Baseline	Δ
2012Q1	2258971.00	6.65	519702.90	-14.23	404373.80	-14.47	115329.10	-13.39	7.20	0.07
2012Q2	2611572.00	6.65	564363.70	-14.22	433483.10	-14.47	130880.60	-13.39	7.30	0.07
2012Q3	2694575.00	6.64	618853.30	-14.23	483303.00	-14.47	135550.30	-13.39	7.65	0.06
2012Q4	2809842.00	6.65	605940.30	-14.24	476762.70	-14.47	129177.60	-13.39	7.74	0.07
2013Q1	2843315.00	6.50	557258.40	-14.49	437111.50	-14.73	120146.90	-13.59	7.07	-0.15
2013Q2	2883471.00	6.48	607006.10	-14.49	471242.40	-14.74	135763.70	-13.61	7.50	-0.15
2013Q3	2794822.00	6.47	650476.50	-14.49	502258.00	-14.75	148218.40	-13.62	8.11	-0.16
2013Q4	2910942.00	6.47	625791.90	-14.50	487493.00	-14.75	138298.90	-13.63	8.61	-0.16
2014Q1	2766205.00	6.43	590855.60	-14.58	461648.30	-14.83	129207.30	-13.68	10.14	-0.09
2014Q2	3230181.00	6.42	656211.30	-14.57	507186.90	-14.83	149024.40	-13.69	10.48	-0.09
2014Q3	3592483.00	6.41	705863.40	-14.58	542871.20	-14.84	162992.20	-13.71	11.67	-0.09
2014Q4	3225514.00	6.41	665888.70	-14.59	516378.40	-14.84	149510.30	-13.71	12.03	-0.09









Scenario 06: Appreciation of nominal exchange rate by 1.4 per cent and a decrease in maximum lending rate by 200 basis points, respectively.

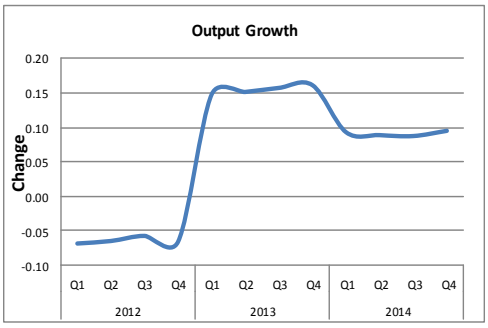
The result of the out-of-sample forecast indicated that a combination of an appreciation in nominal exchange rate by 1.4 per cent and a decrease in maximum lending rate by 200 basis points helped to boost total investment, with investment in non-oil and oil increasing steadily by about 16.8 per cent and 14.7 per cent, respectively. This development led to an increase in output growth, particularly from 2013Q1 where it recorded 7.07 per cent and rose by 0.15 basis point, reflecting the effects of the shocks. Noticeably, there were marginal declines through 2012 due to these shocks. The simulation showed that the growth drivers were mainly building and construction and wholesale sub-sectors. The external sector effect and the financial sector variables did not impact on agriculture growth. The result indicated mixed result for services growth as the shocks led to negative growth for most of the periods (2012Q1 – 2013Q4). Industry growth after showing signs of declerations in 2012Q1, 2013Q1, 2013Q2, 2014Q1 and 2014Q2, improved positively to 11.28 basis points in 2012Q3, 10.80 basis points in 2013Q3, 12.98 basis points in 2014Q3 and 12.34 basis points in 2014Q4.

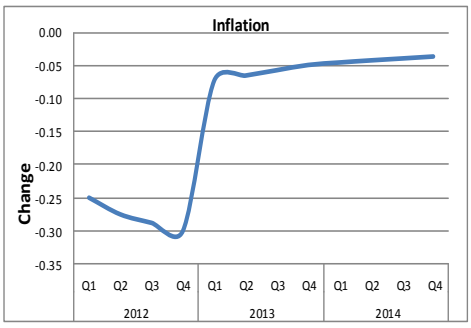
The shocks also pushed consumption up by 0.11 percent in 2013Q4 before declining to 0.10 per cent in 2014Q1 through 2014Q4. This development reflected the significant influence of output and all-share index as the major drivers of consumption.

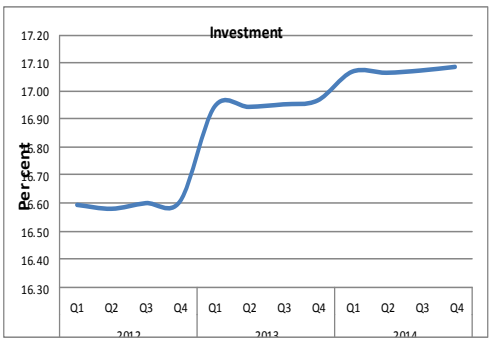
Table 22: Scenario 06 - Appreciation of nominal exchange rate by 1.4 per cent and a decrease in maximum lending rate by 200 basis points, respectively.

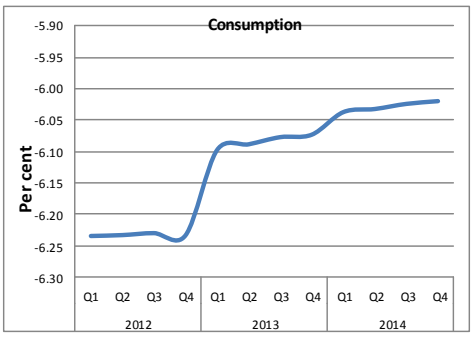
	Output Growth		Agriculture Growth		Industry Growth		Building & Construction Growth		Wholesale Growth		Services Growth	
	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ	Baseline	Δ
2012Q1	7.20	-0.07	24.5	0.0	0.30	-10.98	11.29	1.44	-3.32	0.00	8.97	-0.82
2012Q2	7.30	-0.07	24.7	0.0	4.63	1.44	5.63	1.37	-16.02	0.00	4.46	-0.79
2012Q3	7.65	-0.06	17.0	0.0	3.62	11.28	6.66	1.38	-1.20	0.00	2.07	-0.77
2012Q4	7.74	-0.07	19.3	0.0	-0.06	3.19	11.10	1.44	8.22	0.00	6.54	-0.80
2013Q1	7.07	0.15	14.3	0.0	2.78	-7.66	6.76	1.13	3.71	0.05	8.08	-0.26
2013Q2	7.50	0.15	14.9	0.0	4.47	-3.25	3.31	1.10	0.89	0.08	3.22	-0.25
2013Q3	8.11	0.16	11.7	0.0	7.68	10.80	6.22	1.13	1.89	0.09	2.85	-0.24
2013Q4	8.61	0.16	13.3	0.0	6.50	8.09	9.15	1.16	5.07	0.11	5.96	-0.25
2014Q1	10.14	0.09	12.7	0.0	10.10	-2.73	8.43	0.94	6.16	0.10	7.86	0.02
2014Q2	10.48	0.09	12.9	0.0	10.97	-1.22	5.75	0.92	4.96	0.10	6.71	0.02
2014Q3	11.67	0.09	12.1	0.0	12.82	12.98	9.53	0.95	7.08	0.10	10.60	0.02
2014Q4	12.03	0.09	13.3	0.0	12.18	12.34	11.42	0.97	9.51	0.10	10.28	0.02

	Total Investment		Investment in non-oil		Investment in oil		Inflation		Consumption	
	Baseline	%Δ	Baseline	%Δ	Baseline	%Δ	Baseline	Δ	Baseline	%Δ
2012Q1	519702.90	16.59	404373.80	14.47	115329.10	15.46	11.29	1.44	-3.32	0.00
2012Q2	564363.70	16.58	433483.10	14.47	130880.60	15.46	5.63	1.37	-16.02	0.00
2012Q3	618853.30	16.60	483303.00	14.47	135550.30	15.47	6.66	1.38	-1.20	0.00
2012Q4	605940.30	16.61	476762.70	14.47	129177.60	15.46	11.10	1.44	8.22	0.00
2013Q1	557258.40	16.94	437111.50	14.73	120146.90	15.73	6.76	1.13	3.71	0.05
2013Q2	607006.10	16.94	471242.40	14.74	135763.70	15.75	3.31	1.10	0.89	0.08
2013Q3	650476.50	16.95	502258.00	14.75	148218.40	15.78	6.22	1.13	1.89	0.09
2013Q4	625791.90	16.97	487493.00	14.75	138298.90	15.78	9.15	1.16	5.07	0.11
2014Q1	590855.60	17.07	461648.30	14.83	129207.30	15.86	8.43	0.94	6.16	0.10
2014Q2	656211.30	17.07	507186.90	14.83	149024.40	15.87	5.75	0.92	4.96	0.10
2014Q3	705863.40	17.07	542871.20	14.84	162992.20	15.88	9.53	0.95	7.08	0.10
2014Q4	665888.70	17.09	516378.40	14.84	149510.30	15.89	11.42	0.97	9.51	0.10









Chapter Seven

7.0 Summary and Conclusion

The real sector of Nigeria's economy is the engine of the country's economic transformation over the years. The juxtaposition of several factors including infrastructural gaps, inefficiencies in the public sector project management and service delivery, the resource curse of oil exploration, dysfunctional macroeconomic policy environment, among others had obviously truncated the real sector revolution.

Nevertheless, government has continued to play a catalytic role through the enunciation of policies and provisioning of financing havens to elevate the sector to levels that could make Nigeria an economic hub and a driver of Africa's economic renaissance. Although, recent numbers suggests resilient growth (especially at the heels of recent trepidations in the global economy), it is incontrovertible to see that currently, most countries that were at the same or even lower stage of development decades ago such as Malaysia have transformed their real sectors beyond mean proportions.

The complex interactions of agents and economic activities could obscure the understanding of the adjustment mechanisms required to attain optimal levels of output. This study, therefore, developed a disaggregated model of the real sector of the Nigeria economy to complement macroeconomic model earlier built by the CBN.

The performances of the real sector over the years had mirrored the happenings in the economy as a whole. For years, oil sector had been the dominant sector in terms of foreign exchange earnings. However, its contribution to GDP had been on the decline since the turn of the millennium. The robust growth rate of GDP during the period 1999-2011 was attributed largely to the development in the non-oil sector. The non-oil (GDP) growth averaged 8.9 per cent in the period 2006 – 2010, which grew from 4.4 per cent in 1999 to 8.9 per cent in 2011. The performance of the non-oil sector was driven by the agricultural sub-sector, given its contribution to the GDP, which was over 40 per cent, followed by the services and wholesale and retail trade sectors.

The modeling agenda followed a Keynesian paradigm with structuralist modifications to reflect peculiar characteristics of the Nigerian economy. The model consisted of 15 behavioural equations to reflect consumption, investment, exports, imports and consumer prices on the demand side and the 5 main

activity sectors, namely, agriculture, industry, building and construction, wholesale and retail trade and services. There were also 13 identitie.

Results of the simulations suggested that a depreciation of the exchange rate to N158.0/US$ did not substantially impact on output. An appreciation of the nominal exchange rate subdued inflation rate initially for the first four quarters, before trending upward thereafter. Concomitantly, a steady increase in the growth of output owing to a rise in imports of production inputs as well as reduced cost of production was observed.

A decline in the prime lending rate of 200 basis points contracted output marginally, but consistently by about 0.06 per cent in the first four quarters. The impact subsisted over the next four quarters at an average of 0.19 per cent and subsequently dropped to 0.12 per cent. An increase in the prime lending rate would immediately impact on output growth by 0.06 percentage point in the first four quarters and thereafter would cause it to decline by 0.2 and 0.12 percentage points, respectively, in 2013 and 2014.

Also, a combination of a 1.4 per cent depreciation in the nominal exchange rate (within band) and 200 basis points increase in the prime lending rate retarded oil investment and non-oil investment and hence, total output. But a reversal of the policy mix, buoyed output growth substantially.

7.1 Policy Implications

- Exchange rate shock in the model brought to fore the critical importance of exchange rate in the development process of the country that is highly import-dependent. A cursory examination of an anticipated depreciation in exchange rate from N155 to N158 to the dollar was very informative as the impact on output growth was very minimal, driven principally by activities in the building and construction, industrial and service sectors. Theoretically, this action was expected to stimulate domestic production in the face of more expensive imported alternatives. However, this expected benefit was eroded by the import-dependent nature of the economy. On the other hand, while an appreciation of the exchange rate curbed inflationary pressures, it equally doused consumption and investment in the economy. The reduced domestic prices coupled with high appetite for foreign goods brought about a reduction in consumption and investment. Consequently, although the Bank is currently operating a monetary targeting strategy with an adoption of fine-tuning mechanisms in form of monetary targeting plus, (a hybrid strategy that combines the strengths of both monetary and exchange

rate targeting strategies, it is imperative for the Bank to keep a close watch on exchange rate developments. The CBN's role in the foreign exchange market to enhance exchange rate stability should continue to remain a secondary objective under the monetary targeting framework.

- The finding of a decline in the maximum lending rate by 200 basis points had mixed effects on the growth output and its components, except for building and construction which recorded considerable increase over the 12 forecast periods. The out-of-sample result tied the intricate relationship between the lending rate and the liquidity conditions in the economy. Output growth slowed initially during the forecast horizon, but later turned positive while credit conditions and investment improved tremendously. The growth in output was driven principally by the growth in the service sector. Since monetary policy rate, determined by the Bank, is an anchor rate for the maximum lending rate, the result suggested inertia in the response of economic agents to adjustment to monetary policy shock. Consequently, the timing and frequency of monetary policy action must be consistent with the long-term policy objectives of the central bank so as to avoid issues of dynamic inconsistency and economic agents misunderstanding the intent of the monetary authority.

- Also, a simulation of an appreciation of nominal exchange rate by 1.4 per cent and a decrease in maximum lending rate by 200 basis points induced investments in the oil and non-oil sectors. The consequent result in output growth was driven mainly by the building and construction and wholesale and retail trade sub-sectors. However, the service sub-sector recorded a negative growth. Monetary policy design should incorporate incentive mechanisms that would encourage the flow of credit to the private sector to enable the sector serve actually as the engine of growth relative to the public sector

- The out-of-sample forecast following a depreciation in nominal exchange rate to N158/$ and an increase in maximum lending rate by 200 basis points indicated negative effect on oil and non-oil investment as well as total output. The cumulative effect was a lull in aggregate consumption and reduction in inflationary pressures. With price stability as its main object, The CBN should continuously improve on its monetary and fiscal policy coordination efforts with a view to subordinating the impact of fiscal operations to the goals of monetary policy.

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APPENDIX

S/N	Notation	Definition	Unit
1	**CPIH**	All Items Consumer Prices Index	November 2009 = 100
2	**INFH**	All Items (Headline) Year-on-Year Inflation	Per cent
3	**PLR**	Prime Lending Rate	Per cent
4	**MLR**	Maximum Lending Rate	Per cent
5	**NER**	Nominal Exchange Rate	N/US$ 1.00
6	**RER**	Real Exchange Rate	N/US$ 1.00
7	**ERD**	Exchange Rate Appreciation/Depreciation	Per cent
8	**M**	Imports	Naira Million
9	**XN**	Exports-Non-Oil	Naira Million
10	**XO**	Exports-Oil	Naira Million
11	**X**	Exports	Naira Million
12	**NX**	Net Exports	Naira Million
13	**NM2**	Nominal Broad Money Stock	Naira Million
14	**USCPI**	USA CPI	2005 = 100
15	**FCPI**	OECD CPI	2005 = 100
16	**USINF**	USA Inflation	Per cent
17	**FINF**	OECD Inflation	Per cent
18	**USNY**	USA Nominal GDP	US$ Million
19	**USRY**	USA Real GDP	US$ Million
20	**USYD**	USA GDP Deflator	2005 = 100
21	**FNY**	OECD Nominal GDP	US$ Million
22	**FRY**	OECD Real GDP	US$ Million

23	**FYD**	OECD GDP Deflator	2005 = 100
24	**NCON**	Nominal Private Consumption	Naira Million
25	**NCONF**	Nominal Private Food Consumption	Naira Million
26	**NCONN**	Nominal Private Non-Food Consumption	Naira Million
27	**RCON**	Real Private Consumption	Naira Million
28	**RCONF**	Real Private Food Consumption	Naira Million
29	**RCONN**	Real Private Non-Food Consumption	Naira Million
30	**RINV**	Real Investment	Naira Million
31	**RINVN**	Real Non-Oil Investment	Naira Million
32	**RINVO**	Real Oil Investment	Naira Million
33	**NINV**	Nominal Investment	Naira Million
34	**NINVN**	Nominal Non-Oil Investment	Naira Million
35	**NIVNO**	Nominal Oil Investment	Naira Million
36	**GRE**	Government Recurrent Expenditure	Naira Million
37	**GCE**	Government Capital Expenditure	Naira Million
38	**GTE**	Government Total Expenditure	Naira Million
39	**YE**	Nominal GDP by Expenditure	Naira Million
40	**NYG**	Nominal Agric GDP	Naira Million
41	**NYI**	Nominal Industry GDP	Naira Million
42	**NYB**	Nominal B & C GDP	Naira Million
43	**NYW**	Nominal WRT GDP	Naira Million
44	**NYS**	Nominal Services GDP	Naira Million
45	**NY**	Nominal GDP by Production	Naira Million
46	**RYG**	Real Agric GDP	Naira Million
47	**RYI**	Real Industry GDP	Naira Million
48	**RYB**	Real B & C GDP	Naira Million
49	**RYW**	Real WRT GDP	Naira Million
50	**RYS**	Real Services GDP	Naira Million
51	**RY**	Real GDP by Production	Naira Million
52	**NOY**	Nominal Oil GDP	Naira Million
53	**NNY**	Nominal Non-Oil GDP	Naira Million
54	**ROY**	Real Oil GDP	Naira Million
55	**RNY**	Real Non-Oil GDP	Naira Million
56	**NYdef**	Non-Oil GDP Deflator	1990 = 100
57	**OYdef**	Oil GDP Deflator	1990 = 100

58	**Ydef**	GDP Deflator	1990 = 100
59	**Po**	Oil Price	US$ per Barrel
60	**RMT**	Remittance	Naira Million
61	**ASI**	All Share Index	1984 = 100
62	**RF**	Rainfall	MM
63	**∆NINV**	Change in Nominal Investment	Naira Million
64	**K**	Capital Stock	Naira Million
65	**∆K**	Change in Capital Stock	Naira Million
67	**FDIn**	Foreign Direct Investment: Non-Oil	Naira Million
68	**FDIo**	Foreign Direct Investment: Oil	Naira Million
69	**FDI**	Foreign Direct Investment	Naira Million
70	**XGo**	Export of Goods: Oil	Naira Million
71	**XGn**	Export of Goods: Non-Oil	Naira Million
72	**XG**	Export of Goods	Naira Million
73	**XS**	Export of Services	Naira Million
74	**MGn**	Import of Goods: Non-Oil	Naira Million
75	**MGo**	Import of Goods: Oil	Naira Million
76	**MG**	Import of Goods	Naira Million
77	**MS**	Import of Services	Naira Million
78	**IEC**	Index of Energy Consumption	
79	**CPS**	Credit to Private Sector	Naira Million
80	**OPN**	Oil Production (actual, not OPEC quota)	Million Barrels per Day

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