EXCHANGE RATE, OUTPUT AND INFLATION IN NIGERIA

(1970-2007)

By

JAMEELAH OMOLARA YAQUB

Matriculation Number 124913

B. Sc (ILORIN), M.Sc (IBADAN)

A Thesis in the Department of Economics, submitted to the Faculty of the Social Sciences in partial fulfilment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

SEPTEMBER 2010

ABSTRACT

ral to improving the economic performance of a nation. Over the years, Nigeria adopted both the fixed and managed float exchange rate systems in her attempt at attaining a realistic exchange rate. This is to ensure efficient allocation of foreign exchange resources that may pave way for a non-inflationary growth and a well diversified economy. However, the attainment of these goals remained elusive. Earlier studies on the effects of exchange rate on the Nigerian economy ignored differences in sectoral output responses to changes in exchange rate and economic agentsô expectations. This study, therefore, investigated the effects of anticipated and unanticipated changes in exchange rate on aggregate and sectoral output, and inflationary trends in Nigeria between 1970 and 2007.

A macroeconometric model, based on a modified investment-saving and the liquidity-money supply framework, was employed using secondary data, to capture the direct and indirect relationships between exchange rate movements, output and inflation. Exchange rate was split into anticipated and unanticipated components using the Autoregressive Moving Average method. The behavioural equations were estimated with the three-stage-least-squares technique and a general-to-specific estimation methodology was employed to ensure that important information was not left out. Statistical tests were used to confirm the goodness of fit of the estimated equations. The Theilôs inequality coefficients and the root mean squared errors were used to gauge the modelôs efficiency and tracking ability. Their parameter values were within acceptable range. The model was then used to carry out *ex post* simulations of the effects of anticipated and unanticipated exchange rate depreciation on output and inflation.

Some differences in sectoral output responses to anticipated and unanticipated depreciation were observed. The coefficients of anticipated exchange rate in the equations for aggregate output, agriculture, manufacturing, and output of services were -0.05, -0.15, -0.01, and 0.09, respectively. All of these were statistically significant at 5.00%, implying that anticipated depreciation reduced aggregate output and outputs of agricultural and manufacturing sectors, while it increased services sectorôs output. Unanticipated exchange rate had insignificant negative effects on aggregate and sectoral outputs, except for manufacturing where the effect was positive. Anticipated depreciation had a strong inflationary effect with a significant coefficient of 0.28, while the impact of unanticipated exchange rate on inflation was negligible. Simulation results indicated that, on the average, a 15.00% anticipated depreciation would reduce aggregate output by 2.12% and agricultural, manufacturing and services sectorsô outputs by 9.23%, 2.00%, and 5.32% respectively; while it would raise inflation by 17.17%.

te depreciation had significant contractionary effects on
pt for the services sector) and promoted inflation, while unanticipated depreciation had negligible effects. This implied that policy neutrality hypothesis may not hold for the Nigerian environment and, more importantly, that existing structures could not support an expansionary argument for exchange rate depreciation during the period of study.

Key words: Exchange rate, Output, Inflation, Anticipated and unanticipated depreciation

Word count: 469

DEDICATION

This thesis is dedicated to Almighty **ALLAH** (SWT), the Lord of the Universe, and the source of all knowledge. I also dedicate this work to all lovers of the Truth.

ACKNOWLEDGEMENTS

llah, who has made it possible for me to go this far. I appreciate His Protection, Mercy and Grace at all times, without which this work would not have been completed. To Him alone be glory and adoration for ever.

I am truly grateful to all members of my thesis committee. I am particularly grateful to Dr. I.D. Poloamina, the chairman of the committee, for painstakingly reading my write-ups and making constructive criticisms and useful suggestions at every stage of the work. His encouraging words, affable disposition and easy accessibility went a long way in urging me to forge ahead. I equally appreciate the contributions of other members of my thesis committee: Prof. Egwaikhide is particularly appreciated for his interventions at the initial teething-stage and at the point of rounding off. His words of encouragement instilled in me the confidence when most needed. Dr Adewuyi was always there to run to when things looked gloomy. I have benefited immensely from all the team members and I shall ever remain grateful for this. To you all I say a big ôThank youô.

I will like to register my sincere appreciation to the academic staff in the department of economics. Your dedication and patience have made this work a reality. Particular mention must be made of Profs. Egwaikhide, Iwayemi, Olofin, Adenikiju, Ariyo, Oyejide, Ogunkola (the Programme Director), Garba (Mrs), Ilori (Mathematics department), Drs. Adewuyi, Aminu, Aregbeyen, Ogwumike, Ogun, Bankole, Oyinlola, Fowowe, Babatunde, Folawewo and Oyeranti. I specially appreciate the contribution of Prof. A.G. Garba, who was on Sabattical in the Department when I was writing this thesis. I also acknowledge the role of the non-academic staff of the Department of Economics, University of Ibadan, towards the successful completion of this work, particularly Mrs Ojebode, Mrs Paulina Okebugwu, Wunmi and Mr Etim, you are all wonderful people. My lecturers at the Joint Facilities for the Electives (JFE) are not less appreciated, particularly Drs. Rosalia Vazquez-Alvarez, Kenneth Ojo, and Profs. Owoye, Ndekwu, Kidani, for nurturing in me the love for research. To you all I say ôThank youô.

I acknowledge with gratitude the role of my sponsor, the African Economic Research Consortium (AERC), Nairobi, Kenya, in facilitating the timely completion of this programme. The financial support and the provision of conduicive learning environment by the organisation during the Joint Facility for Electives (JFE) are highly appreciated. Worthy of note is the Executive Director, Bili Lyakurwa; the Director of Training, Marios Obwona ; the CPP Manager, Prof. Mukwanason Hyuha; the Director of Research, Prof. Olu Ajakaiye; Lynnette Onyango and other administrative members of staff of the AERC secretariat and library. This thesis benefited immensely from the contributions made during the two biannual workshops of the AERC, during which the proposal and postfield reports were presented. I am particularly grateful to the resource persons at the workshops and the Chairman of my team at the workshops, Prof. Ademola Oyejide.

I acknowledge with gratitude my employer, the Lagos State University (LASU), for granting me study leave for the Ph.D programme. My colleagues in the Department of Economics, LASU, are appreciated for their support and encouragement, particularly Mrs R.O.

(past and present), Messrs Ogede, Odubunmi, Lawal, ınlana, Drs. Omobitan, Olopoenia, A.K.Akanni, Ige, and Olaleye.

The following people deserve special mention for their unflinching support during the course of this programme: Profs. A.A. Agbaje, the Deputy Vice Chancellor (Academic), University of Ibadan, Gbadegesin, Drs Momoh, Badmus, Alhaja Balogun (Ibadan). I cannot appreciate enough the moral and spiritual support of dear sisters and brothers in the Criterion, the Companion, the Islamic Reflection Group, particularly, Prof (Mrs) Abdulkareem, the Agbajes, Ali-Oluwafuyis, Adams, Abiolas, Salahudeens, Shittu, Adekilekuns and the Onibons. To you all I say, óJazakumullahu Khayranô.

All my colleagues in the 2006 Collaborative Ph.D Programme (CPP) class and at the 2007 JFE are highly appreciated, particularly Ajide- Bello, Tosin, Ibrahim, William, Mrs Fadiran, Awiti, Elizabeth, Grace. My interactions with you all have enriched my research capacity and I am sincerely grateful for this. I benefited immensely from my predecessors in the CPP, particularly Drs Christian Abhotor and Robert Dauda Korsu, Mutiu Oyinlola, Eric Ogunleye and Udoma Afangideh. The Balewite family have been wonderful. I appreciate in particular Rejoice Atiko, Alhaji Adeniyi, Mrs T.M.Yusuf, Mrs Ojo, Miss Ladele, and Henry Hunjo. I am grateful to Drs Henry Hunjo and Abayomi Olusegun Joseph, who proofread my thesis without any financial compensation. I appreciate the Ibisomis in Nairobi. They made me felt at home during the JFE. The contribution of my research assistant, Muhyideen Adejare, is highly recognised.

This acknowledgement will be incomplete if I fail to recognise the contributions of my immediate family members, who were denied one thing or the other as a result of my frequent absence from home while on the Ph.D programme. My husband, Dr T. M. Yaqub, you are particularly appreciated for your support and encouragement from the inception of this programme. You tolerated my almost excessive absence from home without complaining; I shall remain sincerely grateful for this. I appreciate my wonderful children, who condoned with my near invisibility from home. Fadeelah, Zaynab, Naôeemah, Abdullahi-Basit and the baby of the house, Mazeedatul-Khayr, I appreciate you all. May Allah continue to guide and guard you all, give you the best in this world and the hereafter. I sincerely appreciate the support of my parents, Mr and Madam Adetoro. Your continuous prayer is always comforting to me. May Allah in His infinite Mercy, give you both long life, with sound health and faith. My brother and sisters: Abdul-Wasiôu Adetoro, Rahmat, Medina, Tawakalt, I appreciate you all. May God be with you and members of your families.

Jameelah Omolara Yaqub
Department of Economics
Faculty of the Social Sciences
University of Ibadan,
Ibadan, Nigeria.

September, 2010

CERTIFICATION

rried out by **Jameelah Omolara YAQUB** under our supervision in the Department of Economics, University of Ibadan, Ibadan, Nigeria.

é é é é é é é é
Dr I. D. Poloamina

Supervisor and Chairman, Thesis Committee,

B.Sc (Econs) M.Sc (Econs) PhD (Ibadan)

Senior Lecturer of the Department of Economics,

University of Ibadan, Nigeria

é é é é é é é é é .
Festus O. Egwaikhide
Professor of Economics
University of Ibadan, Nigeria

B.Sc (Econs) M.Sc (Econs) PhD (Ibadan)

Member, Thesis Committee,

é é é é é é é é ..
Dr. A.O. Adewuyi
Member, Thesis Committee,

B.Sc (Econs) M.Sc (Econs) PhD (Ibadan)

Lecturer of the Department of Economics,

University of Ibadan, Nigeria

BLE OF CONTENTS

CHAPTER THREE: LITERATURE REVIEW

CHAPTER FOUR: THEORETICAL FRAMEWORK AND METHODOLOGY

Page

Page

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Statement of Problem

The macroeconomic performance of a nation is determined by a number of factors categorised into two; exogenous and endogenous. The exogenous factors include changes in terms of trade, economic activities in industrialized countries and international interest rates and prices. The endogenous factors include fiscal stance and exchange rate policy (Ghura and Grennes, 1993). The exchange rate has been singled out as one of the most important factors influencing economic performance. According to Cottani *et al* (1990), the dismal economic performance in Latin America, Asia and Africa can be linked to real exchange rate behaviour. Moreover, it is widely acknowledged that the real exchange rate is one of the most important relative prices in an economy; therefore, it can be argued that a sound exchange rate policy and an appropriate exchange rate are crucial conditions for improving the economic performance of a nation.

Oyejide and Ogun (1995) and Ogun (2000) have classified Nigeriaôs exchange rate regimes since independence into four, (except the brief period of confusion between 1972 and 1974). These are the fixed rate regime of 1960 to 1970, the adjustable peg regime of 1974 to 1978, the managed float regime of 1978 to 1985 and the flexible exchange rate regime of 1986 to date. The different regimes have implications for the behaviour of economic agents, vis-à-vis expectations of movements in real exchange rate. While the period between 1960 and 1986 was characterised by misaligned exchange rate, the market based exchange rate period is characterised by unprecedented volatile exchange rate (Oyejide and Ogun, 1995), which encouraged speculative activities and changing expectations about exchange rate. Economic agentsô expectations about changes in exchange rate affect their demand and supply decisions, thus affecting output and price. The question of anticipated and unanticipated movements in exchange rate is therefore important during the period when exchange rate becomes more volatile.

Despite the change from one form of exchange rate arrangement to the other, the performance of the Nigerian economy has not been impressive. It has been characterised

nance. The growth rate of Nigeriaôs real output has been low and sluggish, since the 1970s. The growth rate of total real gross domestic product (GDP) averaged 3.6% between 1970 and 2007. Real GDP growth rate suffered persistent decline in the 1970s, with an average growth rate of 6.2%. It declined to 3.1% and 2.3% in the 1980s and 1990s respectively, though rising to 6.3% between 2001 and 2006. Similar trend obtained in the non-oil sector, where agricultural output grew at the rate of 3.4% on the average between 1970 and 2007. Agriculture suffered a decline in output in the 1970s (2% on the average); it recorded a growth rate of less than 5% on the average throughout the 1980s and 1990s, but this declined to 1.9% between 2001 and 2006. Manufacturing output grew at the rate of 2.1% on the average between 1970 and 2006. It recorded a growth rate of 5% in the 1970s but this declined to 3.7% in the 1980s, with a negative growth rate of 1.5% in the 1990s. It only picked up slightly between 2001 and 2006, with a growth rate of 1.1%.

Other macroeconomic indicators did not show better picture. Inflation rate has been rising persistently, from 14.9% on the average in the 1970s to 22.7% and 30.58% in the 1980s and 1990s respectively, declining to 14.5% between 2001 and 2006, this being 21.4% on the average during the period under study. Although total export has been on an upward trend, it has largely been dominated by oil. The share of non-oil exports in total export, which was above 40% in 1970 gradually declined, to about 2% in 2006, (CBN, 2006). In terms of contribution to total GDP, the share of manufacturing sector in total GDP has been declining over time. The share of the manufacturing in GDP, which was 9.3% in 1985, declined to 5.3% in 1995 and went down further to 3.6% in 2000. Agricultural output, which was almost 50% of total GDP in 1970 declined to about 32% in 2006, while petroleum, which was just about 9% of GDP in 1970 rose to about 38% in 2006. The objective of diversification of the economy, which is stressed persistently in most policy measures, has remained elusive as the growth of all components of non-oil GDP remained unimpressive over the years. This trend reveals an increasing dependence on only one product (petroleum), which most economic policies aimed at reversing.

Based on the above, the following research questions become pertinent. What are the driving forces behind changes in output in Nigeria? Which output sector is more susceptible to movements in real exchange rate? Do anticipated exchange rate changes have effects on output and inflation? Do unanticipated changes in exchange rate matters

ria? Do output and inflation react in similar or different manner to anticipated and unanticipated movements in real exchange rate? These questions constitute the main focus of this study

1.2 Objective of study

The broad objective of this thesis is to investigate the effects of exchange rate variations on output and inflation. The specific objectives are threefold. These are:

i) To develop a macroeconomic model of the Nigerian economy.

ii) To investigate the effects of anticipated and unanticipated real exchange rate changes on the output of different sectors of the economy as well as on aggregate output.

iii) To investigate the effects of anticipated and unanticipated exchange rate changes on inflation.

1.3 Justification for the Research

The empirical evidence on the effect of exchange rate movements on output in Nigeria has largely been inconclusive. While Adewuyi (2005) and Odusola and Akinlo (2001) find evidence for expansionary effect of depreciation, Ubok-Udom (1999), among others, support the fact that depreciation is contractionary in Nigeria. A possible cause of divergence in result could be methodological differences. For instance while Adewuyi (2005) adopted the two-stage least squares (2SLS) in order to account for simultaneity problem, Ubok-Udom (1999) used the OLS estimation technique ignoring the simultaneity problem. Adewuyi (2005) focussed on nominal exchange rate but this is not adequate given the fact that inflation differential exists between Nigeria and her trading partners. The use of real exchange rate would be more appropriate as it reflects the competitiveness of Nigerian goods; therefore, the real exchange rate is used in this study.

Secondly, Odusola and Akinlo (2001) used VAR which has been criticised as being *atheoretical*. The use of system two-stage least squares in this study would enable us to take care of the simultaneity problem that may arise in the analysis and also ensure that both direct and indirect effects of changes in exchange rate are captured. Moreover,

Adewuyi (2005) considered only aggregate output. Such analysis is subject to aggregation bias and may obscure important sectoral differences in response to changes in exchange rate. The sectoral analysis carried out in this study would afford us the opportunity of investigating sectoral responses so that appropriate policy could be adopted for different sectors.

Thirdly, earlier studies on the effect of exchange rate on output and inflation have largely ignored the role of expectations. Where expectation is considered (for example Agenor, 1991), it was in a cross country analysis, which ignored country-specific characteristics. Moreover, Agenorôs (1991) covered the period between 1978 and 1987, which excluded more recent period during which the Nigeria exchange rate management system underwent tremendous changes. Expectations about exchange rate changes are important given the high fluctuations of exchange rate in the Nigerian economy, especially after the introduction of the market based exchange rate system. Studies in other countries (for example Kandil, 2004) have shown some significant differential responses to anticipated and unanticipated changes in real exchange rate. This study, therefore, brings in the issue of expectations by decomposing exchange rate changes into anticipated and unanticipated components and investigating the effects of these components on sectoral and aggregate output as well as inflation.

Lastly, this study makes use of real effective exchange rate as opposed to bilateral nominal or bilateral real exchange rate which other studies on Nigeria have used. The use of real effective exchange rate would enable us to combine the nominal exchange rate changes with movements in domestic inflation relative to that of major trading partners to determine the implications of fluctuations in the real effective exchange rate on economic performance. The real exchange rate accounts for price in the domestic economy relative to the weighted average of foreign price in major trading partnersô economies. This channel is important, given the high inflationary experience in Nigeria which may not make nominal depreciation to be translated into real depreciation.

1.4 Scope of Thesis

The study focuses on the effect of exchange rate movements on output and inflation in Nigeria. It covers the period between 1970 and 2007. The choice of 1970 as the starting date of study is influenced by the fact that instability in the value of domestic

ing this time with the attendant effect on expectations about changes in exchange rate. The choice of 2007 as the end date is dictated by the availability of data. The change in real effective exchange rate is decomposed into anticipated and unanticipated components and the effect of each component on total and sectoral outputs as well as inflation is investigated. In this study, output is disaggregated into agricultural output, manufacturing output, petroleum output and services sectorôs output and the effect of exchange rate changes on each component is investigated.

1.5 Organisation of work

The whole thesis is presented in six chapters. Chapter one is preoccupied with the introduction while chapter two contains the background of the study. In this chapter, the exchange rate management arrangements in Nigeria are discussed alongside the performance of economic indicators such as sectoral and aggregate output as well as inflation. Trends in macroeconomic policy which have some bearing on economic performance were also examined in this chapter. In chapter three a review of theoretical, empirical as well as methodological literature on the relationship among exchange rate, output and inflation is presented. Chapter four contains the theoretical framework and methodology while in chapter five; the results of the analysis are presented and discussed. The summary of findings, recommendations conclusion and suggestions for further research are presented in the sixth and final chapter.

CHAPTER TWO

Trends in Exchange Rate Management and Macroeconomic Performance in Nigeria

2.1 Overview of the Exchange Rate Arrangement in Nigeria

The exchange rate management policies in Nigeria, as in any other developing country, are often sensitive and controversial. It is sensitive because changes in exchange rate affect economic agents differently. It is widely acknowledged in the literature focusing on this phenomena that exchange rate policy is one of the factors responsible for the dismal performance of many Sub-Saharan African economies. As a result, authorities in many of these countries do make concerted effort at attaining optimal exchange rate policy in order to ensure price stability and sustainable growth of output. Nigeria is no exception, as different exchange rate regimes, with their different variants, have been experimented with in order to arrive at an optimal exchange rate system.

The exchange rate management system in Nigeria has undergone tremendous changes since 1960 when Nigeria attained independence. From a fixed exchange rate regime between 1960 and 1986, it changed radically in 1986 when the Structural Adjustment Programme (SAP) was introduced, to a market based system. Since the introduction of the market based system, with its different variants, the economy has gone through series of changes, which have substantially affected the trend and stability of the exchange rate. The official exchange rate, which was ₦0.65/$1, on the average in the 1970s, became ₦2.25/$1 on the average in the 1980s. The exchange rate appreciated by 2.47% on the average in the 1970s but depreciated at the rate of 36.15% on the average in the following decade. The condition of the naira was worse in the 1990s as it depreciated on average at the rate of 45.83%, exchanging on average at the rate of ₦19.54/$1, as a result of the operation of the dual exchange rate system[1]. With the abolition of the official exchange rate, the autonomous foreign exchange market (AFEM) became the window for all foreign exchange transactions, private and official, and the naira depreciated further. It exchanged at the rate of ₦50.26/$1, with an average annual depreciation rate of 42.32% (see Table 1). The Dutch Auction System (DAS), which was

[1] The dual exchange rate was abolished in January, 1999.

o arrest the depreciation of the naira as it plunged further in 2002 till 2004 when the Wholesale Dutch Auction System (WDAS) was introduced. With this, the naira regained some strength, appreciating slightly on the average by 1.83% between 2004 and 2006. Other measures that were introduced, which contributed to the firming up of the naira, included allowing *bureaux de change* operators to participate in the official window, prudent fiscal operations and increased surveillance by the Central Bank of Nigeria on the activities of the authorised dealers. A detailed review of the structure of the market, presented below, will give a better understanding of the nature of the movement of the exchange rate.

2.1.1 Foreign Exchange Market in Nigeria

Foreign exchange policy began in Nigeria in 1959 with the establishment of the Central Bank of Nigeria (CBN), which was assigned the responsibility of managing the countryôs currency with the objective of attaining a sound and stable national currency. The evolution of the foreign exchange market in Nigeria was influenced by factors such as the changing patterns of international trade, institutional changes in the economy and structural shifts in production. Prior to the establishment of the CBN, foreign exchange was held in balances abroad by the commercial banks which acted as agents for local exporters, with agriculture being the major foreign exchange earner during this time (CBN 1996).

The increased exports of crude oil in the early 1970s, as a result of the oil boom, enhanced official foreign exchange receipts, thus strengthening the value of the domestic currency. The boom in foreign exchange earning made its management to become crucial in order to ensure that shortages do not arise. However, a comprehensive exchange control measure was not introduced until 1982, when the supply of foreign exchange began to shrink as a result of developments in the international oil market.

GE RATE TREND AND PERCENTAGE CHANGE

YEAR	OFFICIAL EXCHANGE RATE (AVERAGE)		PERCENTAGE CHANGE IN OFFICIAL EXCHANGE RATE	
1970 ï 1979	0.64211		-2.51614	
1980 ï 1989	2.49193		39.14769	
1990 ï 1999	26.3170	50.30075*	46.29291	42.32044*
2000- 2003	116.0938		8.696324	
2004	133.500		3.203473	
2005	132.147		-1.01378	
2006	128.6516		-2.64508	
2007	125.83331		-2.1908	

Note: * Referred to AFEM rate only.
Source: Authorôs computation, compiled from Central Bank of Nigeria Statistical Bulletin, 2007

asures introduced in 1982, to evolve an appropriate mechanism for foreign exchange allocation led to increased activities of speculators and middlemen, leading to the emergence of parallel foreign exchange market. The parallel foreign exchange market activities heightened speculations in the market, making it difficult to predict the path of exchange rate movement. The parallel market premium which emerged as a result of the disequilibrium in the official foreign exchange market led to various forms of abuses such as under-invoicing of export, over-invoicing of imports and round tripping. The resultant economic crisis led to the introduction of the Second-tier Foreign Exchange Market (SFEM) in September, 1986. Under the SFEM, the determination of the Naira exchange rate and allocation of foreign exchange were based on market forces.

Despite the introduction of SFEM, sharp practices were still observed in the foreign exchange market which resulted in volatility in rates and this led to the introduction of further reforms. Such reforms included the formal pegging of the naira exchange rate, the centralization of foreign exchange in the CBN, the restriction of *bureaux de change* to buy foreign exchange as agents of the CBN, the reaffirmation of the illegality of the parallel market and the discontinuation of open accounts and bills for collection as means of payments (CBN, 2002).

The foreign exchange market was liberalized in 1995 with the introduction of the Autonomous Foreign Exchange Market (AFEM) for the sale of foreign exchange to end-users by the CBN through selected authorized dealers at market determined rate. Furthermore, *bureaux de change* were again accorded the status of authorized buyers and sellers of foreign exchange. Further liberalization took place in 1999, when the Inter-bank Foreign Exchange Market (IFEM) was introduced. Two facts that emerged from the above are that the parallel market emerged as a result of the inability of the official supply to satisfy demand, and that bureaucratic procedures in foreign exchange dealings have continued to engender the growth and development of the parallel market.

2.1.2 Foreign Exchange Management in Nigeria before 1986

Prior to 1986, importers and exporters of non-oil commodities were required to obtain appropriate licences from the Federal Ministry of Commerce before they could participate in the foreign exchange market. Authorised dealers passed applications for

other relevant documents to the Central Bank of Nigeria (CBN) for approval and foreign exchange cover, while they deposited the domestic currency equivalent with the CBN. Similarly, exportersô applications were routed through the authorized dealers to the CBN and foreign exchange receipts from such transactions were expected to be surrendered to the CBN in exchange for domestic currency. Generally, the import procedures followed the international standard of opening letters of credit and subsequent confirmation by correspondent banks abroad. However, transactions on unconfirmed letters of credit and open accounts carried foreign exchange risk and the licensed bank and foreign exporters might lose in the process. The use of Form ôMô was introduced in 1979 when the Comprehensive Import Supervision Scheme (CISS) was put in place to guard against sharp import practices such as over-invoicing and importation of undeclared items, which resulted in persistent drain on external reserves. The authorization of foreign exchange disbursement was a shared responsibility between the Federal Ministry of Finance and the CBN. The Federal Ministry of Finance had responsibility for public sector applications while the CBN was responsible for the allocation of foreign exchange for the private sector application. The CBN effected payments in all cases. The Federal Government decentralised foreign exchange allocation in 1984 and allowed licensed banks to approve applications and allocate foreign exchange to customers, subject to the maximum allocated to them by the CBN. This practice was, however, discontinued in 1985 because of abuses by the banks.

The main instruments of foreign exchange management before 1986 were trade and exchange controls and export promotion. During this period, the exchange rate was administratively determined with the objective of reducing external sector imbalances. Trade and exchange controls were the most prominent initially, as they exerted direct impact on various aggregates in the economy. However, from 1981, when the foreign exchange situation worsened and the pressure on the balance of payment persisted, emphasis shifted to export promotion as a means of reducing pressure on the external sector. The government introduced a number of incentives to boost non-oil export. These included arrangement for setting up export processing zones (EPZ), concessions to exporters to retain 25 per cent of their export proceeds, the liberalization of export and import licensing procedures and the provision for the establishment of an export credit guarantee and insurance scheme. Exchange control was discarded on September 26,

ange rate mechanism that would be more responsive to prevailing economic conditions.

2.1.3 Foreign Exchange Management Since 1986

With the adoption of Structural Adjustment Programme (SAP), that emphasised a market-oriented approach to price determination, the management of the foreign exchange market changed substantially. The Second-tier Foreign Exchange Market (SFEM) was introduced on the 26th of September, as fallout of the adoption of SAP. Under this system, the determination of the naira exchange rate was made to reflect market forces and the rate derived from the market served as the means of allocation of foreign exchange.

Within the basic framework of market determination of the naira exchange rate, various methods were applied and adjustments were carried out to fine-tune the system. A transitory dual exchange rate system (first and second-tier) was adopted in September, 1986. The first-tier was managed while the second-tier was subjected to market forces. On 2nd July, 1987, the first and second-tier markets were merged into an enlarged Foreign Exchange Market (FEM). Various pricing methods such as marginal, weighted average and the Dutch Auction System (DAS) were adopted. With the introduction of SFEM, the allocation powers of the Federal Ministry of Finance were transferred to the CBN, but the ministry still retained its approving powers on public sector transactions. Their powers were enhanced in 1989 when it was assigned the responsibility for licensing *bureaux de change*. These *bureaux de change* were set up principally to enlarge the scope of the officially recognised foreign exchange market, to accord access to small users of foreign exchange in a less formal manner and enhanced macroeconomic management. They are required to deal only in privately-sourced funds and are not allowed to finance imports.

The constant fine-tuning of the foreign exchange market culminated in the complete floating of the naira on the 5th of March, 1992, when the system of pre-determined quota was discontinued. The un-abating pressure on the foreign exchange market however, resulted in a policy-reversal in 1994 when the naira exchange rate was formally pegged and the CBN was given the sole authority to allocate foreign exchange to end-users on *pro-rata* basis. The reversal of policy to that of a guided-deregulation in

of the Autonomous Foreign Exchange Market (AFEM). Apart from the institution of an appropriate mechanism for exchange rate determination, other measures introduced included demand management and supply-side policies. The CBN and the government actively fostered the development of institutions such as the Nigerian Export Promotion Council (NEPC) and the Nigerian Export-Import Bank (NEXIM) in an attempt to earn more foreign exchange.

The AFEM metamorphosed into a daily two-way quote Inter-Bank Foreign Exchange Market (IFEM) on 25th October, 1999. The IFEM was expected to broaden and deepen the foreign exchange market on daily basis and discourage speculative activities. Other complementary measures introduced included the intensification of surveillances on banks and imposition of sanctions on those apprehended for unethical practices. Despite all these measures, the objectives of IFEM remained largely unattained as the CBN still accounted for over 90 per cent of the funds traded during the period with the existence of multiple exchange rates as well as an army of foreign exchange speculators and arbitrageurs.

To address these adverse developments and enthrone sanity in the foreign exchange market, the Dutch Auction System (DAS) was re-introduced in July, 2002. Under this system, the CBN intervened twice weekly and end-users bought foreign exchange at their bid rates through the authorised dealers. DAS was able to bring in some stability in the market as it reduced the multiple exchange rates and arbitrage premium between the official and parallel market rates. It however failed to arrest the depreciation of the naira as it plunged further in 2002 till 2004. With the introduction of the Wholesale Dutch Auction System (WDAS) in February, 2006, the naira regained some strength, appreciating slightly on the average by 1.83% between 2006 and 2007, with some level of convergence achieved between the different exchange rates in the market.

2.2.1 Inflation and Foreign Exchange Management in Nigeria

Foreign exchange management in Nigeria has undergone tremendous changes over time, moving from regulated to guided deregulation and finally to deregulation. This is in line with global trends, where best practices are adhered to. With the adoption of the WDAS, some relative stability was observed in the market which can be attributed to improvement in the external reserves position of the economy as well as greater autonomy of the CBN and its increased discretion in deployment of instruments of monetary control to support the DAS. The emergence of an inter-bank market for foreign exchange which stabilised supply gaps between auctions and disciplined fiscal operations particularly in the year 2004, were also influential in the achievement of the relative stability observed in the foreign exchange market during this period.

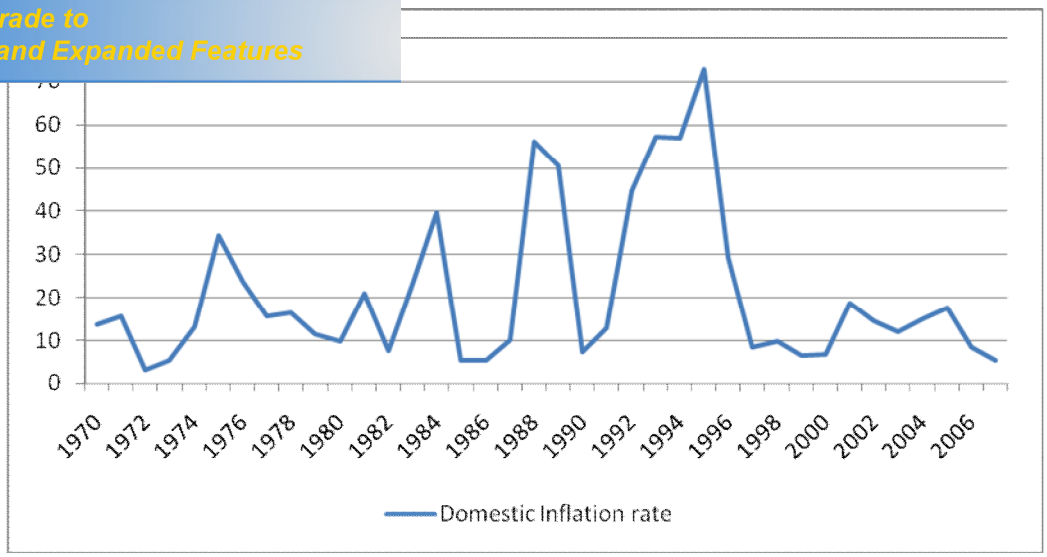
In the next few paragraphs the performance of the economy are examined. The performances at different times were compared. The performance during the 1970s was compared to that of the early 1980s when there was lull in the international oil market. We also examined the performance of the economy during and after SAP as well as during the civilian administration till 2007. It is pertinent to examine the inflationary trend vis-à-vis the exchange rate during the aforementioned periods. Inflation rate which was 15% on the average between 1970 and 1980, (see Table 2), increased in the 1980s. It was 17.1% between 1981 and 1986 but increased to 34.1% between 1987 and 1993 during SAP. The high inflationary trend continued in the 1990s and was 30.7 between 1994 and 1999. However, the trend abated with the coming of the civilian administration. The average inflation rate was 12.75 between 2000 and 2007. Although the inflationary trend abated between 2000 and 2007, the double digit inflation rate was still was of concern to policy makers. The inflationary trend showed that Nigeria had experienced high volatility in inflation rates.

nic Indicators for Nigeria (Average)

	1980	1986	1987-1993	1994-1999	2000-2007	1970-2007
INF	14.9	17.1	34.1	30.7	12.75	21.0
GDP (T)	6.2	1.0	4.2	2.3	6.2	4.3
GDP (A)	-2.0	1.6	8.3	3.8	7.1	3.4
GDP(M)	4.8	-2.5	5.9	-0.8	-2.3	2.2
CAP. UTIL.	74.5	51.1	40.6	31.6	50.8	49.5

Note: INF = Inflation Rate, T = total, A = Agriculture, M = Manufacture CAP. UTIL. = Capacity utilization Rate
The GDPs are growth rates in percentages
Source: Authorõs computation from data obtained from Central Bank of Nigeria Statistical Bulletin, 2007

consideration, four episodes of high inflation exceeding 30% were recorded. Excessive money growth above real economic growth was correlated with high inflation episodes. In addition, some factors reflecting the structural characteristics of the economy were also implicated. Some of these are supply shocks arising from factors such as famine, exchange rate depreciation and fiscal operations of the government (CBN, 1995). Figure 1 showed that the first episode of high inflation above 30% occurred in 1975. The drought in Northern Nigeria was suspected to be responsible for the high cost of food items which constituted a significant proportion of the average consumerôs budget. One other factor implicated in the high inflation rate was the excessive monetization of the oil revenue. The second and the third episodes of high inflation occurred in the 1980s: the second episode occurred in 1984 while the third one occurred in 1987 through 1989. The supply-side factors were dominant in exerting upward pressures on price during the second episode. The severe shortages in consumer goods and services caused mainly by low level of domestic production of output, hoarding activities, long distribution chains and import restrictions were some of the factors responsible for the high inflation during this period. The high inflationary trend which occurred between 1987 and 1989 was attributed to the depreciation of the naira which accompanied the adoption of a market based exchange rate system in 1986. In addition, the fiscal expansion that accompanied the 1988 budget was also implicated in the high price level experienced during this period. Though the expansion was initially financed by credit from the CBN, it was later sustained by increasing oil revenue (occasioned by the increased oil price following the Persian Gulf War), that was not sterilized. However, with the drastic monetary contraction in the middle of 1989, inflation reduced drastically, reaching its lowest point in 1990 (see Figure 1).



Source: Constructed by the author from CBN Statistical Bulletin, 2007

Figure 1: Inflationary Trends in Nigeria (1970 – 2007)

episode was witnessed in 1993 through 1995 before the continuous and drastic plunge that lasted till 1997. After 1990, the inflation rate began to rise and by 1993 the inflation rate rose to 57.2%. By 1995, it attained the peak of 72.8%, which is the highest rate since the 1970s. Similar to what occurred during the third episode, this period also coincided with the period of expansionary fiscal activities and money supply growth. During this period, money supply growth rate was 73% as the authorities were unable to contain the growth of private sector domestic credit and bank liquidity.

As revealed in the inflationary episodes presented above, inflation in Nigeria was driven by both demand and supply side factors. The demand side pressures arose from changes in monetary aggregates as well as fiscal activities of the government while the supply side factors arose from the salient structural characteristics of the economy. Some of these factors included climatic conditions, structure of production and distribution. Moreover, the structure of production, which was tilted towards heavy reliance on imported inputs that were affected by changes in exchange rate, also contributed to the supply side pressures.

Inflation dynamics in Nigeria can also be linked with the exchange rate regimes or policies of exchange rate determination. Table 3 reveals that significant changes in exchange rate occurred during the period when the foreign exchange market became liberalised and the rate was determined by managed float. During this period, exchange rate depreciated persistently except in the last three years when it appreciated slightly. It is interesting to note that there is a correlation between changes in domestic prices and exchange rate. The average depreciation in the periods 1986 ï 1993 and 1994 ï 2003 was 58.94% and 35.50% respectively, with corresponding inflation rates of 30.55% and 23.69%. It is pertinent to understand the driving forces behind the movements of exchange rate and inflation. Under the fixed exchange rate regime, changes in exchange rate were restricted while under managed float, the rate is relatively flexible.

ation Rate under Different
es in Nigeria

Period/Regime	Inflation rate	Rate of Change in Exchange rate
Fixed Exchange Regime 1971-1985	16.41	+2.67
Managed Float 1986-1993	30.55	+58.94
1994-2003	23.69	+35.50
2004-2007	11.65	-0.66

Note: (+) change in exchange rate implies depreciation while (-) sign indicates appreciation.
Source: Computed by the author from data obtained from CBN Statistical Bulletin, 2007 and Annual Reports and Statement of Accounts (various issues)

The macroeconomic performance in Nigeria started on a good note in the 1970s, as the period coincided with the end of the civil war which necessitated the need for massive reconstruction activities. During this period, the total GDP grew at an average rate of 6.2%. The average figure hid the trend of activities as the total GDP grew at the rate of 21.4% between 1970 and 1971. The growth in the total GDP during this period was mainly driven by petroleum, as growth in this sector was 32.4% on the average, with manufacturing sector growing at an average rate of 4.8% and agricultural sector actually declining at a rate of 2% on the average. The period also witnessed an upsurge in the demand for goods and services due to the reconstruction exercise and the increased salary and wages granted on the basis of the Adebo commissionôs recommendation[2]. This led to serious shortages of goods and services and an upward movement in prices, with the inflation rate rising to 14.9% on the average during this time.

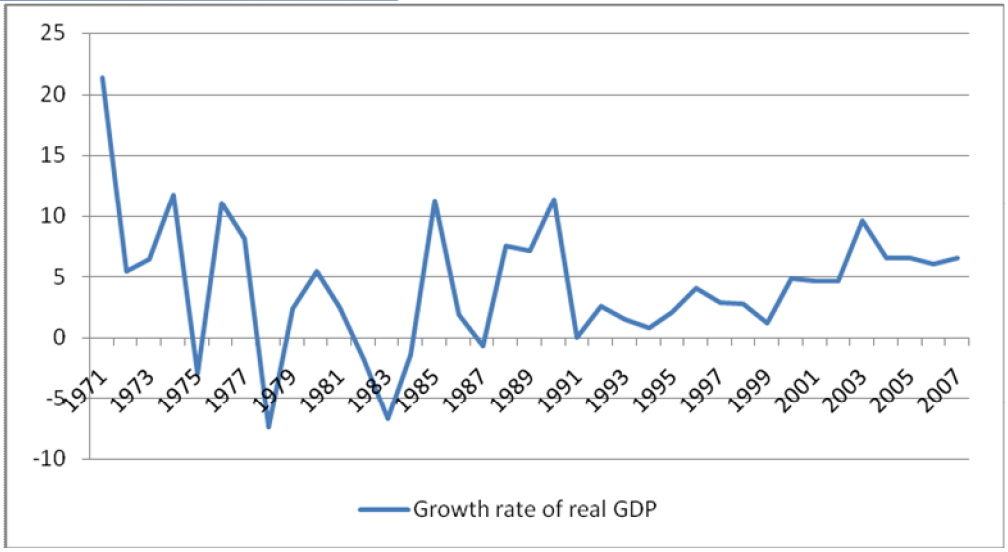
The 1980s started on a sour note for Nigeria, as the international oil market got trapped in a glut. Since the economy was largely driven by oil, total GDP suffered reduction in growth rate. Between 1981 and 1986, the total GDP grew at an average rate of 1% compared with 6.2% in the 1970s (see Table 2). As a result of the precarious economic condition in which the nation found herself, the government introduced economic stabilization measures in April 1982, in order to protect the balance of payments position and revamp the economy. This measure failed to bring any meaningful change in the economy and therefore the government declared a state of National Economic Emergency on the 1st of October, 1985, for a period of fifteen months in order to revamp and stimulate the economy.

As shown in Figure 3, the growth rate of real total GDP was negative in 1975, 1978, 1982 through 1984, as well as in 1987. The drought that occurred in the Northern Nigeria was linked to the negative growth rate in 1975. During this year, the total real GDP declined by 2.96% while agricultural output declined by 8.6% in the same year, showing that agriculture was a drag on growth for that year (see Appendix 1). The decline in the real total GDP in 1978 could be linked to the liberalisation of import

[2] The Adebo commission recommended increase in salaries and wages in order to relieve the high cost of living. This increase in salaries and wages was paid in December 1971.

ened the domestic production of the agricultural and manufacturing sectors. Various policies were put in place to reverse the negative growth rate of GDP in 1979. Such measures included increase in import duties on various commodities, the placing of some commodities under licence or outright ban. Others included concessions to local manufacturers to encourage them to expand their productive capacities and the liberalization of the terms and the availability of credit to farmers (CBN 1982). These policies yielded results as the GDP recorded positive growth rates in 1979 through 1981 (see Figure 2).

However, the positive growth rate was not sustained as the GDP declined from 1982 through 1984. The 1982 - 1984 period was characterised by general lull in economic activities reflecting the weakness of the world market for crude oil. The decline in the GDP in 1982 was associated with the lower rate of monetary expansion due mainly to the sharp decline in foreign exchange earnings. Substantial part of bank credit during the year went to the government sector. Agriculture constituted a drag on the GDP growth in 1983. Agriculture performed poorly as a result of the severe and prolonged droughts in many parts of the country, as well as the wide-spread outbreak of diseases/pest infestations in livestock and crops. Although money supply rose sharply as a result of huge bank credit to the government in order to finance its deficit, government expenditure declined to reflect the decline in oil revenue (CBN 1983). Moreover, as foreign exchange receipt declined, greater restrictions on imports were put in place, which resulted in drastic shortage of imported inputs and subsequent decline in the output of commodities whose manufacture depended mostly on imported inputs.

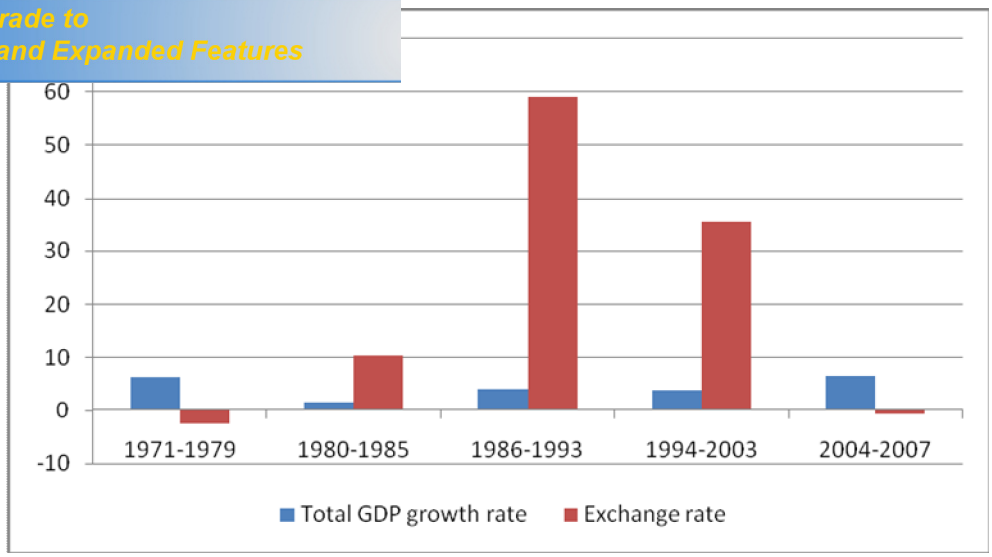


Source: Constructed by the author from CBN Statistical Bulletin, 2007

Figure 2: Growth Rate of Real Total GDP in Nigeria (1970 – 2007)

of the Structural Adjustment Programme (SAP), and the subsequent improvement in the management of the foreign exchange market, the persistent downward pressure on the domestic currency was stemmed for a while. Some improvements were recorded in the growth of GDP between 1988 and 1990. The main drivers of growth during this time were manufacturing, trading and services. The average growth rate of the total GDP, which was less than 1% in the first half of the 1980s, increased to 4.2% on the average between 1987 and 1993, with the highest growth rates occurring in 1988 through 1990. The improved performance of output during this period might be linked to the expansionary fiscal and monetary policies of the government during this period. There was an increased government spending on the development of the rural areas and infrastructural development through the establishment and financing of the Directorate of Food, Roads and Rural Infrastructure (DFRRI) and the National Directorate of Employment (NDE), among others (CBN, 1996). The total GDP growth rate however, nosedived afterwards and the average growth rate between 1994 and 1999 was 2.3%. It however, picked up from the year 2000, with an average growth rate of 6.2% between 2004 and 2007.

Figure 3 showed that there is some correlation between exchange rate changes and growth rate of GDP. Between 1971 and 1979, the average growth rate of GDP was 6.3%; this was associated with a negative change in exchange rate (appreciation) of 2.5%. The same scenario was repeated between 2004 and 2007, when an average GDP growth rate of 6.4% was associated with appreciation of exchange rate. In other sub periods, when the exchange rate depreciated, it was associated with a reduced average growth rate of GDP. As shown in the figure, higher growth rate is associated with appreciation in 1971 ï 1979 and 2004 ï 2007 periods while the periods of depreciation of exchange rate is associated with lower growth rates.

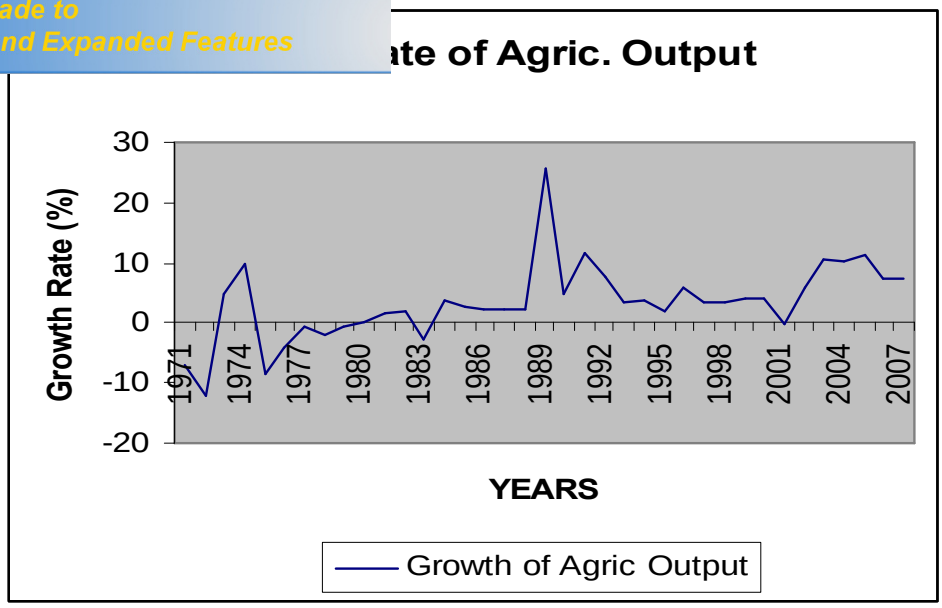


Note: Values are averages over selected periods
Source: Calculated by the author from CBN Statistical Bulletin, 2007

Figure 3: **Exchange rate and Growth Rate of Total GDP in Nigeria 1970 – 2007)**

Output Performance

Agricultural output performance was unimpressive in the early 1970s, declining at an annual average rate of 2.2% between 1971 and 1979. The poor performance of agriculture during this period was caused by various factors, amongst which was inadequate mechanisation of agriculture, vagaries of weather and inefficiencies in the marketing process. In particular, the determination of producer-prices and the practices of licensed buying agents did not provide the much needed incentives for the expansion of output. Another contributory factor in the non-impressive performance of the agricultural sector was the credit policy. During the 1970s, the credit guideline stipulated that a minimum of 4% of the total credit should be allocated to the agricultural sector (CBN 1980). This was rather low considering the fact that agricultural output constituted over 40% of total GDP during this period.



Source: Constructed by the author from CBN Statistical Bulletin, 2007

Figure 4: Growth Rate of Agricultural Output in Nigeria (1970 – 2007)

were put in place to promote productivity in the agricultural sector. One of such policies was the centralization of the fixing of producer prices and the replacement of the two-stage tax on marketing boards by a single tax of 10%. The government also embarked on campaigns to boost agricultural production in addition to other supportive roles of the government (CBN 1988). Some government policies indirectly contributed to improved agricultural performance. Such policies included the ban on importation of poultry and related products. The performance of the sector was however hampered by tardiness in the supply and distribution of fertilizers and other farming inputs, pests and diseases as well as flood. For instance, the decline in 2001 and 2002 (see figure 4) was attributed to the attack of quelea birds in some Northern states as well as the outbreak of cassava mosaic disease in some Southern states (CBN 2002).

2.2.2.2 Trends in Manufacturing Output Performance

The growth rate of manufacturing output was low and sluggish especially in the early 1970s. This was due to the fact that this sector was at its infancy. However, the performance of the sector picked up in the latter part of the decade. The improved performance of the sector during this period could be linked to improved availability of inputs as a result of increased inflow of foreign exchange. The performance of the manufacturing sector nosedived from 1980, as growth decelerated and output actually declined between 1983 and 1985. Three decline episodes were discernable for the manufacturing sector. The first occurred between 1983 and 1985 while the second one was between 1993 and 1995. The third episode occurred between 2003 and 2004.

The first decline episode which occurred in 1983 through 1985 could be linked to the glut in the international oil market, which constrained the availability of foreign exchange for importation of necessary inputs for the manufacturing sector. The period was associated with severe stagflation and accumulation of debt arrears which necessitated tight control on imports. During this period, many industries had to either reduce their working days in a week or close down temporarily. The average capacity utilization rate, which was 63.6% in 1982, reduced to 49.7% in 1983 and was 43.7% on the average between 1983 and 1985. The decline episode of this period was more from the supply side because of the effect of unavailability of foreign exchange for

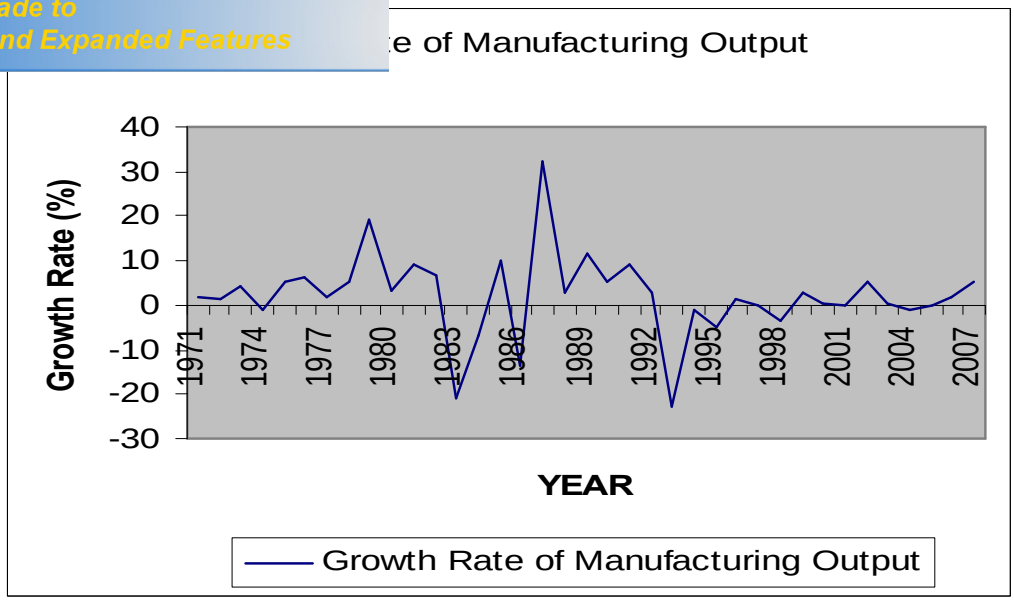
mport control measures of the government aimed at streamlining the issuance and use of import licenses (CBN 1986).

The second decline episode for the manufacturing sector occurred between 1993 and 1995. The poor performance of the manufacturing sector during this period could be linked to prolonged political and labour unrest which engulfed the nation following the annulment of the June 12, 1993 presidential election and the disrupted production activities in almost all parts of the country. Besides, the global economic recession and the sluggish demand for crude oil constrained the availability of foreign exchange for the importation of inputs. The capacity utilization rate was 30.7% on the average during the period while the output of the sector declined on the average by 9.5%.

Since the second decline episode, the performance of the manufacturing sector has remained poor, with growth rate of over 3% observed only in 2002 and 2007 (see Figure 5). The average annual growth rate between 2000 and 2007 is 1.5% while average capacity utilization rate is 50.6%. One of the factors adduced for the poor performance of the sector is the continuous depreciation of the domestic currency which made imported inputs less available, thus stunting the growth of the sector (given the import-dependent nature of the sector). Other factors included low effective demand for locally made goods, occasioned by the continued influx of cheaper and perceived better quality imported products as well as cost of production (CBN, 2001) and poor state of social and economic infrastructure.

Although several measures were put in place to facilitate improved performance in the manufacturing sector, the effects of such measures were negligible if they ever had any. Some of the measures put in place included the establishment of Small and Medium Industries Equity Investment Scheme and 100% physical inspection of goods at the ports, which compelled importers to pay appropriate duties leading to improved competitiveness of local manufactures (CBN 2002). Most of the policies put in place failed to achieve the desired results because of the evolving macroeconomic developments. The expectations would be met only if economic structures are right and flexible. Overall, economic structures and institutions are rigid and indeed dualized in Nigeria. For instance, the agricultural and industrial production base, the money markets and financial institutions are fragmented and somewhat unorganised. Even where they

be altered easily and are often externally dependent and characterised by widespread interventions and regulatory controls, which made it difficult to ensure consistency within and between macroeconomic accounts and policy instruments.



Source: Constructed by the author from CBN Statistical Bulletin, 2007

Figure 5: Growth Rate of Manufacturing Sector Output in Nigeria (1970 – 2007)

The dynamics of inflation and output growth rate in Nigeria is a manifestation of different factors, which include rate of movement of exchange rate, monetary policy, trade policy as well as fiscal policy. It is therefore necessary to examine the movement of exchange rate, inflation and GDP growth vis-à-vis the impact of the interaction of some of the aforementioned factors.

2.3.1 Monetary Policy and Macroeconomic Performance in Nigeria

Monetary policy refers to measures which are designed to regulate the volume, supply and cost of money in an economy. It can be described as the art of controlling the direction and movement of monetary and credit facilities in pursuance of stable price and economic growth (CBN, 1992). The objectives of monetary policy over the years have been the attainment of internal and external balances. However, the emphasis on techniques/instruments to achieve these objectives has changed over the years. While emphasis was placed on direct controls before 1986, the emphasis shifted to indirect control or market-based mechanism since 1986, following the adoption of the Structural Adjustment Programme (SAP)

2.3.1.1 Monetary Policy Before 1986

Prior to the adoption of SAP in 1986, monetary management depended on direct control through the use of instruments such as credit ceilings, selective credit controls, administered interest rates, special deposit as well as mandatory credit allocations or credit rationing to sectors of the economy. The most popular instrument was the credit rationing guidelines, which set the rates of change for the components and aggregate bank loans and advances to the private sector. The objective of sectoral allocation of bank credit in the CBN guidelines was to stimulate the productive sectors and to stem inflationary pressures, while the fixing of interest rate at low levels was to promote investment and growth.

However, the effort of the CBN to reduce the amount of free reserve and credit-creating ability of the banks was not effective; hence, it was difficult to achieve the objectives of monetary policy. As a result, the monetary aggregates, GDP growth rate, inflation rate, government fiscal deficit and balance of payment position moved in

blem of monetary management was anchored on the monetary control framework, which relied heavily on direct control. For instance, the fixing of interest rates at low levels was meant to encourage monetary expansion but it failed to promote the rapid growth of the money and capital markets.

During the period of direct control, the low interest rate on government debt instruments usually failed to attract private sector savers; and since the CBN was required by law to absorb the unsubscribed portion of government debt instruments, large amount of high-powered money were usually injected into the economy. Another factor that contributed to monetary instability during this period was the rapid monetization of foreign exchange earnings, which resulted in large increases in government expenditure during the oil boom era. The post-boom shortages also resulted in monetary instability, since government expenditure was not rationalized and the government resorted to borrowing from the Central Bank to finance its huge budget deficit.

2.3.1.2 Post 1986 Monetary Policy

The glut in the international oil market and its deleterious effect on economic conditions in the country led to the adoption of the Structural Adjustment Programme (SAP) in 1986. The programme was designed to achieve internal and external balances as well as sustainable growth by altering and restructuring the production and consumption patterns of the economy, eliminating price distortions, reducing heavy dependence on crude oil exports and consumer goods imports and enhancing non-oil export (CBN 1988). The main planks of the programme were the deregulation of the external trade and payment arrangements as well as adoption of market-determined exchange rate for the naira and the removal of administrative control on interest rate.

Since the adoption of SAP the instruments of monetary policy has shifted to indirect market-based ones, though the objectives of monetary policy has remained largely the same. The main instrument of monetary policy has been the open market operation (OMO), complemented by reserve requirements and discount window operations (CBN, 2002).

tary and macroeconomic stability, efforts were directed at managing excess liquidity by introducing a number of measures to reduce liquidity in the system. Such measures included the reduction of maximum ceiling on credit growth allowed for banks, the recall of the special deposit requirements against outstanding arrears to the CBN from banks and the withdrawal of public sector deposits from banks to CBN[3]. The use of stabilization securities for the purpose of reducing the excess liquidity of banks were reintroduced in 1990, while the cash reserve requirements of commercial banks were increased several times, but reduced in 2000, 2002, 2003 and 2006 as dictated by the economic circumstance at hand (CBN 2006). Since the rising level of fiscal deficits was identified as a major source of macroeconomic instability, the government not only agreed to reduce the size of its deficit, but to also synchronize fiscal and monetary policies. In order to induce efficiency, the regulatory environment of banks was improved and by 1996, all mandatory credit allocation mechanisms had been abolished.

2.3.2 Fiscal Policy and Macroeconomic Performance in Nigeria

Fiscal policy objectives are not different from the basic macroeconomic objectives in Nigeria. Fiscal policy measures exert their impacts by altering the tax structure as well as the level and composition of government expenditure and revenue. Apart from the major macroeconomic objectives, fiscal policy is also aimed at enhancing government revenue and curtailment of unsustainable government expenditure. The orientation of fiscal measures prior to the adoption of the Structural Adjustment Programme in 1986 was towards greater protection, incentives to the local manufacturing industry and enhancement of government revenue. However, after 1986, the degree of protection reduced and policy thrust shifted to the attainment of self reliance and self sufficiency, especially in food production as well as attainment of a well diversified economy.

2.3.2.1 Fiscal Policy in the Pre SAP Era

The tariff structure in the early 1980s before the adoption of SAP was aimed at greater protection and provision of incentives to local manufacturers. In addition, fiscal

[3] This policy was initially introduced in 1989 to reduce the excess liquidity in the economy but it was suspended in 1998 and reintroduced in July 2004.

promoting a more rapid expansion of agricultural and manufacturing production. Measures adopted during this period included import restriction, increased import duties on some commodities, increased guaranteed minimum prices of major staple food, offering of financial assistance to private entrepreneurs, especially those in the rural areas to reduce the cost they incurred on infrastructure (CBN 1987). However, some of the fiscal policy measures were inconsistent with the main objectives of the policy. For instance, the abolition of The Approved User Scheme and the General Concessionary Rates Duty in 1984 led to increase in the rates on raw materials and intermediate goods, which might have contributed to the low production in the manufacturing sector afterwards.

Despite the different measures adopted to achieve the fiscal policy objectives, the performance of the economy was not impressive. Total GDP actually declined in 1983 and 1984 and grew only marginally by 2.4 per cent in 1985. The external sector was also under intense pressure due to increased debt service burden and accumulated trade arrears. There was acute shortage of inputs to power the industrial sector as a result of shortfalls in foreign exchange receipts. The severe economic problem during this period led to the declaration of a state of National Economic Emergency on the 1st of October, 1985 and the eventual adoption of the Structural Adjustment Programme in July, 1986 (CBN, 1987)

2.3.2.2 Fiscal Policy after the Adoption of SAP

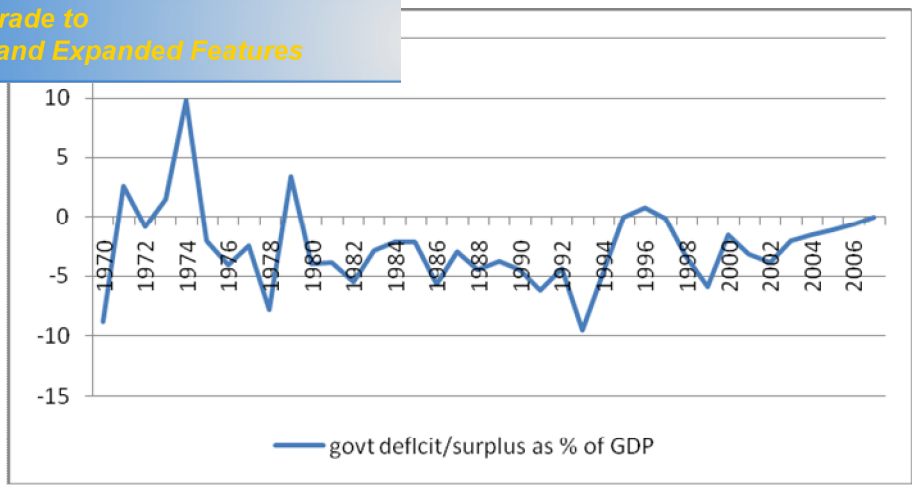
Apart from the major objectives of the Structural Adjustment Programme (SAP), SAP was also aimed at achieving fiscal viability, reduce government budget deficit, generate increased revenue and improve effective control and efficiency in government fiscal operations.

Fiscal measures adopted after SAP involved a less protective fiscal regime. The custom and excise tariff were adjusted such that all imported agricultural equipment were subject to appropriate rates of duty so that locally-assembled equipments would not be disadvantaged (CBN, 1987). Other measures included the gradual divestment of government holding in non-strategic industrial and commercial enterprises. The issue of protection of domestic industry was however not completely done away with during the post-SAP era, as the tariff structure which provided for higher protection for local

The fiscal measures adopted in 1988 could be classified into four groups. They were those aimed at increasing revenue, those designed to guarantee effective protection to domestic industries, those expected to reduce the escalating transportation cost and those directed towards the promotion of Research and Development (R & D) (CBN, 1988).

2.3.2.3. Fiscal Position of Government

The fiscal position of the government during the period under review was in deficit for most of the period. This had implication for the value of the domestic currency depending on how this deficit was financed. The overall fiscal position was only in surplus in 1971, 1973, 1974, 1979 and 1996. On the average, overall fiscal deficit as a percentage of GDP was 0.85% between 1970 and 1979, but increased to over 3% in the following two decades and declined to 1.7% between 2000 and 2007 (see table 4 for overall fiscal position). Although on the average, the deficit/GDP ratio was less than 4% target set as West African Monetary Zone (WAMZ) target. The annual rate of less than 4% was only achieved consistently from 2000 onwards. The poor fiscal position of the government in most years was caused by high debt burden, extra-budgetary expenditures and global economic instability (CBN, 2005).



Source: CBN Statistical Bulletin, Volume 18, December, 2007

Figure 6: Government Deficit/Surplus as a percentage of GDP

lacroeconomic Performance in Nigeria

Period	Average Overall Fiscal Position	Change in Exchange Rate	Growth Rate of Money Supply	Inflation Rate	Growth Rate of Total Output
1970 ï 1979	-0.85	8.58	31.35	15.32	6.26
1980 - 1989	-3.69	28.63	16.54	22.90	2.56
1990 ï 1999	-3.77	34.95	32.27	30.64	2.95
2000 - 2007	-1.70	1.46	26.58	12.41	6.18
1970 - 2007	-2.54	20.09	26.56	20.73	4.35

Source: Computed by the author from CBN Statistical Bulletin, Volume 18, December, 2007

geria (CBN) was the major financing agent of budget deficit in the period under review as it financed over 50% of the deficit in many years. This resulted in rapid expansion of money supply with its attendant pressure on the value of domestic currency and output production. From Table 4 above, periods of high budget deficit were associated with rapid monetary expansion, high depreciation rates and high inflation. Such periods also corresponded to periods of low growth rate of total output, thus showing that there was a link among these various macro variables.

From the analysis of trends presented above, we observe that the performance of the economy could be linked with the exchange rate policy as well as the monetary and fiscal stance of the government. Periods of exchange rate depreciation were associated with high inflationary trends and low output performance. Similar trend was observed during periods of high fiscal deficit. Periods of rapid monetary expansion were also associated with depreciation. however these associations do not imply causality or correlation.

CHAPTER THREE

LITERATURE REVIEW

3.1 Concepts and Definitions

Exchange rate can be defined as the price of one currency in terms of another. It is the rate at which one currency is exchanged for another, for example the units of naira needed to buy a unit of dollar or the units of dollar needed to buy a unit of naira. In this study, exchange rate is defined as the price of a unit of foreign currency in terms of the domestic currency, for instance, the units of the naira needed to buy a unit of the dollar. With this definition, an increase in exchange rate implies depreciation of the naira value while a decrease denotes appreciation.

There are two major time concepts of exchange rate namely the spot rate and the forward rate. The spot rate is the exchange rate for immediate (two-day) exchange of currencies, while the forward rate refers to exchange rate quoted in foreign exchange deals that involve dates longer than two days. There are various other measures or concepts of exchange rate that are used in the literature, but the major ones which are relevant to this study are discussed below.

3.1.1 Nominal Exchange Rate: This is similar to the concept of spot exchange rate mentioned above, but may be viewed in two ways as:

- the price of a unit of foreign currency in terms of the units of domestic currency: for example ₦/$
- the price of a unit of domestic currency in terms of the units of foreign currency: for example $/₦

Obadan (1994), among others, shows that it does not matter which of these definitions is chosen for analysis as long as the measure is well defined and consistent. The nominal exchange rate has largely overshadowed other measures of exchange rate because it is directly observable and it enables people to compare prices of goods directly. However, changes in nominal exchange rate tell us little about the real competitiveness of the currency over time, since it does not consider inflation differential among countries. To take care of this need, the real exchange rate is constructed, which takes into consideration the inflation differentials among different countries.

real exchange rate (RER) is the nominal exchange rate weighted by relative price. The definition and measurement of real exchange rate is fraught with problems because of the choice of what constitutes relative price. Opoku-Afari (2004), among others, distinguishes two principal definitions of the real exchange rate as:

- External Real exchange rate, that is, RER defined in external terms. Here the relative price is the ratio of foreign price to domestic price.
- Internal Real exchange rate, where RER is defined in internal terms, that is, the relative price is the ratio of domestic price of tradable to non-tradable goods within a single country.

Under the external terms, the nominal exchange rate is adjusted for price level differences between countries and this is given as:

$$R = E\frac{P^*}{P} \qquad \text{.....(1)}$$

Where R = Real exchange rate, P^* = Foreign price index, P = Domestic price index and E is the price of a unit of foreign currency in terms of domestic currency.

In logarithmic terms, equation (1) can be written as

$$r = e + p^* - p \qquad \text{.....(2)}$$

(where lower cases represent the logarithms of the upper cases)

The concept of external real exchange rate is derived from the Purchasing Power Parity (PPP) theory, which compares two countries and the relative prices of the baskets of goods produced or consumed in these countries.

Edwards (1989) identified two basic problems associated with defining real exchange rate in external terms. These are (i) the problem of choice of price index to be used as there are many price indices leading to the possibility of multiple real exchange rates and (ii) this index fails to capture changes in relative incentives that guide resource allocation between tradable and non-tradable sectors of the economy.

The internal real exchange rate can be written as

.....(3)

Where P_T and P_N are the price indices of tradables and nontradables respectively; and other variables are as earlier defined.

In logarithmic terms, equation (3) can be presented as

$$r = e + p_T - p_N \qquad \text{.....(4)}$$

Internal RER summarises incentives that guide resource allocation across tradable and non-tradable sectors. An increase in RER, in this case, increases profitability of the tradable sector relative to the non-tradable sector, thus inducing movement of resources from non-tradable to tradable sectors. If relative prices do not change in the rest of the world, the depreciation of the internal RER implies an improvement in the degree of international competitiveness of the home economy.

Edwards (1989) shows that, for a small country, if there are no taxes and the law of one price holds for tradable goods, changes in RER values obtained from both definitions of RER will differ, depending on the behaviour of foreign relative prices of tradable and non-tradable goods.

Although the internal RER definition is theoretically appealing, it is seldom used empirically. This is due to the fact that data on prices are not normally disaggregated into tradable and non-tradable goods. Thus in many empirical work, the external RER definition has been used as a proxy for the internal RER definition.

3.1.3 Other Concepts of Exchange rates

The concept of exchange rate can also be classified into bilateral or multilateral (effective). Therefore, four exchange rate concepts could be distinguished namely:

(i) Nominal Bilateral Exchange rate: This is the price of a foreign currency in terms of the domestic currency. This concept becomes less useful where a country has many trading partners and where there is inflation differential between the domestic economy and the foreign economy.

ange rate: This is the nominal bilateral exchange rate deflated by the relative price between the domestic and foreign country. Real Bilateral Exchange rate takes care of inflation differential between countries but it is relevant where a country has only one major trading partner or where the focus is on a major trading block.

(iii) Nominal effective exchange rate (NEER): This is the weighted average of a currency exchange rate against other currencies. The weights are usually the proportion of a countryôs trade with another country. It can also be defined as a weighted average of a basket of currencies over time. The fact that currencies of different countries which constitute Nigeriaôs trading partners do not necessarily move in the same direction every time necessitate the need to determine effective exchange rate. For example, while the United Statesô dollar is depreciating, the British pound may be appreciating. NEER has several variants, which differ with regard to the following five major aspects.

- The trading partners included in calculating the index
- The base period of the index
- The calculation of the proportionate changes in exchange rates
- The weight used
- The type of averaging formula used

Obadan (1994) argues that the choice of weights used in the computation of the index is of particular importance because the interpretation of the index depends on an appropriate choice of weights assigned to each countryôs currency. As earlier mentioned, NEER is a weighted average or mean of exchange rates. The averaging can be done in two basic ways: the arithmetic and geometric mean.

With the arithmetic mean, NEER can be computed as

$$NEER_A = \sum_{i=1}^{n} w_i \frac{E_{it}}{E_{io}} \qquad \text{.....(5)}$$

Using geometric mean, NEER can be presented as

$$NEER_G = \prod_{i=1}^{n} w_i \frac{E_{it}}{E_{io}} = 100 Exp \sum_{i=1}^{n} w_i \log\left[\frac{E_{it}}{E_{io}}\right] \qquad \text{.....(6)}$$

$NEER_A$ = arithmetically computed NEER of the focus countryôs currency;

$NEER_G$ = geometrically computed NEER of the focus countryôs currency;

w_i = weight assigned to country *i*ôs currency;

E_{it} = exchange rate of the domestic currency in terms of currency of country *i* at time *t*;

E_{io} = exchange rate of the domestic currency in terms of currency of country *i* in the base period;

Exp = ñtake the anti-log ofò;

$\prod$ = multiply over all *i*;

log = logarithm; and

n = number of trading partners.

As in the case of the nominal bilateral exchange rate, the NEER fails to consider the fact that there are usually inflation differentials among trading partners. To take care of the issue of many trading partners and inflation differentials, the concept of real effective exchange rate (REER) was introduced.

iv) Real Effective Exchange Rate

The Real Effective exchange rate (REER) is the nominal effective exchange rate deflated by the relative price of trading partners. The concept of real effective exchange rate takes into account inflation differentials between countries in addition to finding the weighted average of currencies. It thus deflates exchange rate indices by the corresponding indices of relative prices, which is important especially in the period of worldwide inflation differentials. Inflation differential matters for international competitiveness, hence, the concept of REER is very significant for Nigeria which has many trading partners and has also been experiencing high inflation.

ttention is focused on the real effective exchange rate in order to capture the fact that Nigeria has many trading partners and there is the possibility that these countries have inflation rates that differ from that of Nigeria.

The REER can also be computed using either the arithmetic or geometric mean approach. The arithmetic mean approach uses the following formula:

$$REER_A = \sum_{i=1}^{n} w_i \left(\frac{E_{it}^{\Pr} / P_{it}^{\Pr}}{E_{io}^{\Pr} / P_{io}^{\Pr}} \right) * 100 \qquad \text{.....(7)}$$

With the geometric mean, the REER formula becomes:

$$REER_{Gdc} = \prod_{i=0}^{n} \left[E_{dc1} P_{Gi} \right]^{W_i} * \frac{1}{P_{Gd}} * 100 \qquad \text{.....(8)}$$

Where

$REER_{Gdc}$ = REER calculated using the geometric mean method and defined in terms of domestic currency;

$\prod$ = The product of the terms in bracket over the *n* countries;

$E_{it}^{\Pr}$ and $E_{io}^{\Pr}$ = the ratios of the bilateral exchange rates of the *i*th partner country at time t and 0, respectively;

$P_{it}^{\Pr}$ = price index of the *i*th foreign country at time *t* relative to the base year;

E_{dc1} = index of the nominal exchange rate, defined as units of domestic currency per unit of foreign currency;

P_{Gi} and P_{Gd} = the foreign and the domestic aggregate price indices respectively;

all other variables are as earlier defined

$$\sum_{i=1}^{n} w_i = 1 \qquad (9)$$

proach is easier to calculate relative to the geometric mean, but the geometric mean has several advantages over the arithmetic mean according to Hinkle and Montiel (1999). According to them, the geometric mean has certain symmetric and consistency properties that an arithmetic index does not have - an arithmetic index gives an asymmetric treatment to depreciating and appreciating currencies and results in an upward bias. In order words, the arithmetical averages give larger weight to those currencies that change more than other currencies in the index. Further, an arithmetical average is sensitive to the definition of the exchange rate, while a geometrical mean is independent of it (Hinkle and Montiel, 1999). Due to these advantages, the geometric average of real effective exchange rate index is employed in this study.

3.2 DETERMINANTS OF REAL EXCHANGE RATE

3.2.1 Theories of Real Exchange Rate Determination

According to Williamson (1994), the motivation behind the preoccupation with issues of the real exchange rate by economists is the desire to ñidentify an appropriate concept of equilibrium exchange rate and estimating its valueò. The behaviour of the real exchange rate relative to its equilibrium value, which is referred to as misalignment, has significant implications for international competitiveness and domestic resource allocation between tradable and nontradable sectors. This makes a case for having knowledge not only of the actual real exchange rate but also the value of the (long run) equilibrium exchange rate.

There are several models that are used to explain exchange rate but some of them do not refer to real exchange rate. For the real exchange rate, three basic models are discernible, namely, the Purchasing Power Parity (PPP) approach, the macroeconomic balance approach and the behavioural equilibrium exchange rate approach or ñfundamentalsò models.

The PPP approach considers the equilibrium real exchange rate as a constant and it is assumed to be the real exchange rate that prevails in the year in which the current account is in balance. Under this approach, the equilibrium real exchange rate is considered to be an immutable number based on the assumption that the nominal exchange rate adjusts rapidly to price differential between a country and her trading

established by Elbadawi and Soto (1997) that the PPP does not hold.

The macroeconomic approach considers the equilibrium exchange rate as the one that ensures the attainment of both internal and external equilibrium simultaneously. Internal equilibrium in this case is defined as the attainment of full employment level of output and low inflation while external equilibrium is defined as the attainment of sustainable current account deficit (one that can be financed without undue borrowing or unnecessary loss of foreign reserves). Thus, the real exchange rate obtained under this approach is not an immutable number, as in PPP, but the one that changes over time with the factors determining it. Examples of this approach are Mundell, 1971 and Williamson 1985. The problem with this approach is the complexity in determining when an economy attains both internal and external balances. Moreover, it is only a method of calculating the equilibrium real exchange rate, like the PPP, and does not allow for a distinction to be drawn between the effects of temporary (short run) and permanent (long run) changes in the determinants of real exchange rate. In addition, because of its complexity and data requirements, it is more suitable for studies on developed economies.

The behavioural equilibrium approach or ófundamentalsô approach is a model-based approach to the determination of equilibrium real exchange rate. According to this approach, the equilibrium real exchange rate is obtained by first determining the relationship between the observed real exchange rate and a vector of fundamentals (obtained from a reduced form model). Second, for the fact that the actual value of the fundamentals is made up of transitory and permanent components, they are decomposed into trend (permanent) component and transitory (cyclical) components in order to obtain the sustainable levels of the fundamentals. The permanent components of the fundamentals obtained are then substituted into the estimated long run relationship to obtain the long run equilibrium real exchange rate, which does not have any transitory component. However, the value of the equilibrium real exchange rate depends on the fundamentals used and the methodology used to estimate the long run parameters. This approach has been applied by many authors to developing countries [for example Edwards (1989) to twelve developing and middle-income countries and Elbadawi (1994) to Chile, Ghana and India].

ent variants of the ófundamentalô models, the major variables that affect the real exchange rate include the terms of trade, changes in fiscal policy, changes in the value of international transfers, changes in international conditions, the Balassa-Samuelson effect (differential productivity growth in the tradable goods sector), changes in the commercial policy, changes in the monetary policy, changes in the foreign reserves and changes in the exchange rate policy.

3.2.2 Empirical literature on the determination of real exchange rate

The empirical studies on the determinants of real exchange rate are quite challenging. The challenge arises from the fact that both actual real exchange rate and equilibrium real exchange rate have to be determined. Moreover, the equilibrium real exchange rate is not observable. The existing empirical literature, in general, show that PPP is not an appropriate model for the determination of the equilibrium real exchange rate in developing countries because of the slow mean reversion of real exchange rate to a constant level (long run equilibrium implied by the PPP assumption). Thus, there has been a shift away from PPP-based measures to the fundamental frameworks, especially for developing and emerging economies.

Most of the literature on developed countries used the PPP or the macroeconomic approach to determine the equilibrium real exchange rate. Such studies include MacDonald (1998), Antonopoulos (1999) and Kempa (2005) among others. MacDonald (1998) used a reduced-form model of the real exchange rate in a long run setting. His model featured productivity differentials, terms of trade effects, fiscal balances, net foreign assets and real interest rate differentials as key fundamental determinants of the real exchange rate. Using multivariate cointegration methods, the model was estimated for the real effective exchange rate of the United States dollar, Yen and the Deutschmark between 1974 and 1993. He found evidence of a significant and sensible long run relationship for his model, implying that the variables used have important and significant bearing on the determination of both long and short run real exchange rates.

Antonopoulos (1999) tested the so-called ñShaikh hypothesisò, which states that the real exchange rate is fundamentally determined by the ratio of relative real unit labour costs (as a proxy for productivity differentials) of tradable goods between two countries. However, Antonopoulos added capital flow in his model and employs

Greeceôs data from 1960 to 1990. His study provided evidence that real exchange rate movements cannot be explained by the PPP hypothesis, that there is a strong role of the productivity of the export sector of Greece *vis-à-vis* that of the rest of the world, and that there is a less important role of net capital inflows. The evidence from this study suggested that an improvement in the relative productivity of Greeceôs export sector appreciates the countryôs real exchange rate.

Edwards (1989) pioneered the ófundamentalsô model of the determination of real exchange rate for developing countries. He developed a theoretical model of the real exchange rate determination and then estimated its equilibrium value for a panel of twelve developing countries using data from 1962 to 1985, adopting the fixed effect model. His finding is consistent with the theoretical predictions that in the long run, only real variables affect the equilibrium real exchange rate while both real and nominal variables affect it in the short run. The most important variables identified in his study as affecting the equilibrium real exchange rate are the terms of trade, level and composition of government spending, controls on capital flows, foreign exchange and trade controls, technological progress and capital accumulation. An improvement in terms of trade, a rise in government spending, increase in exchange and trade controls and increased capital flows (lagged) are found to appreciate the real exchange rate. On the other hand, technological progress leads to real exchange rate depreciation, contradicting the Ricardo-Balassa hypothesis. Increase in capital accumulation leads to real exchange rate appreciation. The study also found that in the short run, nominal exchange rate depreciation would lead to the depreciation of real exchange rate while an increase in domestic credit would lead to appreciation of the real exchange rate.

Edwardsô work inspired a number of studies, not only on the determinants of real exchange rate, but also on the effects of real exchange rate. These studies include Cottani *et. al.* (1990), for a group of economies comprising developed and developing; Ghura and Grennes (1993), for a panel of sub-saharan African countries including Nigeria; Aron *et. al.* (1997) for South Africa, Mwega (1993) for Kenya; Obadan (1994) for Nigeria; Ogun (2000) for Nigeria; and Baffes *et. al.* (1997) for Cote dôIvoire and Burkina Faso.

d a simple econometric model and empirically estimated it using the ordinary least squares methodology and data on Nigeria from 1970 to 1988. Although the study failed to test variables for stationarity and did not estimate the equilibrium real exchange rate, it found that both structural and nominal factors are important determinants of real exchange rates in Nigeria. In addition, he found that the most important factors are international terms of trade, net-capital inflows, nominal exchange rate policy and monetary policy. The study found that an improvement in terms of trade, appreciation of the nominal exchange rate and increase in net capital inflows would appreciate the real exchange rate, while expansionary monetary policy would depreciate it.

Improving upon the work of Obadan (1994), Ogun (2000), using data on Nigeria from 1960 to 1990, studied the determinants of real exchange rate in Nigeria. He tested for unit roots in the variables as well as cointegration among them, in order to avoid the problem of spurious regression. Because cointegration could not be established, he concluded that all variables have only short-run effects. The important variables in Ogunôs study are nominal exchange rate and excess domestic credit, which is in line with earlier studies. Though he found that improvements in terms of trade (TOT) and increase in excess domestic credit cause real exchange rate to appreciate, the coefficient of TOT is not significant. Ogunôs study focused on bilateral real exchange rate which is inadequate in a period when movements in the exchange rates of several currencies occur either simultaneously or at frequent intervals (Rhomberg, 1976).

From the review of empirical studies presented above, it is observed that the numbers of real variables used as explanatory variables in the determination of the real exchange rate are not uniform (due probably to data problem), while the nominal variables commonly used are nominal exchange rate and excess domestic credit. It can also be observed that in studies involving developing countries, both nominal exchange rate and excess domestic credit have only short term effects on the real exchange rate while the real variables have both long and short run impact on the real exchange rate. The methodology that has been used in the study of determinants of real exchange rate is discussed briefly in the next paragraph.

ants of the real exchange rate have adopted different methodology. While some studies applied the ordinary least squares (OLS) regression to investigate the determinants of the real exchange rate [for example Ghurra and Grennes (1993), Cottani *et al* (1990), Obadan (1994)], some applied the technique of unit root, cointegration and error correction mechanism modelling [examples include Elbadawi (1994), Montiel (1999) and Elbadawi and Soto (1997).

3.3 The Effects of Exchange Rate on Output and Inflation

3.3.1 Theoretical Issues

Exchange rate was not at the centre of analyses of economic growth in the early neoclcassical growth model. Hence, exchange rate did not feature at all in the first generation of neoclassical growth models starting with Solow in 1957. The traditional growth theory focussed attention on savings and investment as the only determinants of growth. However, subsequent discussion of growth considered the capability of societies to raise the productivity of their inputs by directing attention to domestic institutions (see Abramovitz 1986). Later generation of growth models give prominent attention to institutional factors and exchange rate.

Exchange rate is one of the endogenous factors that affect the economic performance of a nation. Exchange rate has an important influence on resource allocation in the economy. According to Oyejide and Ogun (1995) exchange rate can influence at least four key relative prices. These are the internal price of tradeable goods relative to non-tradeable goods, the foreign price of the countryôs export relative to the export prices of its competitors, the domestic currency price of imports relative to the price of domestic substitutes and the price of exports or import substitutes relative to the cost of producing these goods. Thus, exchange rate has relative price effects which underscored the unparalleled influence of exchange rate on both the internal and external sectors of the economy. In addition, it has expenditure switching and expenditure reducing effects, which can alter aggregate demand and output. However, there is no consensus on the direction of the effect of exchange rate on output.

The theory of export-led growth is essentially about the advantage of keeping the price of exportables high enough to make it attractive to shift resources into their

al exchange rate can be used to provide an incentive to shift resources into export production in order to boost the national income, so long as there are conditions making for higher productivity in the exportable industry.

There are three major views on the impact of exchange rate on output namely the traditional view, which comprises the elasticities approach, the absorption approach and the Keynesian approach; the monetarist view; and the *structuralist* view. The traditional view posits that devaluation is expansionary, while the monetarist view holds that devaluation has no effect on output in the long run. The *structuralist* view however believes that devaluation is contractionary. In addition to these major views, other authors have theoretically analysed the impact of exchange rate on output and inflation using the IS-LM framework and its modified version. In this framework, the impact of exchange rate on output and inflation cannot be determined *a priori* since exchange rate impacts on output and inflation through different channels, some of which are contractionary while some are expansionary.

3.3.1.1 The Traditional view on the impact of exchange rate on output

The traditional view about the effect of exchange rate changes on macroeconomic performance is that exchange rate depreciation would improve trade balance, alleviate balance of payment difficulties and accordingly expand output and employment. The mechanism behind these positive effects, according to Taye (1999), is that devaluation switches demand from imports to domestically produced goods by increasing the relative prices of imports, and making export industries more competitive in international markets, thus stimulating the domestic production of tradable goods and inducing domestic industries to use more domestic inputs. The effect of devaluation of local currency involves three steps according to Diaz Alejandro (1963). He submits that devaluation would alter the local prices of exportables relative to other domestic prices, thus providing incentives toward an expanded output of exportables. Secondly, the domestic supply response to these incentives was expected to be vigorous. And thirdly, world demand for such exportables would be elastic. All these together would increase aggregate demand, output and employment.

Dornbusch (1988) stressed that the success of currency depreciation in promoting trade balance and output, largely depends on switching demand in the proper direction

capacity of the home economy to meet the additional demand by supplying more goods. The traditional view thus posits that the devaluation or depreciation of domestic currency has expansionary effect on the economy while revaluation or appreciation is contractionary.

The traditional views can be explained through the elasticities, absorption, the Keynesian approaches and the Laursen-Metzler synthesis. Each of these is discussed in turn.

a) The Elasticities Approach: This approach refers to the adjustment or changes in relative prices brought about by changes in exchange rate. It states that an increase in exchange rate makes export cheaper to foreign residents and also reduces the prices of import-competing goods relative to imports. Thus when a country is faced with given import prices and is able to expand exports at constant cost, increase in exchange rate increases export and reduces import by changing the relative prices of exports and imports. The effect of this is to increase aggregate demand and consequently output. The elasticities approach implies that devaluation will lead to increased output as long as the Marshall-Lerner condition is satisfied. Krugman and Obstfeld (2000) have however noted that, for most countries, the sum of these elasticities is less than 1. This is especially true about Nigeria where oil, which is the major export, cannot respond adequately to real exchange rate depreciation since export quota is fixed by a cartel (OPEC). Likewise, import cannot respond well because of the high dependence on imported intermediate inputs.

A problem with this approach is that it ignores the fact that the devaluation of nominal exchange rate increases the general price level. Thus the increase in the general price level that is engendered by a devaluation/depreciation of the domestic currency may wipe out the benefit of the increase in nominal exchange rate. The depreciation of the nominal exchange rate may increase the general price level through the following channels: (i) increase in prices of imported raw materials, capital and intermediate goods (ii) increase in prices of import-substitutes and (iii) increase in wages, emanating from pressure on employers to increase wages or a wage indexation scheme.

The income effect of devaluation is also ignored in this approach. Although devaluation expands net export initially, it has a secondary effect of increasing imports

rated through the initial rise in net exports. The increase in imports so generated reduces aggregate demand for domestic goods and output. The net effect of the two opposing forces on output is unknown, thus making the effect of depreciation ambiguous *a priori*. By assuming *a priori* that devaluation is expansionary, the elasticities approach, presumes that the income effect of devaluation is zero.

b) The Absorption Approach: In this approach, balance of payment is defined as being equal to the difference between real national income or output and real national absorption. In order to improve the balance of payment position, the authority must either increase output or reduce absorption. To reduce absorption, the authorities can utilize monetary and or fiscal policy. On the other hand, to increase output, the authorities must switch some part of domestic and foreign expenditures from foreign output to domestic output, possibly through relative price adjustment, which is the adjustment of the real exchange rate. The success of devaluation in increasing output here depends on its being able to switch expenditure in the right direction and amount, hence, this approach is similar to the elasticities approach.

c) The Keynesian approach: (also called the multiplier or income approach): This approach addressed one of the shortcomings of the elasticities approach by recognising the income effect of devaluation. This approach, like the elasticities approach, recognises that devaluation actually raises income by increasing export and reducing imports, but it also recognises that the increased income from devaluation raises imports, thus making the final effect of devaluation on output unpredictable. The income approach thus concludes that devaluation is expansionary only if the marginal propensity to spend on domestic output by residents (which is equal to the marginal propensity to consume plus the marginal propensity to invest minus the marginal propensity to import) is less than unity. In the Keynesian approach, it is assumed that demand determines output, and the economy operates at less than full employment condition. Therefore, devaluation, which makes domestic export cheaper to domestic residents as well as foreign residents, will lead to an increase in aggregate demand, income and output, provided the Marshall-Lerner conditions are satisfied and the marginal propensity to spend is less than unity. Although this approach addressed one of the shortcomings of the elasticities approach, it fails to address the fact that devaluation increases the general price level.

thesis: This approach is a synthesis of the income and elasticities approaches in that it takes into account the income effect of devaluation but it assumes prices are rigid, which makes it Keynesian in spirit. This approach takes into consideration the income effect of depreciation as well as the relative price effect, thus synthesising the income and the elasticities approaches. The idea here is that the relative price changes of depreciation lead to an expansion of aggregate demand initially, while the increased income generated brings about an opposing effect.

3.3.1.2. The Monetarist View

The monetarist view is that exchange rate devaluation affects real magnitudes, mainly through real balance effect in the short run but leaves all real variables unchanged in the long run (Domac, 1977). This approach is based on the assumption that the purchasing power parity (PPP) holds. It predicts that in the short run, an increase in the exchange rate leads to increase in output and improvement in the balance of payments, but in the long run, the monetary consequence of the devaluation ensures that the increase in output and improvement in BOP is neutralized by the rise in prices.

3.3.1.3 The *Structuralist* Approach

The consensus on expansionary devaluation hypothesis was broken at the end of the 1970s. An alternative reasoning emerged, which is referred to as the *structuralist* approach. This new thinking raised the possibility that depreciation could be contractionary. Taye (1999) and Acar (2000) identified two categories of channels through which devaluation might cause a reduction in output and employment, namely, the demand side channels and the supply side channels. We present below some of the channels through which this could occur.

The demand side channels

Depreciation could be contractionary when the import cost, real balance, income distribution, external debt, speculative demand, trade liberalization, and tax effects are taken into consideration. Each of these channels is discussed briefly below.

Depreciation usually takes place when countries have a foreign trade deficit and related external balance difficulties. Krugman and Taylor (1978), show that if a country

e effect of depreciation on aggregate demand will be negative. Price increases of traded goods which follow depreciation, given that imports exceed exports, reduce the home countryôs real income and raise the real income of the outside world, since foreign payments exceed foreign exchange receipts. This is referred to as the import cost effect of exchange rate depreciation

Another channel through which depreciation could lead to reduction in output is when depreciation causes prices of traded goods to increase relative, to that of nontraded goods, leading to an increase in the general price level. As prices rise, real money balances decline. The larger the share of traded goods in consumption, the more severe is the increase in the general price level and decrease in real money supply. As real money balances reduce, real expenditure will fall. The effect of this on output is determined by the degree of price flexibility in the economy. The more flexible price is, the less the response of output and employment to exchange rate depreciation.

The income distribution effect is another channel through which depreciation exerts contrationary effect on output. This effect is based on the argument that there are different classes of consumers in a given society [Diaz-Alejandro (1963), Krugman and Taylor 1978)]. These classes may be broadly divided into wage earners and profit earners. The marginal propensity to consume (mpc) for wage earners is presumably higher than that of profit earners. Under these circumstances, depreciation creates an important income redistribution effect in two ways. First, it increases the relative income of profit earners via increased prices of traded goods. Secondly, if wage rigidity exists so that wages do not immediately follow price increase; real wages (W/P) fall due to increase in price. As a result, workersô share in national income falls while profit earnersô share increases. Given the fact that the mpc for wage earners is higher than that of profit earners, there will be an eventual decline in aggregate demand. The magnitude of the reduction is determined by the difference between consumption propensities of workers and of firm (and land) owners.

One other channel of contractionary depreciation identified in the literature is the external debt channel. It is assumed that one of the critical factors that play a role in macroeconomic difficulties of most LDCs is the existence of a large amount of accumulated external debt stock and the interest burden on it. Most of the time, external

or in another strong foreign currency. If the country having a sizeable external debt devalues its currency, then both residents and the government are affected negatively. This is because one unit of foreign currency now costs more units of local currency. Debtors need more local currency to pay for the same amount of debt. In other words, the debt burden of the private and public sectors increases; hence the net wealth decreases as a result of devaluation. The higher the amount of debt and the interest rate charged on it, the higher the deterioration in net wealth and the lower the expenditure and output in the domestic economy.

Another potential negative effect of depreciation on aggregate demand may occur through increased speculative demand for goods. Expecting a real depreciation in the near future, people may try to protect themselves against the deteriorating effects of depreciation on their wealth by buying more today. Such a speculative demand for physical goods may arise especially in countries where the financial markets are not developed and hence there are no other forms of protective tools (bonds, securities, etc.) available. Even though such behaviour might create an expansionary effect initially, the situation reverses later and expenditures fall when depreciation hits the economy, leading to decline in aggregate demand and output.

One other demand channel of contractionary depreciation is through trade liberalization. Many less developed countries (LDCs) have a variety of restrictions on foreign trade, among which import quotas are very common. The trade liberalization effect may arise if the import quotas are removed and trade is liberalized together with depreciation. Depreciation is often considered as a substitute policy for restrictions on imports. Under these circumstances, if a country suddenly removes controls on imports, then imports may increase sharply in the short run. Since imported goods are competing with domestically produced goods, demand for import-competing products may decline, which may lead to a reduction in domestic output.

Another way through which exchange rate depreciation may exert negative impact on aggregate demand and output is when significant *ad valorem* tariffs on exports and imports exist. Since depreciation increases the value of both exportable and importable goods in terms of domestic currency, the amount of tax revenue will be higher, following the depreciation which implies income redistribution from the private

in tax revenue means a fall in the purchasing power of the private sector. Private expenditures are likely to fall parallel to the reduction in private disposable income. Assuming the mpc for the public sector is lower than that of the private sector, overall expenditures will be lower following depreciation leading to reduction in aggregate demand and output. The higher the share of *ad valorem* tariffs in government budget revenues, the more serious is the negative effect on aggregate demand, output and prices.

The Supply side Channels

Although not as many compared to the demand side, there are also a few supply-side channels through which devaluation may be contractionary. These channels function so as to decrease the level of output supply for any given level of prices. There are basically three supply side channels, namely imported input cost, cost of working capital and the wage indexation channels. These are discussed in turn below.

One of the main channels mentioned in several studies including Krugman and Taylor (1978), and Edwards (1986) is the cost of imported input channel. In many developing countries the production process is highly dependent on imported inputs in the form of raw materials, intermediate or capital goods. Depreciation increases the cost of imports in particular, and the cost of domestic production in general, via imported inputs. Decreasing imports in this context implies insufficient inputs necessary for production. Eventually, because of the lack of enough inputs and increasing costs, production will slow down, leading to a contraction in total supply and an increase in general price level. If the reduction in aggregate supply more than offsets the increase in aggregate demand, depreciation will result in a decrease in domestic production. The cost of imported input channel is important in Nigeria given the fact that intermediate goods constitute about 50% of total import.

The cost of working capital is another supply side channel through which depreciation may create contractionary effects. In standard economic theory, capital as a factor of production is usually assumed to be fixed in the short run. Therefore, the variable cost comes from the labour cost, intermediate inputs and raw materials. In an economy where the financial markets are developed, firms can easily borrow from these markets in case they need short-term funds. However, it is a well-known fact that in most

well developed and borrowing facilities are not easily available. Under these circumstances, as mentioned by van Wijnbergen (1986), if depreciation occurs, then the real volume of credit available in the market declines and interest rates tend to rise. This will push up the cost of production, thus reducing the quantity supplied and increasing the price level.

The wage indexation channel is related to the wage system prevailing in the economy. *Ceteris paribus*, depreciation is known to lead to increase in the price of traded goods and eventually the general price level, resulting in a decrease in real wages. It is therefore reasonable to expect workers to demand higher nominal wages in order to protect their purchasing power. If wages are flexible, they will adjust to the new prices following the depreciation. Likewise, if there is a wage indexation mechanism, which automatically increases nominal wages in proportion to price changes, then production costs will increase through higher wages. This increased production cost will lead to a reduction in production, causing output to contract, and as a result, causing further rise in price. Although wage indexation is not operational in Nigeria, workers usually demand for higher nominal wages following a rise in the general price level. Moreover, workers demand is in most cases are not peaceful; there are usually strikes and violent demonstrations leading to loss of work hours and output. Where such increase in wages is granted, it usually comes with a lag, leading to rise in the future cost of production, reduction in output and increase in price.

One other frameworks of analysing the effect of exchange rate on output and price in the literature is the modified IS-LM model. The model was developed based on the assumption of fixed money wages and prices, which implies a perfectly elastic aggregate supply curve where output is determined by the position of the aggregate demand curve (Krugman and Obstfeld, 2000). Following Argy (1994), the model can be expressed in three equations: (i) the first equation represents the goods market equilibrium, that is, IS curve, (ii) the second equation represent the money market equilibrium, that is the LM curve and (iii) the third equation represents the overall balance of payments over initial exports and defines the balance of payments curve, that is the BP curve. The main advantage of this model over some other models is that it includes consumption, investment, government spending, taxes, exports, imports, interest rate, exchange rate, current account, capital account and national output in a single

one of the major policy targets of macroeconomics, can be indirectly linked to the model. Although, the model has been criticised for neglecting the supply side of the economy, it has however remained the primary model used by government policy makers, financial commentators and macroeconomic consultants.

This framework can be used to analyse the role of fiscal, monetary and exchange rate policy in affecting macroeconomic performance in an economy. Although in the modified IS-LM framework, exchange rate does not affect output and price directly, it affect them indirectly through several channels. In the goods market, changes in exchange rate affect export and import through the relative price effect. Depreciation is theoretically expected to have positive effect on export since it makes domestic goods cheaper to foreign consumers. It is expected that depreciation would reduce import as a result of the higher relative price of imported goods. Depreciation would increase net export and income depending on whether Marshall-Lerner condition is satisfied. Where this condition holds, domestic income (output) would increase with depreciation through the goods market. Besides the export-import channel, exchange rate can also affect domestic money supply and through it affect domestic income. Depreciation is theoretically expected to be accompanied by increase in domestic currency, that is, increase in money supply. This is expected to lead to reduction in interest rate and increase in investment. Increase in investment would lead to increase in national income and output, given the national income identity. The interest rate effect of exchange rate changes can also work through the capital flows in the BP equation. With depreciation and the consequent reduction in interest rate due to its expansionary effect on money supply, domestic interest rate becomes lower relative to international interest rate. This is expected to lead to capital flight and reduction in domestic income and output.

Exchange rate could affect price through the domestic price of import, which is known as exchange rate pass through effect. Price can also be affected by exchange rate through the output effect. Figure 7 below presents a flow chart showing the possible links between exchange rate, output and price in an economy. From the theoretical linkage discussed above, the effect of exchange rate on output and price under the modified IS-LM framework cannot be determined *a priori.*

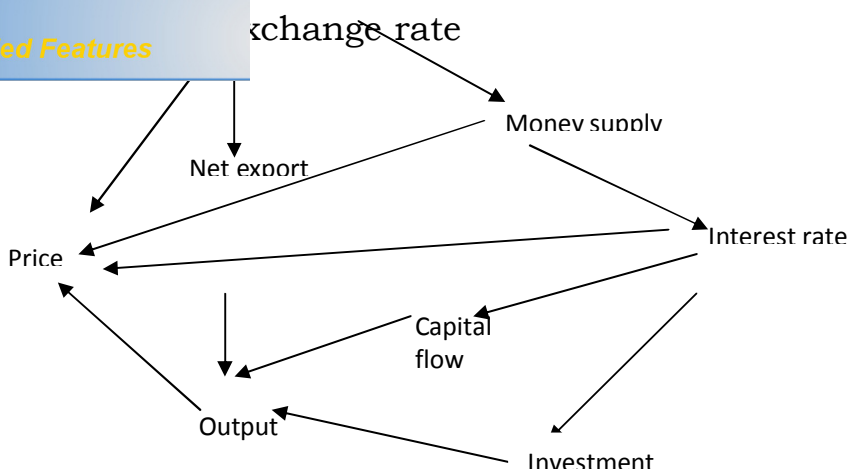


Figure 7: Flow Chart of Linkage among Exchange Rate, Output and Price Under Modified IS-LM Framework

ticipated Exchange Rate Changes and Economic Performance

Some authors have argued that the effect of exchange rate movements depends on whether the movement is anticipated or not. Such authors include Agenor (1991) and Kandil (2004). Agenor (1991) and Kandil (2004) presented a theoretical argument which demonstrated that with the assumption of rational expectation, an anticipated increase in exchange rate (anticipated depreciation) would constitute an adverse supply shock under the assumption that producers use imported intermediate goods which cannot be produced domestically. The adverse supply shock could also come in through higher wages as a result of workers reaction to anticipated depreciation and increase in expected price. As a result of the increase in wage and cost of imported intermediate goods, demand for labour and intermediate goods fall and, consequently, output falls and price rises. As for unanticipated exchange rate depreciation, they showed that actual price will be higher contrary to workers expectations, thus leading to reduction in real wages. The reduction in real wage will increase the demand for labour, leading to increase in output.

On the demand side, Kandil (2004) showed theoretically that exchange rate depreciation, whether anticipated or unanticipated, increases the price of foreign goods in domestic currency which increases the international competitiveness of locally produced goods. It thus makes exports less expensive and imports more expensive. This is expected to increase the demand for domestically produced goods by both domestic residents and foreign residents. In addition, economic agents are known to hold money balances both for transactions and speculative purposes. These balances include foreign currencies. An anticipated depreciation of domestic currency does not affect the current money demand since it has been taken into consideration, but an unanticipated depreciation of domestic currency in period t would lead to a speculation of appreciation in period t+1 to restore the steady-state normal trend of the exchange rate (Kandil, 2004). Consequently, agents increase their speculative demand for domestic currency, establishing a negative relationship between the demand for real money balances and agentsô expectation of the future value of the domestic currency relative to its current value. As agents increase their speculative demand, total real money demand increases, leading to increase in interest rate which moderates the increase in aggregate demand (Kandil, 2004).

depreciation is expected to lead to a reduction in supply and an increase in aggregate demand to make its effect on output and price inconclusive depending on the relative strength of demand and supply shifts. However, the effect of unanticipated depreciation is a contraction of both aggregate supply and demand (through the money demand effect), thus leading to a decrease in output and an increase in price.

3.3.3 Expectations

Economic agentsô expectations about changes in exchange rate have implications for their demand and supply of factors of production as well as for goods and services, and, by extension, for macroeconomic activities. For example, anticipated exchange rate changes are built into prices and this may have effect on demand and supply. There are different models of expectation formations. The most common of these are the adaptive and rational expectations.

3.3.3.1 Adaptive Expectations: According to this model, economic agents expect future values of economic variables like price and income to change slowly (Jhingan 2001). For an example, economic agents form expectations of future inflation rates from a weighted average of experienced past inflation rates and they periodically revise those expectations if actual inflation turns out to be different. An adaptive expectation is the basic assumption about economic environment in any static equilibrium model of the economy (Branson 2005).

Although adaptive expectations have the advantage of being relatively straight forward to operate as a órule of thumbô, it has been criticised for being irrational since it does not make use of all available information at the time of making a forecast, and it is at best appropriate during a stable economic environment.

3.3.3.2 Rational Expectation Hypothesis (REH): This hypothesis assumes that economic agents form expectations about future values of economic variables using a macromodel. It assumes everyone knows the model and uses this knowledge fully. The idea of REH was first put forward by Muth in 1961. He assumed that economic agents optimise and use information efficiently when forming expectations. This information includes the relationship governing economic variables, particularly the monetary and

. REH presumes that individual economic agents use all available and relevant information in forming expectations and that they process this information intelligently. But this, however, does not imply they have perfect foresight or that their expectations are always órightô. REH is referred to as model consistent expectations. It conforms to the law of iterated expectations since all available information and ónewsô are used. The advantage of REH is that it is based on the assumption that economic agents are rational in the pursuit of their maximum expected utility, therefore errors made in expectations are truly errors as opposed to a form of blindness towards oneôs own mistakes (Branson 2005). Based on macroeconomic rational expectation, it is assumed that economic agents make decisions using the most current information and the best available economic theory. It is thus argued on the basis of this that any changes in the aggregate demand policy that are fully anticipated by economic agents will not affect the real output, both in the short and long run. As a result, it is posited that the government can only influence real output when it makes unexpected changes in aggregate demand policy (Egwaikhide *et al*, 2001).

The problem that is however, associated with REH is the information requirement, which may be beyond an ordinary economic agent, who may not have enough incentive to devote the kind of resources needed to make the best possible forecast. Apart from the cost associated with information acquisition, there is also the problem of information asymmetry among different economic agents. For example, the policymakers in most cases have more information about the workings of the economy than the average worker.

Despite the shortcomings of REH highlighted above, it is still relied upon because it avoids the commission of persistent errors which is inherent in adaptive expectations.

3.3.4 Empirical Evidence of the Exchange Rate Effects on Output and Inflation

The empirical evidence of the effects of exchange rate on output is extensive and mixed. The conclusions differ not only quantitatively but also qualitatively. Differences in conclusions may be due to differences in approach, samples, time frame of study or methodology of study.

e used to evaluate the effects of exchange rate on output (macroeconomic performance in general) according to Agenor (1991) and Taye (1999), among others. The first, ñbefore and afterò method, compares relative economic performance before and after the currency is devalued/depreciated, to capture the effects of the change on economic aggregates. The second approach known as ñwith-withoutò or ñcontrol groupò approach, compares the economic performance of devaluing countries with that of non-devaluing countries. The third approach, named ñactual-versus-targetò approach, focuses on evaluating the actual performance of some macroeconomic aggregates compared to their pre-specified targets using econometric models. The fourth approach uses the simulation technique to examine the impact of changes in the exchange rate on economic activity. However, our review of empirical evidence is based on the findings, that is, whether they find that depreciation is contractionary, expansionary or has neutral or mixed effects.

Diaz-Alejandro (1963) analysed the experience of Argentina over the period 1955-1961. He showed that the 1959 devaluation of the *peso* was contractionary, because it induced a shift in income distribution towards high-propensity savers, which, in turn, depressed consumption and real absorption.

Cooper (1971) studied the effects of twenty four devaluations in nineteen countries for the period between 1959 and 1966 and assessed statistically the extent of the response of elements of aggregate demand, inflation, balance of trade and balance of payments to exchange rate devaluation. He found evidence for contractionary tendencies following devaluation but in most cases, with improvements in balance of trade and payments. Diaz-Alejandro (1963) and Cooper (1971) belong to the ñbefore and afterò approach group, which suffer from two major weaknesses. First, they examined only short-run effects of devaluation, whereas in most cases devaluation can hardly be expected to have its principal- let alone its sole ï effect in the following year. Secondly, Cooperôs analysis is based on a strict *ceteris paribus* assumption and will not yield an estimate of the independent effect of a currency depreciation on output whenever other determinants (domestic as well as external factors) of the outcome are changing between the pre-devaluation and the post- devaluation period.

ulated the impact of exchange rate depreciation on the Nigerian economy using a macroeconomic model with annual series from 1960 to 1981 and employing OLS with correction for serial-correlation, where necessary. They found out that the impact of the devaluation of the currency on overall export was nil or negligible. In addition, they found that the impact on agricultural output was negligibly positive or probably negative, while the impact on mining and quarrying as well as the building and construction sector was negative. The effect on manufacturing and services was however positive (though negligible for manufacturing). Overall, their finding was that the level of response of economic activity to devaluation was negative. Olofin *et. al.* (1986*)* study focussed on nominal bilateral exchange rate, which has earlier been mentioned to be inadequate. Moreover, their study did not cover the post-SAP era during which there were continuous changes in the value of the domestic currency (Naira).

Edwards (1986) addressed one of the weaknesses of the earlier works by controlling for other variables such as monetary surprises and terms of trade. He studied the devaluation experiences of twelve developing countries between 1965 and 1980 using the fixed effect procedure. He regressed real GDP on real exchange rate, government spending, terms of trade and money growth. He found that devaluations were contractionary in first the year, even where other factors were controlled for, and that the contractionary effect was completely reversed in the second year. He thus concluded that devaluations were neutral in the medium to long run.

Agenor (1991) criticised Edwards (1986) for estimating an *ad hoc* output equation, which may pose the problem of simultaneity and specification bias. He improved upon Edwards (1986) by explicitly deriving the aggregate output relation under rational expectations which provided a basis for distinguishing between anticipated and unanticipated movements in variables. He developed a theoretical model which incorporated the demand and supply sides of the economy based on the assumption that production depended on imported intermediate input which cannot be produced domestically. In his theoretical model the exchange rate came in through cost of imported intermediate input. According to his derivation, anticipated depreciation of the exchange rate translated into a rise in the expected price level. This would make workers demand for higher nominal wage which would reduce the demand for both labour, intermediate inputs and output. By contrast, unanticipated depreciation would not

ges but would give rise to an unanticipated increase in domestic demand as the relative price of domestic output (unexpectedly) falls. This implied that an unanticipated increase in prices would stimulate aggregate supply.

Agenor (1991) used the data from twenty three countries between 1978 and 1987. He regressed output growth on contemporaneous and lagged levels of the real exchange rate and on deviations of the actual changes in the exchange rate from expected changes in the real exchange rate, government spending, money supply and foreign income. From the results obtained, he concluded that an anticipated depreciation of real exchange rate has a negative effect while an unanticipated depreciation has a positive impact on output. In addition, he found that the contractionary effect of anticipated depreciation remains significant even after a year. The major shortcoming of Agenor (1991) is that he brought in the aggregate demand equation in an *ad hoc* manner, hence, the effect of anticipated and unanticipated exchange rate depreciation through export and import could not be analysed. Moreover, he examined the effects of the exchange rate on aggregate output. The result from such analysis may obscure differences in sectoral responses to changes in exchange rate.

Gylfason and Radetzki (1991) examined the devaluation experience in twelve countries among the thirty seven countries listed by the United Nations Conference on Trade and Development (UNCTAD) as ólleast developedô. They used share and elasticity parameters from international trade and national income accounts statistics published by the United Nations, the World Bank and the IMF to simulate the effect of devaluation on current account and GNP, from both the demand and the supply sides. The study found that devaluation reduced GNP on the average in the countries under study. The weakness of this study is that the result obtained may be biased because some of the parameters used were ó*guestimates*ô which are liable to errors.

Ghurra and Grennes (1993) focussed on the effects of exchange rate behaviours in sub Saharan Africa. They examined data for thirty three countries in Sub Saharan Africa, focussing on two behaviours of real exchange rate namely misalignment and instability. Ghura and Grennes (1993) used three measures of misalignment which are the Purchasing Power Parity (PPP) based measure; model based and black market

found out that all measures of misalignment negatively affected economic growth. The same was found for the instability of real exchange rate.

Ubok-Udom (1999) examined the relationship among exchange rate variations, currency depreciation and the growth of output in Nigeria using data from 1971 to 1995. He employed OLS techniques and found that exchange rate variations negatively affected output growth only when output was expressed in dollar equivalent, but when expressed in naira terms, exchange rate variation has no significant effect on output growth. His analysis may however suffer from the possibility of spurious regression since he neither tested for unit root nor cointegration. Moreover, he did not control for other factors which could impact on output growth.

Most of the studies reviewed above did not distinguish between short and long run effects. Not only this, they failed to control adequately for shocks that might simultaneously induce devaluation and economic contraction (except Agenor (1991), thereby leading to the possibility of spurious correlation between output and exchange rate devaluation. Many also failed to test for unit root and cointegration in the variables used.

Kamin and Klau (1997), attempted to address these limitations by distinguishing between short run and long run effects. They examined data for twenty seven countries and employed error correction specification which helped to distinguish between short and long run effects. From the results, they found that devaluation was contractionary in the short run but there appeared to be no contractionary effects in the long run. They however did not identify the channel through which exchange rate devaluation affected output.

However, Bahmani-Oskooee (1998) investigated the long run relationship between devaluations and output in twenty three less developed countries, by using cointegration techniques and found evidence for contractionary devaluation in the long run in seventeen of these twenty three countries for which he could apply cointegration technique. He showed that the relationship between the exchange rate and output in these countries was temporary. The short run effects in these countries were however mixed.

simulation exercise to determine the effect of exchange rate devaluation on macro variables, using data from Ethiopia for the period of 1961 and 1987. He identified the channel of transmission to be through imports of intermediate inputs and found that devaluation is stagflationary.

Acar (2000), using data from a group of eighteen less developed countries (excluding Nigeria), and regressing the log of real output on government size, money surprise term, terms of trade, real exchange rate and a time trend. He found devaluation to be contractionary in the short run, expansionary in the medium run but neutral in the long run. He also did not test for unit root or cointegration, giving room for the possibility of spurious regression.

Some studies have applied the vector autoregression (VAR) techniques to test the relationship between the exchange rate and output. Among such studies are Kamin and Rogers (2000), and Odusola and Akinlo (2001). Kamin and Rogers (2000), with a five variable VAR model and using data on Mexico for the period between 1980 and 1996, concluded that real devaluation in Mexico was associated with persistent high inflation and contraction of output. Berument and Pasaogullari (2003) arrived at similar conclusion using data from Turkey from 1987 to 2001.

Some studies however found expansionary effect for depreciation. Examples of such studies include Odusola and Akinlo (2001) and Adewuyi (2005). Odusola and Akinlo (2001) applied the restricted VAR model to data from Nigeria and used six variables. They included the official exchange rate, parallel exchange rate, prices, income, money supply and interest rate. They concluded, from the impulse response function, that the exchange rate depreciation exerted an expansionary impact on output in both the medium and long run but that the opposite was obtained in the short run. They equally observed that official exchange rate depreciation led to increase in price. The main weakness of their study is that it failed to identify the mechanism through which the exchange rate impacts on output. In addition, it failed to control for government spending and oil price, both of which are important determinants of aggregate demand in Nigeria. Moreover, their study focused on aggregate output only which may obscure sectoral differences in response to exchange rate changes.

in the 2000s corrected for the observed weaknesses of earlier works, especially, by testing for unit roots and cointegration. Among such are Kandil and Mirzaie (2002), Kandil (2004), Bahmani-Oskooee and Kandil (2007), Kandil *et al* (2007) and Huseyin *et al* (2008). Kandil and Mirzaie (2002) investigated the effect of exchange rate fluctuations on price and output using data from the USA from 1961 to 1994. They identified three channels through which exchange rate impacted on the US economy namely, import and export channel, demand for domestic currency and cost of imported input channel. The results obtained, using non-linear three-stage least squares, showed that the dollar appreciation has an indeterminate effect on output and price when the three channels are combined. Kandil (2004) on the other hand concluded that devaluation is contractionary from the analysis he carried out using annual data from twenty two developing countries (excluding Nigeria). He decomposed exchange rate movements into anticipated and unanticipated components.

Kandil (2004) derived a theoretical framework which improved on Agenor (1991) by explicitly deriving the demand side of the economy. He was thus able to trace the effect of anticipated and unanticipated depreciation through the export and import sectors as well as through the money market. He found that anticipated exchange rate depreciation has contractionary effects on output while it increases the inflationary rate. Unanticipated depreciation was found to have similar effects in most of the countries studied. Adewuyi (2005) investigated the effect of the exchange rate and trade policies on economic performance using data on Nigeria between 1970 and 2000. He employed two-stage least squares and found that currency depreciation had a significant and positive effect on non-oil GDP growth; however the effect of trade policy was found to be negative. The growth of real non-oil GDP was found to be positively affected by import growth reflecting the importance of imported input in production activities in the Nigerian economy. Bahmani-Oskooee and Kandil (2007) concurred with the findings of Adewuyi (2005) on expansionary devaluation, using data on Iran for the period between 1959 and 2003, and applying an error correction mechanism. Kandil *et. al.* (2007), working with data on Turkey between 1980 and 2004 found unanticipated depreciation to be contractionary in the first year of depreciation but expansionary in the following year. Anticipated depreciation, though found to stimulate real growth, could be inflationary. In addition, they found strong evidence of asymmetry in the effects of

rkish economy. Huseyin *et. al.* (2008) found currency devaluation to have mixed result in a number of OECD countries they examined, using quarterly data from 1980 to 2005, and using cointegration and error correction mechanism. They found that devaluation had long run effect on output growth in nine of the twenty three countries examined. While it is contractionary in six of the nine, it is expansionary in the remaining three.

Egwaikhide *et. al.* (1994) investigated the relationship among exchange rate, money supply and inflation in Nigeria, using data from 1970 to 1989 and adopting cointegration and error correction mechanism. They found that the official exchange rate significantly influenced inflation with a lag of one year but the black market rate mirrored inflation more than the official exchange rate.

3.3.5 Effects of exchange rate on output and inflation: Methodology

Empirical studies on the effect of exchange rate on output and price started with the pioneering work of Diaz-Alejandro (1963). This work and the seminal paper of Cooper (1971) used trend analysis to determine the effect of exchange rate changes on output. One of the weaknesses of the earlier work is that they examined only short run effects of devaluation, whereas the effects of devaluation may not be limited to just the first one or two years.

The application of econometric techniques to evaluating the effect of exchange rate started in the late 1970s. However, despite the fact that unit root is common in macroeconomic variables, most early studies using econometric techniques did not test for unit root and hence cointegration. The results from such analyses are thus not free from the problem of spurious regression. Studies that fall into this category include Edwards (1986), Edwards (1989), Cottani *et. al.* (1990), Agenor (1991) and Ghurra and Grennes 1993).

Most studies in the 1990s and 2000s tested for unit root and cointegration. Some of such studies estimated single equation error correction model (ECM) while others adopted the vector autoregression (VAR) or vector error correction mechanism (VECM) with or without impulse response analysis. Studies in this category include Kamin and

(2000), Odusola and Akinlo (2001) Ubok-Udom (1999), Randa (2004), among others.

Although the use of single equation ECM, VAR and VECM involves testing for unit root and cointegration, it does not take into consideration the economy-wide implications of changes in exchange rate, thus important indirect effects of changes in exchange rate on output and price are ignored. Some other studies which have used the macro-model have, however, failed to test for or account for unit root in the data used. These include Taye (1999) and Glyfason and Radetzki (1991).

In line with the findings from the review presented above, this study intends to use macroeconomic modelling with the modified IS-LM framework to capture both the direct and indirect effects of real exchange rate movements on output and inflation. Moreover attempt will be made in the thesis to decompose movements in exchange rate into anticipated and unanticipated so as to isolate the effects of each of the components. The effects of exchange rate changes on aggregate as well as sectoral output are investigated in order to ascertain whether or not there are sectoral differences in response to exchange rate changes and to identify the sector on which the exchange rate has the greatest impact. This has largely been ignored by earlier studies on Nigeria.

CHAPTER 4

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1 Theoretical Framework for the Relationship among the Exchange Rate, Output and Inflation

4.1.1 Relationship between the Exchange Rate and Output

The theoretical framework for this study is the modified IS-LM framework. The advantage of this framework as mentioned in chapter three is that it enables us to study many sectors and markets simultaneously. This framework was also adopted by Taye (1999) and Kandil (2004) among others. In this framework, output is assumed to be demand determined; hence we modelled the demand side of the economy. The demand side consists of three markets namely the goods, money and foreign exchange market, all of which must simultaneously be in equilibrium for the economy to be in equilibrium. Under this condition, the economy attains both internal and external equilibrium, which is the basic objective of exchange rate management.

The Goods Market

Equilibrium in the goods market is obtained when the demand and supply of goods and services are equal, that is, aggregate planned expenditure is equal to income.

The equilibrium condition in this market is given as:

$$y = c + g + i + x - im \qquad (10)$$

Where y is real income, c is real consumption, g is real government expenditure, i is real investment, x is real export and im is real import.

Each component of the goods market is taken in turn:

Consumption Function

According to the simple Keynesian theory, consumption is a function of disposable income (y_{dt});

$$c_t = \beta_0 + \beta_1 y_{dt}, \qquad (11)$$

where $y_{dt} = y - t,$ and t = tax, $t = t_0$

e and $\beta_1 > 0$

Interest rate is included as a determinant of consumption, especially for durable consumer goods because the consumption of durable consumer goods is sometimes financed by borrowing. Moreover, the inclusion of interest rate is predicated on the fact that individuals smooth out their consumption through borrowing and saving, which are affected by interest rate (Romer, 2006). The effect of interest rate on consumption is however indeterminate due to its income and substitution effects which oppose each other. Krugman and Taylor (1978) argued that aggregate consumption could be affected by exchange rate changes in a situation where the marginal propensities to consume differ between wage earners and profit earners. To test this hypothesis, real exchange rate is included in our consumption function, hence, in linear form, our consumption function is modeled as:

$$c = \beta_0 + \beta_1 y_{dt} + \beta_2 r_t + \beta_3 e \qquad (12)$$

$$\beta_1 > 0, \ \beta_2 <> 0, \ \beta_3 <> 0$$

Where y_{dt} = real *disposable income,* r = real interest rate and e = real exchange rate,

Government Consumption

In the simple Keynesian model, government consumption is assumed exogenous or given, that is;

$$g = \bar{g} \qquad (13)$$

But, according to Wagnerôs Law of increasing state activities, government consumption grows as the economy grows (Rosen, 1999). Government expenditure is elastic with respect to income because the traditional functions of the state, in terms of intensity and coverage; grow more rapidly than the expansion of an economy, as a developing country expands. Thus income, which is a measure of the expansion of an economy, is a determinant of government consumption. Government consumption behaviour is determined by the level of economic activity (y_t,), the population size *(POP)*, as well as habit persistence tendency (Ekpo *et al*,2004). Government expenditure is therefore expressed as:

The linear representation of the government consumption expenditure is given in equation (14).

$$g_t = \omega_0 + \omega_1 y_t + \omega_2 POP_t + \omega_3 g_{t-1} \quad (14)$$

$$\omega_1, \omega_2, \omega_3 > 0$$

Where y_t, POP, and g are income, population and government expenditure respectively.

Investment

The simple investment theory posits that investment is negatively related to interest rate. Hence, the investment function is expressed as:

$$i_t = f(r_t) \quad (15)$$

where i is investment and r is real interest rate.

The simple investment function is modified by including the growth rate of the economy (proxied by income, y). This is important for Nigeria, which is a typical developing economy with potentials for growth. The growth rate of the economy serves as an indicator of the expected profitability of investment. The investment function, based on this modification becomes;

$$i_t = f(r_t, y_t)$$

The linear representation of the investment function is presented in equation (16).

$$i_t = i_0 + i_1 r_t + i_2 y_t \quad (16)$$

$$i_1 < 0 \text{ and } i_2 > 0$$

The real exports are determined by the demand and supply factors. Demand for export depends on a measure of foreign economic activity, which is taken as a weighted average of the incomes of trading partners; and the real exchange rate. The higher the income of trading partners, the higher the ability to import, other things being equal, the higher the demand for export. A depreciation of real exchange rate implies that domestic goods are cheaper relative to foreign goods and this increases the demand for home made goods by foreign residents, thus increasing the demand for export.

$$x^d = f\left(y^f, e\right), \quad \frac{\partial x^d}{\partial y^f} > 0, \qquad \frac{\partial \mathrm{x^d}}{\partial e} > 0$$

Where x^d, y^f, and e are export demand, income of trading partners and real exchange rate respectively.

Supply of Export

The supply of export depends on the domestic terms of trade (that is, price of export relative to price of domestic goods) or relative price, domestic income and imports. The higher the relative price, *ceteris paribus*, the higher the supply of export. The same relationship holds for domestic income. In the context of African economies where industrial and other production activities rely heavily on imported inputs, import constitutes a serious constraint on exports (see Khan and Knight, 1988). Import is therefore included in the export function. Real exchange rate is also a determinant of the supply of export. When real exchange rate depreciates, it implies more domestic currency for every unit of foreign currency earned, hence, more domestic currency for goods exported. Thus depreciation promotes the supply of export, other things being equal. Relative price could also be a measure of real exchange rate where this is measured in external terms (Apoku-Afari, 2004). Including both relative price and real exchange rate in the same equation would likely cause a multicolinearity problem. Therefore, relative price is excluded in the supply of export equation. The supply of export is therefore expressed as;

$$x^s = f\left(im, e, y\right), \quad \partial x^s/\partial e > 0, \partial x^s/\partial im > 0, \partial x^s/\partial y > 0$$

change rate and y = domestic income.

At equilibrium, supply and demand are equal, that is:

$$x^d = x^s = x$$

In linear form, the export function is expressed as:

$$x_t = x_0 + x_1 e_t + x_2 y^f{}_t + x_3 im_t + x_4 y_t \qquad (17)$$

$$x_1 > 0, x_2 > 0, x_3 > 0, x_4 > 0$$

The real export is decomposed into its oil and non-oil components. Oil export in Nigeria is determined not only by domestic policies but by quotas fixed by the Organisation of Petroleum Exporting Countries (OPEC). Hence, real exchange rate changes may not have much impact but oil is a major foreign exchange earner in Nigeria, responsible for over 90% of foreign exchange earnings. Therefore, the oil and non-oil exports are modelled separately since they are likely to be influenced by different factors.

Oil Export Function

Oil export is determined primarily by economic activities in the industrial world, who are the major importers of oil; this can be represented by y^f. The price of oil is also a major determinant as OPEC adjusts quotas based on changes in the price of oil. Oil supply may be reduced by OPEC to firm up price. Real exchange rate is included as a determinant to see if it has any effect on oil export in Nigeria. The oil export function is thus represented as below

$$OILEXP = \pi_0 + \pi_1 y_t^f + \pi_2 POIL + \pi_3 y_t + \pi_4 e \qquad (18)$$

Where $POIL$ is the international price of oil and $OILEXP$ is oil export.

$\pi_1 > 0$, $\pi_2 > 0$, $\pi_3 > 0$ and $\pi_4 <> 0$

Non-oil export function

This is represented as

$$im_t + \phi_4 y_t \quad (19)$$

Where *NOILEXP* = non-oil export.

$$\phi_1 > 0, \phi_2 > 0, \phi_3 > 0, \phi_4 > 0, \phi_5 > 0$$

The relationships among the independent and dependent variables are as discussed under export function.

Import Function

The simple import function posits that import is determined by domestic income since this is a measure of ability to import; and real exchange rate. Depreciation of real exchange rate implies an increase in the domestic price of imports. It thus makes import more expensive relative to domestically produced goods. This is expected to lead to a reduction in imports, other things being equal. But this may not be the case, especially for imported intermediate goods and raw materials which have low elasticity of substitution (Krugman and Taylor, 1978). As a result of this, the effect of depreciation of real exchange rate on import may not necessarily be negative.

$$im_t = f\left(y_t, e_t,\right)$$

The linear counterpart of the import function is presented in equation 20

$$im = im_0 + im_1 y_t + im_2 e_t \quad (20)$$

$im_1, > 0$, $im_2 < > 0$

To obtain equilibrium in the goods market, equations (12), (14), (16), (17) and (20) are substituted in equation (10) to obtain equation (21), which is the IS equation, depicting equilibrium condition in the goods market.

$$y_t = \frac{(\beta_0 + i_0 + \omega_0 + x_0 + im_0 - \beta_1 t_0) + (\beta_2 + i_1) r_t + (\beta_3 + x_1 + im_2) e_t}{1 - \beta_1 - i_2 - \omega_1 - x_5 - im_1} + \frac{+\omega_2 POP + \omega_3 g_{t-1} + x_2 y^f + x_3 im}{1 - \beta_1 - i_2 - \omega_1 - x_4 - im_1} \quad (21)$$

$$y_t = \frac{A + (\rho_2 + i_1) r_t + (\rho_3 + x_1 + im_2) e_t + \omega_2 POP + \omega_3 g_{t-1} + x_2 y_t^f + x_3 im}{B} \quad (22)$$

where $A = \beta_0 + i_0 + \omega_0 + x_0 + im_0 - \beta_1 t_0$ and $B = 1 - \beta_1 - i_2 - \omega_1 - x_4 - im_1$

Money Market

Money demand is modelled along the standard money demand theories (Quantity Theory of money (QTM), Keynesian money demand function and Friedmanôs restatement of the QTM. Real money demand is therefore expressed as a function of real income and interest rate, that is

$$m^d = \theta_0 + \theta_1 y_t + \theta_2 r_t \quad (23)$$

Because economic agents may hold foreign money for speculative purposes, demand for money may be influenced by exchange rate. It is argued that an unexpected depreciation of the domestic currency in period t would lead to speculation of appreciation in period t+1 to restore the steady-state normal trend of the exchange rate (Kandil, 2004). The converse may however hold especially in a country like Nigeria, where exchange depreciation was persistent for a long time. The money demand equation is therefore modified to reflect agentsô speculative activities and it is expressed as:

$$m^d = \theta_0 + \theta_1 y_t + \theta_2 r_t + \theta_3 e_t \quad (24)$$

$\theta_1 > 0$, $\theta_2 < 0$ and $\theta_3 <> 0$

Real money supply is equal to the nominal money balances, M, which is assumed to be exogenously determined, deflated by price, P. Therefore, money supply equation is expressed as:

$$m^s = \frac{M_t}{P_t} = \bar{m} \quad (25)$$

Equilibrium condition in the money market requires that real money demand be equal to real money supply, and this modelled as

(26)

From (26), we get (27) below

$$y_t = \frac{\bar{m}_t - \theta_0 - \theta_2 r_t - \theta_3 e_t}{\theta_1} \tag{27}$$

Equation (27) is the LM equation showing equilibrium condition in the money market.

Equating (22) and (27), we obtain (28)

$$\frac{A + (\beta_2 + i_1) r_t + (\beta_3 + x_1 + im_2) e_t + \omega_2 POP + \omega_3 g_{t-1} + x_2 y_t^f + x_3 im}{B} = \frac{\bar{m}_t - \theta_0 - \theta_2 r_t - \theta_3 e_t}{\theta_1} \tag{28}$$

Simplifying (28), we get (29)

$$\theta_1 \left[A + (\beta_2 + i_1) r_t + (\beta_3 + x_1 + im_2) e_t + \omega_2 POP + \omega_3 g_{t-1} + x_2 y_t^f + x_3 im \right] = B \left[\bar{m}_t - \theta_0 - \theta_2 r_t - \theta_3 e_t \right] \tag{29}$$

Re-arranging (29) and making r_t the subject of the formular we have (30)

$$r_t = \frac{B\left[m_t - \theta_0 - \theta_3 e_t\right] - \theta_1 \left[A + \alpha_2 e_t + \omega_2 POP + \omega_3 g_{t-1} + x_2 y_t^f + x_3 im \right]}{\theta_1 \alpha_1 + B\theta_2} \tag{30}$$

where $\alpha_1 = \beta_2 + i_1$ and $\alpha_2 = \beta_3 + x_1 + im_2$

External sector

The external sector is captured by the BP equation, which shows different combinations of income and interest rate that ensures equilibrium in the balance of payments (Appleyard and Field, 2001). The balance of payment (BOP) account has three components namely the current account, the capital account and the official reserve transactions. The BOP is in equilibrium when the balance in the official reserve transaction is zero. The fundamental identity in the BOP equation is expressed as:

(31)

where B is the balance in the official reserve transactions account, CA is current account balance and K is capital account balance.

Equilibrium in the BOP requires that B is zero.

$$CA = x - im \tag{32}$$

where CA is current account balance, x is export and im is import.

Using equations 18, 19 and 20, CA is expressed as equation 33.

$$CA = x - im = \theta_0 + \theta_1 e_t + \theta_2 y_t^f + \theta_3 im_t + \theta_4 y_t + \pi_0 + \pi_1 y_t^f + \pi_2 POIL + \pi_3 y_t + \pi_4 e_t - \left(im_0 + im_1 y_t + im_2 e_t\right) \tag{33}$$

$$CA = f\left(e_t, y_t^f, im_t, y_t, POIL\right) \tag{34}$$

$$K = f\left(r_t\right) \tag{35}$$

Therefore

$$BP = f\left(e_t, y_t^f, y_t, im_t, POIL, r_t\right) \tag{36}$$

Since equilibrium condition for balance of payment requires that BP is zero, (36) can be expressed explicitly as (37)

$$0 = \phi_0 + \phi_1 e_t + \phi_2 y_t + \phi_3 y_t^f + \phi_4 r_t + \phi_5 im + \phi_6 POIL \tag{37}$$

$\phi_3, \phi_4 > 0$, $\phi_2, < 0$, $\phi_1 < > 0$, $\phi_5, < 0$

Expressing (37) in terms of y_t gives (38)

$$y_t = -\left(\frac{\phi_0 + \phi_1 e_t + \phi_3 y^f + \phi_5 im + \phi_6 POIL}{\phi_2}\right) - \phi_4 r_t \frac{1}{\phi_2} \tag{38}$$

Substituting (30) into (38), we obtain (39)

$$\left(\frac{\phi_6}{\phi_2}POIL\right)$$

$$-\frac{\phi_4}{\phi_2}\left(\frac{B\left[m_t-\theta_0-\theta_3 e_t\right]-\theta_1\left[A+\alpha_2 e_t+\omega_2 POP+\omega_3 g_{t-1}+x_2 y_t^f+x_3 im\right]}{\theta_1\alpha_1+B\theta_2}\right) \quad (39)$$

Rearranging (39), we get (40) and (41)

$$y_t=\left(B\frac{\phi_4\theta_0}{\phi_2 C}+A\frac{\phi_4\theta_1}{\phi_2 C}-\frac{\phi_0}{\phi_2}\right)+\left(\frac{B\phi_4\theta_3}{\phi_2 C}+\frac{\phi_4\theta_1\alpha_2}{\phi_2 C}-\frac{\phi_1}{\phi_2}\right)e_t+\left(\frac{\phi_4\theta_1 x_3}{\phi_2 C}-\frac{\phi_5}{\phi_2}\right)im_t+$$

$$\left(\frac{\phi_4\theta_1 x_2}{\phi_2 C}-\frac{\phi_3}{\phi_2}\right)y_t^f-\left(B\frac{\phi_3}{\phi_2 C}\right)m_t+\frac{\phi_6}{\phi_2}POIL+\left(\frac{\phi_4\theta_1\omega_2}{\phi_2 C}\right)POP+\left(\frac{\phi_4\theta_1\omega_3}{\phi_2 C}\right)g_{t-1} \quad (40)$$

$$y_t=\tau_0+\tau_1 e_t+\tau_2 im_t+\tau_3 y_t^f-\tau_4 m_t-\tau_5 POIL_t+\tau_6 POP+\tau_7 g_{t-1} \quad (41)$$

where

$$C=\theta_1\alpha_1+B\theta_2 \quad and \quad \tau_0=B\frac{\phi_4\theta_0}{\phi_2 C}+A\frac{\phi_4\theta_1}{\phi_2 C}-\frac{\phi_0}{\phi_2},\quad \tau_1=\frac{B\phi_4\theta_3}{\phi_2 C}+\frac{\phi_4\theta_1\alpha_2}{\phi_2 C}-\frac{\phi_1}{\phi_2},$$

$$\tau_2=\frac{\phi_4\theta_1 x_3}{\phi_2 C}-\frac{\phi_5}{\phi_2},\ \tau_3=\frac{\phi_4\theta_1 x_2}{\phi_2 C}-\frac{\phi_3}{\phi_2},\ \tau_4=B\frac{\phi_3}{\phi_2 C},\ \tau_5=\frac{\phi_6}{\phi_2},\ \tau_6=\frac{\phi_4\theta_1\omega_2}{\phi_2 C},\ \tau_7=\frac{\phi_4\theta_1\omega_3}{\phi_2 C}$$

4.1.2 Relationship between Exchange Rate and Price

The theoretical framework used for modelling price is the simple price model where the domestic price level is considered as the weighted average of the price of tradable goods (P^T) and non-tradable goods (P^{NT}). This model is applied in modelling the price level by Ubide (1997), for Mozambique Bawumia (2002) for Ghana and Oyinlola (2008) for Nigeria.

The price equation is expressed as

$$P_t=\left(P_t^T\right)^{\lambda}\left(P_t^{NT}\right)^{1-\lambda} \quad (42)$$

of traded goods in total consumption. In linear form equation (42) can be expressed as

$$P_t = \lambda P^T + (1-\lambda) P^{NT} \qquad 0<\lambda<1 \tag{43}$$

The price of tradable is determined in the world market and depends on foreign price (P^f) and nominal exchange rate (E). If we assume the law of one price holds, then, at equilibrium, the price of tradable goods will be equal to its foreign price multiplied by the nominal exchange rate. This is expressed as

$$P^T = E_t P_t^f \tag{44}$$

In linear form (44) can be expressed as (45)

$$p^T = E_t + p_t^f \tag{45}$$

Equations (44) and (45) imply that nominal exchange rate depreciation or an increase in foreign price will increase the domestic price level through an increase in the price of tradable goods (this is referred to as exchange rate pass-through effect)

The price of non-tradable goods is determined by the money market equilibrium condition. Hence

$$p_t^{NT} = \psi \left(m^s - m^d \right) \tag{46}$$

where ψ is a scale factor representing the relationship between economy-wide demand and the demand for non-tradable goods.

Substituting the money demand function in equation (24) into (46), we have

$$p_t^{NT} = \psi \left(m^s - \theta_0 - \theta_1 y_t - \theta_2 r_t - \theta_3 e_t \right) \tag{47}$$

By substituting (45) and (47) into (43) and holding foreign income constant, the price equation is obtained as a function of domestic money supply, income, interest rate and real exchange rate (as nominal exchange rate is already embedded in the real exchange rate). That is

(48)

In linear form, the price equation is therefore expressed as follows:

$$P_t = \delta_0 + \delta_1 m_t^s + \delta_2 y_t + \delta_3 e_t + \delta_4 r_t + \delta_5 y^f \quad (49)$$

a priori expectations are $\delta_1 > 0$, $\delta_2 < 0$, $\delta_3 > 0$ and $\delta_4 > 0, \delta_5 > 0$

4.1.3 Effects of Exchange Rate on Components of Output

Modelling the effect of changes in real exchange rate on total output may obscure the differential response of sectors; hence, we decomposed the aggregate output into agricultural, manufacturing, petroleum and services sector output. Services sector output consists of the output of other sectors of the economy besides agriculture, manufacturing and petroleum. Each of the sectoral output is modelled and estimated. Equation 41 is modified to reflect the peculiar nature of each sector and this is presented below.

Agricultural Output

Apart from the major determinants of output in equation (41), we included rainfall as a determinant of agricultural output since agriculture is mainly rain fed in Nigeria. Government capital expenditure on agriculture was also included in the model to represent infrastructure on agriculture as against total government expenditure in (41). Ekpo *et. al.* (2004) also included these two variables in their model of the agricultural sector. To capture the linkages between the agricultural sector and the manufacturing sector, the output of the manufacturing sector was included in the model for the agricultural sector.

The agricultural output sector is modelled as (50).

$$y_{At} = \tau_0 + \tau_1 RAINFALL + \tau_2 y_{Mt} + \tau_3 CAPAGR + \tau_4 e_t \quad (50)$$

$$\tau_1, \tau_2, \tau_3 > 0, \quad \tau_4 < \ > 0$$

where *RAINFALL, y_{mt} and CAPAGR* are the amount of rainfall, manufacturing output and government capital expenditure in agricultural sector, respectively and y_{AT} is agricultural sector output.

In the equation for the manufacturing sector, we included the import of intermediate goods and the degree of trade restriction (CLOSE). The import of intermediate goods was included to reflect the degree of dependence of the sector on imported intermediate inputs while the degree of trade restriction was included to show how the liberalization of the economy impacts on the performance of the sector. The degree of trade restriction is important in Nigeria because of the possible competition between imported and locally manufactured goods. Both variables were included in the study of Taye (1999) on Ethiopia. Equation (51) is the linear form of the manufacturing output function.

$$y_{mt} = \tau_0 + \tau_1 e_t + \tau_2 tg\exp + \tau_3 e_t + \tau_4 close + \tau_5 im \qquad (51)$$

$$\tau_1, \tau_2, \tau_4 > 0,\ \tau_3 < \ > 0$$

where *tgexp* is the government expenditure on social services, y_{mt} is manufacturing sector output and other variables are as earlier defined.

Petroleum Output

The output function for the petroleum sector was obtained by including the international price of oil, the weighted income of Nigeriaôs major trading partners (foreign income) and capital employed in the sector in basic output equation (equation 41). All these variables were also used by Ekpo *et. al.* In linear form, the function for the output of the petroleum sector is:

$$y_{pt} = \tau_0 + \tau_1 y^f + \tau_2 CAPPETR + \tau_3 e_t + \tau_4 POIL_t \qquad (52)$$

where y^f, *CAPPETR* and *POIL* are foreign income, capital employed in the petroleum sector and the international price of oil respectively and *ypt* is the output of the petroleum sector.

Services Sector Output

Services sector output is the total GDP less the output of the agriculture, manufacturing and petroleum sectors. Equation (53) is the output function for services sector output.

$$_3 POP \qquad (53)$$

$$\tau_1, \tau_3 > 0, \quad \tau_2 < \quad > 0$$

where POP and y_{st} are population and services sector output respectively and other variables are as earlier defined.

4.2 Decomposition of Exchange Rate Changes into Anticipated and Unanticipated Components

Since the main objective of this study is to investigate the effects of anticipated and unanticipated real exchange rate changes on output and price, there is need to decompose the actual exchange rate changes into its anticipated and unanticipated components.

To identify the unanticipated component of exchange rate, there is need to construct an empirical proxy since the unanticipated component is not observable. Two main methods are used in empirical studies to identify the unanticipated components namely time series and structural models. The structural model method was used by Kandil and Mirzaie (2002) and Agenor (1991) among others, while Blenman, Lee and Walker (2006) among others used the time series model. Finn (1986), Meese and Rogoff (1983) and Wolff (1988), however, observed that the time series model outperforms the structural model thus in this study, the time series model was adopted to decompose real exchange rate changes into its anticipated and unanticipated components. As suggested by Blenman *et. al.* (2006), the real effective exchange rate was modelled as an ARMA process and the residual from this equation is used as the unanticipated components of exchange rate. To obtain the anticipated component, we subtracted the unanticipated component from the actual series. Table 5 contains the results for estimated ARMA model which was the basis of decomposition of exchange rate into its anticipated and unanticipated components. These decomposed series are then used as real exchange rate variables in the expectation model to identify the effects of anticipated and unanticipated exchange rate changes.

ed Result for Exchange Rate (ARMA)

	ent	Standard Error	't' Statistic	Probability
Constant	0.46	0.36	1.26	0.22
AR(1)	1.32	0.19	6.78	0.00
AR(2)	0.45	0.19	-2.28	0.03
MA(1)	-0.99	-0.004	-247.5	0.00
Adj R^2	0.94			
D.W	1.84			
A.I.C	1.16			
S.C	0.84			

D.W = Durbin Watson, A.I.C. = Akaike information criterion
S.C =Schwarz criterion

The empirical equations were obtained by including the random errors terms in each of the estimable equation. These are presented below as equations 54 to 65 while equation 66 is an identity. The petroleum sector output is derived as a residual and it serves as an identity. This is to enable us estimate the total output function, because petroleum output is generally agreed to be strongly determined by OPEC quota rather than by domestic policy.

$$c = \beta_0 + \beta_1 y_t + \beta_3 r_t + \beta_4 e + u_{1t} \quad (54)$$

$$g_t = \omega_0 + \omega_1 y_t + \omega_2 POP_t + \omega_3 g_{t-1} + u_{2t} \quad (55)$$

$$i_t = i_0 + i_1 r_t + i_2 y_t + u_{3t} \quad (56)$$

$$ROILEXP = \pi_0 + \pi_1 y_t^f + \pi_2 POIL + \pi_3 y_t + \pi_4 e + u_{4t} \quad (57)$$

$$RNOILEXP_t = \phi_0 + \phi_1 e_t + \phi_2 y^f{}_t + \phi_3 im_t + \phi_4 y_t + u_{5t} \quad (58)$$

$$im = im_0 + im_1 y_t + im_2 e_t + u_{6t} \quad (59)$$

$$m^d = \theta_0 + \theta_1 y_t + \theta_2 r_t + \theta_3 e_t + u_{7t} \quad (60)$$

$$P_t = \delta_0 + \delta_1 m_t^s + \delta_2 y_t + \delta_3 e_t + \delta_4 r_t + u_{8t} \quad (61)$$

$$y_{At} = \tau_0 + \tau_1 RAINFALL + \tau_2 y_{mt} + \tau_3 CAPAGR + \tau_4 e_t + u_{9t} \quad (62)$$

$$y_{mt} = \tau_0 + \tau_1 e_t + \tau_2 tg\exp + \tau_3 close + \tau_4 im + u_{10t} \quad (63)$$

$$y_{sr} = \tau_0 + \tau_1 tg\exp + \tau_2 e_t + \tau_3 POP_t + u_{11t} \quad (64)$$

$$y_t = \tau_0 + \tau_1 e_t + \tau_2 im_t + \tau_3 y_t^f - \tau_4 m_t^s - \tau_5 POIL_t + \tau_6 POP + \tau_7 g_{t-1} + u_{t12} \quad (65)$$

$$y_{pt} = y_t - y_{At} - y_{Mt} - y_{St} \quad (66)$$

The u_{is} are the random errors terms with zero mean values.

In order to identify the effects due to anticipated and unanticipated changes in the real exchange rate, we re-estimated equations 54 to 65 with the anticipated and unanticipated

rate replacing the actual real exchange rate variables. Moreover, the estimated models were made dynamic by including lagged variables because the effect of exchange rate changes is not limited to one period as observed by earlier authors (for example Edward 1989).

4.4 Definition of variables

The definitions of variables used in the study are given below.

c = real private consumption

g = real government consumption

y = real total gross domestic product (GDP)/total output

p = price

ANTR = anticipated real exchange rate

UNANTR = unanticipated real exchange rate

r = real interest rate (in percentage)

OILREV = oil revenue (in Naira)

e = real effective exchange rate

E = nominal effective exchange rate

POIL = international price of oil in dollar

POP = Nigerian population

i = real total investment

ROILEXP = real oil exports

RNOILEXP = real non-oil export

im = real import

y^f = real GDP of Nigeriaôs major trading partners in dollar

y_A = real agricultural sector GDP

y_m = real manufacturing sector GDP

y_p = real petroleum sector GDP

y_s = real service sector GDP

xpenditure on the agriculture

RAINFALL = average annual rainfall in Nigeria

TGEXP = real total government expenditure

CLOSE = closeness of the economy measured by the ratio of GDP to total trade (import + export)

CAPPETR = capital employed in petroleum sector

4.5 Sources and Transformation of Data

This study utilised aggregate time series data from 1970 to 2007. The source of the data is secondary and it is collected mainly from the Central Bank of Nigeriaôs (CBN) Statistical Bulletin (2007), Annual Reports and Statements of Accounts (various issues) as well as the Annual Abstract of Statistics (various issues) published by the National Bureau of Statistics (NBS), formerly called Federal Office of Statistics (FOS). Figures for consumption, government expenditure, total GDP, interest rate, inflation rate, and oil revenue were collected from CBN Statistical Bulletin for 2007. Other variables obtained from this source are oil exports, non-oil export, import, exchange rates, GDP deflators and consumer price index, agriculture GDP, petroleum GDP, services sector GDP and capital employed in the petroleum sector. The population figures and data on rainfall were obtained from the Annual Abstracts of Statistics, published by the Bureau of Statistics. Anticipated and unanticipated exchange rate components were calculated as described in section 4.2 above. The data on trade with Nigeriaôs trading partners used to compute the real effective exchange rates (e) were collected from the International Monetary Fund (IMF) direction of Trade Statistics (various issues). The real effective exchange rate was constructed as a weighted average of the real value of the Nigerian currency in terms of those of the major trading partners. The weights adopted in this study represent the relative share of each trading partner in total trade (exports and imports) for Nigeria[4].

[4] The major trading partners used accounted for over 70% of Nigeriaôs total trade during the period of study. These countries are Belgium, France, Switzerland, Italy, Japan, Netherland, Spain, Germany, United Kingdom and United States of America.

ratios and rate were transformed into natural logarithms so that their coefficients could be explained as elasticities. To obtain the real values of the variables, the data were deflated using the consumer price index. However, total GDP and sectoral GDP were deflated with their respective price deflators in order to obtain their real values.

4.6 CONCEPT OF SYSTEM ESTIMATION

A system is a group of equations containing unknown parameters. The general form of a system is;

$$f\left(Y_t, X_t \beta\right) = \varepsilon_t$$

where Y_t is a vector of endogenous variables, X_t is a vector of exogenous variables, and Ůis a vector of possibly serially correlated disturbances. ɓ is the parameter of the system to be estimated.

Equations in system models usually involve more than one dependent or endogenous variables, thereby necessitating as many equations as the number of endogenous variables. These equations are known as structural or behavioral equations, because they may portray the structure of an economy or the behaviour of an economic agent. A unique feature of system models is that the endogenous variable (i.e regressand) in one equation may appear as an explanatory variable (i.e regressor) in another equation of the system. The structural relationship form of a set of g equations is generally expressed algebraically as;

$$\begin{aligned}
Y_{1t} &= \qquad \beta_{12}Y_{2t} + \beta_{13}Y_{3t} + \ldots + \beta_{1M}Y_{Mt} + \gamma_{11}X_{1t} + \gamma_{12}X_{2t} + \ldots + \gamma_{1k}X_{Kt} + u_{1t} \\
Y_{2t} &= \beta_{21}Y_{1t} \qquad + \beta_{23}Y_{3t} + \ldots + \beta_{2M}Y_{Mt} + \gamma_{21}X_{1t} + \gamma_{22}X_{2t} + \ldots + \gamma_{2k}X_{Kt} + u_{2t} \\
Y_{3t} &= \beta_{31}Y_{1t} + \beta_{32}Y_{2t} \qquad + \ldots + \beta_{3M}Y_{Mt} + \gamma_{31}X_{1t} + \gamma_{32}X_{2t} + \ldots + \gamma_{3k}X_{Kt} + u_{3t} \\
&\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
Y_{Mt} &= \beta_{M2}Y_{1t} + \beta_{M2}Y_{2t} + \ldots + \beta_{M,M-1}Y_{M-1,t} + \gamma_{M1}X_{1t} + \gamma_{M2}X_{2t} + \ldots + \gamma_{Mk}X_{Kt} + u_{Mt}
\end{aligned}$$

where $Y_1, Y_2, \ldots, Y_M = M$ endogenous variables

$X_1, X_2, \ldots, X_K = K$ predetermined variables

$U_1, U_2,$ é , U_M = M stochastic disturbance terms

Total number of observations

$\beta's$ = coefficients of the endogenous variables

$\gamma's$ = coefficients of the predetermined variables

The parameters of the equations in the system can be estimated by estimating each equation in the system separately, using single equation methods or estimating the complete set of the equations in the system simultaneously. However single equation models cannot be applied in this study because of the interdependence of variables. The simultaneous approach is therefore adopted for this study since it is suitable for estimating group of equations that are interdependent.

The estimation of simultaneous equations requires correct specification and identification of the equations involved. Unlike in the single equation model where a mis-specification of one of the equations in the system would affect the estimate of only the misspecified equation, poor estimates for the misspecified equation in the system of simultaneous equations may ñcontaminateò estimates for other equations (Gujarati, 2004). Correct specification implies the inclusion of essential variables and correct listing of variables at the appropriate sides of the equation. Identification of a model, on the other hand, means that the equations in the system are in unique forms that enable unique estimation of their parameters. The equation would be in a unique form and would be identifiable if it excludes one or more variables that are included in other equations of the model.

Three different techniques may be employed to assess the identifiability of a structural equation. These include reduced-form equations, order and rank techniques. Reduced-form equations technique expresses an endogenous variable as a function of predetermined variables. The stuctural equation is said to be identied if there is a one-to-one correspondence between the structural coefficient and the reduced-form coefficients (Gujarati,2004). The Order method of identification requires that for an equation in a system to be identified, it must exclude at least *M-1* variables appearing in the model. If it excluded exactly *M-1* variables, such an equation is just identified. But where it excludes more than M-1 variables, it is overidentified, that is $K - k \geq m - 1$

of *predetermined* or exogenous variables in the system while k represents the number of exogenous variables in a particular equation in the system. *K-k* refers to the number of exogenous variables in the system but which are excluded from a particular equation. The condition $K - k \geq m - 1$ implies that the number of exogenous variables in the model but excluded from a particular equation must be equal or greater than the number of endogenous variables in that particular equation less one (1).

If $K - k = m - 1$, the equation is just identified, but if $K - k > m - 1$, it is overidentified It is worthwhile to note that the parameters of just identified or over ï identified equations can be estimated, while that of unidentified or underidentified can not be estimated.Once one of the structural equations of the model is unidentified, it means the model cannot be estimated unless the functional form of the model is changed.

The rank method provides a necessary and sufficient condition of identification. The condition states that ñan equation in a model containing M equations in M endogenous variables is identified if and only if at least one non-zero determinant of order (M ï 1)(M ï 1) can be constructed from the coefficients of the variables (both endogenous and predetermined), excluded from that particular equation but included in the other equations of the modelò. However, the rank technique involves a laborious procedure that makes it a formidable task for large simultaneous equation models (Gujarati, 2004). For this reason and for the fact that the order method is easy to apply and considered sufficient enough for identification purposes, the order method is commonly used. This method is also adopted in this study for identification purposes.

Table 6 below presents the identification test result based on the order method. As revealed in the table, all equations in our model are overidentified since the number of variables excluded in each (but included in others) is greater than the number of endogenous variables included less than one.

From Table 6, we observed that all our equations are overidentified. Our parameters can therefore be estimated using either two-stage or three-stage-least-squares method.

TEST USING ORDER METHOD

EQUATION	*k*	*m*	K-k	m-1	Remark
Consumption ©	2	2	9	1	Overidentified
Government expenditure (g)	2	2	9	1	Overidentified
Investment (i)	1	2	10	1	Overidentified
Non-oil export (RNOILEXP)	2	3	9	2	Overidentified
Oil export (ROILEXP)	3	2	8	1	Overidentified
Import (im)	1	2	10	1	Overidentified
Money Demand (m^d)	2	2	9	1	Overidentified
Inflation (Inf)	3	2	8	1	Overidentified
Agric output (y_{At})	4	2	7	1	Overidentified
Manuf Output (y_{Mt})	3	2	8	1	Overidentified
Services Output (y_{St})	3	1	8	0	Overidentified
Total Output (y_t)	6	2	5	1	Overidentified

Source: Computed by Author using Order Method

4.7 Estimation Procedures

The nature of the macroeconomic model used in this study is such that some endogenous variables appear as explanatory variables in other equations, thus creating simultaneity problem. To this end, the application of ordinary least squares (OLS) techniques to estimate the coefficients of the variables in the equations of the model would produce biased and inconsistent estimates (Pindyck and Rubinfeld, 1998). In this situation, one may not estimate the parameters of a single equation without taking into account information provided by the other equations in the system (Gujarati, 2004). Therefore, other more appropriate estimation methods are suggested for such situations. Such methods include the two-stage-least square (2SLS) and the three-stage-least squares (3SLS). The use of a more appropriate technique will produce estimators that are consistent and efficient. Our empirical model is a system since it contains more than one equation which are interdependent hence; it was estimated within the system framework. Moreover, our system is over-identified as shown in the last section; we therefore adopted the system two-stage-least square technique to estimate our model.

4.8 Validation Procedures

Each equation in the model was validated with the usual diagnostic tests of ótô statistics and the coefficient of determination, Adjusted R^2. The Jarque-Bera test was used to test for normality of residuals while the Breusch-Godfrey LM test was used to test for the presence of serial autocorrelation in the residuals. The Arch LM test, on the other hand, was used to test for the presence of Autoregressive conditional heteroscedasticity in the residuals while the Ramsey RESET test was used to test for general misspesification of equation. Each of these tests is discussed in detail below.

The Jarque-Bera Test: This is a test statistic for testing if the residuals are normally distributed or not. The test statistic measures the difference of the *skewness* and the kurtosis of the residual series with those from the normal distribution. The Jarque-Bera statistic is distributed as χ^2 with 2 degree of freedom. The formular for calculating the Jarque-Bera statistic is shown in Appendix 2. The reported statistic is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null

value leads to the rejection of the null hypothesis of a normal distribution (Christiaan H. *et al*, 2004).

The Breusch-Godfrey LM test: This is used to test for serial correlation. It belongs to the class of asymptotic tests known as Lagrange multiplier (LM) tests. It may be used for higher order ARMA errors, whether or not there are lagged dependent variables unlike the Durbin-Watson statistics for AR(1) errors. The null hypothesis of the LM test is that there is no serial correlation up to lag order *p*, where *p* is a pre-specified integer. The test statistic is computed by an auxiliary regression as follows. First, suppose you have estimated the regression; $y_t = X_t\beta + \varepsilon_t$

where b is the estimated coefficients and ε are the errors. The test statistic for lag order *p* is based on the auxiliary regression for the residuals $e = y - X\hat{\beta}$:

$$e_t = X_t\gamma + \left(\sum_{s=1}^{p}\alpha_s e_{t-s}\right) + v_t$$

The LM test statistic is asymptotically distributed as a $\chi^2(p)$.

ARCH LM Test: This is a Lagrange Multiplier (LM) test for autoregressive conditional heteroskedasticity (ARCH) in the residuals (Engle 1982). The ARCH LM test statistic is computed from an auxiliary test regression also. The null hypothesis is that there is no ARCH up to order *q* in the residuals. To test for this, we run the regression:

$$e_t^2 = \beta_0 + \left(\sum_{s=1}^{q}\beta_s e_{t-s}^2\right) + v_t$$

where *e* is the residual.

The LM test is asymptotically distributed as $\chi^2(q)$ under general conditions

The Ramsey RESET test: This test is meant to test for general specification error; such errors include omission of variables, incorrect functional form and correlation between the regressors and the error terms. The Ramsey RESET test statistic may be distributed

m. High probability of the statistic indicates that there is no mis-specification error (Patterson 2000).

The ótô test was used as test of significance of each variable while the R-square and Adjusted R-square (coefficient of determination) were used to test for the explanatory power of the explanatory variables included in each equation.

To test the forecasting ability of the model, an examination of graphs of actual and simulated values of endogenous variables were carried out. In addition to this, the Theilôs inequality coefficient as well as its decomposition, namely the bias proportion, the variance proportion and the covariance proportion (which must add up to 1) were used. The Theilôs inequality coefficient should lie between 0 and 1, the closer it is to 1, the better the fit. The bias proportion should be as close to 0 as possible as a value above 0.1 or 0.2 implies the presence of systematic bias and may require a revision of the model (Pindyck and Rubinfeld, 1998). The variance proportion indicates the ability of the model to replicate the degree of variability in the series. This proportion should be low for a model to be considered good. The covariance proportion represents the remaining error after deviations from average values and average variability have been accounted for. It is expected to be large (Pindyck and Rubinfeld, 1998). Other validation criteria, namely the root mean square (RMSE) and the correlation coefficients between actual and simulated series were also employed.

CHAPTER FIVE

PRESENTATION AND INTERPRETATION OF RESULTS

5.1 Descriptive Analysis of Data

Table 7 contains the summary statistics of the variables used in the empirical model. The summary statistics provides information about the mean and standard deviations of the variables. The mean value of the logarithms of total real GDP (y_t) is 12.06 while its standard deviation is 0.65 indicating small dispersion around the mean. The mean inflation rate is 20.34%, with the maximum rate being 72.8% and the minimum being 14%. The standard deviation of inflation is about 17, indicating that wide variation occurred in inflation during the period under study. The probability of the Jarque-Bera statistics for the series showed that most of the series are normally distributed except for inflation rate, price of oil, rainfall, manufactured GDP and closeness.

of the Variables used in the Empirical Model

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Jarque-Bera	Obs
ANTR	3.94	3.90	4.61	3.17	0.33	2.29(0.31)	38
INF	20.34	14.00	72.80	3.20	16.75	1.52(0.42)	38
CAPAGR	4.16	4.14	5.18	2.46	0.56	3.92(0.18	38
CAPPETR	8.29	8.35	9.98	5.70	0.99	2.23(0.28)	38
y^f	9.21	9.46	10.29	7.56	0.81	2.86(0.26)	38
OILREV	10.32	10.32	12.30	7.40	1.05	0.16(0.56)	38
POIL	2.94	2.97	4.15	0.88	0.74	10.19(0.00)	38
y_A	10.91	10.89	12.34	9.92	0.66	1.26(0.51)	38
RAINFALL	6.19	6.09	7.33	5.55	0.45	9.77(0.00)	38
e	3.94	3.98	4.79	2.89	0.49	1.92(0.42)	38
g	9.58	9.57	13.69	8.64	0.83	4.02(0.12)	38
im	8.05	7.24	12.64	4.00	2.65	3.23(0.16)	38
RMD	7.75	7.44	12.37	3.74	2.45	2.340.19)	38
MS	10.48	9.97	14.48	6.47	2.44	1.95(0.39)	38
y_M	9.17	9.38	9.84	7.91	0.54	7.89(0.03)	38
RNOILEXP	5.27	4.50	9.69	1.83	2.22	2.91(2.24)	38
ROILEXP	8.34	7.62	13.44	3.61	2.79	3.08(0.14)	38
c	11.72	11.59	12.74	10.61	0.59	1.45(0.01)	38
y_A	10.71	10.60	12.50	8.48	0.99	1.33(0.12)	38
y_S	10.92	10.89	12.20	9.80	0.51	3.85(0.15)	38
y_T	12.05	11.91	13.48	10.86	0.65	0.70(0.64)	38
i	7.63	7.14	12.53	4.16	2.20	2.97(0.17)	38
r	-3.06	-0.40	20.59	-52.01	15.95	6.28(0.04)	38
UNANTR	0.00	0.02	0.69	-0.55	0.32	4.29(0.13)	38
CLOSE	2.19	2.11	4.84	1.15	0.83	16.49(0.00)	38

Source: Authorôs Computation

Overall, the variables included in each of the equation are able to explain high proportion of variations in the dependent variables as adjusted R^2 ranged between 0.58 (for inflation) and 0.97 (for money demand), indicating good statistical fit. Most of the variables included in the model are significant, given their ótô values. The Jarque-Bera test statistics showed that the error terms are normally distributed in all the equations, as indicated by their probabilities. The Breusch-Godfrey statistics do not indicate the presence of serial correlation in the residuals. The ARCH LM test statistics do not reveal the presence of heteroskedasticity problem, while the Ramsey RESET test statistics do not show that there is mis-specification problem. The diagnostic test statistics for each equation are contained on the tables for the respective equations.

Since the main purpose of the estimated macroeconomic model is to provide a tool for simulation, we examined the ability of the model to simulate values that are close to the historical values[5]. The performance of the model was thus assessed by the forecasting ability of the model. This was done through the examination of graphs of actual and historical simulated series, the Theilôs inequality coefficients as well as its decomposition, root mean square error (RMSE) and the correlation coefficient between the actual and the simulated values of the endogenous variables. The objective of the validation exercise is to determine the extent to which our estimated model `tracksô the economy. Figure 8 below presents the graphs of actual and simulated endogenous series. The graphs show that the time paths of the actual and simulated series are close, implying that our model tracked historical data well. Turning points in the historical series were well tracked by the simulated series, except for the money demand function, where the simulated series failed to track historical data between 1986 and 1987, as well as in 1990 and 1996. The 1986 -1987 period corresponded to the period when SAP was just introduced, while the 1990 ï 1993 period corresponded to the period of political uncertainty in Nigeria, hence, the model was not be able to adequately capture the actual situation in the country at such periods.

[5] This is emphasised in Pindyck and Rubinfeld (1998)

FIGURE 8: GRAPHS OF ACTUAL AND SIMULATED SERIES

ummary statistics of the model validation criteria. For a good model, the RMSE is supposed to be low, which is actually the case for our model. The RMSE ranged between 0.15 for private consumption function to 13.67 for inflation function. RMSE is one of the evaluation criteria as mentioned earlier, but a more important criterion is one which can detect how well the model simulates turning points. This is done by the Theilôs inequality coefficient. The Theilôs inequality coefficient lies between 0 and 1. If it is zero (0), it implies simulated series is equal to actual series and there is a perfect fit, but if it is 1, it implies the predictive performance of the model is bad. The implication of this is that when the actual values are zero, the predicted values are non-zero and vice versa, or the predicted values are negative when the actual values are positive. For all the equations in our model, this coefficient was between 0.008 (for agricultural output) and 0.28 (for inflation). This implied that our predicted values are very close to the actual values.

A decomposition of the Theilôs inequality coefficient is necessary in order to appreciate the validation process, hence, we considered the three components of the coefficient, namely the bias proportion, the variance proportion and the covariance proportion. The three components must add up to 1.

Bias Proportion: The bias proportion is an indication of systemic error and it measures the extent to which the average values of the simulated series and actual series deviate from each other. The bias proportion must be as close to zero as possible. A value above 0.1 or 0.2 should give a course for concern since it means a systematic bias is present, so that revision of the model is necessary (Pindyck and Rubinfeld (1998).

Table 8 indicated that the bias proportion in all the equations of the model is zero, implying the absence of systematic bias.

Variance Proportion: This indicates the ability of the model to replicate the degree of variability in the variable of interest. If the variance proportion is large, it implies that the actual series fluctuated considerably while the simulated series shows little fluctuation or vice versa. The variance proportion should also be low if the model is to adjudged good.

In our model, the variance proportion is low; it ranges from zero (0) (in the manufacturing output equation) to 0.14 (in the government consumption equation)

easure what might be termed unsystematic error, that is, it represents the remaining error after deviations from average values and average variability have been accounted for (Pindyck and Rubinfeld, 1998). This component of the error is less worrisome since we do not expect perfect correlation between simulated and actual series. The covariance proportion is expected to be large. As indicated in Table 8, the covariance proportion is large, ranging from 0.86 (for government consumption equation) and 0.99 (for agricultural output equation). The high covariance proportion shows that discrepancies between the actual and simulated series are due to their imperfect covariance, and nothing can be done about this, in order to improve the forecasting ability of the model.

The correlation coefficient is another evaluation criterion, which should be large if the model is to be considered good for simulation purpose. It ranged from 0.58 (for the inflation equation) to 0.99 (for the money demand equation).

STATISTICS FOR THE MODEL VALIDATION TESTS

Variable	Inequality Coefficient	Decomposition of Theilõs Inequality			Correlation Coefficient	Root Mean Square Error
		Bias Proportion	Variance Proportion	Covariance Proportion		
Inflation	0.275	0.000	0.132	0.868	0.575	13.674
Agric Output	0.008	0.000	0.001	0.999	0.967	0.168
Govt. Consumption	0.024	0.000	0.139	0.861	0.826	0.462
Imports	0.040	0.000	0.034	0.966	0.965	0.681
Money demand	0.021	0.000	0.001	0.999	0.989	0.344
Manuf. output	0.013	0.000	0.001	0.999	0.899	0.237
Non-oil exp.	0.080	0.000	0.063	0.937	0.910	0.907
Oil export	0.041	0.000	0.028	0.972	0.964	0.726
Private consumption	0.006	0.000	0.005	0.995	0.967	0.147
Services Output	0.014	0.000	0.002	0.998	0.953	0.301
Services Output	0.008	0.000	0.037	0.963	0.931	0.182
Investment	0.048	0.000	0.042	0.958	0.937	0.759
Total Gross Domestic Product	0.251	0.000	0.231	0.892	0.821	14.214

Source: Authorõs Computation

on criteria discussed above, our model was considered suitable for policy simulation, since it has low bias and variance proportion with high covariance proportion. Moreover, the low RMSE and high correlation coefficient further attest to the suitability of the model for simulation. The model was thus used for simulation exercises, the results of which are presented in section 5.4.

5.3 Presentation and Discussion of Results

The model was initially estimated with two-stage-least-squares method and the correlation among the residuals were examined (the correlation coefficients of the residuals are presented in Appendix 3). It was discovered there is high correlation between the residuals of some of the equations. The model was thus re-estimated using the three-stage-least-squares method since this would yield more efficient parameter estimates than the two-stage-least-squares method (Pindyck and Rubinfeld, 1981).

The estimated results for the aggregate model and the expectation model are presented in Tables 9 ï 12 and discussed next. Tables 9 and 10 contain the results for the aggregate model one which has the undecomposed (actual) exchange rate while the results for the expectation model, which has components of exchange rate that is, anticipated and unanticipated, are presented in Tables 11 and 12.

5. 3.1 Results for the Aggregate Model

Table 9 contains the result for consumption, government expenditure, investment, oil and non-oil export as well as import. The result for the total output, agricultural, manufacturing and services sectorôs output are contained in Table 10. In the same table, we have the estimated result for inflation and money demand. These results are discussed below.

5.3.1.1 Private Consumption Function

The results for the consumption equation in Table 9 show that national income represented by the real GDP, positively and significantly affects consumption. The coefficient of income is 0.56 and it is significant at the 1% level, indicating that the elasticity of consumption with respect to income is 0.56, that is, 10% increase in income will increase consumption by 5.6%. This implies that marginal propensity to consume is

the period of study which conforms to the Keynesian postulate. Past consumption is also shown to positively and significantly affect present consumption, at the 5% level, indicating that habit persistence is important for consumption in Nigeria. Real exchange rate is negatively related to private consumption in Nigeria, with an elasticity of 0.09. This implies that depreciation of real exchange rate would lead to decrease in consumption, but this effect is only significant at about 10%. The contractionary effect of exchange rate depreciation corroborates the theoretical explanation of Krugman and Taylor (1978). In their explanation, depreciation redistributes income from wage earners to profit earners and since it is assumed that profit earners have lower marginal propensity to consume compared with wage earners, hence depreciation would lead to a reduction in aggregate private consumption. Interest rates, both real and nominal, are not significant; hence, they were dropped from the analysis. Their non-significance implies that the principle of intertemporal substitution in consumption through borrowing and lending does not hold at the aggregate level in Nigeria. This shows that the life cycle hypothesis, which is predicated on the principle of intertemporal substitution, is rejected by aggregate data from Nigeria. Government expenditure has a negative and significant relationship with private consumption which implies that government consumption crowds out private consumption in Nigeria during the period of study. Government expenditure is significant at 10%.

5.3.1.2 Government Consumption Function

Government consumption in Nigeria is found to be positively influenced by real GDP; this relationship is significant at 5%. The coefficient of the variable is 0.69 indicating that 10% increase in the GDP would lead to 6.9% increase in government expenditure (see Table 9). This implies an inelastic response of government expenditure to GDP. It is, however, the lag of GDP, which affects current government expenditure, implying that GDP affects government expenditure with a lag of one year. Interest rate is negatively related to government expenditure but this is not significant. Past government spending is found to be positively and significantly related to present government spending implying that there is habit persistence in government spending in Nigeria. This probably explains the persistence of budget deficit syndrome in Nigeria because in most cases, the government is unwilling to cut its expenditure when the economic situation is unfavourable. Whenever the price of oil, which is the main source of government

such periods would mostly be in deficit. Real exchange rate does not have significant effect on government expenditure, although the relationship is positive.

TE MODEL RESULTS

EQUATION	Private Consumption	Government consumption	Investment	Oil export	Non-oil export	Import
CONSTANT	1.34(1.88)	-5.68(-2.77)	-8.83(-2.03)	-4.95(-1.16)	-1.99(-2.20)	-7.33(-2.66)
y	0.56(3.91)***			0.70(5.14)***	0.32(2.14)**	
$y_{(-1)}$		0.69(2.23)**	0.04(2.03)**			0.52(4.21)***
r_t		-0.03(-1.38)	-0.01(-0.92)			
c(-1)	0.33(2.05)**					
e	-0.09(-1.72)*	0.06(1.21)		-0.36(-1.26)	0.05(2.18)**	
e(-1)						-0.34(-2.02)**
g(-1)	-0.24(1.79)*	0.78(2.87)***				
i(-1)			0.75(4.94)***			
POIL				0.09(2.37)**		
y^f				1.06(1.10)		
im					0.56(6.17)***	
im(-1)						0.56(5.72)***
LRNOILEXP(-1)					0.11(0.97)	
LROILEXP(-1)				0.42(3.96)***		
R^2	0.93	0.67	0.77	0.92	0.87	0.92
ADJ R^2	0.92	0.64	0.76	0.91	0.86	0.92
DW	1.72	1.14	1.79	1.85	1.23	1.87
Jarque-Bera Test Stats	0.43 (0.71)	0.76 (0.56)	0.31 (0.87)	1.23 (0.43)	0.23 (0.54)	0.31 (0.78)
Breusch-Godfrey LM test Stats	0.76 (0.41)	0.31 (0.53)	1.22 (0.21)	1.03 (0.32)	0.89 (0.43)	2.21 (0.17)
ARCH LM test Stats	0.22 (0.43)	0.12 (0.87)	0.17 (0.76)	0.07 (0.86)	0.74 (0.31)	0.21 (0.65)
White Test stats	0.32 (0.87)	3.21 (0.12)	0.65 (0.78)	1.05 (0.51)	3.12 (0.10)	0.65 (0.54)
Ramsey RESET Test stats	0.86 (0.43)	0.76 (0.42)	2.56 (0.09)	0.78 (0.23)	1.02 (0.32)	0.04 (0.65)

Source: Estimated results

NB ***, ** and * indicate variable is significant at 1%, 5% and 10% respectively. ótô values are indicated in parentheses. Values in parentheses under diagnostic tests are probabilities.

As shown in Table 9, current investment in Nigeria is positively and significantly affected by the GDP. It is, however, the lag of GDP which affects current investment. The coefficient of GDP is 0.04, indicating that 10% increase in GDP in one period will only lead to an increase of 0.4% in investment in the next period. This probably explains the low level of investment in Nigeria. The GDP is significant at 5%. Interest rate has negative and insignificant effect on investment in Nigeria during the period of study. The insignificance of interest rate might be due to the fact that real interest rate was negative for most of the period under review as a result of the high inflation rate in Nigeria. Past value of investment positively and significantly affects present investment with a coefficient of 0.75. This is significant at the 1% level.

5.3.1.4. Oil Export Function

The domestic income (GDP) has positive and significant effect on oil export at the 5% level. The degree of response of oil export to a 10% change in the GDP is about 7%. This reflects the rate of expansion in oil export over the period of study. Oil export during the period of study ranged between N36.96million and N685, 262.5million in real terms. Real exchange rate is negatively but insignificantly related to oil export, with a coefficient of 0.36. It is however not surprising that the real exchange rate does not have significant effect on oil export since oil export is determined by export quota fixed by the organisation of oil exporting countries (OPEC). The price of oil (international price) is found to be positively and significantly related to the export of oil. The price elasticity of oil is however low, (0.09). This implies that 10% increase in the international price of oil would lead to 0.9% increase in oil export, other things being equal. Price of oil is significant at the 1% level. Although the income of major trading partners has positive effect on oil export, its coefficient is not significant.

5.3.1.5 Non-Oil Export Function

GDP has positive and significant relationship with non-oil export. The coefficient of GDP is 0.3 which implies that 10% increase in GDP would raise non-oil export by 3%. GDP is significant at 5% level. Non-oil export is positively and significantly influenced by the real exchange rate, implying that depreciation of the real exchange rate promotes non-oil export, however the coefficient is less than unity (0.05), showing that

se to depreciation of real exchange rate is less than proportional. 10% depreciation of exchange rate will increase non-oil export by only 0.5%, this indicate low response of non-oil export to changes in exchange rate. The low coefficient implies that it is only large depreciation that can make meaningful impact on non-oil export in Nigeria. The low response could be as a result of supply and demand bottlenecks which made it difficult for non-oil export to adjust to exchange rate incentives. On the supply side, apart from production bottlenecks which exist in Nigeria, there is also the problem of over-dependence on imported raw materials on the part of manufacturing firms. Hence, as the currency depreciates, it makes the importation of raw materials more expensive, thus hampering the production of some of the non-oil exports. Exchange rate is significant at the 5% level. Import has a positive and significant relationship with non-oil export. The coefficient of import is 0.56 with a significance level of 1%. This implies that 10% increase in import would raise non-oil export by 5.6, other things being equal. This reflects the dependent nature of the Nigerian export sector on imported raw materials and other inputs. Past value of non-oil export is positively related to the current value of non-oil export but this relationship is not significant.

5.3.1.6 Import Function

Last period GDP is positively and significantly related to current import at 1% level of significance. Hence, as income and export grows, the ability to finance import rises, leading to increase in import. The coefficient of income (0.52), indicates that the elasticity of import with respect to income is 0.52. This implies that 10% increase in income would lead to 5.2% increase in import, *ceteris paribus*. This is a reflection of the high marginal propensity to import in Nigeria. Current import in Nigeria is negatively and significantly related to previous period real exchange rate. This implies that real exchange rate depreciation in a previous period leads to a decrease in the current import. The coefficient of real exchange rate is -0.34 and it is significant at 5%, indicating a less-than-proportional response. For example, a real exchange depreciation of 10% can only reduce import by just 3.4%. The less-than-proportional response of import to real exchange rate depreciation is an indication of the import-dependent nature of the Nigerian economy. Moreover, it reflects the inertia of import to changes in exchange rate which may have adverse effect on balance of payment position, especially if there is inertia in the response of export to exchange rate changes.

unction

The result for agricultural output is presented in Table 10. From the table, the real exchange rate has a negative but significant relationship with agricultural output, implying that depreciation of real exchange rate discourages agricultural output. The coefficient of exchange rate is -0.12 and it is significant at 10%. This implies that a 10% depreciation of real exchange rate would reduce agricultural sector output by 1.2%. The possible explanation for the negative relationship between the real exchange rate and agricultural output could be due to the fact that some agricultural inputs like tractors and pesticides are imported; depreciation of the real exchange rate implies that less of these could be imported thus reducing agricultural output. Moreover, depreciation of the real exchange rate implies fewer inputs could be imported for the manufacturing sector, with negative effect on agricultural output, since the output of this sector is positively related to agricultural sector. Agricultural output is positively and significantly related to fixed capital employed in the sector with an elasticity of 0.16%. The less-than-proportional response of agricultural output to capital employed in the agricultural sector showed that capital employed in the agricultural sector is not very productive. This could be a reflection of the level of mechanisation in the sector since the majority of farmers in Nigeria are illiterates who rely on traditional farming methods.

Lagged manufactured output has positive and significant relationship with agricultural output, with an elasticity of 0.42%. This reflects the positive linkages between the agricultural and manufacturing sectors in Nigeria. The output of the agricultural sector serves as input in the manufacturing industry and some manufacturing output is also consumed in the agriculture sector. Rainfall is shown to be positively related to agricultural output (with an elasticity of 0.16), reflecting the fact that in Nigeria, agriculture is mainly rain-fed. This became manifest during the Sahelian drought in the 1980s when agricultural output was badly hit and the prices of food items went up (CBN 1987). Capital employed in agricultural sector, rainfall and manufactured outputs are significant at 1%.

5.3.1.8. Manufacturing sector output function

As shown in Table 10, the relationship between real exchange rate and manufacturing output is positive, implying that depreciation promotes the growth of the

ationship is however significant only at 10%. 10% depreciation of real exchange rate would lead to 1.4% increase in manufactured output in Nigeria. The positive relationship could be because depreciation makes the price of imported substitutes higher, thus increasing the demand for locally produced goods. The positive relationship could also show that the demand effect is stronger than the supply effect since depreciation can also increase the cost of imported raw materials and other inputs used in the manufacturing sector, thus curtailing output. However, the response of manufactured output to exchange rate is low which could be indicative of low effective demand for locally made goods occasioned by the continued influx of cheaper imported products (which are considered to be of higher quality), or increased cost of production (CBN, 2001) and poor state of social and economic infrastructure.

Government expenditure is found to have a negative but insignificant effect on manufacturing sector output in Nigeria. This could be a reflection of the low productivity of government expenditure due to corruption. Import has positive and significant effect on manufacturing output, showing the high dependence of the sector on imported intermediate inputs. Import is significant at 10%. 10% increase in import would lead to 2.5% increase in manufactured output. Closeness, which is a reflection of trade restriction, does not have significant effect on manufactured output in Nigeria as revealed by the result in Table 10. The probable reason for this is the porous nature of Nigerian borders which permits the influx of banned goods, thus making the effect of trade restriction policy insignificant.

FOR AGGREGATE MODEL (CONTINUATION)

		anufacturing output	Services sector Output	Total output	Inflation	Money demand
CONSTANT	-1.15(-1.68)		2.37(2.54)	-10.12(-4.31)	-2.15(-3.42)	-8.28(-2.51)
y						0.84(2.58)***
y(-1)					-4.81(-2.24)**	
r						-0.25(-2.30)**
P						-0.25(-2.45)**
P(-1)					0.37(4.76)***	
e						-0.18(-1.86)*
e(-1)	-0.12(-1.87)*	0.14(1.88)*	0.001(0.01)	-0.06(-1.83)*	4.52(2.26)**	
y^f				1.14(1.32)		
im		0.25(1.85)*				
CAPAGR	0.16(2.58)***					
RAINFALL	0.16(2.01)**					
$y_A(-1)$	0.69(6.01)***					
g		-0.06(-1.23)	0.05(2.38)**	0.06(1.56)		
$y_M(-1)$	0.42(1.97)**	0.90(15.35)***				
CLOSE		0.09(1.52)				
POIL						
MS				0.98(2.54)**	14.3(1.37)	
$Y_s(-1)$			0.75(7.93)***			0.80(8.11)***
R^2	0.96	0.80	0.85	0.89	0.57	0.90
ADJ R^2	0.95	0.78	0.83	0.88	0.52	0.86
DW	2.42	2.10	1.75	1.91	1.91	2.34
Jarque-Bera Test Stats	0.45 (0.67)	5.48 (0.62)	0.54 (0.52)	0.06 (0.79)	1.93 (0.34)	0.87 (0.61)
Breusch-Godfrey LM test Stats	1.50 (0.22)	0.45 (0.32)	0.75 (0.35)	0.65 (0.32)	0.34 (0.63)	0.43 (0.56)
ARCH LM test Stats	0.12 (0.54)	0.36 (0.58)	0.10 (0.64)	1.34 (0.32)	0.03 (0.87)	0.36 (0.83)
White Test stats	1.05 (0.35)	0.34 (0.54)	0.63 (0.25)	2.17 (0.22)	0.68 (0.45)	1.20 (0.38)
Ramsey Test stats	0.88 (0.28)	1.54 (0.29)	1.06 (0.31)	0.21 (0.65)	1.54 (0.18)	0.42 (0.53)

Source: Estimated results

NB ***, ** and * indicate variable is significant at 1%, 5% and 10% respectively. ótô values are indicated in parentheses. Values in parentheses under diagnostic tests are probabilities

ion

Services output consists of other components of the GDP, excluding manufacturing, agricultural and petroleum output. In this group, we have building and construction, government services, hospitality industry and other sectorsô output. They are mainly value added sectors producing mainly intangibles. Services output is found to be positively and significantly affected by government expenditure; this is expected given the components listed above. For example construction, especially road construction and maintenance, is mainly undertaken by the government. Government expenditure has an elasticity of 0.05 and it is significant at 5%. Services output is positively related to the past level of real exchange rate but the relationship is not significant. This relationship can be explained by the nature of the industry, which is mainly service.

5.3.1.10 Total Output Function

Total output is found to be negatively related to the real exchange rate. The coefficient of real exchange rate is -0.06, implying that real exchange rate depreciation is contractionary. Real exchange rate is significant at 10%. The negative effect of the real exchange rate on output corroborates the findings of Odusola and Akinlo (2000), who found a short-run contractionary effect of exchange rate on output. Similar conclusion was arrived at by Kamin and Klau (1997). The size of the coefficient of real exchange rate (-0.06) indicates less than proportional response of total output to real exchange rate changes. Foreign income is found to be positively related to total output but it is not significant even at 10%. Government expenditure has positive but insignificant effect on total output. The non-significance of government expenditure could be a reflection of the high rate of corruption in Nigeria which makes government expenditure unproductive. Money supply has positive and significant effect (at the 5% level) on total output with coefficient of less than unity indicating less than proportional response. This shows the relative effectiveness of monetary policy in Nigeria during the period under study.

5.3.1.11 Inflation function

The relationship between GDP and inflation rate is negative and significant, which conforms to *a priori* expectation. The GDP is significance at the 5% level. The economic implication of the size of the coefficient is that 10% increase in the GDP

y 50%. This underscores the importance of growing the GDP in Nigeria, as a potent tool for combating inflation. The exchange rate in the previous period has positive and significant relationship with current inflation. The exchange rate is significant at the 5% level, with a coefficient of 4.5, which confirms that there is exchange rate pass-through to domestic prices, although with a lag of one year. Growth of money exerts positive but insignificant effect on inflation in Nigeria, which conforms to the finding of Egwaikhide *et al* (1998).

5.3.1.12 Money demand function

Demand for money is positively and significantly related to the real GDP. This corroborates the theoretical expectations of the major schools of thought in monetary economics. It has an elasticity of 0.84 and it is significant at 1%. The elasticity implies that 10% increase in income would lead to 8% increase in money demand, which is a less-than-proportional response. The less-than-proportional response could suggest that there is a reduction in the use of money as a result of financial innovation in the Nigerian economy. Both interest rate and inflation rate are negatively and significantly related to money demand. The negative relationship with interest rate is in line with *a priori* expectation, because as interest rate rises, the opportunity cost of holding money becomes higher, hence, people want to dispose off the money by buying bond or investing in other financial instruments. For inflation, higher inflation also discourages the demand for money as people want to dispose off the money in their possession before it loses value due to inflation. Interest rate and inflation have elasticities of 0.25 each, they are both significant at 5%. Exchange rate has negative and significant relationship with money demand, implying that the depreciation of the real exchange rate would likely lead to lower demand for money. The coefficient of 0.2 implies that 10% depreciation would lead to 2% decrease in money demand. The real exchange rate is significant at 10%.

The result obtained here seems counterintuitive, since the depreciation of domestic currency would mean more quantity of domestic currency is needed to finance existing level of transactions. However, depreciation of currency implies that the value of money has fallen which may discourage the demand for more money.

included in each of the equation are able to explain over 50% of variations in the dependent variables as the coefficients of determination (Adjusted R^2) ranged between 0.52 (for inflation) and 0.97 (for the import function), which indicates good statistical fit. Most of the variables are significant given their ótô values. The Jarque-Bera test statistics show that the errors terms are normally distributed in all the equations, given the probabilities of the Jarque-Bera statistics. The Breusch-Godfrey statistics do not indicate the presence of serial correlation in the residuals. The ARCH LM test statistics do not reveal the presence of heteroskedasticity problem while the Ramsey RESET test statistics do not show that there is mis-specification problem in the model.

5.3.2 Results for Expectation Model

The results for the expectation model are presented in Tables 11 and 12 and discussed below. In this model the real exchange rate variable is replaced by its components: the anticipated and unanticipated changes in real exchange rate, so as to identify the effects of each component separately. Table 11 contains the result for consumption, government expenditure, investment, oil and non-oil export as well as import. The result for the agricultural output, manufacturing, services and total output are contained in Table 12. In the same Table 12, we have the estimated results for inflation and money demand.

5.3.2.1 Private Consumption Function

The results for the consumption equation in Table 11 show that national income represented by the real GDP positively and significantly affects consumption as obtained under the aggregate model. Income is significant at 5%. The coefficient of GDP is less than unity (0.78) indicating a less-than-proportional response (and a marginal propensity to consume of less than unity) of private consumption to changes in GDP. The relationship between present and past consumption is also similar to what obtains in the earlier model. Both anticipated and unanticipated changes in the real exchange rate have negative and significant effects on consumption. This implies that depreciation of real exchange rate, whether anticipated or not, would likely reduce consumption. Anticipated change is significant at 1% while unanticipated change is significant at 5%. The coefficient of exchange rate is less than unity (-0.04 and -0.03 for anticipated and unanticipated changes respectively). This implies that 10% anticipated depreciation

0.4% while unanticipated depreciation of the same percentage would reduce consumption by 0.3%. In absolute terms, the effect of anticipated change in the real exchange rate on consumption is greater than that of unanticipated change in exchange rate.

Interest rates, both real and nominal, are also not significant here. Government consumption has negative and significant effect on private consumption as obtained in the first model, it is however significant at the 5% level in this model.

5.3.2.2 Government consumption function

As shown in Table 11, government consumption in Nigeria is found to be positively influenced by the past real GDP; as in the aggregate model but it is significant at the 1% level. The income elasticity of government consumption is 3.5, indicating a more-than-proportional response of government expenditure to changes in the GDP. Interest rate has positive but insignificant effect on government expenditure. Past government spending is found to be positively and significantly related to present government spending implying that there is habit persistence in government spending in Nigeria. The price of oil has positive and significant effect on government expenditure, revealing the dependence of the government activity on oil. However, the response of government expenditure to changes in the price of oil is less than proportional, given the less-than-unity coefficient (0.34). This relationship could be used to explain persistent budget deficit in periods of fall in oil earnings.

5.3.2.3 Total Investment

Current investment in Nigeria, from the results presented in Table 11, is positively and significantly affected by the GDP. The GDP is significant at 5% level. It is however the lag of GDP which affects current investment as indicated in the result. The coefficient of GDP, which is 0.83, is less than unity indicating a less-than-proportional response of investment to changes in GDP. Past value of investment positively and significantly affects present investment.

The domestic income has positive and significant effect on oil export as obtained in the aggregate model. Past changes in the real exchange rate, both anticipated and unanticipated, have negative impact on oil export, although the effect is not significant. The non-significance of the exchange rate variables could be explained by the fact that oil export is determined by quota fixed by the organisation of oil exporting countries (OPEC) to which Nigeria belongs as mentioned in the first model. The international price of oil is found to be positively but insignificantly related to the export of oil, with a coefficient of 0.19.. The price elasticity of oil export, measured by the coefficient of oil price, is however low (less than one), which indicates very small degree of response of oil export to price. This is due to the effect of OPEC on the oil export of member countries as mentioned earlier. The income of major trading partners has positive effect on oil export at 1% level of significance, although the coefficient is less than unity (0.56) indicating a less-than-proportional response.

ED RESULTS FOR EXPECTATION MODEL

	Consumption	Government Consumption	Investment	Oil export	Non-oil export	Import
CONSTANT	1.52(2.71)	-4.96(-2.44)	-7.72(-1.96)	-18.8(-4.53)	-5.07(-4.23)	-10.0(3.27)
Y	0.78(6.44)***			2.18(4.42)***		
y(-1)		3.46(5.40)***	0.83(2.06)**			0.82(3.69)***
R		0.0002(0.048)	-0.01(-0.64)			
c(-1)	0.04(0.3)					
ANTR(-1)	-0.04(-2.9)***			-0.01(-0.73)	-0.12(-2.30)**	-0.14(-2.66)***
UNANTR(-1)	-0.03(-2.1)**			-0.01(-1.48)	0.11(2.11)**	-0.13(-2.04)**
G	-0.20(-1.84)**					
g(-1)		1.01(5.17)***				
POIL		0.34(2.52)**		0.19(1.34)		
y^f				0.56(3.56)***		
im					1.35(9.81)***	
im(-1)						0.67(8.66)***
LRNOILEXP(-1)					0.01(1.17)	
LROILEXP(-1)				0.59(6.97)***		
AR(1)				-0.26(-2.28)	0.80(9.08)	-0.08(-0.66)
R^2	0.95	0.87	0.89	0.94	0.96	0.93
ADJ R^2	0.94	0.85	0.88	0.93	0.95	0.92
DW	1.94	2.06	1.82	2.21	1.83	1.90
Diagnostic Tests						
Jarque-Bera	0.32 (0.73)	0.88 (0.64)	0.21 (0.90)	1.60 (0.59)	0.27 (0.67)	0.28 (0.87)
LM Breusch-Godfrey Test	0.85 (0.44)	0.40 (0.67)	1.99 (0.15)	1.37 (0.27)	1.06 (0.36)	2.23 (0.13)
LM ARCH Test	0.33 (0.57)	0.01 (0.92)	0.03 (0.86)	0.00 (0.99)	0.87 (0.36)	0.12 (0.73)
White Test	0.24 (0.96)	2.26 (0.05)	0.71 (0.69)	1.14 (0.45)	2.40 (0.04)	0.85 (0.57)
Ramsey RESET	0.94 (0.34)	0.84 (0.31)	3.78 (0.06)	0.89 (0.35)	1.36 (0.25)	0.06 (0.81)

Source: Estimated results

NB ***, ** and * indicate variable is significant at 1%, 5% and 10% respectively. ó ô values are indicated in parentheses. Values in parentheses under diagnostic tests are probabilities.

Non-oil export is positively and significantly influenced by unanticipated change in the real exchange rate while anticipated change in the real exchange rate has a negative and significant effect. Both variables are significant at the 5% level. This implies that unanticipated depreciation of the real exchange rate promotes non-oil export, while anticipated depreciation discourages it. However the coefficients are less than unity in both cases, showing that the response of non-oil export to changes in real exchange rate is less-than-proportional. The response of non-oil export to anticipated changes in real exchange rate is contrary to *a priori* expectation. A possible explanation could be the fact foreign residents expects the depreciation to persist in the future hence they tarry in their demand for export. However, the positive relationship for unanticipated depreciation was like an unexpected windfall, which they would easily grab before it disappears. Past value of non-oil export is positively related to the current value of non-oil export but this relationship is not significant.

5.3.2.6 Import Function

Last period GDP is positively and significantly related to current import at 1% level of significance as shown in Table 11. The elasticity of import with respect to income is 0.8, indicating a less-than-proportional response of import to GDP similar to what obtained under the first model. Both anticipated and unanticipated changes in the real exchange rate have negative effect on import in Nigeria, which conforms to *a priori* expectation. The coefficients in both cases are less than 1 and are significant at 5%. The relationship under anticipated depreciation is counterintuitive because as people expect exchange rate to depreciate, it is assumed that they would import more now before depreciation takes place, hence positive relationship was expected.

5.3.2.7 Agricultural Output Function

Anticipated and unanticipated changes in the real exchange rate have negative relationship with agricultural output, implying that depreciation of the real exchange rate would reduce agricultural output. Anticipated change in the real exchange rate has a coefficient of -0.15 and it is significant at 5% but unanticipated change in the real exchange rate is not significant even at the 10% level (see Table 12). The coefficients in

obtained conforms to the findings of Kandil and Mirzaie (2002) with respect to anticipated depreciation. They however found that unanticipated depreciation promoted agricultural growth. In both cases; they found insignificant relationship between the growth of agricultural output and real exchange rate depreciation.

As indicated in Table 12, agricultural output is positively and significantly related to fixed capital employed in the sector with elasticity of 0.22 and a significant level of about 1%. The low response of agricultural output to capital employed in the sector indicates the low productivity of capital in the sector, similar to what obtained under the first model. Manufactured output has positive and significant relationship with agricultural output, similar to what obtained in the earlier model, with a level of significance of 1%. Rainfall also has similar relationship with what obtained in earlier model.

5.3.2.8 Manufacturing sector output function

As shown in Table 12, the relationship between anticipated changes in the real exchange rate and manufacturing output is negative and significant at 5% with a coefficient of -0.01. This indicates that 10 per cent anticipated depreciation would only bring about 0.1 per cent decrease in the manufacturing sectorôs output. However, unanticipated changes in the real exchange rate have positive but insignificant effect on the manufacturing sectorôs output. This implies that an anticipated depreciation of real exchange rate hampers the growth of the output of the manufacturing sector, although, at a low rate, while unanticipated depreciation promotes it. A possible explanation for this is that when producers anticipates depreciation, they would rush to buy the necessary imported inputs while consumers would also increased their demand for manufactured goods in anticipation of depreciation. When the depreciation eventually takes place, demand for manufacturing goods would fall just as demand for imported input. This would lead to decrease in the output of the manufacturing sector. The findings of this study with respect to real exchange rate depreciation, both anticipated and unanticipated, are similar to the findings of Kandil and Mirzaie (2002). Government expenditure is found to have a negative and insignificant effect on manufacturing sectorôs output in Nigeria. The negative relationship could be explained by the non-productive nature of a

t expenditure as a result of corruption and inefficiency. Import has positive and significant effect on manufacturing output, showing the high dependence of the sector on imported intermediate inputs. Import is significant at 5% with a coefficient of 0.12. This implies that 10% increase in import would raise manufacturing output by 1.2% *ceteris paribus*. Past level of output of manufacturing sector has a positive and significant effect on current level of output. The degree of closeness of the economy is positively and significantly related to manufacturing output. The coefficient of closeness is 0.16 and it is significant at 10% level.

5.3.2.9 Services Output Function

Services sector output is positively and significantly related to anticipated changes in real exchange rate at the 5% level. However, the coefficient of anticipated exchange rate change is small (0.09). Unanticipated real exchange rate changes, although have positive relationship but this is insignificant. In both cases the elasticity is less than unity. The relationship between services sector output and import is insignificant. The services sector output is found to be positively and significantly affected by government expenditure.

LTS FOR EXPECTATION MODEL (CONTINUATION)

		uf. Output	Services sector output	Total output	Inflation	Money demand
CONSTANT	-0.72(-1.90)	2.26(2.73)	1.95(2.28)**	1.54(2.35)**	3.65(1.67)	-9.50(-3.47)*
Y					-13.80(-1.94)**	1.08(3.94)*
y(-1)						
R						0.05(13.90)*
ANTR(-1)	-0.15(-1.96)**	-0.01(2.23)**	0.009(2.01)**	-0.05(-2.73)***	0.28(2.29)**	-0.01(-2.57)***
UNANTR(-1)	0.01(1.46)	0.001(1.1)	0.004(0.45)	0.002(0.75)	-0.11(-0.96)	-0.01(-3.11)***
y^f				0.05(1.89)**		
Im		0.12(2.34)**	-0.02(-0.60)			
LCAPAGR	0.22(2.54)**					
$m^d(-1)$						0.57(8.07)***
RAINFALL	0.18(1.73)**					
y_M	0.65(3.34)***	0.68(5.28)***				
$y_A(-1)$	0.95(18.5)***					
g(-1)		-0.07(-1.45)	0.07(1.97)**	0.08(1.69)*		
$y_M(-1)$		0.62(5.43)***				
CLOSE		0.16(1.73)**				
CAPPETR						
POIL						
Ms				0.57(1.54)	5.34(1.48)	
P(-1)					0.61(6.37)***	0.02(5.21)***
$Y_s(-1)$			0.78(9.35)***			
AR(1)	-0.4(-4.06)					
R^2	0.94	0.82	0.84	0.65	0.59	0.97
Adj R^2	0.93	0.76	0.80	0.63	0.58	0.96
D.W	2.04	1.99	2.05	2.05	2.07	1.92
Diagnostic Tests						
Jarque-Bera	0.55 (0.78)	7.68 (0.82)	0.66 (0.72)	0.00 (0.89)	2.93 (0.23)	0.97 (0.61)
LM Breusch-Godfrey Test	1.59 (0.22)	0.66 (0.52)	0.75 (0.48)	0.89 (0.42)	0.65 (0.53)	0.65 (0.63)
LM ARCH Test	0.22 (0.64)	0.48 (0.49)	0.007 (0.93)	1.75 (0.19)	0.003 (0.95)	0.26 (0.61)
White Test	1.05 (0.45)	0.63 (0.79)	0.72 (0.67)	2.08 (0.14)	0.87 (0.62)	1.50 (0.28)
Ramsey RESET	1.88 (0.18)	1.78 (0.19)	1.23 (0.28)	0.01 (0.91)	2.31 (0.14)	0.54 (0.47)

Source: Estimated results

NB ***, ** and * indicate variable is significant at 1%, 5% and 10% respectively. ά‹ô values are indicated in parentheses. Values in parentheses under diagnostic tests are probabilities

n

The total output is found to be negatively and significantly related to anticipated exchange rate change, with a coefficient of -0.05. This implies that anticipated depreciation would reduce total output. The contractionary effect of anticipated real exchange rate depreciation corroborates the findings of Kandil (2004) with respect to a group of developing countries. On the other hand, unanticipated exchange rate change has positive but insignificant effect on total output. However, in this study, it is only large depreciation that would have appreciable impact on total output since the coefficients of exchange rate are very small. Foreign income has positive and significant effect on total output at 10% level. The coefficient of foreign income is 0.05, which suggests a less than proportional response as obtained under the aggregate model. The effect of government expenditure on total output is positive and significant at 10% unlike what obtained under the first model. The elasticity of government expenditure is small, indicating the fact that government expenditure is less productive in Nigeria, as earlier explained. Money supply has positive but insignificant effect on total output. This contradicts the significant effect obtained under the first model.

5.3.2.11 Inflation Function

The relationship between the GDP and inflation rate is negative and significant, which conforms to *a priori* expectation as obtained in the first model. The level of significance is 5%. Anticipated changes in the real exchange rate have positive and significant relationship with inflation at 5% level of significance; however, the unanticipated real exchange rate change does not have significant effect. Growth of money exerts positive but insignificant effect on inflation in Nigeria as obtained earlier.

5.3.2.12 Money demand function

The demand for money is positively and significantly related to the real GDP as obtained in the aggregate model. It has an elasticity of 1.08 and significant at 1% similar to what obtained earlier. Both interest rate and inflation rate are positively and significantly related to money demand at 1% level of significance. The positive relationship with interest rate is contrary to *a priori* expectation, because as interest rate rises, the opportunity cost of holding money becomes higher, hence, people would want to dispose off the money by buying bond or investing in other financial instruments.

ate is negative for many years during the period covered by the study, due of the high inflation rate, the opportunity cost of holding money is not there, hence the positive relationship observed. Interest rate and inflation have elasticities of 0.05 and 0.02 respectively. Exchange rate, both anticipated and unanticipated, has negative and significant relationship with money demand, implying that depreciation would lead to lower demand for money since depreciation implies that the value of the domestic currency is now lower and people would demand less of it (because it now carries lower purchasing power). The elasticity is 0.01 in both cases and the level of significance is 1%.

5.4 Simulation Results

5.4.1 The Effects of Anticipated and Unanticipated Depreciation of Real Exchange Rate

In order to determine the effects of anticipated and unanticipated changes in real exchange over a period of time on our endogenous variables of interest and to test whether these effects are similar or different, we carried out an ex-post experiment to find out the effect of a 15% anticipated depreciation of real exchange on total output and its components as well as inflation. This is contrasted with the effect of a 15% unanticipated depreciation of real exchange rate during the same period. 15% depreciation rate was chosen because after the adoption of Structural Adjustment Programme (SAP) and the deregulation of the foreign exchange market, the real exchange rate was found to have depreciated on average by about 15% between 1986 and 1990. We therefore evaluated what the effect of this depreciation would have been if it had taken place in 1980. This kind of simulation is regarded as counterfactual simulation since both events are not likely to happen simultaneously. The baseline and the disturbed solutions are then compared in order to answer the question of ówhat is the effect of anticipated and unanticipated change on output and inflationô. The results of the simulation experiment are presented in Table 13. The figures presented in the table are in percentage deviation of the disturbed solution from the baseline solution; hence positive indicates increase while negative indicates decrease from the baseline solution. Case 1 depicts the effects of anticipated depreciation of 15 per cent while case 2 depicts the effects of 15 per cent unanticipated depreciation.

SELINE SOLUTION FROM SCENARIO SOLUTIONS

	INFLATION		MANUF. OUTPUT		AGRIC. OUTPUT		SERVICE SECTOR OUTPUT		TOTAL OUTPUT	
	Case I	Case II	Case I	Case II	Case I	Case II	Case I	Case II	Case I	Case II
1981	2.79	-8.59	-18.61	-6.33	6.26	6.71	8.62	-8.27	2.98	2.15
1982	0.11	-2.72	-10.13	-3.57	5.39	-1.77	3.38	-4.68	-2.13	4.76
1983	44.66	-8.23	-15.90	6.84	4.96	-15.61	-7.73	-6.02	-2.32	4.92
1984	35.83	-7.89	-9.68	11.15	6.75	-12.46	6.58	0.06	-2.02	3.85
1985	13.58	9.72	14.92	8.00	5.81	-11.49	13.56	3.69	3.85	1.76
1986	87.89	-4.83	-12.23	22.48	1.51	0.83	-9.10	-4.15	0.62	1.50
1987	66.25	1.34	-23.16	-18.50	3.77	26.26	-75.10	-5.94	-8.64	1.34
1988	24.47	2.27	-6.17	-11.29	4.19	-33.35	-17.91	-11.22	-13.43	6.51
1989	-35.24	5.05	-17.95	11.73	-15.11	31.93	12.96	-2.29	-5.14	-5.38
1990	-15.80	3.04	31.09	-10.13	-23.84	20.68	-0.36	-2.22	2.31	-3.68
1991	-28.09	-8.26	-7.15	-9.06	-15.37	6.17	6.13	-8.19	-11.74	-2.31
1992	-53.93	-6.70	-3.44	-1.52	-17.09	24.05	16.48	-6.31	-6.33	-6.05
1993	11.50	2.03	11.90	-0.56	-15.13	4.34	14.07	-1.68	-2.29	0.00
1994	7.02	5.27	10.86	13.62	-22.76	8.72	-13.08	4.37	-3.91	-2.14
1995	8.99	6.59	-5.16	-15.13	-19.65	-3.79	21.11	5.78	2.70	6.98
1996	14.69	3.00	-1.35	-5.36	-18.98	-3.17	44.67	3.54	0.09	-2.51
1997	29.38	4.89	-5.97	-7.16	-16.32	-8.85	12.89	3.13	0.36	-1.17
1998	55.50	-2.78	-3.26	0.07	-16.89	-12.29	-31.04	-0.88	-5.74	1.75
1999	-29.96	0.35	-13.76	-4.64	-17.81	-13.15	-11.18	-2.94	-4.44	3.60
2000	38.43	-1.66	-25.60	0.23	-23.98	4.44	-30.59	-1.03	-8.35	0.82
2001	17.76	-2.46	9.13	4.31	-27.37	5.79	-19.36	-0.78	6.96	0.40
2002	-1.83	2.72	-0.20	3.43	-19.93	3.54	-14.97	3.02	-2.00	1.93
2003	12.86	-0.85	-2.87	-0.40	-17.49	2.55	-40.57	3.07	1.18	2.13
2004	22.11	-0.63	5.22	7.62	-22.58	1.24	-26.85	2.79	-3.20	-2.31
2005	24.12	-2.36	3.78	10.08	-19.66	-0.35	10.73	5.77	-2.86	-8.96
2006	32.70	1.34	8.91	8.30	0.74	-10.56	6.05	3.68	3.44	8.81
2007	23.79	2.68	5.87	5.08	3.87	-8.77	3.97	4.88	2.88	6.20
Average	17.17	-0.28	-2.00	0.71	-9.23	0.43	-5.32	-0.85	-2.12	0.92

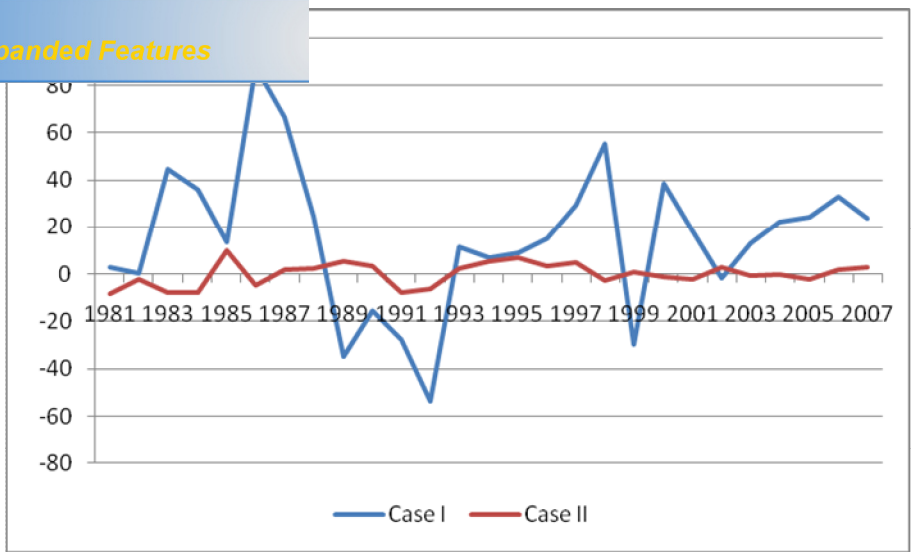
SOURCE: SIMULATED RESULTS

NOTE: Figures in table represent percentage deviation of scenario solution from baseline solution

(+) indicates increase while (-) indicates decrease.

Case I refers to the effect of 15 percent anticipated depreciation while case II refers to the effect of 15 percent unanticipated depreciation.

As shown in Table 13, the inflation rate would be higher throughout the simulation period following 15 per cent anticipated depreciation except between 1989 and 1992 as well as in 1999 and 2002, when the inflation rates were lower. On the average inflation, would be higher by 17.17 per cent following 15 per cent anticipated depreciation. For unanticipated depreciation of 15 per cent, inflation would be lower for most of the period. On the average, inflation would be lower by 0.28 per cent as a result of 15 per cent unanticipated depreciation. The result for inflation shows that on the average an unanticipated depreciation of 15 per cent would lead to lower rate of inflation compared to the same percentage of anticipated depreciation, implying differences in the response of inflation to anticipated and unanticipated depreciation. Figure 9 shows the deviations of inflation from baseline solution for cases I and II.



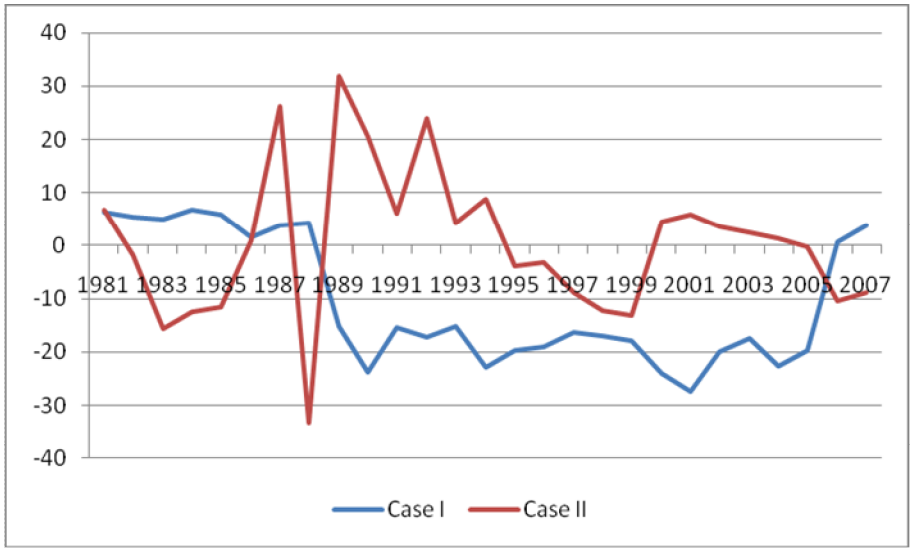
Source: Simulated Results
Note: Case I stands for anticipated depreciation while Case II stands for unanticipated depreciation

Figure 9: Deviations of Inflation from baseline solution

Figures 10 - 13 show deviation of scenario solutions from baseline solutions for sectoral and total output. Figures 10, 11, and 12 show the deviations for the agricultural, manufacturing and services sectorsô output, respectively while Figure 13, shows the deviations for total output.

5.4.2.1. Effects on Agricultural Output

With a 15 per cent anticipated depreciation of real exchange rate, the agricultural sector output would experience an increase for the first eight years and then decrease subsequently (see Table 13). On the average, agricultural output would reduce by 9.23 per cent following 15 per cent anticipated depreciation. For an unanticipated exchange rate depreciation of the same percentage, agricultural output would decline in the first four years, but the decline would be reversed in subsequent years, with an average increase of 0.4 per cent (see Table 13). The effects analysed above showed that agricultural output reacts differently to anticipated and unanticipated depreciation. While the effect of anticipated depreciation is negative on the average for anticipated depreciation, it is positive on the average for unanticipated depreciation, although in absolute terms, the average effect of unanticipicated depreciation is smaller, compared to that of anticipated depreciation (see Table 13). Figure 10 depicts the deviation of growth rates of agricultural output due to anticipated and unanticipated depreciation of real exchange rate. The growth rate would be lower for most years for anticipated depreciation but would be higher for most years for unanticipated depreciation (see Figure 10).

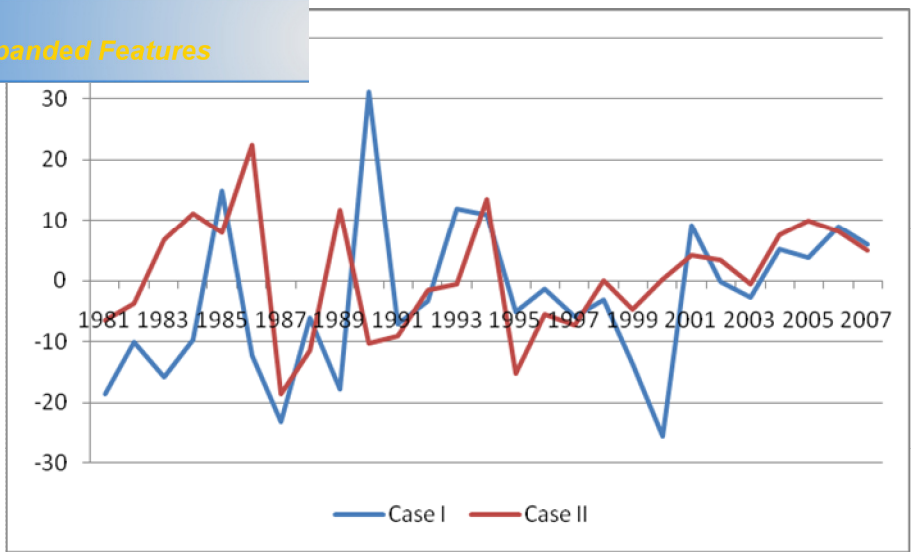


Source: Simulated Results
Note: Case I stand for anticipated depreciation while Case II stands for unanticipated depreciation

FIGURE 10: Deviation of Growth Rate of Agricultural Output

s effects

The performance of the output of the manufacturing sector following a 15 per cent anticipated depreciation, as shown in Table 13, would be higher in nine (9) years out of twenty six years simulated for, while it would be lower for the remaining seventeen years. On the average, manufacturing output would reduce by 2.00 per cent as a result of 15 per cent anticipated depreciation. On the other hand, 15 per cent unanticipated depreciation would result in increase in the manufacturing sector output in fourteen (14) out of the twenty six years simulated for, while it would result in reduction in the manufacturing output in the remaining twelve (12) years. On the average, unanticipated depreciation would lead to 0.7 per cent increase in the manufacturing output. This shows that the effect of anticipated depreciation is greater on the manufacturing sector of the Nigerian economy compared to that of unanticipated depreciation, although the effect of the former is negative while that of the latter is positive. The huge impact of anticipated depreciation here could be a reflection of the high dependence of the Nigerian manufacturing sector on imported intermediate input, which would be adversely affected by an anticipated depreciation. Figure 11 shows the deviation of manufacturing output growth rates for anticipated and unanticipated depreciation.

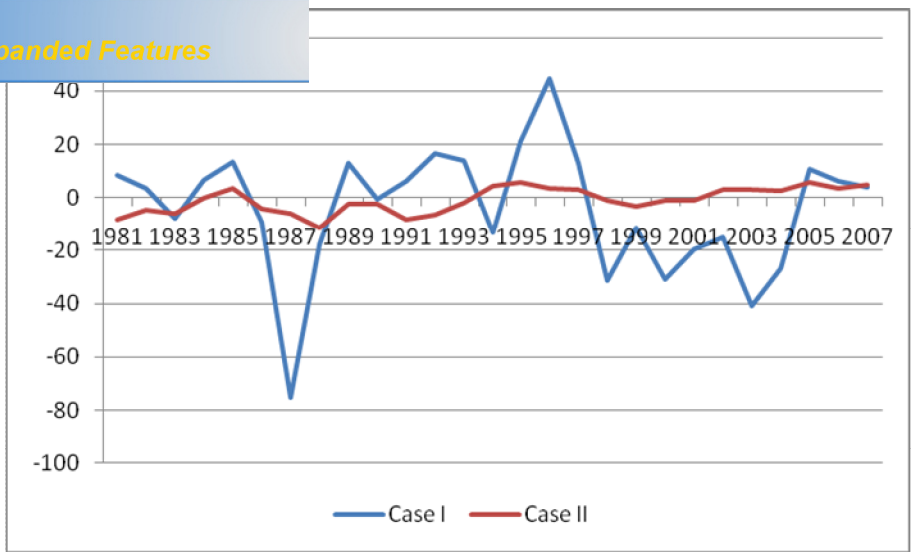


Source: Simulated Results
Note: Case I stand for anticipated depreciation while Case II stands for unanticipated depreciation

FIGURE 11: Deviation of Growth rate of Manufacturing Output

Effects

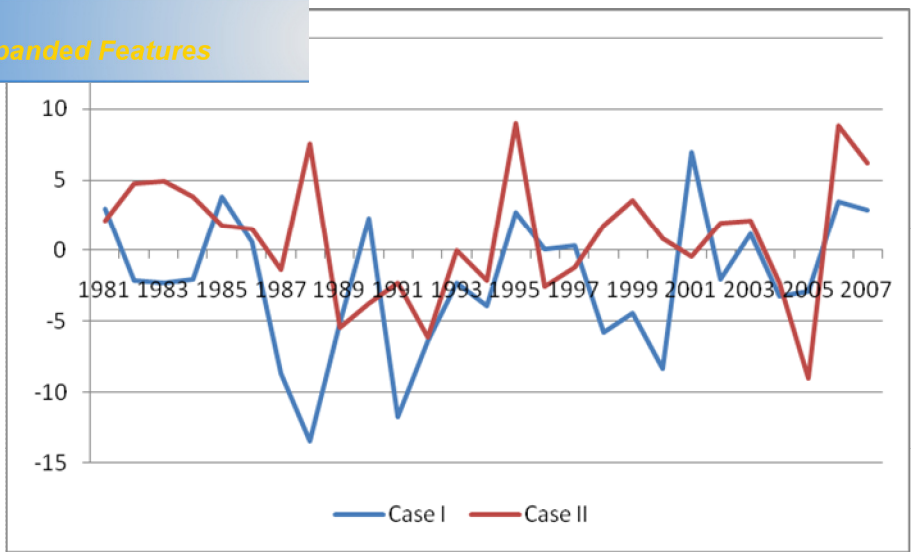
As shown in Table 13, the service sectorôs output growth rate would be higher initially for anticipated depreciation but this higher growth rate would be reversed afterwards. On the average the growth rate of the output of the service sector would decline by 5.23 per cent as a result of 15 per cent anticipated depreciation. For unanticipated depreciation, the effect would be an initial decline in the growth rate of the output of the sector. Although there would be increase in growth rate in some years, the average effect would be a decline in growth rate of 0.9 per cent (see Table 13). Figure 12 shows the deviations of growth rate under both scenarios. Under both anticipated and unanticipated depreciation, the growth rate of the services sector output would decline on the average, though at different rates. The services sector output would decline more under anticipated depreciation in comparison with unanticipated depreciation.



Source: Simulated Results
Note: Case I stand for anticipated depreciation while Case II stands for unanticipated depreciation

FIGURE 12: Deviation of Growth rate of Services' Sector Output

The growth rate of total output would be higher in the first year under anticipated depreciation, but this initial higher growth rate would be followed by decline in subsequent years. Total output growth rate would only be higher in eleven out of the twenty six years but it would be lower in fifteen years. On the average, total output would be lower by 2.12 per cent following 15 per cent anticipated depreciation (see Table 13). Under unanticipated depreciation the growth rate of total output would be higher in the first few years. On the overall, total output would be higher in seventeen (17) years but would be lower in nine (9) years. On the average, total output would be higher by 0.9 per cent under unanticipated depreciation. The effect of anticipated depreciation on the total output is contractionary on the average, while that of unanticipated depreciation is expansionary, although the magnitudes of the effects differ (see Figure 13).



Source: Simulated Results
Note: Case I stand for anticipated depreciation while Case II stands for unanticipated depreciation

FIGURE 13: Deviation of Growth Rate of Total Output

cussion, we found that there are differences in the response of output and inflation to anticipated and unanticipated depreciation. Differences occur not only in direction but also in magnitude. While anticipated depreciation is inflationary on the average, unanticipated depreciation is deflationary on the average. The same trend occurs with respect to output. For agricultural output, anticipated depreciation is contractionary on the average, while unanticipated depreciation is expansionary, with an average reduction of 9.23 per cent under anticipated depreciation and average increase of 0.4 per cent under unanticipated depreciation. A similar scenario is applicable to manufacturing sector output, which reduced by 2.00 per cent for anticipated depreciation but increased by 0.7 per cent for unanticipated depreciation. However, the situation for the services sector differs. For the services sector, both anticipated and unanticipated depreciation caused the growth rate of the output of the sector to decline, albeit, at different rates. The rate of decline is higher under anticipated depreciation compared with unanticipated depreciation as services sector would decline 5.23 percent due to anticipated depreciation of 15 percent but would only decline by 0.85 percent for unanticipated depreciation. Total output also had differential responses to anticipated and unanticipated depreciation. While anticipated depreciation is contractionary on the average, unanticipated depreciation is expansionary, although at a lower rate compared to the rate of contraction for anticipated depreciation. Total output would decline by 2.12 percent following 15 percent anticipated depreciation but would rise by 0.92 percent under unanticipated depreciation of the same percentage. In all cases, the effect of anticipated depreciation is greater than that of unanticipated depreciation, which corroborates the non-significant effect of unanticipated depreciation observed earlier in the estimated results.

5.5 Synthesis of Empirical Results and Study Objectives

The studyôs first major objective is to investigate the effects of anticipated and unanticipated exchange rate changes on the output of different sectors of the economy, as well as on total output. This objective was achieved by building and estimating a small macroeconometric model which captured the link among some sectors of the economy. the exchange rate variable was decomposed into anticipated and unanticipated components. The model was then solved under the controlled and disturbed scenarios over the period 1981 to 2007. In order to capture the effect of anticipated depreciation,

as depreciated by 15 per cent and the solution obtained under this scenario was compared with the baseline solution. This is referred to as case I in this study. Case II refers to the effect of unanticipated depreciation, where the unanticipated exchange rate was depreciated by 15 per cent and the solution obtained here was also compared with the baseline solution.

Under anticipated depreciation, agricultural output would be lower on the average by 9.23 per cent for the period of simulation while manufacturing output would decrease by 2.00 per cent. The services sectorôs output would decrease on the average by 5.32 percent while total output would decrease by 2.12 per cent. This shows that sectoral and total output would decrease as a result of anticipated depreciation although at different rates. We observed that there are differences between initial responses of output compared to subsequent response. For instance, agricultural output initially increased but this increase was reversed afterwards. Moreover, agricultural output was more adversely affected by anticipated depreciation relative to other sectors.

For unanticipated depreciation, there are differences in sectoral responses. While agricultural and manufacturing output increased on the average, the services sector output reduced on the average. Agricultural output would rise by 0.43 per cent on the average; manufacturing output would rise by 0.71 per cent on the average while the services sectorôs output would decline by 0.85 per cent on the average. Total output would rise by 0.92 per cent on the average, as a result of unanticipated depreciation.

Comparing the response to anticipated and unanticipated depreciation, there are differences in the response of agricultural, manufacturing and total output. While anticipated depreciation is contractionary on the average for the agricultural sector, manufacturing and total output, unanticipated depreciation generated expansionary effects on these sectors on average. For the services sector output, both anticipated and unanticipated depreciation are contractionary on the average.

From the above, we clearly observe that there are differences in response to anticipated and unanticipated depreciation in some sectors while in others, the effects are in the same direction but different in magnitude. For total output, the response is in different direction and magnitude. We can therefore conclude that the effects of anticipated and unanticipated depreciation differ across sectors. While anticipated

for all sectors and total output on the average, unanticipated depreciation of the real exchange rate is expansionary for all sectors except for the service sector. However, the magnitudes of effects are different under both scenarios in all cases.

The second objective of the study is to investigate the effects of real exchange rate changes on inflation, distinguishing the effects due to anticipated and unanticipated change. To achieve this objective, we compared the baseline and the scenario solutions under the cases of anticipated and unanticipated depreciation. It was found that anticipated depreciation would lead to an increase in inflation rate in most years with an average increase of 17.17 per cent for the period of simulation, while for unanticipated depreciation, there was a reduction in the inflation rate in the first four years and this would be followed by increase in inflation rate in some years. However, unanticipated depreciation would lead to a decrease of 0.28 per cent in inflation rate on the average.

Overall, anticipated depreciation is inflationary on the average while unanticipated depreciation is deflationary, suggesting that the response of inflation to anticipated and unanticipated depreciation differ both in direction and magnitude.

CHAPTER SIX

SUMMARY AND CONCLUSION

6.1 Summary of Major Findings

- Anticipated exchange rate depreciation was found to have significant contractionary effects on sectoral and aggregate output, however the magnitude of the effects of anticipated exchange rate depreciation differ among sectors.
- Unanticipated exchange rate depreciation has expansionary effects on sectoral and aggregate output although its effect was not significant
- Anticipated depreciation was found to be inflationary while unanticipated depreciation was deflationary.
- The effect of anticipated exchange rate depreciation is found to be greater relative to that of unanticipated depreciation in all cases.
- There are differences in sectoral and aggregate output responses to anticipated and unanticipated depreciation.
- The contractionary effect of depreciation was greater on the agricultural sector compared to other sectors of the economy
- Exchange rate depreciation has contractionary effect on consumption suggesting the possibility of a redistributive effect of exchange rate depreciation in Nigeria, confirming the argument of the *structuralists.*
- There exists a significant positive relationship between the output of the agricultural and manufacturing sectors of the economy.
- The elasticity of import with respect to income was found to be less than unity.
- The exchange rate elasticities of import and exports were found to be small, which showed that import and export response to price incentives (exchange rate) is low. This is a reflection of the nature of existing economic structures in country during the period of study.

6.2 Implications of Findings

The significant effect of anticipated exchange rate depreciation found in this study suggests that even when economic agents anticipate exchange rate depreciation; it

and inflation behaviour. This implies that the policy neutrality hypothesis does not hold in the Nigerian environment.

Surprises in depreciation could bring about some temporary improvement in growth of output and reduce inflation.

Since the responses of import and export to exchange rate depreciation are low, this may have an adverse consequence on the balance of payment position.

The significant positive relationship between agricultural and manufacturing sectorsô output found in this study could be exploited through the provision of infrastructure, to promote employment and reduce poverty.

The elasticity of import with respect to income was found to be less than unity, a situation which could generate balance of payment crises during economic downturn, when income declines.

The existing structures in Nigeria could not support an expansionary argument for exchange rate depreciation.

6.3 Recommendations

Based on the above findings, the following recommendations are made:

The imported inputs used in the agricultural and manufacturing sectors should be subsidized or allowed to be imported at concessionary rates. Moreover, government should invest in research and development so that these inputs can be locally sourced in the nearest future. This would ensure the growth of both sectors and reduce the adverse effect of exchange rate depreciation on the economy.

Furthermore, given the importance of agriculture in promoting food security, generating employment and income and the interrelationship between the agriculture and manufacturing sectors, it is recommended that the government should invest massively in infrastructure to enhance local processing of agricultural products, which could also serve as inputs to the manufacturing sector. This would go a long way in reducing the adverse effect of exchange rate depreciation on output and inflation.

with surprises when it intends to depreciate the exchange since such surprises could generate some temporary increase in output and reduction in inflation.

Since the existing structure could not support and expansionary argument for exchange rate depreciation, policy maker should consider alternative policy measures, to promote the growth of output and reduce inflation.

6.4 Conclusion

This study investigated the effect of real exchange rate depreciation on output and inflation in Nigeria, distinguishing between the effects of anticipated and unanticipated depreciation.

Anticipated real exchange rate depreciation has negative effects on sectoral and total output as well as inflation. Unanticipated real exchange rate depreciation has positive effects on agricultural, manufacturing and total output but its effects are insignificant. The significant effects of anticipated depreciation on output and inflation suggests that even when exchange rate depreciation is anticipated by economic agents, it would still have effects on output and inflation which implies that policy neutrality hypothesis may not hold in Nigeria. Surprises in depreciation could be used to promote output growth and reduce inflation.

Moreover, the existing structures in Nigeria during the period of study could not support an expansionary argument for exchange rate depreciation. Therefore, infrastructure should be improved upon and research should be intensified to promote local sourcing of intermediate inputs so as to reduce the adverse consequence of depreciation on the economy.

6.5 Limitations and Suggestions for Future Research

The main limitation of this study is that it focussed on the demand side of the economy. Future research could incorporate the supply side so that a more complete picture could be captured. Quarterly data could also be used by future researchers to add to the robustness of the study.

Abramovitz, M., (1986), ñCatching up, Forging Ahead and Falling Behindò, *Journal of Economic History*, Vol. 46, pp. 385 ï 406.

Acar M.(2000), Devaluation in Developing Countries: Expansionary or Contractionary?ò, *Journal of Economic and Social Research*, Vol. 2, No. 1, pp. 59-83.

Adewuyi, A.O. (2005), ñTrade and Exchange Rate Policies and Economic Performance in Nigeria: An Empirical Analysisò, *The Nigerian Journal of Economic and Social Studies*, Vol. 47, No. 2, pp. 249-280.

Agenor Pierrer-Richard (1991), ñOutput, Devaluation and the Real Exchange Rate in Developing Coutriesò, *Weltwirtschaftliches Archive,* Band 127.

Ajakaiye, D.O.(1994) ñExchange rate depreciation and sectoral prices in Nigeria 1986-1989ò, *NISER Individual Research Project Report*, NISER, Ibadan

Akpokodje G.O. (2007), ñExchange Rate Volatility and External Trade Performance of Selected African Countries, 1973-2003ò, Unpublished Ph D Thesis submitted to the department of Economics, University of Ibadan, Nigeria.

Anthonopoulos, R., (1999), ñA classical approach to real exchange rate determination with an application for the case of Greeceò, *Review of Radical Political Economics,* Vol. 31, No. 3, pp. 53 -65.

Appleyard D.R. and A.J. Field (2001), *International Economics*, McGraw-Hill Higher Education, Irwin.

Argy V. (1994), International Macroeconomics: Theory and Policy, Routledge, London and New York.

Aron, J., Elbadawi, I.A. and Kahn B., (1997), ñDeterminants of the real exchange rate in South Africaò, Oxford: CSAE. (online). Available: www.csae.ox.ac.uk/resprogs/ (Accessed 21 March 2009).

Atingi-Ego Micheal and Rachel Kaggwa Sebudde (2004), *Uganda's equilibrium real exchange rate and its implications for non-traditional export performance*, AERC Research Paper 140, June.

OôConnell, S.A. (1999), ñSingle-equation estimation of the equilibrium exchange rates, in Hinkle, L.E. and Montiel, P.J. (eds), *Exchange rate misalignment: concepts and measurements for developing countries*, Oxford University Press, New York.

Bahmani-Oskooee, M.(1998), ñAre Devaluations Contractionary in LDCs?ò, *Journal of Economic Development*, Vol. 23, No. 1, pp. 131-144.

Bahmani-Oskooee, M. and Mirzaie A. (2000), ñThe long-run Effects of Depreciation of the Dollar on Sectoral Output,ò *International Economic Journal*, Vol. 14, pp. 51-61.

Bahmani-Oskooee M. and M. Kandil, (2007), ñExchange Rate Fluctuations and Output in Oil-Producing Countries: The Case of Iranò, *IMF Working Paper*, WP/07/113.

Balogun E.D.,(2007), ñExchange rate policy and export performance of WAMZ countriesò, *Munich Personal RePEc Archive.*

Bawumia M. (2002), *Designing an Exchange Rate Mechanism in the West African Monetary Zone*, West African Monetary Institute. Mimeo, February.

Berument H. and M. Pasaogullari,(2003), ñEffects of the real exchange rate on output and inflation: Evidence from Turkeyò, *The Developing Economies*, Vol. 41, No. 4, pp. 401 ï 435.

Bhundia A. (2002), ñAn Empirical Investigation of Exchange Rate Pass-through in South Africaò, *IMF Working Paper,* No. 02/165.

Blenman Lloyd.P., Baeyong Lee and Mark Walker (2006), Measuring Foreign Exchange Exposure in US Multinationals: An Empirical Investigation (1985-1997).

Branson W. H. (2005), *Macroeconomic Theory and Policy*, East-West Press, New Delhi (3rd Edition).

Central Bank of Nigeria, *Annual Reports and Statement of Accounts*, various issues

Central Bank of Nigeria,(2005), *Statistical Bulletin*, Vol. 16,

Central Bank of Nigeria, *CBN Briefs*, various issues.

Chete, L.N. (1995) ñExchange rate depreciation and balance of payments adjustment: The Nigerian caseò, *NISER Individual Research Project Report*, NISER, Ibadan.

. Franses, T. Kloek, and H. K. van Dijk, (2004), *Econometric Methods with Applications in Business and Economics,* Oxford University Press, Great Clarendon Street, Oxford.

Cooper R.N.,(1971) ñCurrency Devaluation in Developing Countriesò, *Essays in International Finance,* No. 86, International Finance Section, Princeton University.

Cottani J., D. Cavallo and M.S. Khan (1990), ñReal Exchange Rate Behaviour and Economic Performance in LDCsò, *Economic Development and Cultural Change*, Vol. 39. Pp 61-76

Diaz-Alejandro, C.F. (1963), ñNotes on the Impact of Devaluation and Redistributive Effectò, *Journal of Political Economy*, Vol.71, pp. 577-580.

Diaz Alejandro C.F (1979), ñAn introduction to the symposium on Exchange rate Policy in Semi-Industrialized Countrieò, *Journal of Development Economics*, Vol. 6, pp. 459-462.

Domac, I. (1977), ñAre devaluations contractionary? Evidence from Turkeyò, *Journal of Economic Development*, Vol 22, No. 2, pp. 145 -163

Dornbusch, R, (1988), *Open Economy Macroeconomics*, 2nd edition, New York.

Edwards, S. (1989) *Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries*. Cambridge, Mass.: MIT Press

Edwards S. (1986), ñAre Devaluations Contractionary?ò, *The Review of Economics and Statistics*, Vol.68, No. 3, pp. 501-508.

Eichengreen Barry (2007), ñThe Real Exchange Rate and Economic Growthò, Unpublished Report prepared for the World Bankôs Commission on Growth.

Egwaikhide F.O, L.N. Chete and G.O. Falokun, (1994), ñExchange rate, Money supply and Inflation in Nigeria: An Empirical Investigationò, *African Journal of Economic Policy (AJEP)*, Vol. 1, No. 1, June, pp 57-73.

Ekpo A. H., John E.U. Ndebbio, Edet B. Akpakpan and Micheal M. Nyong (2004), *Macro-economic Model of the Nigerian Economy*, Vantage Publishers, Ibadan.

ing long run equilibrium exchange rateò, in J. Williamson (ed), *Estimating Equilibrium Exchange Rates*, Institute for International Economics, Washington D.C. pp. 93 ï 131.

Elbadawi, I. A and R. Soto, (1997), ñReal Exchange Rate and Macro Economic Adjustment in Sub-Saharan Africa and other Developing Countriesò, *Journal of African Economies,*Vol 6, No. 3, (AERC Supplement).

Engle, R. R., (1982), ñA general Approach to Langrange Multiplier model diagnosticsò, *Journal of Econometrics*, vol. 20, pp. 83 ï 104.

Ghura D. and T.J. Grennes (1993), ñThe real exchange rate and macroeconomic performance in Sub-Saharan Africaò, *Journal of Development Economics*, Vol. 42 pp. 155-174

Guitian M., (1976), The Effects of Changes in the Exchange Rate on Output, Prices and the Balance of Paymentsò, *Journal of International Economics*, Vol. 6 pp. 65-74.

Gujarati, D.N., (2004), *Basic Econometrics*, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Gylfason T. and M. Radetzki, (1991), ñDoes Devaluation Make Sense in the Least Developed Countries?ò *Economic Development and Cultural Change*, Vol. 40, No. 1, pp. 1-25.

Hinkle, L.E. and P.J. Montiel, (1999), ñExchange rate misalignment, concepts and measurement for developing countriesò, A World Bank research publication. New York: Oxford University Press

Huseyin, K., Seyfettin A., Selman, T. and Ilhan O. (2008), ñCurrency devaluation and Output Growth: An Empirical Evidence from OECD Countriesò, *International Research Journal of Finance and Economics*, Issue 14.

International Monetary Fund, *International Financial Statistics*, various issues

Jerome, A., A. Adenikiju, M. Raheem and J. Adeyemo (1998), ñExchange rate and trade liberalization policies and the promotion of manufactured exports in Nigeriaò, *NISER/SSCN National Research Network on Liberalization policies in Nigeria.*

Jhingan M.L. (2001), *Monetary Economics,* Vrinda Publications (P) Ltd, (5th Edition)

000), Output and the real exchange rate in developing countries: an application to Mexico, Journal *of Development Economics*, Vol. 61, pp. 85-109.

Kamin S. B. and M. Klau, (1997), ñSome multi-country evidence on the effects of real exchange rates on outputò, *BIS Working Paper*, No. 48.

Kandil M.(2004), ñExchange Rate Fluctuations and Economic Activity in Developing Countries: Theory and Evidenceò, *Journal of Economic Development*, Vol. 29, No.1, pp 85-108.

Kandil, M and A. Mirzaie, (2002), ñExchange Rate Fluctuations and Disaggregated Economic Activity in the U.S.: Theory and Evidence,ò *Journal of International Money and Finance*, No. 1, pp. 1-31.

Kandil M., H. Berument and N.N. Dincer (2007), ñThe effects of exchange rate fluctuations on economic activity inTurkeyò, *Journal of Asian Economics*, Elsevier, Vol. 18, No 3, pp 466 ï 489.

Kandil M., and I. A. Mirzaie, (2003), ñThe Effects of Exchange Rate Fluctuations on Output and Prices: Evidence from Developing Countriesò, *IMF Working Paper,* WP/03/200.

Kempa, B., (2005), ñAn oversimplified inquiry into the sources of exchange rate variabilityò, Economic Modelling, No. 22, pp. 439 - 458

Khan M.S. and Montiel P.J. (1996), ñReal exchange rate dynamics in a small, primary exporting countryò. In: Frenkel J.A. and Goldstein, M (eds). *Functioning of the International Monetary System*. Washington: International Monetary Fund.

Khan M.S. and M.D. Knight, (1988), ñImport compression and export performance in developing countriesò, *Review of Economics and Statistics*, vol. 70, pp. 315 ï 321.

Krugman P. and L. Taylor, (1978), ñContractionary Effects of Devaluationò, *Journal of International Economics*, Vol. 8. pp. 445-456.

Krugman P.R. and M. Obstfeld, (2000), *International Economics*, Addison Wesley Longman (Singapore) Pte. Ltd., Indian Branch.

Kwanashie, M., A.G. Garba and J. Bogunjoko(1998), ñExchange rate and trade liberalization and non-oil exports in Nigeria: an empirical investigationò, *NISER/SSCN National Research Network on Liberalization policies in Nigeria.*

Effective Exchange Rate Indicesò, *IMF Staff Papers*, 30(3): September.

MacDonald, R. (1998), ñWhat determines real exchange rate? The long and short for itò, *Journal of International Financial Markets, Institutions and Money,* No. 8, pp.117 ï 153.

Messe, R.A. and K.S. Rogoff, (1983),òEmpirical Exchange Rate Models of the Seventies: Are any fit to Survive?ò, *Journal of International Economics*, Vol 14, pp 3 ï 24.

Montiel, P.J. (1999), ñDeterminants of the long-run equilibrium real exchange rate: an analytical modelò, In: Hinkle, L.E and P.J. Montiel (eds), *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*, New York: Oxford University Press.

Mundell, R.A., (1971), *Monetary Theory: Interest, Inflation and Growth in the World Economy,*Pacific Palisades, Califonia: Goodyear Pub. & Co.

Muth F. John, (1961), ñRational Expectations and the Theory of Price Movementsò, *Econometrica*, Vol. 29, pp 315 ï 335.

Mwega, F.M. (1993), ñReal Exchange Rate misalignment and Macroeconomic Performance in Kenyaò Interim Report presented at research workshop organised by the African Economic Research Consortium, Cape Town, May 29 ï June 1.

Obadan, M.I. (1994), ñReal Exchange Rates in Nigeriaò, An NCEMA mimeograph

Obstfelf M. and K. Rogoff (1995), ñThe Mirage of Fixed Exchange Ratesò, *The Journal of Economic Perspectives*,Vol. 9, No. 4

Odusola A.F. and A.E. Akinlo (2001), ñOutput, Inflation and Exchange rate in Developing countries: Application to Nigeriaò, *The Developing Economies*, Vol. XXXIX, No. 2, pp. 199-222.

Ogun, Oluremi (2000), ñReal Exchange Rate Behaviour and Non-oil Export Growth in Nigeriaò, *African Journal of Economic Policy (AJEP),* Vol 11, No 1, June, pp 69-90

Ogunleye E.K.(2008), ñExchange Rate Volatility and Foreign Direct Investment Inflows in Sub-Sahara Africaò A Ph D Thesis submitted at the Department of Economics, University of Ibadan, Ibadan, Nigeria.

Ajayi (1986), ñSome theoretical and empirical issues in connection with the devaluation of the Nigerian nairaò, *Nigerian Journal of Economics and Social Studies*, Vol. 28, No. 2.

Opoku-Afari M. (2004), ñMeasuring the Real Effective Wxchange Rate (REER) in Ghanaò, *CREDIT* Research Paper No. 04/11.

Oyejide T.A and O.Ogun, (1995),òStructu ral Adjustment and Exchange Rate Policyò in A. Iwayemi (Ed.), *Macroeconomic Policy Issues in an Open Developing Economy: A case Study of Nigeria*, (National Centre for Economic Management and Administration, NCEMA, Ibadan, Nigeria):pp. 307 -327.

Oyinlola M.A. (2008), ñExchange Rate Pass-Through to Domestic Prices of Imports: Evidence from Nigeriaò, A Ph D Thesis submitted at the Department of Economics, University of Ibadan, Ibadan, Nigeria..

Patterson Kerry (2000), *An Introduction to Applied Econometrics: A Time Series Approach*, Palgrave Publishers Ltd, N.Y.

Pindyck R.S and D.L.Rubinfeld, (1981), *Econometric Models and Economic Forecasts,* 2nd ed, McGraw-Hill International Book Company.

Rhomberg, R. (1976), ñIndices of effective exchange rateò, *IMF Staff Papers*. Vol. 23, No 1, pp. 88 ï 112.

Romer, D., (2006), *Advanced Macroeconomics*, 3rd edition, McGraw-Hill, Irwin.

Rosen H.S. (1999), *Public Finance,* McGraw-Hill Book Company, Singapore.

Solimano, A.(1986), ñContractionary Devaluation in the southern cone: The case of Chileò, *Journal of Development Economics*, Vol. 23, pp. 255-285.

Solow, R., (1957), ñTechnical Change and Aggregate Production Functionò, *Review of Economics and Statistics*, Vol 39, pp. 312 ï 320.

Taye, H.K.,(1999), ñThe Impact of Devaluation on Macroeconomic Performance: The Case of Ethiopiaò, *Journal of Policy Modelling*, Vol. 21, No. 4, pp. 481-496.

ts of Inflation in Mozambiqueò *IMF* Working Paper 97/145, International Monetary Fund.

Ubok-Udom, E.U.(1999) ñCurrency depreciation and domestic output growth in Nigeria, 1971-1995ò, *The Nigerian Journal of Economic and Social Studies*, Vol. 41, No. 1, pp. 31-44

Wijnbergen S.V.,(1986), ñExchange Rate Management and Stabilization Policies in Developing Countriesò, *Journal of Development Economics*, Vol. 23, pp. 227-247.

Williamson , J. (1985), *Estimating Equilibrium Exchange Rates*, Washington: Institute for International Economics.

DECONOMIC INDICATORS FOR NIGERIA (1970 – 2007)

YEAR	Inflation rate	Growth rate of real GDP	Growth of agric. output	Growth rate of manufacturing Output	Average Manufacturing Capacity Utilization
1971	15.7	21.35	-7.04	2.1	
1972	3.2	5.48	-12.06	1.3	
1973	5.4	6.42	4.89	4.4	
1974	13.2	11.74	9.86	-0.8	
1975	34.4	-2.96	-8.6	5.1	76.6
1976	23.7	11.08	-4	6.3	77.4
1977	15.6	8.15	-0.54	2.1	78.7
1978	16.6	-7.36	-1.91	5.1	72.9
1979	11.6	2.44	-0.66	19.3	71.5
1980	9.9	5.48	0.06	3.2	70.1
1981	21	2.55	1.62	9.1	73.3
1982	7.6	-1.72	1.85	6.9	63.6
1983	23.2	-6.63	-2.63	-20.7	49.7
1984	39.6	-1.36	3.64	-7	43
1985	5.5	11.33	2.75	10.2	38.3
1986	5.4	1.89	2.21	-13.4	38.8
1987	10.2	-0.69	2.24	32.3	40.4
1988	56.1	7.58	2.39	2.7	42.4
1989	50.5	7.15	25.85	11.7	43.8
1990	7.5	11.36	4.86	5.3	40.3
1991	12.9	0.01	11.54	9.3	42
1992	44.6	2.63	7.68	2.9	38.1
1993	57.2	1.56	3.37	-22.9	37.2
1994	57	0.78	3.83	-0.8	30.4
1995	72.8	2.15	2.07	-4.8	29.29
1996	29.3	4.13	5.94	1.4	32.46
1997	8.5	2.89	3.3	-0.1	30.4
1998	10	2.82	3.31	-3.3	32.4
1999	6.6	1.19	4.16	2.8	34.6
2000	6.9	4.89	4	0.3	36.1
2001	18.9	4.72	-0.3	-0.3	42.7
2002	14.7	4.63	6	5.3	54.9
2003	12.2	9.57	10.5	0.5	56.5
2004	15.1	6.58	10.1	-0.9	55.7
2005	17.7	6.53	11.4	0	54.8
2006	8.4	6.03	7.40	2	53.3
2007	21.35	6.52	7.42	5.1	52.1

Source: Compile by the author from CBN Statistical Bulletin, 2007 and CBN Annual Reports and Accounts (various issues

ulating summary statistics and Jarque-Bera test

i) Jarque-Bera Statistics

$$\text{Jarque-Bera} = Jarque-Bera = \frac{N-k}{6}\left(S^2 + \frac{(K-3)^2}{4}\right)$$ where S is the *skewness*, K is the kurtosis, and k is the number of estimated coefficients used to create the series.

ii) Theilôs inequality coefficient

$$U = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(Y_t^s - Y_t^a\right)^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(Y_t^s)} + \sqrt{\frac{1}{T}\sum_{t=1}^{T}(Y_t^a)^2}}$$

Where U = Theilôs inequality coefficient,

Y^s = Simulated series and

Y^a = actual/historical series

iii) The bias proportion

$$U^B = \frac{(\bar{Y}^s - \bar{Y}^a)^2}{(1/T)\sum(Y_t^s - Y_t^a)^2}$$

Where U^B = bias proportion, the bar on a variable indicates the mean of that variable and other variables are as defined under Theilôs coefficient formular

iv) Variance Proportion

$$U^V = \frac{(\sigma_s - \sigma_a)^2}{(1/T)\sum(Y_t^s - Y_t^a)^2}$$

Where U^V = variance proportion

σ_s = standard deviation of the simulated series

σ_a = standard deviation of the actual series and

ıre as earlier defined.

$$U^c = \frac{2(1-\rho)\sigma_s\sigma_a}{(1/T)\sum(Y_t^s - Y_t^a)^2}$$

Where U^C = covariance proportion

ρ = correlation coefficient between the actual and simulated series and

Other variables are as earlier defined.

APPENDIX 3: CORRELATION COEFFICIENTS OF RESIDUALS OF 2SLS

	PRIV CON	GOVT CON	INV	NON-OILEXP	OILEXPORT	IMP	AGRIC	MANUF	SERV	TOTAL	MONEYDD	INF
PRIV CON	1	-0.07	0.00	0.18	-0.03	-0.01	0.11	0.12	-0.04	-0.31	0.16	-0.08
GOVT CON	-0.07	1.00	0.13	0.04	-0.39	-0.05	-0.03	0.04	-0.09	0.21	-0.01	0.18
INV	0.00	0.13	1.00	0.55	0.52	0.89	0.22	0.00	-0.04	-0.60	-0.19	0.73
NON-OILEXP	0.18	0.04	0.55	1.00	0.29	0.53	0.06	-0.10	-0.08	-0.41	0.03	0.34
OILEXPORT	-0.03	-0.39	0.52	0.29	1.00	0.64	-0.05	-0.22	-0.13	-0.53	-0.09	0.54
IMP	-0.01	-0.05	0.89	0.53	0.64	1.00	0.23	-0.07	0.03	-0.57	-0.08	0.58
AGRIC	0.11	-0.03	0.22	0.06	-0.05	0.23	1.00	-0.04	0.36	-0.29	-0.14	0.07
MANUF	0.12	0.04	0.00	-0.10	-0.22	-0.07	-0.04	1.00	-0.15	0.15	-0.23	0.05
SERV	-0.04	-0.09	-0.04	-0.08	-0.13	0.03	0.36	-0.15	1.00	-0.11	0.07	-0.09
TOTAL	-0.31	0.21	-0.60	-0.41	-0.53	-0.57	-0.29	0.15	-0.11	1.00	-0.08	-0.34
MONEYDD	0.16	-0.01	-0.19	0.03	-0.09	-0.08	-0.14	-0.23	0.07	-0.08	1	-0.38
INF	-0.08	0.18	0.73	0.34	0.54	0.58	0.07	0.05	-0.09	-0.34	-0.38	1