CENTRAL BANK OF NIGERIA

MACROECONOMETRIC MODEL OF THE NIGERIAN ECONOMY

Team comprising Central Bank of Nigeria (CBN),
African Institute of Applied Economics (AIAE),
Centre for Economic and Allied Research (CEAR), and
Nigerian Institute for Social and Economic Research (NISER)

CENTRAL BANK OF NIGERIA

MACROECONOMETRIC MODEL OF THE NIGERIAN ECONOMY

A Commissioned Study Undertaken by a team comprising the Central Bank of Nigeria (CBN), African Institute of Applied Economics (AIAE), Centre for Economic and Allied Research (CEAR), and Nigerian Institute for Social and Economic Research (NISER)

Central Bank of Nigeria
Research Department
33 Tafawa Balewa Way
Central Business District
P. M. B. 0187
Garki, Abuja
Website: www.cbn.gov.ng

Tel: +234(0)946235900

A catalogue record for this publication is available from the National Library.

ISBN: 978-978-53289-6-7

TEAM MEMBERS

CENTRAL BANK OF NIGERIA (CBN)

Charles N. O. Mordi

Michael A. Adebiyi

Adeniyi O. Adenuga

Charles C. Ezema

Magnus O. Abeng

Adeyemi A. Adeboye

Phebian N. Omanukwue

Michael C. Ononugbo

CENTRE FOR ECONOMETRIC AND ALLIED RESEARCH (CEAR)

Akin Iwayemi

Alarudeen Aminu

NIGERIAN INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH (NISER)

Gabriel O. Falokun

AFRICAN INSTITUTE OF APPLIED ECONOMICS (AIAE)

Chukwuma Agu

Moses O. Oduh

TABLE OF CONTENTS

Chapter One:
Introduction and Project Overview

1.1. Introduction and Project Overview

The sustained implementation of wide-ranging economic and financial reforms in Nigeria and the boom in world oil markets (epitomised by the drastic increases in oil price) in the last five years have produced two significant outcomes. The first outcome is the marked improvements in macroeconomic fundamentals such as growth in national income, fiscal and current account balance, inflationary pressures, poverty level and incidence. The second relates to the fact that the economic and financial sector reforms have reshaped the Nigerian economy and set it on the path of sustainable growth and development. Prominent among the reforms in the financial sector is the reform embarked upon by the Central Bank of Nigeria (CBN) in 2005.

The main objective of the CBN's reform was to strengthen the financial sector and establish a sound financial system of international standard to underpin Nigeria's drive for a sustainable social and economic development. The CBN's reform programme has resulted in a stronger banking sector with several of the domestic banks listed, for the first time, among the 500 banks in the world within three years of the start of the reform programme. Several Nigerian banks have now become important players not only in the banking sector in Africa but in the developing world on account of their strengthened financial position as measured by the volume and quality of their assets.

With the emergence of a stronger financial system anchored on banking system and capital market reforms and the CBN Act of 2007, which ensures CBN's autonomy in monetary policy, the Bank has become a more important player in the management of the economy. For CBN to function effectively as an important player in economic management in Nigeria, the need for an adequate and up-to-date knowledge of the workings of the economy becomes imperative. The fact that the banking sector reform has produced a sound financial system and a sort of better understanding of how the system works may not provide enough ground for the effectiveness of monetary policy as lack of knowledge of the workings of the macroeconomy may go a long way in determining the success or otherwise of monetary policy initiatives of the CBN. It thus follows that any effort directed at understanding the way the Nigerian economy works will assist the CBN in no small measure in achieving its monetary policy goals.

The need for an operational and an up-to-date macroeconomic model of Nigeria at the CBN becomes all the more compelling if the CBN is to sustain its key player's status in the economy through its monetary policy formulation, financial sector monitoring, and evaluation of policy actions and outcomes. It is widely acknowledged that getting the policy right and being proactive in monetary matters and offering the correct policy guidance goes beyond simple intuition given the complex feedback relationship between monetary policy and economic and social conditions. The role of economic models in guiding policy has assumed greater policy interest and significance given the commitment to inflation targeting as a framework for monetary policy especially in the emerging economies in which Nigeria is a prominent actor. A commitment to pursue effective and efficient monetary policy requires the development of an up-to-date macroeconometric model that is capable of capturing the various monetary policy transmission channels and their economy-wide impact. Such a model can serve as a basis for critical evaluation and meaningful prediction of monetary policy actions and outcomes. Therefore, the study's outcome (an up-to-date macroeconometric model of Nigeria) will provide an invaluable input to monetary policy analysis and implementation. The model will make for an informed exploration of alternative policy scenarios and sound judgments in policy design and implementation. The new directions in monetary policy making associated with the new CBN Act must be anchored on sustainability of this exercise. The composition of the research team together with the collaboration involved in this project is expected to ensure sustainability of the project.

1.2. Objective of the Project

The main objective of the study is to develop an operational and an up-to-date macroeconometric model of the Nigerian economy. The model can be used for not only monetary policy analysis and forecasting but for any other economic policy (especially fiscal policy) with macro dimension. The model is sufficiently robust to address the following issues:

- The relationship between the monetary policy and the real sector of the economy.
- The effect of fiscal policy shocks on macroeconomic variables.
- The response of macroeconomic variables to oil price shocks.

This study intends to illuminate the issues posed above. To contextualise the model, a review of the economic, financial and social conditions in Nigeria is provided with a focus on the trends, patterns and characteristics.

1.3. Expected Output

The study is expected to produce an operational macroeconometric model of the Nigerian economy. The specific outputs of this study include:

- Review of recent macroeconomic developments in the Nigerian economy;
- Develop a model that would illuminate the relationships between monetary and fiscal sectors of the Nigerian economy, among others.
- Operationalise the model by using it to forecast and simulate future time paths of selected variables

1.4. Overview of the Study Report

This study consists of eight chapters and a statistical appendix. Chapter 2 presents a brief review of recent developments in the Nigerian economy. Chapter 3 provides a brief review of the theoretical and empirical literature on macroeconometric modelling with a focus on developing countries and Nigeria. The purpose of the discussion is to identify the emerging issues in macroeconomic modelling. The theoretical framework and model specification are described in Chapter 4. In Chapter 5 the estimated equations are presented. Model simulations, covering policy analysis based on alternative monetary rules and conduct constitutes the focus of Chapter 6. The last Chapter summaries and concludes the study. The statistical appendix at the end which presents the available data on key Nigerian economic, financial, demographic and social indicators concludes the report.

Chapter Two:
Structure of the Nigerian Economy

2.1. Background

Nigeria is richly endowed with a variety of solid minerals ranging from various types of precious metals to industrial minerals such as barytes, gyspsum, kaolin and marble. Others include coal, iron ore, lead, limestone, tin, columbite and zinc. Statistically, the level of exploitation of these minerals is very minimal in relation to the extent of deposits found in the country.

Throughout the 1960s, agricultural sector was the most significant contributor to the GDP, foreign exchange receipts and government revenue. It was also the highest employer of labour in the economy. Within the early period of post-independence up till the mid-1970s, the government took a policy decision to promote industrial production, which saw a rapid growth of industrial capacity and output, as the relative importance of the manufacturing sector in the economy increased. At the same time though, oil was discovered and attention shifted away from agriculture. This shift led to structural distortions which affected Nigeria's economic growth and development prospects. Misalignment between domestic production and consumption, mono-cultural economic base, overwhelming dependence on crude oil exports, and unbridled import dependence define the character of the economic challenges confronting policymakers and practitioners in the country.

Nigeria is a major oil producer, which accounts, on the average, for over 90.0 per cent of export receipts and about 70.0 per cent of government revenues (see table 1). The massive increase in oil revenue following the Middle-East crises of the mid-1970s created unprecedented and unplanned wealth for Nigeria: the oil boom. Thus, the economy became dangerously dependent on the oil sector and aggravated the misfortunes of the agricultural sector as its relative importance in the economy declined immensely; though the sector remained the highest employer of labour and contributor to GDP.

The accretion to foreign reserves resultant from the oil boom strengthened the domestic currency in the 1970s. This, consequently, encouraged import-oriented consumption, a habit which became difficult to drop even after the oil glut later in that decade. The ensuing crisis from the glut resulted in the depletion of the external reserve, huge and increasing fiscal deficits which culminated into external borrowing. Several policy initiatives taken to correct the defective structure and reduce inefficiencies in the system were not effective.

Table 1: Structure of Revenue and Exports (per cent)

	1970	1975	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009
Revenue	100	100	100	100	100	100	100	100	100	100	100	100
Oil	26.3	77.5	81.1	72.6	73.3	70.6	83.5	85.8	88.6	78.8	83.0	78.7
Non-Oil	73.7	22.5	18.9	27.4	26.7	29.4	16.5	14.2	11.4	21.2	17.0	21.3
Exports	100	100	100	100	100	100	100	100	100	100	100	100
Oil	57.6	92.6	96.1	95.8	97.0	97.6	98.7	98.3	97.7	97.6	97.5	96.7
Non-Oil	42.4	7.4	3.9	4.2	3.0	2.4	1.3	1.7	2.3	2.4	2.5	3.3

Source: Central Bank of Nigeria Annual Reports (Various Issues).

2.2. Output in the Economy

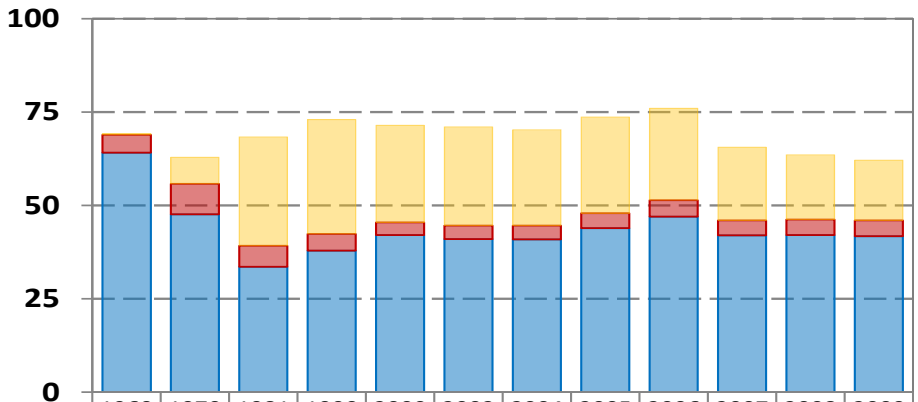
Economic activities broadly fall into three sectors, namely, the primary, secondary and tertiary. The primary sector, consisting basically of agriculture, comprises crop production, livestock, forestry, fishing and mining. This sector is engaged in extraction of renewable and non-renewable natural resources and their outputs are basic inputs into the secondary sector. The secondary sector is made up of manufacturing, utilities and construction activities. Tertiary sector is composed of the service activities including transport, communications, distributive trade, hotel and restaurant, finance and insurance, real estate and other business services, housing, community, social and personal services as well as government services including education and health care delivery.

Nigeria's gross output at 1990 constant prices was estimated at ₦718.6 billion in 2009 up from ₦95.8 billion in 2006. The composition of the GDP by economic activity showed that the economy is agrarian in structure with agriculture accounting for 64.1 and 47.6 per cent of GDP in 1960 and 1970 respectively. The share of agriculture continued to decline to about 33.6 per cent in 1981 but rose again between 1990 and 2002 and had continued to hover around 42 percent since 2008 (see Chart 1).

The pre-independence period witnessed a significant rise in the GDP which ought, but did not, lead to higher per capita incomes and an improved condition of living for the generality of the populace. Following independence, the 1962-1968 Development Plan embodied a shift in strategy from welfare development planning to growth promotion, with less emphasis on equity and more on growth. This led to social and civil discontentment which subsequently resulted in the first

general strike by workers in May 1964. The situation was redressed by increasing the salaries and wages of workers for the first time in Nigeria. However, it created a disparity in the wage structure between the private and public sectors.

Chart 1: Composition of GDP (%)



	1960	1970	1981	1990	2000	2003	2004	2005	2006	2007	2008	2009
Crude Oil	0.3	7.1	29.2	30.6	26	26.5	25.7	25.8	24.6	19.6	17.4	16.1
Manufacturing	4.8	8.2	5.6	4.5	3.4	3.6	3.7	4	4.4	4	4.1	4.2
Agriculture	64.1	47.6	33.6	37.9	42.1	41	40.9	43.9	47	42	42.1	41.8

The period 1967-1979 was marked by oil boom. Revenue from oil increased from ₦33.4 million in 1969 to well over ₦5.0 billion in 1976. This rise in revenue was accompanied by alarming rise in consumption and government expenditure. The Second National Development Plan (1970-1974), addressed issues of social justice and sought as one of its main objectives, "a just and egalitarian society" by seeking to reduce inequalities in inter-personal incomes and promoting balanced development among the various communities. These objectives were reiterated in the Third Development Plan (1975-1980) as well as the intention to ensure an even distribution of income and reduction in unemployment. The main strategy in the Plan for the redistribution of income was investment in public works and infrastructural services and supply of such services at subsidised rates. Among these were free primary education programme, housing, water supply, health facilities and community development targeted at improving the living conditions of the generality of the people.

The period 1979-1985 was characterised by dwindling economic fortunes as oil prices fell. This had a shattering effect on the standard living of the populace. Consequently, the level of poverty increased significantly between 1979 and 1983 and the proportion of people living below the poverty line rose from about 30 per cent in 1979 to about 40 per cent in 1983, worsening thereafter to 54.0 per cent based on provisional estimate in 2009.

Like most African countries, the Nigerian economy is characterised by dualistic production systems whereby the informal market systems, co-exist with formal systems. The formal system tend to be more productive and efficient, owing to the utilisation of modern production techniques which permit very few number of workers to produce for commercial purposes and to cater for domestic consumption as well as exports. The traditional or informal sector is relatively inefficient, producing basically for subsistence.

2.3. Production and Ownership in Agricultural and Industrial Sectors

2.3.1. Agriculture

The agrarian sector comprises a mixed system of informal (traditional) and formal (modern) farming activities. The National Bureau of Statistics (NBS) estimates showed that, on the average, traditional agricultural system accounted for 90.0 per cent of agricultural output, while the modern farm sector accounts for the balance. Traditional farming is characterised by production for subsistence, extensive use of land and the practice of shifting cultivation, and a land tenure system supporting ownership and access through the family system (nuclear and extended). These result in land fragmentation as well as the use of crude and labour-intensive implements such as hoes and cutlasses. Thus, the demand for labour are generally very high at peak periods, such as during weeding and harvesting. The productivity of the subsistence farming system is low and vulnerable to the vagaries of weather.

Overall, agriculture has remained an important sector in the economy; employing a good percentage of the labour force and contributing significantly to GDP. Specifically, the share of agriculture to total GDP averaged about 38.1 per cent, 39.3 per cent, and 42.0 per cent for the periods 1981-1989, 1990-1999, and 2000-2006, respectively. Analysis of the structure of the agricultural sector by economic activities in 2009 showed that crops production remained the predominant sub-sector (90.0 per cent) followed by livestock (6.3 per cent), fishery (3.3 per cent) and forestry (1.3 per cent) (See Chart 2b).

Chart 2a: Agrarian Structure (1970)

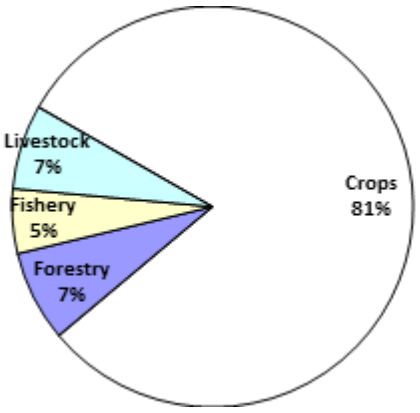
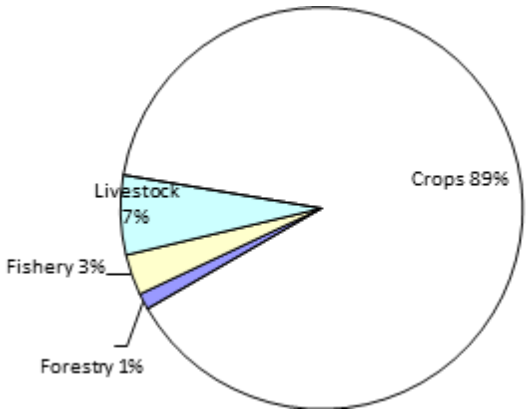


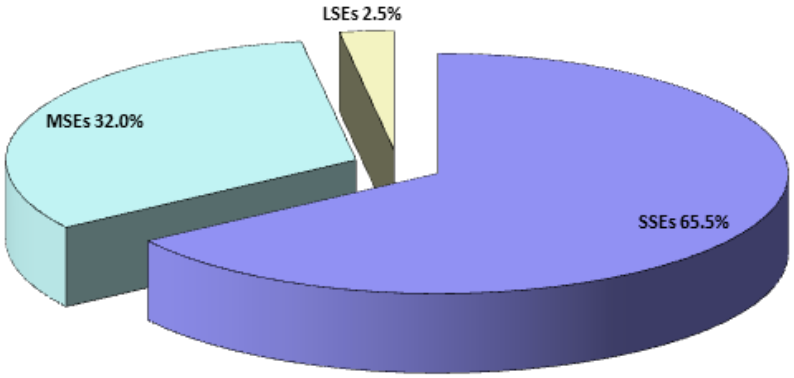
Chart 2b: Agrarian Structure (2009)



2.3.2. Industry

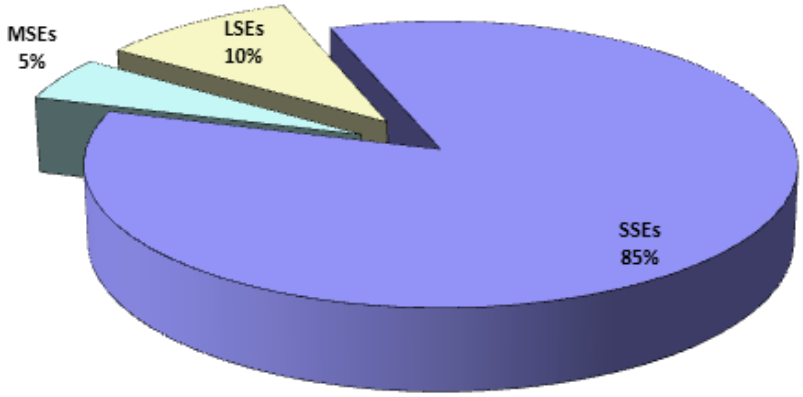
The industry is dualistic and characterised by a large number of informal small enterprises and a few formal modern firms. The size of Nigeria's industrial sector was put at 61,289 establishments, each employing more than 5 workers. While comprehensive and current data are not available, there are indications that small and medium scale enterprise account for about 70.0 per cent of industrial employment and 10.0 to 15.0 per cent of manufacturing output. The small scale enterprises (SSEs) tend to be rural based while the medium scale enterprises (MSEs) produce in urban areas. The SSEs are basically craftsmen and artisans engaged in the production of traditional consumer goods, which include weaving apparel, home and office furniture; footwear and other leather products; food products and services like metal working, printing, auto vehicle repairs and tyre rethreading. The sector tends to locate and concentrate its distribution activities in local markets, thus obtaining the economic advantages of consumer proximity – as in providing services such as tailoring, printing and repair shops and in producing bulk items such as furniture and building blocks.

Chart 3: Industrial Structure by Size



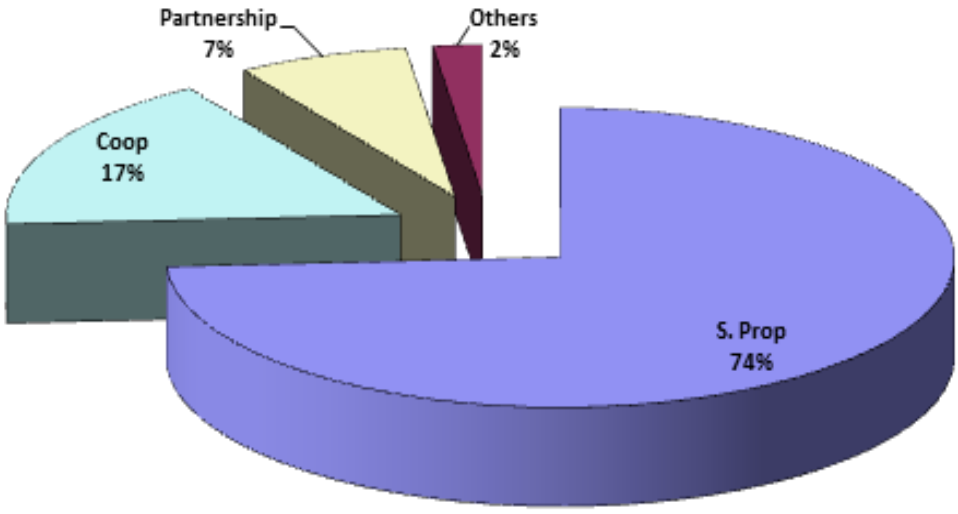
The Nigerian MSEs are more developed than the SSE, with production techniques characterised by organised factory–type processing of more complex goods. They dominate in textiles, readymade garments, metal products, footwear as well as pharmaceutical products, and cater for a wide market. They employ relatively high technology, but unlike large scale enterprises (LSEs), are less capital intensive. In a number of cases, they represent backward integration from trading activities. Access to technology is not a major constraint; they are able to employ technical specialists to install equipment and train employees. The LSEs comprises the modern factories, often with multi-national linkages, using the state-of-the-art technologies and mass-producing for both domestic and export markets. The analysis of industrial structure by size, in 2006, showed that SSEs constituted 65.5 per cent, while the MSEs and LSEs constituted 32.0 and 2.5 per cent respectively (See Chart 2).

Chart 4: Industrial Structure by Output



Of the total amount of industrial establishments, only 2.5 per cent engaged more than 100 persons, while a little over 95.0 per cent engaged less than 50 persons. It should be noted that, by focusing on establishment employing more than 5 persons, a large number of informal micro-enterprises may have been ignored. These enterprises are typically located in odd places and can usually be sited on roadsides, under highway bridges as well as in cluster of small groups vending similar products and services. Many of them employ relatively simple industrial tools for repairing vehicles, welding metals, weaving cloth, tailoring, carpentry, milling, shoemaking, etc. Ownership structure among the informal enterprises is dominated by sole proprietorship which accounts for 74.5 per cent. This is followed by cooperatives accounting for 16.6, while partnerships and others (including Government corporations and incorporated companies) account for 7.3 and 1.6 per cent respectively (See Chart 5). Geographically, there is heavy concentration of activity in the south western and eastern regions of the country.

Chart 5: Industrial Structure by Ownership



2.4. The Public Sector and Privatisation

Nigeria has a large public sector especially in power, telecommunication, petroleum and steel sectors. These organisations were characterised, in many cases, by inefficiency, poor management, unreliable services, high costs, and poor cost coverage, sporadic maintenance and heavy losses. At the peak of their operations, and consequent losses, these enterprises consumed as much as a third of the budget of the Federal Government every year. In order to reverse this trend, diversify ownership and make public enterprises more efficient, the

country embarked on a privatisation programme which is part of a broader economic reform under the structural adjustment programme (SAP). The privatisation programme also aimed to promote greater private sector participation in economic activity, improve efficiency and reduce the burden on public finances. Earlier privatisation programmes laid emphasis on power, telecommunications, and downstream petroleum sectors.

The privatisation programme involved issuance of licence to independent power producers, granting of licence to private GSM operators and other operators in the telecommunications industry, and the deregulation of the downstream oil and gas sector. Though, government enterprises still participate in these industries, the entrance of privately owned establishments led to increase in overall industry efficiency, especially in telecommunications. In the power sector, the Power Holding Company of Nigeria remains a major player in the industry although the absolute monopoly it enjoyed in the past is gradually being removed.

Deregulation of the downstream oil and gas sector, which is part of the reforms in that sector, was aimed at reducing government interference, especially with oil pricing. It was conceived to imply the deregulation of petroleum product prices and removal of restrictions on the supply of products. The deregulation aimed to resolve such challenges as product scarcity, poor maintenance of refinery, smuggling of petroleum products, adulteration of petroleum products, and rampant pipeline ruptures and vandalism which had plagued the system.

Owing to the growing importance[1] of gas in the global economy and the need to diversify the mining industry, the Federal government embarked on measures aimed at harnessing the gains of the gas business. Given Nigeria's huge reserves of natural gas (93 per cent of Africa's deposit, the seventh in the world and enough to last about 72 years), the development of gas resources has attracted priority attention from government. Consequently, government has embarked on projects targeted at boosting domestic utilisation and export of gas as well as reducing the industry's environmental hazards. Specifically, the following projects were initiated: Gas-to-Liquid (GTL), Petrochemicals from Natural Gas, Liquid Petroleum Gas (LPG), Liquefied Natural Gas (LNG), and the West Africa Gas Pipeline Project.

2.5. The Nigerian Financial System

The Nigerian financial sector is dualistic in nature with formal and informal financial intermediation co-existing, reflecting cultural and social forces more

[1] It is widely believed that gas would be the fuel of the 21st century just as coal and oil were in the 19th and 20th centuries, respectively.

than economic forces. The informal financial system is subordinate to the formal financial system and is essentially designed to serve social and microeconomic goals. The market is characterised by small scale deposit mobilisation and lending, little or no record-keeping, dominance of cash transactions, ease of entry and exit, lending based on personal recognition, and higher interest rates than the formal sector, among others.

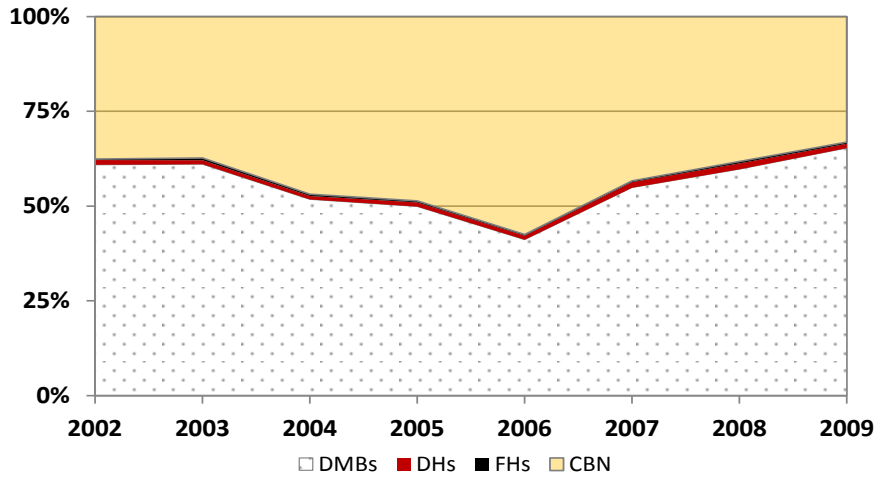
Formal institutions, which presently predominates the financial system, consist of the regulatory authorities, the financial market, the development finance institutions, and other financial institutions. The regulatory authorities include the Central Bank of Nigeria (CBN), the Federal Ministry of Finance, the Nigeria Deposit Insurance Corporation (NDIC), the Securities and Exchange Commission (SEC), the National Insurance Commission (NAICOM) and the National Pension Commission (PENCOM). The financial market consists of the money market (deposit money banks (DMBs)) and capital market (Nigerian Stock Exchange (NSE)). Development finance institutions include Urban Development Bank, Federal Mortgage Bank of Nigeria (FMBN), Bank of Industry (BOI), Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB), Nigerian Export-Import Bank (NEXIM) and Education Bank. Other financial institutions include discount houses (DHs), insurance companies, finance companies (FCs), community banks (CBs), primary mortgage institutions (PMIs) and bureaux de change (BDCs) as well as microfinance banks (MFBs).

The financial system grew rapidly from 1986-2000 due to the liberalisation of the sector. The number of commercial banks rose from 14 banks in 1970 to 66 in 1993 but declined to 54 in 2000. Similarly, the number of merchant banks rose from 1 in 1970 to 53 in 1993 and subsequently declined to 38 in 2000. In terms of branch network, the combined commercial and merchant bank branches rose from 1,323 in 1985 to 2,549 in 1996 but declined to 2,306 in 2000. The financial landscape was significantly altered when in 2001 the dichotomy between the commercial and merchant banks was removed following the introduction of universal banking. Under this system the erstwhile commercial and merchant banks transformed into deposit money banks (DMBs) and were allowed to engage in both money and capital market activities as well as in insurance business depending on individual bank's operational preferences. Hence 23 commercial and merchant banks changed their names and/or status for various reasons, including their conversion to public liability companies as well as the need to portray a new identity. Consequently, the number of deposit money banks (DMBs) in operation in the country stood at 89 between 2001 and 2004. Total branch network increased to 3,010 in 2002 and by 2004 it has expanded to 3,492. However, the oligopolistic structure of the banking system persisted as ten

banks out of the eighty-nine in operation accounted for about 52 per cent of total assets, 54.4 per cent of total deposit liabilities, and 43 per cent of total credit in 2004. To redress the perennial problem of systemic distress in the banking industry, among other problems, the CBN rolled out a 13-point reform agenda on July 6, 2004 which was aimed at recapitalising and consolidating the banking industry for efficient service delivery. After the banking sector consolidation ended on December 31, 2005, the number of DMBs shrank to 25 with 3,535 branches. By end 2006, the number of DMBs remained at 25 while the number of branches further reduced to 3,468. However, with the merger of Stanbic bank and IBTC in 2007, the number of DMBs fell to 24. As at 2009, the number of banks in the banking industry remained at 24, while the number of bank's branches grew by 8.4 per cent from 5,134 in 2008 to 5,565. There has also been substantial growth in the number of other financial institutions especially, Bureaux de Change (BDCs). The number of approved BDCs increased from 1,264 at end-December, 2008 to 1,601 at end-December 2009. There are 99 primary mortgage institutions (PMIs), 110 finance companies (FCs), 5 discount houses (DHs), 910 microfinance banks (MFBs), 5 development finance institutions (DFIs), 1 stock and 1 commodity exchanges, and 73 insurance companies.

In terms of asset base, total assets of the central bank, commercial, merchant and development banks put together grew from ₦1.6 billion in 1970 to ₦954 billion in 1995. By 2006, total assets of the banking system (CBN and DMBs) had grown to ₦17,207.4. In terms of structural composition, commercial banks asset accounted for between 50–59 per cent of the asset base in 1970-87. As at end 2009, CBN asset stood at 33.1 per cent of the total while DMBs held 65.3 per cent (chart 6).

Chart 6: Structure of Financial System by Asset Base



The CBN, which accounted for 18.5 per cent of credit to the economy in 1970-1974, had grown to account for between 50 and 60 per cent in 1980-1996. However, its contribution to credit growth fell by 22.6 per cent in 2000 and has remained negative ever since with the exception of 2004 and 2005 that grew by 24.0 and 10.9 per cent. Credit to private sector increased from 65.8 per cent in 2006 to 94.6 per cent in 2009. In terms of beneficiaries, government's share in banking system's credit was estimated to be between 50-60 per cent in 1980-1996 but declined to 24.0 per cent in 2004 and further to negative 48.1 per cent in 2006 while the private sector claims increased from 76.0 per cent in 2004 to 94.6 per cent in 2009.

Chart 7: Structure of Institutional Credit

	1980	1996	2000	2004	2005	2006	2007	2008	2009
Private Sector	66.7	43.4	122.6	76.0	71.3	65.8	87.0	87.9	94.6
Govt	33.3	56.6	-22.6	24.0	10.9	-48.1	-40.8	-33.9	-21.2

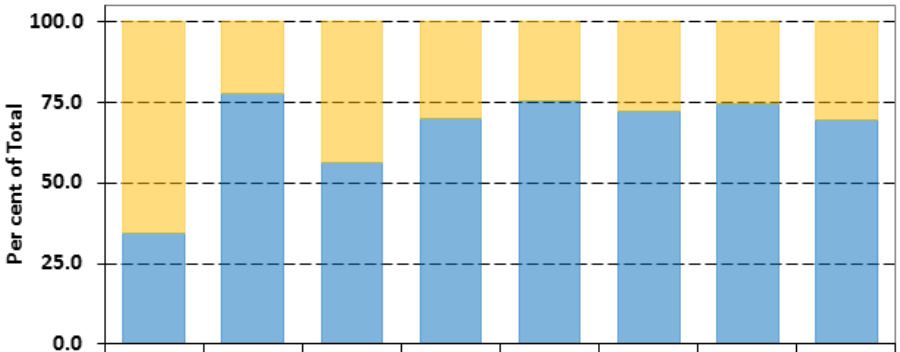
The total number of PMIs that operated in the country rose from 23 in 1991 to 280 in 1995, and increased further to 99 in 2009. However, asset base of the PMIs which stood at ₦2.24 billion in 1992 had risen to ₦114.39 billion in 2006. As at end-December, 2009, the total assets stood at ₦329.6 billion, indicating a decline of 0.1 per cent from the preceding year's level. The development was attributed largely, to the decline in the deposit liabilities of the PMIs.

2.6. Foreign Trade and Exchange Markets

Like most of the other sectors and activities, Nigeria's foreign trade and exchange rate markets are dualistic with the predominance of formal sector over the informal or parallel market sector. Although outlawed, many people openly engage in parallel foreign exchange transactions in the country. It is estimated that the parallel market caters for up to 10 per cent of the foreign exchange needs, especially of individuals engaged in overseas travels and trans-border trade, etc. The volume of unrecorded trade with neighbouring countries has been on the increase, following the implementation of the ECOWAS protocol on

free movement of persons and the considerable liberalisation of external trade. Chart 8 shows the composition of external trade for oil and non-oil sectors.

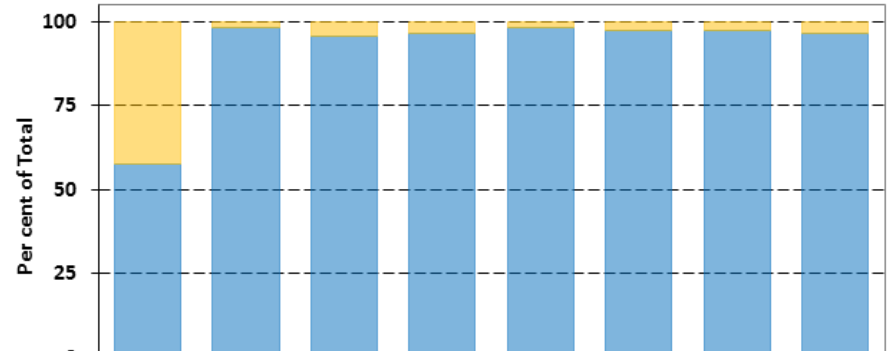
Chart 8: Total External Trade



	1970	1996	1998	2004	2006	2007	2008	2009
Non-Oil	65.8	22.6	43.8	30.3	24.5	27.7	25.8	30.6
Oil	34.2	77.4	56.2	69.7	75.5	72.3	74.2	69.4

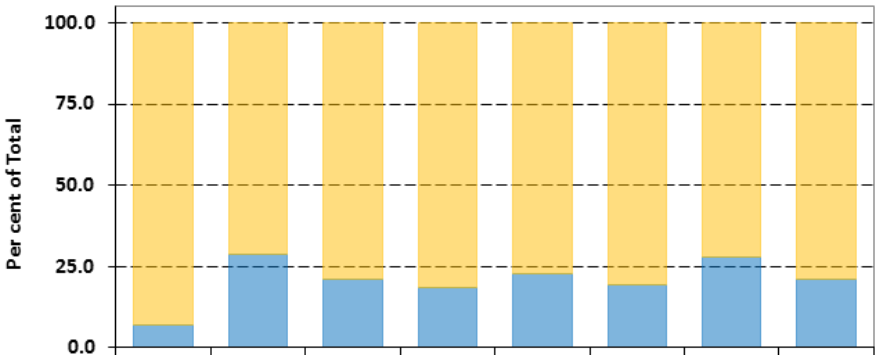
Generally, foreign trade is dominated by the oil sub-sector which accounted for 96.7 per cent in 2009 while non-oil exports accounted for 3.3 per cent. By contrast, non-oil imports dominated total imports, accounting for 78.8 per cent in 2009.

Chart 9: Structure of Exports



	1970	1996	1998	2004	2006	2007	2008	2009
Non-Oil	42.4	1.8	4.5	3.6	1.8	2.4	2.5	3.27
Oil	57.6	98.2	95.5	96.4	98.2	97.6	97.5	96.73

Chart 10: Structure of Imports



	1970	1996	1998	2004	2006	2007	2008	2009
Non-Oil	93.1	71.2	79.0	81.4	77.2	80.5	72.0	78.8
Oil	6.9	28.8	21.0	18.6	22.8	19.5	28.1	21.2

Chart 11a: Composition of Imports in 1996

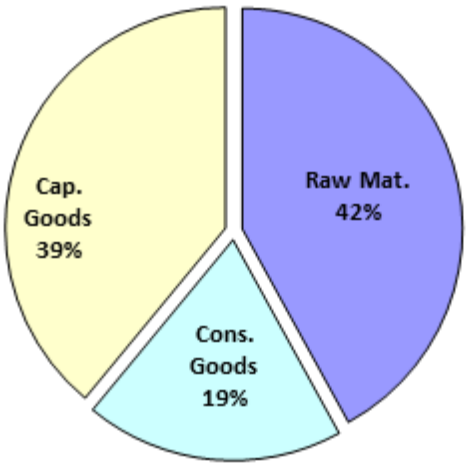
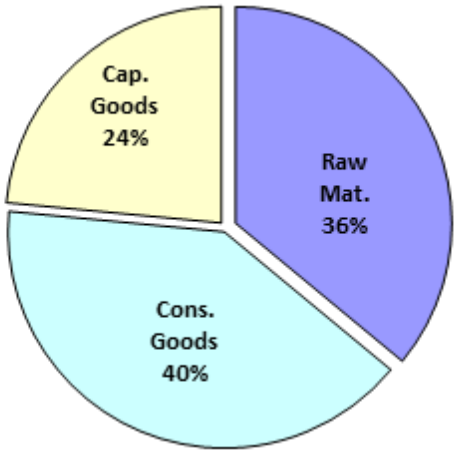


Chart 11b: Composition of Imports in 2009



The patterns and trends in external trade and balance of payments position underscored the high degree of external dependence of the Nigerian economy. The foreign exchange content of domestic production and consumption is very high, thus, making the economy highly vulnerable to external shocks. There have been changes in the composition of non-oil imports in favour of consumer goods over the last decade, indicating decline in production and increase in dependence. Consumer goods which accounted for only 19.0 per cent of total imports in 1996 had gone up to 40.0 per cent of total imports in 2009 while raw materials with total share of 42.0 per cent in 1996 declined to 36.0 per cent.

2.7. Fiscal Profile

Government revenues in Nigeria are classified into oil and non-oil. The oil revenue includes proceeds from sales of crude oil, petroleum profit tax (PPT), rents and royalties, while the components of non-oil revenue are companies income tax, customs and excise duties, Value-Added Tax (VAT) and personal income tax. Since the 1970s, oil revenue has been the dominant source of government revenue, contributing over 70 per cent to federally-collected revenue.

The distribution of revenue from the Federation Account is done at two levels: first between Federal, State and Local Governments and second among component State and Local Governments. Over the years, the principle and formula for revenue allocation among the three tiers of government has been the subject of intense debate and controversy. This has necessitated the constitution of several Revenue Allocation Commissions since independence. Between 1979 and 1994, many ad-hoc changes or amendments were made to the revenue allocation formula through various decrees. The amendments have, however, not succeeded in quelling the resultant controversies among the tiers of governments.

From the distributable total revenue of ₦4,537.8 billion in 2009, statutory allocation was ₦2,831.7 billion. Out of the allocation, the Federal Government received ₦1,353.6 billion, state governments obtained ₦686.6 billion, local governments got ₦529.3 billion and the derivation fund received ₦262.2 billion. In the current structure, before the distribution of the federally collected revenue the following are deducted from source: Joint Venture Cash Calls, excess crude/PPT/royalties, and 13.0 per cent derivation for the oil producing states. In addition, Federal Inland Revenue Services (FIRS) and the Nigeria Customs Services (NCS) collect 4.0 and 7.0 per cent of the total collected revenue before the Federation Account is shared among the three federating units in line with the constitutional provisions. The balance is thereafter, shared based on the allocation formula. External debt services and Special funds are borne by the Federal Government.

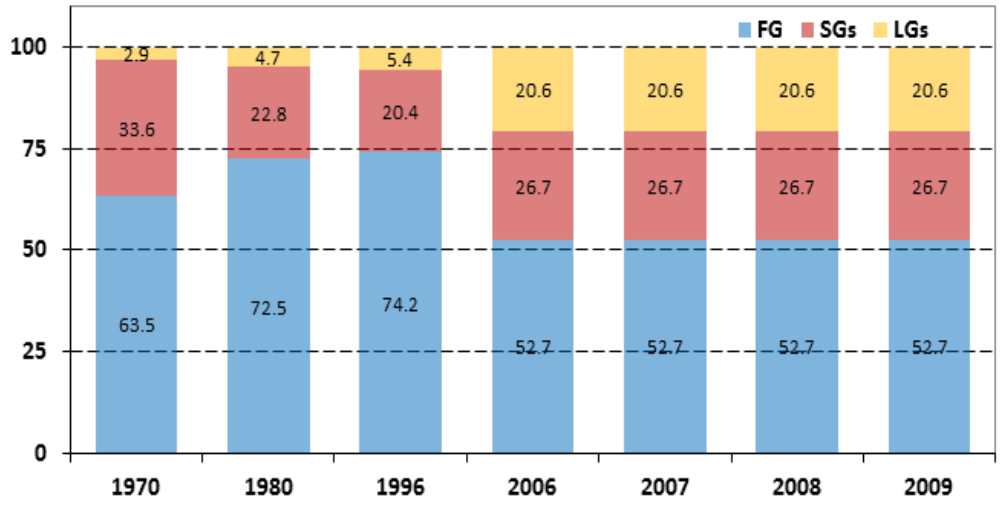
The sales tax which existed before was introduced as Value-Added Tax (VAT) system in 1994, and was shared in the ratio 20:50:30 per cent to federal, states and local governments, respectively. However, it has been revised at least four times since, the last revision in 1999 proffered the ratio 15:50:35 per cent for federal, states and local governments, respectively.

The Constitution also provides for independent revenue by the three tiers of government in addition to the statutory allocations from the Federation Account. The independent revenue of the federal government comprises personal income tax, operating surpluses of federal parastatals, dividends from federal government

investments in publicly quoted companies, rent on government properties, interest and capital repayment on loans on-lent to state governments and parastatals, etc. Other sources of revenue for state governments include internally-generated revenue, grants and subventions. The major sources of internally-generated revenue of the local governments are property tax; radio and television licences; levies on underdeveloped plots used for commercial purposes; community taxes; development levy; and other general rates. Generally, since the 1980s there has been very high dependence on statutory allocations from the Federation Account, particularly for the lower tiers of government.

An analysis of the consolidated fiscal operations of the three-tiers of government between 1970 and 2009 showed the overwhelming dominance of the Federal Government. For instance, out of the total revenue of ₦6,117.7 billion in 2009, 52.7 per cent accrued to the Federal Government, while the state and local governments' shares were 26.7 and 20.6 per cent, respectively (see Chart 13). The expenditure profile followed the same pattern. Past trends since 1986 were quite similar, confirming that the fiscal behaviour of the Federal Government dictates the tempo of general economic activity.

Chart 12: Fiscal Profile by Revenue Share (% of Total)



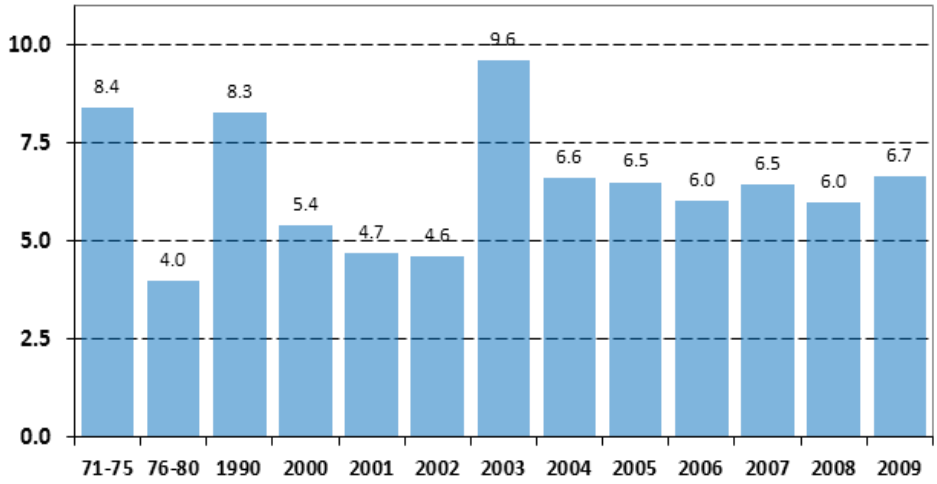
2.8 The Broad Macro Economy

2.8.1. Real Output Growth

Nigeria's real domestic output grew at an average of 4.9 per cent between 1960 and 2007, rising sharply from a moderate average of 4.9 per cent between 1960-1965 to 8.4 per cent in 1971-1975. It rose further to 9.6 per cent in 2003. Increase in

crude oil exploration and export led to the oil boom which contributed to appreciable increase in real GDP in the first half of the 1970s. In 2004, the output growth was 6.6 per cent and it further increased marginally to 6.7 per cent in 2009. The rise in output growth was driven by improved macroeconomic environment, relative stability in the goods and foreign exchange markets and enhanced investor confidence in the economy.

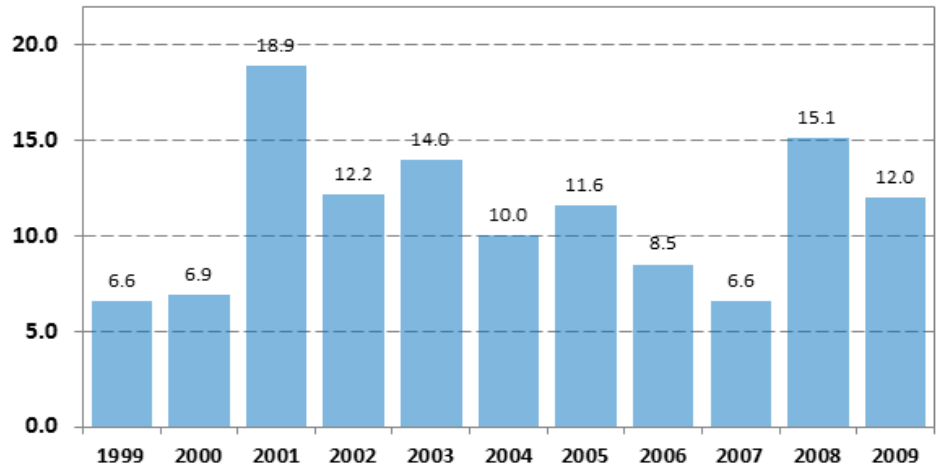
Chart 13: Real GDP Growth Rate (%)



2.8.2. Inflation

Inflation rate during the review period averaged 11.13 per cent, rising from a single-digit of 6.6 per cent in 1999 to about 18.9 per cent in 2001, before declining to 6.6 per cent in 2007. The figure again jumped to about 15.1 per cent in 2008 and then declined further to12.0 per cent in 2009. The rise in inflation in 2001 was attributed to increases in the domestic pump-price of petroleum products, while that of 2003 was sequel to rise in aggregate demand occasioned by the tempo of political activities during the 2003 election. Inflationary pressure eased significantly in the years from 2004 except in 2008 and 2009 which were attributed to the effects of the global financial crisis that led to naira depreciation and general credit crunch creating some cost-push factors. Clement weather, appreciation and relative stability of the naira coupled with robust macroeconomic policies all contributed to the general downward trend in price.

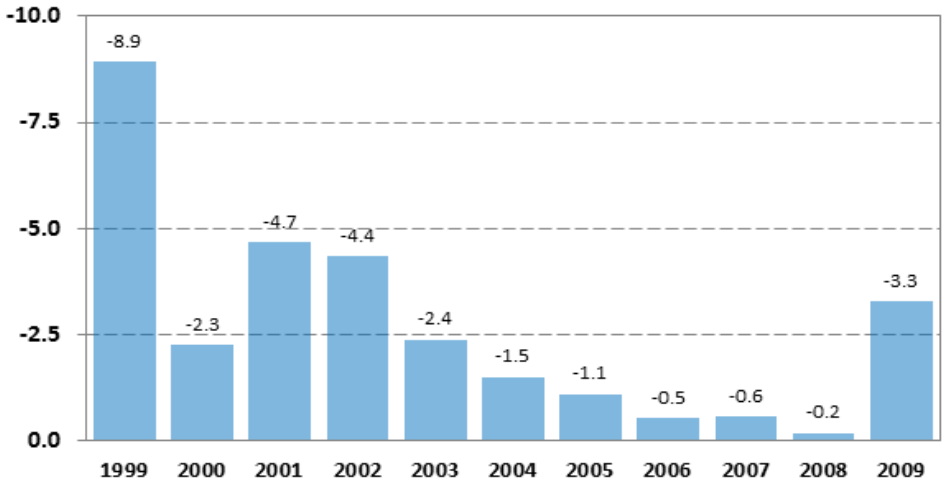
Chart 14: Inflation Rate (%)



2.8.3. Overall Fiscal Balance

Nigeria has a history of high fiscal and overall deficits. However, since 1999, fiscal deficit has consistently declined. Between 1999 and 2000, deficit went down from about 9 per cent of GDP to 2.3 per cent of GDP. The figure, however, went up to 4.68 per cent and 4.4 per cent in 2001 and 2002, respectively. Thereafter, the figure continued its downward trend till it reached 0.2 per cent of GDP in 2008. Again the global financial crisis forced the deficit up again in 2009 when the overall deficit of 3.3 per cent of GDP was recorded. Generally, the lower deficit reflected the twin factors of enhanced revenue from the oil sector and the effect of the non-release of some capital votes during the year, due to the late approval of the Appropriation Bills. The low deficit ratio observed in 2008 was largely attributed to the strict observance of fiscal rule on oil benchmark which led to the accumulation of huge savings. This compared favourably with the WAMZ convergence criterion target of 4.0 per cent of GDP.

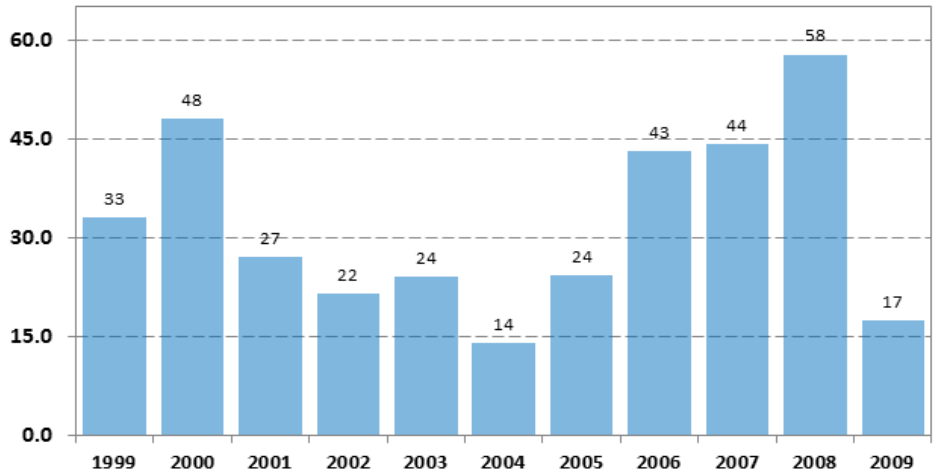
Chart 15: Overall Fiscal Balance (% GDP)



2.8.4. Broad Money Growth

Growth in monetary aggregates especially broad money (M2) generally witnessed a high volatility during the review period. The highest growth of 57.78 per cent recorded in 2008 was substantially driven by the rapid expansion in the net foreign assets of the banking system driven by favourable global price of crude oil up till July that year. Broad money growth rate reached the lowest ebb of 14.02 per cent in 2004 for the first time in more than a decade owing principally to the effectiveness of monetary policy complemented by the fiscal discipline of the Federal Government. Other contributory factors included the modest increase in aggregate banking system credit (net) to the domestic economy, especially the contractionary effects of the fall in net credit to government and, other assets (net) of the banking system. Against the expectations of consolidating and sustaining the growth rate of the 2004, broad money growth, however, expanded significantly to about 57.78 per cent in 2008 before declining sharply to 17.46 per cent in 2009. The sharp decline is occasioned by the effects of the global financial crises which resulted in a sharp decline in Net Foreign Assets (NFA) and the credit squeeze in the economy as DMBs were either unable or reluctant to lend to the economy following the erosion of their capital as the bank reform programme forced them to make full provisions of their non-performing assets.

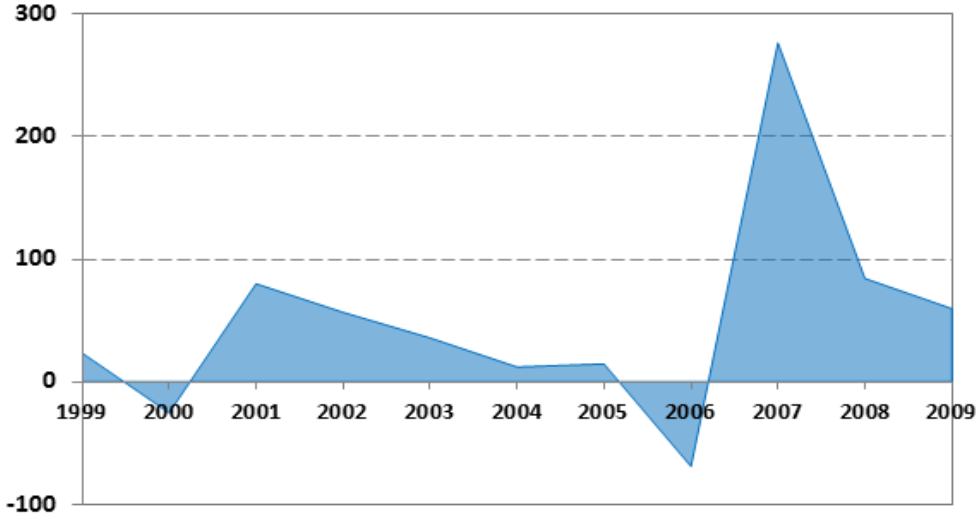
Chart 16: Broad Money Growth (%)



2.8.5. Net Domestic Credit

Developments in the domestic credit to the economy were mixed, beginning 1999. Growth in net credit to the economy was negative for 2000 and 2006, but positive for other years. While the decline in 2000 was attributed to sharp decline in credit to the federal government, the decline of 65 per cent in 2006 resulted largely from the high earnings from crude oil exports, which enhanced government's revenue profile and buoyed its deposits with the banking system. However, the figure rose sharply in 2007 driven entirely by credit to the private sector before trending downwards thereafter.

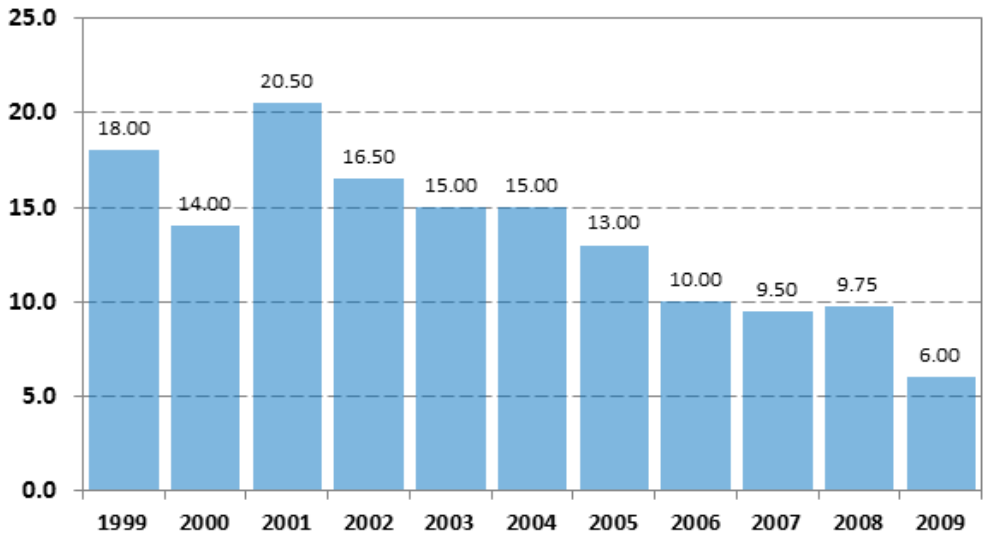
Chart 17: Net Domestic Credit Expansion (%)



2.8.6. Monetary Policy Rate

The monetary policy interest rate referred to as the Minimum Rediscount Rate (MRR) was changed to the Monetary Policy Rate (MPR) in December 2006. The MRR, which was the nominal anchor for interest rates in the economy, trended downward during the review period reflecting the proactive drive by the CBN to ameliorate the cost of funds in the economy. The MRR averaged 15 per cent between 1999 and 2005 before it was replaced by the Monetary Policy Rate (MPR) in December 2006. The MPR is a transactions rate aimed at enhancing transmission of monetary policy actions. At inception, it was fixed at 10.0 per cent with a band of ±300 basis points, thus repositioning the CBN as a lender of last resort. The CBN has used MPR proactively to direct the movement of interest rates in the economy. As at the time of this study, the rate stood at 6.0 per cent with upper band of 200 basis points and lower band of 500 basis points.

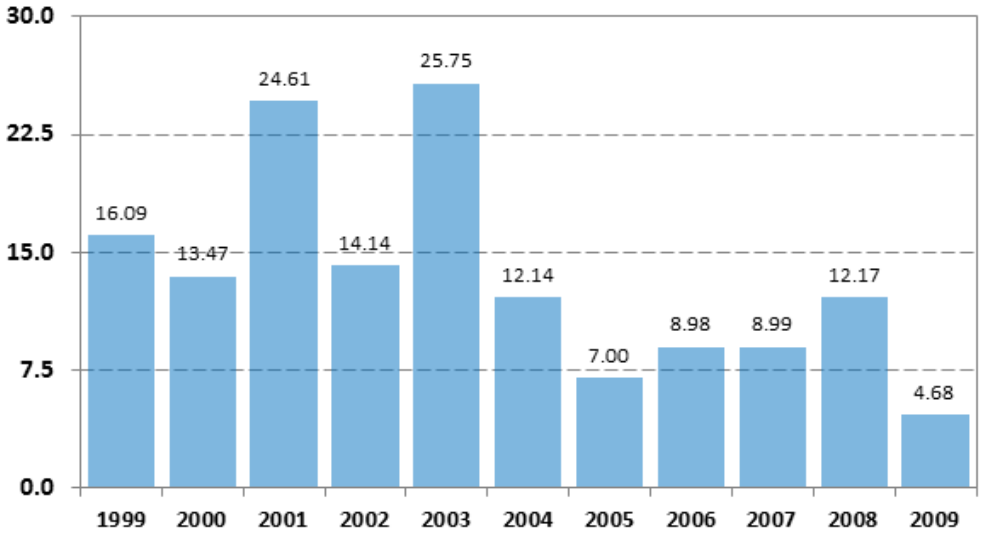
Chart 18: Policy Interest Rate (%)



2.8.7. Inter-bank Call Rate

The inter-bank call rate, the rate at which banks borrow among themselves, indicated a volatile movement throughout the review period. The irregular trend is a reflection of the liquidity surfeit in the system. The rise in 2001 for example, reflected the impact of demand pressure and tight monetary policy stance while the decline witnessed during the following year was as a result of the downward adjustment in MRR and the relative ease of monetary conditions. The banking sector consolidation and implementation of the new monetary policy framework generally moderated volatility in the inter-bank rate in those years.

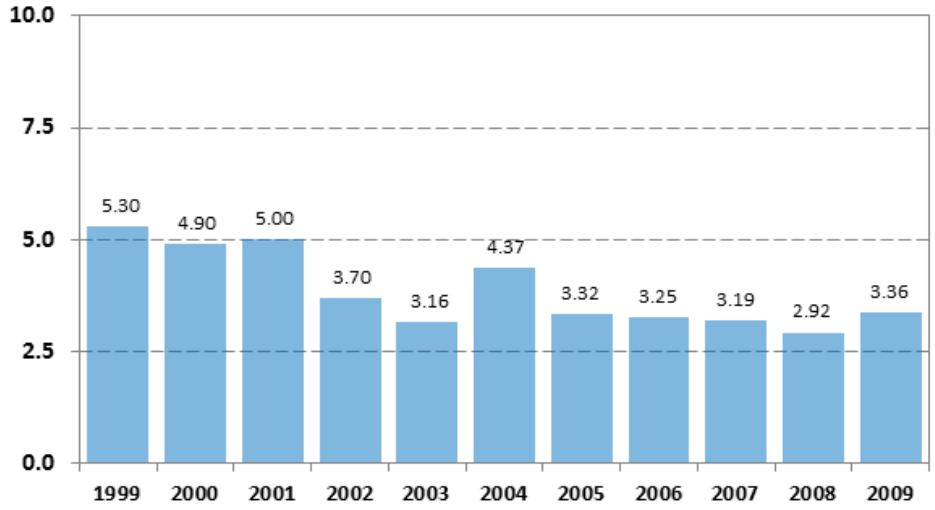
Chart 19: Inter-bank Call Rate (%)



2.8.8. Savings Rate

The deposit savings rate declined from an average of 3.86 during the period 1999 to 2009. This low rate is an indication of weak competition and liquidity surfeit in the banking system, due in part to dichotomous and oligopolistic banking structure and the dominance of government in deposit and credit transactions. Some other factors that have helped to keep the deposit rate low include introduction of the Universal Banking System by the CBN, downward review of MRR and the suasion to reduce lending rates in order to stimulate investment. Average saving rate fell to as low as 2.92 per cent in 2008 before increasing marginally to 3.36 in 2009, reflecting liquidity surfeit in the banking system

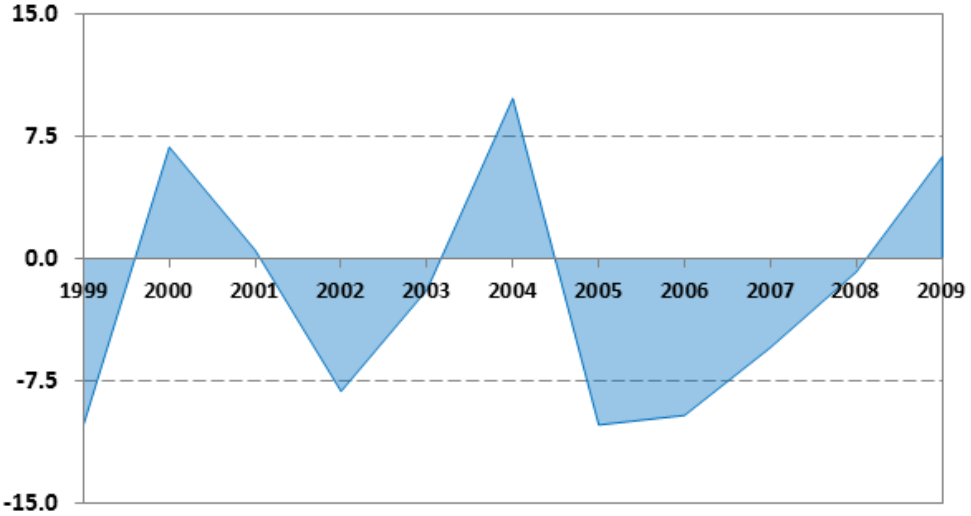
Chart 20: Savings Deposit Rate (%)



2.8.9. The Balance of Payments (BOP)

The BOP as a percentage of GDP has been characterized by high volatility during the review period. The overall BOP balance as a percentage of GDP improved significantly from negative 10.23 per cent in 1999 to 6.86 per cent in 2000 before deteriorating back to negative 8.15 per cent in 2008. In 2004, an impressive figure of 9.85 per cent was recorded before it deteriorated back to 10.21 per cent and 9.63 per cent in 2005 and 2006, respectively. This favourable development was attributed largely to improvement in the current account, as against the persistent deterioration in the capital and financial account while the decline was due significantly to the draw-down of external reserves and deferred payments of scheduled debt service obligations. The BOP to GDP share improved again to 6.27 per cent in 2009 due mainly to increased crude oil revenue despite the global financial crisis.

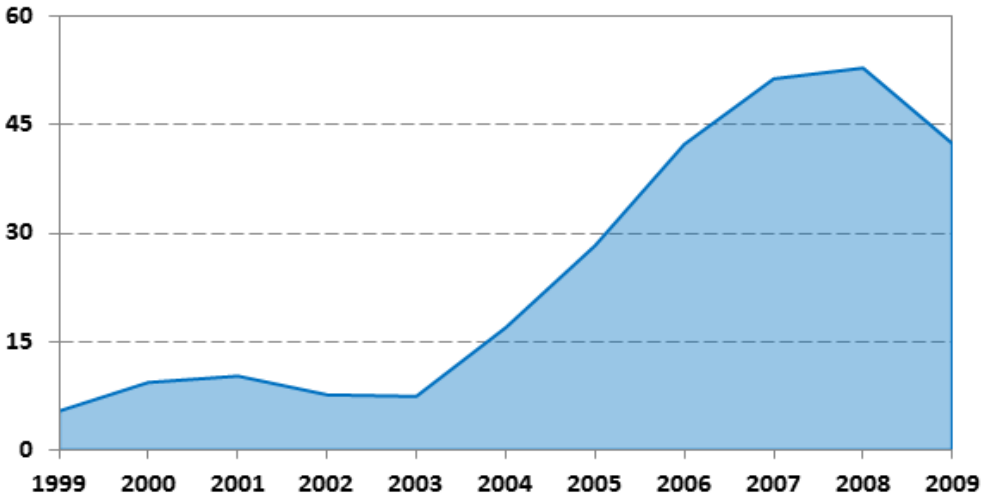
Chart 21: Overall BOP (% GDP)



2.8.10. External Reserves

Being a mono-product economy, Nigeria's stock of external reserves depends critically on the exogenously determined international price of crude oil. The stock of external reserves rose persistently from US$5,424 million in 1999 to US$10,267 million in 2001. Since then the figure has trended upwards till 2009 when it declined marginally to US$42,382 million, down from US$52, 823 million in 2008. This figure is adequate to finance approximately 18 months of imports and compared favourably with international bench mark of three months import cover.

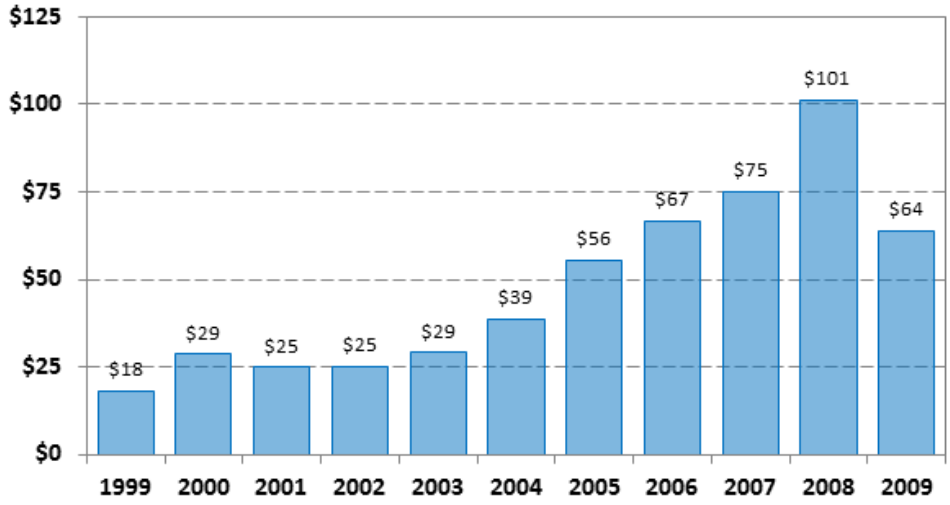
Chart 22: External Reserves (US$ Billion)



2.8.11. Average Crude Oil Price

Aside a couple of years, the average price of Nigeria's reference crude, the Bonny Light, has been on steady increase since 1999. From just US$17.95 per barrel in 1999, it has risen to more than US$66.81 per barrel. A number of factors have been responsible for this including the buoyancy of Organisation for Economic Cooperation and Development (OECD) economies as well as the recovery of East Asian economies. The rise in global energy demand, especially from China and India, and anxiety over supply disruptions in Nigeria, Iraq and Iran, Hurricanes Katrina and Rita that ravaged oil installations in the Gulf of Mexico, the prolonged face-off between Iran and the United States as well as the general insecurity in the Middle East have all contributed significantly to the rising price of crude oil.

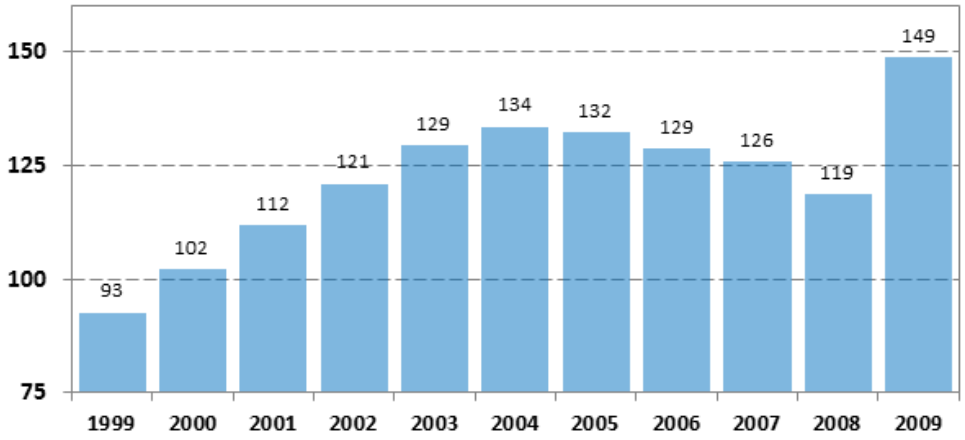
Chart 23: Average Crude Oil Prices



2.8.12. Average AFEM/DAS Rate

The average exchange rate of the naira was ₦92.30 per US$1 in 1999. It depreciated continuously until it was ₦133.50 per US$1 in 2004. The depreciation owed mainly to fall in foreign exchange inflow in the face of increased demand pressure. By 2006, however, the naira started appreciating against the US dollar reaching ₦128.70 per US$1. The appreciation was driven by a number of policy changes introduced by the CBN. These include further liberalisation of the foreign exchange market through the introduction of the Wholesale Dutch Action System (WDAS), granting of approval to BDC operators to access the CBN foreign exchange window, among others. Importantly, the characteristic volatility in the exchange rate of the Naira moderated significantly with the introduction of these policies.

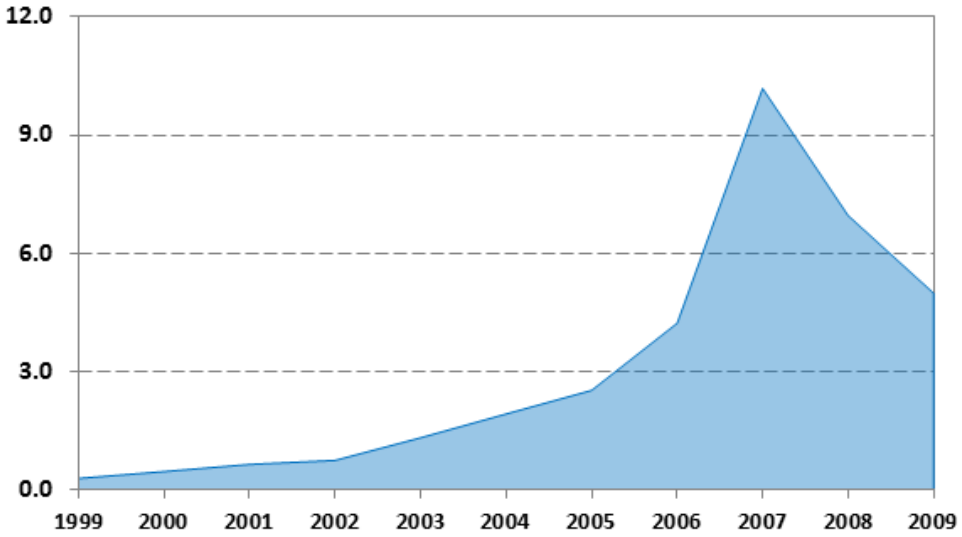
Chart 24: Average IFEM/DAS Rates (₦/US$)



2.8.13. Stock Market Capitalisation

The stock market has witnessed significant transformation since 1999. Capitalisation of the stock market rose by over 250 percent from ₦2,294.10 billion in 1999 to ₦748.73 billion in 2002. By 2007, capitalisation of the market had risen astronomically to ₦10.18 billion, a rise of about 670 per cent from its 2002 levels. The rise in the market capitalisation reflects price appreciation of equities, improved confidence in the market as well as new listings on the Exchange. Regulation of the market has also improved substantially and efforts intensified to modernise its infrastructure. A number of developments like the recapitalisation of banks as well as equities and insurance firms, supplementary issues by firms in other sectors, improved corporate results, increased investor confidence in the market and general improvements in the macroeconomic environment collectively led to rise in stock prices. However, the figure declined to ₦6,957 billion and ₦4,989 billion in 2008 and 2009, respectively. The decline was mainly driven by the effects of the global financial crises.

Chart 25: Stock Market Capitalization (₦'Trillion)



2.9 Recent Developments in the Financial Sector

Over the last few years, the financial sector has experienced a boost. A number of reforms have been initiated with the aim of improving the effectiveness and efficiency in service delivery of the sector. This section reviews some of the recent developments such as the banking consolidation, insurance reforms and the financial system strategy (FSS) 2020.

2.9.1. Bank Consolidation

In July 6, 2004 the CBN embarked on the banking sector consolidation with the announcement of the 13-point agenda. With the reform programme, banks were required to achieve minimum shareholders' funds of ₦25.0 billion by end-December 2005. This was to be achieved through the injection of fresh capital into the system and/or via mergers and acquisitions. The reform was introduced to enable Nigerian banks become active players in the domestic and global financial markets. Prior to the reforms, there were 89 banks in Nigeria. At the expiration of the deadline, however, 25 banks emerged from merger/acquisition of 75 of the erstwhile 89 banks. The licences of the remaining 14 banks, which had negative shareholders' funds at the end-of the exercise, were revoked.

The bank consolidation programme brought a number of positive developments to the sector and the overall economy. The country now has relatively well-capitalised banks, which has boosted public confidence in the system. A good number of banks currently have shareholders' funds in excess of ₦100.0 billion. The consolidation exercise also resulted in increased awareness and deepening

of the capital market and a significant decline in money market interest rates. Ownership of banks become tremendously diluted thereby reducing the problem of insider and corporate governance abuse. The public quoting of virtually all banks ensured a wider regulatory oversight with the Securities and Exchange Commission (SEC) and the Nigerian Stock Exchange (NSE) now joining the regulatory team.

Following the consolidation exercise, growth of credit to the private sector increased marginally from 26.6 per cent in 2004 to 30.8 per cent in 2005. Prime lending rate also declined from 18.9 per cent in 2004 to 17.3 per cent in 2006. Total deposits liabilities expanded by 45 per cent in 2006 as against the growth of 24 per cent recorded in 2004. The number of account holders grew from 14.8 million with ₦1.8 trillion worth of deposits as at end-September 2004 to 21.87 million with ₦5.3 trillion worth of deposit as at end-September 2007. There has also been improved efficiency in banking sector intermediation as the ratio of currency outside banks to broad money declined from 16.0 per cent to 12.1 per cent as at end-September 2007 (Soludo, 2007).

2.9.2. Pension Reforms

Owing to the numerous problems confronting both the public and private sector pension schemes, Nigeria embarked on reform of the pension industry in 2004. Prior to the reforms, the public sector operated largely the Pay As You Go (PAYG) scheme, which depended on budgetary provisions from various tiers of government for funding. The scheme became unsustainable due to lack of adequate and timely budgetary provisions and increases in salaries and pensions. Over time, the number of pensioners became very large and grossly affected the support ratio. Pension administration was weak, inefficient, cumbersome, and lacked transparency. The private sector scheme, on the other hand, was characterised by low compliance ratio due to lack of effective regulation and supervision. Many private sector employees were not covered by any form of pension scheme.

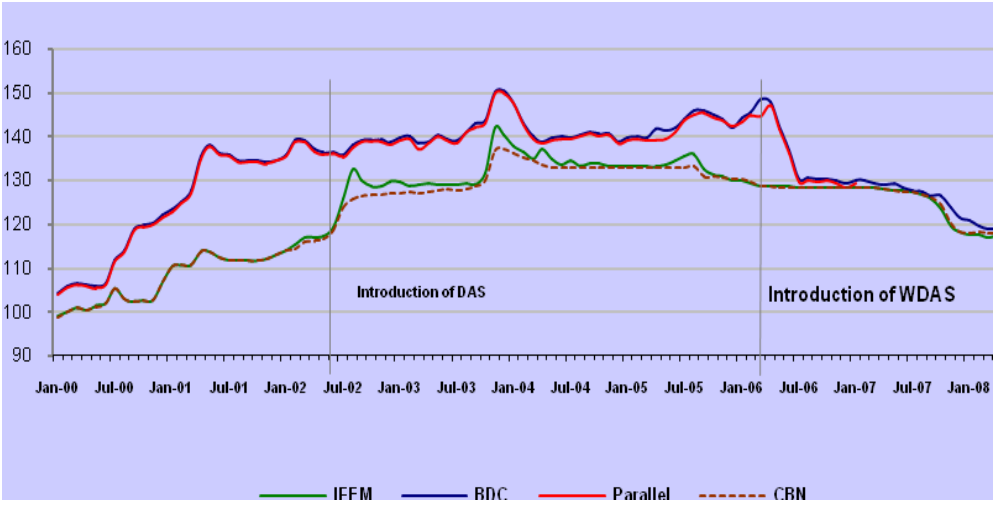
The Pension Reform Act was enacted in 2004, with the aim of developing a sustainable system with the capacity to provide a stable, predictable and adequate source of retirement income for workers. The Act brought a defined contribution system that was fully funded, privately managed and based on individual accounts for both the public and private sector employees. Under the act, it is mandatory for all workers in the public service of the Federation and the Federal Capital Territory, and workers in the private sector where the total number of employees is 5 or more to join the contributory scheme. The Act also established the National Pension Commission (PENCOM) as the sole regulator and

supervisor on all pensions matters in the country. The Commission was also empowered to grant Licences to Pension Fund Administrators (PFA) and Pension Fund Custodians (PFC). PENCOM is also to maintain a national data bank on pension matters as well as receive and investigate complaints against PFCs, PFAs and their employers and agents. The PFCs are responsible for the warehousing of the pension fund assets while the PFAs are licenced to open Retirement Savings Accounts for employees and invest/manage the pension funds as prescribed by PenCom. There are currently 4 PFCs and 25 PFAs operating in the country. In addition, 7 organizations have been licensed to operate as Closed Pension Funds Administrators (CPFAs), thereby managing and investing their own pension funds. As at end 2007, there were 2.78 million registered contributors with assets valued at ₦815.0 billion, compared to approximately 0.88 million contributors and asset value of ₦558.0 billion in June 2006.

2.9.3. Wholesale Dutch Auction System (WDAS)

Following liberalisation of the foreign exchange market under the structural adjustment programme (SAP), the CBN introduced the Dutch Auction System (DAS) in July 2002. Under the system, end-users bought foreign exchange at their bid rates through authorised dealers. In February 2006, the foreign exchange market was further liberalised with the introduction of the Wholesale Dutch Auction System (WDAS) based on a two-way quote. The adoption of WDAS was meant to consolidate the gains recorded under the retail framework, enhance market depth as well as achieve convergence in rates between the official and other segments of the market.

Chart 26: Naira-US$ Exchange Rate Movements (2000-2008)



With this System, the CBN remained an active market participant and could buy or sell foreign exchange depending on market conditions, while the authorised dealers which hitherto, only bought on behalf of their customers were now free to transact on their own account. In addition, they were allowed to trade with such funds in the inter-bank market. Introduction of WDAS helped to substantially close the gap between the official and parallel markets, reduce distortions, deepen the market by expanding supply sources for foreign exchange (e.g. oil firms, foreign investors and Global Depository Receipts (GDR) of some indigenous banks and reduce volatility of the naira exchange rate.

2.9.4. Financial System Strategy (FSS) 2020

As a means towards repositioning Nigeria to be one of the twenty largest economies by the year 2020 by consolidating on the gains in the financial sector, monetary authorities flagged off the Financial System Strategy (FSS) initiative in June 2007[2]. This initiative also aims at improving the linkage between the financial and real sectors, building virile financial institutions that are global players, ensuring that Nigeria becomes an international financial hub in Africa, and that the financial sector serves its role as growth catalyst for other sectors of the domestic economy. The FSS 2020 strategy embodies improvement of ICT infrastructure, legal/regulatory environment and human capital, driven by such activity sectors as mortgage, capital and money markets, foreign exchange market, credit as well as small and medium enterprise finance.

2.9.5. Microfinance Banks (MFBs)

Part of the steps taken to get financial intermediation closer to the people was the establishment of community banks. However, the community banks were plagued by poor corporate governance, weak capital base and institutional capacity, lack of deposit insurance, declining activity among licensed banks, low financial intermediation and insider abuse. In addition, there is the possibility that the "large banks" that emerged from the banking consolidation may not finance very micro economic activities and enterprises. In 2005, therefore, the CBN

2 *The Governor of Central Bank of Nigeria, Prof. C.C. Soludo formally inaugurated a technical working committee to draft the long term financial framework for the FSS 2020 on August 10, 2006. The committee was composed of representatives of all regulatory bodies in the financial system, some financial consultancy firms, Money Market Association, the organized labour and representatives of the manufacturers Association of Nigeria.*

launched a strategy to convert the community banks and Non-governmental Organizations (NGO)-microfinance institutions to Microfinance banks (MFBs), with the Microfinance Policy, regulatory and supervisory framework. The policy aimed to establish MFBs that would be "self-sustaining, stable and form an integral arm of the communities in which they operated", with minimum operating capital requirement of ₦20 million for unit MFBs and ₦1 billion for state MFBs. The MFBs are expected to serve the finance needs of the large informal sector, linking it to the mainstream financial sector. Processing and licencing waivers were granted by relevant regulatory authorities to aid this conversion process, while certification for improved corporate governance was initiated. As at December 2007, 607 community banks had been converted to MFBs.

2.9.6. Primary Mortgage Institutions (PMIs) and the Insurance sub Sector

Between 2001 and 2006, the number of primary mortgage institutions grew from 79 with total asset base of ₦33.5 billion to 91 with asset base of ₦114.39 billion. However, there is still wide room for improvement in the sector as the reforms that have swept the other sub sectors of the financial sector remained to be undertaken in the sector. Efforts are in place, though, to improve self regulation by the PMIs as well as interactions with supervisory bodies.

The insurance sub-sector has also witnessed significant growth with gross premium income of the sub-sector increasing from ₦37.8 billion in 2002 to about ₦45 million in 2004. However, the same challenges of low capitalisation faced the sector. Thus, in 2003 there was an increase in capital requirement for all categories of firms in the insurance sector. Capital requirements for life insurance was increased from ₦150 million to ₦2 billion, general insurance; from ₦200 million to ₦3 billion, life and general business; from ₦350 million to ₦5 billion and reinsurance; from ₦350 million to ₦10 billion. As at 14th November 2007, 49 insurance and re-insurance companies were granted approval by National Insurance Commission (NAICOM) to operate in Nigeria.

2.9.7. Nigerian Stock Exchange (NSE)

The Nigerian Stock Exchange has recorded significant developments over the last 8 years both in the new issues and secondary market. The Exchange in a bid to improve the efficiency of the market has improved market infrastructure, such as upgrading of automated trading systems, expansion in investors, memorandum of understandings signed with stock exchange across Africa, revision of regulatory and operational guidelines, amongst others. There has been increased awareness of stock market activities locally and internationally. Investors now have increased confidence in the Nigerian stock market as is reflected by the greater recourse to the market by local investors (companies and government)

as well as foreign investors. Stock market indicators show remarkable improvement. For instance, market capitalisation has increased from ₦747.6 in 2002 to ₦5,120.9 in 2006, an increase of 584 per cent, with the banking sector accounting for 41.8 per cent of the capitalisation in 2006. Market capitalisation as a ratio of gross output increased from 9.4 per cent in 2002 to 28.1 per cent in 2006 while turnover value grew by about 691 per cent between the two years. All-share index increased from 12,137.7 in 2002 to 33,358.3 in 2006. Four new sub-sectors – mortgage companies, road transportation, foreign listings and leasing – have been added to the listing on the stock exchange, increasing listed sectors to 31 as at 2009.

Chapter Three:
Theoretical Framework and Literature Review

3.1. Theoretical Framework

3.1.1. Historical Overview

The need to clarify, illustrate, test, compare and quantify theoretical relationships led to the emergence of macroeconomic models in the study of economics. Over time, such models have been used to produce scenarios and compare possible alternative policies as well as evaluate possible effects of changes in macroeconomic policies and forecast major variables. The development and growth of macroeconomic models have undergone a number of stages and there currently exist different classes of models, which characteristically followed evolutions in economic theory and the prevalence of different schools of economic thought.

For nearly two hundred years (between 1776 and 1936), the classical framework of demand and supply (as core forces of economic determination) and of price (as arbiter) dominated economic thinking. The Classical Model largely assumes the existence of an equilibrium point where product, labour and factor markets clear and in a way therefore is anchored on the micro-behaviour of agents in an economy. Such an equilibrium point is assumed to involve the full employment of factors of production – particularly labour and capital. Demand and supply equilibrate under a market-clearing price.

However, while a number of theoretical models were developed and used, particularly to illustrate theoretical relationships during the era of classical predominance, the development and widespread use of large-scale empirical macroeconomic models began with the Keynesian revolution in 1936 (coinciding with the publication of Tinbergen's classical model the same year). This is not surprising given that the classical model is self-regulating, self-sufficient and wholly dependent on market forces, with little provision for policy input. On the contrary, Keynes analyses of the Great depression of 1930s provided for possible disequilibrium in the goods and factor markets, necessitating intervention by the third arm of aggregate demand (government) to correct such distortions or disequilibrium conditions. In effect, while classical economics was mainly supply-driven, Keynes emphasised the place of demand.

Shortly after Keynes, Neo-Keynesians like Hicks (1937), Modigliani (1944) among others tried to link the demand and supply sides of the economy. The SI-LL curve

(now IS-LM curve), which tried to simultaneously solve the product (real) and money markets and showed income and interest rates as linking variables in the two markets, was one of such efforts. Over time, these simple representations have had profound impact on theory and policy. Multitudes of efforts have since gone into formalising these relationships as well as linking the major postulations of Keynes to the workings of the price mechanism.

During the 1950s and 1970s large Keynesian macroeconomic models became regular tools for forecasting demand in macroeconomics (Kydland and Prescott, 2004). Tinbergen (1939) had laid much of the statistical groundwork, and Klein (1965) built an early prototype Keynesian econometric model with 16 equations. By the end of the 1960s there were several competing models, each with hundreds of equations. The original Keynesian IS-LM model provided three-sector structural relationship (though not empirically formalised by Keynes), and was extended by Mundell (1963) and Fleming (1963) to include the external sector. The Mundell-Fleming extension showed that within an open economy framework, equilibrium was attained by adjustments in exchange rate (in addition to income and interest rate).

The inability of the Keynesian theory to explain stagflation of the 1970s led to the rise of the neo-classical group of models (1970 to date), with attention on the business cycle and micro-foundations of macro relationships. The model recognised four components of the business cycle – secular (trend), business cycle, seasonal, and random components. Contrary to the postulations of earlier models, it tried to define fluctuations in the business cycle not in terms of adequacy or otherwise of selected explanatory variables, but as efficient response of output to exogenous variables. The implied recommendation was for government to stay out of business. In a way, therefore, RBC models were neo-classical.

Neither classical theories (including the business cycle modifications) nor Keynesian economics seemed to fully explain structural rigidities and bottlenecks in developing economies. As a response, therefore, structural models, inspired by the Prebisch-Singer hypothesis, emerged. The basic stance of structural models was that each economy had to be evaluated on the strength of its macro aggregates rather than on the basis of any pre-conceived theoretical frameworks.

Empirical models closely followed developments in theoretical literature. But they have also closely mirrored fundamental changes in the structure of leading economies around the globe, growing computational capabilities and complex

estimation techniques as well as the increasing relevance of outlier behaviour of the group of developing countries. In effect, the capacity of any single group of macromodels to capture all aspects of the complexities of the modern macroeconomy became evident. Alternative assumptions about the link between micro behaviour and macro outcomes as well as the place of expectations and rationality in economic behaviour led to numerous criticisms. Led by the famous Lucas (1976) critique, these critiques covered issues ranging from the capacity of the models to reflect economic realities to their predictive and forecast accuracy.

One of the immediate results of the Lucas critique was widespread adoption of rational expectations in macroeconomic forecasting models. The Lucas analysis also led to the emergence of a new generation of econometric models explicitly based on micro-foundations in which firms and households are assumed to make decisions based on long-run optimisation frameworks. Vector Autoregressive (VAR) models led by Sims (1980) also emerged based on the perceived weakness of large-scale econometric models in properly identifying the behavioural relations among agents in the economy. VAR models adopted more flexible identification of the behavioural relations among economic agents and incorporated temporal dependence of the endogenous variables on its previous values. Unlike structural models, VAR models do not impose an *a priori* structure on the dynamic relationships among economic variables.

But beyond specification, the integrity of data and the regularity of their behaviour were also called to question leading to the evolution of the hypothesis of non-stationarity of economic variables. First, Nelson and Plosser (1982) concluded that the hypothesis of non-stationarity cannot be rejected for a wide range of data commonly used for macroeconomic models. Research surrounding the absence of stationarity led to a re-evaluation of what constitutes a long-run equilibrium relationship, and prompted a revisiting of the problem of spurious regression described by Granger and Newbold (1973). This led to a more rigorous analysis of the time series properties of economic data and the implications of these properties for model specification and statistical inference. The non-stationarity hypothesis led to further work by Engle and Granger (1987), Johansen (1991), and Phillips (1991) on the presence of long-run equilibrium relationships among macroeconomic data series, presently referred to in the literature as co-integration. A framework was also designed to deal with such co-integrated, non-stationary, mean reverting series, known as the error-correction framework.

3.1.2. Classes of Models

Model structures have historically followed developments in the theory and methodology outlined above. Generally, macroeconomic models could be grouped into three: simple theoretical models, empirical forecasting models and dynamic stochastic general equilibrium models. The simple macroeconomic models are static and in some cases dynamic macroeconomic models that follow the IS-LM model and Mundell-Fleming model of Keynesian macroeconomics, and the Solow model of neo-classical growth theory. Based on few structural equations and few variables, they represent macroeconomic aggregates rather than individual choice variables. Though, the equations relating these variables are intended to describe economic decisions, they are not usually derived directly by aggregating models of individual choices. Empirical forecasting models became popular in the 1940s and 1950s and are meant to capture and provide future forecasts of macroeconomic variables which significance in economic policymaking was rising astronomically within the period. Variables to be included are, however, guided by economic theory. Dynamic stochastic general equilibrium models are more or less products of the Lucas critique of 1979. They were developed mainly to capture structural relationships among various economic agents and micro foundations of macroeconomic relationships based on rational choice. Some variants of DSGE include computable general equilibrium (CGE), dynamic stochastic general equilibrium (DSGE), and Agent-based computational equilibrium (ACE) models.
Within the broad group of dynamic macroeconomic and stochastic general equilibrium models, there are also unique classes of models. Each class shares common characteristics such as theoretical and/or methodological similarities. Some of the groups include:

3.1.2.1 The Traditional structural models (TSM)

These typically followed the Keynesian paradigm featuring sluggish adjustment of prices or price rigidities. These models usually assumed that expectations were adaptive but subsumed them in the general dynamic structure of specific equations in such a way that the contribution of expectations alone was not identified. The MPS and Multi-Country (MCM) models formerly popular in the US Federal Reserve are examples of this form of models.

In its general form, TSM comprised a wide variety of macroeconometric models used in policy evaluation until the late 1970s. Popular models in this category included the 1950s Klein-Goldberger model of the US economy; the 1960s and 1970s RDX models of the Canadian economy; the 1960s Brookings and the MPS (MIT-Penn-SSRC) models of the US economy. Despite some differences in

specification and estimation methods, this group of models shared some common characteristics which included:

- They were large-scale with high levels of disaggregation, assumed adaptive expectations, and had short-run dynamics based on the Keynesian IS-LM paradigm. Until the early 1970s, these models also featured a long-run trade-off between inflation and unemployment.

- Demand was disaggregated into consumption, investment, government expenditure, and net exports. Government expenditure was typically treated as an exogenous variable but the other components of aggregate demand were modelled as functions of the relevant macroeconomic variables.

- Potential output was typically determined by supply factors. In these models, the balance of payments was modelled using a structural portfolio-balance approach in which the nominal exchange rate was determined implicitly as the price that clears the balance of payments.

A key limitation of this group of models was the inconsistency of the specifications with optimisation behaviour of households and firms. There were also challenges with a priori specification of the data characteristics as well as what had been considered in the literature as arbitrary assumptions used for equation identification. Due to a possible bi-directional relationship among the variables as argued by Sims (1980) it was wrong to exogenise some variables as it was difficult to justify the restrictions needed to support exogeneity of such variables. Lucas (1979) noted that TSM ignored expectations and could be regime-inconsistent; thus, a poor instrument for policy evaluation.

3.1.2.2 Rational expectations structural models (RESM)

Unlike Vector Autoregression (VAR) and Traditional Structural Models (TSM), the RESM are generally forward-looking, rational expectations models with a combination of Classical and Keynesian features. Examples of RESM included the US and Multi-Country models of the Federal Reserve Board, Taylor's multi-country model, and the IMF's Multimod; some of which were still active. There were both large scale and small scale (optimising IS-LM) variants of the RESM. There models were not without limitations though. Prominent among these were the divergence between theoretical restrictions placed on the models and variables and the constraints of estimation techniques. They also faced the challenge of poor disaggregation which often meant that they could not take up trade related variables such as in the BOP.

3.1.2.3 Equilibrium Business-Cycle Models (EBCM)

This group of models was a fusion of the real business cycle models and the monetary general equilibrium models (the former assumed that productivity shocks drove business cycles while the later assumed that they were predominantly caused by monetary or financial disturbances). These models generally assumed rational expectations and were based on explicit optimisation behaviour by both households and firms. EBCM assumed that labour and goods markets were always in equilibrium and that expectations are rational. All equations were closely based on assumptions that households maximised their own welfare and firms maximised profits. A key feature of RBCM is the calibration rather than standard estimation of equations. This had the advantage of returning data ex-post and as such ensured data integrity.

In spite of these qualities, RBCM were based on sample sizes and therefore had low predictive power. It was also often the case that RBCM sacrificed theoretical coherence in order to enhance their ability to match selected properties of the data. Thus, they were unlikely to be robust to policy regime changes and were, therefore, subject to the Lucas critique. While these models were popular in academic research, they were not widely used in practical policy evaluation and forecasting exercises because they were technically challenging, required enormous resources to maintain, and were often designed to answer academic questions rather than address practical interests.

3.1.2.4 Vector Autoregression (VAR) models

VAR models popularised by Sim (1980) employed a small number of estimated equations to summarise the dynamic behaviour of the entire macroeconomy. VAR models were generally *atheoretical*. They questioned the reason for exogenising some variables while endogenising others. This derived from the possibility of a *bi-directional* causality between economic variables and as such, placing a dichotomy between endogeniety and exogeniety restricted the explanatory power of these variables. Thus, the simple reason behind VAR was to cover inter-relationship among variables not necessarily for parameter estimation. The models were estimated by seeming unrelated regression SURE[1]. VAR models were developed with a view to accounting for such characteristics like non-stationarity, possible co-integration and error correction mechanism of time series data.

[1] This will yields the same result with OLS if the equations have the same right hand side variables and the same lag length.

3.2. A Survey of Macroeconomic Models in Some Selected Developed and Developing Countries

3.2.1. Macroeconomic Models in Ghana

Between 1968 and 1997, 53 different models were surveyed in Ghana. Out of these, 18 incorporated financial variables in their endogenous models. All the studies employed annual time series data in testing their models. Also, most of the authors employed Input-Output (I-O) models to generate their I-O table for the Ghanaian economy. The problem with this methodology was the need to constantly update the tables to reflect current economic changes.

3.2.2. Macroeconomic Models in South Africa

Different attempts were made to design macroeconomic models for South Africa. Between 1972 and 1994, 75 studies were conducted. Of these 33 reflected the monetary sector. Most of them made use of quarterly data, while the methodology adopted in these models ranged from Computable General Equilibrium (CGE), Revised Minimum Standard Model (RMSM), and FPS (IMF). The study conducted by De Wet et al (1994) appeared to be the most relevant for a developing economy, like Nigeria, for three reasons: firstly, they incorporated the monetary sector into their models; secondly, they employed high frequency data (quarterly time series data), which had made the application to monetary policy relevant; and lastly, the study reflected the reform programmes in South Africa.

3.2.3. Macroeconomic Models in Kenya

In Kenya, 51 studies were conducted in an attempt to design macroeconomic models for the country between 1965 and 1993. Out of these studies, 9 accounted for the importance of monetary policy. Most of the studies adopted Vector Autoregression or input-output approaches. The study conducted by Altshuler (1989) as cited in Uebe (1995), appeared to be the most relevant to the financial sector. The model contained 96 equations, which comprised of 46 stochastic equations and 50 identities. 10 of the stochastic equations captured the financial sector. However, a key shortcoming of this model was its reliance on annual time series as opposed to higher frequency data, which are more relevant to monetary policy analysis. This was also an indication that Kenya had problem in collecting high frequency data, as at the time the studies were conducted.

3.2.4. Macroeconomic Models in Lesotho

Matlanyane (2005) identified 6 major macroeconomic models in Lesotho; 3 of which were used by the Central Bank of Lesotho. A prevalent feature of the models, according to Matlanyane, was their focus on specific areas of the

economy, with the monetary sector and monetary policy forming the crux of two of the central bank's models. Some of the major shortcomings of macroeconometric models built in Lesotho were their obsoleteness due to the non-availability of high frequency data, and hence their failure in policy analysis and forecasting; the inadequate recognition of the critical role of the supply side of the economy in their models; the high aggregation and the inability of the models to forecast key economic variables like unemployment rates and others (Matlanyane, 2005).

The Central Bank of Lesotho used two models that mirror the economy. The first was the core framework used by the IMF in the implementation of the country's stabilisation programme, constructed by the Central Bank in conjunction with the IMF following the Polak (1997) model. The model consisted of four endogenous and three exogenous variables namely money stock, nominal income, imports of goods and services, net foreign assets, exports of goods and services, net capital inflows and net domestic credit. While two of the equations were identities, others related money stock to incomes and imports. These models were used to derive the reduced form of equations. Though the models had several advantages, they were, however, not without limitations, especially the disregard of the real sector of the economy.

3.2.5. Macroeconomic Model in Indonesia

Tanuwidjaja and Choy (2007) developed small-scale macroeconomic model (SSMM) of a forward-looking nature that captures the dynamics of the Indonesian economy. The model was designed to carry out policy analysis and to analyse the effects of policy shocks on the Indonesia economy. Batini and Haldane (1999) model was employed as theoretical underpinnings coupled with Taylor (1993) rule and the McCallum (1988) rule for money supply. Based on this Indonesian SSMM, the study conducted deterministic and stochastic econometric simulation exercises to capture the essence of monetary policy transmission mechanism in the economy. The study specifically examined the role of the central bank's credibility in ensuring the achievement of the inflation target. The findings from the study showed the absence of credibility for the Bank of Indonesia.

Also the study experimented with two types of monetary policy rules (Taylor and McCallum) and compared their relative merits in mitigating output and inflation variability in the Indonesian economy. It found that both rules performed equally well. However, the paper recommended the adoption of Taylor rule as a mechanism to support the move towards inflation targeting.

3.2.6. Macroeconomic Model in Venezuela

Following Batini and Haldane (1999), Svensson (2000), Gómez (2002), and Martínez, Messmacher and Werner (2002), the Venezuelan model consisted of four building blocks: a price equation; an aggregate demand equation (IS curve); an exchange rate equation (UIP); and a policy rule. The first two equations were estimated using quarterly data for the period 1989-2001. The exchange rate was determined as an asset price by the uncovered interest rate parity condition and the policy rule was calibrated for alternative preferences of the central bank. All the equations in the model were forward-looking in all markets which allowed for the inclusion of the effect of agent's expectations. The model included features from the New-Keynesian framework based on dynamic optimisation models with nominal rigidities and imperfect competition in line with the works of McCallum and Nelson (1999), Clarida, Gali and Gertler (1999), among others. Using this approach provided a richer analysis when compared to the traditional backward-looking IS-LM-AS specification because aggregate behavioural equations were derived from inter-temporal optimisation by households and firms, incorporating expectations.

In spite of its simplicity, the model captured the essential transmission mechanisms of monetary policy and allowed for the analysis of the effect of policy actions. The findings indicated that disinflation was more costly without credibility. The model also reflected the fact that a forecast-based rule for the interest rate produced less volatility on output and inflation than a rule based on past information. This was an important result that policymakers should take into account. Having a strict targeting policy versus a flexible one did not seem to produce significantly different results in terms of output and inflation.

3.2.7. Macroeconomic Models in Malaysia

Between 1964 and 1996, about 45 macroeconometric models were developed for the economy of Malaysia. Ahmad (1978) version-2 as noted by Uebe (1995) had the highest number of 141 equations. The model had 109 exogenous variables with 91 stochastic and 50 non-stochastic variables. Most Malaysian models relied on annual data, with only 4 models using quarterly series. This was a pointer to the general weaknesses of the models and their unsuitability for adoption in inflation targeting economies. Another significant feature of Malaysian models was the adoption of Input-Output analysis which gave prominence to the various sectors of the economy. About half of the models did not include monetary or financial variables. In terms of relevance and applicability, the Ahmad (1978) version-1 model was more appealling more owing largely to its use of about 39 monetary and financial variables, and more so it was the model adopted by the Central Bank of Malaysia.

3.2.8. Macroeconomic Models in India

The study by Pandit (2000) argued that India had one of the longest histories of macro-econometric modeling amongst developing countries. According to the study, works on macro-econometric models in this country could be grouped into doctoral dissertations by scholars, private sector modellers (including the international agencies) and public institutions efforts (including the academic and research institutes). To the study, a larger proportion of the macro-econometric models for the country were policy focused within the context of short-term to medium-term development initiatives. Specifically, a larger number of the models had been utilised to address macroeconomic issues ranging from price effects, fiscal deficits, macroeconomic instability, inter-sectoral dependences, investments, savings, consumption, resource mobilisation, public sector capital formation, trade flows to balance of payments. In the past, some of these models have explicitly highlighted agriculture, existence and growth of a large public sector, the role of planning and associated policy regime (Klein, 1965; 1983). Most of the models appeared to be Keynesian in so far as components of effective demand were carefully modelled on Keynesian lines. But a closer probing revealed that in most cases the level of activity was supply driven.

Efforts were made to incorporate new information by way of data refinement, changes in the perception of contemporary economic issues, new developments in theory, infrastructures and quantitative methodology (Pandit, 2000; and Valadkhani, 2005). For instance, Guisan (2004) used annual time series data for the period 1960-2002 for a number of countries including China, India and Japan and found that increases in both human and physical capital as well as a higher degree of trade openness contributed to higher GDP growth. In fact, his cross-country econometric results indicated that a higher degree of trade openness not only increased foreign demand and hence GDP but also positively related foreign trade with supply side factors leading to an expansion of industry, building and services. In addition, Guisan (2004) showed that lack of infrastructures and funds had imposed serious restrictions on the supply side of many Asian countries and hence their economic growth including China and India.

In spite of the concerted efforts at model building in India, some short comings had been identified. For instance, it was argued that Krishnamurty and Pandit (1996) in their model of India's trade flows did not conduct any diagnostic check on the estimated equations. In addition, reviews showed that most of the recently constructed models were becoming smaller and targeted at short-run phenomenon (Pandit, 2000; and Valadkhani, 2005).

3.2.9. Macroeconomic Models in the United Kingdom

The UK had a robust track record of model building. Approximately, there were about 202 comprehensive and elaborate macroeconometric models and 11 regional models constructed as at 2000 for the UK economy. About half of these models used high frequency quarterly data series and a similar number incorporated monetary and financial variables with the Treasury model of 1982. As observed in Uebe (1995), most of the UK models did not include sectoral variables in their Input-Output analysis. Others adopted CGE and VAR techniques in estimating their models. Among the regional models, only Foster and Marley (1988) which developed a model for Scotland, included two monetary and financial variables; though they were constrained to using annual data.

3.2.10. Macroeconomic Models in the United States of America

The US had a good stint of macroeconomic models. Between 1939 and 2000, about 350 macromodels and 135 regional models were constructed for the US economy. Of these, the Ciminero et al. (1979) had 869 equations using quarterly data series in their input-output analysis. The model also incorporated 40 monetary and financial variables. Eckstein (1976) included the highest number of monetary and financial variables (202) and 193 variables in his 1981 version.

Fair (2004) developed a multi-country (MC) econometric model for US. In the model, there were 39 countries for which stochastic equations were estimated. There were 31 stochastic equations for the United States and up to 15 each for the other countries. The total number of stochastic equations was 362, and the total number of estimated coefficients was 1,646. In addition, there were 1,111 estimated trade share equations. The total number of endogenous and exogenous variables, not counting various transformations of the variables and the trade share variables, was about 2,000. Trade share data were collected for 59 countries, and so the trade share matrix was 59 by 59. The estimation period began in 1954 for the United States and 1960, as data permitted, for the other countries. The estimation technique was 2SLS and when there were too few observations to make the technique practical the ordinary least squares was used. The estimation accounted for possible serial correlation of the error terms. The variables used for the first stage regressors for a country were the main predetermined variables in the model for the country.

There was a mixture of quarterly and annual data in the model. Quarterly equations were estimated for 14 countries, and annual equations were estimated for the remaining 25. There were quarterly data on all the variables that fed into the trade share equations, namely the exchange rate, the local currency price of exports, and the total value of imports per country. When the model was solved,

the predicted annual values of these variables for the countries were converted to predicted quarterly values using a simple distribution assumption. The quarterly predicted values from the trade share equations were converted to annual values by summation or averaging when this was needed.

From the MC model, the US+ model was developed with an additional 85 stochastic equations. Each of the additional equations explained an exogenous variable and was a fifth order autoregressive equation with the constant term and time trend added. Equations were estimated for all the exogenous variables in the model except for the price of imports, the age variables and dummy variables. Autoregressive equations were estimated from 85 variables and logs were used for some of the variables. The estimation technique was ordinary least squares.

3.2.11. Macroeconomic Models in France

France had 132 macromodels and 9 regional models between 1962 and 2000. Majority of the models used annual data series, while few used quarterly and monthly series. As cited in Uebe (1995), Insee (1976) and Villa et al (1980) included about 202 and 200 monetary and financial variables, respectively, in their equations that were over a thousand. A reasonable number of the models took adequate account of input-output sectoral analysis with Rossignol (1980) including as many as 37 variables in his input-output analysis. A significant drawback of the regional models was the complete exclusion of monetary variables.

3.2.12. Macroeconomic Models in Japan

The Japanese macroeconometric modelling experience started with the Economic Planning Agency piloting the construction of a model with 18 equations, 10 exogenous variables using quarterly data series in 1958. Between 1958 and 1987, about 195 models of the economy had been developed. Ito et al (1992), as cited in Uebe (1995), specified the model with the least number of equations (1), while Kawasaki (1979) modelled 2050 equations, excluding monetary and financial variables using half year data series. Except for the 1980s where most models used annual data, most other models used half year or quarterly data series. Generally, most Japanese models significantly captured monetary and financial variables. In terms of input-output analysis, majority of the models did not capture sectoral activities.

The review of the international experience revealed that there is the need for the new generation of modellers to take into consideration, the current developments in building large scale macro-econometric models. In addition,

the models should be subjected to a number of econometric diagnostic tests. These current developments consisted of improvements in computational capacity, new developments in econometric methods, new macroeconomic theories and advances in the quality and availability of the required data (Bodkin, Klein and Marwah, 1991).

3.3. Macroeconomic Models in Nigeria

In this section we reviewed some of the existing macromodels in the developing countries with special emphases on macroeconomic models developed in Nigeria[2]. Historically, the building of macro-econometric model in Nigeria dated pre-independence. Some pioneering works in this direction were from both the private and public sectors of the economy. While the private sector consisted of mainly the Non-Governmental Institutions and International Agencies on the one hand, the public sector model builders were primarily from the academic institutions including the research institutes such as the Nigerian Institute of Social and Economic Research (NISER), NIEC, etc and other government agencies/institutions like National Planning Commission, Central Bank of Nigeria and National Bureau of Statistics.

Specifically, the introduction of national development plans (NDPs) by successive governments from independence to date as a strategy for promoting rapid economic development of the nation provided the needed drive for developing a number of multi-sector models for projecting the future time-path of the nation's economy.

In short, macro-econometric models that had been developed in Nigeria were directed at the following:

- Output and employment projections;
- Identifying structural changes in terms of growth potentials;
- Price stability and sectoral price effects;
- Impacts of macroeconomic policies (fiscal and monetary);
- Debt and poverty nexus;
- Fiscal deficits;
- Macroeconomic shocks;
- Exchange and lending rates;
- Tax reforms including tariff;
- Investment potentials, among others

[2] There are also some macro models built by Ph.D and MSc students that are not reviewed here.

Some of the known macroeconomic models built to analyse the Nigerian economy in the last four decades included Ojo (1972), UNCTAD (1973), World Bank (1974), Uwujaren (1977), Fair (2004), Oshikoya (1990), Olofin *et al*. (1977, 1985), Ajakaiye (1995) NISER(1983), Soludo (1988, 2002), Iyoha (2003), UNCTAD (1973), Ekeoku N. I. (1984).

The econometric model by Ojo (1972) was aimed at providing some inputs into the preparation of a medium term plan in Nigeria during the first National Development Plan (NDP) (1962-68) and thus, meeting the needs of that particular period. The author estimated the model using a dataset that spanned the period 1951 to 1965. The structure of the model was based on a Keynesian demand determined model in which variables such as private consumption, private investment, exports and imports were endogenised and variables like government consumption and investment expenditures were exogenously determined. The equations captured the agricultural sector (3 equations), foreign trade sector (2 equations) and public sector (4 equations). He specified dynamic equations and employed the two-stage least square technique. He also derived the reduced form of the model and performed the predictability tests. The study showed that the multiplier effect of a change in world economic activity on Nigeria's GDP was very high. However, the study failed to incorporate the monetary sector. Also, the model was unable to incorporate the inflationary effect on macroeconomic variables and there was the absence of production and demand for labour functions.

Further effort at designing a macroeconomic model for Nigeria was carried out by UNCTAD (1973). Annual data spanning between 1955 and 1966 were employed. The model comprised of 37 equations, including 23 behavioural and 14 definitional or identities. 46 variables were identified in the model specification, out of which 10 were exogenous (Mordi 1988). Behavioural equations for both demand and supply side were estimated using the OLS technique. However, the problems with the models ranged from inadequacy of the estimation technique to exclusion of the monetary sector from the model.

The World Bank (1974) model was aimed at stimulating a growth pattern for the economy that was consistent with given development in the agriculture and petroleum sectors. The model, which was basically Keynesian in nature, treated agricultural and petroleum sectors as exogenous variables. A two-gap model was specified with investment/saving functions on the one hand, and the export-import functions on the other (Mordi, 1988). An important feature of the model, according to the authors, was the employment-income component which was used to simulate demand for employment and income in each sector. These

results were then applied to construct national accounts and compute consumption, investment, and employment in succeeding time periods. The model, which contained about 105 relations, could not be considered as one of the conventional econometric models because of its complexities. Apart from the difficulty involved in classifying the relations into behavioural and non-behavioural equations, and determining the parameters of the model from the time series, the model omitted the monetary sector in its analysis, thereby limiting its relevance to monetary policy analysis.

Uwujaren (1977) developed an econometric model of the Nigerian economy aimed at providing inputs into the preparation of the medium-term development plans of the time. The major difference between Uwujaren (1977) and Ojo (1972) was in the inclusion of both the demand and the supply sides of the economy. In Uwujaren (1977), a Harrod–type production function was specified in which capital was constrained. Moreover, as advancement over the Ojo's model, Uwujaren incorporated both money and price blocks into his model. The model was estimated to cover the period 1953 to 1973 using annual data which involved a longer period compared to Ojo's model.

Olofin *et al.* (1977 and 1985) with the support of the Centre for Econometric and Allied Research (CEAR) were efforts at meeting the needs of the Nigerian economy in terms of building a consistent multi-sector planning model that was flexible in forecasting and projecting macroeconomic aggregates for development plans during the 1970s and 1980s. The 2006 model was aimed at generating forecasts for the second phase of National Economic Empowerment and Development Strategy (NEEDS II) 2007-2011. The two macroeconometric models by Olofin *et al* (1977 and 1985) were built for CEAR. The first two were MAC III and MAC IV, which were claimed to be the only operational models of the Nigerian economy, and were the most disaggregated as that time. The origin of these models could be traced to the models earlier constructed by Olofin (1977). Thus, the structure of the models was identical to their precursors, except that a number of refinements and modifications were made in these later versions with a view to obtaining an operational model of the Nigerian economy.

The CEAR models (MAC III and MAC IV) were based on Keynesian postulations of income determination. The models consisted of eight blocks, namely: supply, consumption, capital formation, population and employment, wages and prices, government, financial, and external sectors. The supply block in the CEAR-MAC III model was further divided into nine sub-sectors consisting of: primary (crop, livestock, forestry and fisheries; petroleum and other mining); secondary (manufacturing and crafts); and tertiary (utilities and construction; transport and

communication; government services and other services). In the CEAR-MAC IV model the supply block was further disaggregated into twelve sub-sectors giving a total of nineteen sectors. In both models the basic input-output (I-O) analysis framework was adopted in the production sector, (Mordi, 1988).

The CEAR-MAC III model was made up of 43 stochastic equations and 54 identities, giving a total of 97 endogenous variables, including 28 predetermined (policy) variables. The CEAR-MAC IV model on the other hand, had a total of 137 equations, 76 of which were stochastic and the remaining 61 identities. The behavioural equations of the models were either in simple linear or log forms. Dynamic features were incorporated into the models through extensive use of lags and some first difference specifications. The significance of oil revenue to the Nigerian economy was reflected in the specification of separate equations for this activity. Other salient features of the models were the incorporation of relevant exogenous variables for fiscal or monetary policy analyses.

The estimation technique was principally OLS based on annual data from 1969-1981 with corrections made where necessary for autocorrelation. The linkage of the monetary and financial block to the other blocks in the CEAR models was very weak. The sector was not elaborately specified with the result that an integration of the sector with the others remained unexplored, despite the high level of disaggregation achieved in both models. In addition, the OLS technique was employed to obtain parameter estimates in an inter-dependent economic system. This had the obvious implication of producing parameter estimates which were both inconsistent and biased, although efficient when large samples were used. Attempt was made at addressing the shortcomings identified in the last two models of CEAR (i.e 1977 and 1985) in the 2006 version. For instance, the monetary and financial sector was well linked with the other blocks in the model. However, the model was weak in output *cum* employment linkage due to paucity of employment data.

NISER (1983) assembled some experts to build an econometric model of the Nigerian economy. The model was further reviewed in 1984. The 1984 model consisted of seven blocks, namely: production; balance of payments; demand; foreign trade; employment; price and money. It was made up of 77 equations out of which 44 are stochastic and 33 are identities. The production block comprised of 18 equations, 10 behavioural and 8 identities. Out of the 10 stochastic equations, the agricultural sector had 5, while manufacturing, petroleum, other mining, utilities/building and services had one each. A major achievement of this breakdown was the endogenity of the petroleum sub-sector. The forms of production functions adopted were in general the simple Cobb-

Douglas with disembodied technical progress and a capital requirement Harrod-type production function with capital as the main constraining variable. The last postulation essentially presumed surplus labour. These production functions were applied to other sectors other than the service sector where other arguments were advanced to explain production due to lack of firm labour and capital stock figures.

The demand block was made up of 17 equations, 6 of which were behavioural and 11 were identities. The behavioural equations were for consumption (private and public), investment (private and public), and taxes (direct and indirect). External trade block consisted of 16 equations, 11 behavioural and 5 identities. Out of the 11 behavioural equations, export had 5 for food, raw materials, petroleum and allied products, services and miscellaneous exports; while imports had 6, namely: food, raw materials, capital, manufactured goods, services and other unclassified commodities. The specification for exports adopted the demand approach, while the specification for imports included the level of foreign exchange reserves as explanatory variable to test the hypothesis that this serves as a constraint to the level of import during the period. The employment block contained 6 equations with one identity and the remaining behavioural. Employment in agriculture, manufacturing, petroleum and other mining were modelled. While an aggregate supply function represented by the labour force equation made up the fifth behavioural equation. The price block contained 11 equations, 9 behavioural and 2 identities. A GDP deflator was defined and modelled for each of the sectoral economic activities in the production block, while the specification for the inflation rate was for the overall rate, food prices and accommodation. The money block had 5 equations, 3 of which were behavioural and 2 identities. The behavioural equations were for currency in circulation, demand deposits and savings/time deposits. These represented demand for money equations with their specifications based on the partial stock adjustment procedure. The linkage between the monetary block and the rest of the economy was very weak and blurred. The balance of payments block contained 4 equations all of which were identities.

The estimation procedure employed in the NISER model was a block by block repeated ordinary least squares technique. This served as a major drawback of the NISER model, apart from its lack of discernable linkages among the various blocks, and the absence of elaborate monetary sector block. Thus, the net effect of a policy initiated in one sector (or block) on the other sectors could not be easily diagnosed. This notwithstanding, the NISER model attained one of the highest level of disaggregation ever, of any model of the Nigerian economy.

After the attainment of independence in 1960, the introduction of the five-year life span National Development Plans (NDPs) spanning 1962 through 1985 highlighted the need for a realistic I-O table for Nigeria. Thus, in 1985 Aboyade was commissioned to construct a feasible I-O table by the National Planning Commission/Federal Office of Statistics and this resulted in the 1987 I-O table of Nigeria. Like Carter's 1957 I-O table, Aboyade's work identified the linkages in the economy, the technological coefficients and the Leontief matrix inversion. The 1987 I-O table consisted of over 60 sectors and was used to identify the inter-sectoral linkage effects in the economy.

Similarly, during 1985-1989, the Policy Analysis Department (PAD) of NISER (see Ajakaiye, 1995) on behalf of the Federal Ministry of Industry, Abuja developed the 1985 and 1987 I-O tables. The two tables were used to analyse inter-dependencies of the manufacturing sector with other sectors of the economy. In a nutshell, the two tables identified the growth potentials in terms of export oriented-growth, output expansion, employment generation potentials, final domestic demand potentials, and import replacement potentials. However, the models' ability to track the feedback effects of policies was deficient.

Major work on I-O table was done by the then Federal Office of Statistics (FOS) now the National Bureau of Statistics (NBS) in 1985, 1990, 1995 and 1996. During this period, four I-O tables, 1985, 1990, 1995 and 1996 were constructed with 19 by 19 sectors including government as a separate sector. The tables displayed inter-sectoral dependencies/linkage effects, technological coefficients and the Leontief matrix inversion. The tables had been utilised by various stakeholders such as NISER, scholars, etc. for multi-sectoral planning models in Nigeria. NISER, in 2001 and 2004, updated the NBS 1996 I-O table of Nigeria to serve as inputs to its multi-sectors general equilibrium planning models used to analyse various macroeconomic issues ranging from price effects, employment generation, growth potentials, exchange and interest rates effects, debts, external trade, value added tax and poverty analysis.

Soludo (2002) attempted to evaluate the status of macroeconomic modelling and application to policymaking in Africa. The study reviewed existing models in selected African countries as well as major multilateral policy institutions such as the World Bank, the IMF, and the United Nations Economic Commission of Africa (UN-ECA). The study concluded that since it was impossible not to use some kind of model (implicit or explicit) in policy analysis, formal (explicit) models should be preferred to the rule of thumb or implicit models. The various typologies of models that were either applied or had potential applications for policy in Africa were reviewed, and the strengths and weaknesses of each highlighted. Rather than

being seen as competitors, the study argued that policymakers would be better-off maintaining different model.

Iyoha (2003) attempted to specify, estimate and simulate a medium sized macro-econometric model for the Nigerian economy. Building on the models of Ojo (1972), Olofin (1977), Uwujaren (1977), Gosh and Kazi (1978) and others, Iyoha's model consisted of 5 sectors with 39 equations (20 stochastic and 19 identities). The sectors included: domestic expenditure; government sector; international trade and the balance of payments; production and prices; and the monetary sector.

Using OLS technique and annual time series, he estimated 20 equations and concluded that the results were satisfactory. Historical simulation conducted showed that the performance of macroeconomic model was satisfactory. Also, from the policy simulation, the results showed that 'as in more developed economies, fiscal policy was an effective instrument for counter-cyclical income stabilisation in the Nigerian economy' (Iyoha, 2003, p.173). However, the model failed to take into consideration the impact of reforms in the economy. Also, a model of financial sector was not considered in the study at all.

However, in spite of these efforts at developing a number of consistency multi-sector planning models for the country during the period, modest achievements were recorded. For instance, it had been argued that the nation's four NDPs (1962-1985), National Rolling Plans (NRPs) spanning 1986 through 1998, and the National Economic Empowerment and Development Strategies (NEEDS) 2003-2007, suffered greatly from the absence of macro-econometric model of the Nigerian economy as the basis for consistent projections of forecasts of future levels of key macro-variables of the economy and the inevitable use of an eclectic approach for projections during these periods. Also most of the existing models in Nigeria were estimated with annual data rather than quarterly or monthly. Recent findings showed that annual data were deficient in capturing fundamental changes in the structure of the economy over the years and were generally weak for simulation and forecasting purposes. In addition, annual data usually led to serious doubt on the effective identification of the behavioural relations among economic agents in the short- or medium-term.

Further, the review of macroeconomic models in Nigeria had shown that many of these models were deficient in monetary and financial specifications, output *cum* employment linkages and data frequency. This formed the crux of this study.

Chapter Four:
Methodology and Specification

While some "system of equations" models followed the Keynesian macroeconomic theory, some depicted neo-classical postulations; and others in aligned structuralist or Leontief value added approaches (Diebold, 1998). Among the class of models, the structuralist approach gave relatively adequate attention to the supply side and recognised important characteristics of developing economies. They were also more eclectic and flexible in approach. As a result, an eclectic approach was used in the specifications in this work. However, a number of blocks and equations required specific inclination to either the neo-classical or the Keynesian modeling approach. Since the aim was to mimic the Nigerian economy, such inclinations entailed modifications in approach to suit the specific characteristics of each block and therefore the aspect of the economy concerned. Some of these peculiarities included economic dualism, poor quality of data, underutilisation of resources, considerable unemployment with public sector as the largest employer of labour, dearth of capital and limited technology, high import dependence, weak linkages among sectors, ineffective taxation system and weak institutions.

The model was divided into six blocks namely; supply, private demand, government, external, monetary and financial, as well as price blocks. The overall model contained 20 behavioural equations with 16 identities. Specification and estimation of all the behavioural and linking equations were mainly in nominal forms following standard practices. However, the aggregate supply block and the money demand equation were specified in real terms. The various blocks and identities were described as follow.

4.1. Supply Block

The National Bureau of Statistics (NBS) classified production activities in Nigeria into 33 sectors.[3] But for the purpose of this study, we aggregated all these sectors into two; namely oil and non-oil sectors. The reason for the aggregation was to reflect the dualistic structure of the economy and also to underline the importance of the oil sector as the driver of the economy. In recent times, oil as a percentage of government revenue hovered around 85.0 per cent while oil

[3] See NBS National Accounts Statistics, 2006

export as a percentage of total export was in the neighbourhood of 98.0 per cent. Again, the sector contributed about 25.0 per cent of GDP.[4]

4.1.1 Production

Each of the production sectors was assumed to employ a Cobb-Douglas technology. In a typical Cobb-Douglas production function the main inputs were labour and capital. In the equations that follow, other relevant inputs/factors that determined production in the Nigerian environment besides labour and capital were considered.

4.1.1.1 Oil Sector

This sector embraced oil and gas production. Firms in this sector were largely foreign-owned and production activity was largely capital-intensive, high-tech and import dependent. However, Nigeria belonged to a cartel – the organisation of petroleum exporting countries (OPEC) which gave quota to member countries. As such, while a lot of factors had the possibility of driving production in the sector, including but not limited to foreign demand, foreign lending rate, import of capital goods, etc, it was not clear that they did because Nigeria had to produce in line with assigned quota. It was difficult though to discountenance the potential impact of oil price which determined the accruals to factors of production, and could influence investment decisions of agents in the sector. Given the above, production in the sector was assumed to be driven by OPEC quota (OPEC) and oil price (Po) as follows.

$$\mathrm{Y_o} = \alpha_{0,1} + \alpha_{2,1}\mathrm{P_o} + \alpha_{3,1}\mathrm{OPEC} + \mu_1 \qquad (4.1)$$

4.1.1.2 Non-Oil Sector

This sector embraced all other sectors of the economy besides oil. Key components of this sector were agriculture, manufacturing, building and construction, wholesale and retail, and services. Production in this sector was influenced by cost of funds, which was represented by domestic maximum lending rate. This rate was chosen because participants in this sector were mostly small and medium scale enterprises with low credit ratings, thereby requiring a risk premium in the interest charged on loans. The quantum of credit available to this sector (represented by credit to the private sector) determined to a great extent the production activities. Firms in this sector relied substantially on capital; part of which were domestically available and part of which were imported. As such, both the domestic stock of capital in the non-oil sector and imported intermediate inputs were assumed to impact on production. A key component in

[4] CBN Statistical Bulletin, 2006

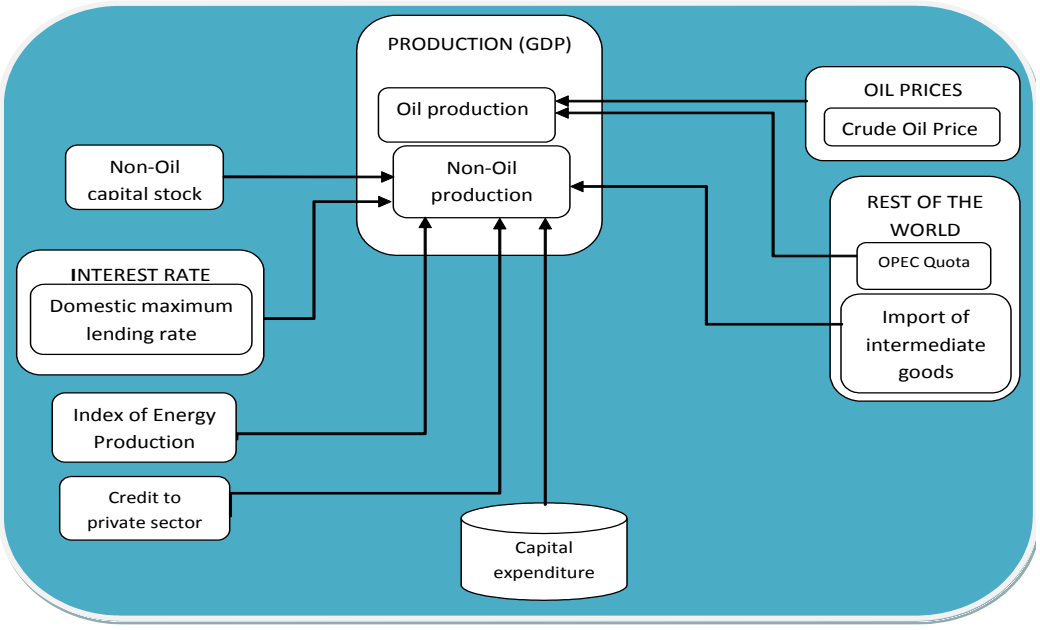
the production process across sectors was energy, without which production activities could be hampered. Thus, the index of electricity production was used as a proxy for energy requirement. Public infrastructure acted as a catalyst to production activities. The ratio of government capital expenditure to total government expenditure was used as a proxy for the level of public infrastructure development. Production in the non-oil sector was, therefore, modelled as a function of credit to the private sector (C_{ps}), domestic maximum lending rate (R_m), capital stock in non-oil (K_n), GDP deflator (P_y), imports (M), index of electricity production (IEP) and ratio of government capital expenditure to total government expenditure (GCR).

$$Y_n = \alpha_{0,2} + \alpha_{1,2}C_{ps} - \alpha_{2,2}R_m + \alpha_{3,2}K_n + \alpha_{4,2}M_i + \alpha_{5,2}IEP + \alpha_{6,2}GCE + \mu_2 \quad (4.2)$$

Identities

Y=YO+YN (1)

Figure 4.1: Flowchart of the Supply Block



4.2 Private Demand Block

Alternative frameworks existed for demand analysis, the most prominent being the Keynesian identity. Modelling of this block followed this identity but captured only private consumption and investment. Government fiscal activities were

captured under a different block to fully account for its relevance as an enabler of growth especially since it constituted a significant part of gross output.

4.2.1. Private Consumption

The key determinants of private consumption in the literature were income and prices. Following Friedman's inter-temporal optimisation theory, income expectations and the distribution of present income among dependants as well as alternative expenditure needed integral determinants of consumption. However, in a cash-based economy, like Nigeria, real money balances could have greater effects on levels and contents of consumption basket. In a significantly import dependent economy, variety and price of imported consumption products depended largely on the exchange rate. However, we modeled exchange rate in terms of relative prices and not simply the unit price of the domestic currency to a particular foreign currency, say the US dollar. With a high emigration rate since the mid-1980s, remittances from abroad had been on the increase and were now a major supplement to household income and consumption for all classes of the populace. Therefore, private consumption (CON) was a function of income (Y), consumer price index (CPI), remittances (RMT) and real exchange rate (REER).

$$\text{CON} = \beta_{0,3} + \beta_{1,3}\text{Y} - \beta_{2,3}\text{CPI} + \beta_{2,3}\text{REER} - \beta_{4,3}\text{RMT} + \mu_3 \qquad (4.3)$$

4.2.2. Private Investment

As in the aggregate supply block, private investment was categorised into investment in oil and investment in non-oil sectors. Given Nigeria's history of macroeconomic instability, the theory of the irreversibility of investment decision was considered suitable relative to orthodox theories of investment. However, important aspects of the accelerator and Keynesian theories were also considered in specific cases.

4.2.2.1 Investment in the Oil Sector

The oil sector in Nigeria operated under a public-private partnership arrangement, which involved contributions from both parties. Government's contribution was captured by the joint venture cash calls and the bulk of private sector contribution came via foreign direct investment. The sector had witnessed considerable disruptions owing to activities of militants. But specifically modeling such disruptions could be difficult on account of poor data. In this study, the impact of disruptions on investement in the oil sector was rather proxied using volatility of production in the oil sector. As in other standard specifications of demand, income and price both featured as determinants. Price in this case took

two forms – domestic prices (CPI) and the price of the product in the international market, viewed as the incentive to investment. Therefore, investment in the oil sector (INV_o) was specified as a function of output variability in the oil sector (Y_{vo}), domestic price level (CPI), oil GDP (Y_o), oil FDI (FDI_o), returns on investment in the oil sector (P_o)[5]. The relationship was specified as:

$$INV_o = \beta_{0,4} - \beta_{1,4} Y_{vo} - \beta_{2,4} CPI + \beta_{3,4} Y_o + \beta_{4,4} FDI_o + \beta_{5,4} P_o + \mu_4 \quad (4.4)$$

4.2.2.2 Investment in the Non-Oil Sector

In the non-oil sector, government influence on private investment came through two channels –credit to government which had potential crowding out effects and government capital expenditure which was assumed to complement private investment. We assumed that agents could (and regularly did) exercise the option to wait in investment decisions when the macroeconomy was too volatile to accommodate their investment. In particular, returns from investment were discounted for sunk costs which were partially or wholly irreversible as well as the probability that other associated costs might not be fully recovered in a difficult-to-predict environment as obtained in Nigeria. In line with the accelerator principle, domestic output played a critical part, but was complemented by investments from outside the economy. Finally, the cost of funds, proxied by the maximum lending rate was also incorporated. Investment in the non-oil sector (INV_n) was, therefore, specified as a function of output variability in the non-oil sector capturing the macroeconomic instability (Y_{vn}), non-oil GDP (Y_n), non-oil FDI (FDI_n), credit to government (C_g), government capital expenditure (GCE), and domestic maximum lending rate (R_m). The functional form of this relationship was specified as:

$$INV_n = \beta_{0,5} - \beta_{1,5} Y_{vn} + \beta_{2,5} Y_n - \beta_{3,5} C_g + \beta_{4,5} FDI_n + \beta_{5,5} GCE - \beta_{6,5} R_m + \mu_5 \quad ...(4.5)$$

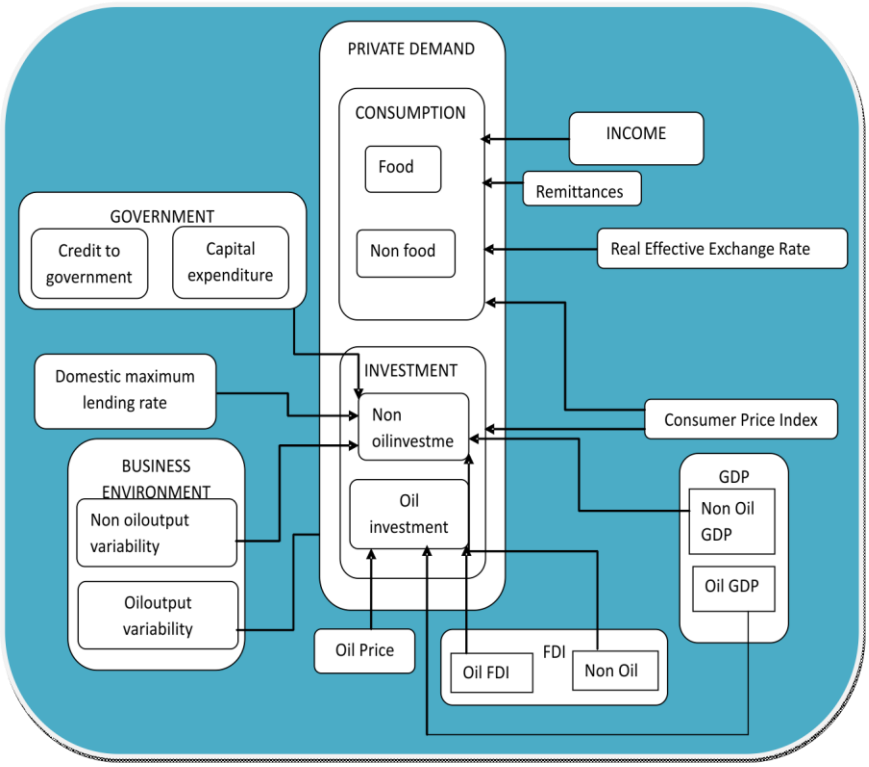
Identities[6]

$$INV = INV_o + INV_n \quad (2)$$

$$DD = CON + INV \quad (3)$$

[5] Proxied by the oil price or ratio of operating surplus to capital stock in the oil sector.
[6] Where CCA represents capital consumption allowance (depreciation)

Figure 4.2: Flowchart of the Demand Block



4.3 Government Block

In developing economies, the specification of the government block was usually Keynesian in approach. Historically, development under the various development plans (1962-1985) was government-driven. Also, the oil boom of the 1970s led to huge investment in public enterprises/infrastructures, which resulted in Dutch disease. Accelerated government spending also led to huge fiscal deficits and debt overhang. The external debt stock as a proportion of GDP was 50.45 per cent in 2002 (CBN, 2006). However, the various policy regimes from 1986 to date introduced economic reform programs with the primary objective of transforming the economy into a private sector-led economy. Government was expected to provide the enabling environment. In spite of these efforts, government expenditure and employment were still substantial. Ideally then, the specification of government should incorporate its overall role as a facilitator of growth in terms of revenue, expenditure, debt service, deficit financing, employment and investor. Two factors limited the extent to which this could be done. First, government actions in many segments of economic life were not known to be driven by logical, known variables. In many cases, government actions did not simply follow textbook principal-agent relationships. The implication was that often, explanatory variables failed to conform to expectations. Deficit decisions

for example might simply not follow structured programme of financing based on available resources within the economy, but might reflect an independent decision to shore up economic activities by an unknown coefficient. Secondly, available data on government activities limited what could be done. So in this block, we considered government expenditure and revenue only and allowed the rest of government to come in as definitions.

4.3.1 Government Consumption Expenditure

Government expenditure was broken down into recurrent and capital expenditure, but only recurrent expenditure was endogenised; capital expenditure was treated as a policy variable. Variations in size and components of capital expenditure were important fiscal policy tools in terms of complementing private investment as well as determining deficits and financing options.

4.3.1.1 Recurrent Expenditure

Government expenditure was generally constrained by its revenue. This was particularly the case in developing countries where access to alternative finance mechanisms was restricted. But in cases where government had access to alternative funding sources, this might not apply. In Nigeria, government regularly borrowed from the domestic banking system to supplement revenue or meet inter-temporal constraints in the budget. Even though it recently constrained itself in terms of financing from the central bank, sale of bonds was now an entrenched practice that helped government in offsetting its expenditure responsibilities. So available financing sources impacted government expenditure. Equally, government recurrent expenditure was necessarily constrained by the its capital expenditure since the two made up the whole. There was both complementation and competition effects of capital expenditure. First, the size of capital expenditure in a particular year constrained what was available for recurrent expenditure in that year. But also, capital expenditures for any year had recurrent implications for subsequent years. Overall, the size of government was huge relative to other sectors of the economy and often exhibited ratchet effect and incrementalism in expenditure behaviour. In this model, recurrent expenditure (GRE) was determined by government capital expenditure (GCE), credit to government (C_g), fiscal deficit financing (FDF) and output (Y).

$$\mathrm{GRE} = \delta_{0,6} + \delta_{1,6}\mathrm{GCE} + \delta_{2,6}\mathrm{C_g} + \delta_{3,6}\mathrm{FDF} + \delta_{4,6}\mathrm{Y} + \mu_6 \qquad (4.6)$$

4.3.2 Government Revenue

Government revenue was categorised into oil and non-oil. Oil revenue included proceeds from crude oil/gas sales (domestic and exports), petroleum profit tax and royalties and others, while non-oil revenue included company income tax, custom and excise duties, value-added tax, independent revenue of the Federal and state governments, and others. The volume of imports influenced the revenue derivable from custom duties. In the same vein, oil revenue was, to a large extent, influenced by the volume of exports. The stochastic bahavioural equations and identities were specified as follows:

4.3.2.1 Oil Revenue

virtually all segments of oil revenue (PPT, royalties, etc) depended on production size. Earnings on oil, particularly for oil sold outside the shores of the land, depended on exchange rate and the price of oil. We then included the most prominent component of oil revenue (PPT) into the equation such that oil revenue (GRV_o) was a function of oil output (Y_o), oil exports (X_o) (measured in millions of barrels per day), and oil price (P_o) as follows:

$$\mathrm{GRV_o} = \delta_{0,7} + \delta_{1,7}\mathrm{Y_o} + \delta_{2,7}\mathrm{NER} + \delta_{3,7}\mathrm{P_o} + \delta_{4,7}\mathrm{PPT} + \mu_7 \qquad (4.7)$$

4.3.2.2 Non-Oil Revenue

The most prominent components of non-oil revenue (GRV_n) included the companies income tax, customs and excise duties and value added tax. The first and last items were functions of domestic output. Even customs and excise duties levied on capital goods and raw materials partially reflected domestic production needs and so were functions of income. But it was important that the role of imports be explicitly accounted for. But the volume of imports acted with the tax rate for imported products – the tariff – to define government revenue. So in the model, government non-oil revenue was determined by non-oil output (Yn), imports (M) and tariff (TAR)

$$\mathrm{GRV_n} = \delta_{0,8} + \delta_{1,8}\mathrm{Y_n} + \delta_{2,8}\mathrm{M} + \delta_{3,8}\mathrm{TAR} + \mu_8 \qquad (4.8)$$

Identities

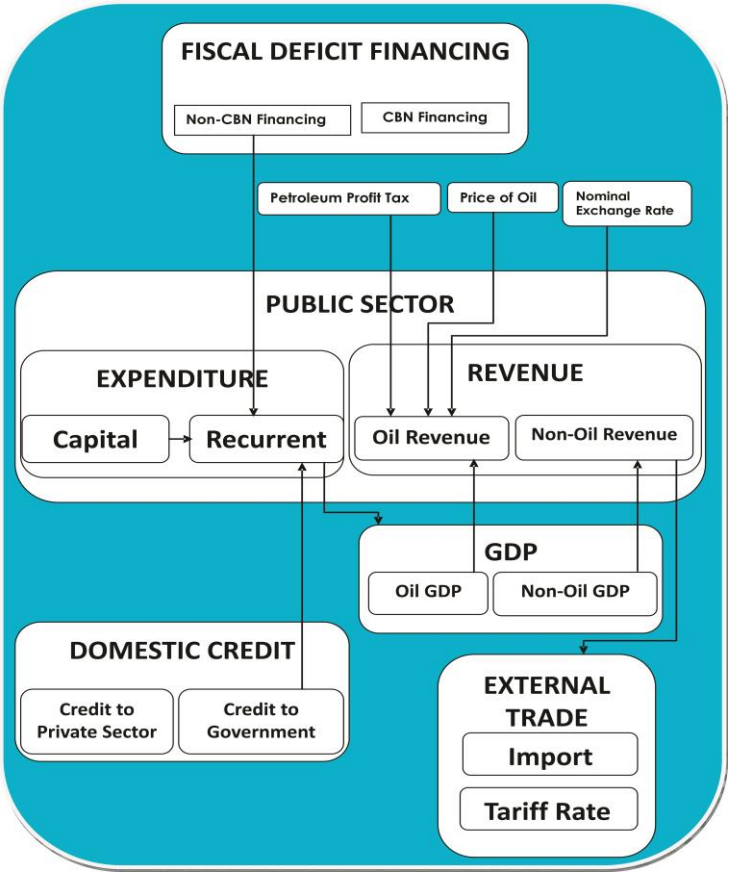
$$\mathrm{GRV} = \mathrm{GRVO} + \mathrm{GRVN} \qquad (4)$$

$$\mathrm{TGE} = \mathrm{GCE} + \mathrm{GRE} + \mathrm{TDS} \qquad (5)$$

$$FD = GRV - TGE \quad (6)$$

$$OFD = FD - FDF \quad (7)$$

Figure 4.3: Flowchart of Government Block



4.4 External Block

4.4.1 Trade Balance

4.4.1.1 Exports

Exports were categorised into oil and non-oil exports. The former represented up to 95 percent of exports. While this presently helped the government to maintain a ready source of revenue, the aim of government was to restructure exports to give advantage and priority to non-oil exports. So even though non-oil exports still constituted a small proportion of total exports, it was nonetheless modelled.

4.4.1.1.1 Oil Exports

Oil exports depended on oil production and as in the supply block, production was in turn determined by quota allowances from OPEC. But in addition to these standard determinants of oil export, it was regularly acknowledged that since most of Nigeria's oil exports were to the OECD, output of those countries critically determined its oil exports. The majority of Nigeria's exports went to the United States; so instead of spreading across to all OECD countries, for the purpose of oil exports, output of the United States was used to proxy foreign demand. So oil exports (X_o) were explained by oil production (Y_o), OPEC quota (OPEC) and the US GDP (Y_{fus})

$$X_o = \nu_{0,9} + \nu_{1,9} Y_o + \nu_{2,9} OPEC + \nu_{3,9} Y_{fus} + \mu_9 \quad (4.9)$$

4.4.1.1.2 Non-oil Export

Modeling non-oil exports was a bit less straightforward. Nigeria's non-oil export items consisted mainly of natural resources and primary products from agriculture; industrial and processed commodities remained insignificant minority. An assumption made in this work was that non-oil exports depended on a supply-constrained domestic non-oil production structure. Such factors as energy supply and domestic credit availability went a long way to determine exports of non-oil items. Since a significant proportion consisted of agricultural products, agricultural production mattered for overall non-oil exports. Changes in the exchange rate impacted returns to exports and could create a positive incentive for exporting. So non-oil exports (X_n) were determined by production in the agriculture sector, the nominal exchange rate (NER) and credit to the private sector (CPS)

$$X_n = \nu_{0,10} + \nu_{1,10} YAGR + \nu_{2,10} NER - \nu_{3,10} CCPS + \mu_{10} \quad (4.10)$$

4.4.1.2 Imports

Imports constituted a significant share of inputs for both domestic production and final consumption. Import demand was traditionally a function of output and price. Income remained relevant whether in relation to imports of capital/intermediate products for further production or in relation to importation of products for final consumption. However, given that a number of importers relied on DMB loans and guarantees for their operating capital, the domestic lending rates became an important factor. Trade policy effects were captured using implicit tariff[7]; in the present model though, the variable played an additional role in representing other prices. In addition to the exchange rate, it

[7] Tariff is scattered across time and products, leading to different averages representing tariff rates. For time series purposes, the ratio of revenue from customs duties to total imports is used as a proxy for tariff rate.

showed the prices of imports and defines capacity to pay for imported products. The stock of reserves was important in defining ability of the economy to fund imports. So on the whole, imports (M) were determined by gross domestic product (Y), nominal exchange rate (NER), domestic maximum lending rate (R_m), implicit tariff rate (TAR) [8] and reserves .

$$M = \nu_{0,11} + \nu_{1,11} Y - \nu_{2,11} NER - \nu_{3,11} R_m - \nu_{4,11} TAR + \nu_{5,11} RES + \mu_{11} \quad (4.11)$$

4.4.2 Remittances

In Nigeria, remittances had become the second largest source of foreign exchange after oil. In 2007, total remittances stood at US$18 billion (CBN, 2008). Studies had shown that the major determinants of remittances included migration trends, wage rates, exchange rates, interest rate differential, political risk, and income.[9] Increased emigration in the 1980s was orchestrated by poor economic conditions in the country at the time. Most of the movements were to developed countries which in turn were critical sources of migrant remittances back to Nigeria. A number of these remittances were directed to consumption, while some were designated for investment. As a result, domestic macroeconomic factors that affected consumption and investment should also drive remittances. The literature also provided for remittances as affected by the economic situation of the migrant's host community as well as the migrant's family back home. So income came in at two levels – host country income and income of sending family. The volume of remittances and even the willingness to remit, at least at the margin, were influenced by the exchange rate. In recent times, performance of the stock market significantly affected remittance inflows. So it was safe to assume that it could proxy for remittance-related investments in other sectors. Therefore, in addition to standard literature, remittances (RMT) in this study were specified as a function of income (Ypc), nominal exchange rate (NER), stock market capitalisation (SMK) and output of host countries proxied by output of OECD countries (Y_{foecd})

$$RMT = \nu_{0,12} + \nu_{1,12} YPC + \nu_{2,12} NER + + \nu_{3,12} SMK + \nu_{4,12} Y_{foecd} + \mu_{12} \quad (4.12)$$

Identities

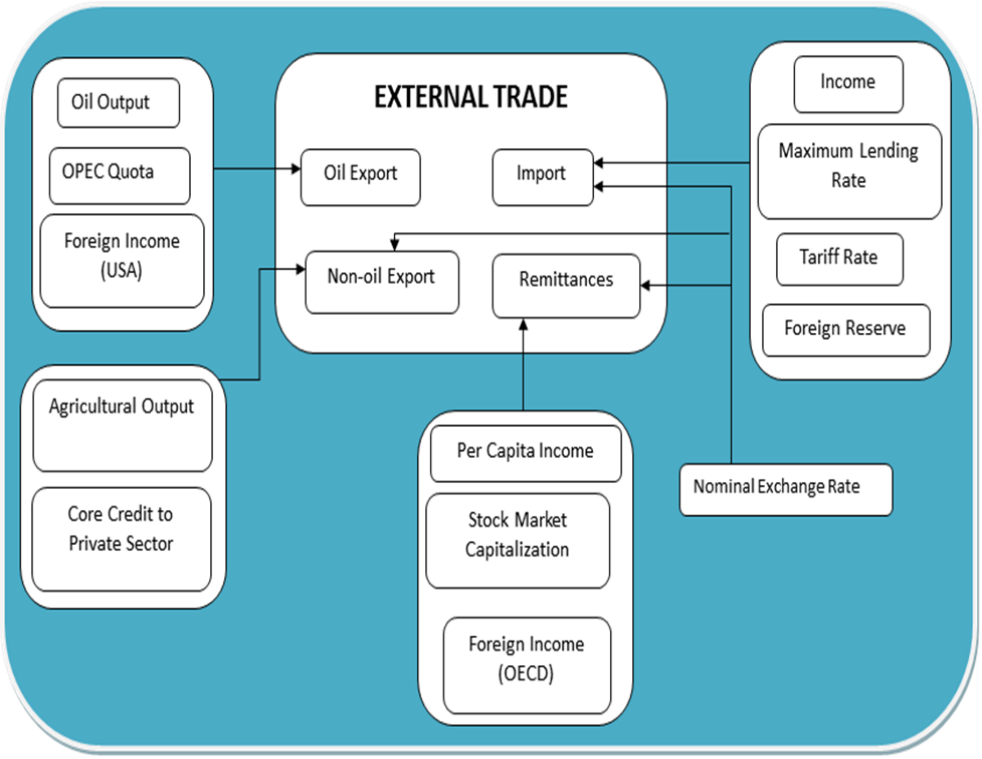
$$X = X_O + X_N \quad (8)$$

$$CAB = X\text{-}M + RMT \quad (9)$$

[8] $TAR = \left[\left(\frac{ID}{M}\right)100\right]$ where ID is import duties and M is total imports.

[9] See Tomori and Adebiyi (2007)

Figure 4.4: Flowchart of External Block



4.5 Monetary and Financial Block

The standard approach to modelling money demand had, in recent times, come under strong criticisms due to perceived instability in the velocity of demand for money in an economy. Although the debate on money demand in Nigeria was inconclusive, it was an acknowledged fact that currency outside banks was relatively high. Therefore, specifications in the monetary block in this work began with the money supply identity. An additional advantage of the supply approach was that the components were measurable and consistent with the CBN accounting system. The approach used the neo-classical identity of money supply as the sum of balance sheet of the banking system. The balance sheet consisted of net foreign assets, net domestic credit and other assets (net). Other assets (net) were assumed to be a residual in the money supply identity. Following the literature, the most pervasive determinant of the different components of money supply was money market interest rates. The size of government in Nigeria and the consequent relevance of fiscal deficits in the determination of money supply were also captured in the equations. Real demand for money balances function was specified as the mirror image of supply and the block was closed by equating both.

4.5.1. Net Foreign Assets

Net foreign assets (NFA) comprised the net foreign assets of the CBN and those of deposit money banks (DMBs). Theoretically, net foreign assets were driven by the nominal exchange rate (NER), reserves (RES), imports (M) and exports (X). Nominal exchange rate was the price incentive for increasing or decreasing NFA, imports and available reserves determine investments or divestments in NFA while exports were the means of enriching NFA.

$$NFA = \phi_{0,13} + \phi_{1,13}X_n - \phi_{2,13}M + \phi_{3,13}RES \pm \phi_{4,13}NER + \mu_{13} \quad (4.13)$$

4.5.2. Net Domestic Credit

Domestic credit normally consisted of credit to the private sector and credit to government. In this work, credit to the private sector was endogenised while credit to government was further divided into two depending on the source – credit to government from the CBN and credit to government from the DMBs. The size of CBN financing for any given year therefore depended on the size of the deficit and the size of credit to government from other sources. Given Nigeria's fiscal federalism and the institutional relationship of the Federal Government to the CBN, the CBN statutorily provided credit to only the Federal Government. States and local governments often accessed loans from DMBs. Like other aspects of the government block, credit to government from the CBN was exogenised to reflect independent decisions by the Federal Government to access it for fiscal regulatory and other purposes and so was not endogenously modelled. Besides, government's access to CBN credit had recently been limited by fiscal rules. So it was obtained as a residual from modelling credit to the private sector.

4.5.2.1 Credit to the Private Sector

Determinants of credit to the private sector in the literature included gross output, lending rate, credit to government and total deposit liabilities. Output and the lending rate served as income and price variables for credit to the private sector. Credit to government for a typical capital-constrained developing country crowded out private borrowing as government competed with the private sector for limited cash balances. Total deposit liabilities (TDL) formed the base for all credits; its size therefore became a limiting factor for the size of aggregate domestic credit.

$$CCPS = \phi_{0,14} + \phi_{1,14}Y - \phi_{2,14}R_m - \phi_{3,14}C_{gdmb} + \phi_{5,14}TDL + \mu_{14} \quad (4.14)$$

4.5.2.2 Credit to Government from the DMBs

The banking sector was actively involved in providing credit to all tiers of government. Over time, government's inclination to access DMB credit had tended to depend on central bank's policies on public funds with the DMBs. Sub-national governments particularly relied on credit from the DMBs given that they did not have statutory access to credit from the central bank. This way, credits to lower tiers of government often competed with credit to the private sector. DMBs credit to government (C_{gdmb}) was determined by total deposit liabilities of the DMBs (TDL) which acted as the base. Treasury Bills rate was brought in as the returns for alternative investment opportunities for DMBs assets and so related negatively with credit to government. The defining demand factor for credit by all tiers of government was total expenditure. So it was also brought in as a determinant of credit from DMBs.

$$C_{gdmb} = \phi_{0,15} + \phi_{1,15}TDL + \phi_{2,15}TBR + \phi_{3,15}TGE) + \mu_{15} \quad (4.15)$$

4.5.3. Demand for Real Money Balances

Demand for real money was modelled to reflect the three basic pruposes for holding cash balances – transactions, precautions and speculative. Output and price were prominent among the variables that defined transactions and precautions motives while the all-share index and interest rate differential captured returns to alternative investment openings for money. So real money demand was specified as a function of output (Y), consumer price index (CPI), all-share price index (ASI) and interest rate differential (IRD).

$$Md = \phi_{0,16} + \phi_{1,16}Y - \phi_{2,16}CPI - \phi_{3,16}ASI + \phi_{4,16}IRD + \mu_{16} \quad (4.16)$$

Identities

$$CG = CGCBN + CGDMB \quad (10)$$

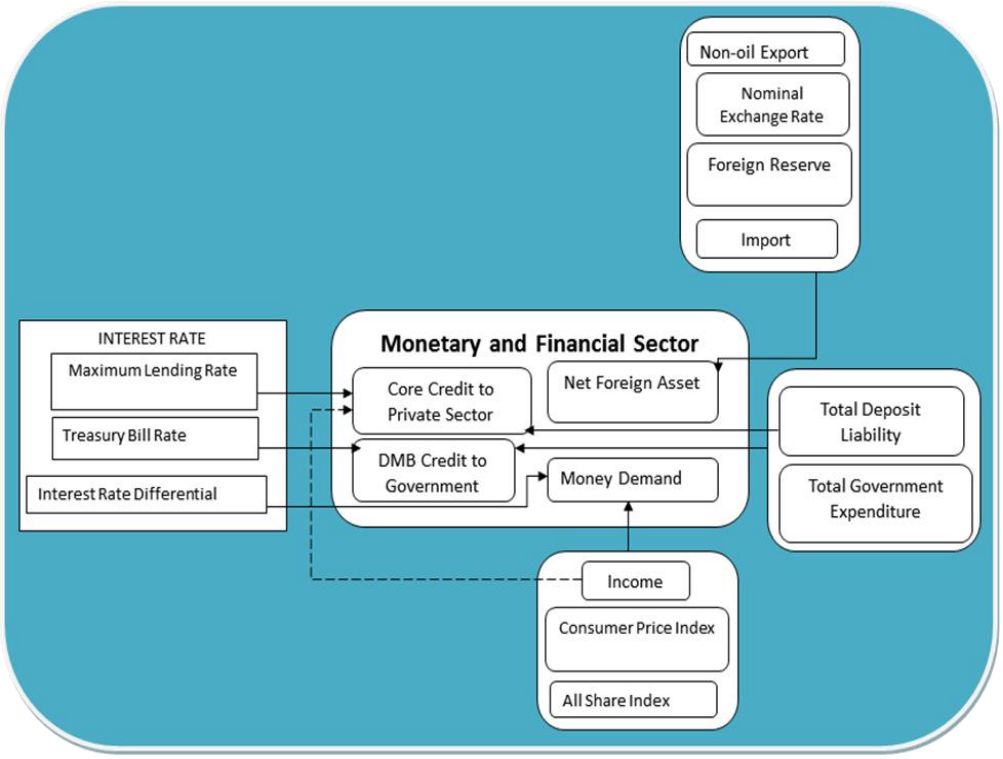
$$NDC = CPS + CG \quad (11)$$

$$Ms = NFA + NDC + OAN \quad (12)$$

$$Md = Ms/P \quad (13)$$

$$Md = Ms \quad (14)$$

Figure 4.5: Flowchart of Monetary and Financial Block



4.6 Price Block

Prices in Nigeria were not entirely market determined and free of any intervention. Given the size and structure of the informal economy, a number of underground institutions interplayed to set wages and prices. Unions and associations, often by a combination of sanctions and incentives influenced the behaviour of their members and ultimately influenced the direction and magnitude of price changes. Public sector wage setting and intervention in price setting were also familiar phenomena. Consequently, prices were often sticky downwards. However, as in every market economy, the forces of demand and supply remained an integral part of price-setting in Nigeria and conventional laws of prices still obtained. As a result, the modeling approach adopted in the price block was structuralist.

The price block comprised major price indices and deflators (consumer price index and output deflator), exchange rate and interest rates. Emphasis in the block was laid on proper linkages within other blocks and with the rest of the model.

4.6.1. Headline Consumer Price Index

Headline consumer price index captured the overall trend in prices of final demand products. Even though the National Bureau of Statistics splitted the index into food (non-core) and non-food (core) CPI, the two consumer price indices are aggregated in the model. This was because most policy analyses were based on the overall index, rather than individual components of the index. Given Nigeria's high import dependence and the probable exchange rate pass-through, the exchange rate was considered an important variable in the determination of the headline consumer price index. The contribution of Government to GDP was relatively high and so was the impact of its expenditure on consumer prices. Activities of DMBs in the setting of the lending rate influenced money supply and liquidity and therefore consumer prices. A significant part of price changes in Nigeria was assumed to be the outcome of both demand pressure and supply constraints. Overall productivity in the economy generally fell short of aggregate demand and so was heavily complemented by imports. Such supply constraints manifested in the difference between potential and actual output. Demand pressure on the other hand, mounted with increased demand by agents – in private consumption and government expenditure. Of course, the impact of such pressure was fuelled by domestic money supply. Thus, headline CPI was specified as a function of nominal exchange rate (NER), domestic maximum lending rate (R_m), private consumption (CON), output gap (Y_g), total government expenditure (TGE), and money supply (M_2).

$$\mathrm{CPI} = \sigma_{0,17} + \sigma_{1,17}\mathrm{NER} - \sigma_{2,17}\mathrm{R_m} \pm \sigma_{3,17}\mathrm{CON} + \sigma_{4,17}\mathrm{Y_g} + \sigma_{5,17}\mathrm{TGE} + \sigma_{6,17}\mathrm{M_2} + \mu_{17} \quad (4.17)$$

4.6.2. Nominal Exchange Rate

A major theoretical framework for external sector analysis in an open economy was the uncovered interest parity (UIP). However, there were limitations to the adoption of wholesale UIP reflecting extent of capital account liberalisation, interest rate regimes and developments in other macroeconomic fundamentals. Nigeria's exchange rate policy had moved from a fixed to a fairly liberalised regime, with occasional intervention by monetary authorities. Consequently, nominal exchange rate was modelled using a modified UIP. In addition to income and interest rate differential, shifts in domestic nominal variables like money supply and inflation were known to influence the exchange rate. Government expenditure and oil price were included to reflect the considerable weight of fiscal actions and the relative dependence of the economy on one natural resource respectively, on monetary outcomes. Thus, the nominal exchange rate (NER) was determined by real money supply (Ms), GDP (Y), interest rate

differential (IRD), consumer price index (CPI), total government expenditure (TGE), and oil price (P_o).

$$NER = \nu_{0,18} - \nu_{1,18}Ms + \nu_{2,18}Y - \nu_{3,18}IRD - \nu_{4,18}CPI + \nu_{5,18}TGE + \nu_{6,18}P_o + \mu_{18} \quad (4.18)$$

4.6.3. Domestic Maximum Lending Rate

Theoretically, the lending rate within an economy was determined using a mark-up on the central bank monetary policy rate. Sometimes, the practice was different though. The process of the determination of this mark-up was a combination of several influences on the banking sector. In Nigeria, with a relatively high cost of doing business, inflation rate, macroeconomic instability and other risk factors, banks were continually under pressure to ensure that returns on loans and advances covered the net present value of funds as at the time of repayment. Consequently, the margin between the policy rate or the savings rate and the lending rate was often very high. Monetary authorities usually raised policy rates in order to reduce excess liquidity and thereby curb inflation. This was consistent with the understanding in theory that money supply affects the lending rate. Given that the economy was relatively import-dependent, exchange rate should also be a determinant of the lending rate. However, for the purpose of this work, the determination of the lending rate was limited to monetary variables, particularly because the empirical determination of the size of structural impediments that affect bank mark-up could be imprecise. Thus, domestic maximum lending rate (R_m) was specified as a function of inflation (INF), monetary policy rate (MPR), and money supply (M_s).

$$R_m = \phi_{0,19} + \phi_{1,19}INF + \phi_{2,19}MPR - \phi_{3,19}M_2 + \mu_{19} \quad (4.19)$$

4.6.4. GDP Deflator

Output deflator would naturally follow changes in real output relative to changes in domestic price. In an open economy though, determinant prices were not only domestic but would include those filtering into the domestic economy from exchange rate changes. So output deflator (P_y) was determined by consumer price index (CPI), nominal exchange rate (NER), and output (Y).

$$P_y = \sigma_{0,20} + \sigma_{1,20}CPI + \sigma_{2,20}NER + \sigma_{3,20}Y + \mu_{20} \quad (4.20)$$

Identities

$$INF = (((CPI - CPI(-4)) / CPI(-4)) \quad (15)$$

$$MLR = RRM + INF \quad (16)$$

Figure 4.6: Flowchart of the Price Block

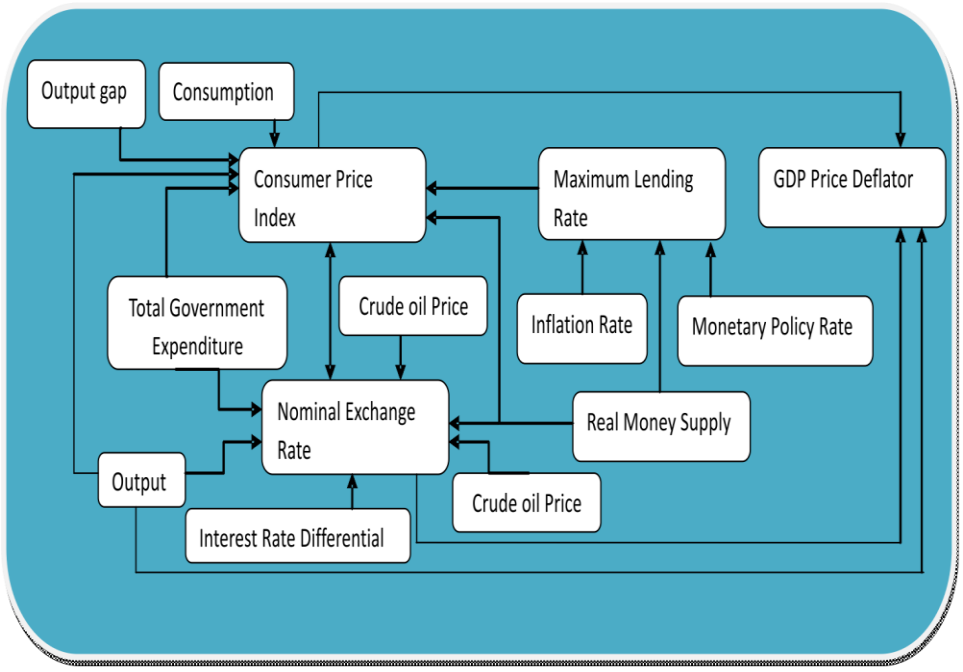
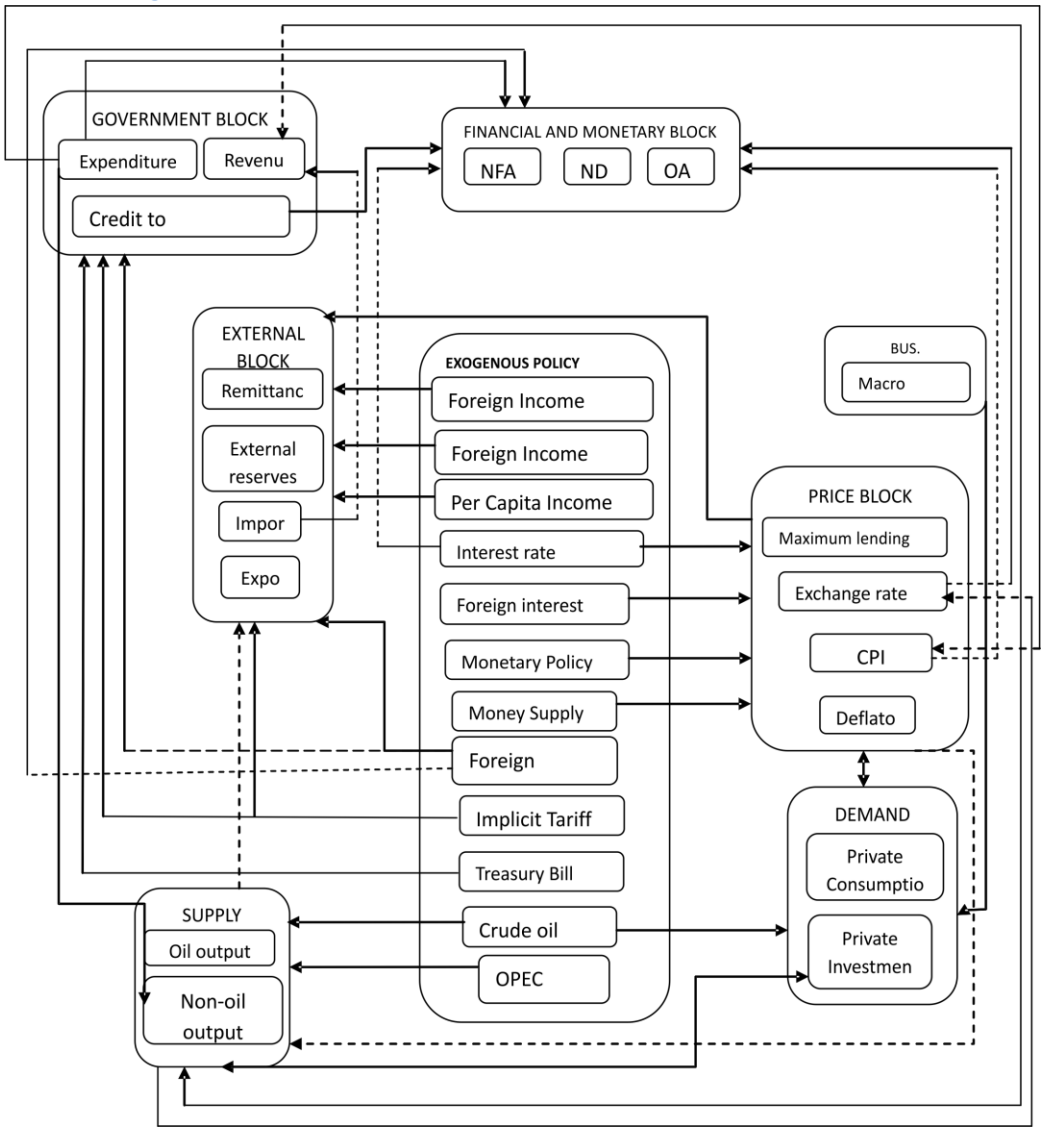


Figure 4.7: Overall Flowchart of CBN Macroeconometric Model



4.7 Data Requirements

The two main sources of data used in this model were the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN). Other sources included the Ministry of Finance, Debt Management Office (DMO), Organization of Petroleum Exporting Countries (OPEC), *OECD.Stat Extracts* and International Financial Statistics (IFS).

Data used for estimation and simulation in the model spanned 1985Q1 – 2007Q4. Whereas some of the datasets were used as reported by the responsible

institutions, others were generated through extrapolation from their annual series. This was carried out bearing in mind the importance of data attributes of the affected datasets in order to derive extrapolated series with credible economic interpretation. 1990 was chosen as a common base year for all indexed series, resulting in the need to rebase some of the data sets. The choice of 1990 was consequent on its use as the base period for National Accounts statistics reported by the National Bureau of Statistics (NBS), especially in the case of gross domestic product (GDP).

The choice of quarterly series was predicated on two crucial factors. Firstly, sufficient degrees of freedom relating to number of observations was critical, especially when estimating over-parameterised models. The Nigerian case was such that annual data series hardly dated back beyond 1970. Secondly, for monetary policy purposes, annual data results could hardly hold sway for a model conceived to track economic developments which, invariably, affected the financial sector. Generation of high frequency (quarterly) datasets from low frequency (annual) series was, thus, carried out on E-views based on the econometric strength of the software. Keen attention was given when disaggregating flows and stocks as well as useful guides on linkages, which were indicated in the model identities. In the study, real data sets were used for estimation and consequently, for simulations. Monetary and financial aggregates were deflated using the all item consumer price index, while other nominal macroeconomic datasets were converted to real indices using the implicit gross domestic product deflator. All variables, except interest rates, were in logarithms. Detailed explanation on the data generation and related issues were discussed in Appendices 1 and 2.

4.8 Estimation Techniques

Different techniques subsisted for model estimation included among others least squares techniques (LS), maximum likelihood (ML) and autoregressive techniques (AR). The choice of an estimation technique depended on the size of the model, data availability and recursive nature of the variables. In estimating this model, however, ordinary least squares technique was adopted. The choice of OLS was premised on the robustness of the technique and the size of the model.

The time series properties of the variables were examined using Augmented Dickey Fuller test. The order of integration was tested and, thereafter, co-integration tests were carried out to determine the long-run relationships among the variables. The error correction modelling (ECM) technique was adopted for the various stochastic equations in the model to incorporate long-run economic relationships. The model was then solved as a system of equations. The estimated

model was evaluated to ensure that the parameters were theoretically consistent and statistically satisfactory. Root Mean Square Percentage Error (RMSPE) and Theil inequality (U) were used to evaluate within-sample performance.

Chapter Five:
Empirical Analysis

5.1 Time Series Properties of the Variables

Unit root tests were performed on all the variables using the Augmented Dickey-Fuller (ADF) test, and the results were presented in appendix 3. Most of the variables were integrated of order 1. A few like government revenue from oil, oil output volatility and inflation rate were integrated at level forms i.e. I(0) while some others like credit to the private sector, oil and non-oil outputs, government recurrent expenditure, petroleum profits tax, total government expenditure and money supply were integrated of order 2 i.e. I(2).

In testing for co-integration, the study employed the Engle-Granger two step algorithm. Under this approach, each of the stochastic equations was estimated in levels (static model) and their respective residuals generated. Unit root tests were then performed on the residuals in level using ADF test. If the residual was stationary in level, it implied the existence of co-integration. The results, though not reported here, indicated the existence of co-integration in most of the equations. Thus, each existing linear co-integration relationship was represented as an error correction model (ECM).

5.2 Estimation Results

5. 2.1 Supply Block

Data constraints prevented the estimation of employment equations leaving estimated supply block with only two equations: oil and non-oil output. The results of the estimation were presented in tables 5.1 and 5.2. For the oil sector, oil price and OPEC quota allocation to the country played critical roles in the determination of oil GDP. For non-oil output, imports of intermediate inputs happened to be the most critical determinant, remaining significant between the second and fourth quarters. Most other explanatory variables were only marginally relevant. Most estimation in the supply block followed an AR process.

5. 2.1.1 Oil Output

The final estimated oil GDP equation was specified as a function of its lag value, oil price and OPEC quota to the country. Value added in the oil sector (Yo) were highly responsive to oil price (Po) and OPEC quota (OPEC), which were determined mainly by factors exogenous to the economy. The results also showed that a 10 per cent change in crude oil price would bring about approximately 2.4 percentage change in oil sector value added in the short run.

The magnitude of the output change with respect to OPEC quota wss smaller than the price effect. In other words, the result suggested that oil GDP was more sensitive to price changes than OPEC quota. Disequilibrium in the long-run relationship between oil production and its determinants automatically adjusted at the rate of 14 per cent per quarter.

Different test statistics for the model confirmed the robustness of the estimates. The model explained about 34 per cent of the variations in output of oil and the Durbin-Watson autocorrelation coefficient at 2.01 indicated the absence of autocorrelation among the explanatory variables. Relevant information criteria confirmed there are no specification errors.

Table 5.1: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NYO)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NYO(-1))/(PY(-1))/100)))	0.442654	0.088991	4.974147	0.0000
D(LOG(NPO))	0.238248	0.058545	4.069485	0.0001
D(OPEC(-3))	0.041186	0.046385	0.887924	0.3769
ECM_YO(-1)	-0.143215	0.043424	-3.298055	0.0014
Adjusted R-squared	0.322787	Durbin-Watson stat		2.011189

5.2.1.2 Non-oil Output

Attempt to specify and model non-oil output to closely follow conventional Cobb-Douglas production function was not successful as labour data was not available. The stock of domestic capital in the non-oil sector showed up as important in determining non-oil output. Being more diverse, the determinants of non-oil output were also relatively more diverse. Besides capital stock, some of the most important determinants related to access and cost of credit – quantum of credit to the private sector and the maximum lending rate. These findings were akin to the predictions of gap models regarding the place of capital and related constraints that affected productivity in developing countries and reflected concerns about supply-side structural impediments to growth that were expressed by several studies in the past. Intermediate goods imports also played a very significant role in determining value added in non-oil production. This was consistent with widely-held notion of Nigeria as an import-dependent economy, with both import of intermediate and final products playing key roles in

determining production and consumption in the economy. In contrast to the positive roles played by many of the variables listed so far, government capital expenditure did not seem to help growth. This was an important finding given the relatively large size of government and the implications of the annual budget on growth. Even though the coefficient in this case was relatively weaker than in many of the previous variables, it was nonetheless significant and raised concerns about the public-private complementarity view of public expenditure in Nigeria. Low quality and efficiency of the expenditures hampered their overall effectiveness. Disequilibrium in the long-run relationship between the dependent and explanatory variables was corrected at the rate of about 6 per cent per quarter.

Table 5.2: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NYN/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG((NYN(-1))/(PY(-1)/100)))	0.359693	0.066959	5.371820	0.0000
D(LOG(NCCPS/(PY/100)))	0.099591	0.025852	3.852383	0.0002
D(LOG((NCCPS(-4))/(PY(-4)/100)))	0.058242	0.024382	2.388755	0.0191
NRM-INF	-0.000415	0.000133	-3.120963	0.0025
D(LOG(NKN/(PY/100)))	0.155109	0.019052	8.141271	0.0000
D(LOG((NMI(-4))/(PY(-4)/100)))	0.014543	0.008442	1.722736	0.0885
D(LOG((NGCE(-1))/(PY(-1)/100)))	-0.054671	0.029076	-1.880321	0.0634
ECM_YN(-1)	-0.060582	0.023755	-2.550270	0.0125
C	0.011534	0.003032	3.804121	0.0003
Adjusted R-squared	0.739174	Durbin-Watson stat		1.768629

5.2.2 Private Demand Block

Private demand block consisted of three equations namely – private consumption and investments in the oil and non-oil sectors. While consumption was sticky upwards as predicted by standard consumption models, volatility mattered for both oil and non oil investments. Again, increasing credit to government did not seem to help non-oil private investment. Overall, price variables did not drive private demand.

5.2.2.1 Consumption

The original specification of the consumption equation followed a standard demand function with price and income as key explanatory variables. However, while income was significant in the parsimonious equation, coefficients of price variables were not. The final equation in table 5.3 indicated that in addition to income, remittances and real deposit rate affected consumption. With the rudimentary development of and poor access to effective credit system in the economy, there was little reference to money and the financial market in the determination of consumption. The real deposit rate was the only relevant financial indicator and served to indicate willingness to forgo current consumption given potential returns from such decision. The surge in remittances was a recent development. Despite this, remittances impacted on consumption. Of course like most other variables in the study, previous levels of consumption were very important in defining current levels of consumption.

The test statistics for the model indicated that 41 per cent of the variations in food consumption was explained by the model and the Durbin-Watson statistic at 1.92 indicated the absence of autocorrelation among the explanatory variables. Adjustment to short-term disequilibrium in consumption was significant at the rate of 19 per cent per quarter. Also, relevant information criteria confirmed that the model was correctly specified.

Table 5.3: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NCONS)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NCONS(-1))/(PY(-1))/100)))	0.437234	0.095485	4.579058	0.0000
D((LOG((NCONS(-2))/(PY(-2))/100)))	0.187777	0.101474	1.850496	0.0676
D(LOG((NY)/(PY/100)))	0.823797	0.337652	2.439782	0.0167
D((LOG((NY(-4))/(PY(-4))/100)))	0.600186	0.343248	1.748551	0.0839
D((LOG((NRMT(-4))/(PY(-4))/100)))	0.033763	0.019575	1.724818	0.0881
NRD-INF	-0.000408	0.000231	-1.766018	0.0809
ECM_CONS(-1)	-0.194622	0.045145	-4.311060	0.0000
C	-0.022078	0.009246	-2.387850	0.0191
Adjusted R-squared	0.365544	Durbin-Watson stat		1.915539

5.2.2.2 Oil Investment

Mirroring the oil production sector, investment in the oil sector was driven by both internal and external factors, mainly domestic production of oil, and oil price. The oil sector in Nigeria was apparently foreign-driven and the formulation and estimation of the oil equation in this work tried as much as possible to incorporate this fact. However, such variables like foreign direct investment included in the specification did not appear significant or correctly signed and so had to be dropped. In contrast, investment in the oil sector was largely dependent on its previous values. In addition to the lag of the dependent variable, two variables – oil output volatility in the sector and oil price were critical determinants of oil investment. Oil output was potentially the most important determinant, with investors taking stock of trends in oil output to come to decisions about investment. Expectedly, the impact of oil output indicated rationality on the part of investors who ploughed back a sizable chunk of outputs from the sector. Oil investment was responsive to output from the sector but was only significant after four quarters. As an indicator of instability, oil volatility was brought in to proxy for the disruptions in production in the sector. For some years in the immediate past, there had been significant disruptions in oil production owing to activities of militants. Volatility in oil production proxied for the impact of such disruptions on investment in the oil sector and true to expectations, it significantly and negatively influenced investment in the sector. Oil price impacted investment too, but only minimally. In fact, the coefficient was only significant at about 20 per cent – higher than conventionally acceptable levels of statistical significance. The overall oil investment result confirmed the pre-eminence of consideration for sunk costs, irreversibility of investment decisions and the relative weight assigned to instability in macro environment by investors in any sector. In fact, the relative insignificance of oil price was such that one could safely conclude that investors in the sector were not particularly influenced in their decisions to invest or not by the direction of movements of market prices at any point in time, but looked at long term profitability which might not be directly related to immediate prices. It implied that even when oil prices were low, previous investments continued to be serviced and a fall in the price of oil might not necessarily lead to fall in investment in the sector. The model showed that correction for short-term disequilibrium in oil investment was about 24 per cent per quarter.

Table 5.4: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NINVO)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NINVO(-4))/(PY(-4))/100)))	0.272649	0.090961	2.997426	0.0035
D((LOG((NYO(-4))/(PY(-4))/100)))	0.309833	0.127884	2.422758	0.0174
YVO(-4)	-0.562925	0.287213	-1.959959	0.0531
D(LOG(NPO))	0.112087	0.085388	1.312684	0.1926
ECM_INVO(-1)	-0.241179	0.068433	-3.524326	0.0007
Adjusted R-squared	0.245232	Durbin-Watson stat		1.716175

5.2.2.3 Non – Oil Investment

Estimates as presented in table 5.5 also confirmed that risk was an important factor in investment decisions in non-oil investment. Domestic output volatility was significant in determining investment in the non-oil sector. Again, this confirmed risk as an important factor in investment decisions in the country on the whole. The Nigerian economy was regularly rated among the most volatile economies in the world. Several segments of economic, political and social volatilities contributed to the overall perception of the economy as being very volatile.

In addition to risk, output and the lag of the dependent variable were equally significant in the determination of investment. The impact of the lag of the dependent variable reflected inter-temporal dependence of investment; with the level of investment at any one period determining that in another and the volume of output being important in indicating the share of investment. Foreign direct investment and credit to government were also important determinants of investment in the non-oil sector; the former indicated the exposure of the domestic economy to the external sector and the latter showed the relative crowding out of private investment by public access to funds. Interestingly, while crowding out could be proven, complementarity of government capital expenditure on private investment could not be established. In fact, government capital expenditure though in the specification, could not be shown to have impacted on private investment. Again, monetary variables could not be confirmed to be as important as real variables. Domestic maximum lending rate in particular was not significant even though it was rightly signed. It had to be

dropped from the final model. Table 5.5 showed the estimated coefficients of non-oil investment in the model.

Table 5.5: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NINVN)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NINVN(-4))/(PY(-4))/100)))	0.246828	0.091030	2.711508	0.0080
D(LOG((NYN)/(PY/100)))	0.735684	0.226828	3.243348	0.0017
D((LOG((NFDIN(-4))/(PY(-4))/100)))	0.026096	0.016853	1.548406	0.1251
YVN	-1.166607	0.556624	-2.095862	0.0389
D((LOG((NCGM(-2))/(CPI(-2))/100)))	-0.159444	0.115320	-1.382622	0.1702
ECM_INVN(-1)	-0.153489	0.055848	-2.748341	0.0073
Adjusted R-squared	0.258737	Durbin-Watson stat		1.790854

5.2.3 Government Block

Government was a significant component of gross output in the Nigerian economy, being second only to private consumption. Consequently, it was accounted for within the aggregate demand block. But given the unique nature of government in Nigeria (as in most developing countries), it became necessary to model it separately. In this study, government capital expenditure was exogenised, while government recurrent expenditure, as well as oil and non-oil revenues were endogenised.

Interestingly, while government recurrent expenditure was linked to aggregate growth and oil revenue was linked to oil output, it could not be confirmed that non-oil output affected non-oil revenue. Some components of aggregate output like imports influenced government non-oil revenue. But that was all. Conversely, oil output impacted government revenue from oil and government expenditure seemed to grow with output growth. Experience showed that the likes of debt service (whether domestic or external) responded only to their lags and to the stock of debt and were, therefore, not linked to domestic output either. In the present effort, debt services were exogenised. The implication was that government survived despite and only marginally relied (if at all) on the real

sector. The implication of this, both for model simulation and for policy design, was not trival.

5.2.3.1 Government Recurrent Expenditure

The specification of the recurrent expenditure equation originally incorporated both financial and real sector variables. Some of the variables in the model included credit to government, government capital expenditure, fiscal deficit financing and gross output. The idea behind government capital expenditure is that most capital expenditures had recurrent implications and so would tend to ratchet up recurrent expenditures. The parsimonious model indicated that beside the lag of the dependent variable, only two variables significantly impacted on recurrent expenditure – output and government capital expenditure. The duo of credit to government and fiscal deficit financing – both indicating similar influences of government – were not significant. The pattern in most (particularly the lower) tiers of government was to borrow from DMBs at critical times to finance recurrent expenditure. It was therefore assumed that the size, pattern and availability of financing for deficits would influence the size and trends in recurrent expenditure. But this could not be established. The implication was that though government might access different financing regularly, its recurrent expenditures were not tied in any way to these. Rather, on the aggregate, given the nature of some of the items in the recurrent expenditure list, consideration for inclusion of these items for most governments was hardly about credit availability or financing options.

Budgeting in Nigeria had historically been incremental---and expenditure had seemingly followed. Budget particularly was mostly the addition of a factor to the budget of the previous year. It was, therefore, no surprise that the coefficient estimates indicated a ratchet effect on government recurrent expenditure. The 'ratchet factor' regularly jumped by multiples during booms and stayed up during troughs. Adjustment rate to disequilibrium of government expenditure in the model was rather low at about 5 per cent as shown in table 5.6.

Table 5.6: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NGRE))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NGRE(-1)))	0.441599	0.084706	5.213324	0.0000
D(LOG(NY))	0.343349	0.107595	3.191121	0.0019
D(LOG(NGCE))	0.182660	0.092798	1.968361	0.0520
ECM_GRE(-1)	-0.059308	0.028750	-2.062868	0.0419
Adjusted R-quared	0.260779	Durbin-Watson stat		2.032336

5.2.3.2 Government Revenue from Oil

Proceeds from the Federation account were distributed at regular intervals among the three tiers of government. Over time, oil revenue had come to constitute no less than 85 per cent of total government revenue. Oil revenue was specified to be a function of oil output, oil price, nominal exchange rate and petroleum profits tax. Consistent with a priori expectations, government revenue from oil should be positively related to these factors. Interestingly, the impact of oil price on oil revenue was marginal enough to be considered negligible. Instead, oil output, nominal exchange rate and petroleum profits tax determined trends in oil revenue. It was possible to imagine that the combined impact of oil production and exchange rate swamped the impact of oil price. Petroleum profits tax, which was really a component of oil revenue rather, had one of the highest and most significant impacts on oil revenue. As in most of the variables earlier considered in this section, the lag of oil revenue was not only significant but also had a high coefficient, following after PPT and oil output in the model. Adjustment rate for short-run disequilibrium in the long-run relationship between oil revenue and its determinants was about 7 per cent per quarter as indicated in table 5.7.

Table 5.7: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NGRVO))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NGRVO(-1)))	0.190264	0.066424	2.864378	0.0052
D(LOG(NPO(-3)))	0.051444	0.052462	0.980587	0.3294
D(LOG(NYO))	0.253843	0.053091	4.781252	0.0000
D(LOG(NPPT))	0.363866	0.027600	13.18377	0.0000
D(LOG(NER))	0.103825	0.046328	2.241086	0.0275
ECM_GRVO(-1)	-0.073829	0.035980	-2.051931	0.0431
Adjusted R-squared	0.820027	Durbin-Watson stat		1.496301

5.2.3.3 Non-Oil Revenue

Given the structure of the Nigerian economy, non-oil revenue should not only be more closely linked to real sector activities; its determination should ostensibly be more robust as well. But interestingly, that was not the case. The first two-quarter lagged values of non-oil revenue (the dependent variable) impacted it quite significantly. Imports and tariff rate completed the circle of determinants for non-oil revenue. The results clearly indicated that there was very little link between non-oil revenue and non-oil output. We bore in mind that previous equations indicated no link between government revenue from oil and either aggregate or non-oil output. With no link also between government non-oil revenue and domestic output, it became a fact that there was no link between government revenue on the whole and non-oil sector on the whole. This was abnormal but a fact substantiated by day-to-day observations. Only one component of government revenue, the value added tax (VAT) should be dependent on non-oil output. But given that a large component of vatable products in the country were imports, the means of such link with the domestic environment was lost. In effect, government literally survived without the non-oil sector. Tariff was an import related component of non-oil revenue and actual imports also affect non-oil revenue. So the entirety of government revenue was drawn from either imports or oil. With this sort of revenue base, the government neither owed any allegiance to the non-oil sector, to develop it nor depended on it for survival. Disequilibrium in the long-run relationship between non-oil revenue and its determinants was adjusted at the rate of 37 per cent per quarter. The summary of the coefficients and test statistics for the model were presented in table 5.8.

Table 5.8: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NGRVN))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NGRVN(-1)))	0.332548	0.080039	4.154837	0.0001
D(LOG(NGRVN(-2)))	0.208402	0.083528	2.495001	0.0144
D(LOG(NM))	0.341437	0.066391	5.142855	0.0000
D(TAR)	0.029686	0.008057	3.684720	0.0004
ECM_GRVN(-1)	-0.375942	0.063866	-5.886379	0.0000
Adjusted R-squared	0.395950	Durbin-Watson stat		2.129119

5.2.4. External Sector Block

The external block consisted of four equations including oil and non-oil exports, imports and remittances. The overall effects of most domestic macroeconomic variables (not the least non-oil output) were mixed. While some links could be established between some components of the external sector and those of the domestic real sector, the links were nearly non-existent in some others. Oil exports, for example, drew from oil production and non-oil exports drew mainly from agricultural exports, but imports had a more diversified set of determinants and were very weakly related to the real sector while per capita income was only marginally related to remittances. Domestic monetary variables were worse hit. Despite including the likes of lending rate and other monetary determinants in a number of the equations, the overall performance turned out weaker than would be expected in an economy the stage of Nigeria's. No monetary variable affected remittances and the nominal exchange rate (if it could really be considered to be one) was only weakly relevant for imports. Credit to the private sector, which by casual observation could be thought to be an important input into non-oil exports, was insignificant. In fact, the few domestic monetary variables that were retained in the external sector block were kept in order to maintain some semblance of linkage with the monetary and price blocks. The implication was that working to control different segments of the external sector using domestic policy instruments might be difficult for policymakers. This was not altogether unrelated to the fact that the external sector was mono-product in outflows, with oil dominating the bulk of transactions and the non-oil sector being only marginal in both content and size. Meanwhile, its diversified inflows was not exactly a reflection of a diversified and growing domestic base.

5.2.4.1 Oil Export

Oil export was principally driven by two major factors besides the size of oil export for any previous period – non-oil output and OPEC quota to the country. Oil price seemed not to be relevant – definitely not when these two variables were taken into account. Given the structure of production and export of oil in Nigeria, this result was hardly surprising. Increased oil exports should be the outcome of increased domestic production. This was particularly the case given that direct consumption from domestically produced crude was nil for most of the period under consideration. This was due to the fact that for many years (no less than 10 years out of the 25 in the sample), domestic oil refining was put to a halt on account of non-functional refineries. So nearly all crude production meant crude exports. The only impediment to total export of total output in the oil sector for those years remained OPEC quota which limited the number of barrels the country could export per day. However, while significant, OPEC quota was not as critical as production, possibly indicating potential leakages in adherence to the quota allocation. Expectations that foreign output should influence oil production could not be confirmed from the estimates.

Different test statistics for the model confirmed the robustness of the estimates. The model explained about 40 percent of the variations in oil export and the Durbin-Watson autocorrelation coefficient at 2.05 indicated the absence of autocorrelation among the explanatory variables. Probability function statistics among the different explanatory variables were also low enough to make for consistent and reliable estimates as indicated in table 5.9. About 79 per cent of disequilibrium in the long-run relationship between oil exports and its determinants were corrected within a quarter.

Table 5.9: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NXO)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NXO(-1))/(PY(-1))/100)))	0.257962	0.096520	2.672618	0.0089
D(LOG((NYO)/(PY/100)))	0.530898	0.187050	2.838265	0.0056
D(OPEC)	0.193306	0.105156	1.838289	0.0692
ECM_XO(-1)	-0.791401	0.113378	-6.980223	0.0000
Adjusted R-squared	0.374269	Durbin-Watson stat		2.046724

5.2.4.2 Non-Oil Export

Components of non-oil exports included agriculture, manufacturing and selected services exports. Exports of these non-oil products consisted between 2 and 10 per cent of total exports within the period covered by the sample. Though small, the significance of the non-oil component of exports was that the country had historically worked hard to diversify and move exports away from oil to these non-oil exports as well as diversify the sources of non-oil exports. The specification of equations followed the understanding that agriculture contributed a much greater proportion of non-oil exports. Manufactured exports were rather small with the country being a significant net importer. As such, instead of including aggregate non-oil output or even manufacturing value added in the specification, the study limited variable selection to only agricultural outputs. But the specification was also careful not to exclude selected monetary variables like credit to the private sector and nominal exchange rate as possible determinants. The results showed that only agricultural output impacted non-oil exports; the coefficient of private sector credit was so weak it was considered negligible. The implication was that in the short-run, maintaining some presence in the non-oil exports segment of the economy implied attention to agriculture. Maybe the picture could change over the longer term, with some sectoral changes in the broad macro economy.

Table 5.10: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NXN)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NYAGR(-1))/(PY(-1))/100)))	1.060211	0.477044	2.222458	0.0286
D((LOG((NCCPS(-1))/(CPI(-1))/100)))	0.561298	0.783965	0.715974	0.4758
ECM_XN(-1)	-0.636644	0.094986	-6.702478	0.0000
Adjusted R-squared	0.355742	Durbin-Watson stat		2.021719

5.2.4.3 Imports

As earlier noted, Nigeria had quite a diversified imports base. Import demand in the model was specified to respond to both real sector and price variables. Such prices as nominal exchange rate, domestic maximum lending rate and tariffs should impact on imports with reserves serving as a resource base and therefore a constraining factor. The parsimonious representation of the model in table 5.11 showed that most of the variables included in the equation were only marginally

significant; with the exception of tariff. Domestic lending rate and reserves had to be dropped from the equation as they remained consistently irrelevant. By implication, the reserves constraint probably did not hold; Nigeria was a diversified importer and was so whether reserves were on their way up or thinning out. It seems imports tariff rate was the only deterrent to more imports in Nigeria. With a t-statistic way ahead of that of any other determinant in the equation, it was clear that tariff mattered for imports, implying that it was about the most effective handle to controlling imports. This was consistent with history of imports in the country. Tariff levels were historically high and a major consideration for decisions to import. Even though the country embarked on trade liberalisation anchored on tariff reduction since the late 1980s, the country's average tariff level remained higher than SSA average for many years. Indeed, tariff and port constraints remained some of the reasons for increased patronage of Cotonou ports by Nigerian importers. This probably explained the unending advocacy by the Manufacturers' Association of Nigeria (MAN) for special tariffs on imported inputs in order to reduce overall cost of production. The estimates indicated that the exchange rate could also serve as a policy handle, though it was much less effective than tariff. The expected impact of the lending rate (reflecting perceived financing for imports through the domestic banking sector) could not be confirmed.

Different test statistics for the model confirmed the robustness of the estimates. The model explained about 70 per cent of the variations in imports and the Durbin-Watson autocorrelation coefficient at 1.84 indicated the absence of autocorrelation among the explanatory variables. Probability function statistics, among the different explanatory variables, were also low enough to make for consistent and reliable estimates.

Table 5.11: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NM)/(PY/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NM(-2))/(PY(-2))/100)))	0.104245	0.058839	1.771715	0.0798
D(LOG((NY)/(PY/100)))	1.168359	0.817124	1.429843	0.1562
D(LOG(NER(-4)))	-0.155024	0.083124	-1.864965	0.0654
D(TAR)	-0.094875	0.007175	-13.22367	0.0000
ECM_M(-1)	-0.398264	0.080160	-4.968336	0.0000
Adjusted R-squared	0.686954	Durbin-Watson stat		1.840820

5.2.4.4 Remittances

Remittances reflected both economic and social incentives. It had a relatively shorter history than most other economic phenomena in Nigeria; but it had grown to be one of the most important segments of the external sector. But modeling the determination of remittances was relatively less easy than understanding channels of its flows. Given the relatively social bent, quite a number of variables that could be said to impact it at the macro level did not have long time series (where any are kept at all). An approach adopted in the modelling of remittances therefore was to combine intuitive knowledge of micro drivers of remittances with broad macroeconomic indices that ought to affect it. Income levels of households did affect it, even though the direction was unclear. At very low income levels, migration (especially international migration) was hindered by lack of funds thereby placing a lid on remittance potentials. At very high income levels, the pressure from a migrant to send remittances back to the household was expectedly low. To reflect potential impact of income, per capita income was included as a determinant. Depreciated exchange rates also meant higher remittance inflows. Given trends in recent years where growth of the stock market might have influenced a surge in remittances, stock market capitalisation and income of the host country completed the circle of determinants. Given the relatively scanty theoretical foundation for remittance inflows particularly at the macro levels, much of the specification was based on observed trends and understanding of the workings of the Nigerian economy. The specification was structured to follow a simple supply function incorporating income (domestic and foreign) and the nominal exchange rate. Foreign income partially served to track impact of increased external productivity on remittance inflow.

Contrary to expectations, all the variables with the exception of per capita income in the domestic economy were insignificant. The nominal exchange rate was not significant in determining remittance inflows, showing that once the decision to travel was made, the decision to remit was no longer a function of movements in exchange rate as much as it was of previous remittance volumes or of the per capita income of the household receiving the remittance. Interestingly, as expected, poorer households received higher remittances. Improved productivity in foreign countries also did not seem to matter in the determination of the size and direction of remittances. There was little doubt that at the micro level, income of the host country might matter. But when aggregated, such host country income ceased to matter. This was the case possibly because there was an aggregation of host countries in this study. Adjustment for short-run disequilibrium between the dependent variable and its long run determinants was 20 per cent per quarter. Different test statistics for the model confirmed the robustness of the estimates. The model explained about 31

per cent of the variations in remittances and the Durbin-Watson autocorrelation coefficient at 1.88 indicated the absence of autocorrelation among the explanatory variables.

Table 5.12: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NRMT))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NRMT(-1)))	0.346218	0.102670	3.372159	0.0011
D(LOG(NRMT(-2)))	0.227577	0.104145	2.185202	0.0314
D(LOG(YPC))	-0.665717	0.440887	-1.509948	0.1345
D(LOG(YPC(-2)))	-0.792547	0.454163	-1.745071	0.0843
ECM_RMT(-1)	-0.204264	0.043367	-4.710136	0.0000
C	0.025741	0.025091	1.025884	0.3077
Adjusted R-squared	0.274589	Durbin-Watson stat		1.883910

5.2.5 Monetary and Financial Block

Monetary and financial block consisted of four equations namely: net foreign assets, credit to the private sector, DMBs credit to government and money demand. The first three equations reflected the money supply identity while the last was real demand for money balances which complemented the supply equations to give a full picture of the monetary sector. The money supply variables identified and used followed the CBN classification namely the sum of net foreign assets and domestic credit; 'other assets net' was the residual in this classification and so was not modelled. The money demand equation on the other hand was based on identified classical determinants of money demand in the economy. The specification drew extensively from previous studies on money demand in Nigeria.

The findings showed that monetary dependents in the money supply segment of the block were driven by monetary determinants and again, linkage with the real sector was quite weak. Money demand, on the other hand, was a function of income, interest rate and price indicating influence of all spheres of the classical motives for holding money balances – transactions, precautionary and speculative. Net foreign assets was partially influenced by exports; but that was the only linkage with non-monetary aggregates. The rest of the confirmed determinants in the parsimonious equation were nominal exchange rate, reserves and of course, the lag of the dependent variable. Credit to the private sector reacted to credit to government and to deposit liabilities of the DMBs while credit

to government from the DMBs was affected by Treasury Bills rate, total government expenditure and total deposit liabilities of DMBs. The consistent effect of total deposit liabilities of DMBs in all segments of net domestic credit (to private and government sectors) largely supported a longstanding emphasis of the central bank on the liabilities and assets health of the DMBs – a consideration that largely underpinned the banking consolidation programme of 2004. Interestingly, while a lot of emphasis was placed on the exchange rate, it seemed that beyond the externally inclined net foreign assets, the impact of the exchange rate on domestic money supply was minimal.

5.2.5.1 Net Foreign Assets

Using both available studies and deep understanding of the economy being modelled, attempts were made to incorporate net foreign determinants of the variable. Such explanatory variables as exports, imports, reserves and nominal exchange rate were in the long-run specification. The inclusion of reserves was considered appropriate given that the larger proportion of net foreign assets was controlled by the central bank and that DMBs share of net foreign assets was relatively weaker. This translated to net foreign assets being a partial policy tool of the central bank. True to expectations, net foreign assets were highly reliant on its previous sizes. Even though a number of other determinants were significant in determining trends in NFA, the proportion of change in net foreign assets emanating from one quarter size of the variable was nearly one for one. Nominal exchange rate and exports size mattered for net foreign assets. Reserves as a significant backup source for net foreign assets as shown by the coefficient estimates is consistent with the history of both implicit and explicit policy defence of the exchange rate using reserves. In effect, net foreign assets mimicked movements in reserves used to defend the exchange rate. In addition, as net foreign assets were expressed in local currency terms, depreciation of the exchange rate implied higher values for the assets held in foreign currencies. These two channels translated to a 61 per cent elasticity of exchange rate depreciation on accumulation of net foreign assets, while a percentage change in reserves led to a 0.05 per cent change in net foreign assets. The model also found positive autoregressive relationship between net foreign assets and its first-quarter lag. Disequilibrium by exogenous shocks to long-term relationship in the model was corrected at the rate of about 7 per cent per quarter.

Table 5.13: Parsimonious Error Correction Model

Dependent Variable: LOG(NNFA)

	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NNFA(-1))	1.002383	0.001527	656.4428	0.0000
D(LOG(NER))	0.607350	0.103519	5.867055	0.0000
D(LOG(X))	0.158107	0.074842	2.112532	0.0374
D(LOG(X(-3)))	0.172081	0.072778	2.364467	0.0202
D(LOG(NRES))	0.059756	0.028714	2.081117	0.0403
ECM_NFA(-1)	-0.066579	0.046202	-1.441036	0.1530
Adjusted R-squared	0.994631	Durbin-Watson stat		1.952553

5.2.5.2 Credit to the Private Sector

As earlier noted, net credits to the economy depended on movement of a number of financial aggregates – with relatively weak link to real sector variables. This was true for credit to the private sector and credit to government. Besides a fairly significant autoregressive second-quarter lag, other determinants of credit to the private sector included credit to government from DMBs and total deposit liabilities. The model showed that credit to government crowded out credit to the private sector. Such crowding out was significant enough contemporaneously with a probability value of 7 per cent but was more so after one quarter at the 5 per cent significance level. Indeed, the only other significant variable affecting credit to the private sector was total deposit liabilities of DMBs. This was hardly surprising. First, the stock of credit was defined by the liabilities and DMBs were often faced with the choice of lending to a risk-free government or to a risk-laden private sector. Often, the decision was in favour of the former. The effect on private lending was usually indirect – through tightening of borrowing conditions, hiking interest rates for all forms of borrowing, and rejecting loan applications for any form of long-term investments and rather concentrating on short-term loans for trading purposes. In the case of an interest rate hike, public institutions very easily outstripped private investors on access to credit. Strikingly, income and the maximum lending rate did not matter for credit to the private sector. In a way, this reflected a misnomer –productivity did not determine who gets credit; some other factors do. Equally, though very high, lending rate was not the definitive factor in access to credit either. Access to credit was defined by factors that even preceded negotiations of appropriate interest rates between deposit money banks and user agents in the economy.

Table 5.14: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NCCPS))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NCCPS(-2)))	0.162947	0.097885	1.664666	0.0994
D(LOG(NCGDMB))	-0.056044	0.030932	-1.811818	0.0733
D(LOG(NCGDMB(-1)))	-0.067708	0.033518	-2.020071	0.0463
D(LOG(NTDL))	0.413986	0.100931	4.101654	0.0001
ECM_CCPS(-1)	-0.305855	0.065260	-4.686686	0.0000
C	0.036980	0.012252	3.018410	0.0033
Adjusted R-squared	0.269520	Durbin-Watson stat		2.160373

5.2.5.3 DMBs Credit to the Government

The specification of DMBs credit to the government included DMBs total deposit liabilities, Treasury Bills rate and total government expenditure. The final equation indicated that all the explanatory variables were correctly signed and significant – some more so than others. A percentage increase in total deposit liabilities of the DMBs led to a corresponding increase of 0.86 per cent in DMBs credit to government. This reflected government high patronage with the DMBs as they operated accounts with the banks, leaving little credit for the private sector; thus, confirming "the crowding out" viewpoint of public sector credit on private sector. The parsimonious model was shown in table 5.15. Altering Treasury Bills rate led to changes in credit to government. Investment in Federal Government instruments meant attention to Treasury Bills rate by DMBs. Being returns to investment in government instrument, the TBR also affected what was available to give to lower tiers of government. As should be expected, total government expenditure defined the quantum of credit to government. When expenditures were high relative to either the size or inter-temporal flow of revenue, credit increased correspondingly.

Adjustment rate to disequilibrium in fundamentals of DMBs credit to government was relatively fast at 20 per cent per quarter. Different test statistics for the model confirmed the robustness of the estimates. The model explained about 21 per cent of the variations in DMB credit to government and the Durbin-Watson autocorrelation coefficient at 2.01 indicated the absence of autocorrelation among the explanatory variables.

Table 5.15: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NCGDMB))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NTDL))	0.859394	0.309681	2.775095	0.0067
D(TBR)	0.025284	0.012654	1.998077	0.0487
D(LOG(NTGE(-4)))	0.679145	0.417673	1.626019	0.1074
ECM_CGDMB(-1)	-0.196847	0.073542	-2.676674	0.0088
C	-0.046837	0.041342	-1.132914	0.2603
Adjusted R-squared	0.171374	Durbin-Watson stat		2.013825

5.2.5.4 Money Demand

The structure of money demand mattered so much for monetary policy in any economy. Over time, diverse assumptions were made about money demand. While a few of these had been stylised and seemingly cut across economies and time, others were economy-specific and depended on the particular structure of the economy under consideration. For example, money demand motive had over time largely become serialised and agreements reached on different drivers of money demand. However, the stability of money demand was largely dependent on the structure of the banking sector, holdings of cash among other factors. The literature on money demand in Nigeria was long and vast and largely showed that money demand had been fairly stable over time. The money demand specification in this work therefore took that as axiomatic and concentrated on the determination of money demand. Explanatory variables explored included income, aggregate price level, all share index and interest rate differential. Income was mainly to capture the transactions motives for holding real money balances while prices defined precautionary holdings. All share index and interest rate differential (between deposit and lending rates) proxied returns and therefore speculative holding motives.

Coefficient estimates showed that income, interest rate differential and price mattered for money demand. Money demand in the model depended not only positively on income, but was inversely affected by inflation and interest rate differentials. Income mattered after four quarters while interest rate differentials mattered after first and fourth quarters. Domestic price level was significant at contemporaneous and first quarter lags. All three explanatory variables were simultaneously very significant. Changes in holdings of real money balances was

affected by real income change after four quarters. Speculative holdings also became stronger after four quarters. Speculative holdings specifically for asset trading in the stock market could not be proven as the coefficient of the all share index was not significant, but holdings for speculations in the money market obtained. Given the relatively high inflation rates over time, it was no surprise that prices mattered significantly both contemporaneously and after only one quarter.

The rate of adjustment to disequilibrium in fundamentals for the determination of money demand was about 13 per cent per quarter. The model explained about 51 per cent of the variations in money demand and the Durbin-Watson autocorrelation coefficient of 2.07 indicated absence of autocorrelation among the explanatory variables.

Table 5.16: Parsimonious Error Correction Model

Dependent Variable: D(LOG((NM2)/(CPI/100)))

	Coefficient	Std. Error	t-Statistic	Prob.
D((LOG((NM2(-2))/(CPI(-2))/100)))	0.150797	0.080432	1.874832	0.0642
D((LOG((NM2(-4))/(CPI(-4))/100)))	0.206002	0.084282	2.444192	0.0166
D((LOG((NY(-4))/(CPI(-4))/100)))	0.351897	0.110812	3.175609	0.0021
D(NRD(-1)-INF(-1))	-0.001864	0.000973	-1.915924	0.0587
D(NRD(-4)-INF(-4))	-0.003404	0.000884	-3.849877	0.0002
D(LOG(CPI))	-0.605192	0.142573	-4.244794	0.0001
D(LOG(CPI(-1)))	-0.399366	0.146740	-2.721596	0.0079
ECM_M2(-1)	-0.131607	0.041190	-3.195145	0.0020
C	0.053327	0.011888	4.485611	0.0000
Adjusted R-squared	0.463213	Durbin-Watson stat		2.069094

5.2.6 Price Block

Prices provided the handle for policies and were usually the mechanisms of transmission of policy changes to both aggregate supply and demand of real and financial products. In a liberalised economy, this was achieved through restructuring of incentives, the outcome of either a targeted policy programme or as sometimes was the case, unintended fallout of a policy gone awry. For this

purpose, deliberate attempts were made in the specification and modelling of all blocks to ensure effective and appropriate linkage with prices.

Some relevant prices like import and export price deflators could not be modelled on account of data. Specifications in the block were, therefore, limited to the consumer price index, nominal exchange rate, domestic maximum lending rate and GDP deflator. With the exception of domestic maximum lending rate which was modelled to follow movements in monetary policy instruments and outcomes, every other price variable was linked to the real sector in the specifications. However, only the GDP deflator was very strongly linked in the results. Observed linkage in the nominal exchange rate equation was too weak to allow for variations in real outcomes based on exchange rate changes. The strength of the relationship between monetary policy rate and the maximum lending rate was appreciable and gave indications of effective transmission of monetary policy to financial rates. But the weak link to other financial rates and to the real sector could be a reason for short-circuiting policy transmission to the real sector. Attempts were consistently made to steer relationship of the prices to domestic factors. This was not to shy away from the serious policy challenges facing an open economy like Nigeria, but to limit factors to those that could be either directly or indirectly affected by policies. This trend was also partly influenced by available data.

5.2.6.1 Consumer Price Index (CPI)

With the collapse of food and non-food consumption into one aggregate, the consumer price index also had to be collapsed into one. Key apriori determinants included nominal exchange rate, maximum lending rate, consumption, output gap, total government expenditure and money supply. Maximum lending rate, consumption and government expenditure would illuminate demand-pull pressure on domestic prices while output gap reflected supply-related pressure on prices (generally referred to as cost-push factors in the literature). The nominal exchange rate would show the pass-through of exchange rate to domestic prices.

The results indicated that domestic inflation neither reflected factor cost pressures nor external price pass-through. Besides an up-trending effect in prices was shown by the significant first and fourth quarter impacts of the dependent variable, only domestic money supply and maximum lending rate showed up as significant determinants of aggregate price changes. Money supply followed in significance after the lags of the dependent variable with a 10 per cent change in money supply leading to a 1.6 per cent change in prices at the contemporaneous level and reducing to a 1.2 per cent change in prices after

one quarter. The lending rate was important, but only at about 10 per cent while the impact of consumption was a lot more marginal. Other demand variables like government expenditure did not show up relevant at all. Output gap also was insignificant. This indicated that the economy was not really driven by increased production as much as it was driven by increased demand and money supply variations. Table 5.17 showed the error correction specification of the final model and indicated that correction of disequilibrium in the long-run relationship was at the rate of 7 per cent per quarter. The model explained 43 per cent of variations in price level with a Durbin-Watson statistic of 1.97 indicating the absence of autocorrelation.

Table 5.17: Parsimonious Error Correction Model

Dependent Variable: D(LOG(CPI))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(CPI(-1)))	0.288340	0.090429	3.188593	0.0020
D(LOG(CPI(-4)))	0.468763	0.084182	5.568433	0.0000
D(LOG(NCONS(-1)))	0.090848	0.077248	1.176053	0.2428
D(LOG(NM2))	0.164311	0.064224	2.558414	0.0122
D(LOG(NM2(-1)))	0.123019	0.063218	1.945952	0.0549
NRM(-1)	-0.001767	0.001044	-1.693368	0.0940
ECM_CPI(-1)	-0.070549	0.034179	-2.064072	0.0420
C	0.028895	0.023642	1.222156	0.2249
Adjusted R-squared	0.382540	Durbin-Watson stat		1.965674

5.2.6.2 Nominal Exchange Rate

The nominal exchange rate equation was specified to incorporate oil price alongside a number of domestic real and monetary variables. The short-term error correction equation, however, showed the impact of only a few of the specified variables – and even a fewer proportion of the impactful variables were significant. Among all factors in the determination of exchange rate, government expenditure was most critical. Oil price and income had rightly signed but weakly significant coefficients with probabilities of 15 per cent and 21 per cent respectively. Consumer price index was worse with a 75 per cent probability of not being significant. Efforts to incorporate the impacts of money supply and interest rate differential were far less successful as these were individually wrongly signed or so insignificant that they were dropped at some point in the estimation.

The above indicated that government expenditure was the only domestic fundamental strong enough to drive exchange rate.

The model explained about 22 per cent of the variations in nominal exchange rate and the Durbin-Watson autocorrelation coefficient at 1.81 indicated the absence of autocorrelation among the explanatory variables. Adjustment for short-run disequilibrium between the dependent variable and its long-run determinants was about 24 per cent per quarter as shown in table 5.18.

Table 5.18: Parsimonious Error Correction Model

Dependent Variable: D(LOG(NER))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(NPO(-3)))	-0.149570	0.103657	-1.442933	0.1525
D(LOG(NTGE))	0.624477	0.218056	2.863839	0.0052
D(LOG(NY(-1)))	0.331435	0.262932	1.260537	0.2107
D(LOG(CPI))	0.086894	0.267061	0.325372	0.7456
ECM_NER(-1)	-0.238360	0.060206	-3.959070	0.0001
Adjusted R-squared	0.180847	Durbin-Watson stat		1.805521

5.2.6.3 Domestic Maximum Lending Rate

The domestic maximum lending rate had been so severally used as an explanatory variable in order to reflect the objective of transmitting monetary policy through other interest rates. The specification of the maximum lending rate equation therefore, had to consider a backward linkage to the policy rate. So the primary determinants were inflation, monetary policy rate and money supply. The monetary policy rate (MPR) turned out to be the next most important determinant of the maximum lending rate after the one period lag of the dependent variable. Conversely, real money supply and inflation were statistically weak in explaining movements in the maximum lending rate. Money supply expectedly had an inverse relationship with the lending rate while, inflation had a positive relationship, but both had probabilities in excess of 50 per cent. It seemed changes in monetary policy rate as well as the dependent variable outweighed changes in most other variables leading to poor impact of the latter group. In effect, the model indicated strong positive backward linkage with the policy rate but unclear or insignificant linkage with other determinants. The weak impact of inflation could suggest other structural influences on money market rates way

beyond those captured by conventional models which had to rely on variables with time series data. The results were quite instructive in indicating that monetary policy really drove maximum lending rate, while other non-policy variables did not matter. The relevance or otherwise of cost of doing business index could not be confirmed due to data limitations. Adjustment to temporary disequilibrium in the long-run relationship between the dependent and explanatory variables was at the rate of 20 per cent per quarter. The model explained 80 per cent of variations in maximum lending rate.

Table 5.19: Parsimonious Error Correction Model

Dependent Variable: NRM

	Coefficient	Std. Error	t-Statistic	Prob.
NRM(-1)	0.996657	0.018051	55.21363	0.0000
D(MPR)	0.616422	0.153327	4.020298	0.0001
INF(-3)	0.007096	0.010974	0.646635	0.5195
D(LOG(NM2(-2)))	-0.641922	2.841549	-0.225906	0.8218
ECM_RM(-1)	-0.200501	0.086979	-2.305177	0.0234
Adjusted R-squared	0.793247	Durbin-Watson stat		1.674033

5.2.6.4 Gross Domestic Product (GDP) Deflator

Output deflator was initially disaggregated into oil and non-oil deflator but was later re-aggregated. It was modelled as a function of consumer price index (CPI), nominal exchange rate and output. The model showed that output deflator followed autoregressive process for the first and second lags with both having significant impacts. Though important up to the second lag, the impact (magnitude and statistical significance) of the lags of output deflator got lower as the lag increased. Contemporaneous income equally mattered for output deflator with a t-statistic of about 48 and a coefficient level of 0.92. It was the single most important determinant, stronger than even the first two lags of the dependent variable that were found to be significant. A 10 per cent change in the exchange rate led to a 0.09 per cent change in output deflator while a 10 per cent change in CPI led to a 0.2 per cent change in output deflator. Though the exchange rate was more significant than the consumer price index, neither of the two was as significant as income. Probabilities of accepting the null hypothesis of no effect for the nominal exchange rate and consumer price index stood at 9 per cent and 17 per cent, respectively. In effect, nominal exchange rate also somewhat 'passed-through' to domestic output price deflator, with an elasticity of 0.09 per cent, which was significant only at 10 per cent. The weak

relationship between consumer price index and output deflator suggested the possibility that CPI impact had been nested into GDP deflator, especially given that the latter was a more comprehensive measure of price changes. Disequilibrium in the long-term relationship between output deflator and its determinants was corrected for at the rate of 3 per cent per quarter.

The model explained 98 per cent of the variations in GDP deflator and the Durbin-Watson autocorrelation coefficient of 2.05 indicated the absence of autocorrelation among the explanatory variables.

Table 5.20: Parsimonious Error Correction Model

Dependent Variable: D(LOG(PY))

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(PY(-1)))	0.612676	0.099857	6.135531	0.0000
D(LOG(PY(-2)))	0.233206	0.100919	2.310812	0.0232
D(LOG(CPI(-3)))	-0.022879	0.016372	-1.397439	0.1658
D(LOG(NY(-1)))	-0.573574	0.096007	-5.974309	0.0000
D(LOG(NY))	0.923081	0.019234	47.99339	0.0000
D(LOG(NY(-2)))	-0.210751	0.095437	-2.208277	0.0298
D(LOG(NER))	0.009180	0.005346	1.717118	0.0895
ECM_PY(-1)	-0.033166	0.015703	-2.112147	0.0375
Adjusted R-squared	0.977939	Durbin-Watson stat		2.056414

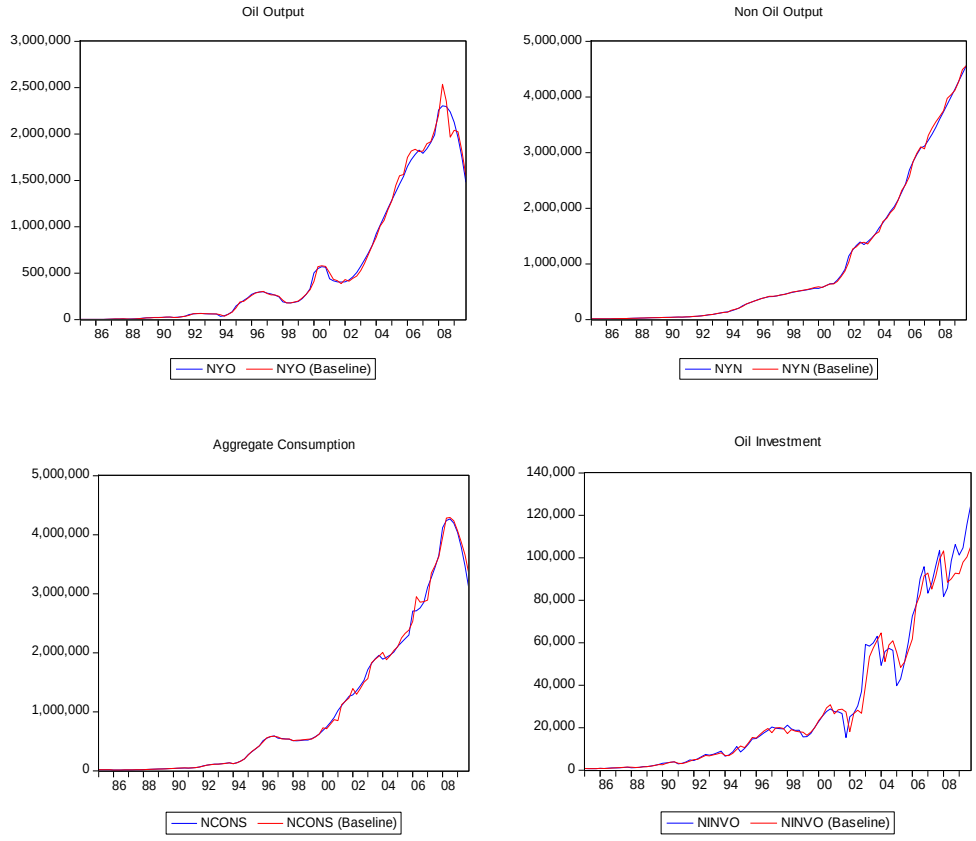
5.3 Model Appraisal and Simulation

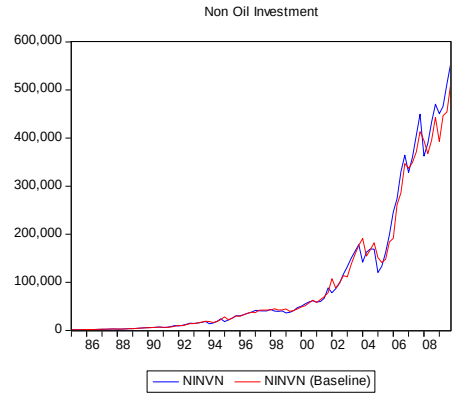
5.3.1 Model Appraisal

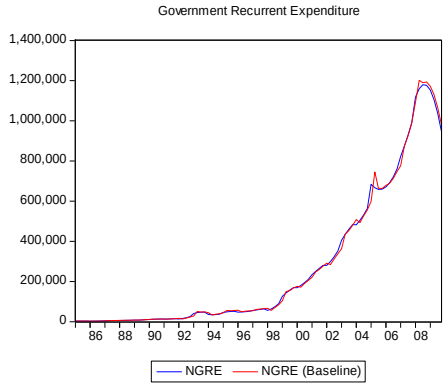
Within-sample simulations were conducted to test the reliability of the model in predicting the movement of the endogenous variables. While assessment of the examination of the goodness of fit of the models and coefficient estimates of individual variables was important for good macroeconometric modeling, good statistical properties in individual equations did not necessarily imply a good performance of the model as a whole. Rather, good forecasting performance of the model depended on the quality of data, how well the behavioral equations were linked and how economically meaningful the coefficient estimates were. Figure 5.1, which showed the actual and simulated values of endogenous variables, and provided evidence for the good performance of the model.

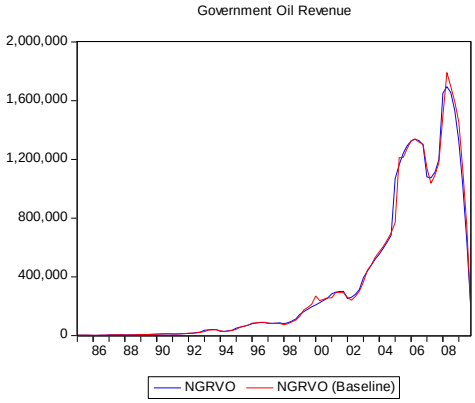
A cursory examination of the graphs indicated that the model tracked the time paths and turning points of the endogenous variables reasonably well. This was a good indication that the model captured the workings of the Nigerian economy with respect to the behaviour of the variables of interest and, suggested its suitability for policy simulation.

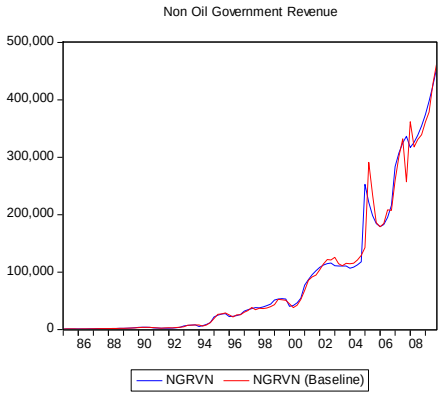
Figure 5.1: Actual and Simulated Values of the Endogenous Variables

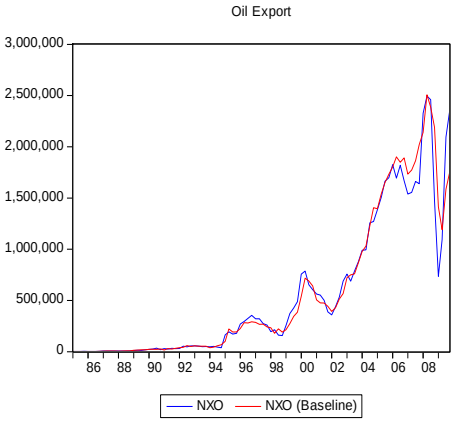


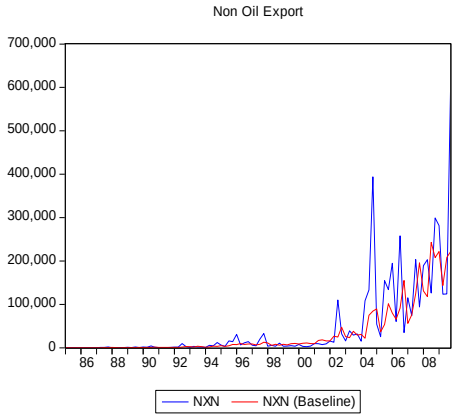

Non Oil Investment
600,000
500,000
400,000
300,000
200,000
100,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NINVN
NINVN (Baseline)

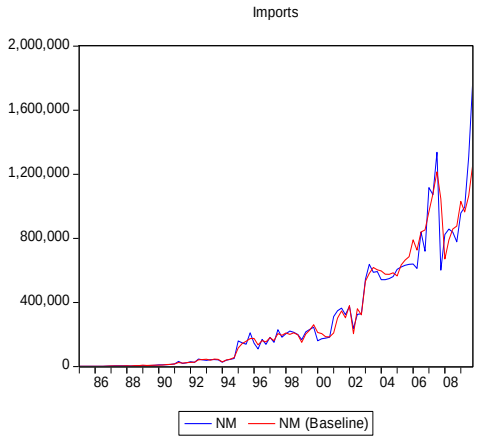

Government Recurrent Expenditure
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NGRE
NGRE (Baseline)

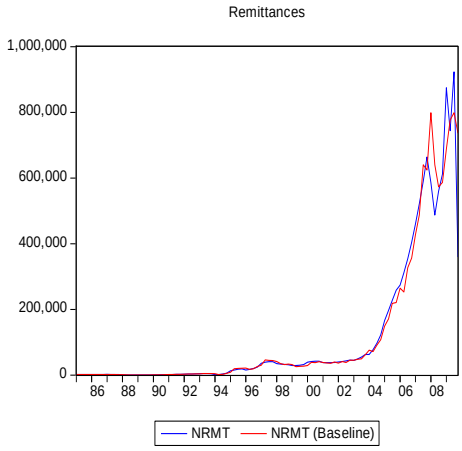

Government Oil Revenue
2,000,000
1,600,000
1,200,000
800,000
400,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NGRVO
NGRVO (Baseline)

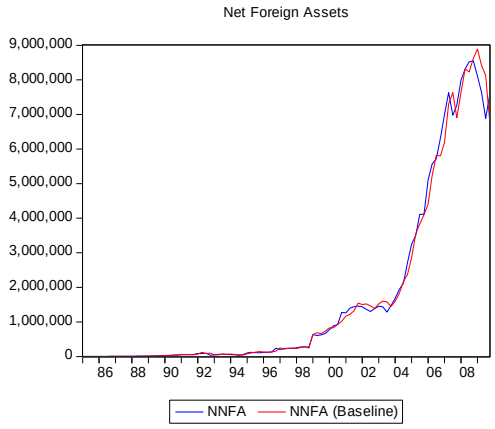

Non Oil Government Revenue
500,000
400,000
300,000
200,000
100,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NGRVN
NGRVN (Baseline)

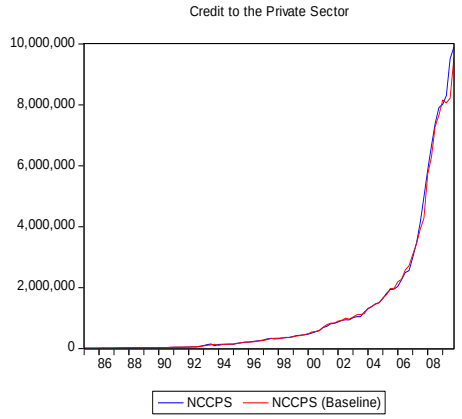

Oil Export
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NXO
NXO (Baseline)

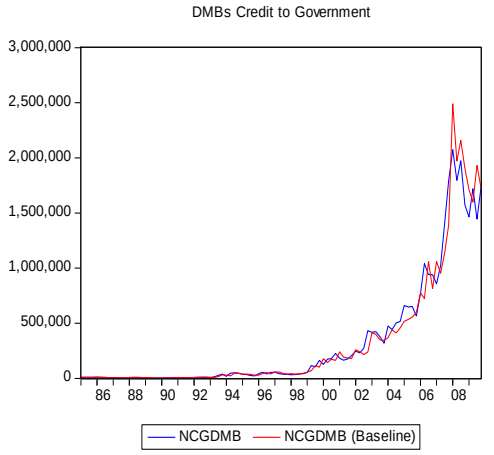

Non Oil Export
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NXN
NXN (Baseline)

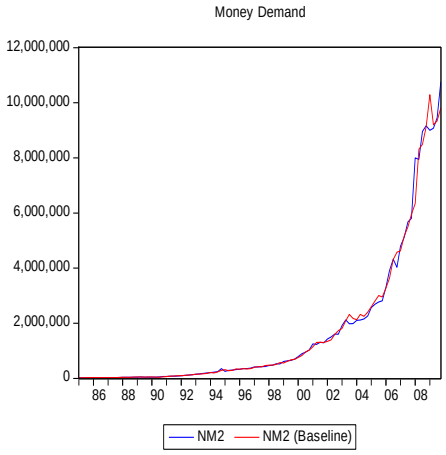

Imports
2,000,000
1,600,000
1,200,000
800,000
400,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NM
NM (Baseline)

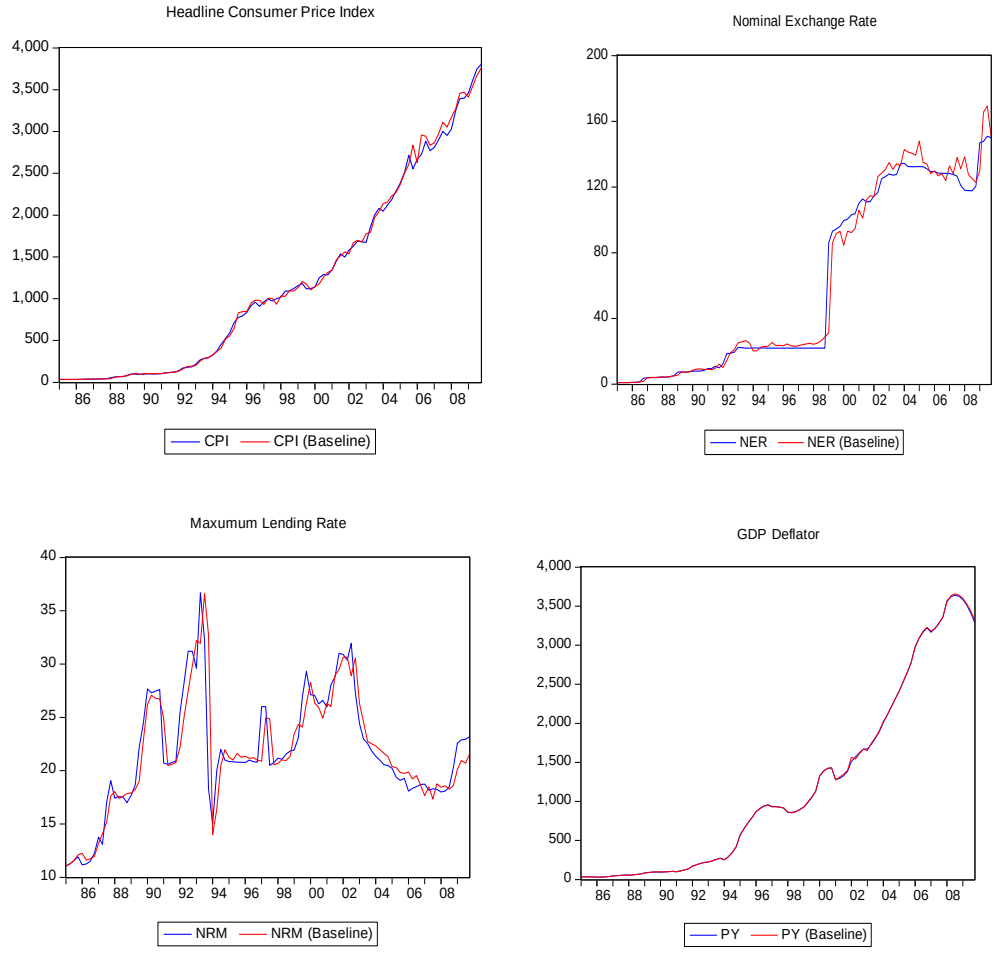

Remittances
1,000,000
800,000
600,000
400,000
200,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NRMT
NRMT (Baseline)


Net Foreign Assets
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NNFA
NNFA (Baseline)


Credit to the Private Sector
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NCCPS
NCCPS (Baseline)


DMBs Credit to Government
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NCGDMB
NCGDMB (Baseline)


Money Demand
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
86 88 90 92 94 96 98 00 02 04 06 08
NM2
NM2 (Baseline)



5.3.2 Model Simulation

Given the above tests and the level of satisfactory performance observed in many of the variables and equations, this section attempted to provide simulation on possible outcomes of changes in selected variables. The process was to introduce shocks in selected policy variables and trace their impacts given the relationships in the model. The aim was to examine what would happen to selected macroeconomic variables if a particular policy instrument was altered. There were two approaches to answer this type of questions: ex-post and ex-ante impact simulation. The ex-post approach compared the baseline and alternative scenarios of the macroeconomic variables of interest provided after introducing the shock. This study focused on ex-post simulation and some of the issues for which some alternative scenarios were considered include:

- The relationship between the monetary policy and the real sector of the economy.
- The effect of fiscal policy shocks on macroeconomic variables.
- The response of macroeconomic variables to oil price shocks.

5.3.2.1 Simulation Scenarios

- Scenario 01:- a decrease in the price of crude oil by 10 per cent.
- Scenario 02:- an increase in the price of crude oil by 15 per cent.
- Scenario 03:-a decrease in monetary policy rate (MPR) by 500 basis points.
- Scenario 04:- an increase in monetary policy rate (MPR) by 400 basis points.
- Scenario 05:-How would macroeconomic variables be affected assuming the government capital expenditure increased by 10 per cent.

5.3.2.2 Simulation Results

There were three policy variables used for the simulation: crude oil prices, CBN Monetary Policy rate MPR and government capital expenditure. The results of the five scenarios were presented in table 5.37.

Table 5.37: Simulation Results of Macroeconomic Variable- Crude Oil Price Shocks

S/N	Macroeconomic Variables	Policy Variable				
		Baseline	Crude oil price declines by 10%		Crude oil price increase by 15%	
			Scenario 01	Δ in Scenario 01	Scenario 02	Δ in Scenario 02
1	Real GDP growth rate	-6	-6	0	-5	1
2	Real GDP growth rate in oil sector	-25	-26	-1	-25	0
3	Real GDP growth rate in non-oil sector	6.4	5.9	-0.5	7.2	0.8
4	Real investment growth rate	16.2	16.2	0	16.1	-0.1
5	Real investment growth in the oil sector	11.1	10.9	-0.2	11.5	0.4
6	Real investment growth in the non-oil sector	17.3	17.5	0.2	17.2	-0.1
7	Nominal growth in total Revenue	-36.2	-36.3	-0.1	-36.1	0.1
8	Nominal Growth in oil Revenue	-46.8	-46.8	0	-46.7	0.1
9	Nominal Growth in non-oil Revenue	16.4	16.2	-0.2	16.7	0.3
10	Nominal Government Recurrent Expenditure	-4.9	-5	-0.1	-4.7	0.2
11	Inflation rate	10.2	10	-0.2	10.2	0
12	Nominal Net Foreign Assets	-2.4	-2.4	0	-2.4	0
13	Growth in Real Money Supply	9.6	9.6	0	9.6	0
14	Nominal Maximum Lending Rate	22	22.1	0.1	22	0
15	Nominal exchange rate	162.3	162.2	-0.1	162.3	0
16	Credit to the Private Sector (Nominal)	26.5	26.5	0	26.5	0

Simulation Results of Macroeconomic Variables- Monetary Policy Rate (MPR)

S/N	Macroeconomic Variables	Baseline	MPR decline by 500 basis points		MPR increase by 400 basis points	
			Scenario 03	Δ in Scenario 03	Scenario 04	Δ in Scenario 04
1	Real GDP growth rate	-6	-6	0	-6	0
2	Real GDP growth rate in oil sector	-25	-25	0	-25	0
3	Real GDP growth rate in non-oil sector	6.4	6.4	0	6.4	0
4	Real investment growth rate	16.2	16.2	0	16.2	0
5	Real investment growth in the oil sector	11.1	11.1	0	11.1	0
6	Real investment growth in the non-oil sector	17.3	17.3	0	17.3	0
7	Nominal growth in total Revenue	-36.2	-36.2	0	-36.2	0
8	Nominal Growth in oil Revenue	-46.8	-46.8	0	-46.8	0
9	Nominal Growth in non-oil Revenue	16.4	16.4	0	16.4	0
10	Nominal Government Recurrent Expenditure	-4.9	-4.9	0	-4.9	0
11	Inflation rate	10.2	10.2	0	10.2	0
12	Nominal Net Foreign Assets	-2.4	-2.4	0	-2.4	0
13	Growth in Real Money Supply	9.6	9.6	0	9.6	0
14	Nominal Maximum Lending Rate	22	21.9	-0.1	22.1	0.1
15	Nominal exchange rate	162.3	162.3	0	162.3	0
16	Credit to the Private Sector (Nominal)	26.5	26.5	0	26.5	0

Simulation Results of Macroeconomic Variables- Government Capital Expenditure

S/N	Macroeconomic Variables	Baseline	Capital Expenditure increases by 10 per cent	
			Scenario 05	Δ in Scenario 05
1	Real GDP growth rate	-6	-6	0
2	Real GDP growth rate in oil sector	-25	-25	0
3	Real GDP growth rate in non-oil sector	6.4	6.4	0
4	Real investment growth rate	16.2	16.2	0
5	Real investment growth in the oil sector	11.1	11.1	0
6	Real investment growth in the non-oil sector	17.3	17.3	0
7	Nominal growth in total Revenue	-36.2	-36.2	0
8	Nominal Growth in oil Revenue	-46.8	-46.8	0
9	Nominal Growth in non-oil Revenue	16.4	16.4	0
10	Nominal Government Recurrent Expenditure	-4.9	-5	-0.1
11	Inflation rate	10.2	10.2	0
12	Nominal Net Foreign Assets	-2.4	-2.5	-0.1
13	Growth in Real Money Supply	9.6	9.6	0
14	Nominal Maximum Lending Rate	22	22	0
15	Nominal exchange rate	162.3	162.6	0.3
16	Credit to the Private Sector (Nominal)	26.5	26.5	0

Note:

Source: Computed from CBN Macroeconometric Model of the Nigerian Economy.

Scenarios 01 and 02 – oil price asymmetry

In scenario 01, a decrease in the price of crude oil by 10 per cent reduced total revenue by 0.1 percentage points, which reduced the government recurrent expenditure by the same percentage points. This reduction in government expenditure reduced investment and GDP (oil) by 0.1 and 1.0 percentage points, respectively. Consequently, inflation and maximum lending rate declined by 0.2 and 0.1 percentage point, respectively. Also, exchange rate appreciated by 0.1 percentage point. On the other hand, increase in oil price by 15 per cent raised total revenue, government recurrent expenditure, oil investment and total real GDP by 0.1, 0.2, 0.4 and 0.2 percentage points, respectively.

Scenarios 03 and 04 – Change in CBN Monetary Policy Rate (MPR)

In scenario 03, the increase in MPR by 400 basis points resulted in an increase (0.1 percentage points) in the nominal maximum lending rate without any impact on price. Similarly, a reduction in MPR by 500 basis points only reduced maximum lending rate without any impact on price and exchange rate. This result which showed a weak relationship between monetary policy and the real side of the economy largely reflected past monetary policy framework prior to recent financial liberalization. It also showed the weakness of monetary policy rate to influence real sector of the economy.

Scenario 05 –Increase in Government capital expenditure

Scenario 05 examined the increase in capital expenditure by 10 per cent. The result showed that nominal government recurrent expenditure would fall by 0.1 percentage points. Also, while nominal exchange rate depreciated by 0.3 percentage points, net foreign assets fell by 0.1 percentage points. However, the shocks had no impact on the real sector of the economy.

Chapter Six:
Summary and Conclusion

An attempt was made to construct a medium macroeconometric model for the Nigerian economy that was capable of incorporating the essential features of the economy while making extensive use of economic theory. In the model, activities of five sectors (i.e. the real, the external, the fiscal and monetary and the price sectors) were discussed under six blocks namely supply, private demand, government, external, monetary/financial and price blocks. Behavioural equations were specified according to economic theory and estimated within the eclectic macroeconomic framework using recent econometric techniques. The linkages of the six blocks were identified and the model solved simultaneously to incorporate those linkages. The complete model was then simulated over the historical period and standard model evaluation tests were performed. Single-equation analyses indicated that the behavioural equations were well specified and in-sample performance was good. The results of the dynamic simulation indicated that the simulated data reproduced most of the turning points of the time series in the actual data well. Further, the dynamic simulation of the model produced satisfactory results, as they showed that the economic variables behaved according to a priori expectations.

Given the nature of the mandates in the work and specifications of the different equations in the blocks, several data challenges were encountered. Paramount among these included unavailability of employment statistics, incomprehensive data length applicable to human capital, proxied for by school enrolment from primary through tertiary institutions, and joint venture cash call (JVC) in the case of government counterpart investment fund in the oil sector. Other areas of serious data limitations were in the generation of a quarterly series on the stock-flow relationship between total money stock and output used in computing the 'financial deepening' variable. There were also challenges with the generation of nominal and real effective exchange rates as available data could not be disaggregated to obtain necessary relationships between nominal and real effective exchange rates, necessary for linking the two variables through identities. In the case of government financial statistics, data sets on revenue, expenditure, fiscal deficits and financing were aggregated across all tiers of government. In the case of local government data sets, however, available data only dated back to 1993.

Given these limitations and the exploratory nature of the work, coupled with the fact that macroeconometric modeling was a continuous process, these results could at best be treated as preliminary. The model would need to be maintained and regularly fine-tuned to reflect the dynamic nature of the Nigerian economy. While treating the results as preliminary and providing for improvement in its contents and linkages, it was nonetheless a useful starting point for further works. There was, therefore, the need to improve upon it and to further develop CBN sectoral models that would reflect the real, monetary, external and fiscal sectors, of the Nigerian economy, which would be useful for policy analysis in the nearest future.

REFERENCES

Adamu, S. O. (1996). *National Accounting in a Developing Country: The Case of Nigeria*. (Ibadan University Press, U.I Ventures Ltd)

Adenikinju, A. (2002). A Paper presented at the Regional Macroeconomic Modelling, Forecasting and Policy Analysis workshop, organized by the *West African Institute for Financial and Economic Management* (WAIFEM), Lagos. August 18 – September, 19, 2003

Ajakaiye, D. O. (1995). Short Run Macroeconomic Effects of Bank Lending Rates in Nigeria, 1987-91: A Computable General Equilibrium Analysis. *AERC Research paper 34,* Nairobi, Kenya.

Batini, N. and A. G. Haldane (1999). *Forward-looking rules for monetary policy*, in Taylor, J. B. (ed), *Monetary Policy Rules*, Chicago: University of Chicago Press for NBER

Bill Gibson (2002) Essays on Late Structuralism.

Bodkin, R.G., Klein, L.R., and Marwah, K. (1991). *A History of Macroeconometric Model-Building*. Aldershot: Edward Elgar.

CBN "Banking Supervision Annual Report" Various issues

CBN "Annual Report and Statement of Accounts" Various Issues

CBN (Forthcoming) "*The Changing Structure of the Nigerian Economy and Implications for Development*"

CBN (2005). "*Microfinance Policy, Regulatory and Supervisory Framework for Nigeria*"

Charles N. O. Mordi (1988). A Macroeconometric Models of the Nigerian Economy, *Ph.D proposal* submitted to the Department of Economics, UNILAG, Lagos.

Challenge (2004). "Structuralist Economics": Challenge to the Mainstream Interview with Lance Taylor. *Challenge* Vol.47, no.5, September /October (pg 104-115)

Ciminero, G. L. (1979). An Industry-based Macroeconomic Forecasting Model, *Mimeograph*, New York

Clarida, R., J. Gali, and M. Gertler (1999). The Science of Monetary Policy: A New-Keynesian Perspective, *NBER Working Paper* 7147.

d'Alcantara, G. and Italianer, A. (1982). "European Project for a Multinational Macrosectoral Model." *CEC*, MS11, XII/759/82.

de Silva, A. (2008). Forecasting Macroeconomic Variables Using a Structural State Space del.MPRA, Online at http://mpra.ub.uni-muenchen.de/11060/.

De Wet, L. Geert, Jonkergouw, Estelle, Koekemoer Renee (1994). An Econometric Monetary Policy model for South Africa in Macro models, *Institute of Econometrics and Statistics*, University of Lodz, 1994, 61-96

Dervis, K.; de Melo, J. and S. Robinson (1989). General Equilibrium Models for Development Policy. World Bank Research Publications, *The World Bank*, Washington, D.C. Experience in Africa, AERC

Eckstein (1976). A Survey of a Large-Scale Macroeconometric Models: Their Workings and Shortcomings, J.M. Crews, in *Surveys of Recent Empirical Research*, 122

Ekeoku N.I. (1984). Simulation and Fiscal Policy Analysis with a Macroeconometric Model of the Nigerian Economy. Ph.D. Thesis, University of Ibadan.

Engle, R. F ; C. and W. J. Granger (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing *Econometrica*, Vol. 55, No. 2. (March), pp. 251-276.

Granger, C.W.J. and P. Newbold (1973). Some comments on the evaluation of economic forecasts, *Applied Economics* 5, 5-47.

Fair, R.C. (2004). *Estimating how the macroeconomy works.* Harvard University Press

Falokun, G. O. (1996). Inter-Industry Indicators of Export Promotion Potential in Nigeria. *NISER Monograph Series* No. 11, NISER, Ibadan.

Falokun, G. O. (1998). Sources of Industrial Growth in Nigeria: A Factor Decomposition Approach. *NISER Monograph Series* No 2. (NISER), Ibadan. Nigeria.

Falokun, G.O. (1999). Inter-sectoral Indicators of Employment Potential in Nigeria. *NISER Monograph Series* No. 2 (NISER), Ibadan. Nigeria.

Fleming, J. Marcus. 1963. Domestic Financial Policies under Fixed and under Floating Exchange Rates. *International Monetary Fund Staff Papers* 9: 369 379

Foster, J. and J. Malley, (1988). Impact of foreign direct investment on the Scottish economy, in F.Harrigan, P.G.McGregor, Recent Advances in Regional Modelling, Pion, London, 129-130

Ghosh, D. and Kazi, U. (1978). "A Macroeconomic Model for Nigeria". 1958-19. Physica-Verlag, *Vienna Empirical Economics*, Vol. 3, Issue 3, pp135-154.

Gómez, J. (2002). The implementation of inflation targeting in Colombia, *Mimeo,* Banco de la República, Bogotá

Guisan, M.C (2004). Human Capital, Trade and Development in India, China, Japan and Other Asian Countries, 1960-2002: Econometric Models and Causality Tests. *Applied Econometrics and International Development* 4(3), pp.123-38.

Haider A. Khan (2005). Assessing Poverty Impact of Trade Liberalization Policies: A Generic Macroeconomic Computable General Equilibrium Model for South Asia. *ADB Institute Discursion Paper* No 22.

Hansen, Gary (1985). Indivisible labor and the business cycle. *Journal of Monetary Economics.* 16, 309-327s

Hicks J. R. (1937). Mr Keynes and the Classicals *A Suggested Interpretation,* April, Pp. 147- 159

IMF (1987). Theoretical Aspects of the Design of Fund-Supported Adjustment Programs, IMF

Iyoha, M. A. (2003). An Overview of leading Issues in the Structure and Development of the Nigerian Economy since 1960 in: *Nigerian Economy: Structure, Growth and Development.* Edited by Milton Iyoha and Chris Itsede.

Jerome A (2004). A Survey of Macroeconomic Models for Policy Analysis and Forecasting in South Africa, Work in Progress Prepared for Presentation at the *Ninth Annual Econometrics Modelling for Africa*, University of Cape Town

Jhingan, M. L. (1975). *The Economics of Development and Planning (with special reference to India)*. Vani Educational Books, New Delhi.

Johansen, S. (1991). "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, Vol. 59, No. 6, pp. 1551–1580.

John H. (1937). Mr Keynes and the Classics: A suggested simplification, *Econometrica*

Kawasaki, K. (1979). Macroeconomic Performance of the Scandinavian Model, *Economic Research Institute,* Economic Planning Agency, Discussion, Paper No. 72, Tokyo, March 1997, 35-39

Keynes J.M. (1937) General Theory of Employmnent. *The Quarterly Journal of Economics,* Vol. 51, No. 2, pp. 209-223

Klein, L.R. (1983). *Lectures in Econometrics.* Amsterdam: North-Holland.

Klein, L. R. (1965). What Kind of Macroeconomic Model for Developing Economies? *The Econometric Annual of the Indian Economic Journal* XIII (3), pp. 313-24.

Kriegsmann K. P. (1976). DRI European Model, Version EU84A, Typical country model - An overview, - Documentation, European Service, *DRI Europe Working Paper, Series* No.8, 24

Krishnamurty, K. and Pandit, V. (1996). Exchange Rate, Tariff and Trade Flows: Alternative Policy Scenarios for India. *Indian Economic Review* 31(1), pp. 57–89.

Krugman, P. (1994). *Peddling Prosperity* (New York: W.W. Norton & Company, 1994), pp. 47-53.

Kydland F. and E. Prescortt (2004). Finn Kydland and Edward Prescortt's Contribution to Dynamic Macroeconomics: The Time Consistency of Economic Policy and the Driving Forces Behind Business Cycles. *The Swedish Academy of Science*.

Lucas, R.E.J. (1976), "Econometric policy evaluation: a critique", in *The Phillips Curve and Labor Markets*, Brunner, K. and Meltzer, A.H. (eds.), North-Holland, Amsterdam.

Martínez, L., Messmacher, M. and Werner, A. (2002). A Small Structural Macroeconomic Model for Mexico, *Mimeo*, Banco de Mexico, Ciudad de Mexico

Matlanyane R. A. (2005), "A Macroeconometric Model for the Economy of Lesotho: *University of Pretoria*, Ph.D Thesis.

McCallum, B. and E. Nelson (1999). An Optimizing IS-LM specification for monetary policy and business cycle analysis, *Journal of Money, Credit and Banking*, Volume 31.

McCallum, B.T. (1988), Robustness Properties of a Rule for Monetary Policy, *Carnegie*-Monetary Policy Rules (ed. John B. Taylor). *National Bureau of Economic Research Conference Report*.

Modigliani, F. (1944) Liquidity Preference and the Theory of Interest and Money Author(s) *Econometrica*, Vol. 12, No. 1 (Jan., 1944), pp. 45-88

Mundell, Robert A. 1963. Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *Canadian Journal of Economics and Political Science* 29: 475–485

Nelson, C. R. and C. L. Plosser (1982). Trends and random walks in macroeconomic time series: Some evidence and implications, *Journal of Monetary Economics* 10. 139-162.

NISER (1983). The NISER Econometric Model of the Nigerian Economy, *Nigerian Institute of Social and Economic Research*, Ibadan.

Ojo, G.O. (1972). "An Econometric-Simulation Model of the Nigerian Economy", PhD Thesis, State University of Science and Technology, Ames, Iowa.

Olaiya, L. (2006). Banks, micro-finance institutions and portfolio delineation, *Guardian newspapers.* www.ngrguardiannews.com

Olofin, S. (1985). Modelling Nigeria's Economic Development, Ibadan University Press, Ibadan.

Olofin, S. (1977). "A Tentative Specification of an Econometric Model of the Nigerian Economy", *mimeo*, University of Ibadan.

Oshikoya, T.W. (1990) *The Nigerian Economy: A Macroeconometric and Input-Output Model,* Praeger Publishers, New York

Osman, O. M. (1984). A Social Accounting Matrix for Egypt. In *Proceedings of the Seventh International Conference on Input-Output Techniques.* United Nations. New York.

Rossignol, P. (1980). Propage, Modèle Detaillé de projections a moyen terme, in: *D'economie et Statistique,* No.121, 1980, 66-73

Pandit, V. (2000). Macro-econometric Policy Modelling for India: A Review of Some Analytical Issues. Development Planning Centre, *Institute of Economic Growth; Working Paper* No. 74.

Patrick N. Osakwe (2002). A Primer on Macroeconomic Forecasting and Policy Evaluation models. *Economic Commission for Africa ECA,* Addis Ababa, Ethopia

Paul Krugman (1994). *Peddling Prosperity* (New York: W.W. Norton & Company, 1994), pp. 47-53, 197-205.

Perron, P. (1989). "The Great Crash, the Oil Price Shock and the Unit Root Hypothesis," *Econometrica*, 57(6): 1361-1401.

Phillips R. F. (1991). A constrained maximum likelihood approach to estimating switching regressions. A *Journal of Econometrics* 48, 241-262

Polak, J.J. (1997). The IMF Monetary Model: A Hardy Perennial, *Finance and Development*,

Policy Analysis and Implications, University of Pretoria, South Africa.

Pyatt, G. and J. Round (1985). Social Accounting Matrices: A Basis for Planning, Washington, D.C. *The World Bank*.

Research Paper 201, African Economic Research Consortium, Nairobi, May 2002 *Rochester Conference Series on Public Policy*, 29, 173–204.

Rossignol, P. (1980). Propage, Modèle Detaillé de projections a moyen terme, in: *D'economie et Statistique,* No.121, 1980, 66-73

Romer, D. (2002). Short run fluctuation. University of California, Berkeley, *Political Economy*, Vol. 84, No. 6, pp. 1161–76.

Rotemberg, J. and M. Woodford (1997). An Optimization-Based Econometric Framework for the Evaluation of Monetary Policy, *NBER macroeconomics annual 1997*, Cambridge, MIT Press

Sims, C.A. (1980), "Macroeconometrics and reality", *Econometrica*, 48(1): 1-48.

Soludo, C. *C. (1998). Macroeconomic Policy Modelling of the African Economies.* ACENA Publishers.

Soludo, C.C. (2002). Macroeconomic modelling and economic policy making: A survey of experience in Africa, *AERC*

Soludo, C.C (2007). Governor's end of year address to staff of the CBN, 2007.

Stone, J. E. N. (1966). The Social Accounts from a Consumer Point of View, *Review of Income and Wealth Series* 12, No. 1, pp 1-35.

Svensson, L. (2000). Open-economy inflation targeting, *Journal of International Economics*, Volume 50, Issues, 1

Tanuwidjaja, E. and K. M. Choy (2007). Central Bank Credibility and Monetary Policy: Evidence from Small Scale Macroeconomic Model of Indonesia, *National University of Singapore*

Taylor, J. B. (1993), Discretion Versus Policy Rules in Practice, *Carnegie-Rochester Conference Series on Public Policy* 39, 195–214.

Taylor, L. (1979). Macro Models for Developing Countries. *Economics Handbook Series* (McGraw-Hill Book Company, New York).

Taylor, L. C. (1990). Socially Relevant Policy Analysis: Structuralist Computable General Equilibrium Models for the Developing World. Taylor, L. (ed.) *Massachusetts Institute of Technology.* London.

Taylor, L. (1999). Monetary Policy Rules. *NIBER Business Cycle Series* Volume 1.

Tinbergen, J. (1939). Statistical Testing of Business-Cycle Theories, Business Cycles in the United States of America, 1919–1932. Geneva: League of Nations Volume 2.

Tomori, S. & M. A. Adebiyi (2007) Migrants' Remittances and the Economy: Theoretical and Impact Issues. In: *Toward Africa's Renewal.* Edited by Jeggan C. Senghor and Nana K. Poku, Ashgate Publisher, London, chapter 12, Pp. 295-319

Torben I. and D. Soskice (2006). New Macroeconomics and Political Science.

Uchendu, Okorie (1988). Second-Tier Foreign Exchange Market Devaluation, and the Impact Effects: A Simulation Study for Nigeria 1986-1990. A PhD Dissertation, Howard University

Uebe, G. (1995). World of Economic Models: A catalogue of Typical Specifications of Economic Models, (ed). Aldershot: Avebury.

UNCTAD (1973). Model of the Nigerian Economy, Ball (ed.) *The interntional Linkage of the National Model.* Amsterdam: North Holland Pub. Coy.

Uwujaren, G.P. (1977). "Specification and Estimation of an Economy-wide Macroeconometric Model of Nigeria", *The Nigerian Journal of Economic and Social Studies*, vol. 14, No. 3.

UNCTAD. (1973). "Model of the Nigerian Economy", Ball (ed.) *The International Linkage of National Economic Models*. Amsterdam: North Holland Pub. Coy.

United Nations Statistical Office (1975). Towards a System of Social and Demographic Statistics, *Department of Economic and Social Affairs,* ST/ESA/STAT/SERF/18, New York, United Nations.

United Nations Statistics Office (1968). A System of National Accounts, Series F No. 2, Rev. 3, New York, United Nations

Valadkhani, A. (2005). Macro-econometric Modelling: Approaches and Experiences in Developing Countries. *Applied Econometrics and International Development.* AEID. Vol. 5-1.

World Bank. (1974). "World Bank Long-term Projection Model of the Economy", *in Nigeria, Options for Long-term Development*. Baltimore: Johns Hopkins Press

APPENDIX 1

Table 4.1: Variables Definitions, Types and Units

	Notation	Definition	Type	Unit
1	ASI	All Share Price Index	Exogenous	Index
2	C	Consumption	Identity	Million naira
3	CAB	Capital Account Balance	Identity	Million naira
4	CDB	Cost of Doing Business	Exogenous	Index
5	Cf	Real Private Food Consumption	Endogenous	Million naira
6	Cg	Credit to Government	Exogenous	Million naira
7	Cgcbn	CBN Credit to Government	Endogenous	Million naira
8	Cgdmb	DMBs Credit to the Government	Endogenous	Million naira
9	Cn	Real Private Non-Food Consumption	Endogenous	Million naira
10	CPI	Consumer Price Index	Exogenous	Index
11	CPIc	Core Consumer Price Index	Exogenous	Index
12	CPIn	Non-core Consumer Price Index	Exogenous	Index
13	Cpn	Credit to the Non-oil Sector	Endogenous	Million naira
14	Cpo	Credit to the Oil Sector	Endogenous	Million naira
15	Cps	Credit to the Private Sector	Exogenous	Million naira
16	CUn	Non-oil Capacity Utilization	Endogenous	Per cent
17	DD	Private Demand	Identity	Million naira
18	DDS	Domestic Debt Service	Endogenous	Million naira
19	DDSK	Domestic Debt Stock	Exogenous	Million naira
20	DND	Dummy Variable Capturing the Niger Delta Issue	Exogenous	Binary
21	DPR	Dependency Ratio	Exogenous	Per cent
22	EDS	External Debt Service	Endogenous	USD
23	EDSK	External Debt Stock	Exogenous	USD
24	ERv	Exchange Rate Variability	Exogenous	Per cent
25	FD	Fiscal Deficits	Identity	Million naira

26	FDF	CBN Fiscal Deficit Financing	Exogenous	Million naira
27	FDI	Foreign Direct Investment	Identity	Million naira
28	FDIn	Non-oil FDI	Endogenous	Million naira
29	FDIo	Oil FDI	Endogenous	Million naira
30	FNDP	Financial Deepening	Identity	Million naira
31	FPI	Foreign Portfolio Inflow	Endogenous	USD
32	GCE	Government Capital Expenditure	Identity	Million naira
33	GCR	Ratio of Government Capital Expenditure to Total Government Expenditure	Exogenous	Per cent
34	GEY	Ratio of Government Recurrent Expenditure to GDP	Exogenous	Per cent
35	GRE	Government Recurrent Expenditure	Endogenous	Million naira
36	GRV	Government Revenue	Identity	Million naira
37	GRVn	Government Non-oil Revenue	Endogenous	Million naira
38	GRVo	Government Oil Revenue	Endogenous	Million naira
39	GS	Gross Domestic Savings	Exogenous	Million naira
40	HK	Human Capital (Education Enrollment)	Exogenous	Million naira
41	IEP	Index of Electricity Production	Exogenous	Index
42	IIPf	OECD Index of Industrial Production	Exogenous	Index
43	INF	Inflation	Exogenous	Per cent
44	INFe	Inflation Expectation	Exogenous	Per cent
45	INV	Investment	Identity	Million naira
46	INVn	Investment in the Non-oil Sector	Endogenous	Million naira
47	INVo	Investment in the Oil Sector	Endogenous	Million naira
48	IRD	Interest Rate Differential	Exogenous	Per cent
49	JVC	Joint Venture Cash Call	Exogenous	Million naira
50	K	Capital	Identity	Million naira
51	KI	Capital import	Identity	USD
52	Kn	Capital Stock in Non-oil	Exogenous	Million naira

53	Ko	Capital Stock (foreign and domestic) in oil	Exogenous	Million naira
54	L	Labour	Identity	Million in numbers
55	Ln	Labour Demand in Non-oil	Endogenous	Million in numbers
56	Lo	Labour Demand in Oil	Exogenous	Million in numbers
57	M	Imports	Identity	Million naira
58	M2	Real Money Balances	Exogenous	Million naira
59	Mi	Imports of Intermediate Inputs	Endogenous	Million naira
60	Mk	Import of Capital Goods	Exogenous	Million naira
61	Mo	Other Imports	Endogenous	Million naira
62	MPR	Monetary Policy Rate	Exogenous	Per cent
63	MY	Import/Output Ratio	Exogenous	Per cent
64	NDC	Net Domestic Credit	Exogenous	Million naira
65	NEER	Nominal Effective Exchange Rate	Exogenous	Per cent
66	NER	Nominal Exchange Rate	Exogenous	Per cent
67	NFA	Net Foreign Assets	Endogenous	Million naira
68	NOS	Number of Listed Companies	Exogenous	Million naira
69	NX	Net Exports	Identity	Million naira
70	OAN	Other Assets (net)	Exogenous	Million naira
71	ODF	Deficit Financing Other Than the CBN	Identity	Million naira
72	OPEC	OPEC Output	Exogenous	Million naira
73	Pmd	Import Price Deflator	Exogenous	Per cent
74	Po	Oil Price	Exogenous	USD
75	Pxd	Export Price Deflator	Exogenous	Index
76	Py	GDP Deflator	Identity	Index
77	Pyn	GDP Deflator for Non-oil	Exogenous	Index
78	Pyo	GDP Deflator for Oil	Exogenous	Index
79	RER	Real Exchange Rate	Exogenous	Per cent

80	RES	External Reserves	Endogenous	Million naira
81	Rf	Foreign Lending Rate	Exogenous	Per cent
82	Rm	Domestic Maximum Lending Rate	Exogenous	Per cent
83	RMT	Remittances	Endogenous	Million naira
84	Rp	Domestic Prime Lending Rate	Exogenous	Per cent
85	SMK	Stock Market Capitalization	Exogenous	Million naira
86	TAR	Implicit Tarrif Rate	Exogenous	Per cent
87	TBR	Treasury Bill Rate	Exogenous	Per cent
88	TDL	DMBs Total Deposit Liabilities	Exogenous	Million naira
89	TDS	Total Debt Service	Identity	Million naira
90	TDSK	Total Debt Stock	Exogenous	Million naira
91	TGE	Total Government Expenditure	Identity	Million naira
92	W	Wage	Identity	Million naira
93	WH	Real Wealth (Proxied by the sum of Broad Money and Stock Market Capitalisation	Exogenous	Index
94	Wn	Real Wage in Non-oil Production	Exogenous	Million naira
95	Wo	Real Wage in Oil Production	Exogenous	Million naira
96	X	Exports	Identity	Million naira
97	Xn	Non-Oil Exports	Endogenous	Million naira
98	Xo	Oil Exports	Endogenous	Million naira
99	Y	Output	Exogenous	Million naira
100	YD	Real Personal Disposable Income	Exogenous	Million naira
101	YDe	Income Expectation	Exogenous	Million naira
102	Yg	Output Gap	Exogenous	Million naira
103	Yn	Output in Non-oil	Endogenous	Million naira
104	Yo	Output in Oil	Endogenous	Million naira
105	Yv	Macroeconomic Variability	Exogenous	Per cent
106	Yvn	Output Variability in the Non-oil Sector	Exogenous	Per cent

APPENDIX 2

Using a sector approach, a metadata on the model data was presented in Table 4.2. The tables identified the time series, key data attributes, source and method of derivation.

Table 4.2: Metadata of Data Sets Used for the Model

Financial Sector

S/N	Notation	Name of Series	Unit	Key Data Characteristics	Source	Method of Generation
1	ASI	All Share Index: Equities (1990 = 100)	Index	Stock	NSE	ASI is rebased to 1990 from the 1984 indexed ASI series
2	Cg	Credit to Government	Million Naira	Stock	CBN	Reported
3	Cgcbn	Credit to Government by CBN	Million Naira	Stock	CBN	Reported
4	Cgdmb	Credit to Government by DMBs	Million Naira	Stock	CBN	Reported
5	Cpn	Credit to Non-Oil Sector	Million Naira	Stock	CBN	Cpn = Cps - Cpo
6	Cpo	Credit to Oil Sector	Million Naira	Stock	CBN	Proxy for Cpo is DMBs' credit to mining & quarrying sector
7	Cps	Credit to Private Sector	Million Naira	Stock	CBN	Reported
8	GS	Gross Savings	Million Naira	Stock	NBS	Reported
9	M2	Real Money Balances	Million Naira	Stock	CBN/NBS	M2 = (Nominal M2/CPI)*100
10	NDC	Net Domestic Credit	Million Naira	Stock	CBN	Reported
11	NFA	Net Foreign Assets	Million Naira	Stock	CBN	Reported
12	NOS	Number of Listed Securities:	Number	Stock	NSE	Quarterly NOS is generated from reported

		Equities				annual NOS
13	OAN	Other Assets (Net)	Million Naira	Stock	CBN	Reported
14	SMK	Stock Market Capitalization: Equities	Million Naira	Stock	NSE	1985Q1 – 1997Q4: generated from disaggregated annual SMK using 'cubic match last procedure' on E-views. 1998Q1 – 2007Q4: reported
15	TDL	Total Deposit Liabilities of DMBs	Million Naira	Stock	CBN	Reported
16	WH	Real Wealth	Million Naira	Stock	CBN & NSE	WH = [(M2 + SMK)/CPI]*100

Real Sector

S/N	Notation	Name of Series	Unit	Key Data Characteristics	Source	Method of Generation
17	CON	Real Consumption	Million Naira	Flow	NBS	Annual CON is disaggregated using 'quadratic-match sum' procedure on E-views.
18	Cf	Real Consumption of Food	Million Naira	Flow	NBS	1st: Annual Cf generated using NBS household expenditure & poverty statistics to determine proportion of income expended on food; this ranged from 53% - 71%. 2nd: Annual Cf is disaggregated using 'quadratic-match sum' procedure on E-views.
19	Cn	Real Consumption of Non-Food	Million Naira	Flow	NBS	Cn = CON - Cf
20	CUn	Non-Oil Capacity Utilization	Per Cent	Stock	CBN	Annual CUn is disaggregated using 'linear-match last' procedure on E-view
21	DD	Private Demand	Million Naira	Flow	NBS	Disaggregated annual DD using 'quadratic-match sum' procedure on E-views.
22	IEP	Index of Electricity	1990 = 100	Stock	CBN	Reported

		Production				
23	IIPf	OECD Index of Industrial Production	1990 = 100	Stock	OECD Stat	Reported
24	INV	Investment	Million Naira	Flow	NBS	Proxy is GFCF. Annual INV is disaggregated using 'quadratic-match sum' procedure on E-views
25	INVn	Investment in Non-Oil Sector	Million Naira	Flow	NBS	INVn = INV - INVo
26	INVo	Investment in Oil Sector	Million Naira	Flow	NBS	1st: Annual INVo is derived as a proportion of INV using percentage contribution of oil sector in value added to total value added in output. 2nd: Annual INVo is disaggregated using 'quadratic match-sum' procedure on E-views
27	K	Total Capital Stock	Million Naira	Flow	NBS	Proxy is GFCF plus capital stock balance. At 1985 (year 1): K = GFCF + capital stock balance of 1984. Annual K is disaggregated using 'quadratic match-last' procedure on E-views
28	Kn	Capital Stock in Non-Oil Sector	Million Naira	Flow	NBS	Kn = K - Ko
29	Ko	Capital Stock in	Million	Flow	NBS	1st: Annual Ko is

		Oil Sector	Naira			derived as a proportion of K using operating surplus percentage contribution of oil sector in the total. 2nd: Annual Ko is disaggregated using 'quadratic-match sum' procedure on E-views
30	Py	GDP Deflator	1990 = 100		NBS	Py = [(Nominal Y/Y)]*100
31	Y	Real Gross Domestic Production	Million Naira	Flow	NBS	Annual Y is disaggregated using 'quadratic-match sum' procedure on E-views
32	YD	Real Personal Disposable Income	Naira	Flow	NBS	YD = (Y/Population)
33	YDe	Expected Real Personal Disposable Income	Naira	Flow	NBS	Computed as preceding 4-quarter moving average of YD series
34	Yg	Real Output Gap	Million Naira	Flow	NBS	Yg = Y – Y*, where Y* is potential real output derived by passing Y through the Hodrick-Prescott (HP) filter on E-views.
35	Yn	Real Non-Oil Output	Million Naira	Flow	NBS	Yn = Y - Yo
36	Yo	Real Oil Output	Million Naira	Flow	NBS	Annual Yo is disaggregated using 'quadratic-match sum'

						procedure on E-views
37	Yv	Macroeconomic Variability		Measure of volatility	NBS	$Yv_t = (y_t - y^*)^2$, where $y_t = [Ln(Y_t) - Ln(Y_{t-1})]$ and $y^* = \Sigma y_t/n$
38	Yvn	Non-Oil Output Variability		Measure of volatility	NBS	$Yvn_t = (yn_t - yn^*)^2$, where $yn_t = [Ln(Yn_t) - Ln(Yn_{t-1})]$ and $y^* = \Sigma yn_t/n$
39	Yvo	Oil Output Variability		Measure of volatility	NBS	$Yvo_t = (yo_t - yo^*)^2$, where $yo_t = [Ln(Yo_t) - Ln(Yo_{t-1})]$ and $yo^* = \Sigma yo_t/n$

External Sector

S/N	Notation	Name of Series	Unit	Key Data Characteristics	Source	Method of Generation
40	CAB	Current Account Balance	Million Naira	Flow	CBN	CAB = NX + RMT
41	ERv	Exchange Rate Volatility		Measuring variability	CBN	$ERv_t = (er_t - er^*)^2$, where $er_t = [Ln(ER_t) - Ln(ER_{t-1})]$ and $er^* = \Sigma er_t/n$
42	FDI	Foreign Direct Investment	Million Naira	Stock	CBN	Annual FDI is disaggregated using 'cubic-match last' procedure on E-views
43	FDIn	Non-Oil FDI	Million Naira	Stock	CBN	FDIn = FDI - FDIo
44	FDIo	Oil FDI	Million Naira	Stock	CBN	1st: Annual FDIo from 1985 – 1993 is reported. Annual FDIo series from 1994 – 2007 is generated as a proportion in the range 65% - 75% of total FDI. 2nd: Annual FDIo is disaggregated using 'cubic-match last'

						procedure on E-views
45	FPI	Foreign Portfolio Inflow	Million Naira	Stock	CBN	FPI = KI - FDI
46	KI	Capital Import	Million Naira	Stock	CBN	$KI_t = KI_{t-1} + \Delta KI_t$, where $\Delta KI_t = \Delta RES_t - \Delta CAB_t$
47	M	Imports	Million Naira	Flow	CBN & NBS	Reported
48	Mi	Import of Intermediate Inputs	Million Naira	Flow	CBN & NBS	Reported Mi comprises (1) crude inedible materials, (2) mineral fuel, etc, (3) oils, fats & waxes, (4) chemicals & related products and (5) machinery & transport equipments.
49	Mk	Import of Capital Goods	Million Naira	Flow	CBN & NBS	Reported Mk comprises (1) chemicals & related products and (2) machinery & transport equipments.
50	Mo	Other Imports	Million Naira	Flow	CBN & NBS	Mo = M - Mi
51	MY	Import/Output Ratio	Ratio	Measure of import-dependence	CBN & NBS	MY = M/Nominal Y
52	NEER	Nominal	1990 =		IFS of	Reported

		Effective Exchange Rate	100		the IMF	NEER is rebased to 1990 from the 2000-indexed series
53	NER	Nominal Exchange Rate	N/USD 1.00		CBN	Reported
54	NX	Net Exports	Million Naira	Flow	CBN & NBS	Reported
55	OPEC	OPEC Quota for Nigeria	Million Naira	Stock	OPEC	Reported
56	Po	Price of Crude Oil (Bonny Light)	US Dollar per barrel	Stock		Reported
57	RES	External Reserves	Million Naira	Stock	CBN	Reported
58	RER	Real Effective Exchange Rate	1990 = 100		IFS	Reported RER is rebased to 1990 from the 2000 indexed series
59	RMT	Remittances	Million Naira	Flow	CBN	Annual RMT is disaggregated using 'quadratic-match sum' procedure on E-views
60	TAR	Implicit Tariff Rate	Per Cent		CBN & NBS	TAR = [(Import Duties/M)*100]
61	TOT	Terms of Trade	Ratio		CBN & NBS	Reported
62	X	Exports	Million Naira	Flow	CBN & NBS	Reported
63	Xn	Non-Oil Exports	Million Naira	Flow	CBN & NBS	Reported
64	Xo	Oil Exports	Million Naira	Flow	CBN & NBS	Reported

Government Sector

S/N	Notation	Name of Series	Unit	Key Data Characteristics	Source	Method of Generation
65	DDS	Domestic Debt Service	Million Naira	Flow	CBN	Annual DDS is disaggregated using 'quadratic-match sum' procedure on E-views.
66	DDSK	Domestic Debt Stock	Million Naira	Stock	CBN	Annual DDSK is disaggregated using 'quadratic-match sum' procedure on E-views.
67	EDS	External Debt Service	Million Naira	Flow	CBN	Annual EDS is disaggregated using 'quadratic-match sum' procedure on E-views.
68	EDSK	External Debt Stock	Million Naira	Stock	CBN	Annual EDSK is disaggregated using 'quadratic-match sum' procedure on E-views.
69	FD	Fiscal Deficit	Million Naira	Flow	CBN	Annual FD is disaggrega

						ted using 'quadratic-match sum' procedure on E-views.
70	FDF	Fiscal Debt Financing by CBN	Million Naira	Flow	CBN	Annual FDF is disaggregated using 'quadratic-match sum procedure on E-views
71	GCE	Government Capital Expenditure	Million Naira	Flow	CBN	Annual GCE is disaggregated using 'quadratic-match sum' procedure on E-views.
72	GCR	Ratio of GCE to TGE	Per Cent		CBN	GCR = [(GCE/TGE) *100]
73	GEY	Ratio of TGE to Nominal Y	Per Cent		CBN	GEY = [(TGE/Nominal Y)*100]
74	GRE	Government Recurrent Expenditure	Million Naira	Flow	CBN	Annual GRE is disaggregated using 'quadratic-match sum' procedure on E-views.
75	GRV	Government Total Revenue	Million Naira	Flow	CBN	GRV = GRVn + GRVo
76	GRVn	Government Non-Oil Revenue	Million Naira	Flow	CBN	Annual GRVn is disaggregated using

						'quadratic-match sum' procedure on E-views.
77	GRVo	Government Oil Revenue	Million Naira	Flow	CBN	Annual GRVo is disaggregated using 'quadratic-match sum' procedure on E-views.
78	ODF	Other Sources of Deficit Financing	Million Naira	Flow	CBN	ODF = FD*(-1) - FDF
79	TDS	Total Debt Service	Million Naira	Flow	CBN	TDS = DDS + EDS
80	TDSK	Total Debt Stock	Million Naira	Stock	CBN	TDSK = DDSK + EDSK
81	TGE	Total Government Expenditure	Million Naira	Flow	CBN	TGE = GCE + GRE + TDS

Price

S/N	Notation	Name of Series	Unit	Key Data Characteristics	Source	Method of Generation
82	CPI	All Item Consumer Price Index	1990 = 100	Stock	NBS	Reported CPI rebased to 1990 from 2003 indexed CPI series
83	CPIc	Core Consumer Price Index	1990 = 100	Stock	NBS	Reported CPI rebased to 1990 from 2003 indexed CPIc series
84	CPIn	Non-Core Consumer Price Index	1990 = 100	Stock	NBS	Reported CPI rebased to 1990 from 2003 indexed CPIn series
85	INF	Inflation Rate	Per Cent		NBS	Reported
86	INF*	Target Inflation	Per Cent		CBN	Reported
87	INFe	Expected Inflation	Per Cent		CBN & NBS	$INFe_t = aINF_{t+1} + (1 - a)INF_t^*$, where a is a measure of CBN credibility in meeting set target inflation and $0 < a < 1$. As $a \sim 1$, the credibility of the CBN

						improves. a = $(\Sigma INF_t^*)/(\Sigma INF_t)$
88	IRD	Interest Rate Differential between the Domestic and the Foreign	Per Cent		CBN & IFS	IRD = Rm - Rf
89	MPR	Monetary Policy Rate	Per Cent		CBN	Reported as MRR from 1985Q1 – 2006Q3 & as MPR from 2006Q4 – 2007Q4
90	Rf	Foreign Prime Lending Rate	Per Cent		IFS	Rf proxy is the USA prime lending rate
91	Rm	Domestic Maximum lending Rate	Per Cent		CBN	Reported
92	Rp	Domestic Prime Lending Rate	Per Cent		CBN	Reported
93	TBR	Treasury Bills Rate	Per Cent		CBN	Reported

APPENDIX 3

Table 5.37: Augmented Dickey Fuller (ADF) Unit Root Test: 1985:1- 2007:4.

Variable		ADF test stat	Critical Values			Order of integration
			1%	5%	10%	
Yo	Levels	1.94	-2.59	-1.94	-1.61	I(1)
	First diff	-3.32	-2.59	-1.94	-1.61	I(0)
Yn	Levels	2.45	-3.50	-2.89	-2.58	I(1)
	First diff	-7.21	-3.50	-2.89	-2.58	I(0)
Rf	Levels	-3.18	-4.07	-3.46	-3.16	I(1)
	First diff	-3.53	-4.07	-3.46	-3.16	I(0)
Ko	Levels	-2.62	-4.07	-3.46	-3.16	I(1)
	First Diff	-4.66	-4.07	-3.46	-3.16	I(0)
Mk	Levels	-3.53	-4.07	-3.46	-3.16	I(0)
	First Diff	-9.61	-4.46	-3.46	-3.16	I(0)
IIPf	Levels	-0.49	-3.51	-2.90	-2.58	I(1)
	First Diff	-4.34	-3.51	-2.90	-2.58	I(0)
Po	Levels	0.87	-2.59	-1.94	-1.61	I(1)
	First Diff	-5.52	-2.59	-1.94	-1.61	I(0)
Pyo	Levels	-2.72	-3.51	-2.90	-2.58	I(1)
	First Diff	-4.40	-3.51	-2.90	-2.58	I(0)
OPEC	Levels	-1.37	-3.51	-2.90	-2.58	I(1)
	First diff	-5.15	-3.51	-2.90	-2.58	I(0)
Cps	Levels	1.72	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.09	-2.59	-1.94	-1.61	I(0)
Rm	Levels	-0.25	-2.59	-1.94	-1.61	I(1)
	First Diff	-8.32	-2.59	-1.94	-1.61	I(0)
Kn	Levels	-3.75	-2.59	-1.94	-1.61	I(0)
	First Diff	-2.36	-2.59	-1.94	-1.61	I(0)
PYn	Levels	-1.09	-3.51	-2.90	-2.59	I(1)
	First diff	-3.35	-3.51	-2.90	-2.59	I(0)
IEP	Levels	1.17	-2.59	-1.95	1.61	I(1)
	First Diff	-4.41	-2.59	-1.95	-1.61	I(0)
INVo	Levels	-2.01	-3.51	-2.90	-2.58	I(1)
	First Diff	-3.76	-3.51	-2.90	-2.58	I(0)
INVn	Levels	-0.70	-3.51	-2.90	-2.58	I(1)
	First Diff	-3.35	-3.51	-2.90	-2.58	I(0)

Yv	Levels	-2.49	-2.59	-1.94	-1.61	I(0)
	First Diff	-10.84	-2.59	-1.94	-1.61	I(0)
Yvn	Levels	-6.91	-2.59	-1.94	-1.61	I(0)
	First Diff	-9.79	-2.59	-1.94	-1.61	I(0)
Yvo	Levels	-3.47	-4.07	-3.46	-3.16	I(0)
	First Diff	-14.09	-4.07	-3.46	-3.16	I(0)
Yd	Levels	-0.17	-2.59	-1.94	-1.61	I(1)
	First Diff	-2.39	-2.59	-1.94	-1.61	I(0)
INF	Levels	-2.89	-3.51	-2.90	-2.58	I(0)
	First Diff	-6.67	-3.51	-2.90	-2.58	I(0)
FDIo	Levels	-4.64	-4.06	-3.50	-3.16	I(0)
	First Diff	-11.45	-4.06	-3.50	-3.16	I(0)
FDIn	Levels	-4.43	-4.06	-3.50	-3.16	I(0)
	First Diff	-12.53	-4.06	-3.50	-3.16	I(0)
CUn	Levels	-1.45	-3.50	-2.89	-2.58	I(1)
	First Diff	-3.11	-3.50	-2.89	-2.58	I(0)
DD	Levels	-2.99	-4.06	-3.50	-3.16	I(2)
	First Diff	-3.22	4-06	-3.50	-3.16	I(1)
RRM	Level	-2.84	-2.59	-1.94	-1.61	I(0)
	First Diff	-7.00	-2.29	-1.94	-1.61	I(0)
Cf	Levels	0.95	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.09	-2.59	-1.94	-1.61	I(0)
Cn	Levels	1.42	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.06	-2.59	-1.94	-1.61	I(0)
CAB	Levels	-1.35	-4.06	-3.46	-3.16	I(1)
	First Diff	-7.81	-4.06	-3.46	-3.16	I(0)
RMT	Levels	-2.55	-4.06	-3.46	-3.16	I(1)
	First Diff	-6.12	-4.06	-3.46	-3.16	I(0)
M_2	Levels	1.29	-2.59	-1.94	-1.61	I(1)
	First Diff	-2.59	-2.59	-1.94	-1.61	I(0)
FD	Levels	-1.79	-4.06	-3.46	-3.16	I(1)
	First Diff	-5.81	-4.06	-3.46	-3.16	I(0)
Cg	Levels	-1.07	-2.59	-1.94	-1.61	I(2)
	First Diff	0.16	-2.59	-1.94	-1.61	I(1)
SMK	Levels	3.68	-2.59	-1.94	-1.61	I(1)
	First Diff	-2.09	-2.59	-1.94	-1.61	I(0)
FNDP	Levels	-0.88	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.44	-2.59	-1.94	-1.61	I(0)
TBR	Levels	-2.38	-3.51	-2.89	-2.58	I(1)

	First Diff	-5.20	-3.51	-2.89	-2.58	I(0)
GS	Levels	0.52	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.36	-2.59	-1.94	-1.61	I(0)
NOS	Levels	2.77	-2.59	-1.94	-1.61	I(1)
	First Diff	-4.62	-2.59	-1.94	-1.61	I(0)
Cps	Levels	-1.23	-4.06	-3.46	-3.16	I(1)
	First Diff	-10.71	-4.06	-3.46	-3.16	I(0)
Cpo	Levels	-1.96	-4.06	-3.46	-3.16	I(1)
	First Diff	-5.77	-4.06	-3.46	-3.16	I(0)
Cpn	Levels	-1.45	-4.06	-3.46	-3.16	I(1)
	First Diff	-9.66	-4.06	-3.46	-3.16	I(0)
Xo	Levels	-3.81	-4.06	-3.46	-3.16	I(0)
	First Diff	-11.12	-4.06	-3.46	-3.16	I(0)
Xn	Levels	-4.40	-4.06	-3.46	-3.16	I(0)
	First Diff	-10.27	-4.06	-3.46	-3.16	I(0)
IIPf	Levels	-3.16	-4.06	-3.36	-3.16	I(1)
	First Diff	-3.90	-4.06	-3.46	-3.16	I(0)
RER	Levels	-4.48	-4.06	-3.46	-3.16	I(0)
	First Diff	-7.64	-4.06	-3.46	-3.16	I(0)
TOT	Levels	-3.90	-4.06	-3.46	-3.16	I(0)
	First Diff	-12.60	-4.06	-3.46	-3.16	I(0)
IRD	Levels	-0.59	-2.59	-1.94	-1.61	I(1)
	First Diff	-4.43	-2.59	-1.94	-1.61	I(0)
FPI	Levels	-1.63	-4.06	-3.46	-3.16	I(1)
	First Diff	-13.75	-4.06	-3.46	-3.16	I(0)
ERv	Levels	-4.01	-4.06	-3.46	-3.16	I(0)
	First Diff	-9.08	-4.06	-3.46	-3.16	I(0)
Mi	Levels	-0.72	-4.06	-3.46	-3.16	I(1)
	First Diff	-7.40	-4.06	-3.46	-3.16	I(0)
Y	levels	-0.64	-4.06	-3.46	-3.16	I(2)
	First Diff	-2.42	-4.06	-3.46	-3.16	I(1)
TAR	Levels	-1.26	-2.59	-1.94	-1.61	I(1)
	First Diff	-12.41	-2.59	-1.94	-1.61	I(0)
Mo	Levels	-3.02	-4.06	-3.46	-3.16	I(1)
	First Diff	-5.87	-4.06	-3.46	-3.16	I(0)
NER	Levels	-2.04	-4.06	-3.46	-3.16	I(1)
	First Diff	-4.67	-4.06	-3.46	-3.16	I(0)
RES	Levels	-4.55	-4.06	-3.46	-3.16	I(0)
	First Diff	-13.44	-4.06	-346	-3.16	I(0)

NX	Levels	-3.32	-3.51	-2.89	-2.58	I(0)
	First diff	-4.78	-3.51	-2.89	-2.58	I(0)
EDS	Levels	-1.37	-2.59	-1.94	-1.61	I(1)
	First Diff	-3.98	-2.59	-1.94	-1.61	I(0)
NFA	Levels	-11.41	-2.59	-1.94	-1.61	I(0)
	First Diff	-3.38	-2.59	-1.94	-1.61	I(0)
ODF	Levels	-5.14	-4.06	-3.46	-3.16	I(0)
	First Diff	-6.97	-4.06	-3.46	-3.16	I(0)
Cgcbn	Levels	-1.41	-4.06	-3.46	-3.16	I(1)
	First Diff	-6.89	-4.06	-3.46	-3.16	I(0)
Cgdmb	Levels	0.01	-3.51	-2.81	-2.51	I(1)
	First Diff	-13.91	-3.51	-2.81	-2.51	I(0)
TDL	Levels	-1.27	-4.06	-3.46	-3.16	I(1)
	First Diff	-3.64	-4.06	-3.46	-3.16	I(0)
ASI	Levels	4.98	-3.51	-2.81	-2.51	I(2)
	First Diff	-2.22	-3.51	-2.81	-2.51	I(1)
CPI	Levels	-2.24	-3.51	-2.81	-2.51	I(2)
	First Diff	-2.42	-3.51	-2.81	-251	I(1)
Yg	Levels	0.51	-4.06	-3.46	-3.16	I(2)
	First Diff	-3.34	-4.06	-3.46	-3.16	I(1)
GRE	Levels	-2.06	-2.59	-1.94	-1.61	I(0)
	First Diff	-6.23	-2.59	-1.94	-1.61	I(0)
GRV	Levels	-0.42	-2.59	-1.94	-1.61	I(1)
	First Diff	-6.37	-2.59	-1.94	-1.61	I(0)
GRVo	Levels	-2.87	-4.06	-3.46	-3.16	I(1)
	First Diff	-6.01	-4.06	-3.46	-3.16	I(0)
GRVn	Levels	-1.74	-4.06	-3.46	-3.16	I(I)
	First Diff	-4.25	-4.06	-3.46	-3.16	I(0)
GEY	Level	-2.31	-4.06	-3.46	-3.16	I(1)
	First Diff	-5.69	-4.06	-3.46	-3.16	I(0)
DDS	Levels	-2.07	-4.06	-3.46	-3.16	I(1)
	First Diff	-7.24	-4.06	-3.46	-3.16	I(0)
FDF	Levels	-3.10	-4.06	-3.46	-3.16	I(1)
	First Diff	-5.42	-4.06	-3.46	-3.16	I(0)
MPR	Levels	-2.94	-4.06	-3.46	-3.16	I(1)
	First Diff	-7-84	-4.06	-3.46	-3.16	I(0)

Note: Critical Level for ADF is 95 per cent

ISBN: 978-978-53289-6-7