TITLE

IMPACT OF OIL SECTOR TRADE ON NIGERIAN ECONOMIC GROWTH.

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A FACULTY POST FIELD PRESENTED TO THE FACULTY OF SOCIAL SCIENCES, NNAMDI AZIKIWE UNIVERSITY, AWKA. IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (Ph.D) IN ECONOMICS.

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CERTIFICATION

This is to certify that this Ph.D. dissertation titled, **"Impact of oil sector trade on Nigerian economic growth"** was carried out by **Obisike, Ndubueze Ezindu** with registration number 2013117004F is an original research carried out by me, except where references are made to published literatures, and has not been submitted elsewhere for the award of any certificate, degree or diploma.

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APPROVAL

This is to certify that this Ph.D. dissertation titled, **"Impact of oil sector trade on Nigerian economic growth"** was carried out by **Obisike, Ndubueze Ezindu** with registration number 2013117004F, in partial fulfillment of the requirement for the award of Doctor of Philosophy (Ph.D) in Economics and approved by the under signed on behalf of the School of Postgraduate Studies, Nnamdi Azikiwe University, Awka.

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DEDICATION

This work is dedicated to Sir Chidi, Obisike Nkoro (JP) and Lady Gold, Eznwanyi Obisike.

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Obisike, Ndubueze Ezindu.

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List of Abbreviations

ADF: Augmented Dickey-Fuller
AEG: Augmented Engle-Granger
AGO: Automotive Gas Oil
ARDL: Autoregressive Distributed Lag
ARIMA: Autoregressive Integrated Moving Average
ATELAS: Aggregate Trade Elasticity
BPG: Breusch-Pagan-Godfray
bpsd: barrels per stream day
CBN: Central Bank of Nigeria
CC: Current value of Capital
CCEP: Current value of Crude oil Export Price
CEPGR: Crude oil Export Price Growth Rate
CEPGR: Crude oil Export Price Growth Rate
CEPGR: Crude Oil Export Revenue Growth Rate
CERGR: Autoregressive Conditional Heteroscedasticity
CERGR: Crude oil Export Revenue Growth Rate
CERGR: Crude Oil Export Revenue Growth Rate
CLP: Current value of Labour Productivity
CNGDP: Current value of Nigerian Gross Domestic Product
CPPIP: Current value of Petroleum Products Import Prices
CRS: Cross River State
CRSEP: Cross River State Economic Performance
CTOT: Commodity Terms of Trade
DFTOT: Double Factorial Terms of Trade
DPK: Dual Purpose Kerosene
DPR: Department of Petroleum Resources
D-W: Durbin-Watson
ECM: Error Correction Mechanism
EDEBT: External Debt

EG: Engel-Granger

EGR: Economic Growth Rate

EPGR: Export Price Growth Rate

EIA: Energy Information Administration

EXCHR: Exchange rate.

ESS: Expected Sum of Square

FDI: Foreign Direct Investment

FGN's: Federal Government of Nigeria's

GARCH: Generalized Autoregressive Conditional Heteroskedastic

GDP: Gross Domestic Product

GEXP: Government Expenditure

GMM: General Methods of Moment

GRC: Growth rate of Capital

GRL: Growth rate of Labour

H-O: Heckscher-Ohlin

ICGR: Import Cost Growth Rate

INF: Inflation

IPGR: Import Price Growth Rate

ITOT: Income Terms of Trade

JB: Jarque-Bera

KPMG: Klynveld Peat Marwick Goerdeler

KRPC: Kaduna Refinery and Petrochemical Company

LF: Licensing Fees

NAPIMS: National Petroleum Investment Management Services

NCDMB: Nigerian Content Development & Monitoring Board

NDDC: Niger Delta Development Commission

NEGR: Nigerian Economic Growth Rate

NGDP: Nigerian Gross Domestic Product

NIPC: Nigerian Investment Promotion Commission

NNOC: Nigerian National Oil Company

NNPC: Nigerian National Petroleum Corporation

NP:	Ng-Perron
OCTOT:	Oil Commodity Terms of Trade
ODFTOT:	Oil Double Factorial Terms of Trade.
OLS:	Ordinary Least Square
OPEC:	Organization of Petroleum Exporting Countries
OREV:	Oil Revenue
PECOS:	Price Elasticity of Crude oil Supply
PEPPD:	Price Elasticity of Petroleum Products Demand
PAM:	Presidential Amnesty Programme
PC:	Past value of Capital
PCEP:	Past value of crude oil export price
PCI:	Per Capita Income
PCI:	Product Complexity Index
PHRC:	Port-Harcourt Refinery and Petrochemical Company
PLP:	Past value of Labour Productivity
PMS:	Premium Motor Spirit
PNGDP:	Past value of Nigerian Gross Domestic Product
PP:	Phillips-Perron
PPIEGR:	Finished Petroleum Products Import Expenditure
PPIPGR:	Petroleum Products Import Price Growth Rate
PPIPGR:	Petroleum Products Import Price Growth Rate
PPMC:	Pipelines and Product Marketing Company limited
PPPIP:	Past value of Petroleum Products Import Prices
PPT\R:	Petroleum Profit Tax/Royalties
RGDP:	Real Gross Domestic Product
TOT:	Terms of Trade
U.S.A:	United States of America
VAR:	Vector Autoregressive
VECM:	Vector Error Correction Model
WRPC:	Warri Refinery and Petrochemical Company

Abstract

Nigeria is one of the country's in the world with huge crude oil deposit, and large refinery paradoxically Nigeria exports crude oil and imports refined petroleum products. As a result, this study examined the impact of oil sector trade (export and import) on Nigerian economic growth from 1983 to 2017. With precise interest on the impact of oil supply and demand growth rates, and oil terms of trade on Nigeria's oil sector growth rate as well as the impact of oil sector growth rate on Nigeria's economic growth rate. In order to capture the objectives of the study, relevant methods of analysis were adopted which include; Engle-Granger test statistic and Granger causality test. The E-G test reveals that oil supply variables (CEPGR and CERGR), oil demand variables (PPIPGR and PPIEGR), and oil terms of trade variables (OCTOT and ODFTOT) have positive impact on Nigeria's oil sector growth rate within the study period, in turn oil sector growth rate had positive impact on Nigeria's economic growth rate. The causality test shows that Nigeria is vulnerable to external shocks while the elasticity test indicates that oil import is income and price elastic positively while oil export is price elastic negatively. Given the empirical results on average, the study conclude that the pattern of oil trade going on in Nigeria has the capacity to lead to perpetual underdevelopment in Nigeria and thereafter recommend that Nigerian Government should channel oil trade towards exportation of both crude oil and refined petroleum products.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Trade is simply the exchange of goods and services which promotes economic growth. It is broadly categorized into domestic and international trade and its operation anchors on different sectors of an economy in order to actualize sustainable economic growth (Anyanwuocha, 2005). Expatiating on international trade, many sectors of the world economy are deeply engaged in international trade for sustainable economic growth oil sector alike. Drawing largely from international oil trade, oil sector trade involves transfer of oil produce beyond the boarder of a country by its oil sector (or agent) in exchange for money or for non-oil commodity, or for debt settlement in order to promote economic growth and development objectives (Ogbu, 2018).

On the other hand, economic growth according to Anthony (2014) means sustained increase in Gross Domestic Product (GDP) of a country derived from greater amount of domestic input productive efficiency, size of terms of trade and volume of trade. Stern (1988) cited in Okpara (2016) submits that in bid to increase a nations GDP, her export has to increase which results to increased export revenue, and the increase in export revenue in turn improves a nation's capacity to import. These premises summarily imply that economic growth and international trade are interdependent, all things being equal.

In practice, international trade activities are controlled by different sectors of an economy which in turn influences economic growth at large. This implies that economic growth depends greatly on sectoral international trade and oil sector alike. Focusing on Nigeria, Akanni (2014) specifically opined that the volume of crude oil export is the major international trade driving Nigeria's economic growth. In the same vein, empirical studies such as Abdulkareem and Abdulhakeem (2015), Nwanna and Eyedayi (2015), Ahuru and James (2015), Odularu (2014), and Nweze and Edeme (2015) who examined the impact of international oil trade on Nigeria's economic growth found that crude oil price and revenue have positively impacted on Nigeria's economic growth. However, Offiong, Atsu, Ajaude and Ina (2015) hold contrary opinion.

Nigeria's oil sector which has been applauded relatively by empirical studies emerged as the major source of revenue in Nigeria in the late 1960's and early 1970's as a result of relative rise

in international price of crude oil (Yusuf, 2015). Discovery of oil in Nigeria in 1956 and its commercial production in 1958, coupled with rise in international price of crude oil in the late 1960's and early 1970's changed the focus of Nigeria's economic base from agricultural sector to the oil sector (Afolabi, 2017).

After the oil wind fall in late 1960's some progressive measures were taken to ensure efficiency in the oil sector. For instance, by 1989 Nigeria had completed and commissioned four refineries with crude oil carrying capacity of 445,000 barrels per day (bpd). Before 1989 precisely in 1971 Nigeria joined the Organization of Petroleum Exporting Countries (OPEC), and during the peak of oil boom in 1973, Nigerian National Oil Company (NNOC) was established which was renamed Nigerian National Petroleum Corporation (NNPC) in 1977 (Odularu, 2014; Umar & Jerry, 2014; Donwa, Mgbame & Onobun, 2015).

NNPC was established with sole responsibility to handle all oil and gas production as well as its domestic and international distribution through her major resource sub-sectors namely; a) upstream sector, and b) downstream sector among others (Umar & Jerry, 2014). Statutorily, the upstream sector is designed to produce and distribute crude oil domestically and internationally, while the downstream sector is designed to produce and distribute refined petroleum products domestically and internationally, and to import (demand) the same in case of routine maintenance of domestic refineries or in case of excess domestic demand over domestic production or for re-exportation for revenue generation (Umar & Jerry, 2014).

The mandate to export both crude oil and refined petroleum products proved abortive as Nigerian oil sector settled for paradoxical operation, that is exportation (supply) of crude oil through the upstream sector and importation (demand) of refined petroleum products through the downstream sector. Against all odds, statistical evidence has shown that the upstream sector has performed relatively better than the downstream sector. Table 1.1 below reveals that on average of seven years counting from 1983 to 2017, export quantity, international price and export revenue of crude oil have witnessed consistent increase except in 1990-1996 when price dropped from $24 barrel per day (bpd) to $19 bpd and in 2011-2017 when exported quantity dropped from 801,246,705 bpd to 786,017,226 bpd (NNPC, 2017).

Table 1.1: A seven year average of quantity of crude oil export, International price of crude oil (Bonny light) and Crude oil export revenue in Nigeria (1983 – 2017).

Year	Export quantity (barrel per day)	Export price ($)	Nominal export revenue ($)
1983-1989	400,412,849	24	7,964,522,357
1990-1996	578,120,500	19	10,950,760,729
1997-2003	704,319,727	29	20,100,574,757
2004-2010	801,246,705	62	48,673,339,089
2011-2017	786,017,226	95	75,959,689,602

Source: NNPC Statistical Bulletin, 2017 and OPEC Statistical Bulletin, 2017.

Following statistical trend, Odularu (2014) maintained that the downstream sector has performed far below expectations both in production and servicing the domestic demands for refined petroleum products despite its heavy reliance on importation. This assertion is evidenced by domestic production rate of Nigeria refineries from 2007 to 2017 as shown in Figure 1.1 below.

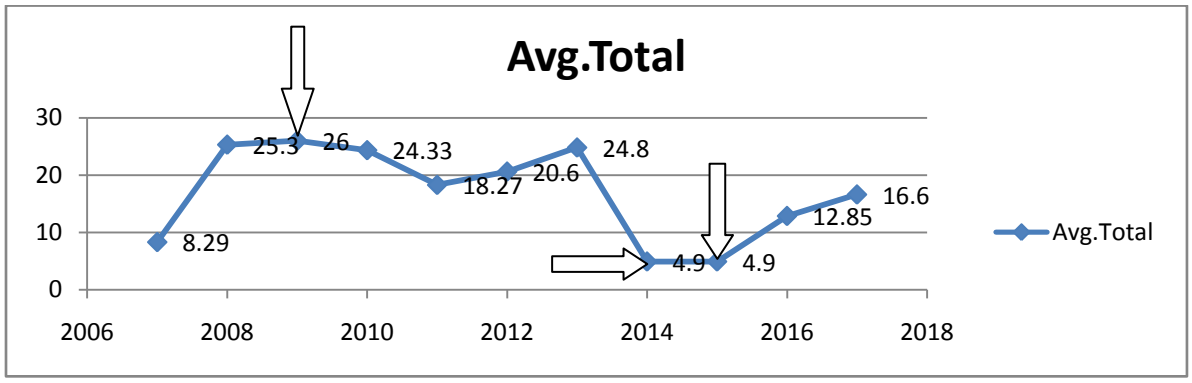

Figure 1.1: Domestic production rate in Nigeria in metric tons (2007 – 2017)

Source: NNPC Statistical Bulletin, 2017.

Figure 1.1 points out that the best production rate Nigeria has had from all the refineries from 2007 to 2017 is 26% in 2009 fiscal year while 2014 and 2015 production rate which stood at 4.9% each remained the worse. The odd of poor production rate as shown in figure 1.1 has created a stairway for importation of refined petroleum products coupled with continuous increase in domestic demands resulting from increase in population growth rate and fuel consuming facilities etc. Figures 1.2 and 1.3 below show the quantity of refined petroleum products imported, supplied, and demanded for from 1998 to 2017 respectively.

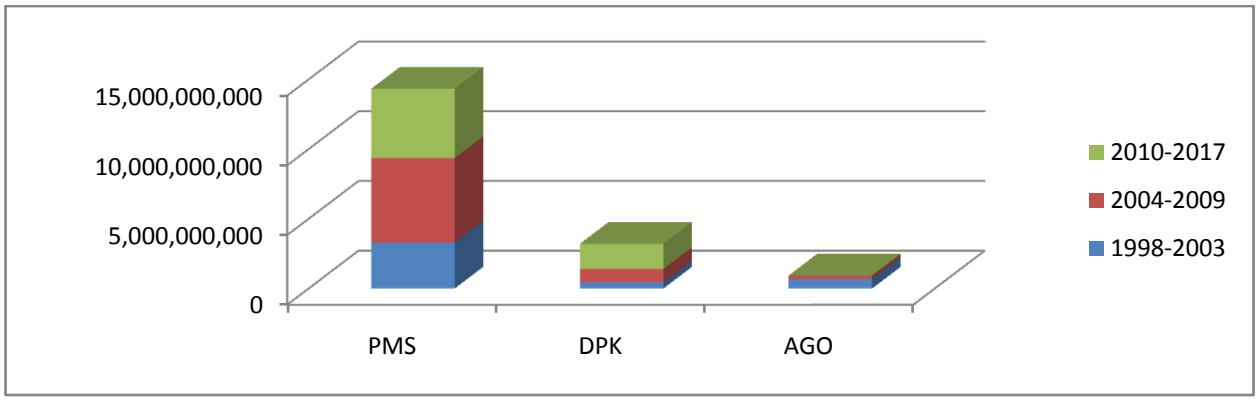

Figure 1.2: Imported refined petroleum products (thousand per litre) from 1998-2017.
Source: NNPC/PPMC report of various years.

Figure 1.2 indicates that Petroleum Motor Spirit (PMS) dominated the import list of refined imported petroleum followed by Dual Purpose Kerosene (DPK) while Automotive Gas Oil (AGO) is the least. Within 1998-2003, 2004-2009, and 2010-2017 the total imported refined petroleum recorded 14,331,384,931 litres for PMS; 3,210,023,910.60 litres for DPK, and 936,087,562.20 litres for AGO respectively. Importation of the aforementioned refined petroleum products did not prohibit the odd of domestic demand from exceeding total supply.

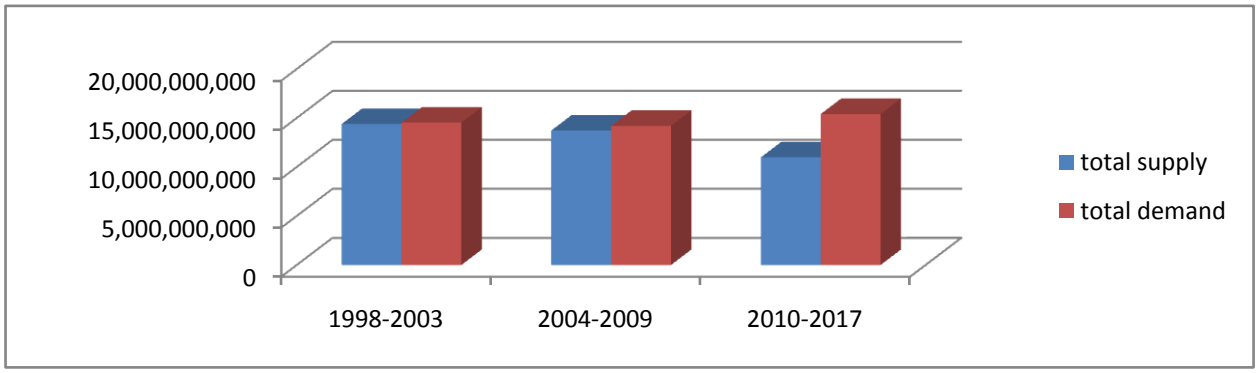

Figure 1.3: Total refined petroleum products supplied and demanded (thousand per litre) from 1998-2017.
Source: NNPC/PPMC report of various years.

Figure 1.3 reveals that total refined petroleum supplied (total supply is the sum of domestic production and the quantity imported) from 1998 to 2017 fall short of the quantity demanded. This resulted to another weird deficit which stood at -141,585,462.8 litres within 1998-2003, -479,525,202.8 litres, and -32,113,658,747 litres within 2004-2009 and 2010-2017 respectively.

The odds facing upstream oil-export-activities and downstream oil-import-activities have contributed to inconsistent and down trending growth rate of the oil sector as summarized in figure 1.4 below.

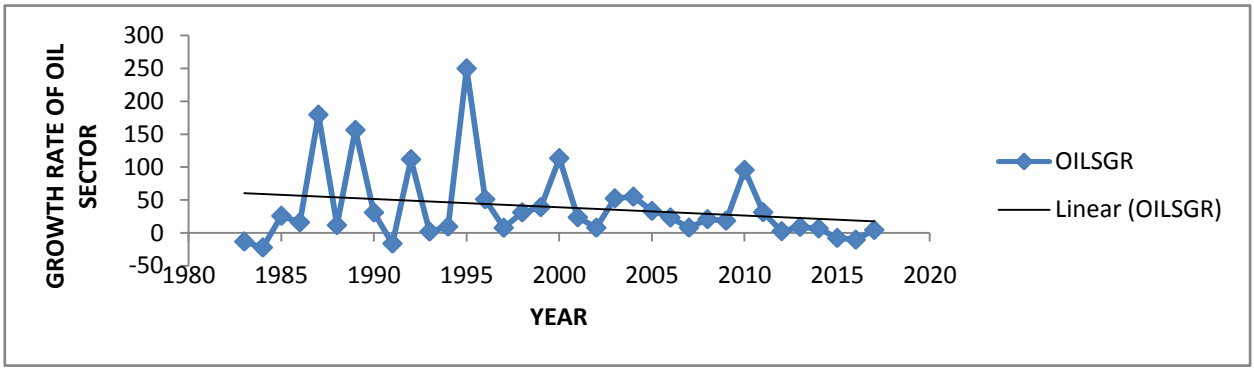

Figure 1.2: Growth rate of Nigerian oil sector.
Source: computed from CBN bulletin 2017.

Regardless of inconsistent and down trending growth rate of the Nigerian oil sector, the sector on average has played and continues to play a dominant role and occupies a strategic position in the economic growth of Nigeria. Azaiki and Shagary (2007) opined that after joining OPEC in 1971, crude oil export revenue contributed to 24% of Nigerian gross domestic product (NGDP) in 1972 which increased to 30.2% and 32.7% in 1973 and 1974 respectively.

In the late 80's the contributions of crude oil export revenue to NGDP declined when compared to the 70's, from 1986 to 1989 crude oil export revenue contributed to 21.5%, 17.3%, 13.9% and 13.8% of Nigeria's GDP respectively (CBN, 1997). This falling trend changed in the 90's down to 2000's; for instance, in 1992, 1995, 1996, 2007, 2010 and 2014 respectively crude oil export revenue contributed to 30.2%, 31%, 30%, 48%, 56% and 52% of NGDP while in 2009 and 2015 its contribution dropped to 37% and 35% respectively and dropped drastically to less than 20% in 2016 and 21.6% in 2017 (CBN, 2017). Beyond the contribution of oil sector to Nigerian's GDP, it is also the major source of foreign exchange earnings by accounting for more than 89 per cent of foreign exchange earnings in Nigeria (Oleosodo, 2018).

Despite the contributions of oil sector to Nigeria's economic growth, the sector has been engulfed by vacillations. For instance, the upstream sub-sector has severally faced and still facing export price, revenue and quantity fluctuations while the downstream sub-sector has faced

and still facing poor production, import dependent, import price fluctuations, short supply and increase in import expenditure. Amid of these odds, plethora of literature have focused more on examining the impact of oil supply (export activities of the upstream sub-sector) on Nigeria's economic growth disregarding the demand bloc (import activities of the downstream sub-sector). While in practice net performance of the upstream and downstream sub-sectors determine the performance of the oil sector. Second, empirical studies have focused largely on impact of oil supply on Nigeria's economic growth as if the link between oil supply and Nigeria's economic growth is direct, practically oil trade impacts directly on oil sector performance which in turn impacts on Nigeria's economic growth.

Another important factor which empirical literatures have ignored is the oil terms of trade. Onoh (2015) pointed out that some of the external regions in which upstream sector is exporting crude oil to, are partly the same in which the downstream sector is importing refined petroleum products from. Hence, there is a need to query oil trade gain or efficiency and one of the ways with which this can be done is to examine oil terms of trade as proposed by Prebisch-Singer (1950) cited in (Appleyard and Field, 1998).

Further, Prebisch-Singer (1950) as cited in Todaro and smith (2009) posits that exportation (supply) of primary products from developing nations into developed nations and importation (demand) of manufactured products from developed nations into developing nations will contribute to development of the later and perpetual underdevelopment of the former except oil producing countries. This assertion strengthens the need to query the impact of oil sector trade on oil sector performance and oil sector performance on Nigerian economic growth recognizing the oil export and import blocs.

1.2 Statement of the Problem

This study is propelled by some worrisome outlooks surrounding international oil trade in Nigeria. To start with, crude oil exploration result under the upstream sector in 2017 revealed that oil reserve in Nigeria is estimated to be about 2.9 million barrels per stream day (NNPC, 2017). Out of which Nigerian government budgeted to produce 2.3 million barrels per stream day, National Bureau of Statistics (NBS, 2017). From the budgeted quantity, statutorily 445,000 barrels is allocated to domestic refineries under the downstream sector meaning that the upstream sector reserves the right to export 1,855,000 barrels per stream day. Using OPEC

conversion factor for Nigeria crude oil on average, all the refineries in Nigeria are expected to produce refined petroleum products worth approximately 67,372,063.4 litres per day and 24,590,803,141litres per year.

NNPC (2017) submits that domestic demand for refined petroleum products in Nigeria stood at 20,470,510,125 litres. Hence, if we inspect the quantity of crude oil upstream sector is meant to produce and export per day, and as well compare the downstream expected production capacity to 2017 domestic demand for refined petroleum products we will quickly discover that Nigeria has the capacity to export both crude oil and refined petroleum products. Alternatively, Nigeria has the capacity to export crude oil without reasons to import refined petroleum products and this in turn will contribute positively to her economy, all things remaining unchanged.

Within the period of this study, what is rather obtainable in Nigeria is; (i) exportation of crude oil which is facing challenges of price fluctuation and pipeline vandalism, and ii) importation of refined petroleum products as a result of poor domestic production of Nigerian refineries, and this is surrounded with doubting benefits, uncertainties and numerous problems. Another issue of worry is that some countries in which Nigeria is exporting crude oil to are partly the same in which she is also importing refined petroleum products from. Given these problems, there is a need to query the impact of oil trade (exportation of crude oil and importation of refined petroleum products) on Nigeria's oil sector performance and the impact of oil sector performance on Nigeria's economic growth.

Nevertheless, these problems highlighted have attracted measures from Nigerian government in order to stem down the tide of pipeline vandalism and low domestic production, and in order to enhance oil export, achieve oil export revenue stability and produce refined petroleum at full capacity to enable reduction of oil import expenditure. Some of the measures include establishment of Niger Delta Development Commission (NDDC) in 2000 during Olusegun Obasanjo's administration, introduction of Presidential Amnesty Programme (PAP) in 2009 during the late President Yar'Adua's administration and routing maintenance of refineries. Despite these measures pipeline vandalism is partially ongoing, crude oil export revenue is still not stable, domestic production is still low, importation of refined petroleum products is still ongoing and import cost of refined petroleum products is still an integral part of import expenditure in Nigeria.

Empirically, these problems have attracted not only policies and measures but research attentions as well; empirical literatures have examined the impact of oil sector trade on Nigerian economic growth and submit different findings. For instance Abdulkareem and Abdulhakeem (2015), Nwanna and Eyedayi (2015) and Ahuru and James etc. observed that crude oil price have positive impact on Nigeria's economic growth whereas crude oil price volatility have negative impact on Nigeria's economic growth. Odularu (2014) and Nweze and Edeme (2015) discovered that crude oil revenue have positive effect on Nigeria economic growth while Baghebo and Atima (2014) and Offiong et al (2015) hold the reverse. Hence, the controversy on the impact of oil sector trade on Nigeria's economic growth remains. That notwithstanding, these studies no doubt have made impact in literature and have contributed to knowledge, yet there are gaps that require further research investigations.

Reviewed literatures focused more on the supply bloc of Nigeria's oil trade by considering crude oil price and its volatility as well as crude export revenue and neglected the demand bloc which covers refined petroleum import price and expenditure. In Nigeria, the demand bloc is an integral part of oil trade in Nigeria and need to be recognized while examining oil trade in Nigeria. Secondly, reviewed literatures have not examined Nigeria's oil trade in relation with oil sector performance rather the focus has been on the relationship between oil trade and Nigeria's economic growth. In practice oil sector trade activities impact directly on oil sector performance not on Nigeria's economic growth, and in turn oil sector performance impacts directly on Nigeria's economic growth. Thirdly, the trade variables proposed by Prebisch-Singer has been neglected by the literatures reviewed. The variables include growth rate of the supply and demand blocs of trade as well as terms of trade which measures trade gain.

Given the gaps identified, and an attempt to bridge the gaps, this study intends not only to factor the supply and demand blocs of Nigeria's oil trade in its analysis or to capture the trade variables proposed by pessimist's trade activists, but to examine the impact of oil trade growth rate on oil sector growth rate. Secondly to examine impact of oil sector growth rate on Nigeria's economic growth rate as well as analyze the causal link between oil sector performance growth rate, oil supply and demand growth rates and terms of trade. Given the problems highlighted and the research gaps identified, the following research questions are raised.

1.3 Research Questions

1. What impact has oil supply growth rate, oil demand growth rate and oil terms of trade on Nigeria's oil sector growth rate?
2. What impact has oil sector growth rate on Nigeria's economic growth rate?
3. What causal link exists between oil supply growth rate, oil demand growth rate, oil terms of trade and Nigeria's oil sector growth rate?

1.4 Objectives of the Study

1. To determine the impact of oil supply growth rate, oil demand growth rate and oil terms of trade on Nigeria's oil sector growth rate.
2. To examine the impact of oil sector growth rate on Nigeria's economic growth rate.
3. To investigate the direction of causality existing between oil supply growth rate, oil demand growth rate, and oil terms of trade and Nigeria's oil sector growth rate.

1.5 Research Hypotheses

Hypothesis one

H_0; Oil supply growth rate, oil demand growth rate and oil terms of trade have no significant impact on Nigeria's oil sector growth rate.

H_1; Oil supply growth rate, oil demand growth rate and oil terms of trade have significant impact on Nigeria's oil sector growth rate.

Hypothesis two

H_0; Oil sector growth rate has no significant impact on Nigeria's economic growth rate.

H_1; Oil sector growth rate has significant impact on Nigeria's economic growth rate.

Hypothesis three

H_0; No causal relationship exists between oil supply growth rate, oil demand growth rate, oil terms of trade and Nigeria's oil sector growth rate.

H_1; Causal relationship exists between oil supply growth rate, oil demand growth rate, oil terms of trade and Nigeria's oil sector growth rate.

1.6 Significance of the Study

This study which empirically evaluated the impact of oil sector trade on Nigerian economic growth will be useful to the following:

The government : It will guide the government in the areas of policy making and implementation as it relates to oil trade precisely crude oil price growth rate, petroleum products price growth rate, crude oil revenue growth rate, imported petroleum products cost growth rate and oil terms of trade.

Oil sector management: It is hoped that this study and recommendations thereafter made will be of immense benefits to the oil sector management policy makers in Nigeria. This will enable the policy makers compared their previous policy stance, where they got it wrong and for improvement given current empirical evidences.

Researchers: This study will also be an invaluable reference material for scholars and other researchers of economics, precisely development economics in the universities, and other tertiary institutions. In addition, it will also contribute to the body of knowledge in the field of development economics, petroleum economics, energy economics and other related fields of study.

Nigerians: The findings and recommendations made thereafter will also stand as guide to the Nigerians who is interested in future governance on the right measure to take with respect to oil sector trade in Nigeria.

1.7 Scope of and delimitation to the Study

This study covered from 1983 to 2017, this period was chosen to capture the periods Nigeria witnessed fluctuations in international price of both crude and refined petroleum products and periods Nigeria witnessed both positive and negative economic growth rate. This is because Nigerian economic performance anchors strongly on oil trade.

It suffices to say that some constraints were encountered in the cause of this study. For instance, there are discrepancies in respect of information/data on volume and prices of imported refined petroleum products as the information on newspapers differ from information on authorized data collection institutions. Hence for data verification, the researcher relied on data from OPEC,

NBS, CBN, NNPC and WDI. In addition, Nigeria imports numerous refined petroleum products but the refined petroleum products considered in this work are the major once with consistent data which include: premium motor spirit (PMS), dual purpose kerosene (DPK) and automotive gas oil (AGO).

CHAPTER TWO
REVIEW OF RELATED LITERATURE

This chapter provides the conceptual framework and literature, basic theories, empirical literatures and justification of the study etc.. The conceptual framework shows how the Nigeria's oil sector structure is linked to the theoretical variables and how these variables impact on Nigeria's economic growth through the oil sector.

2.1 Review of Theoretical Literature

2.1.1 Review of Conceptual Framework

1973 oil boom created stairway for Nigerian economy to depend heavily on upstream oil sector for revenue generation through crude oil exportation. On the other hand, the inability of the domestic refineries to produce at least for domestic consumption have made Nigerian economy to rely heavily on importation of refined petroleum products through the downstream sector. This simply implies that Nigeria's oil sector trade activities cut across supply bloc (exportation of crude oil) and demand bloc (importation of petroleum products). Through the supply bloc Nigeria generate revenue and incur cost through the demand bloc, these trade activities determine not only oil sector performance but Nigeria's economic growth also since Nigerian economy depends heavily on oil trade. In practice the oil supply and demand blocs are subject to changes (negative or positive), when these changes occur either way, it affects the performance of the oil sector as well as Nigerian economy at large.

The performance and growth rate of Nigerian oil sector is determined by a) individual performance and growth rates of the supply and demand blocs b) joint performance and growth rates of the supply and demand blocs. Under the individual performance and growth rate of the supply bloc we have two major determinants i) growth rate of crude oil export price, and ii) growth rate of crude oil export revenue. Under the individual performance and growth rate of the demand bloc we have two major determinants also which include; 1) growth rate of imported price of refined petroleum products 2) growth rate of imported refined petroleum products expenditure. Under the joint performance and growth rates of the supply and demand blocs we have also two major determinants; first, oil commodity terms of trade which measures the gap between crude oil export price and refined petroleum products import price; second, oil double

factorial terms of trade which measures the gap between crude oil export revenue and refined petroleum products import expenditure (cost). All these variables determine the performance and growth rate of Nigeria's oil sector as well as her economy at large. The figures 2.1 below explain these links.

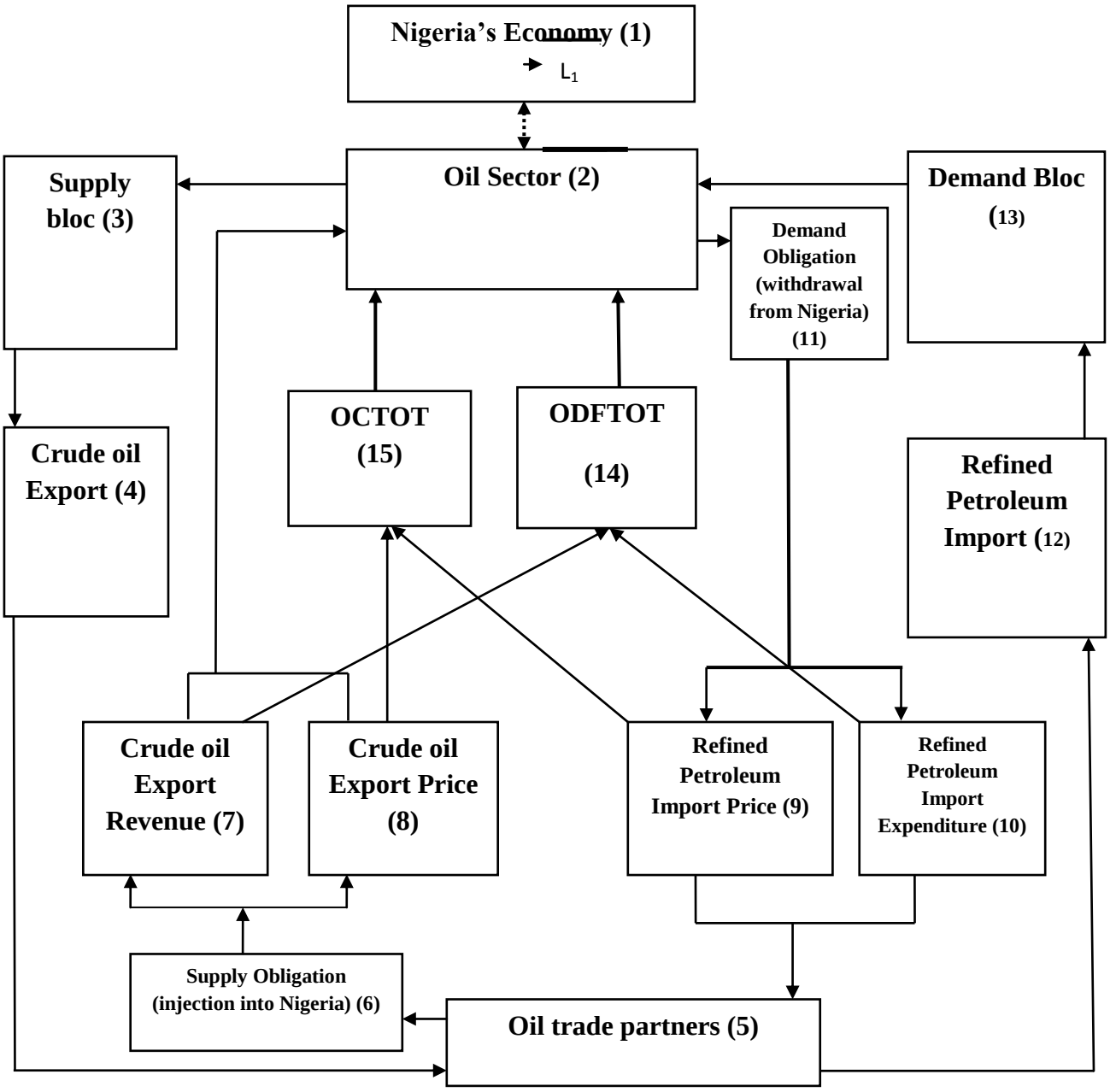

Figure 2.1: The link between Nigeria's oil supply bloc, oil demand bloc, oil terms of trade, and oil sector and Nigeria's economy.
Source: Researchers' Concept.

In figure 2.1 above, the downwards pointing arrow that is line one (L_1) indicates that oil sector is a sector under Nigeria's economy, while the upwards pointing arrow of L_1 shows that the oil sector has influence over the Nigeria's economy. Boxes 3 and 13 show that Nigeria's oil sector trade is structured into supply (export) and demand (import) blocs. Figure 2.1 also indicates that the supply bloc and the demand bloc have influence on the oil sector individually and simultaneously. Individual impact of the supply bloc on oil sector is traceable from boxes 3, 4, 5, 6, 7, 8 and 2, while the individual impact of the demand bloc on oil sector is traceable from boxes 11, 9, 10, 5, 12, 13 and 2. Simultaneous impact of the oil supply and demand blocs on oil sector is shown on interaction between boxes 16 and 2. Oil terms of trade (OTOT) is divided into oil commodity terms of trade (OCTOT) and oil double factoral terms of trade (ODFTOT). OCTOT and ODFTOT capture simultaneously the supply and demand blocs through ratio of export price to import price (P_x/P_m), and ratio of export revenue to import expenditure (P_xQ_x/P_mQ_m). Further figure 2.1 shows that oil sector trade activities have direct impact on the oil sector not on Nigeria's economy, while the oil sector performance has direct impact on Nigeria's economy. Since the supply bloc and the demand bloc have influence on the oil sector individually and simultaneously, their growth rate also has direct impact on the oil sector growth rate. In the same vein oil sector growth rate has direct impact on Nigeria's economic growth rate.

2.1.1.1 Conceptual Literature.

Conceptual literature herein shows brief definition of the variables and how the variables are linked.

Drawing largely from Anthony (2014), Nigeria's economic growth means sustained increase in Gross Domestic Product (GDP) of Nigeria derived from greater amount of domestic input productive efficiency, size of terms of trade and volume of domestic and international trade. Emphasizing on international trade, Nigeria's international trade is managed by different sectors of the economy which in turn influences her economic growth. This implies that Nigerian economic growth depends on sectoral international trade. In this work oil sector is the sector of interest which is established by Nigeria's economy in order to facilitate her economic growth. This means that oil sector is expected to promote Nigeria's economy growth. In the same vein, growth rate of Nigeria's economy depend greatly on oil sector growth rate, theoretically it is

believed that Nigeria's oil sector growth rate will promote her economic growth rate since the nation is rich in oil and depends primarily on oil proceeds.

In fine, Nigeria's oil sector participates in exportation of crude oil (supply bloc) and importation of refined petroleum products (demand bloc). The oil supply bloc herein refers to crude oil export variables which includes a) Export price of crude oil, b) Export revenue from crude oil. The oil demand bloc refers to refined petroleum variables which includes a) Import price of refined petroleum products, b) Import expenditures on refined petroleum products. Theoretically growth rate of these blocs determines the growth rate of Nigeria's oil sector.

Oil term of trade measures the ratio or gap between oil export revenue and petroleum import expenditure as well as the gap between export price of crude oil and import price of petroleum products. Two types of oil terms of trade are considered in this study, which include: a) Oil Commodity Terms of Trade (OCTOT) and b) Oil Double Factoral Terms of Trade (ODFTOT**).** From theoretical view point, these variables have the capacity to influence Nigeria's economic growth rate positively.

2.1.2 Review of Basic Theories

The theories discussed in this paper include; economic growth theory and trade theories that are relevant to the study. Despite the contributions of the theories to the study and how fitted they are there are yet acceptable criticisms leveled against them.

Meade's Neo-Classical Model of Economic Growth:

Meade (1961) cited in Jhingan (2008) constructed a neo-classical model of economic growth which is designed to show the simplest path to economic growth rate. Meade constructed his model around the following assumptions: (i) laissez-faire closed economy where there is perfect competition (ii) there is constant returns to scale (iii) two commodities only are produced in the economy; (a) consumption goods and (b) capital goods (iv) machines are the only form of capital in the economy (v) all machines are assumed to be alike (vi) it is assumed that there is a constant money price of consumption goods (vii) there is full use of land, natural resources and (viii) the ratio of labour to machinery can be changed both in the short and long run.

In the economy visualized by Meade's neo-classical model of economic growth, the net output produced depends upon three factors: (i) the net stock of capital available in form of machines (ii) the amount of available labour force (iii) the availability of land and natural resources. This relationship is expressed in form of the production function as,

$$Y = f(K,L,N) \quad (2.1),$$

Where, Y is the net output, K the existing stock of capital (machines), L the labour force and N land natural resources. Assuming the amount of N to be fixed, net output can increase in any one period with the growth in K and L. This relationship is shown as;

$$\Delta Y = q\Delta K + r\Delta L \quad (2.2),$$

Where Δ in each case represents an increase and q and r represents the incremental product of capital and labour respectively. The increase over the years in the rate of annual net output (ΔY) is equal to the increase in the stock of machinery (ΔK) multiplied by q plus the increase in the amount of labour (ΔL) multiplied by r plus. The annual proportionate growth rate of output is;

$$\Delta Y/Y = qK/Y * \Delta K/K + rL/Y * \Delta L/L \quad (2.3),$$

Where ΔY/Y is the proportionate growth rate of output, ΔK/K and ΔL/L are the proportionate growth rate of capital and labour respectively, qK/Y and rL/Y are the proportional marginal product of capital and labour respectively. Equation 2.3 above shows that growth rate of output depends on the weighed sum of the capital and labour growth rates (Jhingan, 2008).

Meade's model has been severely criticized by kendrich due to its unrealistic assumptions; first the model assumed perfect competition and closed laissez-faire economy which is unrealistic. Second, the model did not give clear explanation of proportional marginal product of capital and labour. Third, it focused on inputs growth rate and neglected the contribution of sectorial activities on sectorial growth rate and contribution of sectorial growth rate to economic growth rate. This model also neglected international trade transactions and the role of institutional factors in the development process. Despite these defects, Meade's model has the chief merit of demonstrating the influence of input growth rates on economic growth rate. The major reason for adopting Meade's model in this study is that Meade's model used economic growth rate as dependent variable, and in this study the dependent variables are Nigerian oil sector growth rate and Nigeria's economic growth rate.

Prebisch-Singer Commodity Terms of Trade (CTOT) Hypothesis:

Two economists Raul Prebisch and Hans Singer from Argentina and Germany respectively submitted independently the terms of trade theory in 1950 which is a two facet theory. Before forwarding the theory, they identified two types of negative effects on primary products of Less Developed Countries (LDC's) which usually results to their negative commodity terms of trade. First negative effect occurs because of systematically different in institutional features of product and factor markets, such as cost-plus-pricing and unionization of labor in the industry. The second negative effect is based on technical progress which cuts across asymmetric distribution of primary products and asymmetric impact of future demand. Asymmetric distribution of primary products and its impact of future demand are favorable to Developed/Industrial countries (DC's/IC's) while unfavorable to LDC's primary products.

The TOT hypothesis is stated in two forms 1) Commodity Terms of Trade (CTOT) and 2) Income Terms of Trade (ITOT). The two constructs focused on the economic implication of exportation of primary products from LDC's into DC's and importation of manufactured products from DC's into LDC's. The theory has gained popularity in literature as a measure of trade efficiency that captures simultaneously the supply and demand sides of international trade. CTOT is the simplest TOT for measurement of international trade efficiency or trade gain. CTOT for any country is defined as the price of that country's export divided by the price of its import or the ratio of country's export to her import or the gap between country's export and her import, CTOT is represented as (P_X/P_M) or ((P_X/P_M)-1)). Economic interpretation of the CTOT is that, as the price of export rises relative to the price of imports, the price gap between export and import should be large enough to purchase a larger quantity of import and bring higher utility and welfare to the citizens of the importing country which will further lead to economic growth and development and vice versa.

For Prebisch-Singer CTOT will always be negative for developing countries and will always contribute negatively to her economic growth even in the long run because demand pressure of manufactured products outstrips the demand pressure of primary products, oil producing countries excluded. By implication manufactured products conducts higher prices than primary products oil products excluded. In addition they opined that primary products of the LDCs face negative aggregate trade elasticity in international market as a result of i) inelastic price of

primary exports, ii) elastic price of imported manufactured products, and iii) inelastic income elasticity. Following the argument of Prebisch-Singer oil producing countries will not face the aforementioned incidence.

Income Terms of Trade (ITOT) on the other hand, attempts to quantify the trend of a country's export based capacity to import goods, as opposed to only the price relations between exports and imports. A rise in ITOT indicates that the country's export earnings now permit her to purchase a greater quantity of imports, ITOT is measured thus $((P_X/P_M)/ P_M)$). Prebisch-Singer hypothesized that ITOT for LDC's is and will continue to be negative because they import more as their income increases and this in turn will lead to elastic income elasticity (Jhingan, 2006).

Some scholars including the followers of Prebisch-Singer have criticized and improved the TOT theory to the credit of forerunners (Jhingan, 2006). For instance TOT theory has been expanded to Single Factoral Terms of Trade (SFTOT), Double Factoral Terms of Trade (DFTOT) and Cross Terms of Trade (CRTOT).

Emmanuel's Double Factoral Terms of Trade (DFTOT)

In 1969 Arthur Emmanuel a Swedish born British economist expanded the Prebisch-Singer ITOT hypothesis by forwarding DFTOT with the view that ITOT will lead to unequal trade measurement and could be misleading (Duraiappah, 1978). In Emmanuel's postulate, he asserts that the double factors (that is price of export and import, and quantity of export and import) which determines trade gain need to be considered in terms of trade measurement. He forwarded a measurement for DFTOT as thus P_XQ_X / P_MQ_M against P_XQ_X / P_M which Prebisch-Singer described as ITOT; by interpretation, P_XQ_X represents export revenue, P_X is the price of export and Q_X is the quantity exported, P_MQ_M represents import expenditure, P_M is the import price while Q_M is the quantity imported (Jhingan, 2006; Appleyard & Field, 1998). Further, he added that international trade benefits primary export developing countries when the gap between primary export revenue and manufactured import cost is positive or when per unit revenue generated from primary export is high enough to offset per unit cost incurred from manufactured import, if otherwise, trade will deter the development of the primary exporting developing countries.

The DFTOT hypothesis holds relative opinion with CTOT hypothesis in some context and slight different in some cases. For instance, Emmanuel opined that DFTOT for developing countries influences her economy negatively because they export primary products to developed countries which are price inelastic and import manufactured products from developed countries which are price elastic. This assertion is relatively the same with CTOT hypothesis; in furtherance he added other factors that distinguished his construct from that of Prebisch-Singer. First, he opined that economic and policy decisions of the developed countries spill over negatively into developing countries, thereby resulting to seasonal positive DFTOT in a short period and negative seasonal DFTOT in long period. Secondly, domestic expenditure of the developing countries is too high such that their seasonal positive DFTOT cannot influence their economy positively rather it leads to *immenserized growth. Third,* the pressures from international trade directly or indirectly devalue the currencies of the developing countries thereby contribute to unequal exchange and trade. From these reasons, Emmanuel concludes that DFTOT is unequal between developing and developed countries except oil producing countries.

Like other theories in economics, the TOT theories exist with acceptable critiques; first Ellsworth (1971) criticized Prebisch-Singer and Emmanuel for concluding that TOT is negative for LDC's on aggregate without considering the way international trade data are recorded. Exports he emphasized are usually recorded Free on Board (F.O.B) while imports are usually recorded Cost, Insurance, and Freight (C.I.F). Second, TOT theories neglected quality changes in products and recognized only export-import prices and export-import quantity. Third, the range of elasticity of income, import and export were not specified. TOT theories only noted that primary export of LDC's is price inelastic and their manufactured import is price elastic while their income elasticity to import is income inelastic except oil producing LDC's. In application, inelastic elasticity range from perfectly inelastic ($e_p = 0$) and fairly inelastic ($e_p = \pm 0.1$ to ± 0.9) while elastic elasticity range from perfectly elastic ($e_p = \pm 2$ or $\pm \infty$) and fairly elastic ($e_p = \pm 1.1$ to $\pm$ 1.9) and unitary elasticity range from ± 1. But TOT theories did not explain elasticity concept in detail.

Regardless of the criticisms, TOT theories have been utilized by many empirical studies to measure trade efficiency and gain and for sector specific studies (see Marquez, 1990; Diakosavvas & Scandizzo, 1991).

Prebisch-Singer's CTOT and Emmanuel's DFTOT hypothesis can be applied in Nigeria's oil sector trade given the following reasons: First, the theories capture both export (supply) and import (demand) blocs, and Nigeria's oil sector trade cuts across supply and demand blocs under the management of the upstream and downstream sectors respectively. Second, the composition of the TOT theories cut across individual and simultaneous performance of the supply and demand blocs, and Nigeria's oil sector trade is structured such that the supply and the demand blocs stand as separate entities in terms of exportation of crude oil and importation of refined petroleum products, and their simultaneous performance as a single entity determines Nigeria's oil sector international trade balance which in turn impacts on Nigeria's economic growth.

Third, the TOT theories are rich in composition in that they forwarded variables that can be used to examine both individual and simultaneous activities of the supply and the demand blocs of international trade. For instance, whereas export price and revenue, and import price and expenditure captures the supply and the demand blocs of international trade individually, CTOT and DFTOT capture the supply and the demand blocs of international trade simultaneously.

2.1.3 Review of Other Theoretical Issues

These reviews take into account the brief overview of Nigerian oil sector and NNPC export and import activities through upstream and downstream sub-sectors.

2.1.3.1 Brief Overview of Nigerian Oil Sector

The key Legal and regulatory agencies are;

Ministry of Petroleum Resources

This is the government administrative arm that deals with policy formulation and provides the general direction to other agencies in the sector for the exploration and production of both oil and gas resources. It also oversees all other sectors including downstream, midstream and oil services.

Nigeria National Petroleum Corporation (NNPC)

NNPC is a statutory corporation through which the Federal Government of Nigeria (FGN) participates in the oil and gas industry. The NNPC's primary function is to oversee the regulation of the oil industry through her subsidiaries such as The National Petroleum Investment Manage-

ment Services (NAPIMS), with secondary responsibilities which include overseeing the development of upstream and downstream sectors. NAPIMS, a subsidiary of NNPC, supervises Federal Government of Nigeria's (FGN's) investments in the oil industry.

Department of Petroleum Resources (DPR)

The DPR is responsible for ensuring compliance with the terms governing the award of oil licenses to companies engaged in petroleum operations. Other functions include the following:

(i) Monitors the oil companies' operations to ensure consistency with international industry standards and practices.

(ii) Issues the annual permit (DPR Permit) to the companies, without which they would be unable to operate in the industry.

Nigerian Investment Promotion Commission (NIPC)

The NIPC is responsible for registering foreign investments in Nigeria including oil and gas industry. It also acts as a liaison between investors and government ministries, departments, institutional lenders and other institutions concerned with foreign investments.

Notable incentives in the NIPC Act include, but not limited to, the following:

(i) Enlargement of the modes of payment for foreign equity to include spare parts, raw materials and other business assets acquired without initial disbursement of foreign exchange from Nigeria. (ii) Guarantees foreign investors the unrestricted transferability of dividends or profits attributable to foreign investment in Nigeria and capital repatriation in the event of liquidation. Dividend payments are subject to withholding tax at 10% as final tax.

Nigerian Content Development and Monitoring Board (NCDMB)

The major functions of the NCDMB are to implement the provisions of the Nigerian Oil and Gas Industry Content Development Act, 2010, with respect to supervising, coordinating, administering, monitoring and managing the development of Nigerian Content in the industry. The NCDMB is also to assist local contractors and Nigerian companies to develop their capabilities and capacities.

The key areas of focus of the NCDMB are as follows: (a) Training and employment of Nigerians (b) Facilitate establishment of critical facilities such as pipe mills, docking and marine facilities, pipe coating facilities (c) Promoting indigenous ownership of marine vessels, offshore drilling rigs, etc (d) Integration of indigenes and businesses residing in oil producing areas into main-stream of industry economic activity (e) Promoting services which support industry activities such as banking, insurance, legal, etc.

Niger Delta Development Commission (NDDC)

The roles of the NDDC are to: (a) Formulate policies and guidelines for the development of the Niger-Delta area. (b) Conceive, plan and implement, in accordance with set rules and regulations, projects and programmes for the sustainable development of the Niger-Delta areas (c) Prepare master plans and schemes designed to promote the physical development of the Niger-Delta area and the estimates of the costs of implementing such master plans and schemes (d) Implement all the measures approved for the development of the Niger- Delta area by the FGN and the member states of the commission. (e) Identify factors inhibiting the development of the Niger-Delta area and assist the member states in the formulation and implementation of policies to ensure sound and efficient management of the resources of the Niger-Delta area. (f) Tackle ecological and environmental problems that arise from the exploration of oil mineral in the Niger-Delta area and advise the FGN and the member states on the prevention and control of oil spillages gas flaring and environmental pollution (Klynveld Peat Marwick Goerdeler [KPMG], 2014).

Upstream sector

The upstream sector is responsible for exploration of crude oil and its exportation from Nigeria to rest of the world. In international market, crude oil is the 9^{th} most traded product and the 1060^{th} most complex product according to the product complexity index (PCI) (KPMG, 2014). Internationally, the upstream major trade partners cut across; North America, South America, Central America, Europe, Ocenia/Pacific countries, Asia and far East and African with North America as her largest market. From 2007 to 2017 the upstream sector exported crude oil amounting to the volume in barrel per day as indicated in figure 2.2.

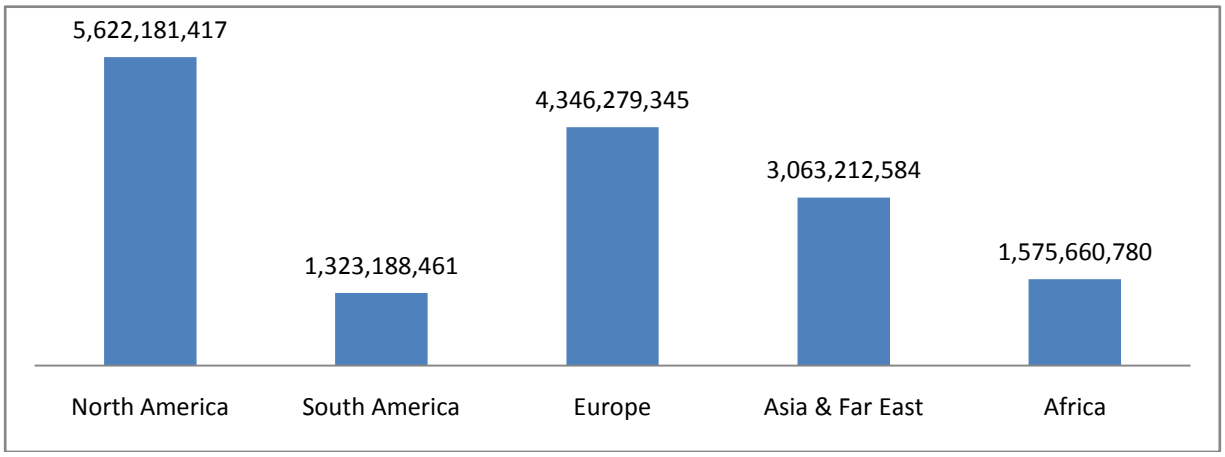

Figure 2.2: The average volume of crude oil export from Nigeria to her major trade partners in crude oil from 1997-2017.
Source: NNPC Bulletin 2017.

Generally, the upstream sector from 1983 to 1989 has on average exported crude oil worth 400,412,849 barrels at average price of $24 per barrel. From 1997-2003 average crude export stood at 704,319,727 and increased to 786,017, 226 in 2011-2017 at average price of $29 per barrel and $95 per barrel respectively (NNPC, 2017).

On the other hand, crude oil export revenue flowing from upstream trade activities has been fluctuating. In 1983 crude oil export revenue stood about ₦7.9 billion and increased to ₦211.9 billion in 1992 which is about 2582.3% increase in ten years. In 1999 oil export revenue increased to about ₦1.2 trillion and further increased to 6.3 trillion in 2005 and 11.1 trillion in 2011 and dropped to 5.6 trillion in 2015 and 7.5 trillion in 2016. This indicate 427.4% growth rate between 1999 and 2005, and 76.9% growth rate between 2005 and 2011, and -49.6% growth rate between 2011 and 2015, and 33.3% growth rate between 2015 and 2016.

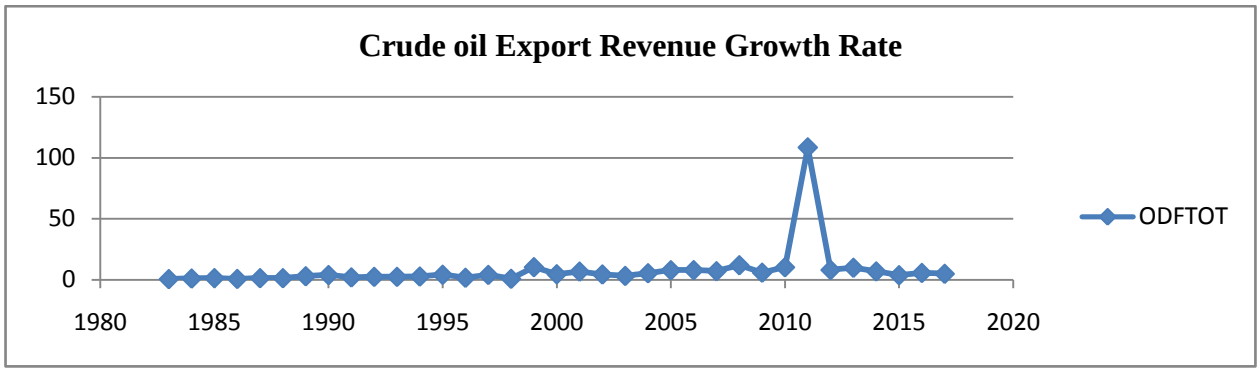

Figure 2.2: Summary of Nigerian crude oil export revenue growth rate from 1983 to 2017.
Source: National Bureau of Statistics NBS.

All the points below zero line in figure 2.3 above indicate negative crude oil export revenue growth rate, whereas all points on zero line indicate zero crude oil export revenue growth rate and all the points above zero indicate positive crude oil export revenue growth rate.

Further, from 1983 to 2017 international price of bonny light crude oil have witnessed negative growth rates in nine periods, for instance in 1998, 2009 and 2016 growth rate of bonny light crude oil stood at -31.43%, -33.56% and -47.45% respectively.

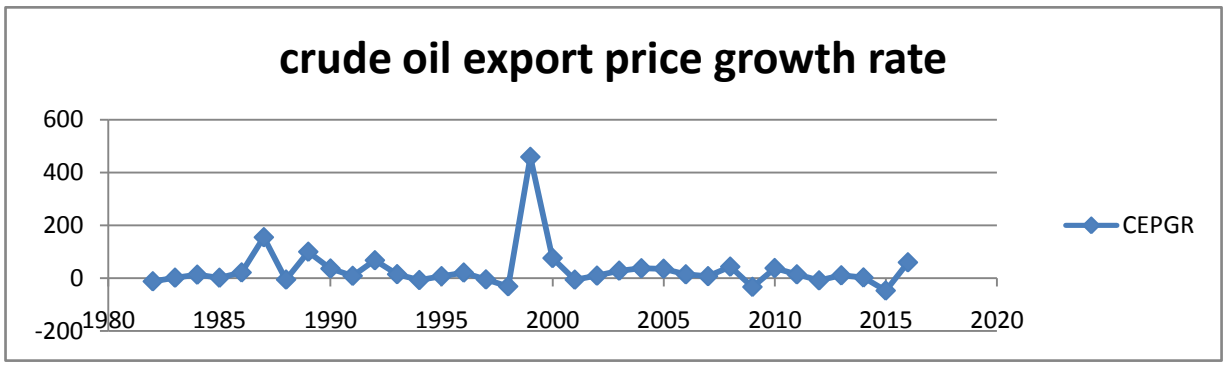

Figure 2.3: Summary of Growth Rate of International Price of bonny light crude oil from 1983 to 2017.
Source: NNPC Statistical Bulletin, 2017.

All points on zero line in figure 2.4 indicate zero crude oil export price growth rate and all points below zero line indicate negative crude oil export price growth rate while all the points above zero line indicate positive crude oil export price growth rate.

Downstream sector

With respect to trade, the downstream sector is responsible for importation and exportation of refined petroleum products from Nigeria to rest of the world. Internationally, refined petroleum products are the 3rd most traded product and the 750th most complex product according PCI (KPMG, 2014). Under the management of NNPC downstream sector, Nigeria own four state refineries with total production capacity of 445,000 barrels per stream day (bpsd) in crude oil. Port-Harcourt refinery carries 210,000 bpsd, Warri refinery carries 125,000 bpsd and Kaduna refinery carries 110,000 bpsd (Oladapo, 2014). Using OPEC crude oil to refined petroleum conversion factor for Nigerian crude oil, all the refineries in Nigeria are suppose to produce approximately 67,372,063.4 litres per day and 24,590,803,141 litres per year worth of refined petroleum products (OPEC, 2015). From the expected productive capacity of Nigerian refineries, evidence has shown that these refineries are producing far below expectations. The tables below show average domestic refining production rate from 1998 to 2017.

Table 2.1 Six years average of domestic production rate from 1998 to 2017.

Refinery/Year	1998-2003	2004-2009	2010-2017
KRPC	23.62	17.16	18.43
PHRC	46.54	34.68	8.47
WRPC	45.15	20. 10	27.20
Average total	38.42	24.00	17.69

Source: NNPC Statistical Bulletin, 2017.

Table 2.1 above shows that domestic production rate is decrease consistently on average, from 1998-2003 domestic production rate stood at 38.42% which reduced to 17.69% within 2010-2017. Poor domestic production as shown above is one of the major reasons for petroleum importation.

Table 2.2: Six years average of domestically produced refined petroleum products (thousand per litre) from 1998-2017.

Year	KRPC	PHRC	WRPC	Total
1998-2003	1,435,467,411	5,401,190,315	3,118,634,205	9,955,291,931
2004-2009	1,042,889,514	4,024,298,749	1,388,298,198	6,455,486,462
2010-2017	1,120,551,191	982,747,961.9	1,878,453,164	3,981,752,317
Average Total	3,598,908,116	10,408,237,026	6,385,385,567	20,392,530,710

Source: NNPC/PPMC report of various years.

Table 2.3: Imported refined petroleum products (thousand per litre) from 1998-2017.

Year	PMS	DPK	AGO	Total
1998-2003	3,294,320,480	452,329,429.6	681,788,696.3	4,428,438,606
2004-2009	6,062,702,900	946,278,570	254,298,865.9	7,263,280,336
2010-2017	4,974,361,551	1,811,415,911	0	6,824,656,939
Average Total	14,331,384,931	3,210,023,910.60	936,087,562.20	18,516,375,881

Source: NNPC/PPMC report of various years.

Table 2.4: Total refined petroleum products supplied and demanded (thousand per litre) from 1998-2017.

year	total supply	total demand	surplus/deficit
1998-2003	14,383,730,537	14,525,316,000	-141,585,462.8
2004-2009	13,718,766,797	14,198,292,000	-479,525,202.8
2010-2017	10,980,496,050	15,401,273,143	-32,113,658,747
Average Total	39,082,993,384	44,124,881,143	-32,734,769,412.60

Source: NNPC/PPMC report of various years.

From the total column in table 2.2 one will quickly discover that domestic production is decreasing as the leg length increases, while the total column in table 2.3 indicates that importation of petroleum are increasing relatively. Surplus/deficit column in table 2.4 shows that domestic demand is greater than total supply (total domestically produced plus total imported). Table 2.3 also indicates that out of the three petroleum products of study interest, only AGO is produced more domestically while PMS and DPK are based on importation.

The petroleum products imported into Nigeria are flowing in from different countries of the world at varying international prices, which in turn attract huge costs from Nigerian government.

Nigerian major trade partners with respect to refined petroleum products and the average percentage of oil trade are as follows: Belgium 34%, Netherlands 31%, France 7.7%, Latvia 4.1%, Malaysia 4.1%, Canada 3.5%, Spain 2.8%, Norway 2.2%, United Kingdom 22%, U.S.A 2.8%, Cote D'Ivore 1.7%, Lithuania 1.0%, Estonia 0.93%, United Arab Emirate 1.0% and Israel 0.97%. International price of imported petroleum products from the above mentioned countries has been fluctuating. For instance from 1983 to 1989 average price of refined petroleum products stood at ₦1.33 and increased to ₦11.16 from 1990 to 1997 indicating 735.7% growth rate and further increased to ₦67.81 from 1998 to 2005 and ₦121.20 from 2006 to 2017 indicating 507.92% and 78.72% growth rates respectively. Expenditure on refined petroleum products in the same aforementioned periods stood at ₦8.3billion, ₦58.86billoin, ₦434.3billion and ₦842.4 billion showing 607.7%, 641.4% and 93. 1% growth rates respectively (NBS, 2017).

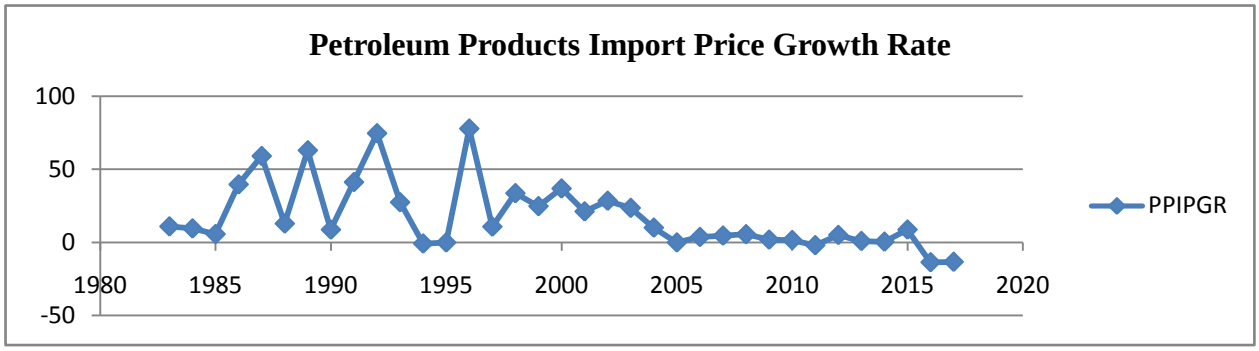

Figure 2.4: Summary of Petroleum Products Import Price Growth Rate from 1983 to 2017.
Source: National Bureau of Statistic (NBS).

Price of imported petroleum has been fluctuating from 1983 to 2017, with zero growth rates in 1995 and 2005, and negative growth rates in 1994, 2011 and 2016 amounting to -0.74%, -1.86% and -13.5% respectively. On the other hand, from 1983 to 2017 expenditures on imported petroleum have witnessed both negative and positive growth rates which are graphically summarized below.

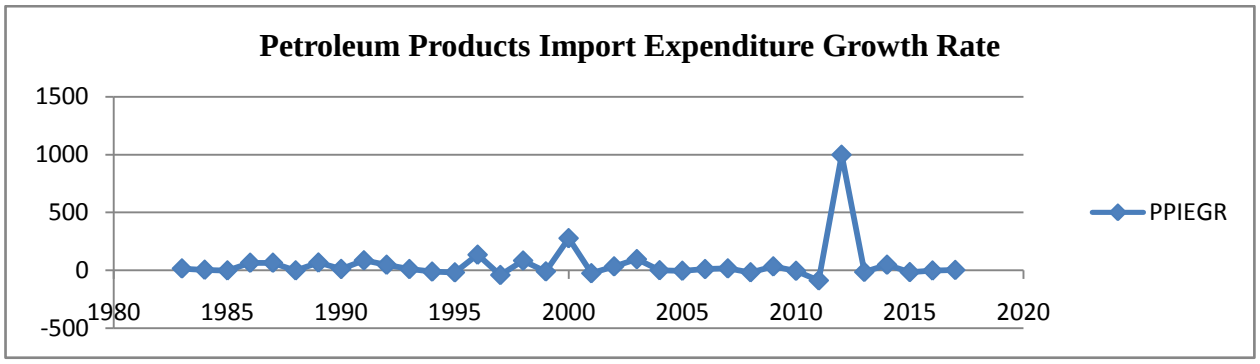

Figure 2.5: Summary of Petroleum Products Import Expenditure Growth Rate from 1983 to 2017.
Source: National Bureau of Statistic (NBS).

Joint activities of Upstream and Downstream sector

From the above background we will quickly discover that; a) oil trade have lasted for more than three decades in Nigeria b) both crude oil and petroleum products are complex and highly tradable products c) relatively Nigerian crude oil supply and petroleum products demand are linked to the same destinations d) price of crude oil and petroleum products are both downwards and upwards flexible e) crude oil revenue and expenditure on petroleum products are inconsistent.

Given these characteristics, it is paramount to ascertain if there are gains accruable to this pattern of oil trade, and one of the ways to achieve this is to factor in the joint trade activities of the upstream and downstream sectors through terms of trade technique. The terms of trade technique considered in this study are i) commodity terms of trade which measures the ratio and/or gap between export price of crude oil and import price of petroleum products ii) double factorial terms of trade which measures the ratio and/or gap between export revenue from crude oil and import expenditure on petroleum products.

From available data, the gap between export price of crude oil and import price petroleum products is large. From 1983 to 1986 OCTOT stood at ₦32.6:₦1 (gap of ₦31.6), from 1987 to 1991 it increased to ₦45.8:₦1 (gap of ₦44.8). From 1992 to 1996; 1997 to 2001; 2002 to 2006; 2007 to 2011 and 2012 to 2017 OCTOT respectively stood at ₦35.5:₦1; ₦39.3:₦1; ₦58.5:₦1; ₦95.4:₦1 and ₦92.7:₦1. By implication OCTOT in Nigeria is positive, and this is contrary to Prebisch-Singer hypothesis.

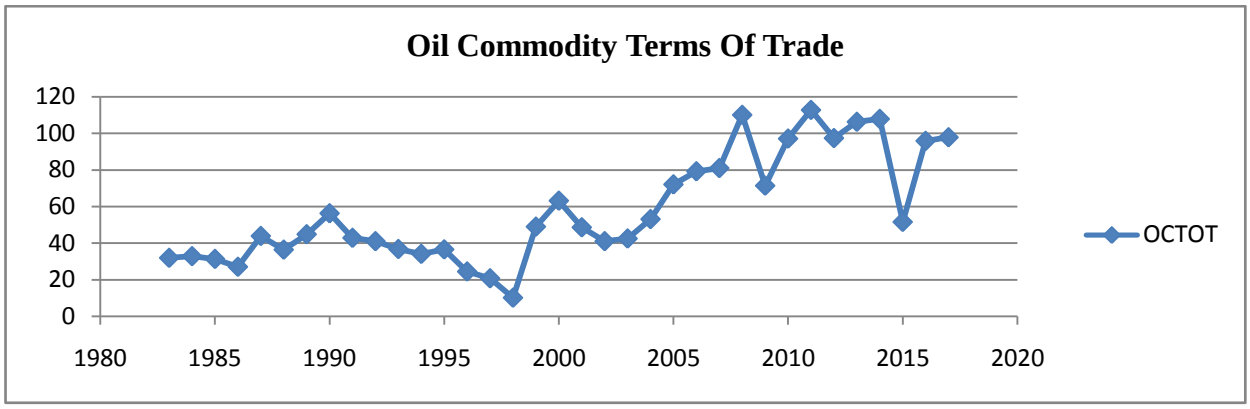

Figure 2.6: Summary of Nigeria's oil terms of trade from 1983 to 2017.
Source: National Bureau of Statistic (NBS).

On the other hand, Nigeria has witnessed positive but fluctuating double factorial terms of trade in her oil sector trade. For instance, from 1983 to 1986 ODFTOT stood at ₦2:₦1, which increased to ₦2.4:₦1from 1987 to 1991, and further increased to ₦2.7:₦1from 1992 to 1996. The increase gained more support which amounted to ₦5.4: ₦1 and ₦5.8:₦1from 1997 to 2001 and 2002 to 2006 respectively. From 2007 to 2011 ODFTOT stood at ₦28.7:₦1, and from 2012 to 2017 it dropped drastically to ₦6.9:₦1. Economically speaking if other sectors of Nigerian economy are properly managed to at least equilibrium point, revenue generated from crude oil export within this study period is large enough to offset the cost incurred in petroleum import. Secondly, given the gaps between crude oil export revenue and petroleum import cost there shouldn't be outcry of fuel subsidy removal from federal Government. Finally, ODFTOT in Nigeria is positive which contradicts Emmanuel's TOT hypothesis.

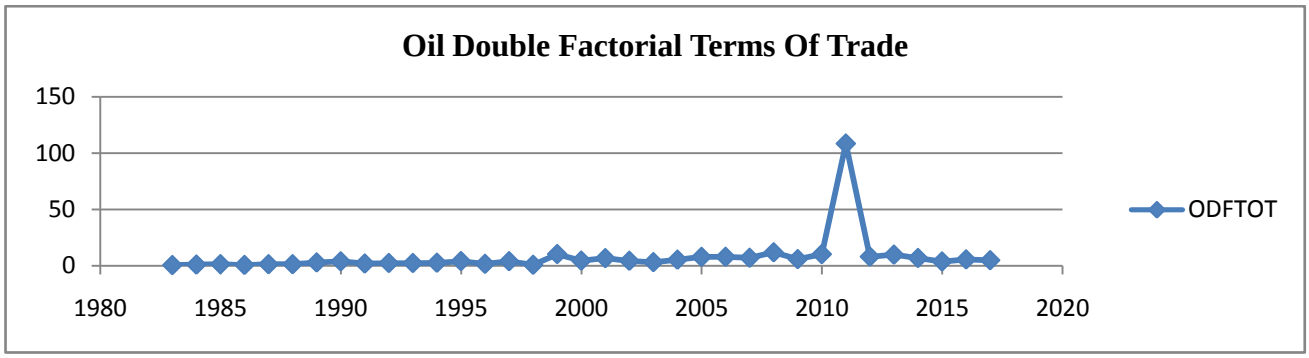

Figure 2.7: Summary of Nigeria's oil double factorial terms of trade from 1983 to 2017.
Source: National Bureau of Statistic (NBS).

Summarily, within this study period Nigeria has witnessed positive fluctuating terms of trade in her oil sector trade as shown in figure 2.7 and 2.8, and this is contrary to Prebisch-Singer and Emmanuel's TOT hypothesis.

In the face of oil export and import activities by the upstream and downstream sectors as shown in figures 2.3, 2.4, 2.5, 2.6, 2.7 and 2.8 respectively, Nigerian oil sector and Nigerian economy at large have witnessed both positive and negative growth rates which may be attributed to these trade activities since Nigerian economy depend solely on oil sector activities.

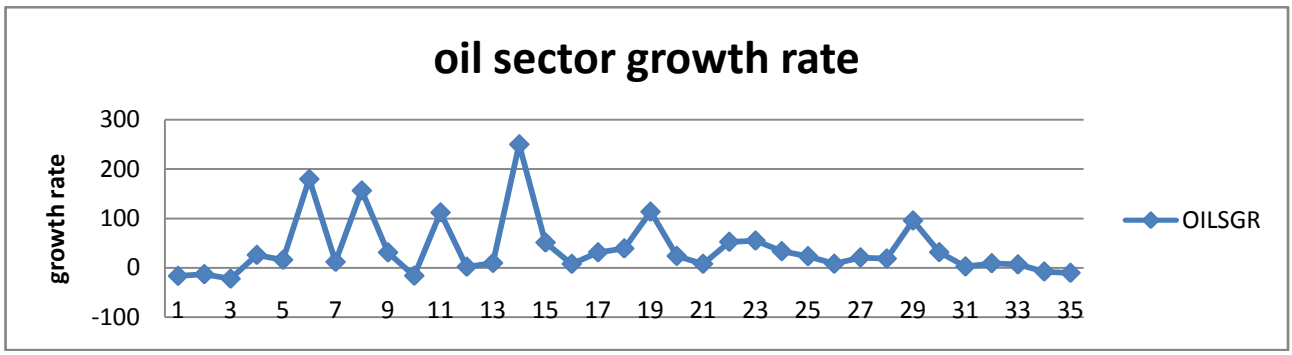

Figure 2.8: Trend of oil sector growth rate from 1983 – 2017.
Source: CBN Statistical Bulletin.

In 1983, 1984, 1991, 2015 and 2016 oil sector witnessed negative growth rate recording to -13.2%, -22.3%, -16.2%, -7.7% and -10.4% respectively. Since 1983 down to 2017 the best growth rate record is 249.8% in 1995, followed by 179.5% in 1987, 156.3% in 1989, 113.4% in 2000, 111.8% in 1992 and 95.5% in 2010 (CBN, 2017).

In 1983, 1984, 1991 and 2016 Nigeria witnessed negative growth rates recording -7.58% and -0.51%, -0.55% and -1.58% respectively. Outside the aforementioned periods Nigerian economic growth rate has been positive with best performance of 14.6% in 2002, 11.6% in 1990 and 10.4% in 2004 (CBN, 2017). A close review has shown that except in 2015, all the negative growth rates witnessed by the oil sector affected Nigerian economic growth rate with difference in magnitude. The negative effect is large on the economy and less on oil sector.

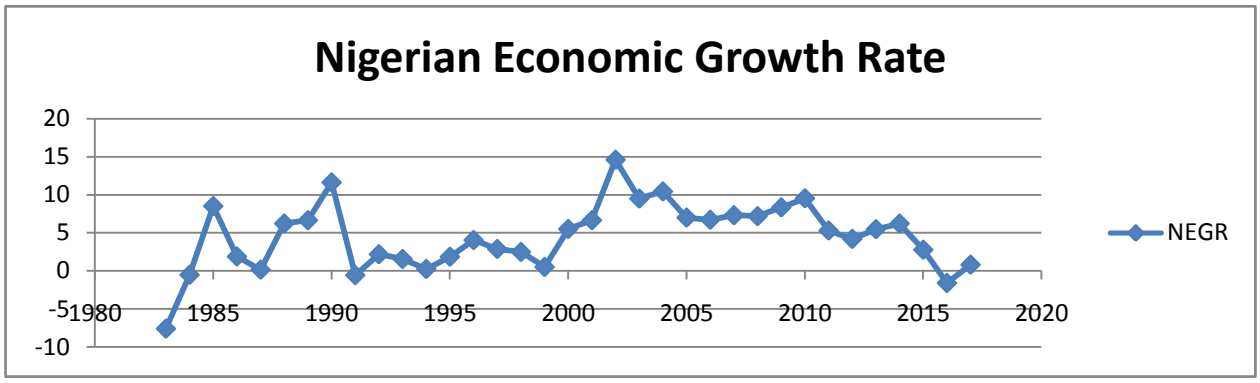

Figure 2.9: Trend of Nigerian economic growth rate from 1983 – 2017.
Source: CBN Statistical Bulletin.

Given the fluctuating nature of Nigerian oil sector and Nigerian economy, the outstanding questions are: i) what impact have changes in oil export and import on changes in Nigerian oil sector? ii) what impact has changes in Nigerian oil sector on changes in Nigerian economic growth? iii) What effect has oil terms of trade on changes in Nigerian oil sector? iii) does changes in Nigerian oil sector predict the direction of changes in oil export and import variables? etc.. To give answers to the above question and beyond have attracted a lot of literature which will be discussed in literature review.

International oil trade

At international frontier oil is traded physically or by customization and by commoditization. Customizable oil trade is divided into a) spot oil market, and b) forward oil market. The term "spot oil market" generally refers to a short-term oil transaction where oil physically changes hands very soon after the seller receives payment. On the other hand, forward oil markets refer to contracts where buyers and sellers agree up-front on a price for a commodity that will be delivered at some point in the future. Customizable oil trade (spot and forward oil market) entails one-on-one transactions between two companies or a company and a country or between two

countries. In customization oil produce can be exchanged for money or for another commodity or for debt settlement, many countries including OPEC members sell more at spot oil market "price" (Cunningham, 2015).

Commoditization of oil trade means the exchange of oil produce in commodity exchange market like other commodities/stocks such as Gold, silver and currency. Oil exchange floor is where oil suppliers and buyers meet to trade various blends of oil via options, futures and physical delivery of crude oil and other oil products. In commoditization of oil trade, oil is traded with options and futures contract. Oil options and futures contract are standardized exchange-traded contracts in which the contract buyer agrees to take delivery from the seller, a specific quantity of oil at a predetermined price on a future delivery date. The difference between futures and forward oil markets can be confusing at times. The primary difference is that a futures contract is a highly standardized oil commodity sold through a commodity/financial exchange, rather than a highly customizable contract bought and sold through one-on-one transactions. OPEC members sell more on customizable oil market rather than commoditized oil market whereas the reverse holds for non-OPEC members. Oil futures and forward markets protect and "hedge" against rising or falling prices resulting from all forms of turmoil that causes global oil price volatility (EIA, 2016).

The major exchanges in which oil is traded are; The New York Mercantile Exchange (NYMEX) in New York City, The Intercontinental Exchange (ICE) in London and Atlanta, West Texas Intermediate (WTI) in U.S, The Tokyo Commodity Exchange (TOCOM) in Japan, Singapore exchange (SGX), Dubai exchange (DGX) and newly established International Energy Exchange (IEE) in Shanghai China. Different forms of crude oil blends and grades are trade in the aforementioned exchange floors globally. For instance, Light sweet crude are exchanged in NYMEX, TOCOM and WTI while ICE exchange Brent crude oil and SGX, DGX and IEE exchange medium-sour crudes, this indicates that oil are heterogeneous commodity (Seth, 2015).

Crude oil is heterogeneous in that some can be extracted at a cost of a few dollars per barrel wheal others requires sophisticated equipment, techniques and processing to extract, and is thick as tar, requiring special methods to transport it to the refinery (and to refine into saleable petroleum products). In general, oil with a low viscosity is referred to as "light," while thicker, higher-viscosity crude oils are referred to as "heavy." Light oils are generally valued higher than

heavy oils. The viscosity of crude oil is measured on a scale known as the American Petroleum Institute (API) gravity. The API gravity scale measures how heavy or light a crude oil is, relative to water (thus the terms heavy and light oil). The API gravity of a crude oil is measured by taking its specific gravity (density relative to water). Sulfur content is another important factor that determinants the value and heterogeneity of crude oil; the lower the sulfur content the better. "Sweet" oils are low in sulfur, while “sour” oils have higher sulfur content (British Petroleum, 2016).

The API gravity of crude oils varies from 5^0 API to 55^0 API. Average crudes have a 25^0 API to 35^0 API range whilst light crudes range from 35^0 to 45^0 API and heavy oils below 25^0 API (Mian, 2011). Light and sweet crude oils are more desirable and usually priced higher than heavy, sour crude oils. This is because gasoline and diesel fuel which typically sell at a premium to residual fuel oil or other “bottom of the barrel” products, can usually be produced easily and cheaply using light sweet crude oil and these crudes require far less sophisticated and energy intensive processes. Sour crudes are corrosive and require extra treating costs (EIA, 2012).

Nigeria is one of the countries in the world that has Light-sweet crude and enjoy rosy oil price during upward oil price trend. Nigeria’s Bonny light has conducted the highest price in OPEC since 2012-2018 among OPEC reference basket and corresponding components spot prices with United Arab Emirates Murban as second. Nigeria’s Forcados has conducted the third highest price in OPEC since 2012-2018 among OPEC selected spot crude oil price behind Malaysia’s Miri and Tapis respectively (OPEC, 2018). Because of heterogeneous nature of oil product, OPEC forwarded crude and refined petroleum products barrel/tonne conversion factor for her members.

Table 2.5: OPEC Conversion factors

CRUDE OIL				
Standard factors	Metric tonne	Long ton	Barrels	Cubic metres (kilolitres)
Metric tonne	1	0.984	7.33	1,165
Long ton	1,016	1	7.45	1,128
Barrels	0.136	0.134	1	0.159
Cubic metres (kilolitres)	0.858	0.887	6,289	1
BY COUNTRY (barrel/tonne)				
Algeria	8.06677			
Angola	7.31017			
Ecuador	7.02728			
IR Iran	7.40156			
Iraq	7.39482			
Kuwait	7.21000			
Libya	7.67078			
Nigeria	7.42038			
Qatar	7.15292			
Saudi Arabia	7.34446			
United Arab Emirates	7.58250			
Venezuela	6.79135			
Average OPEC	7.34591			
REFINED PETROLEUM PRODUCTS (barrel/tonne)				
Liquefied Petroleum Gas	11.6482			
Aviation spirit	8.6162			
Natural gasoline	8.4998			
Motor spirit	8.4998			
Kerosene	7.7652			
Jet fuel	7.7652			
Distillate fuel oil	7.2296			
Lubricating oils	6.9886			
Other fuel oils	6.9118			
Residual fuel oils	6.6208			
Asphalt and bitumen	6.0478			

The quality of Nigeria's crude oil and the need for oil in world production output coupled with globalization which opened the horizon for nations to engage in multi and bilateral agreement have attracted oil trade between Nigeria's and many regions of the world economy.

Nigeria's crude oil trade partners

Statistical evidence has shown that Nigeria exports crude to many regions of the world with North America, South America, Europe, Asia & Far East and Africa occupying as the major partners. Table 2.6 below shows the quantity of crude oil exported to the stated regions from 1997-2017.

Table 2.6: Regional crude oil export (thousand per barrel), and international average price of forcados and Bonny light crude oil ($ per barrel)

Year	North America	South America	Europe	Asia & Far East	Africa	IPCO
1997-2003	266,715,327	48,612,256	175,449,418	143,117,419	53,091,428	22
2004-2010	377,347,514	73,263,067	150,758,961	125,047,222	83,927,478	69
2011-2017	118,451,850	67,151,600	294,688,670	169,437,157	88,075,492	86

Source: NNPC and OPEC bulletin 2017.

Table 2.6 above indicates that North America is the major importer of crude oil from Nigeria, however from 2012-2017 North America's import dropped drastically when compared with1997-2011 period. NNPC (2017) revealed that U.S and Canada imports about 88% of crude oil exported to North America; Energy information Administration (EIA, 2017) reports that U.S is the highest consumer of energy in the world oil alike as well as the highest producers of energy sources in the world except in oil despite shale oil evolution. EIA (2017) also reveals that Canada has made tremendous improvement in oil production mainly in deep water offshore and oil sands. These reports may raise concern over the future of Nigeria in oil market precisely in North America; howbeit, Europe, Asia & Far East and Africa markets are relatively encouraging. Regardless, for in-depth understanding and for policy formation since the export quantity and international price of crude oil fluctuates there is a need to query crude oil export stability and year-by-year price elasticity of crude oil export to the different regions.

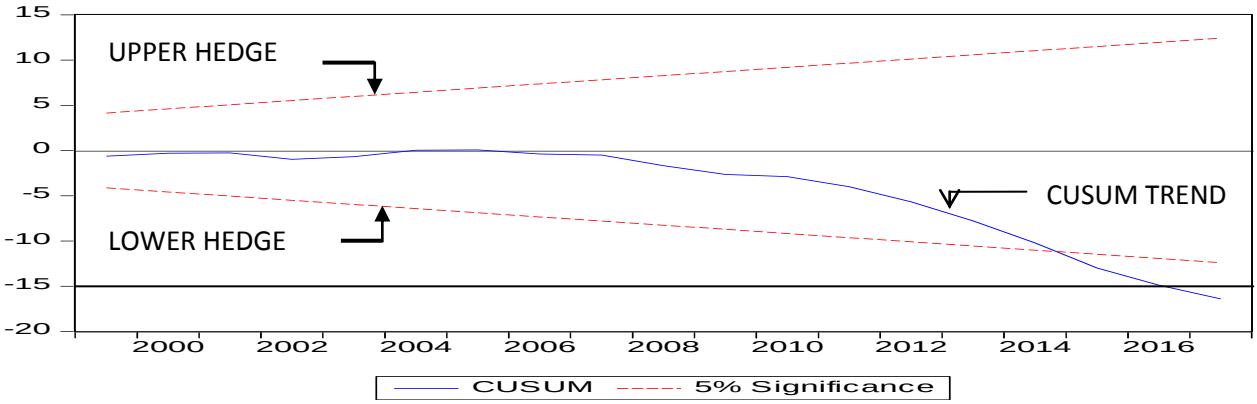

Figure 2.9: CUSUM stability test of crude oil export to North America and international price of crude oil from 1997 – 2017.
Source: Authors computation using NNPC and OPEC bulletin 2017.

The CUSUM stability test indicates that crude oil export to North America is downward and unstable given fluctuations in international price of crude price from 1997– 2017. This is evidenced by the CUSUM trend which surpassed the lower hedge (lower dotted line) line even at -15. This implies that relevance of Nigeria oil may crash in North America's oil market in the near future, and it rekindles the speech of Sheik Ahmed Zahi Yamani, the longtime Saudi oil minister and a key founder of OPEC, who summed up the world oil market the most nicely. He said, "The age of stone came to an end, not for lack of stones, and the oil age will end not for lack of oil, but oil will first price out itself, and pave way for energy technology which will creates endless hole in oil market" (Farrell & Brandt, 2006).

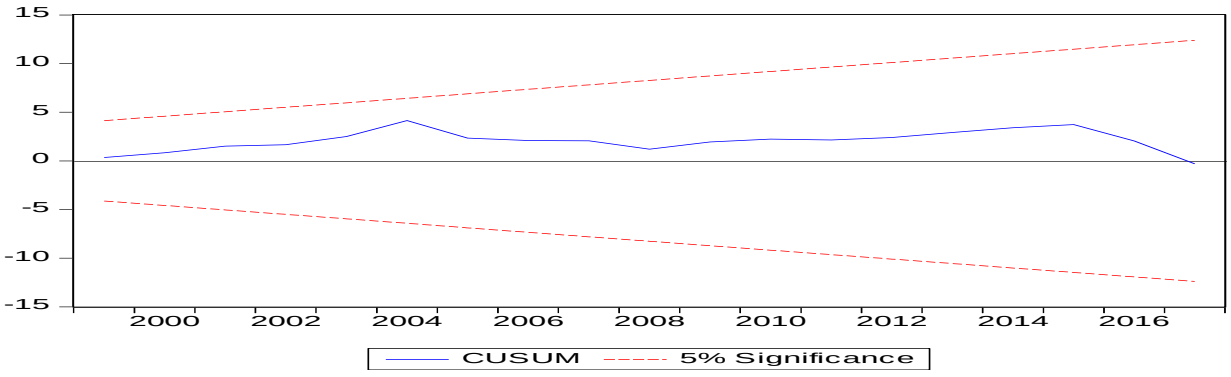

Figure 2.10: CUSUM stability test of crude oil export to South America and international price of crude oil from 1997 – 2017.

Source: Authors computation using NNPC and OPEC bulletin 2017.

Figure 2.10 shows that crude oil export to South America is relatively stable given fluctuations in international price of crude price from 1997– 2017 though with a sign of deterioration in the near future. This is supported by the CUSUM trend pointing to negative segment of the stability curve. It further shows a relative negative risk or the tendency of dropping out of South America's oil market which may be a deter Nigeria's oil export revenue.

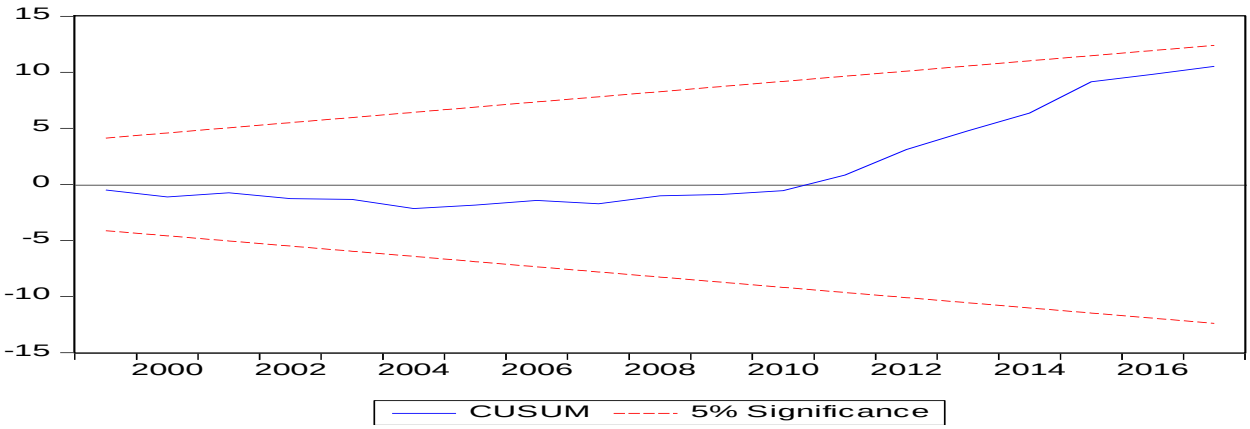

Figure 2.11: CUSUM stability test of crude oil export to Europe and international price of crude oil from 1997 – 2017.
Source: Authors computation using NNPC and OPEC bulletin 2017.

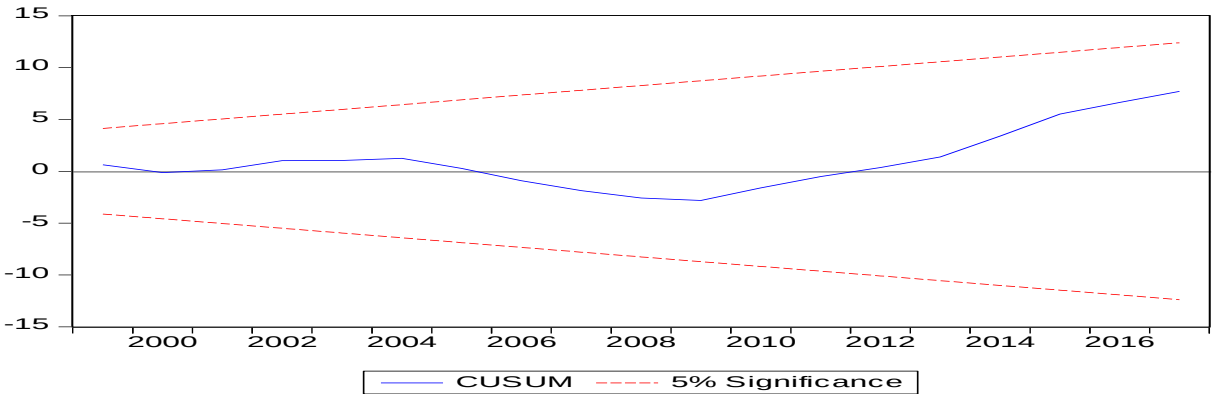

Figure 2.12: CUSUM stability test of crude oil export to Asia & Far East and international price of crude oil from 1997 – 2017.
Source: Authors computation using NNPC and OPEC bulletin 2017.

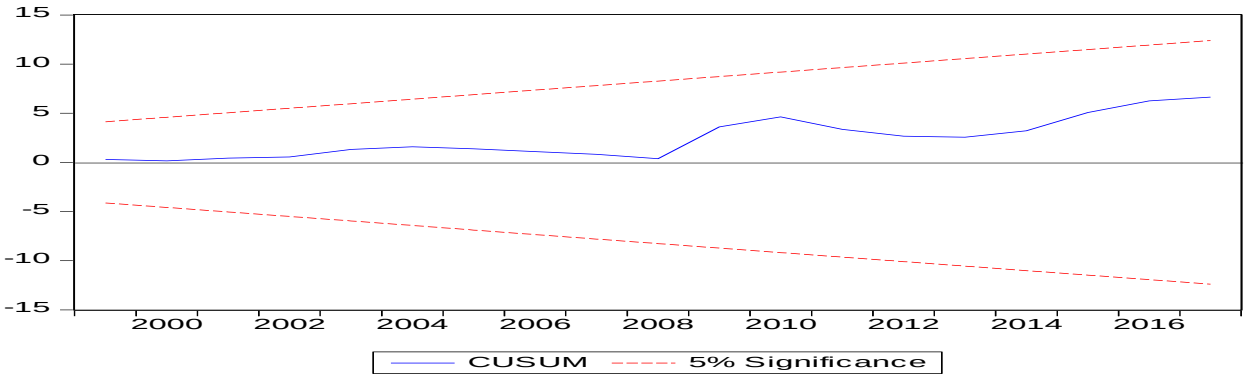

Figure 2.13: CUSUM stability test of crude oil export to Africa and international price of crude oil from 1997 – 2017.
Source: Authors computation using NNPC and OPEC bulletin 2017.

Figures 2.11, 2.12 and 2.13 indicate that Europe, Asia & Far East and Africa oil market are stable given fluctuations in international price of crude price from 1997– 2017. Meaning that within the aforesaid period Nigeria have enjoyed encouraging markets in Europe, Asia & Far East and Africa and have earned stable oil revenue thereof.

Table 2.7: Price elasticity of Nigeria's crude oil export to her trade partners (using point elasticity approach) from 1998-2017

year	North America	South America	Europe	Asia & Far East	Africa
1997-2003	-0.7068	-0.9469	-0.9684	0.6876	-0.0926
2004-2010	0.3056	0.2675	-0.1088	-0.4151	-0.5175
2011-2017	-7.9350	2.5843	10.8445	-0.1468	0.9602
Ave.Total	-8.3362	1.9049	9.7672	0.1256	0.3500

Source: Authors computation using NNPC and OPEC bulletin 2017.

Table 2.7 shows that within 1997-2017 price elasticity of Nigeria's crude oil export to North America is negative perfect elastic meaning that decrease (increase) in crude oil price on average attracts greater than proportionate increase (decrease) in quantity demanded. While Nigeria's crude oil exports to Europe and South America is positive perfect elastic and fairly elastic respectively meaning that decrease (increase) in crude oil price on average attracts greater than proportionate decrease (increase) in quantity demanded in these markets. Asia & Far East and Africa are positive fairly inelastic meaning that in these markets decrease (increase) in crude oil price on average attracts less than proportionate decrease (increase) in quantity demanded. It

suffices to say that this explanation is limited to price only but in practice there are wide range of factors that determines crude oil import and export.

Gyagri et al. (2017) highlighted the following factors as determines of crude oil export: API gravity and sulphur content, Supply and Demand pressures, Production and Consumption pressure, activities of Organization of Petroleum Exporting Countries (OPEC), Futures Market, actions of Speculators and Brokers, Exchange Value of the Dollar, activities of the Governments of oil Consuming and Producing Countries, Political Tensions and Economic Factors, Natural Factors, Other Energy Sources and Refinery Capacity.

Nigeria's trade partners via refined petroleum products

Like crude oil, refined petroleum products are traded physically and by commoditization through spot, forward oil market and oil futures contract respectively. Onoh (2015) forwards that the same countries Nigeria is exporting crude oil to, are partly the same in which she is importing refined petroleum products from. Table 2.8 below sourced from Product Complexity Index Ranking (PCIR) shows the regions and the percentage of refined petroleum products imported from each into Nigeria.

Table 2.8: Imported quantity of refined petroleum products in percentage (%)

year	North America	South America	Europe	Asia & Far East	Africa
1997-2003	4.50	9.5	49.8	3.94	17
2004-2010	4.25	11.47	62.85	1.99	18.82
2011-2017	11.02	0.25	76.85	4.35	6.94

Source: PCIR (2017).

Generally tables 2.6 and 2.8 sourced from NNPC and PCIR respectively show that the regions Nigeria is exporting crude oil to, are the same in which she is importing refined petroleum products from, this is not substantially different from Onoh (2015) report. Issues of this nature, coupled with high fluctuation in international price and crude oil export revenue, excessive refined petroleum import dependent, macroeconomic instability, unstable exchange rate, high level poor poverty etc. amidst of high oil deposit have attracted plethora of empirical literature geared towards examining the impact of oil sector trade on Nigerian economic growth.

2.2 Review of Empirical Literature

The empirical literatures herein are research works closely related to the study under review which tried to examine the impact of oil sector trade on Nigerian economic growth with diverse technique of analysis.

Studies on crude oil price shocks and Nigerian economic growth.

Ben, Abayomi and David (2016) examined the effects of crude oil price shock on macroeconomic performance in Nigeria using yearly data from the year 1979 to 2014 and adopted unrestricted Vector Autoregressive model. They estimated the relationship between oil price changes, inflation rate, GDP and real exchange rate and observed that a change in oil price leads to a more than proportionate change in real exchange rate, interest rate and GDP in Nigeria. They recommended thereafter that Nigeria government should diversify from the oil sector to other sectors of the economy so that crude oil will no longer be the mainstay of the economy and frequent changes in crude oil price will not influence exchange rate volatility significantly in Nigeria. Ben et al made good contribution to knowledge by finding out that a change in crude oil price leads to a more than proportionate change in real exchange rate, interest rate and Gross Domestic Product in Nigeria. Regardless, their study is defeated in some areas; for instance, the macroeconomic variables adopted by Ben et al are affected not only by (oil supply bloc) crude oil price shocks. Exchange rate, interest rate and GDP are also affected by (oil demand bloc) cost and prices of imported petroleum products but Ben et al did recognize these factors in their study. Hence, there is need to factor-in the demand side of oil trade for comprehensive analysis. The present study tries to bridge this gap by analyzing the effect of oil supply and oil demand on Nigeria oil sector performance, with precise interest on the impact oil supply growth rate and oil demand growth rate on Nigeria oil sector performance growth rate.

Abdulkareem and Abdulhakeem (2015) examined crude oil price and macroeconomic volatility in Nigeria1980 – 2012 and provided analytical insight on modelling macroeconomic and oil price volatility in Nigeria. The paper employed Generalized Autoregressive Conditional Heteroskedastic (GARCH) model and its variants with daily, monthly and quarterly data. The findings of the study revealed that: all the macroeconomic control variables considered in the study such as real gross domestic product, interest rate and exchange rate are highly volatile

including the core variable which is crude oil price; the asymmetric models outperform the symmetric models; By implication, the Nigerian economy is vulnerable to both internal shocks (interest rate volatility, real GDP volatility) and external shocks (exchange rate volatility and oil price volatility). Therefore, the study concluded that more credence should be given to asymmetric models in dealing with macroeconomic volatility in Nigeria and oil price volatility should be considered as relevant variable in the analysis of macroeconomic fluctuations in Nigeria. The study recommended that Nigerian economy should be diversified by revamping other sectors such as the agricultural sector and the industrial sector in order to reduce the impact of oil price uncertainty on macroeconomic volatility. Abdulkareem and Abdulhakeem no doubt have made a clear point by finding out that the Nigerian economy is vulnerable to both internal shocks and external shocks, but the issues of worry in their study is that they focused only on crude oil export trade which is only an aspect of oil trade in Nigeria. Before 1980 Nigeria have started oil export and import trade, and both sides of trade have influence on Nigerian economy and other macroeconomic variables therein. As a result, analysing one side of oil trade be it the price effect or the revenue effect may not show the true impact of oil trade on Nigerian economy and other macroeconomic variables, as a result, there is need to analyse both sides of oil trade in order to ascertain the real impact of oil trade on Nigeria economy. Nevertheless, the work done by Abdulkareem and Abdulhakeem tried to be more in-depth than Ben et al, but the focus of their studies relied on supply side of oil trade, precisely on price effect of oil supply without considering the price effect of oil demand. In order to bridge this gap the present study factored in oil supply and oil demand and focused precisely on oil supply growth rate, oil demand growth rate and oil terms of trade. This variables are considered in order to take into account changes in oil supply and oil demand as well as gap the between oil export and oil import.

Ahuru and James (2015) examined the impact of oil price volatility on Nigerian economic growth from 1980 to 2013. The study relied on secondary data which was subjected to unit root and co-integration tests and the variables were stationary with evidence of two co-integrated variables, this ensures long-run relationship between the dependent and independent variables in the study. The study made use of VAR and dynamic simulations of forecasting error variance decomposition alongside pair wise granger causality as techniques of analysis. Nominal exchange rate, inflationary rate, public expenditure, oil price volatility were the explanatory

variables while real GDP was adopted as the dependent variable. The study found bidirectional relationship between real GDP and all the explanatory variables. Secondly, the study found also that price volatility does not significantly stimulate real GDP. The study recommended that efforts should be made to safeguard Nigerian economy through appropriate revenue policy measure such as promotion of sound fiscal institutions, promotion of budget flexibility and diversification of the revenue base of Nigerian economy. The work of Ahuru and James is relatively like the work of Abdulkareem and Abdulhakeem, and Ben et al that focused on the effect of supply side variables on Nigerian economy. Statistical evidence has shown that Nigeria is deeply engaged with oil importation (demand) through her downstream sector. Ahuru and James neglected the effect of oil demand on Nigerian economy, whereas oil demand is an integral part of oil trade in Nigeria. Again, Ahuru and James did not substantiate the impact of oil price volatility on Nigerian oil sector performance before stretching it to Nigerian economic growth. It is worth noting that the link between sectorial trade and other sectorial activities are directly linked to the sectorial performance and indirectly linked to general economic growth. But Ahuru and James linked Nigerian economic growth directly to oil sector trade and this is a defeat to their study. Having identified this gap, the present study tries to bridge this gap by analyzing the effect of oil supply and oil demand trade on Nigerian oil sector performance and the impact of oil sector performance on Nigerian economic growth.

Donwa, Mgbame and Onobun (2015) examined the relationship between oil price volatility and Nigerian economic growth. The study covered the period 1970 to 2013, made use of secondary data and applied OLS technique of analysis for the data evaluation. The broad objective of the study was to ascertain the impact of oil price volatility on government revenue and expenditure. Government revenue and expenditure are the dependent variables of the two models specified in the study, whereas global oil prices volatility was used as the core explanatory variable while rate of inflation, level of oil consumption and exchange rate movement was used as control variables. The variables were subjected to co-integration and error correction mechanism test for long and short run status. The obtained results revealed that there exist both long and short run relationship between the depend variables and the explanatory variables, The study also revealed that in the short-run, Nigeria was able to witness increasing economic growth because of the high global oil prices, but in the long-run, the inconsistency of oil prices and lack of diversification of

the productive base of Nigerian economy had a negative effect on Nigeria's government revenue and expenditure. Thus, the study found that global oil prices volatility are the cause of Nigeria's unstable rate of economic growth. This is because oil price changes have considerable effect on government revenue and expenditure. The study also found that Nigeria being a mono-product economy has a special case of the Dutch Disease. The study thus recommended; that the Nigerian government should endeavor to have increased production in non-oil sector and diversify her economy. For instance Nigerian government should industrialize her economy, have fiscal prudence, make reforms in budgetary operations, diversify her exports, maintain accountability and good corporate governance while at the same time avoid waste through privatization and commercialization of government owned corporations. Like Ahuru and James, Abdulkareem and Abdulhakeem, and Ben et al who neglected the effect of oil demand on Nigerian oil sector performance and Nigerian economic growth, Donwa et al neglected the effect of oil demand on Nigerian oil sector performance and Nigerian economic growth. These studies did not consider the effect of petroleum importation on Nigerian oil sector performance and Nigerian economic growth and did not query crude oil supply price elasticity, petroleum import price volatility and elasticity and its effect on Nigerian oil sector performance and Nigerian economic growth. The present study tries to bridge this gap by examining the volatility of Nigerian oil terms of trade which cuts across oil supply and demand as well as examine the impact of oil supply growth rate, oil demand growth rate, crude oil supply price elasticity, petroleum import price elasticity and oil terms of trade on Nigerian oil sector performance growth rate and Nigerian economic growth rate.

Emmanuel (2015) studied the impact of crude oil price volatility on economic growth in Nigeria from 1970 to 2014. The growth variable was proxy to RGDP while crude oil export price, crude oil export revenue, domestic oil revenue and oil reserves was adopted as control variables and crude oil price volatility as the core explanatory variable. The study found that, oil price volatility has negative impact on the economic growth while the control variables had positive impact on the Nigerian economy. Based on the findings, the study summarily recommended that Nigeria should diversify from crude oil export dependent to refined goods export dependent. Emmanuel's work followed the trend of other scholars who has examined effect of oil trade on Nigerian economy from supply point view meanwhile considering the structure and length of

time of oil trade in Nigeria, and changes witnessed in Nigeria's economy as a result of changes in oil trade, studies are meant to factor-in not only the effect crude oil supply on Nigeria economic growth, attentions need to be channeled to effect of oil supply and oil demand growth rate on Nigerian oil sector performance growth rate and Nigerian economic growth rate. The present study tries to bridge this gap by examining the effect of oil supply growth rate, oil demand growth rate on Nigerian oil sector performance growth rate and Nigerian economic growth rate.

Mgbame, Donwa and Onyeokweni (2015) examined the impact of crude oil price volatility on Nigeria economic growth from 1980 to 2011. They found that crude oil price volatility has positive and significant impact on Nigeria economic growth. They recommended thereafter, that Nigeria should diversify its export revenue base in order to minimize over reliance on crude oil, and government should ensure efficiency in operations of budgetary, fiscal prudence, corporate governance, encourage savings and proper accountability as these will further protect the economy from unforeseen negative impact of oil price volatility. Like other literature reviewed , Mgbame et al did not consider the demand side of oil trade in Nigeria and the length of time of oil trade in Nigeria, and the changes witnessed in Nigeria's economy as a result of changes in oil trade. With level of oil export and import activities in Nigeria, studies are meant to factor-in not only the effect oil supply, but also the demand side and examine the effects of the two sides on Nigerian oil sector performance and Nigeria economic growth. In order to close such study gap, the present study tried examine the effect of oil supply growth rate, oil demand growth rate on Nigerian oil sector performance growth rate and Nigerian economic growth rate.

Nwanna and Eyedayi (2015) analyzed the impact of crude oil price volatility on economic growth of Nigeria. The study utilized secondary data from various sources and covers a period of 1980 to 2014. Multiple regressions were used as a tool for data analysis and the findings revealed that there is a positive and significant relationship between oil price and economic growth. Based on the findings the researchers hereby concluded that oil price volatility does not have a positive impact on the economy but oil price itself does. In the light of the above findings, the researchers hereby recommended that, the country should diversify her export revenue base as a means of minimizing reliance on crude oil revenue, and embrace fiscal prudence, reform in budgetary operations, export diversification, revival of the non-oil sector of the economy, accountability and corporate governance.

Ogboru, Terry and Idisi (2015) empirically examined the impact of changes in crude oil prices on economic growth in Nigeria from 1986 to 2015, and relied of secondary data. The explanatory variables adopted in the study are crude oil price, inflation rate, real effective exchange rate, fuel pump price, and GDP growth rate is the dependent variable. The variables were subjected to unit root tests, co-integration test, and granger causality test and the Vector Error Correction Model (VECM) was employed as techniques of analysis. The pretest result shows that there exists both long and short run relationship between the dependent variable and the independent variables, and the study analyzed only the short run effect. The study found that changes in crude oil price impacts positively on Nigerian economic growth rate, they also discovered that a positive and unidirectional relationship that runs from crude oil prices to GDP growth rates exists. The study recommends the need for diversification, building of buffers, more refineries and overhaul of the existing ones. Ogboru et al bridged a study gap by considering the length of time of oil trade in Nigeria, and the changes witnessed in Nigeria's economy as a result of changes in oil trade, but they considered only the changes in the supply side of oil in Nigeria without considering the changes in the demand side. In order to bridge this study gap, the present study focused and examines the effect of oil supply growth rate, oil demand growth rate on Nigerian economic growth rate.

Ibrahim, Ayodele, Hakeem and Yinka (2014) employed the General Methods of Moment (GMM) to examine the impact of crude oil price shocks on the Nigerian economy, using data from 1981 to 2012. After appropriate robustness tests, the study found out that oil price shocks insignificantly retards economic growth while oil price itself significantly improves it. The significant positive effect of oil price on economic growth confirms the conventional wisdom that oil price increase is beneficial to oil-exporting country like Nigeria. Shocks however create uncertainty and undermine effective fiscal management of crude oil revenue. Ibrahim et al tried to bridge a research gap by adopting a different technique of analysis, however, the trend or focus of their study did not differ considerably because crude oil price shocks is integral to oil supply variables. The present study tries to bridge this gap by examining the effect of oil demand on Nigerian economic growth.

Okoro (2014) examined the relationship between oil price volatility and economic growth in Nigeria linking crude oil price volatility, crude oil prices, crude oil revenue and Gross Domestic Product. Using quarterly data sourced from the Central Bank of Nigeria (CBN) statistical bulletin

and World Bank Indicators (various issues) spanning 1980-2010, a non-linear model of oil price volatility and economic growth was estimated using the VAR technique. The study revealed that oil price volatility has negative significant influence on Nigerian economic growth. Furthermore, the result also showed that the Nigerian economy depend strongly on crude oil, to such extent that the country‘s budget is tied to particular price of crude oil. This is not a good sign for a developing economy, more so Nigeria relies almost entirely on revenue from the oil sector as a source of foreign exchange earnings. This therefore portends some dangers for the economic survival of Nigeria. It was recommended amongst others that there should be a strong need for policy makers to focus on policies that will strengthen/stabilize the economy with specific focus on alternative sources of government revenue. Finally, there should be reduction in monetization of crude oil receipts (fiscal discipline), aggressive saving of proceeds from oil booms in future in order to withstand vicissitudes of oil price volatility in future. Despite the use of VAR technique for analysis Okoro followed the path of Ibrahim et al, Nwanna and Eyedayi, Mgbame et al, Emmanuel, Ahuru and James, and Donwa et al who focus on crude oil price volatility and its effect on Nigerian economy, and neglected the effect of oil demand price and its effect on Nigerian economy. In order to bridge this study gap, the present study focused and examines the effect of oil supply growth rate, oil demand growth rate on Nigerian economic growth rate.

Wilson, David, Inyiama and Beatrice (2014) analyzed the relationship between crude oil prices and key macroeconomic variables in Nigeria using time series data from 1980 to 2010. The study examined whether there is prediction between crude oil prices and macroeconomic indicators (inflation, interest rate, exchange rate and real gross domestic product) as well as the impact of crude oil prices on the applied macroeconomic indicators, the research work adopted the Granger causality and the ordinary least squares techniques of analysis respectively. After ensuring data stationarity, the results revealed that in the short run, crude oil price volatility have negative significant impact on Nigeria’ GDP whereas crude price have positive but insignificant relationship with the Nigerian Gross domestic product. Based on the findings, the study recommended that Nigeria should diversify her economy from crude oil export dependent into other sectors of the economy. Wilson et al channeled their work to a new area by examining the relationship between crude oil prices and key macroeconomic variables in Nigeria. But the worry concerning their study is that the macroeconomic variables selected in Wilson et al are not

affected only by crude oil prices; they are affected also by petroleum import prices. Hence, there is need to query the impact of both oil supply and oil demand on macroeconomic variables Nigerian oil sector performance and Nigerian economic growth. The major departure between the present study and Wilson et al is that the later focused of supply side of oil trade while the former factored in both oil supply and oil demand.

Oriakhi and Osaze (2013) examined the impact of crude oil price volatility and its consequences on the growth of the Nigerian economy from 1970-2010. Using quarterly data and employing the VAR methods, the study found that crude oil price volatility impacted positively on real government expenditure, real exchange rate and real import, while it impacted negatively on real GDP, real money supply and inflation, this implies that crude oil price changes determines government expenditure level. The study therefore recommended that government of Nigeria should embrace fiscal prudence, reform in budgetary operations, export diversification, revival of the non-oil sector of the economy, accountability and corporate governance. Oriakhi and Osaze followed the path of Ibrahim et al, Nwanna and Eyedayi, Mgbame et al, Emmanuel, Ahuru and James, and Donwa et al who focus on crude oil price volatility and its effect on Nigerian economic growth, and neglected the effect of oil demand price and its effect on Nigerian economy. In order to bridge this study gap, the present study focused and examines the effect of oil supply growth rate, oil demand growth rate on Nigerian economic growth rate. It is important to note that exclusion of demand side of oil trade while analyzing the effect of oil trade on Nigerian economy is a serious omission because Nigeria is deeply engaged with oil export and import, hence, the two sides must be considered for proper oil trade analysis. Secondly, oil export price volatility affects export revenue directly while oil import price shocks affects import expenditure directly; hence, proper analysis should take into account oil commodity terms of trade which measures simultaneously the full effect of oil export and import as did by the present study.

Umar and Abdulhakeem (2010) examined the effect of crude oil price shocks and Nigerian economy using Variance Autoregressive (VAR) model. Results show that crude oil price shocks have significant impact on real GDP, money supply and unemployment. Its impact on consumer price index is not significant. This implies that three key macroeconomic variables in Nigeria are significantly explained by exogenous and the highly volatile variable. Hence, the economy is

vulnerable to external shocks. As a result, Nigerian performance will be volatile and macroeconomic management will become difficult. The study therefore recommends that Nigeria should diversify her economy in order to minimize the consequences of external shocks. Despite the application VAR as technique of analysis and adoption of price index as part of independent variable in one of the study models, the work of Umar and Abdulhakeem is like other studies such as Okoro, Ibrahim et al, Nwanna and Eyedayi, Mgbame et al, Emmanuel, Ahuru and James, and Donwa et al that focused on the effect of crude oil price shocks on Nigeria economy. In order to bridge this study gap, the present study focused and examines the effect of oil supply growth rate, oil demand growth rate on Nigerian economic growth rate.

Studies on crude oil revenue (income) and Nigeria's economic growth

Nwoba and Abah (2016) examined the impact of crude oil revenue on the growth of the Nigerian economy from 1960 to 2010, with specific interest on the impact of crude oil revenue by multinational oil companies on Nigeria economy growth. The study relied on secondary data which was subjected to unit root and co-integration pretests. The variables exhibit stationarity at first difference, the study then applied ordinary least square (OLS) regression for analysis and found that both in the short run and long run crude oil revenue from multinational oil companies in Nigeria have positive and significant impact on Nigerian economic growth. The study therefore recommended that government should regulate multinational oil companies in Nigeria to reinvest up to 70% of their income after tax in Nigeria for job creation, and sustainable economic growth. Unlike Umar and Abdulhakeem, Okoro, Ibrahim et al, Nwanna and Eyedayi, Mgbame et al, Emmanuel, Ahuru and James, and Donwa et al that focused on the effect of crude oil price shocks, Nwoba and Abah focused on crude oil revenue and the growth of the Nigerian economy and crude oil revenue no doubt is a strong factor in Nigerians economy. Again, Nwoba and Abah tried to close a study gap by conducting a micro study at firm level, but their study did not show the number of multinational oil companies of the study interest and did not also show the individual performance of the multinational oil companies in Nigeria, rather they showed their aggregate performance, that notwithstanding, their study are close to previous studies because the core explanatory variable in the study is oil revenue which is a fraction of oil supply variables. The present study is not a micro study, yet it will bridge a study gap by incorporating

the oil demand side in its analysis because Nigeria is deeply engaged in both oil supply and demand at the international frontier.

Abayomi, Adam and Alumbugu (2015) examined economic impact of crude oil exportation on Nigerian economy from 1970 – 2012. The study relied on secondary data based on the model used in the research work and unit root test was conducted on the data in order to ascertain if the variables are stationary or not, after which they performed co-integration test to analyze the long run relationship among the variables, Vector Autoregressive (VAR) and Vector Error Correction Model (VECM) was also employed for impulse response and short-run analysis respectively. The result obtained from the empirical analysis shows that there exists both long and short-run relationship between the dependent variable and the explanatory variables. The short run results revealed also that crude oil export revenue have positive impact of low magnitude on Nigerian economic growth. The conclusion of the study is that crude oil exports should not be promoted at all cost, but rather the utilization and allocation of the physical resources and labor complement of the country should be utilized in the most advantageous combination with foreign resources and markets to promote domestic oil production. Secondly, economic diversification should be seen as an economic management strategy aimed at ensuring stability of incomes. Like other studies, Abayomi et al did not put into consideration the demand side of oil trade in Nigeria and the accruable shocks in both oil supply and demand trade. This is a big defeat to their study because Nigeria is deeply engaged with oil export and import, and both side influences the direction of Nigerian economy. As a result studies on oil trade in Nigeria should factor in both sides of oil trade in order to properly ascertain the full effect of oil trade on Nigerian economy. Bridging the gap identified in Abayomi et al distinguished the present study from Abayomi et al.

Nweze and Edame (2015) examined oil revenue and economic growth in Nigeria from 1981 to 2014. Secondary data on gross domestic product (GDP) was used as a proxy for economic growth; oil revenue (OREV), and government expenditure (GEXP) which represented the explanatory variables were sourced mainly from CBN publications. In the course of empirical investigations, various advanced econometric techniques like Augmented Dickey Fuller Unit root test, Johansen Co-integration Test and Error Correction Mechanism (ECM) were employed and the result reveals among others: That all the variables were all stationary at first difference, meaning that the variables were integrated of the same order justifying cointegration and error

correction mechanism test. The co-integration result indicated that there is long run relationship among the variables with three cointegrating equation(s). The result of the error correction mechanism (ECM) test indicated that all the variables except lag of government expenditure exerted significant impact on economic growth in Nigeria. However, all the variables exhibited their expected sign in the short-run but exhibited negative relationship with economic growth in the long-run except for government expenditure, which has positive relationship with economic growth both in the long-run and short-run. The study also found that oil revenue has positive relationship of low magnitude on economic growth in Nigeria. Hence, concluded that Government should use the revenue generated from petroleum to invest in other domestic sectors such as Agriculture and manufacturing sector in order to expand the revenue source of the economy and further increase the revenue base of the economy. Nweze and Edame tried to bridge the gap in literature by examining the effect of oil revenue on Nigerian economic growth unlike other studies that focused on the crude oil price volatility. However, oil revenue is a fraction of oil supply variables, the demand side such as cost of imported petroleum products was not captured by Nweze and Edame. The present study tries to bridge this gap by examining the effect of oil demand growth rate on Nigerian economic growth rate.

Offiong et al (2015) analyzed the impact of crude oil revenue on Nigerian economic growth, evidence from cross river state. This study opined that with decreasing demand for fossil oil globally, international price of crude oil have fallen continuously, reaching an all time low of below $30 lately. This has several implications on the Nigerian public finance structure at national and sub-national levels. The study analyzed the impact of this plunge on the economic development of Cross River State (CRS), Nigeria and found that crude oil revenue shocks affected the State's economy inversely. Consequently, the study recommended that CRS government should de-emphasize the over-reliance on crude oil revenue and seek and optimize earnings from other non-oil sectors of the economy. Further, the State's economy should be diversified to boost internally generated revenue with less dependence on Federal government revenue allocation. Finally, there should be effective machinery for checks and balances put up by the government to stem fiscal abuse and wastage of resources by the ministries, departments and agencies in the State. Offiong et al tries to bridge research gap by conducting a micro

research at state level. However, the focused of Offiong et al is still linked to supply side of oil without considering the demand side and its effect on CRS.

Baghebo and Atima (2014) examined the impact of crude oil revenue on economic growth of the Nigerian economy from 1980 to 2011. The study relied on secondary data and used OLS and econometric approaches for the study analysis. The stationary status of the time series data was examined using Augmented Dickey Fuller test. The regressand is Real Gross Domestic Product (RGDP), The regressors are crude oil revenue as core variable and foreign direct investment, corruption index, external debt as control variables. The series attained stationary after differencing. The Johansen cointegration test was conducted to ascertain the long run equilibrium condition of the variables in the model. The variables were cointegrated because four cointegrating equations were found. The Parsimonous model was established to account for the short run dynamic adjustments required for stable long run equilibrium. It was discovered that the variables: crude oil revenue and corruption index impacts negatively on Real GDP, while FDI and EXDEBT have positive impact on the growth of the economy. This means that the resource curse theory is proven to be true in Nigeria. The study concludes that, if the petroleum industry bill is passed and implemented to the letters, there exists hope for the Nigerian nation. Baghebo and Atima followed the path of Nwoba and Abah, Nweze and Edame, and Offiong et al who examined the impact of crude oil revenue on Nigerian economic growth, these studies anchors on oil supply activities without taking in account the oil demand activities. From statistical evidence Nigeria is deep into oil supply and oil demand and both sides contributes to the state of her economy, hence, analysing the effect of oil sector trade on Nigeria economy requires the inclusion of both supply and demand bloc of oil sector trade.

Odularu (2014) investigated the relationship between crude oil export revenue and Nigerian economic performance from 1978 – 2012. Secondary data was used for the study and crude oil export revenue, exchange rate and crude oil domestic consumption were used as explanatory variables while Gross Domestic Product (GDP) served as dependent variable. The variables were subjected to unit root and co-integration preliminary test; the findings revealed that the variables were stationary at first difference and at the same time cointegrated. ECM was used for disequilibrium correction and result revealed that there exist short run relationship between the dependent variable and independent variables. The study adopted OLS technique of analysis to

evaluate the short run result obtained. The result revealed that crude oil domestic consumption and crude oil export revenue have contributed to the improvement of the Nigerian economy. The study therefore, recommended that government should implement policies that would encourage the private sector to participate actively in the crude oil sector. Odularu aligned his study focus with Baghebo and Atima, Nwoba and Abah, Nweze and Edame, and Offiong et al who examined the impact of crude oil revenue on Nigerian economic growth, these studies anchors on oil supply activities without taking in account the oil demand activities. From statistical evidence as shown in the background to the study, Nigeria is deep into oil supply and oil demand and both sides contributes to the state of her economy, hence, analysing the effect of oil sector trade on Nigeria economy requires the inclusion of both supply and demand bloc of oil sector trade.

Ibeh (2013) examined the impact of oil revenue on the economic growth in Nigeria from 1980 to 2010, the research work adopted oil revenue, exchange rate volatility, gross capital formation as explanatory variable and GDP as dependent variable. Summarily, the study came up with the conclusion that oil export revenue plays a key role in the growth of the Nigerian economy. Before 1980 Nigeria have started oil export and import trade, and both sides of trade have influence on Nigerian economy. Analysing one side of oil trade may not show the true impact of oil trade on Nigerian economy, as a result, there is need to analyse both sides of oil trade in order to ascertain the real impact of oil trade on Nigeria economy. But Ibeh focused on supply side of oil trade, in order to bridge this gap the present study factored in the oil supply and oil demand in its analysis.

Ogbonna and Ebimobowei (2012) analyzed the effects of crude oil income on the Nigerian economy for the period 2000 to 2009. The study specified three models using the gross domestic product (GDP), per capita income (PCI), and inflation (INF) as the explained variables, and crude oil revenue as core explanatory variable to the three models specified in the study, petroleum profit tax/royalties (PPT\R), and licensing fees (LF) were also adopted as the explanatory variables to the three models specified. This study relied on secondary data and applied ordinary least squares (OLS) for data analysis and evaluation. The results obtained shows that oil revenue have a positive and significant relationship on GDP and PCI, but a positive and insignificant relationship on INF. Similarly, PPT/R has positive and significant relationship on GDP and PCI, but a negative and insignificant relationship on inflation. It was also found that LF

has positive but insignificant relationship between GDP, PCI and INF, respectively. Based on these findings, this study concludes that crude oil income and PPT/R have positively and significantly impacted on Nigerian economy when measured by GDP and PCI for the period 2000 to 2009. Ogbonna and Ebimobowei did not take into account oil import expenditure, a country such as Nigeria that is into oil export and import should consider the weight of oil import expenditure on oil export revenue before the full effect of oil trade. This is one of the factors that distinguished the current from Ogbonna and Ebimobowei, because this study recognized the weight of oil import expenditure on oil export revenue.

Abiola and Okafor (2013) maintained that one of the fundamental challenges facing policymakers in Nigeria is the benchmarking of crude oil price in the budgeting process and that the appropriate projection of future behavior of crude oil price is imperative in setting and achieving macroeconomic objectives of the government. As a result they surveyed the various forecasting models and examined the current Moving Average benchmarking method to determine the best forecasting model for Nigeria. Using quarterly data from 2005Q1 to 2012Q4 on oil price benchmark, the study found that ARIMA model is the best forecasting model for projecting Nigeria's crude oil price benchmark. Based on this scenario, it was also found that $80 could be the appropriate crude oil price benchmark for 2013 fiscal year. The study suggests that benchmarking of crude oil should be based on the crude oil price fundamental to enhance predictability of policy and promote macroeconomic stability.

Foreign studies

Zhang (2018) examined the effect of crude oil price fluctuations on Canada's aggregate economic activities from 1985-2015. The study made use of secondary data and adopted vector autoregressive (VAR) linear and nonlinear models to estimate the effect of oil price fluctuations on real GDP, real effective exchange rate (REER), real wage, inflation, and short and long-term interest rates. The study found that oil price has significant effects on real GDP, REER and inflation. Furthermore, in the non-linear model, evidence shows that a drop in oil prices has a greater positive impact on real GDP than the rise in oil prices. In the short term, rise in oil prices has a positive effect on the economy. While in the long-run, the effect turns to negative. Like Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) who disregarded the demand side of oil trade in

Nigeria, Zhang (2018) disregarded the demand side of oil trade in Canada whereas Canada imports crude oil. In fact, Canada is one of the major importers of Nigerian crude oil and Nigeria imports refined petroleum products from Canada, hence, there is a need to examine the trade relationship of the two countries recognizing the supply and demand blocs.

Zhang, Lan and Xing (2018) examined the global trade pattern of crude oil and petroleum Products from 2006 to 2015 using Normalized Mutual Information (NMI) or what is known as Analysis Based on Complex Network (ABCN). The study found that; 1) The connectivity of the network of petroleum products is higher than the connectivity of the network of crude oil and the partition of the network of petroleum products is greater than that of the network of crude oil, 2) The financial crisis in 2008 integrated global trade pattern of crude oil and petroleum products, 3) The geographical factor is becoming more obvious in the trade pattern of crude oil, but not so obvious in the trade pattern of petroleum products. Like Millington (2016), Zhang, Lan and Xing conducted a robust study that factored supply and demand network connectivity unlike Ebrahim, Inderwildi, and King (2014), Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) that focused on supply side only. The work under review examined the impact of both the supply and demand sides of oil trade on Nigerian oil sector performance with precise focus on growth rate of the phenomenon.

Foudeh (2017) analyzed the long run effects of oil prices on economic growth of Kingdom of Saudi Arabia (KSA) from 1995Q4-2015Q4 using ARDL bounds testing. The study examined the impact of KSA's oil trade partners on KSA economic growth. The major trade partners included in the work are: China, Japan, South Korea, United Kingdom, USA, India, Canada, France and Germany. The obtained empirical results show a strong positive direct impact of oil price growth rates on the gross domestic product (GDP) growth rates of KSA during the period under study. Again, despite the fact that China is the most important trading partner of KSA, china's oil price growth rates doesn't affect Saudi GDP growth rates indirectly. Rather oil price growth rates weaken the positive long run effect exercised on the GDP growth rates of KSA via trading with Japan. Although trading with South Korea and UK have negative significant effects on the Saudi GDP growth rates, oil price growth rates has no possible indirect effect via trading with UK. But, it has a positive effect on the weighted GDP growth rates of S. Korea via trading with KSA.

Trading with USA, India, Canada, France and Germany have no significant impacts on Saudi economy.

Gyagri, Amarfio and Marfo (2017) used historical approach to examine the determinants of global pricing of crude oil. The objective of the study was to give a general understanding of the crude oil market and the formation of the oil pricing system in the long and short term. The factors highlighted as the major determinants of global pricing of crude oil are; Supply of and demand for crude oil, production of crude oil, crude oil consumption, activities of the corporate organizations such as of Organization for Petroleum Exporting Countries (OPEC) and Organization for Economic Co-operation and Development (OECD), futures market contract, speculators and brokers, exchange value of the dollar, Government in consumer and producer countries, Political tensions, economic factors, natural factors and refinery capacity. These factors encompass supply and demand sides of oil trade, this is unlike Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) that neglected the demand side of oil trade in context of Nigeria whereas oil demand is an integral part of oil trade in Nigerian and occupies large fraction of import expenditure.

Jebran, Abdullah, Elhabbaq and Ali (2017) analyzed the impact of income and price elasticity of crude oil demand on Pakistan economic growth using annual data from 1981 to 2013. The dissertation adopted ARDL bounds testing approach to estimate for both and long and short-run relationship between income and price elasticity of crude oil demand and Pakistani economic growth. The empirical results of the study revealed that income and exchange rate show significant positive relationship with crude oil demand both in the short run and in long run. The analyses also show that crude oil price and domestic production have negative effect in both short and long run on crude oil demand. Income was found to be a stronger determinant of crude oil demand in both short and long run. The study therefore recommended that strategies should be formulated and adopted which has the capacity control the demand of crude oil without affecting the economic growth of Pakistan. Stambuli (2013) and Jebran et al highlighted the importance of demand side of oil trade in Tanzania and Pakistan respectively. This logic can be stretched in other countries such as Nigeria in order to examine the impact oil demand trade on Nigerian economic growth.

Tehranchian and Seyyedkolaee (2017) examined the impact of oil price volatility (OPV) on Iran's economic growth using threshold regression model to analyze the time series data from 1980-2014. Findings of the study show that the threshold value of OPV was approximately 1148. The study also found that the coefficient of OPV decreased in the second regime of oil price shocks compared to the first one regime, as a result, the effectiveness of the OPV on economic growth of Iran decreased over time.

Gasmi and Laourari (2016) investigated the impact of real oil revenue fluctuations on Algeria's economic growth using data from 1960 to 2015. The study relied on secondary data and applied a measure of real oil revenues developed by Gasmi and Laourari (2015) which is endogenous to Algeria's international trade structure. In order to estimate both the short-run and the long-run dynamic relationship between real oil revenues and Algeria's economic growth and industrial sector growth they adopted vector autoregressive (VAR) model and multivariate Johansen co-integration technique of analyze respectively. The co-integration analysis suggests that a long-run relationship exists between real oil revenues, real GDP, and industrial growth in Algeria, while the VAR impulse response function and the variance decomposition analysis suggest that the impact of unexpected shifts in real oil revenues on the country's economic and industrial growth is negative. The study highlighted the importance of supply side of oil trade on Algeria's economic growth, this approach is not different from research conducted by Abayomi et al (2015), Nweze and Edeme (2015), Offiong et al (2015), Baghebo and Atima (2014), Odularu (2014), Ibeh (2013) and Ogbonna and Ebimobowei (2012) in Nigerian context. These studies are defeated on the basis that both Algeria and Nigeria are heavy importers of refined petroleum products as shown in (OPEC, 2018), hence the need to examine the oil demand bloc of the respective countries.

Millington (2016), investigated the impact of low crude oil prices on the Canadian economy from 1986 to 2013 using Input-Output model, a computable version of the Walras General Equilibrium (WGE) model. He found that Canada's economic outlook was affected by decline in the price of oil and that it affected other commodities, currency, investment and employment in the economy. The study also discovered that stronger U.S currency growth weakened Canadian dollar but boosted non-energy exports. Further findings revealed that investment spending and job creation within the study period have also begun to pick up in non-energy sectors, although

significant slack remains in the labour market. The forecast result of the study also observed that overall, Canadian economic growth could be on average of 23 percent lower if low oil prices persist over the next seven years. Hence, recommend that Canadian economic needs to improve more on bitumen and offshore unconventional production. Millington comparatively conducted more robust study than Ebrahim, Inderwildi, and King (2014), Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) by considering the reactions of oil prices on non-energy sector and on other macroeconomic. Despite that, the demand side of oil price was disregarded in the analysis.

Ebrahim, Inderwildi, and King (2014) examined the impacts of oil price volatility (OPV) on Macroeconomic variables in united state of America from 1986 to 2013. The macroeconomic variables under consideration are consumption, investment, industrial production, unemployment and inflation. The study considered both supply and demand sides of price volatility. They found that high degree of OPV has damaging and destabilizing effects on the macroeconomic indicators in U.S. They recommended that U.S government should develop more unconventional energy production technique in other energy sources in order to combat side effects of OPV. The study is more comprehensive when compared with Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) who considered only supply price volatility. The study under review relatively follows Ebrahim, Inderwildi, and King by considering the supply and demand sides of oil trade in Nigeria.

Stambuli (2013) investigated price and income elasticity of oil demand in Tanzania from 1972-2010. The study made of secondary data and adopted ARDL bounds testing, Nerloves' Partial Adjustment Model (NPAM) to estimate the price and income elasticity of oil demand and adopted Chow test approach of analysis to test for structural break of oil demand in Tanzania. The study empirically found that there is no structural break in the estimated oil demand equation. It also found that in the short-run the demand for oil was both price and income inelastic while in the long-run demand for oil was income elastic and price inelastic, meaning that oil demand in Tanzania was more sensitive to income changes relative to oil price changes. The study recommended that Tanzania should opt for bio-fuels and speed up the exploration and later extraction of the discovered oil and gas fields as these will enable the country to save more

foreign currencies which are spent on oil importation. Stambuli highlighted the importance of demand side of oil trade in Tanzania, a logic which can be stretched in other countries Nigeria alike since demand attracts expenditure, depletes national income and import inflation if not properly checkmated.

Diakosavvas and Scandizzo (1991) examined the long-run deterioration in terms of trade of both developed oil and non-oil rich countries and less developed oil and non-oil rich countries. They found both rising and falling trends in both developed and less developed countries. The result of long run bahaviour of primary product prices versus the price of manufactured goods revealed that both developed and less developed countries witnessed long run relative decline in primary-product prices and long run relative increase in manufactured-product prices. Hence, the author's however, stated that this is not identical to secular deterioration in Less Developed Countires (LDC's) terms of trade, since Developed or Industrialized Countries (DC's or IC's) also export primary products and LDC's export manufactured goods. Long run decline in primary-product prices and long run increase in manufactured-product prices is not identical also to secular deterioration in LDC's terms of trade, since developed countries also export primary products and less developed countries export manufactured goods. Further, using data from the International Monetary Funds (IMF's) international financial statistics and international financial statistic yearbooks, the study calculated the trend behavior of TOT for the 1970's and 1980's. The result revealed that developed countries experienced a 0.6 percent annual average decline in their TOT over the aforementioned period, while the LDCs experienced a 3.4 percent annual average improvement. However, if oil-exporting countries are removed from the developing-country calculations, the LDCs experienced a 1.0 percent annual average TOT deterioration. They conducted similar study in 1990's, and found that the developed countries TOT rose to 105.4 by 1995 precisely, while the LDCs' TOT fell to 97.2. However, the oil exporters experienced a dramatic decline to 65.3, while non-oil LDC exporters' TOT fell only slightly to 99.8. Given this result therefore, it is important to distinguish oil producers from the non-oil-exporting LDC.

Marquez (1990) estimated price elasticity of oil imports and exports of Canada, Germany, Japan, United Kingdom, United States, other developed non-OPEC countries, developing non-OPEC countries and OPEC from 1973Q1-1985Q4 using point elasticity approach. The result shows that

Germany, Japan, United Kingdom, United States, other developed non-OPEC countries and developing non-OPEC countries had negative but fairly inelastic import price elasticity, negative fairly inelastic export price elasticity and negative fairly elastic aggregate price elasticity accept United Kingdom that had and negative fairly inelastic aggregate price elasticity. On the other hand, Canada and OPEC had negative but fairly elastic import price elasticity, negative fairly inelastic export price elasticity and negative fairly elastic aggregate price elasticity. Marquez conducted more robust study by considering both supply (export) and demand (import) price elasticity and by adoption of point elasticity approach which shows year-by-year export-import price response to quantity exported and imported respectively. The study is unlike Gasmi and Laourari (2016), Wilson, David, Inyiama and Beatrice (2014), Okoro (2014), Ibrahim, Ayodele, Hakeem and Yinka (2014) and Nwanna and Eyedayi (2015) that focused on supply side only. Marquez (1990) is defeated in some areas, for instance, the price elasticity of export-import in his study is based on aggregate trade instead of sector specific examination. However, the work under review adopted fractionally the approach of Marquez (1990) in that point elasticity of oil export-import is part of the post test conducted in the study in order to ascertain year-by-year price elasticity of oil export-import in Nigeria.

Table 2.9: Summary of Empirical Literature Reviewed

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or Location	Method	Findings	Gap
Ben, Abayomi and David (2016)	Effects of Crude Oil Price Shock on Macroeconomic performance in Nigeria 1979- 2014	Time series	between oil price changes, inflation rate, Gross Domestic Product and real exchange rate	Nigeria.	Unrestricted Vector Autoregressive Model	observed that a proportionate change in oil price leads to a more than proportionate change in real exchange rate, interest rate and Gross Domestic Product in Nigeria	Did not factor-in the demand side of oil trade, which is integral in Nigerians trade activities.
Nwoba and Abah (2016)	Impact of crude oil revenue by multinational oil companies on Nigeria economy growth from 1960 to 2010.	Time series	Oil Revenue by multinational companies in Nigeria and GDP.	Nigeria.	OLS	The found that there exist both short run and long run relationship between crude oil revenue from multinational oil companies and Nigerian economic growth. secondly, crude oil revenue from multinational oil companies in Nigeria have positive and significant impact on Nigerian economic growth.	Nwoba and Abah (2016) failed to factor-in oil import activities in Nigeria.
Abdulkareem and Abdulhakeem (2015)	Modeling macroeconomic and oil price volatility in Nigeria.	Time series	RGDP, interest rate and exchange rate and crude oil price.	Nigeria	GARCH	The findings reveal that: all the macroeconomic control variables considered in the study such real gross domestic product, interest rate and exchange rate are highly volatile including the core variable which is crude oil price.	Ignored oil import and supply growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Ahuru and James (2015)	The impact of oil price volatility on Nigerian economic growth.	Time series	Crude oil price volatility and public expenditure.	Nigeria.	VAR	The study finds out that oil price volatility significantly stimulate most of the macroeconomic variables and Nigeria's public expenditure. Furthermore, public expenditure impacts on most of the macroeconomic variables.	Did not consider oil import and supply growth rate.
Emmanuel (2015)	the impact of crude oil price volatility on economic growth in Nigeria from 1970 to 2014	Time series	RGDP, crude oil export price, crude oil export revenue, domestic oil revenue, oil reserves and crude oil price volatility.	Nigeria	OLS	The study found that, oil price volatility (OPV) has negative impact on the economic growth while the control variables had positive impact on the Nigerian economy.	Neglected oil import and supply growth rate.
Mgbame, Donwa and Onyeokweni (2015	Impact of crude oil price volatility on Nigeria economic growth from 1980 to 2011	Time series	Oil price volatility and GDP.	Nigeria.	Trend Analytical Method	Their findings revealed that crude oil price volatility have positive and significant impact on Nigeria economic growth.	Ignored oil import and supply growth rate.
Nwanna and Eyedayi (2015)	The impact of crude oil price volatility on economic growth of Nigeria. 1980-2014.	Time series	Crude oil price, Crude oil price volatility and and economic growth.	Nigeria	OLS	Findings revealed that there is a positive and significant relationship between oil price and economic growth. And negative relationship between oil price volatility and economic growth.	Neglected oil import and supply growth rate and oil terms of trade.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Nweze and Edame (2015)	The relationship between oil revenue and economic growth inNigeria 1981- 2014.	Time series	GDP, crude oil revenue and government expenditure.	Nigeria	Cointegration and ECM	Long and short run relationship exists between variables.	Neglected oil import and supply growth rate.
Offiong, Atsu, Ajaude and Ina (2015)	The impact of crude oil revenue on Nigerian economic growth: evidence from cross river state.	Time series	Oil revenue and state output.	Nigeria	OLS.	Findings revealed that international oil price shocks affected the State's economy inversely.	Neglected oil import
Ogboru, Terry and Idisi (2015)	Impact of changes in crude oil prices on economic growth in Nigeria from 1986 to 2015	Time series	crude oil price, inflation rate, real effective exchange rate, fuel pump price, and GDP growth rate	Nigeria	Error Correction Model (VECM)	The study found that changes in crude oil price impacts positively on Nigerian economic growth rate, they also discovered that a positive and unidirectional relationship that runs from crude oil prices to GDP growth rates exists	Ignored oil import and supply growth rate.
Baghebo and Atima (2014)	The impact of petroleum on economic growth in Nigeria	Time series	GDP, Oil revenue, corruption perception index and FDI	Nigeria	ECM	All the variables contribute significantly to GDP in Nigeria.	Neglected oil import

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Ibrahim et al (2014)	Impact of oil price shocks on the Nigerian economy, using data from 1981 to 2012.	Time series	oil price shocks, economic growth and oil price itself.	Nigeria	OLS	The study finds out that oil price shocks insignificantly retards economic growth while oil price itself significantly improves it.	Ibrahim et al (2014) Neglected oil import
Odularu (2014)	The relationship between of crude oil on Nigerian economic performance from 1978 – 2012.	Time series	crude oil export revenue, exchange rate, crude oil domestic consumption and GDP	Nigeria	OLS	The result reveals that crude oil domestic consumption and crude oil export revenue have contributed to the improvement of the Nigerian economy.	Neglected oil import
Okoro (2014)	The relationship between oil price volatility and economic growth in Nigeria 1980-2010.	Time series	Crude oil price volatility, crude oil prices, crude oil revenue and GDP.	Nigeria	VAR	The result obtained in this study indicated a negative relationship between the oil price volatility and economic growth in Nigeria.	Neglected oil import and oil demand growth rate.
Wilson et al (2014)	The causal relationship between crude oil prices and key macroeconomic variables in Nigeria.	Time series	Inflation, interest rate, exchange rate and RGDP, crude oil prices and crude oil price volatility.	Nigeria	Granger Causality and OLS	The results suggest that in the short run, crude oil price volatility affect Nigerian GDP negatively. Again the findings indicate that there is a positive but insignificant relationship between crude oil price and the Nigerian GDP.	Neglected oil import and supply growth rate.
Abiola and Okafor (2013)	the current Moving Average benchmarking method to determine the best forecasting model for Nigeria 2005Q1 to 2012Q4	Time series	crude oil price	Nigeria	ARIMA model	The study finds that ARIMA model is the best forecasting model for projecting Nigeria's crude oil price benchmark.	Neglected oil import and supply growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Ibeh (2013)	the impact of oil revenue on the economic growth in Nigeria (1980-2010)	Time series	oil revenue, exchange rate volatility, gross capital formation and GDP	Nigeria	OLS	This study came up with the conclusion that oil export revenue plays a key role in the growth of the Nigerian economy.	Neglected oil import and oil demand growth rate.
Oriakhi and Osaze (2013)	The impact of oil price volatility and its consequences on the growth of the Nigerian economy from 1970-2010.	Time series	oil price volatility, real government expenditure, real exchange rate and real import, RGDP, real money supply and inflation,	Nigeria	VAR	Oil price volatility impacted directly on real government expenditure, real exchange rate and real import, while it impacted negatively on real GDP, real money supply and inflation.	Neglected oil import and oil demand growth rate and oil terms of trade.
Ogbonna and Ebimobowei (2012)	The effects of crude oil income on the Nigerian economy for the period 2000 to 2009.	Time series	GDP, per capita income, inflation, crude oil revenue, petroleum profit, tax/royalties and licensing fees.	Nigeria	OLS	The results obtained show that there is a positive and significant relationship between GDP, PCI and oil revenue, but there is a positive and insignificant relationship between oil revenue and INF. Similarly, PPT/R has a positive and significant relationship with GDP and PCI, but a negative and insignificant relationship with inflation. It was also found that LF has a positive but insignificant relationship between GDP, PCI and INF.	Neglected oil import and oil demand growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or Location	Method	Findings	Gap
Umar and Abdulhakeem (2010)	The effect of crude oil price shocks and Nigerian economy	Time series	Crude oil price shocks, real GDP,money supply and unemployment,Consumer price index.	Nigeria.	Variance Autoregressive (VAR	Crude oil price shocks have significant impact on real GDP, money supply and unemployment. Its impact on consumer price index is not significant.	Neglected oil import volatility
Ben, Abayomi and David (2016)	Effects of Crude Oil Price Shock on Macroeconomic performance in Nigeria 1979-2014	Time series	between oil price changes, inflation rate, GDP and real exchange rate	Nigeria.	Unrestricted Vector Autoregressive Model	observed that a proportionate change in oil price leads to a more than proportionate change in real exchange rate, interest rate and GDP in Nigeria	Did not factor-in the demand side of oil trade, which is integral in Nigerians trade activities.
Nwoba and Abah (2016)	Impact of crude oil revenue by multinational oil companies on Nigeria economy growth from 1960 to 2010.	Time series	Oil Revenue by multinational companies in Nigeria and GDP.	Nigeria.	OLS	The found that there exist both short run and long run relationship between crude oil revenue from multinational oil companies and Nigerian economic growth. secondly, crude oil revenue from multinational oil companies in Nigeria have positive and significant impact on Nigerian economic growth.	Failed to factor-in oil import activities in Nigeria.
Abdulkareem and Abdulhakeem (2015)	Modeling macroeconomic and oil price volatility in Nigeria.	Time series	RGDP, interest rate and exchange rate and crude oil price.	Nigeria	GARCH	The findings reveal that: all the macroeconomic control variables considered in the study such real gross domestic product, interest rate and exchange rate are highly volatile including the core variable which is crude oil price.	Ignored oil import and supply growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Ahuru and James (2015)	The impact of oil price volatility on Nigerian economic growth.	Time series	Crude oil price volatility and public expenditure.	Nigeria.	VAR	The study finds out that oil price volatility significantly stimulate most of the macroeconomic variables and Nigeria's public expenditure. Furthermore, public expenditure impacts on most of the macroeconomic variables.	Did not consider oil import and supply growth rate.
Emmanuel (2015)	the impact of crude oil price volatility on economic growth in Nigeria from 1970 to 2014	Time series	RGDP, crude oil export price, crude oil export revenue, domestic oil revenue, oil reserves and crude oil price volatility.	Nigeria	OLS	The study found that, oil price volatility (OPV) has negative impact on the economic growth while the control variables had positive impact on the Nigerian economy.	Neglected oil import and supply growth rate.
Mgbame, Donwa and Onyeokweni (2015	Impact of crude oil price volatility on Nigeria economic growth from 1980 to 2011	Time series	Oil price volatility and GDP.	Nigeria.	Trend Analytical Method	Their findings revealed that crude oil price volatility have positive and significant impact on Nigeria economic growth.	Ignored oil import and supply growth rate.
Nwanna and Eyedayi (2015)	The impact of crude oil price volatility on economic growth of Nigeria. 1980-2014.	Time series	Crude oil price, Crude oil price volatility and and economic growth.	Nigeria	OLS	Findings revealed that there is a positive and significant relationship between oil price and economic growth. And negative relationship between oil price volatility and economic growth.	Neglected oil import and supply growth rate and oil terms of trade.
Nweze and Edame (2015)	The relationship between oil revenue and economic growth inNigeria 1981-2014.	Time series	GDP, crude oil revenue and government expenditure.	Nigeria	Cointegration and ECM	Long and short run relationship exists between variables.	Neglected oil import and supply growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Offiong, Atsu, Ajaude and Ina (2015)	The impact of crude oil revenue on Nigerian economic growth: evidence from cross river state.	Time series	Oil revenue and state output.	Nigeria	OLS.	Findings revealed that international oil price shocks affected the State's economy inversely.	Neglected oil import
Ogboru, Terry and Idisi (2015)	Impact of changes in crude oil prices on economic growth in Nigeria from 1986 to 2015	Time series	crude oil price, inflation rate, real effective exchange rate, fuel pump price, and GDP growth rate	Nigeria	Error Correction Model (VECM)	The study found that changes in crude oil price impacts positively on Nigerian economic growth rate, they also discovered that a positive and unidirectional relationship that runs from crude oil prices to GDP growth rates exists	Ignored oil import and supply growth rate.
Baghebo and Atima (2014)	The impact of petroleum on economic growth in Nigeria	Time series	GDP, Oil revenue, corruption perception index & FDI	Nigeria	ECM	All the variables contribute significantly to GDP in Nigeria.	Neglected oil import
Ibrahim et al (2014)	Impact of oil price shocks on the Nigerian economy, using datafrom 1981 to 2012.	Time series	oil price shocks, economic growth and oil priceitself.	Nigeria	OLS	The study finds outthat oil price shocks insignificantly retards economic growth while oil priceitself significantly improves it.	Neglected oil import
Odularu (2014)	The relationship between of crude oil on Nigerian economic performance from 1978 – 2012.	Time series	crude oil export revenue, exchange rate, crude oil domestic consumption and GDP	Nigeria	OLS	The result reveals that crude oil domestic consumption and crude oil export revenue have contributed to the improvement of the Nigerian economy.	Neglected oil import
Okoro (2014)	The relationship between oil price volatility and economic growth in Nigeria 1980-2010.	Time series	Crude oil price volatility, crude oil prices, crude oil revenue and GDP.	Nigeria	VAR	The result obtained in this study indicated a negative relationship between the oil price volatility and economic growth in Nigeria.	Neglected oil import and oil demand growth rate.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Wilson et al (2014)	The causal relationship between crude oil prices and key macroeconomic variables in Nigeria.	Time series	Inflation, interest rate, exchange rate and RGDP, crude oil prices and crude oil price volatility.	Nigeria	Granger Causality and OLS	The results suggest that in the short run, crude oil price volatility affect Nigerian GDP negatively. Again the findings indicate that there is a positive but insignificant relationship between crude oil price and the Nigerian GDP.	Neglected oil import and supply growth rate.
Abiola and Okafor (2013)	the current Moving Average benchmarking method to determine the best forecasting model for Nigeria 2005Q1 to 2012Q4	Time series	crude oil price	Nigeria	ARIMA model	The study finds that ARIMA model is the best forecasting model for projecting Nigeria's crude oil price benchmark.	Neglected oil import and supply growth rate.
Ibeh (2013)	the impact of oil revenue on the economic growth in Nigeria (1980-2010)	Time series	oil revenue, exchange rate volatility, gross capital formation and GDP	Nigeria	OLS	This study came up with the conclusion that oil export revenue plays a key role in the growth of the Nigerian economy.	Neglected oil import and oil demand growth rate.
Oriakhi and Osaze (2013)	The impact of oil price volatility and its consequences on the growth of the Nigerian economy from 1970-2010.	Time series	oil price volatility, real government expenditure, real exchange rate and real import, RGDP, real money supply and inflation,	Nigeria	VAR	Oil price volatility impacted directly on real government expenditure, real exchange rate and real import, while it impacted negatively on real GDP, real money supply and inflation.	Neglected oil import and oil demand growth rate and oil terms of trade.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic or Nature of Study	Type of Data	Main Variables	Country or location	Method	Findings	Gap
Ogbonna and Ebimobowei (2012)	The effects of crude oil income on the Nigerian economy for the period 2000 to 2009.	Time series	GDP, per capita income, inflation, crude oil revenue, petroleum profit, tax/royalties and licensing fees.	Nigeria	OLS	The results obtained show that there is a positive and significant relationship between GDP, PCI and oil revenue, but there is a positive and insignificant relationship between oil revenue and INF. Similarly, PPT/R has a positive and significant relationship with GDP and PCI, but a negative and insignificant relationship with inflation. It was also found that LF has a positive but insignificant relationship between GDP, PCI and INF.	Neglected oil import and oil demand growth rate.
Umar and Abdulhakeem (2010)	The effect of crude oil price shocks and Nigerian economy	Time series	Crude oil price shocks, real GDP, money supply and unemployment, Consumer price index.	Nigeria.	Variance Autoregressive (VAR	Crude oil price shocks have significant impact on real GDP, money supply and unemployment. Its impact on consumer price index is not significant.	Neglected oil import volatility
Zhang (2018)	effect of crude oil price fluctuations on Canada's aggregate economic activities from 1985-2015	Time series	Oil price fluctuations, real GDP, real effective exchange rate, real wage, inflation, and short and long-term interest rates.	Canada.	Vector autoregressive (VAR) linear and nonlinear.	The study found that oil price has significant effects on real GDP, REER and inflation.	Did not factor the demand side of oil trade, which is integral in Canada's trade activities.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic/ Nature of Study	Type of Data	Main Variables	Country/ location	Method	Findings	Gap
Zhang, Lan and Xing (2018)	Global trade pattern of crude oil and petroleum Products from 2006-2015	Time series	crude oil and refined petroleum products	Canada.	Normalized Mutual Information	1) The connectivity of the network of petroleum products is higher than the connectivity of the network of crude oil and the partition of the network of petroleum products is greater than that of the network of crude oil, 2) The financial crisis in 2008 integrated global trade pattern of crude oil and petroleum products, 3) The geographical factor is becoming more obvious in the trade pattern of crude oil, but not so obvious in the trade pattern of petroleum products.	Did not consider growth rate trade pattern connectivity.
Foudeh (2017)	Analysis of long run effects of oil prices on economic growth of Kingdom of Saudi Arabia (KSA) from 1995Q4-2015Q	Time series	oil price of China, Japan, South Korea, United Kingdom, S. Korea, USA, India, Canada, France and Germany and GDP growth rates of KSA.	Kingdom of Saudi Arabia (KSA)	ARDL bounds testing.	China's oil price growth rates do not affect Saudi GDP growth rates indirectly .Rather oil price growth rates weaken the positive long run effect exercised on the GDP growth rates of KSA via trading with Japan. Although trading with South Korea and UK have negative significant effects on the Saudi GDP growth rates, oil price growth rates has no possible indirect effect via trading with UK. But, it has a positive effect on the weighted GDP growth rates of S. Korea via trading with KSA. Trading with USA, India, Canada, France and Germany have no significant impacts on Saudi economy.	Did not factor the demand side of oil trade, which is integral in KSA's trade activities.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic/ Nature of Study	Type of Data	Main Variables	Country/ location	Method	Findings	Gap
Gyagri, Amarfio and Marfo (2017)	Determinants of global pricing of crude oil in the long and short term.		Crude oil Supply, demand, production, consumption, activities of the corporate organizations, futures market contract, speculators and brokers, exchange, Government in consumer and producer countries, Political tensions, economic factors, natural factors and refinery capacity.	Ghana	Historical approach.		No quantitative or qualitative analysis.
Jebran, Abdullah, Elhabbaq and Ali (2017)	Impact of income,price elasticity of crude oil demand on Pakistan economic growth from 1981 to 2013.	Time series	Income (GDP) and import price of crude oil, quantity of imported crude oil into Pakistan economy.	Pakistan	ARDL bounds testing	The study found that income was found to be a stronger determinant of crude oil demand in both short and long run.	Did not factor the supply side of oil trade in Pakistan.
Tehranchian and Seyyedkolaee (2017)	Impact of OPV on Iran's economic growth from 1980-2014.	time series	OPV and Iran's GDP	Iran	Threshold regression analysis	The study found that the threshold value of OPV was approximately 1148. It also found that the coefficient of OPV decreased in the second regime of oil price shocks compared to the first one regime.	Neglected oil revenue fluctuation in Iran.
Gasmi and Laourari (2016)	Impact of real oil revenue fluctuations on Algeria's economic growth from 1960-2015	time series	real oil revenues, real GDP, and industrial growth in Algeria,	Algeria	Multivariate VAR model and Johansen co-integration techniqu e	The study found that long-run relationship exists between the dependent and independent variables of the study while the VAR impulse response function and the variance decomposition analysis suggest that the impact of unexpected shifts in real oil revenues on the country's economic and industrial growth is negative.	

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic/ Nature of Study	Type of Data	Main Variables	Country/ location	Method	Findings	Gap
Millington (2016)	impact of low crude oil prices on the Canadian economy from 1986 to 2013	time series	Price of oil, other commodities, currency, investment, employment, non-energy exports.	Canada	Input-Output model	The forecast result of the study observed that in overall, Canadian economic growth could be on average of 23 percent lower if low oil prices persist over the next seven years	Neglected the demand side of oil trade in Canada.
Ebrahim, Inderwildi, and King (2014)	Impacts of OPV on Macroeconomic variables in U.S.A from 1986 to 2013.	time series	OPV, consumption, investment, industrial production, unemployment and inflation.	U.S.A	OLS	They found that high degree of OPV has damaging and destabilizing effects on the macroeconomic indicators in U.S.	Did not factor the oil revenue of U.S.
Stambuli (2013)	Price and income elasticity of oil demand in Tanzania from 1972-2010.	time series	Crude oil import price, Tanzania income (GDP), and quantity of crude oil imported in Tanzania	Tanzania	ARDL bounds testing and Chow test	The study empirically found that there is no structural break in the estimated oil demand equation. It also found that in the short-run the demand for oil was both price and income inelastic while in the long-run demand for oil was income elastic and price inelastic.	Log approach of elasticity measurement does not explore yearly elasticity outlook.
Diakosavvas and Scandizzo (1991)	Long-run deterioration in terms of trade of both developed oil and non-oil rich countries and less developed oil and non-oil rich countries 1970 and 1995.	Cross section data.	Primary and manufactured products TOT and oil TOT.	U.S.	TOT weighted index	The study observed that long run secular deterioration is not identical to LDC's primary products terms of trade only, and that negative TOT can occur in oil producing countries.	The study failed to measure oil price and income elasticity.

Table 2.9: Summary of Empirical Literature Reviewed (Continued)

Author/ Year	Topic/ Nature of Study	Type of Data	Main Variables	Country/ location	Method	Findings	Gap
Marquez (1990)	price elasticity of imports and exports of Canada, Germany, Japan, United Kingdom, United States, other developed countries, developing countries and OPEC from 1973Q1-1985Q4	Cross section data.	Oil and non-oil export-import and aggregate elasticity.	Maxico	Point elasticity approach	The result obtained from the study shows that Germany, Japan, United Kingdom, United States, other developed countries and developing countries had negative but fairly inelastic import price elasticity, negative fairly inelastic export price elasticity and negative fairly elastic aggregate price elasticity accept United Kingdom that had and negative fairly inelastic aggregate price elasticity. Further Canada and OPEC had negative but fairly elastic import price elasticity, negative fairly inelastic export price elasticity and negative fairly elastic aggregate price elasticity.	The study failed to measure income elasticity and did not provide impact of the calculated variables on economic growth of the countries of study interest.

Source: Researcher's compilation, (2019)

2.3 Summary of Literatures Reviewed

The summary of literatures reviewed hereunder includes theoretical and empirical literature.

Theoretically, Prebisch-Singer and their follower Emmanuel are known for pessimist view over exportation of primary from LDC's to DC's and importation of manufactured products from DC's into LDC's as a means economic growth in LDC's. This strongly led to their postulation that TOT will always be negative for developing countries and will always contribute negatively

to her economic growth even in the long run. In addition they added that primary products of the LDCs face negative aggregate trade elasticity in international market as a result of i) inelastic price of primary exports, ii) elastic price of imported manufactured products, and iii) elastic income elasticity. However, they excluded oil producing countries from victim of negative TOT, inelastic price of primary (crude oil) exports and elastic income elasticity. Meanwhile the theory has been partly criticized for not providing a structural equation for impact analysis

Marquez (1990), and Diakosavvas and Scandizzo (1991) have empirically examined the postulation of Prebisch-Singer and Emmanuel and found mixed results which further intensifies its criticism. Despite the criticisms, TOT theories have been utilized by many empirical studies to measure trade efficiency and to capture the supply and demand sides of international trade. Again, the TOT theories are also rich in composition in that they forwarded variables that can be used to examine both import-export price ratio and revenue-expenditure ratio in international trade. The TOT theory can be applied in Nigeria's oil sector trade because its composition covers both supply and demand sides of international trade and Nigeria's oil sector trade cut across supply and the demand blocs.

Meade on the other hand constructed a neo-classical model of economic growth which is designed to show the simplest path to economic growth rate. Unlike other growth theories Meade's theory focused on economic growth rate as a function of inputs growth rate. In an open economy, international trade is considered as one of the input factors for economic growth. Following Meade's concept with respect to open economy, it means that economic growth rate dependent partly on international trade growth rate. Nonetheless, in Meade's model TOT was not considered but it provided a structural equation for impact analysis while Prebisch-Singer and Emmanuel recognized TOT but did not providing a structural equation for impact analysis. As a result, the study under review merged these theories in order to eliminate the deficiencies encountered in each and used the modified version of the theories to account for a robust analysis of impact of oil sector trade on Nigeria's economic growth with precise interest on impact of oil sector trade growth rate on oil sector performance growth rate, and impact of oil sector performance growth rate on Nigeria's economic growth rate.

Empirically, the controversy over the performance of Nigeria's economy through her oil trade engagements have attracted plethora of empirical literatures from Nigerian scholars. Many

Nigerian scholars have examined the effect of oil trade on Nigeria's economic growth, with different analytical techniques and arrived with varying findings and recommendations. Abdulkareem and Abdulhakeem (2015); Nwanna and Eyedayi (2015); Ahuru and James (2015); Donwa et al (2015); Emmanuel (2015) and Oriakhi and Osaze (2013) etc. examined the impact of crude oil price volatility on Nigerian economic growth. These studies made use of different techniques of analysis and observed that crude oil price have positive impact on Nigeria's economic growth whereas crude oil price volatility have negative impact on Nigeria's economic growth. The work done by Abdulkareem and Abdulhakeem (2015) which appear slightly different from other studies applied GARCH model, precisely asymmetric and symmetric models and found that Nigeria is vulnerable to both internal and external shocks through interest rate volatility, real GDP volatility and exchange rate volatility, crude oil price volatility respectively. From the findings of these studies, they all recommended for diversification of Nigerian economy from (mono-cultural) crude oil export dependent into multi-cultural economy.

Abayomi et al (2015); Nweze and Edeme (2015); Offiong et al (2015); Baghebo and Atima (2014); Odularu (2014); Ibeh (2013) and Ogbonna and Ebimobowei (2012) etc. analyzed the impact of crude oil revenue (income) on Nigeria's economic growth. These studies have empirically identified both long and short run relationship between crude oil revenue and Nigerian economic growth with diverse findings. Abayomi et al (2015) discovered a short-run positive relationship of low magnitude between crude oil revenue and economic growth in Nigeria. Nweze and Edeme (2015) held the same opinion with Abayomi et al (2015), from their study findings they observed also that in the short-run there exists a positive relationship of low magnitude between crude oil revenue and Nigerian economic growth while in the long-run reverse is the case. While Nweze and Edeme (2015) analyzed both long and short run results, Abayomi et al (2015) based their study analysis on short run only.

Offiong et al (2015) conducted a micro study by narrowing the scope of their study specifically to Cross River State. The study examined the effect of crude of revenue on Cross River State economic performance (CRSEP), their findings revealed that crude oil revenue have inverse relationship with CRSEP. The disagreement between Offiong et al (2015) and Abayomi et al (2015) and Nweze and Edeme (2015) may be as a result of scope of study and variables of interest. Baghebo and Atima (2014) observed that crude oil revenue have a negative impact on

Nigerian economic growth both in the short and long run, these partly agreed with Nweze and Edeme (2015) who discovered that in long-run crude oil revenue have negative impact on Nigerian economic growth. On the other hand, the findings from Baghebo and Atima (2014) opposed the findings of Abayomi et al (2015) and Nweze and Edeme (2015) who identified a short run positive relationship between crude oil revenue and Nigerian economic growth. Odularu (2014); Ibeh (2013) and Ogbonna and Ebimobowei (2012) held the same view with Abayomi et al (2015) and Nweze and Edeme (2015) which is contrary to Baghebo and Atima (2014). Odularu (2014) found a positive short-run impact between crude oil revenue and Nigerian economic growth from 1978 to 2012. Ibeh (2013) and Ogbonna and Ebimobowei (2012) discovered also that crude oil revenue have positive effect on Nigeria economic growth in the short-run from 1980 to 2010 and from 2000 to 2009 respectively. The disagreements in studies concerning crude oil revenue and economic growth of Nigeria may be as a result of application of different techniques of analysis or choice of control variables.

Generally, despite the attempts made by the reviewed literatures there are yet gaps that require further research attention. Reviewed literatures focused on fraction of oil supply without considering growth rate of oil supply. Secondly, they all neglected oil demand and its growth rate as well as oil terms of trade. These variables neglected by previous studies are important in analysis of oil trade in Nigeria, because Nigerian government over decades is deeply engaged in crude oil supply and refined petroleum products demand through her upstream and downstream sectors. Hence, there is need to consider growth rates of oil supply and oil demand. More so, there is need to take into account the effect of ratio or gaps between oil export and import prices as well as oil export revenue and oil import expenditure and one of the ways through which this can be done is by adopting terms of trade technique.

However, some authors have examined the impact of both supply and demand blocs of oil trade on economic growth, and have estimated the effect of terms of trade, income and price elasticity on economic growth. These studies are attributed to non Nigerian authors they include: Zhang et al (2018), Gyagri et al (2017), Jebran et al (2017), Diakosavvas and Scandizzo (1991) and Marquez (1990).

2.4 Justification for the Study

One of the factors that justify an academic research work is its ability to draw conclusions about a phenomenon or behavior based on theoretical or logical reasons, or to draw conclusions about a phenomenon or behavior based on facts or observed evidence (Bhattacherjee, 2012). Hence, this study is justified based on the following reasons:

Theoretical: Prebisch-Singer and Emmanuel are acknowledged for their pessimist view over exportation of primary from LDC's to DC's and importation of manufactured products from DC's into LDC's as a means of economic growth in LDC's. Their pessimist view governed their opinion which states that TOT for LDC's will always be negative and will always contribute negatively to their economic growth even in the long run. In furtherance they opined that primary products of the LDCs face negative aggregate trade elasticity in international market as a result of i) inelastic price of primary exports, ii) elastic price of imported manufactured products, and iii) elastic income elasticity.

However, they excluded oil producing LDCs from falling into the trap of negative TOT, inelastic price of primary (crude oil) exports, elastic price of imported manufactured products and elastic income elasticity as the reserve of these features are expected from oil producing LDCs. This opinion has attracted empirical studies which aimed at confirming its authenticity, Diakosavvas and Scandizzo (1991) found that both oil and non-oil producing countries have the tendency to witness both negative and positive TOT. Marquez (1990) used point elasticity approach to measure year-by-year price elasticity of oil export and import and found mixed results. Since Nigeria exports crude oil and imports refined petroleum products there is a need to examine the same phenomenon in Nigeria's oil sector. In order to actualize this objective, the study under review adopted year-by-year price elasticity of export and import as did by Marquez (1990) with respect to Nigeria's oil sector as part of post in order to ascertain price elasticity of crude oil export and refined petroleum import. TOT was factored as part of the estimable international trade variables, as this will enable the researcher to ascertain not only the status of Nigeria's oil TOT but also to make certain of its impact on Nigeria's oil sector growth rate.

Research gap: this work tries to bridge the gap which previous studies were unable to. Research works that have examined the impact of oil international trade on Nigerian economic growth focused on supply side of oil international trade, as a result they considered only the oil supply

variables such as crude oil price, crude oil revenue (income) and crude oil price volatility. These studies were coined in different topics with different analytical tools yet the core explanatory variables they adopted are crude oil price, crude oil price volatility and crude oil revenue (income). Abdulkareem and Abdulhakeem (2015), Ayadi (2015), Nwanna and Eyedayi (2015), Ahuru and Jame (2015), Donwa et al (2015) and Emmanuel (2015) etc. examined the impact of crude oil price and its volatility on Nigerian economic growth, while Nwaeze and Edeme (2015); Offiong et al (2015); Abayomi et al (2015); Baghebo and Atima (2014); Odularu (2014); Ibeh (2013) etc. examined the impact of crude oil revenue (income) on Nigerian economic growth. Howbeit, these studies focused on supply side of Nigerian oil trade without considering the demand bloc.

The results obtained from these studies may be misleading because the researchers focused on halve of the full circle of oil trade in Nigeria. In practice oil trade in Nigeria cut across supply and demand sides, therefore to draw a strong inference from Nigerian oil trade, both supply and demand sides should be recognized. Further, the supply and demand sides of Nigerian oil trade operate individually as entities under the upstream and downstream sub-sectors respectively and operate jointly as an entity under NNPC. Hence, research investigations are meant to capture the operation of the sectors separately and jointly. This study achieved the aforementioned by taking into account the variables that can capture the supply and demand sides of oil trade individually and jointly. Again since oil sector trade has lasted for decades in Nigeria with evidence of fluctuations and its effect has caused changes in Nigerian economy as a result of high dependency oil sector, the study under review focus precisely on oil sector trade growth rate and its impact on oil sector performance growth rate, and impact of oil sector performance growth rate on Nigeria’s economic growth rate.

CHAPTER THREE

RESEARCH METHOD

The purpose of this chapter is to provide adequate and appropriate methods that will give answer to the research questions, capture the objectives of the study and reject or accept the null hypotheses of the study. This chapter covers theoretical framework, model specification, estimation technique and procedure as well as nature and sources of data for the study.

3.1 Theoretical Framework

The theoretical framework guiding this study is drawn from: a) Meade's neoclassical model of economic growth, b) Prebisch-Singer commodity terms of trade hypothesis, and c) Emmanuel's double factoral terms of trade hypothesis.

This work adapted Meade's neoclassical model for two major reasons; first, in Meade's model economic growth rate is the dependent variable, and in this research work, sector and economic growth rates are also the dependent variables. Secondly, in Meade's model labour and capital growth rates were used as explanatory variables to economic growth rate which is part of the explanatory variables in this study.

Adopting also in this work is the terms of trade (TOT) theories, the TOT theories captures export price and import price as well as export revenue and import cost simultaneously in order to assess the ratio or the gap between export price and import price as well as the gap between export revenue and import cost. TOT theories has been criticized for not providing structural equation for impact analysis, as a result, the researcher then factor in terms of trade constructs into Meade's model to form a linear model in order to justify the research questions, objectives and the hypotheses of the study.

Meade's model is specified as;

$$Y = f(K,L,N) \qquad 3.1$$

Where Y, K, L and N are as in equation 2.1, Assuming the amount of N to be fixed, net output can increase in any one period with the growth in K and L, this is expressed as;

$$\Delta Y = q\Delta K + r\Delta L \qquad 3.2$$

Where Δ in each case represents an increase and q and r represents the incremental product of capital and labour respectively. The increase over the years in the rate of annual net output (ΔY) is equal to the increase in the stock of machinery (ΔK) multiplied by q plus the increase in the amount of labour (ΔL) multiplied by r. The annual proportionate growth rate of output is specified as;

$$\Delta Y/Y = \Delta K/K + \Delta L/L \quad 3.3$$

Where ΔY/Y is the proportionate growth rate of output, ΔK/K and ΔL/L are the proportionate growth rate of capital and labour respectively. Equation 3.3 above shows that growth rate of output depends on the weighed sum of the capital and labour growth rates (Jhingan, 2008).

Meade's model did not include export and import activities as well as terms of trade as explanatory variables to economic growth rate, and one of the objectives of this study is to query the impact of oil supply growth rate, oil demand growth rate, and oil terms of trade on Nigeria's oil sector growth rate. Hence, the researcher modified Meade's model by including oil supply and demand growth rates and oil terms of trade in Meade's model. The modified model is expressed as;

$$\Delta Y/Y = \Delta K/K + \Delta L/L + \Delta S/S + TOT \quad 3.4$$

Where ΔY/Y, ΔK/K, and ΔL/L are as in 3.3 and ΔS/S is trade growth rate. ΔS/S is decomposed into export growth rate and import growth rate. The export growth rate and import growth rate are further decomposed into export price growth rate, export revenue growth rate, import price growth rate, import cost growth rate, and TOT is decomposed into oil commodity terms of trade and oil double factoral terms of trade.

Equation 3.4 is expanded as;

$$\Delta Y/Y = \Delta K/K + \Delta L/L + \Delta EPGR/EPGR + \Delta ERGR/ERGR + \Delta IPGR/IPGR + \Delta ICGR/ICGR + ((P_X/P_M)-1)) + ((P_XQ_X/P_MQ_M)-1)) \quad 3.5$$

Aligning equation 3.5 to this study, ΔY/Y = Nigeria's oil sector growth rate (NOSGR), ΔK/K = Growth rate of Capital (GRC), ΔL/L = Growth rate of Labour (GRL), ΔEPGR/EPGR = Crude oil export price growth rate (CEPGR), ΔERGR/ERGR = Crude oil export revenue growth rate (CERGR), ΔIPGR/IPGR = Refined Petroleum products import price growth rate (PPIPGR), ΔICGR/ICGR = Refined Petroleum products import expenditure growth rate (PPIEGR),

((P_X/P_M)-1)) = Oil commodity terms of trade (OCTOT) and ((P_XQ_X/P_MQ_M)-1)) = Oil double factoral terms of trade (ODFTOT).

Further, since another objective of this study is to examine the impact of oil sector growth rate on Nigeria's economic growth rate, Meade's model was further modified as thus;

$\Delta Q/Q = \Delta K/K + \Delta L/L + \Delta Y/Y + (\Delta Q/Q)_{t-1} + EXCHR$ 3.6

Where $\Delta Y/Y$, $\Delta K/K$, and $\Delta L/L$ and $\Delta Y/Y$ are as in 3.5 and $\Delta Q/Q$ = Nigeria's economic growth rate, $(\Delta Q/Q)_{t-1}$ = lag of Nigeria's economic growth rate, and EXCHR = exchange rate.

3.2 Empirical Model Specification

From equation 3.5, the appropriate model for objective one of this study is specified thus:

NOSGR=(GRC + GRL + CEPGR + CERGR+ PPIPGR+ PPIEGR + OCTOT + ODFTOT) 3.7

The econometric form of equation 3.6 is presented as;

$NOSGR = b_o + b_lGRC + b_2GRL + b_3CEPGR + b_4CERGR + b_5PPIPGR + b_6PPIEGR + b_7OCTOT + b_8ODFTOT + u.$ 3.8

b_l ; b_2 ; b_3 ; b_4 ; b_5 ; b_6; b_7 and $b_8 > 0$

u = stochastic variable

From equation 3.6, the appropriate model for objective two is specified thus:

$NEGR = (GRC + GRL + NOSGR + NEGR_{t-1} + EXCHR)$ 3.9

The econometric form of equation 3.8 is presented as;

$NEGR = \alpha_o + \alpha_lGRC + \alpha_2GRL + \alpha_3NOSGR + \alpha_4NEGR_{t-1} + \alpha_5EXCHR + \varepsilon$ 3.10

α_l ; α_2 ; α_3 ; α_4 ; $\alpha_5 > 0$

ε = Error term.

3.3 Definition of Variables/Justification for the Model

Growth Rate measures the rate at which a variable changes within a specific time period basically one year. This study adopted the growth rate measurement as applied in Aluko (2004) which is stated as ((Cα / Pβ) -1)* 1OO. Where Cα is the current value of variable of interest, Pβ is the past value of variable of interest and -1 is a constant.

Nigeria's Oil Sector Growth Rate (NOSGR) is the dependent variable of the model one in this study and it measures the rate at which Nigeria's oil sector performance changes from one year into another. In this study, NOSGR is computed as ((COSP/ POSP) -1)* 1OO. Where COSP is the current value of oil sector performance, POSP is the past value of oil sector performance and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model. It is expected that all the trade explanatory variables adopted in this study will contribute positively to NOSGR.

Growth Rate of Capital (GRC) in this study is proxied to capital expenditure growth rate. Growth rate of capital measures the rate at which capital changes from one year into another. GRC in this study is computed as ((CC / PC) -1)* 1OO. Where CC is the current value of capital expenditure, PC is the past value of capital expenditure and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model. It is expected that GRC will contribute positively to growth of NOSGR.

Growth Rate of Labour (GRL) in this research work is proxied to growth rate of employment in Nigeria. Growth rate of labour measures the rate at which labour changes from one period into another basically for a year. GRL is computed as ((CLP / PLP) -1)* 1OO. Where CLP is the current value of labour productivity, PLP is the past value of labour productivity and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model. It is expected that GRL will contribute to growth of NOSGR positively.

Crude Oil Export Price Growth Rate (CEPGR) is the percentage change in price of crude oil from one period to another. In this study, CEPGR is computed as ((CCEP / PCEP) -1)* 1OO. Where CCEP is the current value of crude oil export price, PCEP is the past value of crude oil export price and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model, it is expected that CEPGR will contribute positively to NOSGR.

Crude Oil Export Revenue Growth Rate (CERGR) is the percentage change in crude oil export revenue within a specific time period mainly for one year. In this study, CERGR is computed as ((CCER / PCER) -1)* 1OO. Where CCER is the current value of crude oil export revenue, PCER is the past value of crude oil export revenue and -1 is a constant. Theoretical backup to this

variable is the Meade's neo-classical model, it is expected that CERGR will contribute negatively to NOSGR.

Petroleum Products Import Price Growth Rate (PPIPGR) is the percentage change in price of imported petroleum products from one year into another. PPIPGR in this study is computed as ((CPPIP / PPPIP) -1)* 1OO. Where CPPIP is the current value of petroleum products import prices, PPPIP is the past value of petroleum products import prices and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model, it is expected that PPIPGR will contribute negatively to NOSGR.

Petroleum Products Import cost Growth Rate (PPIEGR) measures the rate of increase and/or decrease in cost of imported petroleum products from one period into another basically for one year. In this study, PPIEGR is computed as ((CPPIC / PPPIC) -1)* 1OO. Where CPPIC is the current value of petroleum products import costs, PPPIC is the past value of petroleum products import costs and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model, it is expected that PPIEGR will contribute negatively to NOSGR.

Oil Commodity Terms of Trade (OCTOT) measures the gap between crude oil export prices to petroleum import prices. On the other hand, OCTOT measures the rate at which per unit price of crude oil export off sets per unit price of imported petroleum products. In this study OCTOT is computed as $((CP_x / CP_m) -1)$. Where CP_x is the current value of crude oil export price, CP_m is the current value of petroleum products import prices and -1 is a constant. Theoretical backup to this variable is the Prebisch-Singer TOT hypothesis. It is expected that OCTOT will contribute positively to NOSGR.

Oil Double Factorial Terms of Trade (ODFTOT**)** measures the gap between crude oil export revenue to petroleum import costs. It measures the rate at which per unit revenue generated from crude oil export off sets per unit cost incurred in petroleum products importation. In this study ODFTOT is computed as $((CP_xQ_x / CP_mQ_m) -1)$. Where CP_xQ_x is the current value of crude oil export revenue, CP_mQ_m is the current value of petroleum products import costs and -1 is a constant. Theoretical backup to this variable is the Emmanuel's TOT hypothesis. It is expected that ODFTOT will contribute positively to NOSGR.

Nigerian Economic Growth Rate (NEGR) is the dependent variable of model two in this study and it measures the rate at which Nigerian's GDP changes from one year into another, in this study NEGR is computed as ((CNGDP / PNGDP) -1)* 1OO. Where CNGDP is the current value of Nigerian Gross Domestic Product, PNGDP is the past value of Nigerian Gross Domestic Product and -1 is a constant. Theoretical backup to this variable is the Meade's neo-classical model. It is expected that GRC, GRL, NOSGR, $NEGR_{t-1}$ and EXCHR will contribute positively to NEGR.

3.4 Estimation Techniques and Procedures.

This study adopted estimation techniques and procedures that are relevant to the study. They include: Unit root test, Co-integration test, Error correction test and Granger causality test.

3.4.1 Unit Root Test

Akpanta (2013) unit root test is a pre-test which is used to examine whether a time series data is stationary or not, in order to avoid running a spurious regression. Unit root test ensures validity of the test statistics such as t-test statistic, F-test statistic and coefficient of determination (R^2). Unit root test can be conducted through several techniques such as (a) Augmented Dickey-Fuller (ADF), (b) Phillips-Perron (PP) test statistic and (c) Ng-Perron (NP) test statistics etc. Akpanta (2013) posits that there is no empirical evidence of superiority of one unit root test technique to the others, rather they complement each other. As a result this study therefore employs ADF and PP unit root test statistics but emphasized more on ADF. The ADF equation is specified below as thus;

$$\Delta Y_t = \beta_0 + \beta_2 t + \psi Y_{t-1} + \alpha_1 \sum_{i=1}^{p} \Delta Y_{t-1} + \varepsilon_t \qquad 3.11$$

Unit root test hypothesis and decision rule are stated thus:

$H_{0:}$ the variables has unit root (not stationary)

$H_{1:}$ the variables has no unit root (stationary)

Decision rule: reject H_0 if ADF is greater than critical value in absolute terms at chosen level of significance.

3.4.2 Co-integration Test

After establishing the existence of stationarity and their order of integration identified, next is to determine if the dependent and independent variables are co-integrated for robust long-run analysis and this can only be achieved through co-integration test. The nature of co-integration test to be applied in a study is subject to stationarity test outcomes. For instance, if the variables of study interest are integrated at purely order zero that is 1(0) or purely order one that is 1(1), under such stationarity outcomes single co-integration tests such as Johansen or Engle-Granger respectively are appropriate for long-run analysis. Contrarily, if the variables are fractionally integrated at 1(0) and 1(I) ARDL bound testing become more appropriate. To save space, this study emphasized more on Engle-Granger and ARDL bound testing.

Augmented Engle-Granger (AEG) co-integration test (long-run test)

Single co-integration tests precisely Engle-Granger co-integration test is appropriate if the variables of study interest are integrated at purely 1(1). The Engle-Granger co-integration test equation is stated as:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta x_t \ldots\ldots\ldots + \beta_p \Delta x_{tp} + \varepsilon_t \qquad 3.12$$

If two or more variables are co-integration, that is, there is a long-run or equilibrium relationship between the variables. Of course, in short-run there may be disequilibrium. Therefore, error term in short-run equation is treated as equilibrium error. Correction of such error is the major import of Error Correction Mechanism or Model (ECM). We can use this error term to tie the short-run behavior of the dependent variable (Gujarati, 2004).

AEG co-integration test hypothesis and decision rule

$H_{0:}$ the variables are not co-integration

$H_{1:}$ the variables are co-integration

Decision rule: reject H_0 if residual stationarity test is greater than its level critical value in absolute terms at chosen level of significance.

Augmented Engle-Granger Error Correction Model (short-run test)

This test is carried out to correct maybe equilibrium error (disequilibrium) in short-run, such that the error term in short-run equation can be tie to the short-run behavior of the dependent variable. The short-run equation is stated as:

$\Delta Y_t = \beta_0 + \beta_1 \Delta x_t + \ldots\ldots\ldots + \beta_p \Delta x_{tp} + \beta_2 ECM(-1) + \varepsilon_t$ 3.13

β_2 decides how quickly equilibrium is restored in short-run and $ß_2$ is expected to be negative.

ECM hypothesis and decision rule are thus stated:

$H_{0:}$ there is no short-run relationship between the variables.

$H_{1:}$ there is short-run relationship between the variables.

Decision rule: reject H_0 if the coefficient of ECM(-1) is negative at chosen level of significance.

Autoregressive Distributed Lag (ARDL) bounds testing co-integration

Unlike single co-integration tests which are applicable if time series are serially integrated, that is purely 1(0) and 1(I), ARDL bounds testing co-integration is applicable if the variables are fractionally integrated at 1(0) and 1(I). Long-run and short-run unrestricted ARDL bounds testing approach developed in 2001 by Pesaran, Shin and Smith (Pesaran, Shin & Smith, 2001) is specified below as;

$\Delta \ln Y_t = \beta_0 + \beta_1 \ln Z_{t-1} + \sum_{i=1}^{k} \alpha_1 \Delta \ln Y_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta \ln Z_{t-1} + \mu_t$ 3.14

Where μ_t is the white noise or error term, the first part of the right hand side of equation 3.14 with parameter β_1 represents the long-run parameter of the models and the second part with parameter α_2 represents the short-run of the models.

ARDL bounds testing hypotheses is stated as:

H_0: the variables are not co-integrated

H_1: the variables are co-integrated

Decision rule:

Reject H_0 if the computed F-statistic falls above the upper critical bounds at chosen level of significance and accept H_0 if otherwise stated.

Do not Reject H_0 if the computed F-statistic falls below the lower critical bounds at chosen level of significance.

Take no decision about H_0 if the computed F-statistic falls inside the lower and upper critical bounds at chosen level of significance.

The short run relationship among the variables is specified as;

$$\Delta \ln Y_t = \sum_{i=1}^{k} \alpha_1 \Delta \ln Y_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta \ln Z_{t-1} + \lambda ecm_{t-1} + \mu_t \qquad 3.15$$

Where ecm_{t-1} is the short-run dynamic error correction factor, λ is the coefficient of ecm_{t-1} that measures the speed of adjustment in the short-run into the long-run and μ_t is the white noise error term.

If the coefficient of ecm_{t-1} is negative we then conclude that there exist short-run relationship between the independent variables and dependent variable. As a result, the study analysis will rely on short run results because of the advantages short-run results have over long-run results. Short-run results have the following advantages over long-run results (a) short run results give multiplier effect of the independent variables on the dependent variable (b) short-run is a convenient model that corrects disequilibrium in short-run into long-run (c) Short-run results resolves the problem of spurious regression by taking into account the lag of error correction model (ECM) which eliminates trends from the model (d) ECM fits into both general and specific approach to econometric model and (e) the error term in Short-run result is a stationary variable etc (Gujarati, 2004).

Granger causality test (for objective three)

This work also adopted Granger causality technique of analysis in order to capture objective three of the study which is set to examine the direction of causality between oil supply growth rate, oil demand growth rate, oil terms of trade and oil sector growth rate in Nigeria. The empirical causality result of this study are calculated within a simple or pair wise Granger-Causality test in order to test whether each of the independent variables Granger Cause Nigeria's oil sector growth rate and vice versa. This research work, adopted causality technique as applied in (Mahdavi & Sohrabian, 2014). Mahdavi and Sohrabian (2014) applied causality test within the scope of the dependent variable and each of the independent variables. This is unlike some studies that carried out causality test between the dependent variable and the independent variables as well as among the independent variables. Using the same approach with Mahdavi

and Sohrabian (2014), rather than twelve equations where we have six core variables, the causality equations herein are specified in two equations as;

$$(NOSGR)_t = \lambda + \sum_{i=1}^{m} \beta i(\ NOSGR)_{t-I} + \sum_{j=i}^{n} Tj\ (\alpha)_{t-1} + \mu_t \quad 3.16$$

$$(\alpha)_t = \psi + \sum_{i=1}^{p} \theta i(\alpha)_{t-I} + \sum_{j=i}^{q} \sigma j\ (NOSGR)_{t-1} + \varepsilon_t \quad 3.17$$

α is representing all the independent variables while βi, Tj, θi and σj are estimable coefficients of the variables in equations 3.16 and 3.17. Based on the estimated coefficients for the equations (3.16) and (3.17) four different hypotheses and decision rules about the relationship between NOSGR and α are formulated thus:

1) Unidirectional Granger-causality from α to NOSGR. In this case α increase the prediction of the NOSGR but not vice versa. Thus

$$\sum_{j=i}^{n} Tj \neq 0 \text{ and } \sum_{j=i}^{q} \sigma j = 0 \quad 3.18$$

H_0; there exist no unidirectional causality from α to NOSGR.

H_1; there exist unidirectional causality from α to NOSGR.

Decision rule: Reject H_0 if Probability F-value is less than or equal to 0.05 and accept H_0 if Probability F-value is greater than 0.05.

2) Unidirectional Granger-causality from NOSGR to α. In this case the NOSGR increases the prediction of the α but not vice versa. Thus

$$\sum_{j=i}^{n} Tj = 0 \text{ and } \sum_{j=i}^{q} \sigma j \neq 0 \quad 3.19$$

H_0; there exist no unidirectional causality from NOSGR to α.

H_1; there exist unidirectional causality from NOSGR to α.

Decision rule: Reject H_0 if Probability F-value is less than or equal to 0.05 and accept H_0 if Probability F-value is greater than 0.05

3) Bidirectional (or feedback) causality. In this case NOSGR increases the prediction of the α and vice versa. Hence,

$$\sum_{j=i}^{n} Tj \neq 0 \text{ and } \sum_{j=i}^{q} \sigma j \neq 0 \quad 3.20$$

H_0; there exist no bidirectional causality between NOSGR and α.

H_1; there exist bidirectional causality between NOSGR and α.

Decision rule: Reject H_0 if Probability F-value is less than or equal to 0.05 and accept H_0 if Probability F-value is greater than 0.05.

4) Independence between NOSGR and α. In this case there is no Granger causality in any direction, thus

$\sum_{j=i}^{n} Tj = 0$ and $\sum_{j=i}^{q} \sigma j = 0$ 3.21

H_0; there exist no causality in any direction between NOSGR and α.

H_1; there exist both unidirectional and bidirectional causality between NOSGR and α.

Decision rule: Reject H_0 if Probability F-value is less than or equal to 0.05 and accept H_0 if Probability F-value is greater than 0.05.

Obtaining any of the results above makes it possible to detect the causal relationship between each independent variable and NOSGR.

3.5 Evaluation of Estimates

The evaluation of estimates is divided into three stages

1. Economic a-priori criteria
2. Statistical Criteria: first order test
3. Econometric Criteria: second order Test

Economic criteria (a-priori expectation): Economic criteria refer to the expected signs and magnitude of the estimated parameters concerning economic impact of the independent variables and dependent variable as propounded by theories. Based on the economic theories adopted in the study, the independent variables are expected to take the following signs in respect of the dependent variables.

Table 3.1 A-Priori Expectation for Model one

Independent variables	A-priori expectation signs
Growth Rate of Capital (GRC)	Positive
Growth Rate Labour (GRL)	Positive
Crude Oil Export Price Growth Rate (CEPGR)	Positive
Crude Oil Export Revenue Growth Rate (CERGR)	Positive
Refined Petroleum Products Import Price Growth Rate (PPIPGR)	Positive
Refined Petroleum Products Import Expenditure Growth Rate (PPIEGR)	Positive
Oil Commodity Terms of Trade (OCTOT)	Positive
Oil Double Factoral Terms of Trade (ODFTOT**)**	positive

Source: Researcher's Compilation (2019).

Table 3.2 A-Priori Expectation for Model two

Independent variables	A-priori expectation signs
Growth Rate of Capital (GRC)	Positive
Growth Rate Labour (GRL)	Positive
Nigeria's Oil Sector Growth Rate (NOSGR)	Positive
Lag of Nigeria's Economic Growth Rate ($NEGR_{t-1}$)	Positive
Exchange Rate (EXCHR)	Positive

Source: Researcher's Compilation (2019).

Statistical Criteria (First Order Test): This stage includes; the coefficient of determination (R^2), adjusted coefficient of determination (R^{-2}), t-statistic and F-statistic.

Coefficient of Determination (R^2): Coefficient of determination is used to measure the explanatory power of the explanatory variables on the dependent variables. It denotes the percentage of variation in the dependent variable explained by the independent variable. Therefore, the higher and closer the R^2 is to unity, the higher is the explanatory power of the

explanatory variables and vice versa. If on the other hand, R = 0, it indicates that the explanatory variables could not explain the changes in the dependent variable, R^2 ranges from 0 to +1.

The Adjusted Coefficient of Determination (R^{-2}): Coefficient of determination (R^2) does not take into account the loss of degrees of freedom from the introduction of additional explanatory variables in the function which in fact raises the value of R^2. To correct this defect, adjusted coefficient of determination (R^{-2}) is introduced to take into account the penalty of introducing additional explanatory variables. Adjusted coefficient of determination clearly decreases as new regressors which do not add value to the model are introduced.

T- Statistic: This is used to test the individual statistical significance of the estimated parameters. Decision rule for t- Statistic is stated as thus: Reject H_0 if t-computed is greater than t-tabulated and accept H_0 if otherwise stated at chosen level of significance with (n-k) degree of freedom. Where n is the number of observations and K is the number of parameters.

F- Statistic: This test is used in regression analysis for conducting overall significance of the regression. Decision rule for F- Statistic is stated as thus: reject H_0 if the calculated F - statistic (F*) is greater than the tabulated F-value, and accept H_0 if otherwise stated at chosen level of significance with (V_1;V_2) degree of freedom. Where V_1 = K-1 and V_2 = N-K, N is the number of observations and K is the number of parameters.

Econometric criteria (Second Order Test): This aims at investigating whether the assumptions of the classical linear regression model met in this study. The following econometric criteria are examined:

Normality test: This study employs normality test in order to ascertain if the error term in the regression model is normally distribution or not. The test follows a residual diagnostics checking precisely Jarque-Bera which follows chi-square probability distribution (Gujarati, 2004).

Hypothesis:

H_0: $U_i = 0$ (the error term follows a normal distribution)

H_1: $U_i \neq 0$ (the error term does not follow a normal distribution)

Decision Rule: Reject H_0 if $\chi^2_{cal} > \chi^2_{tab}$, and accept H_0 if otherwise.

Test for Autocorrelation: This is a problem which is usually associated with any time series data. This study employs Durbin-Watson (D-W) technique for autocorrelation test. According to Gujarati (2004) Durbin-Watson has optional asymptotic properties and is more efficient for all sample sizes. The D-W value is used to ascertain whether or not there exists the presence of autocorrelation.

Autocorrelation hypothesis:

$H_{0:}\ u_i = 0$ (the error terms are not autocorrelated with a first order scheme)

$H_{0:}\ u_i \neq 0$ (the error terms are autocorrelated with a first order scheme)

Decision rule

If $0 < d < d_L$, reject H_0 of no positive autocorrelation

If $4 \leq d \leq d_u$, take no decision on H_0 of no positive autocorrelation.

If $4\text{-}d_L < d < 4$, Reject H_0 of no negative autocorrelation

If $4\text{-}d_u \leq d\ (4\text{-}d_L)$, take no decision on H_0

If $du < d < 4\text{-}d$, do not reject H_0 of no autocorrelation, positive or negative.

Muticollinearity test: Muticollinearity test is used to dictate the presence of perfect or exact linear relationship among some or all explanatory variables of a regression model. Multicolinearity is inherent in most economic relationships and can be dictated using the correlation matrix. Once the pair wise correlation coefficient between two or more explanatory variables are in excess of 0.8, we then conclude that there is presence of multicollinearity between the variables signifying that there is an exact influence among the explanatory variables on the dependent variable.

Test for Heteroskedascity: An important assumption of the classical linear regression model is that disturbance term "U" appearing in the population regression function is homoskedastic, which means the U's all have the same variance (Gujarati, 2004). Violation of this assumption leads to standard errors and t-values that are biased. Such bias leads to wrong as well as faulty conclusions regarding the statistical significance of the ECM estimates. This research work employs Breusch-Pagan-Godfray (BPG) test in order to ascertain whether the error term of the regression model are homoskedastic and/or has a constant variance.

Hypothesis:

$H_{0:}$ U's = 0 (the error terms are homoskedastic)

$H_{1:}$ U's ≠ 0 (the error terms are heteroskedastic)

Decision rule: reject H_0 if the calculated χ^2 is greater than critical value of χ^2 at chose level of significance and accept H_0 if stated otherwise.

3.6 Test of Research Hypotheses and Decision Rule

This study employs technique of estimations that will enable the researcher to achieve the objectives of the study and nullify or validate the null hypotheses of the study.

Hypothesis One

H_0; Oil supply growth rate, oil demand growth rate and oil terms of trade have no significant impact on Nigeria's oil sector growth rate.

H_1; Oil supply growth rate, oil demand growth rate and oil terms of trade have significant impact on Nigeria's oil sector growth rate.

Decision Rule: Reject H_{01} if P-value ≤ 0.05 at 5% level of significance, and accept H_{01} if otherwise stated

Hypothesis Two

H_0; Nigeria's oil sector growth rate has no significant impact on Nigeria's economic growth rate.

H_1; Nigeria's oil sector growth rate has significant impact on Nigeria's economic growth rate.

Decision Rule: Reject H_{01} if P-value ≤ 0.05 at 5% level of significance, and accept H_{01} if otherwise stated.

Hypothesis Three

H_0; No causal relationship exists between oil supply growth rate, oil demand growth rate, oil terms of trade and Nigeria's oil sector growth rate.

H_1; Causal relationship exists between oil supply growth rate, oil demand growth rate, oil terms of trade and Nigeria's oil sector growth rate.

Decision Rule: Reject H_0 if P-value ≤ 0.05 at 5% level of significance, and accept H_0 if otherwise stated.

3.7 Data Sources

This study relies on time series data ranging from 1983-2017. The Data sets for this study were sourced from CBN Statistical bulletin of various years, NBS bulletin of various years, NNPC bulletin of various years, and OPEC bulletin of various years and WDI.

CHAPTER FOUR

RESULT PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

The empirical results from data analysis are presented in this chapter. The results include pre-test results, data analysis, post test results. Empirical findings are also discussed.

4.1 Result Presentation and Analyses

Pre-test results: This section includes unit root test, co-integration test and error correction test.

Table 4.1 Augmented Dickey-Fuller (ADF) unit root test Model one.

VARIABLES	ADF	Critical 5%	PP	Critical 5%	Order	Remarks
Dependent variable model one						
NOSGR	-7.6813	-3.5577	-13.8359	-3.5577	I(I)	Reject H_0
Dependent variable model two						
NEGR	-5.6877	-3.5577	-11.8002	-3.5577	I(I)	Reject H_0
Independent control variables for all the models						
CGR	-6.1840	-3.5628	-5.8583	-3.6529	I(I)	Reject H_0
LGR	-7.5415	-3.5577	-11.8997	-3.5577	I(I)	Reject H_0
Independent variables for model one						
CEPGR	-5.6973	-3.5529	-5.7452	-3.5529	I(I)	Reject H_0
CERGR	-5.0318	-3.5577	-7.1169	-3.4529	I(I)	Reject H_0
PPIPGR	-4.1424	-3.5507	-5.7075	-3.5258	I(I)	Reject H_0
PPIEGR	-6.0767	-3.5076	-6.3808	-3.6259	I(I)	Reject H_0
OCTOT	-5.7891	-3.5577	-5.7891	-3.5577	I(I)	Reject H_0
ODFTOT	-4.4333	-3.5742	-7.9802	-3.5577	I(I)	Reject H_0
Independent variables for model two						
NOSGR	-7.6813	-3.5577	-13.8359	-3.5577	I(I)	Reject H_0
$NEGR_{t-1}$	-7.0234	-3.5577	-14.0849	-3.5577	I(I)	Reject H_0
EXCHR	-3.6888	-3.5529	-3.6832	-3.5529	I(I)	Reject H_0

Source: Author's Computation 2019.

Unit root test hypothesis and decision rule

$H_{0:}$ The variable has unit root (not stationary)

$H_{1:}$ The variable has no unit root (stationary)

Decision rule: reject H_0 if ADF is greater than critical value in absolute terms at chosen level of significance.

From unit root test, it is obvious that all the variables in model one and two are stationary at order I(I), we therefore reject H_0 across all the variables and models, and then conclude that the variables are stationary (the variables have no unit root) in all the models specified. Since all the variables are stationary at order I (I), this study therefore adopted Engel-Granger two stage co-integration test in models one and two. First stage of EG co-integration test states that residual is a level stationary variable and second stage states that there should be at least one co-integrated variable in the equation.

Table 4.2: Residual unit root test

Model one						
VARIABLE	ADF	Critical 5%	PP	Critical 5%	Order	Remarks
Resid01	-7.3326	-2.9540	-7.5085	-2.9540	I(0)	Reject H_0
Model two						
VARIABLE	ADF	Critical 5%	PP	Critical 5%	Order	Remarks
Resid02	-4.0473	-2.9511	-4.4473	-2.9511	I(0)	Reject H_0

Source: Author's computation 2019.

Table 4.3: Engel-Granger co-integration test model one

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
NOSGR	-4.118873	0.6499	-23.00700	0.6411
CGR	-6.061111	0.0710	-35.21932	0.0677
LGR	-2.412293	0.9943	-15.70338	0.9448
CEPGR	-6.119848	0.0648	-35.40325	0.0641
CERGR	-6.462436	0.0372**	-36.89796	0.0403**
PPIPGR	-6.805533	0.0207**	-38.92446	0.0197**
PPICGR	-6.275487	0.0505**	-36.92114	0.0399**
OCTOT	-3.890262	0.7406	-23.84673	0.5906
ODFTOT	-2.530695	0.9912	-14.59071	0.9645

** denote co-integration

Source: Author's computation 2019.

Table 4.4: Engel-Granger co-integration test model two

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
NEGR	-4.094974	0.2860	-21.59014	0.3411
CGR	-6.507234	0.0038**	-37.53619	0.0043**
LGR	-2.837020	0.8161	-13.76166	0.8026
NOSGR	-6.284883	0.0061**	-36.67693	0.0060**
$NEGR_{t-1}$	-6.102696	0.0089**	-36.14956	0.0074**
EXCHR	-5.525281	0.0283**	-32.89804	0.0231**

** denote co-integration
Source: Author's computation 2019.

Table 4.2 shows that residual series in equation one and two are stationary variables, while tables 4.3 and 4.4 indicate that the time series in model one and two are co-integrated. In model one there are three co-integrating variables as shown in table 4.3 while 4.4 shows that there are four co-integrating variables.

Engel-Granger co-integration test hypothesis and decision rule.

H_0: the variables are not co-integrated

H_1: the variables are co-integrated

Decision rule:

Reject H_0 if there is no single co-integrating variable at chosen level of significance and accept H_0 if otherwise stated.

Tables 4.2, 4.3 and 4.4 indicate that the dependent and independent variables specified in model one and two of this study are co-integrated since the residuals are integrated at order zero and we had at least one co-integrating variable in the model one and two. This indicates that there exist long run relationship between the dependent and independent variables in all the models specified in this study. Granger representation theorem cited in Gujarati, Porter and Gunasekar (2012) states that if two variables dependent and independent are co-integrated, the relationship between the two can be expressed as error correction mechanism (ECM). This means that in short-run there may be disequilibrium which will warrant treating the error term in equations 3.12 and 3.14 as equilibrium error. Correction of the may be disequilibrium in co-integration equation is the major import of ECM. If short-run disequilibrium is not corrected (that is, if coefficient of ecm_{t-1} is positive) we conclude that the dependent variable cannot adjust to equilibrium level in the short-run, as a result the analysis of the study will be based on long-run result. On the other hand, If the short-run disequilibrium is corrected (that is, if coefficient of

ecm_{t-1} is negative) we conclude that the dependent variable can adjust to equilibrium level in the short-run as a result the study analysis will rely on short run result. Meanwhile since we have more than one co-integrating variables in all the models specified, we will reject H_0 which states that there is no single co-integrating variable in the models at 5% level of significance and accept H_1.

Engel-Granger Error Correction Model (Short-run).

Table 4.5 Error correction test

Model one			
Variable	Coefficient	t-statistic	Prob.*
ECM01(-1)	-0.2108	19.7737	0.0022
Model two			
Variable	Coefficient	t-statistic	Prob.*
ECM02(-1)	-0.4634	-3.9872	0.0000

Source: Author's Computation 2019.

Table 4.5 reveals that there exists short-run disequilibrium in model one and two specified in the study. The negative coefficients imply that for short-run disequilibrium in model one to be corrected in the long run, it will require 21% speed of adjustment, while that of model two will require 46.3% speed of adjustment. Given the ECM results, the analysis of this study relied on short run result and the particular short run result to be applied is the model with minimum Akaike information criterion, Schwarz criterion and Hannan-Quinn criterion.

Data/Result Analysis

The analysis of this study relies on short-run result with minimum Akaike, Schwarz and Hannan-Quinn information criteria across all the models specified.

Table 4.6 Engel-Granger ECM (Short-run) result for model one

Dependent Variable	NOSGR		
independent Variables			
Variable	Coefficient	t-Statistic	Probability
CGR	4.146449	-5.236067	0.0044
LGR	1.657720	-3.145183	0.0005
CEPGR	2.775121	7.658067	0.0027
CERGR	4.219029	8.844265	0.0007
PPIPGR	0.028050	5.145988	0.0012
PPIEGR	0.044065	12.59380	0.0005
OCTOT	1.020002	5.827248	0.0011
ODFTOT	1.193407	7.229369	0.0009
ECM(-1)	-0.210842	19.77376	0.0022
Other test statistic			
Variables	Values		
R-squared	0.680300		
Adjusted R-squared	0.527000		
F-statistic and Prob(F-statistic)	6.200032 (0.000001)		
Durbin-Watson stat	1.758174		
Information criteria			
Akaike info criterion	6.167916		
Schwarz criterion	6.576055		
Hannan-Quinn criterion	6.305243		

Source: Author's Compilation 2019.

The above short run model is the model with minimum Akaike, Schwarz and Hannan-Quinn criteria values. Economically, the above short-run result reveals first among other that a unit increase in capital and labour growth rates (CGR and LGR) in Nigeria will increase Nigeria's oil sector growth rate (NOSGR) by 4.14 and 1.66 units respectively. Second, a unit increase in Nigeria's Crude oil Export Price Growth Rate (CEPGR) and Crude oil Export Revenue Growth Rate (CERGR) will increase NOSGR by approximately 2.78 and 4.22 units respectively. Third, a unit increase in Nigeria's Petroleum Products Import Price Growth Rate (PPIPGR) and Petroleum Products Import Expenditure Growth Rate (PPIEGR) will increase NOSGR by approximately 0.03 and 0.04 units respectively. Fourth, a unit increase in Nigeria's Oil Commodity Terms of Trade (OCTOT) and Oil Double Factorial Terms of Trade (ODFTOT) will

increase NOSGR by approximately 1.02 and 1.19 units respectively. On the other hand, t-test statistics shows that CGR and LGR have negative significant impact on NOSGR, while CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT have positive significant impact on NOSGR. F-test shows that overall test statistics is positive and statistically significant.

Table 4.7: Engel-Granger short-run result for model two

Dependent Variable	NEGR		
Independent Variables			
Variable	Coefficient	t-Statistic	Probability
CGR	1.306000	3.000333	0.0000
LGR	0.365423	0.067542	0.7755
NOSGR	2.812342	2.999567	0.0110
$NEGR_{t-1}$	0.602399	3.134640	0.0040
EXCHR	2.555232	-4.561111	0.0200
ECM02(-1)	-0.463489	-3.987200	0.0000
Other test statistic			
Variables	Values		
R-squared	0.752004		
Adjusted R-squared	0.562233		
F-statistic and Prob(F-statistic)	2.940000 (0.000000)		
Durbin-Watson stat	1.807000		
Information criteria			
Akaike info criterion	5.008300		
Schwarz criterion	6.567851		
Hannan-Quinn criterion	5.673460		

Source: Author's Computation 2019.

Form economics point of view, Table 4.7 above reveals first among other things that a unit increase in capital growth rate (CGR) in Nigeria will increase Nigeria's economic growth rate (NEGR) by approximately 0.31unit and a unit increase in labour growth rates (LGR) will decrease NEGR by approximately 0.37 units. It shows also that an increase in NOSGR increases NEGR by 2.81unit, while an increase in lag of Nigeria's economic growth rate ($NEGR_{t-1}$) increases NEGR by 0.60unit. In addition, increase in oil exchange rate increases NEGR by approximately 2.56 units. Statistically, we reject H_0 and conclude that CGR, NOSGR, $NEGR_{t-1}$ and EXCHR have statistical significant impact on NEGR, and accept H_0 for LGR. Regardless of the controversy in T-test statistic, the F-test result obtained in model two suggests that F-computed is greater than F-tabulated meaning that we should reject H_0 and conclude in overall

that CGR, NOSGR, $NEGR_{t-1}$ and EXCHR have significant impact on Nigerian economic growth rate.

4.1.1 Evaluation of Estimate.

Estimated results are evaluated based on (a) Economic criteria (a priori expectations), (b) statistical criteria (c), econometric criteria and (d) price elasticity of crude of export, refined petroleum import and income elasticity of refined petroleum import (Point elasticity approach).

Economic Criteria (a-priori expectation)

Model one

Table 4.8: a-priori expectation

Independent variables	Exp. signs	Obtained results	Remarks
CGR	+	4.146449	Conform to a-priori
LGR	+	1.657720	Conform to a-priori
CEPGR	+	2.775121	Conform to a-priori
CERGR	+	4.219029	Conform to a-priori
PPIPGR	+	0.028050	Conform to a-priori
PPIEGR	+	0.044065	Conform to a-priori
OCTOT	+	1.020002	Conform to a-priori
ODFTOT	+	1.193407	Conform to a-priori

Source: Researcher's Computation 2019.

Table 4.8 shows that all the variables conformed to a-priori expectation, however CGR, CEPGR and CERGR are more economically significant to reckon with given their signs and magnitude. LGR, OCTOT and ODFTOT are more of breakeven factors as their unit increase can only contribute to a unit increase in NOSGR. Economically with the values of LGR, OCTOT and ODFTOT it may be difficult for oil trade to drive NOSGR successfully and effectively. Despite the positive signs possessed by PPIPGR and PPIEGR the magnitudes of the variables are not encouraging to affirm strongly that they have impacted positively on NOSGR. Generally, the results obtained indicate that downstream oil import are more of withdrawal than injection since a unit increase in PPIPGR and PPIEGR could only contribute to 0.02 and 0.04 units of NOSGR which is infinitesimal.

Model two

Table 4.9: a-priori expectation

Independent variables	Exp. signs	Obtained results	Remarks
CGR	+	1.306000	Conform to a-priori
LGR	+	0.365423	Conform to a-priori
NOSGR	+	2.812342	Conform to a-priori
$NEGR_{t-1}$	+	0.602399	Conform to a-priori
EXCHR	+	0.555232	Conform to a-priori

Source: Researcher's Compilation 2019.

Table 4.9 shows that all the variables in model two of the study conformed to a-priori expectation. Nevertheless, NOSGR and CGR contributed respectively to NEGR more than other variables. While contributions of LGR, $NEGR_{t-1}$ and EXCHR to NEGR are relatively daunt despite possessing positive sign. This may imply that growth rate of labour output is less than proportionate to its expected output, and that reinvestment of national income is relatively poor or below expectation. In addition it means also that Nigerian government has poorly managed fluctuations of dollar which ordinarily determines the position of crude oil export revenue and refined petroleum import expenditure.

Statistical Criteria (First order test).

This stage includes; t-statistic, F-statistic, coefficient of determination (R^2) and adjusted coefficient of determination (R^{-2}).

Model one

Table 4.10: T-test statistic

Independent Variables	t-computed	Probability	Remarks
CGR	-5.236067	0.0044	Reject H_0
LGR	-1.145183	0.0905	Reject H_0
CEPGR	7.658067	0.0027	Reject H_0
CERGR	8.844265	0.0007	Reject H_0
PPIPGR	5.145988	0.0012	Reject H_0
PPIEGR	12.59380	0.0005	Reject H_0
OCTOT	5.827248	0.0011	Reject H_0
ODFTOT	7.229369	0.0009	Reject H_0

Source: Researcher's Computation 2019.

T-test statistic decision rule states that H_0 should be rejected if P-value is less than or equal to 0.05 and be accepted if stated otherwise. From the T-test results in table 4.10 above, it shows that P-value for CGR, CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT is less than 0.05. Hence, we conclude that the variables have significant impact on NOSGR, whereas CGR and LGR had negative significant impact on NOSGR, CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT had positive significant impact on NOSGR. Contrarily, the P-value for LGR is greater than 0.05, thus we conclude that LGR has no significant impact on NOSGR. Generally, given the results obtained we reject H_0 that stated thus; Oil supply growth rate (CEPGR and CERGR), oil demand growth rate (PPIPGR and PPIEGR) and oil terms of trade (OCTOT and ODFTOT) have no significant impact on Nigerian oil sector growth rate and accept H_1.

Model two

Table 4.11: T-test statistic

Independent Variables	t-computed	Probability	Remarks
CGR	3.000333	0.0000	Reject H_0
LGR	0.067542	0.7755	Accept H_0
NOSGR	2.999567	0.0110	Reject H_0
$NEGR_{t-1}$	3.134640	0.0040	Reject H_0
EXCHR	-4.561111	0.0200	Reject H_0

Source: Researcher's Computation 2019.

T-test result shown in table 4.11 above indicates that P-value for CGR, NOSGR, $NEGR_{t-1}$ and EXCHR is less than 0.05, as a result we conclude that the variables have statistical significant impact on NEGR. On the other hand, P-value for LGR is greater than 0.05 hence we conclude that LGR has no statistical significant impact on NEGR. Extensively, from the T-test results we reject H_0 and accept H_1 that stated that NOSGR has significant statistical impact on Nigerian economic growth rate.

Table 4.12: F-test statistic

Model One			
F-computed	F-tabulated 5%	Probability	Remarks
6.200032	2.53	0.000001	Reject H_0
Model Two			
F-computed	F-tabulated 5%	Probability	Remarks
2.940000	2.53	0.000000	Reject H_0

Source: Researcher's Computation 2019.

F-test results obtained in model one and two shows that F-computed is greater than F-tabulated across all models. Therefore, we reject H_0 and conclude that overall oil supply growth rate (CEPGR and CERGR), oil demand growth rate (PPIPGR and PPIEGR) and oil terms of trade (OCTOT and ODFTOT) have significant impact on Nigerian oil sector growth rate, and that NOSGR has significant statistical impact on Nigerian economic growth rate.

Coefficient of determination (R^2): from the estimated results, the value of R^2 in model one is 0.68 which implies that 68% of changes in NOSGR are explained by LGR, CGR, CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT. The value of R^2 in model two is 0.75, meaning that 75% of changes in NEGR are explained by LGR, CGR, NOSGR, $NEGR_{t-1}$ and EXCHR.

Adjusted coefficient of determination (R^{-2}): R^{-2} penalizes a model for addition of less value added variables or addition of variables of the same behavior. From the results obtained, all the values of R^{-2} indicate that the explanatory variables in this study are not perfectly related. Evidence to that effect is the value of the estimated R^{-2} for model one which is 0.52, and for model two which is 0.56. By implication there is about 52% non-collinearity among LGR, CGR, CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT, while about 56% non-collinearity exist among NOSGR, $NEGR_{t-1}$ and EXCHR.

Table 4.13: Pair Wise Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	Remarks
CEPGR does not Granger Cause NOSGR	33	0.0009	0.005	CEPGR→NOSGR
NOSGR does not Granger Cause CEPGR		0.2134	0.809	NOSGR ≠ CEPGR
CERGR does not Granger Cause NOSGR	33	0.0003	0.000	CERGR→NOSGR
NOSGR does not Granger Cause CERGR		0.8724	0.429	NOSGR ≠ CERGR
PPIPGR does not Granger Cause NOSGR	33	0.4614	0.635	PPIPGR ≠ NOSGR
NOSGR does not Granger Cause PPIPGR		0.0002	0.002	NOSGR → PPIPGR
PPIEGR does not Granger Cause NOSGR	33	0.0037	0.027	PPIEGR ↔ NOSGR
NOSGR does not Granger Cause PPIEGR		0.0042	0.006	
OCTOT does not Granger Cause NOSGR	33	0.0049	0.0024	OCTOT→NOSGR
NOSGR does not Granger Cause OCTOT		1.2140	0.312	NOSGR ≠ OCTOT
ODFTOT does not Granger Cause NOSGR	33	0.0028	0.000	ODFTOT→ NOSGR
NOSGR does not Granger Cause ODFTOT		0.3424	0.999	NOSGR ≠ ODFTOT

Source: Researcher's compilation 2019.

Firstly, pair wise granger causality test shows that there exists causal link flowing from CEPGR, CERGR, OCTOT and ODFTOT to NOSGR without feedback, these implies that there exists unidirectional relationship flowing from CERGR, OCTOT and ODFTOT to NOSGR. Secondly, NOSGR causes PPIPGR without feedback. Thirdly, PPIEGR causes NOSGR with feedback; this confirms a bidirectional relationship between PPIEGR and NOSGR.

4.1.2 Econometric criteria (post test).

Normality test: empirical results from Jarque-Bera (J-B) normality test shows that J-B P-value for model one is equals to 0.59, and J-B P-value for model two is equals to 0.28. As a result we reject H_1 which stated that the error terms of the models are not normally distributed and accept H_0 and conclude that the error terms of the models specified are normally distributed.

Test for Autocorrelation: empirical result from Durbin-Watson (D-W) test shows that computed D-W for model one is equals to 1.7, while for model two is 1.80. Durbin-Watson table for model one and two show that D-W lower case (d_L) is equals to 1.160 and 1.222, and D-W upper case (d_u) is equals to 1.803 and 1.726 respectively. Given the Durbin-Watson decision rule, we take no decision on model one and two H_0 and conclude that there is no evidence of autocorrelation or no autocorrelation with a first order scheme in the specified models.

Multicollinearity test:

Table 4.14: Correlation Matrix for Multi-Collinearity test (model one).

	NOSGR	CGR	LGR	CEPGR	CERGR	PPIPGR	PPIEGR	OCTOT	ODFTOT
NOSGR	**1.000000**	**0.064623**	**0.484590**	**-0.117701**	**0.034481**	**-0.208373**	**-0.005398**	**0.367991**	**0.301045**
CGR	**0.064623**	**1.000000**	**-0.126418**	**0.159107**	**0.094078**	**0.171915**	**-0.118014**	**-0.236291**	**0.093963**
LGR	**0.484590**	**-0.126418**	**1.000000**	**-0.094871**	**-0.171834**	**-0.437489**	**0.192463**	**0.710719**	**0.403491**
CEPGR	**-0.117701**	**0.159107**	**-0.094871**	**1.000000**	**0.332755**	**0.266138**	**-0.042123**	**-0.006089**	**0.203297**
CERGR	**0.034481**	**0.094078**	**-0.171834**	**0.332755**	**1.000000**	**0.328923**	**-0.046773**	**-0.040485**	**0.189142**
PPIPGR	**-0.208373**	**0.171915**	**-0.437489**	**0.266138**	**0.328923**	**1.000000**	**-0.078982**	**-0.484578**	**-0.053224**
PPIEGR	**-0.005398**	**-0.118014**	**0.192463**	**-0.042123**	**-0.046773**	**-0.078982**	**1.000000**	**0.273964**	**-0.201815**
OCTOT	**0.367991**	**-0.236291**	**0.710719**	**-0.006089**	**-0.040485**	**-0.484578**	**0.273964**	**1.000000**	**0.048100**
ODFTOT	**0.301045**	**0.093963**	**0.403491**	**0.203297**	**0.189142**	**-0.053224**	**-0.201815**	**0.048100**	**1.000000**

Source: Researcher's Computation 2019.

From the table 4.14 above, we discovered that the entire pair wise correlation matrix is not in excess of 0.8. We therefore conclude that there is no presence of multi-collinearity among the variables in the model one signifying that each independent variable in the model influences the dependent variable differently.

Table 4.15: Correlation Matrix for Multicollinearity test (model two)

	NEGR	CGR	LGR	NOSGR	$NEGR_{t-1}$	EXCHR
NEGR	**1.0000**	**0.0882**	**0.2877**	**-0.0792**	**-0.0075**	**0.0538**
CGR	**0.0882**	**1.0000**	**-0.2199**	**0.2315**	**-0.2058**	**-0.0113**
LGR	**0.2877**	**-0.2199**	**1.0000**	**-0.5040**	**0.0859**	**0.2379**
NOSGR	**-0.0792**	**0.2315**	**-0.5040**	**1.0000**	**0.1163**	**-0.1432**
$NEGR_{t-1}$	**-0.0075**	**-0.2058**	**0.0859**	**0.1163**	**1.0000**	**-0.0915**
EXCHR	**0.0538**	**-0.0113**	**0.2379**	**-0.1432**	**-0.0915**	**1.0000**

Source: Researcher's Computation 2019.

The multicollinearity test shown in table 4.15 above disclosed that the entire pair wise correlation matrix is not in excess of 0.8. As a result, we conclude that there is no presence of multicollinearity among the variables in the model specified, this also signifies that each independent variable in the model influences the dependent variable differently.

Test for Heteroskedascity: like other statistical test, BPG test-statistic is divided into χ^2_{cal} and χ^2_{tab}. χ^2_{cal} = ½ * ESS (Expected Sum of Square). From empirical results obtained ESS for model one is equals to 2.534554, and 2.338904 for model two respectively. Therefore χ^2_{cal} for model one and two 1.267277 and 1.169454, from table, χ^2_{tab} = 2.17973. From the BPG test decision rule which states: reject H_0 if the calculated χ^2 is greater than critical value of χ^2 at chose level of significance and accept H_0 if stated otherwise. We therefore accept H_0 and conclude that the error terms specified in models one and two are homoskedastic.

Point elasticity: the point elasticity approach is used to compute year-by-year income elasticity of refined petroleum import, price elasticity of crude of export and price elasticity refined petroleum import. Adenikinju, Ajakaiye, Decaluwe and Iwayemi (2009), degrees of elasticity of income, import and export are symbolically expressed as;

Income/import/export is perfectly elastic if $e_p = \pm 2$ or $\pm \infty$

Income/import/export is fairly elastic if $e_p = \pm 1.1$ to ± 1.9

Income/import/export is perfectly inelastic if $e_p = 0$

Income/import/export is fairly inelastic if $e_p = \pm 0.1$ to ± 0.9.

Income/import/export is unitary elastic if $e_p = \pm 1$.

Where e_p stand for elasticity of income/import/export, it suffices to note that in principle we ignore the negative signs while interpreting the elasticity result. In this paper, the negative signs were recognized because of its policy implication in practice.

Table 4.16: a seven year average of income elasticity of refined petroleum import, price elasticity of crude of export and price elasticity refined petroleum import.

YEAR	INERPIM (₦ & metric ton)	PECOS ($ & Barrel)	PEPPD (₦ & metric ton)
1983-1989	0.283943	-1.34271	0.500014
1990-1996	0.2086	0.404771	-3.99953
1997-2003	0.432429	-0.93783	0.730057
2004-2010	0.1574	-0.02506	6.227414
2011-2017	9.204929	-0.57719	69.88197
Ave. Total	10.2873	-2.47801	73.33993
INERPIM = Income elasticity of refined petroleum import; PECOS = price elasticity of crude oil export; PEPPD = price elasticity of refined petroleum import.			

Source: Author's Computation 2019.

Table 4.16 above reveals that income elasticity of refined petroleum import (INERPIM) has had positive sign of different degree from 1983-2017. Within 1983-1989, 1990-1996, 1997-2003 and 2004-2010 INERPIM recorded 0.28%, 0.20% 0.43% and 0.15% respectively which is fairly inelastic positively. This signifies that a unit increase in Nigerian national income increases her capacity to import refined petroleum products but less than proportionate increase in income. In 2011-2017 INERPIM stood at 9.20% which is perfectly elastic positively, meaning that a unit increase in Nigerian national income increases her capacity to import refined petroleum products more than proportionate increase of her income. Total average of INERPIM from 1983-2017 was positive and perfectly elastic recording approximately 10.29%, indicating that from 1983-2017 on average a unit increase in Nigerian national income increased her capacity to import refined petroleum products more than proportionate increase in income.

Economically speaking, the result of INERPIM implies that Nigeria is spending large portion of her national income on importation of refined petroleum products under study. Given the huge crude oil reserve and deposit in Nigeria and the size of her domestic refinery, coupled with domestic consumption of refined petroleum products according to (NNPC, 2017) importation of refined petroleum products is not in favour of Nigeria's economy at all. It also implies that there are little or no close energy alternatives or substitutions to refined petroleum in Nigeria. This further means that price may not be the major determinant of refined petroleum importation in Nigeria other factors such as increase in fuel consuming facilities and population growth rate may be responsible. Such importation behavior may lead to imported inflation, high cost of

domestic production, increase in poverty, low living standard and finally uninterrupted economic deterioration or complicated economic situation.

Table 4.16 reveals that within 1983-1989 price elasticity of crude oil supply (PECOS) was fairly elastic negatively that is -1.34%, meaning that increase in price of crude oil from 1983-1989 led to more than proportionate decrease in quantity of crude oil exported by Nigeria. From 1990-1996 PECOS was fairly inelastic positively recording 0.40%, which means increase in crude oil price brought about less than proportionate increase in quantity of crude oil exported. Within 1997-2003 and 2011-2017 PECOS was fairly elastic negatively recording -0.93% and -0.57% respectively, this simply means that within these periods increase in price of crude oil led relatively to more than proportionate decrease in quantity exported. In 2004-2010 PECOS was inelastic negatively recording -0.02%. Generally, from 1983 to 2017 PECOS proved to be elastic negatively recording -2.47% meaning that increase in price of crude oil within the aforementioned periods brought about more than proportionate decrease in quantity exported. Economically, this implies that either there is no gain in crude oil export or that the gain is relatively insignificant.

From economics point of view the PECOS result shows that exportation of crude oil may be more in favour of countries importing from Nigeria. It also sends a signal that there are huge alternatives or substitutions to crude in the world economy, hence, price alone may not be the major determinant of crude oil consumption. For instance, other factors such as OPEC policies and deviation from policies by members, domestic vandalism, domestic economic unrest, activities of non-OPEC members, and increase in innovation of alternative energy sources in DCs etc may be the chief determinants of crude oil export in Nigeria.

Table 4.16 also shows that Price elasticity of refined petroleum demand (PEPPD) was perfectly elastic negatively (that is -3.99%) from 1990-1996 meaning that an increase in price of refined petroleum products within the period brought about more than proportionate decrease in quantity imported. From 1983-1989 and 1997-2003 PEPPD was fairly inelastic positively (0.50% and 0.73% respectively) meaning that an increase in price of refined petroleum products within the periods brought about less than proportionate increase in quantity imported. Within 2004-2010

and 2011-2017 PEPPD was perfectly elastic positively recording 6.23% and 69.88% respectively. This implies that an increase in price of refined petroleum brought about more than proportionate increase in quantity imported. Total average of PEPPD from 1983 to 2017 recorded 73.33% meaning positive perfectly elastic elasticity. By implication, on average increase in price of refined petroleum products from 1983 to 2017 brought about more than proportionate increase in quantity imported in Nigeria.

From economics point of view it means that importation of refined petroleum products is not in favour of the Nigerians and Nigeria's economy at large. It also implies that there are no alternatives or substitutions to refined petroleum in Nigeria, and that price may not be the major determinant of refined petroleum importation. Other factors such as increase in fuel consuming facilities, population growth rate and poor domestic power supply may have contributed huge to refined petroleum importation in Nigeria. This form of trade structure may lead to imported inflation, high cost of production, low individual and national income, poverty, low living standard and finally perpetual underdevelopment.

It suffices to note that point elasticity approach has some deficiencies because it measures price, income and quantity relationship without recognizing other factors that can influence export-import quantities. However, it occupies a relevant consign in policy formation and analysis.

4.2 Evaluation of Research Hypotheses

The hypotheses of this study are justified with different statistical techniques ranging from short run Engel-Granger statistic, t-statistic and pair wise granger causality test.

Hypothesis one

H_{01}; Oil supply growth rate, oil demand growth rate and oil terms of trade have no significant impact on Nigerian economic growth rate.

H_{11}; Oil supply growth rate, oil demand growth rate and oil terms of trade have significant impact on Nigerian economic growth rate.

Decision Rule: Reject H_{01} if P-value ≤ 0.05 at 5% level of significance, and accept H_{01} if otherwise stated.

T-test result shows that CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT and ODFTOT have significant impact on NOSGR at 5% level of significance, we therefore reject H_0 and conclude that oil supply growth rate (CEPGR and CERGR), oil demand growth rate (PPIPGR and PPIEGR) and oil terms of trade (OCTOT and ODFTOT) have significant impact on Nigerian oil sector growth rate.

Hypothesis two

H_0; Nigeria's oil sector growth rate has no significant impact on Nigeria's economic growth rate.
H_1; Nigeria's oil sector growth rate has significant impact on Nigeria's economic growth rate.

Decision Rule: Reject H_{01} if P-value ≤ 0.05 at 5% level of significance, and accept H_{01} if otherwise stated.

T-test result shows that NOSGR has significant impact on NEGR at 5% level of significance; we therefore reject H_0 and conclude that NOSGR has significant impact on Nigerian economic growth rate.

Hypothesis three

Granger causality test result shows that NOSGR and CEPGR are independent of each other; we therefore accept H_0 and conclude that no causal link exists between NOSGR and CEPGR.

Pair wise granger causality test result shows that there exists unidirectional causality flowing from CERGR, OCTOT and ODFTOT to NOSGR without feedback, hence, we reject H_0 and conclude that there exists unidirectional causality from CERGR, OCTOT and ODFTOT to NOSGR.

Granger causality test result indicates that NOSGR causes PPIPGR without feedback; we therefore reject H_0 and conclude that there exists unidirectional causality from NOSGR to PPIPGR.

Granger causality test indicates that PPIEGR causes NOSGR with feedback; we therefore reject H_0 and conclude that there exist bidirectional causality between NOSGR and PPIEGR.

4.3 Discussion of Findings.

The discussion of findings herein tries to highlight the outcomes of the results from the models used to capture the objectives of the study. Hence, emphases were placed on economic criteria, statistical criteria, granger causality and elasticity. Further the results obtained were compared with the results of related empirical literatures reviewed and as well as the theoretical postulations adopted in this study.

The broad objective of this study is to examine the impact of oil sector trade on Nigerian economic growth from 1983 to 2017. While the specific objectives are; (1) to determine the impact of oil supply growth rate, oil demand growth rate and oil terms of trade on Nigeria's oil sector growth rate, (2) to examine the impact of oil sector growth rate on Nigeria's economic growth rate, and (3) to investigate the direction of causality existing between oil supply growth rate, oil demand growth rate, and oil terms of trade and Nigeria's oil sector growth rate.

The data requirements for the study were collected and subjected to statistical pre-test, the study adopts Engel-Granger test statistic because the variables were stationary at first difference and had at least one co-integrating variable. Granger causality test was also adopted to test the causal link between oil supply growth rate, oil demand growth rate, and oil terms of trade and Nigeria's oil sector growth rate. The statistical and economic analysis of the model one and two of the study is based on short run results as shown in table 4.6 and 4.7.

In the model one of this study, the individual test statistic reveals that oil supply growth rate variables (CEPGR and CERGR), oil demand growth rate (PPIPGR and PPIEGR) and oil terms of trade (OCTOT and ODFTOT) have positive significant impact on NOSGR. In the same vein the overall test statistics reveals that all the explanatory variables have positive significant impact on NOSGR. Economically, CEPGR, CERGR PPIPGR, PPIEGR, OCTOT and ODFTOT have positive impact on NOSGR. Whereas CEPGR, CERGR and ODFTOT had positive impact of high magnitude on NOSGR, OCTOT exhibits moderate positive on NOSGR, while PPIPGR and PPIEGR had positive impact of low magnitude on NOSGR.

The statistical and economic results obtained from the model one of this study agree with Prebisch-Singer and Emmanuel hypothesis which posit that TOT will always be negative for developing countries and will always contribute negatively to her economic growth except oil producing countries. This is unlike Diakosavvas and Scandizzo (1991) who found that both oil and non-oil rich countries have the tendency to witness both positive and negative TOT.

Empirically despite the diverse approaches adopted by different studies, the result obtained from crude oil export price growth rate agree with the findings of Donwa et al (2015), Mgbame et al (2015), Ogboru et al (2015) and Umar and Abdulhakeem (2010) who found positive relationship between crude oil export price and its changes thereof and Nigerian economic growth. It also agrees with findings of Zhang (2018) who found positive relationship between crude oil export price and Canada's economic growth. Partly it agrees with the outcome in Foudeh (2017) which found that crude oil price growth rate had positive impact on Kingdom of Saudi Arabia (KSA) economic growth from 1995-2015.

However, some empirical studies held different opinion, Ahuru and James (2015), Emmanuel (2015), Nwanna and Eyedayi (2015), Ibrahim (2014), Okoro (2014) and Oriakhi and Osaze (2013) found that crude oil price effects have contributed negatively to Nigeria's economic growth. Tehranchian and Seyyedkolaee (2017), Gasmi and Laourari (2016) and Millington (2016) found that crude oil price fluctuations have negative impact on economic growth of Iran, Algeria and Canada respectively. Further the results obtained from crude oil export revenue growth rate agree with the findings of Nwoba and Ahuru (2016), Abayemi et al (2015) and Nweze and Edame (2015). These studies found that crude oil export revenue have positive impact of low magnitude on Nigeria's economic growth, However, Baghebo and Atima (2014) holds the reverse.

From the second model it was observed statistically that CGR, NOSGR and $NEGR_{t-1}$ have positive significant statistical impact on Nigerian economic growth rate, while EXCHR and LGR have negative and no statistical significant impact on Nigerian economic growth rate respectively. Economically it was found that all the variables in model two of this study conformed to a-priori expectation. Nevertheless, NOSGR and CGR contributed more to NEGR than LGR, $NEGR_{t-1}$ and EXCHR. This outcome confirms with Akanni (2014) who opined that the volume of crude oil export is the major international trade driving Nigeria's economic growth

which invariably means that oil sector external trade performance is the major driver of Nigeria's economic growth.

Causality test result reveals the following; first, CEPGR, CERGR, OCTOT and ODFTOT have the capacity to predict the direction of NOSGR without feedback. Second, NOSGR predicts the direction of PPIPGR without feedback while PPIPGR predicting the direction of NOSGR. Finally, PPIEGR and NOSGR predict the direction of each other, by implication PPIEGR depend on NOSGR and vice versa. The causal link between NOSGR and CEPGR did not agree with Meade's postulate because he believes that CEPGR (which can serve as a proxy to demand decision of the Nigerian trade partners) predicts the direction of NOSGR without feedback. But the result obtained shows that NOSGR and CEPGR are independent of each other.

The causal link between CERGR, OCTOT, and ODFTOT and NEGR is in tandem with Meade's postulate and Prebisch-Single and Emmanuel's hypotheses. This is because Prebisch-Single and Emmanuel argued that demand and supply decisions of the developed nations determines the growth of developing nations which is always unfavourable to developing nations except oil producing countries. From this study CERGR, OCTOT, and ODFTOT can serve as proxy to demand and supply decisions of the developed nations trading with Nigeria and the obtained results indicates that these variables can contribute to gradual under development in Nigeria and Nigeria is one of the top fifteen crude oil producing and exporting countries in the World.

The result obtained from point elasticity revealed that total average of income elasticity of imported refined petroleum products (INERPIM) from 1983-2017 was positive and perfectly elastic recording approximately 10.29%. It indicates that from 1983-2017 on average a unit increase in Nigerian national income increased her capacity to import refined petroleum products more than proportionate increase in income. And this is unfavourable to Nigeria's economy as an oil rich nation with domestic refineries that can service domestic demand for refined petroleum products without options to import.

Second, it shows that from 1983 to 2017 price elasticity of crude oil supply (PECOS) proved to be elastic negatively recording -2.47% meaning that increase in price of crude oil within the aforementioned periods brought about more than proportionate decrease in quantity exported.

Economically, this implies that either there is no gain in crude oil export or that the gain is relatively insignificant, and this is also unfavourable to Nigeria's economy as oil dependent nation. Third, total average of price elasticity of imported refined petroleum products (PEPPD) from 1983 to 2017 recorded 73.33% meaning positive perfectly elastic elasticity. By implication, on average increase in price of refined petroleum products from 1983 to 2017 brought about more than proportionate increase in quantity imported in Nigeria. Further it implies that Nigeria imports more as price of refined petroleum products increases in international market. This is also harsh to Nigeria's economy given the volume of her crude oil deposit, size of her refineries and domestic consumption.

Empirically, some studies have analyzed price and income elasticity of import and export with different technique arrived with different outcome. For instance Jebran et al (2017) analyzed the impact of income elasticity of crude oil demand (import) on Pakistan economy. They found that income is a stronger determinant of crude oil import in Pakistan both short and long run, this is closely related to the result obtained in this study with respect to refined petroleum importation in Nigeria. It was also observed that Nigeria's National income stimulates importation of refined petroleum importation. Stambuli (2013) investigated income elasticity of crude oil demand in Tanzania and found that in the short-run the demand for crude oil was income inelastic while in the long-run it was income elastic. For Nigeria the study under review found that income elasticity of refined petroleum importation is income elastic.

Marquez (1990) estimated price elasticity of imports and exports of Canada, Germany, Japan, United Kingdom, United States and OPEC from 1973Q1-1985Q4 using point elasticity approach. He found that OPEC had negative but fairly elastic import price elasticity, negative fairly inelastic export price elasticity and negative fairly elastic aggregate price elasticity. Contrarily, using the same elasticity approach for Nigeria this study found that refined petroleum import price elasticity is positive and elastic while crude oil export price elasticity is negative and elastic.

Theoretically, Prebisch-Singer and Emmanuel hypothesis posit that TOT will always be negative for developing countries and will always contribute negatively to her economic growth. They also state that primary products of the LDCs face negative aggregate trade elasticity in

international market as a result of (i) inelastic price of primary exports, (ii) elastic price of imported manufactured products, and (iii) elastic income elasticity of import. However, they excluded oil producing countries from victim of the said conditions. Using point elasticity approach, this study found on average within the study period that for Nigeria crude oil (primary product) export price elasticity is negative and elastic, while refined petroleum (manufactured product) import price and income elasticity is positive and elastic. This means that the variables are not in tandem with Prebisch-Singer and Emmanuel's hypothesis.

Summarily, the results obtained from the study are mixed, whereas the Engle-Granger estimation result reveals that oil sector trade growth rate have positive impact on oil sector performance growth rate, the granger causality and elasticity results show the otherwise.

4.4 Policy Implications of Findings

Policy implication of the study finding tries to point out negative and positive economic implication of the results on Nigerian economy. Hence, the implications of economic criteria results of the model one and two as well as implications of the causality and elasticity tests of this study were highlighted.

The impact of oil supply growth rate (that is CEPGR which recorded 2.77 and CERGR which recorded 4.21) by the upstream sector on Nigerian oil sector growth rate as observed from economic criteria result implies that; growth rate of export activities by the upstream sector have contributed immensely to the growth rate of Nigerian oil sector. On the other hand, Low impact of oil demand growth rate (PPIPGR which recorded 0.02 and PPIEGR which recorded 0.04) on Nigerian oil sector growth rate implies that; growth rate of refined petroleum products importation activities by the downstream sector are contributing near to nothing to the growth rate of Nigerian oil sector. Put differently it also implies that downstream oil import activities are gradually deterring performance of the oil sector.

Further, OCTOT and ODFTOT having 1.02 and 1.19 unit impact on NOSGR respectively implies that oil importation activities is depleting the little benefits from crude exportation, this because OCTOT and ODFTOT measure export-import price ratio and revenue-expenditure ratio respectively. It also implies that the gap between export-import prices and revenue-expenditure

in Nigeria's oil sector is slim. A framework and trend by EIA in 2011 explained more concerning products made from a barrel of crude oil and price interaction between crude oil and products from crude oil.

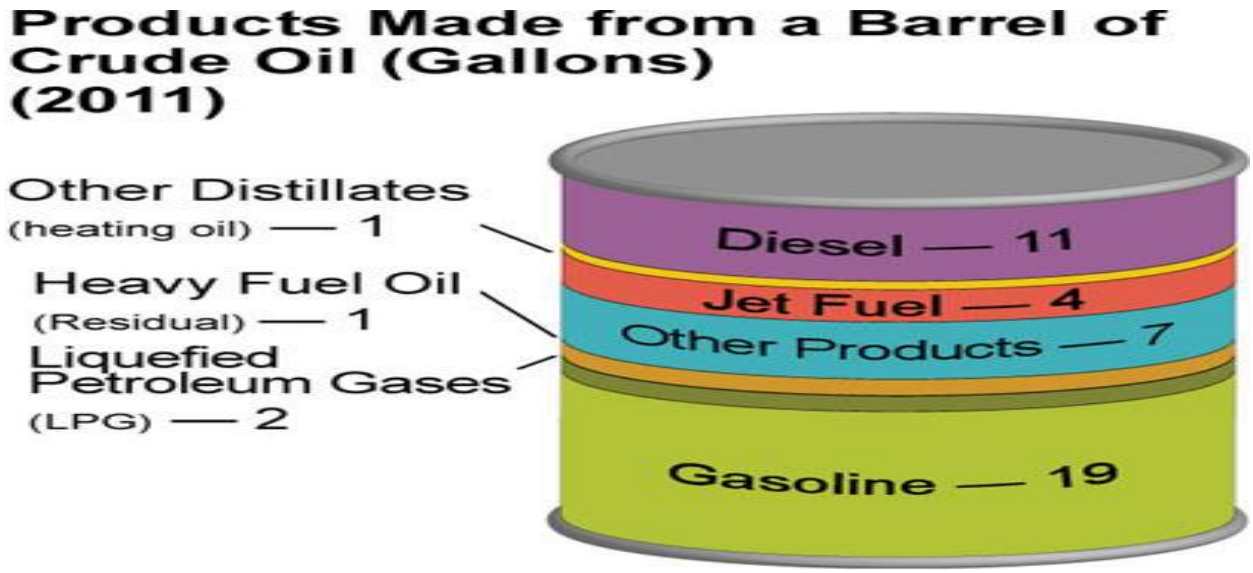

Figure 4.1: products made from a barrel of crude oil (Gallons)

Source: EIA 2011.

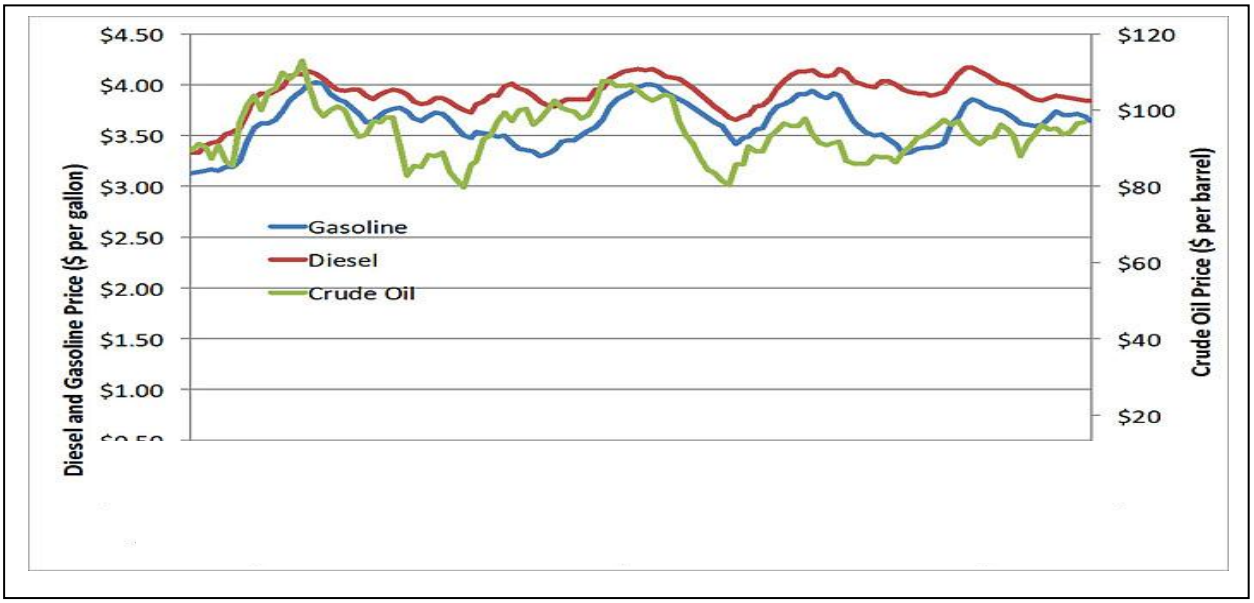

Figure 4.2: price trend of Crude oil, Gasoline, Diesel ($ per barrel and gasoline)
Source: EIA 2011.

Figure 4.1 shows that many products are produced from crude oil, but figure 4.2 indicates that gasoline and diesel which are among sub-products of crude oil are competing strongly with crude oil in terms of price. This scenario can go a long way to partly explain why OCTOT and ODFTOT have approximately a unit impact on NOSGR.

From the second model of this study it was observed that NOSGR had positive impact on NEGR, meaning that positive impact of oil trade activities on NOSGR stretches to Nigerian economy growth. Howbeit, on average the impact of oil trade activities on NOSGR is higher when compared with the impact of NOSGR on NEGR. This may occur as a result of the right to retain part of oil revenue by NNPC, Sayne, Gillies and katsouris (2015) submit that the right to retain revenue facilitates some of the corrupted practices in NNPC. They noted precisely in 2004 that NNPC retained around $1.6 billion or 27 percent of the Domestic Crude Allocation's (DCA's) full assessed value and by 2012 the amount had jumped to $7.9 billion or 42 percent. This implies that NNPC do not submit all her full assess revenue to federal government hence the impact of oil trade on oil sector performance may differ from the impact of sector performance on Nigeria's economic growth.

On the other hand, economic implications of the causality test are as follow; first, CEPGR, CERGR, OCTOT and ODFTOT granger causing NOSGR without feedback point at the inability of Nigeria's oil trade policies to predict the direction of the aforementioned variables, while the variables with or without policies have influence on NOSGR. It also shows that NOSGR are exposed to external shocks, hence, CERGR, OCTOT and ODFTOT are risk variables despite their positive impact on NOSGR. Secondly, NOSGR predicts the direction of PPIPGR without feedback; it means that as Nigerian economy is expanding in petroleum consumption there is a tendency of price of imported petroleum products to increase consistently without impacting positively on Nigeria's economic growth rate. It means also that NOSGR is causing price of imported petroleum products to increase without meaningful economic benefits. Hence, PPIPGR is not a variable required for effective economic growth in Nigeria.

Finally, bidirectional relationship which exists between PPIEGR and NOSGR as shown by the granger causality test implies that PPIEGR can be controlled by policies in Nigerian oil sector with economic benefit in return. For instance, expenditures on imported petroleum products can be controlled by improving domestic production of petroleum products in Nigeria.

Price elasticity of crude oil supply (PECOS) been elastic negatively has different economic implications. First, in practice it implies that crude oil price is inversely related to the quantity exported. Second, it implies that crude oil has energy substitutes in the world economy such that any increase in its price will lead to less than proportionate decrease in its exported quantity. The CUSUM test for North America is a typical example because Nigeria is gradually losing the North American market given improvement in energy industry in U.S.A and Canada. Third, it means that increase in price of crude oil attracts excessive supply mainly from non-OPEC members, and such supply behavior may cause not only reduction in quantity supplied but has the capacity to force down the price. These have the capacity to welcome perpetual underdevelopment in Nigeria in the long-run since Nigeria relies heavily on oil.

Price elasticity of imported refined petroleum products (PEPPD) been elastic positively implies that price of imported refined petroleum is positively related to the quantity imported. It implies that refined petroleum has little or inadequate energy substitutes in Nigeria, as such any increase in its price will lead to more than proportionate increase in its imported quantity given consistence increase in fuel consuming facilities and population growth rate in Nigeria. Income elasticity of imported refined petroleum products been elastic positively implies that there is positive relationship between increase in Nigeria's national and increased importation of refined petroleum. This form of trade structure may lead to imported inflation, high cost of domestic production, low individual and national income, high poverty, low living standard and perpetual underdevelopment as well as transfer of real income from Nigeria to her trade partners with to via refined petroleum products.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter summarizes the major findings of this research work. This is followed by the conclusion drawn from the study and recommendations thereof.

5.1 Summary

Prebisch-Singer (1950) and Emmanuel (1969) postulated that trade which involves exportation of primary products from developing nations into developed nations and importation of manufactured products from developed nations into developing nations will contribute to perpetual underdevelopment of the letter except in oil producing countries (Todaro and Smith, 2009). In context, Nigeria is not just rich in crude oil deposit but she is among the top fifteen crude oil producers and exporters in the world, and one of the top ten importers of refined petroleum products in the world among oil rich countries. Hence the need to examine the impact of oil sector trade on Nigeria's economic growth.

In fine, studies such as Abdulkareem and Abdulhakeem (2015), Ayadi (2015), Nwanna and Eyedayi (2015), Ahuru and Jame (2015), Donwa et al (2015), Emmanuel (2015), Nwaeze and Edeme (2015), Abayomi et al (2015), Baghebo and Atima (2014), Odularu (2014) and Ibeh (2013) have examined the impact of oil sector trade on Nigerian economic growth. Thus, these studies focused on supply side of Nigerian oil trade without considering the demand bloc whereas in practice Nigeria's oil trade cut across supply and demand bloc. Secondly, these studies did not ascertain the impact of oil trade on oil sector performance whereas in practice oil trade impacts first on the oil sector and the oil sector in turn impacts on the economy at large.

Therefore a research gap exist which requires further investigation in order to capture not only the full circle of oil trade in Nigeria but also to examine its impact on Nigeria's oil sector as well as determine the impact of oil sector on Nigeria's economy growth. Considering the fact that Nigeria depends heavily on oil sector activities mainly on international oil trade, combined with the fact that oil trade has lasted for decades in Nigeria with evidence of fluctuates which also caused fluctuates in Nigerian economy. This study therefore focused precisely on the impact of

oil trade growth rate on oil sector performance growth rate as well as the impact of oil sector performance growth rate on Nigeria's economic growth rate from 1983 to 2017.

In order to bridge the identified gaps, the study under review set the following objectives; to determine the impact of oil supply growth rate, oil demand growth rate and oil terms of trade on Nigeria's oil sector growth rate. To examine the impact of oil sector growth rate on Nigeria's economic growth rate. To investigate the direction of causality existing between oil supply growth rate, oil demand growth rate, and oil terms of trade and Nigeria's oil sector growth rate. Thereafter related literatures were reviewed and appropriate theories adopted, the components of the adopted theories are suitable to capture the objectives of the study.

Afterward appropriate methods were espoused and required data collected, the data sets were subjected to statistical pre-test in order to ascertain the robustness of the variables after which the researcher adopted Engel-Granger test statistic. The Engel-Granger statistical test revealed that there exist both long and short-run relationship between oil supply growth rate, oil demand growth rate, and oil terms of trade and Nigerian economic growth rate. The statistical and economic analysis of the study is based on short run results as shown in tables 4.6 and 4.7 in order to capture objectives one and two while granger causality test was adopted to capture objective three of the study see table 4.13. In addition point elasticity was also adopted as part of post test as did in Marquez (1990) in order to ascertain if the elastic behavior of the variables are as postulated by theory.

The results empirically obtained from economic and statistical criteria indicate that oil supply growth rate variables (CEPGR and CERGR), oil demand growth rate variables (PPIPGR and PPIEGR) and oil terms of trade variables (OCTOT and ODFTOT) have positive economic and statistical impact on NOSGR, and this is in tandem with theoretical postulation adopted in the study. The causality test reveals that NOSGR can only predict or cause PPIPGR out of the six oil trade variables considered in this research work. Secondly, only PPIEGR interacts with NOSGR in bidirectional manner out of six oil trade variables adopted in the study. Thirdly, CEPGR, CERGR, OCTOT and ODFTOT predict the direction of NOSGR without feedback. The elasticity results revealed that income elasticity of refined petroleum importation is positive and elastic, and price elasticity of crude oil supply is negative and elastic while price elasticity of refined petroleum importation positive and elastic.

Summarily, the observed result shows that oil supply by upstream sector have more potential to promote Nigerian economic growth if properly managed. Secondly it was observed that the downstream sector is more responsible for decline in joint trade performance of the upstream and downstream sub-sectors. Finally, from Prebisch-Singer and Emmanuel argument it appears that trade elasticity and terms of trade go in the same direction. But empirical findings of this study observed that in Nigerian oil sector, these variables do not go in the same direction always. For instance, Nigeria's oil trade elasticity partly conformed to theoretical hypotheses, while the oil terms of trade did not. Regardless, it suffices to say that these variables are economically meaningful to serve as policy instruments for individuals and nations in terms of domestic and international trade.

5.2 Conclusion

This study undertakes the impact of oil sector trade on economic growth in Nigeria with specific interest on the impact of oil supply growth rate, oil demand growth rate, trade elasticity and oil terms of trade on Nigerian economic growth rate from 1983 to 2017. Enshrined in the body of the work include relevant growth and economics theories, the reasons for adoption of these theories were stated and the assumptions, proponents, critiques of the theories were highlighted. Related empirical literatures were reviewed to further give a more robust outlook to the research work from which research gaps were drawn. Methods of analysis relevant to capture the study objectives were adopted. Empirical findings revealed that oil supply, oil demand and oil terms of trade confirmed to theoretical expectation, though the supply variables exhibits low impact. Whereas the causality test revealed that CEPGR, CERGR, OCTOT and ODFTOT predict the direction of NOSGR without feedback, the elasticity test shows that income elasticity of refined petroleum importation, price elasticity of refined petroleum importation and price elasticity of crude oil supply are elastic positively and elastic negatively respectively.

To be more specific, economic criteria results unveiled that the upstream sector outperformed the downstream sector within this study period. Evidence to that effect is the contributions of the upstream and downstream to NOSGR in respect of oil export and oil demand. The export variables from the upstream sector contributed more to NOSGR than the downstream import variables. As a result, the low performance of the downstream sector reflected in low performance of the joint trade performance of the sub-sectors as evidenced by relative low

contributions of OCTOT and ODFTOT to NOSGR. OCTOT and ODFTOT contributed 0.02unit and 0.92unit to NOSGR as against 2.77 units and 4.21units by upstream sector. This may be as a result of low contribution of downstream sector which stood at 0.02 and 0.04 units. Despite the odds, Engle-Granger estimation shows that oil trade have positive impact on NOSGR which is in-line with theoretical views adopted in this study. Again it was also observed that the Nigeria's oil sector growth rate (NOSGR) contribution to NEGR is less when compared with the contribution of oil trade on NOSGR, this may be as a result of the right NNPC reserves to retain part of her oil revenue.

Causality test indicates that CEPGR, CERGR, OCTOT and ODFTOT have the competence to predict the direction of NOSGR without feedback, meaning that internal policies are not responsible for shocks in Nigerian oil sector rather external factors. This is because crude price is not determined by Nigerian Government and oil revenue rest upon demand for crude oil from other countries which Nigerian Government is not in control of.

The elasticity results show that Nigeria is facing triple deficit, first income elasticity of refined petroleum importation been positive and elastic means that it took the shape of supply curve which denotes that suppliers (suppliers of refined petroleum products to Nigeria) of refined petroleum products benefit from the market than the consumers (Nigeria in this case). Second, price elasticity of refined petroleum importation been positive and elastic means that its curvature slope upward like supply curve rather demand curve which it is ought to be. It indicates consumer deficit and supplier surplus, or an indirect way of financial leakage via petroleum importation. Third, price elasticity of crude oil supply been positive and elastic means that supply curve of crude oil export is downward slope like a demand curve. A situation of such favours the consumer (nations importing crude oil from Nigeria) and deters the supplier (Nigeria in this case). In summary, elasticity results indicate that oil trade is not in favour of Nigeria.

Following the results obtained from Engle-Granger estimation, Granger causality test and point elasticity the researcher then conclude that; a) on average Nigeria's oil trade pattern is surrounded with doubting benefits and may not be good enough to set economic growth and developmental platform required in the economy, b) terms of trade, price and income elasticity do not go in the same direction always as proposed by Prebisch-Singer and Emmanuel, c) Nigeria as an oil producing country is not excepted from falling into the trap of income elastic

elasticity and price elastic of manufactured products as proposed by Prebisch-Singer and Emmanuel, and d) the structure of oil trade going on in Nigeria has the tendency to seat perpetual underdevelopment in Nigeria's economy.

5.3 Recommendations

Based on the findings and conclusions of this study, the following recommendations were made; firstly, Nigerian Government should prioritize fixing the refineries to produce at full capacity and channel oil trade towards exportation of both crude oil and refined petroleum products in order to expand oil revenue base of the economy and zero import expenditure of refined petroleum. Alternatively, Nigerian Government should export crude oil and service domestic demands for refined petroleum products through domestic refineries without reasons for refined petroleum products importation.

Secondly, Government should sell off compromise of all forms and make the domestic refineries functional as well as promote local methods of oil refining and reward domestic innovation. In such ways import expenditure of refined petroleum products will reduce if possible to zero and it will in turn improve oil elasticity and terms of trade. Again, it will enable petroleum industry to serve effectively as feedback industry to sub-petroleum industries such as plastic, cosmetic and wax industries etc. thirdly, Government should come up with new reforms on economic diversification which will gear towards promotion of other productive sectors of the economy such as mining, agriculture, *pharmaceutical*, ceramic and steel industries with a vision to produce and export refined/manufactured/finished products without recourse to exportation of primary products. Improving other sectors of Nigerian economy by producing and exporting manufactured products will reduce excessive load and dependence from oil sector.

5.4 Contribution to knowledge.

Unlike previous studies that focused on examining the impact of oil trade on Nigerian economic growth with specific interest on the supply side of oil trade in Nigeria. The present study have contributed to existing literatures by examining the impact of oil supply and oil demand blocs on Nigerian economic growth with specific interest on oil supply growth rate, oil demand growth rate, oil terms of trade and Nigerian economic growth rate. This contribution to knowledge is imperative because findings of previous literatures only revealed fraction of the entire oil trade

going on in Nigerian economy while the outcome of the present study captured both oil supply and oil demand going on in Nigerian economy. The present study also evaluated trade performance of the upstream and downstream sub-sectors individually and jointly, since the supply bloc and demand bloc is managed by upstream and downstream sub-sectors respectively.

Again in Nigeria, oil trade (supply and demand) has lasted for a very long time and has witnessed changes which have the capacity to account for changes in Nigerian economy. As a result, there is a need to examine the impact of changes in oil trade on changes in Nigerian economy from both supply and demand blocs. But previous studies reviewed neglected the demand bloc of Nigerian oil trade and its inherent changes. But the variables neglected by previous studies formed part of the present study for better analysis of Nigerian oil trade.

Further, as argued by pessimist's trade activists it appears that elasticity of income, price and terms of trade go in the same direction. But this study has empirically found that in the context of Nigeria oil sector, these variables do not go in the same direction always. This is a contribution to knowledge because it will serve as policy stance to policy maker to note that elasticity and terms of trade do not go in the same direction always and may yield different results. Again, this study also found that despite the fact that Nigeria exports primary oil product and imports refined oil products its trade operational outcome does not follow the pessimists trade hypotheses exactly but fractionally.

5.5 Agenda/Suggestion for further studies.

This study has successfully examined the impact of oil sector trade on Nigerian economic growth and thereafter recommend that further studies should be carried out which will incorporate refined petroleum exportation because fraction of imported refined petroleum in Nigeria are re-exported. Again available statistics have shown that both developed and developing oil rich countries export crude oil and import refined petroleum. There is a need for further studies to conduct a comparative analysis by examining the impact of oil sector trade on economic growth of developed and developing countries. Because of improvements in energy industry mainly in North American region and the statistical evidence of declined import from the region, coupled with the fact that the region is the highest energy consumer in the world. There is a need to ascertain the impact of energy (oil) consumption decision of the region on Nigeria's oil supply.

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APPENDICE

Appendix I: DATA SET USED FOR THE STUDY ANALYSIS.

YEAR	NEGR	NOSGR	CGR	LGR	CEPGR	CERGR	PPIPGR	PPIEGR	OCTOT	ODFTOT	EXCHR
1983	-7.5766	-13.206	-23.866	30.3382	1.28913	-5.6354	10.9635	14.8426	31.9341	0.652255	0.7241
1984	-0.5088	-22.314	-16.08	31.2469	12.6364	32.1263	9.58084	3.77949	32.8525	1.10356	0.7649
1985	8.52483	25.8669	33.2821	31.313	1.00888	14.4616	5.7377	-2.1407	31.3385	1.4604403	0.8938
1986	1.89966	15.9672	56.0342	32.9508	21.0947	18.9371	39.6641	64.1801	27.0389	0.7824178	2.0206
1987	0.17024	179.561	-25.265	32.803	154.503	122.034	59.0194	64.3869	43.8749	1.4074782	4.0179
1988	6.23327	11.7366	30.8764	33.8237	-5.8984	-1.6321	12.9145	-1.9978	36.3983	1.4164617	4.5367
1989	6.65606	156.304	80.2628	34.6548	99.5867	173.496	62.9057	65.926	44.8191	2.9830568	7.3916
1990	11.6276	30.959	59.9604	35.4978	35.9263	38.0731	8.76028	10.5339	56.2637	3.9754257	8.0378
1991	-0.552	-16.266	17.8484	36.4624	8.18565	12.3735	41.2329	84.9374	42.8645	2.0232179	9.9095
1992	2.19349	111.823	40.3036	37.5919	67.2612	69.2853	74.5728	46.7748	41.0274	2.4868803	17.2984
1993	1.56881	1.91156	37.0656	38.7375	14.4801	9.38782	27.4679	9.63504	36.7452	2.4790175	22.0511
1994	0.25657	9.50001	30.121	39.9488	-7.724	-5.7682	-0.7402	-12.499	34.0895	2.7466395	21.8861
1995	1.87235	249.834	70.8139	41.1673	6.97588	12.0219	0	-19.255	36.5373	4.1979137	21.8861
1996	4.05203	51.0612	75.7713	42.434	20.6531	23.1169	77.7591	133.847	24.4782	1.736625	21.8861
1997	2.88592	7.68045	26.6409	42.3497	-5.4027	8.18442	10.8076	-41.777	20.751	4.0849351	21.8861
1998	2.4956	31.0748	14.5981	43.65	-31.43	-31.715	33.6425	82.9178	10.1601	0.8982677	21.8861
1999	0.52184	39.0433	61.1658	43.575	458.821	436.545	24.8052	-10.881	48.9696	10.428542	92.6934
2000	5.5185	113.446	-51.92	43.8555	75.6657	85.055	36.8478	276.499	63.1439	4.617299	102.1052
2001	6.66685	23.6743	83.2094	45.2736	-6.2855	2.33844	21.1913	-26.435	48.6011	6.8143875	111.9433
2002	14.6044	7.77845	-26.743	44.8875	8.89826	-7.402	28.4793	32.652	41.0415	4.4548491	120.9702
2003	9.50261	52.4082	-24.796	48.396	27.8277	52.4344	23.5965	95.2385	42.4808	3.2589287	129.3565
2004	10.442	54.9383	45.3318	50.018	36.9429	50.8395	10.1152	-0.4862	53.0742	5.4555381	133.5004
2005	7.00846	33.363	47.8918	47.4444	35.0899	30.7868	0	-5.2589	72.0487	7.9116537	132.1470
2006	6.72597	23.2671	6.33642	49.7882	13.8966	10.3664	3.7374	9.37341	79.2025	7.9925584	128.6516
2007	7.31808	7.87788	37.4549	50.9894	6.97694	3.63151	4.68735	14.9854	80.9566	7.1046148	125.8331
2008	7.19929	20.7713	26.5526	53.3577	43.0564	30.8891	5.62162	-18.412	110.004	12.001908	118.5669
2009	8.35334	18.4617	19.9717	50.7095	-33.559	-29.458	1.92767	32.5461	71.3576	5.919724	148.8802
2010	9.53979	95.5442	-23.328	51.4191	37.7399	54.8422	1.64854	-5.7315	97.0489	10.366097	150.2980
2011	5.30792	31.3797	3.923	51.1849	13.7846	8.17636	-1.8688	-88.772	112.689	108.51084	153.8616
2012	4.20589	2.49674	-4.7737	51.6385	-9.0792	-8.1181	5.11745	997.596	97.3349	8.1673673	157.4994
2013	5.48779	9.00312	26.7162	52.22	10.1253	1.01506	0.99761	-15.345	106.222	9.9390102	157.3112
2014	6.22294	6.60272	-29.346	53.56	2.0345	6.66848	0.55314	47.026	107.802	6.9363359	158.5526
2015	2.7864	-7.7707	4.49907	55.32	-47.454	-49.101	8.79371	-16.848	51.5498	3.8580541	193.2792
2016	-1.5831	-10.402	-12.423	54.4432	59.3649	33.2916	-13.508	-3.1413	95.8248	5.685388	253.4923
2017	0.8239	4.36124	0.93114	58.3947	42.6782	53.4456	-13.209	1.7644	97.7764	4.983272	305.7901

Sources: see below

- Nigerian Economic Growth rate (NEGR) is computed from Nigerian Gross Domestic Product at 2010 constant basic prices (N' billion) sourced from CBN bulletin.
- Capital Growth rate (CGR) is computed from Nigerian gross capital formation (N' billion) from CBN and NBS bulletin.
- Labour Growth rate (LGR) is a direct data on labour growth rate from NBS bulletin.
- Crude oil export price growth rate (CEPGR) is computed from international price of bonny light crude oil sourced from NNPC and OPEC bulletin.
- Crude oil export revenue growth rate (CERGR) is computed from crude oil export revenue sourced from NBS bulletin.
- Petroleum products import price growth rate (PPIPGR) is computed from international

  Price of refined petroleum products source from OPEC bulletin
- Petroleum products import expenditure growth rate (PPIEGR) is computed from expenditures on imported refined petroleum products source from NBS bulletin.
- Oil commodity terms of trade (OCTOT) is computed from weight of international price of bonny light crude oil over international price of refined petroleum products imported in Nigeria source from NNPC, OPEC and NBS bulletin.
- Oil double factorial terms of trade (ODFTOT) is computed from weight of crude oil export revenue over expenditures on imported refined petroleum products in Nigeria sourced from NBS bulletin.

Appendix II: Augmented Dickey-Fuller unit root test.

NOSGR I(I)

Null Hypothesis: D(NOSGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.681375	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NOSGR,2)
Method: Least Squares
Date: 04/19/18 Time: 10:32
Sample (adjusted): 1985 2017
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NOSGR(-1))	-1.305020	0.169894	-7.681375	0.0000
C	2.087978	1.571994	1.328235	0.1945
@TREND("1983")	-0.096444	0.079333	-1.215684	0.2339

R-squared	0.672429	Mean dependent var	0.073477
Adjusted R-squared	0.649838	S.D. dependent var	6.987984
S.E. of regression	4.135104	Akaike info criterion	5.765962
Sum squared resid	495.8735	Schwarz criterion	5.903375
Log likelihood	-89.25539	Hannan-Quinn criter.	5.811510
F-statistic	29.76522	Durbin-Watson stat	2.037584
Prob(F-statistic)	0.000000		

NEGR I(I)

Null Hypothesis: D(NEGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.687770	0.0000
Test critical values:	1% level	-3.676874	
	5% level	-3.557759	
	10% level	-3.000666	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NEGR,2)
Method: Least Squares
Date: 04/19/18 Time: 10:32
Sample (adjusted): 1985 2017
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NEGR(-1))	-1.305020	0.169894	-7.681375	0.0000
C	2.087978	1.571994	1.328235	0.1945
@TREND("1983")	-0.096444	0.079333	-1.215684	0.2339

R-squared	0.672429	Mean dependent var	0.073477
Adjusted R-squared	0.649838	S.D. dependent var	6.987984
S.E. of regression	4.135104	Akaike info criterion	5.765962
Sum squared resid	495.8735	Schwarz criterion	5.903375
Log likelihood	-89.25539	Hannan-Quinn criter.	5.811510
F-statistic	29.76522	Durbin-Watson stat	2.037584
Prob(F-statistic)	0.000000		

CGR I(I)

Null Hypothesis: D(CGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.184016	0.0001
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CGR,2)
Method: Least Squares
Date: 11/15/18 Time: 09:44
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR(-1))	-4.001504	0.647072	-6.184016	0.0000
C	19.33715	21.62508	0.894200	0.3794
@TREND("1983")	-0.524937	1.041710	-0.503919	0.6186

R-squared	0.848862	Mean dependent var	-1.070396
Adjusted R-squared	0.825610	S.D. dependent var	121.8792
S.E. of regression	50.89675	Akaike info criterion	10.84417
Sum squared resid	67352.46	Schwarz criterion	11.07545
Log likelihood	-163.0846	Hannan-Quinn criter.	10.91956

F-statistic	36.50713	Durbin-Watson stat	1.915150
Prob(F-statistic)	0.000000		

LGR I(I)

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.541546	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGR,2)
Method: Least Squares
Date: 04/12/18 Time: 14:14
Sample (adjusted): 1985 2017
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGR(-1))	-1.338775	0.177520	-7.541546	0.0000
C	1.201285	0.478291	2.511618	0.0178
@TREND("1983")	-0.009508	0.022704	-0.418788	0.6785

R-squared	0.662574	Mean dependent var	0.030292
Adjusted R-squared	0.639304	S.D. dependent var	1.966367
S.E. of regression	1.180961	Akaike info criterion	3.259594
Sum squared resid	40.44538	Schwarz criterion	3.397006
Log likelihood	-49.15350	Hannan-Quinn criter.	3.305142
F-statistic	28.47243	Durbin-Watson stat	2.088911
Prob(F-statistic)	0.000000		

CEPGR I(I)

Null Hypothesis: D(CEPGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.697325	0.0000
Test critical values:	1% level	-4.284580	
	5% level	-3.552973	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CEPGR,2)
Method: Least Squares
Date: 05/19/18 Time: 22:54
Sample (adjusted): 1986 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CEPGR(-1))	-2.043330	0.304868	-5.697325	0.0000
D(CEPGR(-1),2)	0.389058	0.177735	2.188981	0.0374
C	18.40050	43.78238	0.420272	0.6776
@TREND("1982")	-1.113316	2.178755	-0.510987	0.6135

R-squared	0.774675	Mean dependent var	-1.964018
Adjusted R-squared	0.749639	S.D. dependent var	216.4271
S.E. of regression	108.2917	Akaike info criterion	12.32745
Sum squared resid	316631.6	Schwarz criterion	12.51248
Log likelihood	-187.0755	Hannan-Quinn criter.	12.38776
F-statistic	30.94228	Durbin-Watson stat	2.188577
Prob(F-statistic)	0.000000		

CERGR I (I)

Null Hypothesis: D(CERGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.031830	0.0012
Test critical values:	1% level	-4.356068	
	5% level	-3.557759	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CERGR,2)
Method: Least Squares
Date: 05/19/18 Time: 22:55
Sample (adjusted): 1991 2017
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CERGR(-1))	-7.546850	1.426339	-5.031830	0.0001
D(CERGR(-1),2)	5.496005	1.331037	4.129114	0.0007
C	14.18927	33.56543	0.422735	0.6778
@TREND("1983")	-1.377488	1.544268	-0.892001	0.3848

R-squared	0.910467	Mean dependent var	-6.756600
Adjusted R-squared	0.868333	S.D. dependent var	154.8311

S.E. of regression	56.18189	Akaike info criterion	11.16249
Sum squared resid	53658.89	Schwarz criterion	11.59799
Log likelihood	-136.1124	Hannan-Quinn criter.	11.28790
F-statistic	21.60914	Durbin-Watson stat	1.901091
Prob(F-statistic)	0.000000		

PPIPGR I (I)

Null Hypothesis: D(PPIPGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.142487	0.0001
Test critical values:	1% level	-4.296729	
	5% level	-3.550750	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PPIPGR,2)
Method: Least Squares
Date: 05/19/18 Time: 22:57
Sample (adjusted): 1987 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PPIPGR(-1))	-3.010357	0.470362	-4.142487	0.0000
D(PPIPGR(-1),2)	1.123139	0.345647	3.249382	0.0033
D(PPIPGR(-2),2)	0.425855	0.176709	2.409923	0.0236
C	9.023480	9.961350	0.905849	0.3737
@TREND("1983")	-0.529180	0.490113	-1.079711	0.2906

R-squared	0.834703	Mean dependent var	0.402790
Adjusted R-squared	0.808255	S.D. dependent var	52.40249
S.E. of regression	22.94636	Akaike info criterion	9.255207
Sum squared resid	13163.38	Schwarz criterion	9.488740
Log likelihood	-133.8281	Hannan-Quinn criter.	9.329916
F-statistic	31.56067	Durbin-Watson stat	2.187379
Prob(F-statistic)	0.000000		

PPIEGR I (I)

Null Hypothesis: D(PPIEGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-6.076709	0.0004
Test critical values:	1% level	-4.296729	
	5% level	-3.507644	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PPIEGR,2)
Method: Least Squares
Date: 05/19/18 Time: 22:58
Sample (adjusted): 1987 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PPIEGR(-1))	-4.624709	0.828191	-6.076709	0.0000
D(PPIEGR(-1),2)	2.519467	0.671178	3.753796	0.0009
D(PPIEGR(-2),2)	1.312390	0.392751	3.341528	0.0026
C	-159.1731	183.1144	-0.869255	0.3930
@TREND("1983")	13.71211	9.713278	1.411687	0.1704

R-squared	0.847459	Mean dependent var	-0.320098
Adjusted R-squared	0.823053	S.D. dependent var	953.5559
S.E. of regression	401.1144	Akaike info criterion	14.97738
Sum squared resid	4022319.	Schwarz criterion	15.21092
Log likelihood	-219.6607	Hannan-Quinn criter.	15.05209
F-statistic	34.72263	Durbin-Watson stat	2.115594
Prob(F-statistic)	0.000000		

OCTOT I(I)

Null Hypothesis: D(OCTOT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.789164	0.0002
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OCTOT,2)
Method: Least Squares
Date: 04/22/18 Time: 22:10
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OCTOT(-1))	-1.276761	0.220543	-5.789164	0.0000
C	321.9295	692.0402	0.465189	0.6453
@TREND("1983")	-11.29653	35.22144	-0.320729	0.7507

R-squared	0.544076	Mean dependent var	-165.9355
Adjusted R-squared	0.512633	S.D. dependent var	2614.862
S.E. of regression	1825.480	Akaike info criterion	17.94613
Sum squared resid	96638906	Schwarz criterion	18.08355
Log likelihood	-284.1381	Hannan-Quinn criter.	17.99168
F-statistic	17.30354	Durbin-Watson stat	1.791309
Prob(F-statistic)	0.000011		

ODFTOT I(I)

Null Hypothesis: D(ODFTOT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.433398	0.0075
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ODFTOT,2)
Method: Least Squares
Date: 04/22/18 Time: 22:12
Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ODFTOT(-1))	-2.381808	0.537242	-4.433398	0.0002
D(ODFTOT(-1),2)	1.121905	0.458479	2.447017	0.0225
C	3411.300	1619.954	2.105801	0.0463
@TREND("1983")	-172.7676	79.04178	-2.185776	0.0393

R-squared	0.680352	Mean dependent var	21.52853
Adjusted R-squared	0.610864	S.D. dependent var	5050.106
S.E. of regression	3150.296	Akaike info criterion	19.13037
Sum squared resid	2.280008	Schwarz criterion	19.41326
Log likelihood	-271.3904	Hannan-Quinn criter.	19.21897
F-statistic	9.790846	Durbin-Watson stat	1.767630
Prob(F-statistic)	0.000041		

EXCHR 1(1)

Null Hypothesis: D(EXCHR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.688829	0.0374
Test critical values:	1% level	-4.262735	
	5% level	-3.552973	
	10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHR,2)
Method: Least Squares
Date: 07/28/19 Time: 09:12
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHR(-1))	-0.684057	0.185440	-3.688829	0.0009
C	-3.137528	6.396336	-0.490520	0.6273
@TREND("1983")	0.553372	0.328367	1.685227	0.1023

R-squared	0.318112	Mean dependent var	1.583545
Adjusted R-squared	0.272653	S.D. dependent var	20.11991
S.E. of regression	17.15919	Akaike info criterion	8.609453
Sum squared resid	8833.134	Schwarz criterion	8.745499
Log likelihood	-139.0560	Hannan-Quinn criter.	8.655228
F-statistic	6.997760	Durbin-Watson stat	1.974862
Prob(F-statistic)	0.003204		

$NEGR_{t-1}$ 1(1)

Null Hypothesis: D(NEGR(-1)) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.023498	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NEGR(-1),2)

Method: Least Squares
Date: 07/28/19 Time: 09:15
Sample (adjusted): 1986 2017
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NEGR(-2))	-1.239851	0.176529	-7.023498	0.0000
C	1.786041	1.675690	1.065854	0.2953
@TREND("1983")	-0.094159	0.080819	-1.165055	0.2535

R-squared	0.629919	Mean dependent var	-0.357416
Adjusted R-squared	0.604396	S.D. dependent var	6.588055
S.E. of regression	4.143692	Akaike info criterion	5.770111
Sum squared resid	497.9354	Schwarz criterion	5.907524
Log likelihood	-89.32178	Hannan-Quinn criter.	5.815660
F-statistic	24.68061	Durbin-Watson stat	2.080302
Prob(F-statistic)	0.000001		

Appendix III: Phillips-Perron (PP) unit root test

NOSGR I(I)

Null Hypothesis: D(NOSGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.83596	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	15.49605
HAC corrected variance (Bartlett kernel)	2.451311

Phillips-Perron Test Equation
Dependent Variable: D(NOSGR,2)
Method: Least Squares
Date: 04/22/18 Time: 22:14
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NOSGR(-1))	-1.305020	0.169894	-7.681375	0.0000
C	2.087978	1.571994	1.328235	0.1945
@TREND("1983")	-0.096444	0.079333	-1.215684	0.2339

R-squared	0.672429	Mean dependent var	0.073477
Adjusted R-squared	0.649838	S.D. dependent var	6.987984
S.E. of regression	4.135104	Akaike info criterion	5.765962
Sum squared resid	495.8735	Schwarz criterion	5.903375
Log likelihood	-89.25539	Hannan-Quinn criter.	5.811510
F-statistic	29.76522	Durbin-Watson stat	2.037584
Prob(F-statistic)	0.000000		

NEGR I(I)

Null Hypothesis: D(NEGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*

Phillips-Perron test statistic		-11.80022	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	15.49605
HAC corrected variance (Bartlett kernel)	2.451311

Phillips-Perron Test Equation
Dependent Variable: D(NEGR,2)
Method: Least Squares
Date: 04/22/18 Time: 22:14
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NEGR(-1))	-1.305020	0.169894	-7.681375	0.0000
C	2.087978	1.571994	1.328235	0.1945
@TREND("1983")	-0.096444	0.079333	-1.215684	0.2339

R-squared	0.672429	Mean dependent var	0.073477
Adjusted R-squared	0.649838	S.D. dependent var	6.987984
S.E. of regression	4.135104	Akaike info criterion	5.765962
Sum squared resid	495.8735	Schwarz criterion	5.903375
Log likelihood	-89.25539	Hannan-Quinn criter.	5.811510
F-statistic	29.76522	Durbin-Watson stat	2.037584
Prob(F-statistic)	0.000000		

CGR I(I)

Null Hypothesis: D(CGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.858303	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.652973	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1775.330
HAC corrected variance (Bartlett kernel)	359.3541

Phillips-Perron Test Equation
Dependent Variable: D(CGR,2)
Method: Least Squares
Date: 05/21/18 Time: 15:15
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR(-1))	-1.563514	0.154550	-10.11658	0.0000
C	11.44795	16.80218	0.681338	0.5011
@TREND("1983")	-0.630753	0.850249	-0.741844	0.4641

R-squared	0.779220	Mean dependent var	1.732171
Adjusted R-squared	0.763993	S.D. dependent var	91.10737
S.E. of regression	44.26042	Akaike info criterion	10.50712
Sum squared resid	56810.55	Schwarz criterion	10.64453
Log likelihood	-165.1139	Hannan-Quinn criter.	10.55267
F-statistic	51.17615	Durbin-Watson stat	2.559086
Prob(F-statistic)	0.000000		

LGR I(I)

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.89972	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.263918
HAC corrected variance (Bartlett kernel)	0.259602

Phillips-Perron Test Equation
Dependent Variable: D(LGR,2)
Method: Least Squares
Date: 04/22/18 Time: 22:20
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGR(-1))	-1.338775	0.177520	-7.541546	0.0000
C	1.201285	0.478291	2.511618	0.0178
@TREND("1983")	-0.009508	0.022704	-0.418788	0.6785

R-squared	0.662574	Mean dependent var	0.030292

Adjusted R-squared	0.639304	S.D. dependent var	1.966367
S.E. of regression	1.180961	Akaike info criterion	3.259594
Sum squared resid	40.44538	Schwarz criterion	3.397006
Log likelihood	-49.15350	Hannan-Quinn criter.	3.305142
F-statistic	28.47243	Durbin-Watson stat	2.088911
Prob(F-statistic)	0.000000		

CEPGR I(I)

Null Hypothesis: D(CEPGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.745262	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.552973	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	11651.76
HAC corrected variance (Bartlett kernel)	484.3450

Phillips-Perron Test Equation
Dependent Variable: D(CEPGR,2)
Method: Least Squares
Date: 05/21/18 Time: 15:16
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CEPGR(-1))	-1.470919	0.164160	-8.960268	0.0000
C	14.28131	42.97855	0.332289	0.7421
@TREND("1983")	-0.890860	2.172305	-0.410099	0.6847

R-squared	0.734663	Mean dependent var	-1.976496
Adjusted R-squared	0.716364	S.D. dependent var	212.9077
S.E. of regression	113.3892	Akaike info criterion	12.38859
Sum squared resid	372856.4	Schwarz criterion	12.52600
Log likelihood	-195.2174	Hannan-Quinn criter.	12.43414
F-statistic	40.14759	Durbin-Watson stat	2.360922
Prob(F-statistic)	0.000000		

CERGR I(I)

Null Hypothesis: D(CERGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 24 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.116980	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.452970	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6562.846
HAC corrected variance (Bartlett kernel)	353.1340

Phillips-Perron Test Equation
Dependent Variable: D(CERGR,2)
Method: Least Squares
Date: 05/21/18 Time: 15:18
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CERGR(-1))	-1.528945	0.157731	-9.693381	0.0000
C	17.57552	32.27937	0.544481	0.5903
@TREND("1983")	-1.038528	1.631819	-0.636424	0.5295

R-squared	0.764172	Mean dependent var	-1.081243
Adjusted R-squared	0.747908	S.D. dependent var	169.4896
S.E. of regression	85.09854	Akaike info criterion	11.81456
Sum squared resid	210011.1	Schwarz criterion	11.95197
Log likelihood	-186.0329	Hannan-Quinn criter.	11.86011
F-statistic	46.98560	Durbin-Watson stat	2.479108
Prob(F-statistic)	0.000000		

PPIPGR I(I)

Null Hypothesis: D(PPIPGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.707543	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.525870	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	607.5111
HAC corrected variance (Bartlett kernel)	72.34940

Phillips-Perron Test Equation
Dependent Variable: D(PPIPGR,2)
Method: Least Squares
Date: 05/21/18 Time: 15:19
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PPIPGR(-1))	-1.507336	0.158637	-9.501785	0.0000
C	2.016256	9.808369	0.205565	0.8386
@TREND("1983")	-0.146813	0.495790	-0.296119	0.7692

R-squared	0.756917	Mean dependent var	0.888494
Adjusted R-squared	0.740152	S.D. dependent var	50.79180
S.E. of regression	25.89125	Akaike info criterion	9.434747
Sum squared resid	19440.35	Schwarz criterion	9.572160
Log likelihood	-147.9560	Hannan-Quinn criter.	9.480296
F-statistic	45.15032	Durbin-Watson stat	2.387533
Prob(F-statistic)	0.000000		

PPIEGR I(I)

Null Hypothesis: D(PPICGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.380806	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.625972	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	205451.9
HAC corrected variance (Bartlett kernel)	10687.60

Phillips-Perron Test Equation
Dependent Variable: D(PPICGR,2)
Method: Least Squares
Date: 05/21/18 Time: 15:20
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PPICGR(-1))	-1.501440	0.160657	-9.345653	0.0000
C	22.46420	180.3979	0.124526	0.9018
@TREND("1983")	-1.244605	9.117405	-0.136509	0.8924

R-squared	0.750734	Mean dependent var	-1.281220
Adjusted R-squared	0.733544	S.D. dependent var	922.3970
S.E. of regression	476.1360	Akaike info criterion	15.25834
Sum squared resid	6574459.	Schwarz criterion	15.39576
Log likelihood	-241.1335	Hannan-Quinn criter.	15.30389
F-statistic	43.67085	Durbin-Watson stat	2.338987
Prob(F-statistic)	0.000000		

OCTOT I(I)

Null Hypothesis: D(OCTOT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.789164	0.0002
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3019966.
HAC corrected variance (Bartlett kernel)	3019966.

Phillips-Perron Test Equation
Dependent Variable: D(OCTOT,2)
Method: Least Squares
Date: 04/22/18 Time: 22:29
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OCTOT(-1))	-1.276761	0.220543	-5.789164	0.0000
C	321.9295	692.0402	0.465189	0.6453
@TREND("1983")	-11.29653	35.22144	-0.320729	0.7507

R-squared	0.544076	Mean dependent var	-165.9355
Adjusted R-squared	0.512633	S.D. dependent var	2614.862
S.E. of regression	1825.480	Akaike info criterion	17.94613
Sum squared resid	96638906	Schwarz criterion	18.08355
Log likelihood	-284.1381	Hannan-Quinn criter.	17.99168
F-statistic	17.30354	Durbin-Watson stat	1.791309

Prob(F-statistic)	0.000011

ODFTOT I(I)

Null Hypothesis: D(ODFTOT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.980234	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	9473938.
HAC corrected variance (Bartlett kernel)	2757112.

Phillips-Perron Test Equation
Dependent Variable: D(ODFTOT,2)
Method: Least Squares
Date: 04/22/18 Time: 22:31
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ODFTOT(-1))	-1.150924	0.183177	-6.283140	0.0000
C	1350.522	1241.868	1.087492	0.2858
@TREND("1983")	-78.93593	63.06902	-1.251580	0.2207

R-squared	0.576521	Mean dependent var	8.744576
Adjusted R-squared	0.547316	S.D. dependent var	4805.555
S.E. of regression	3233.265	Akaike info criterion	19.08943
Sum squared resid	3.03E+08	Schwarz criterion	19.22684
Log likelihood	-302.4309	Hannan-Quinn criter.	19.13498
F-statistic	19.74020	Durbin-Watson stat	2.088698
Prob(F-statistic)	0.000004		

$NEGR_{t-1}$ I(1)

Null Hypothesis: D(NEGR(-1)) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 26 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.08493	0.0000
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	

	10% level	-3.212361

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	15.56048
HAC corrected variance (Bartlett kernel)	1.677460

Phillips-Perron Test Equation
Dependent Variable: D(NEGR(-1),2)
Method: Least Squares
Date: 07/28/19 Time: 09:22
Sample (adjusted): 1986 2017
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NEGR(-2))	-1.239851	0.176529	-7.023498	0.0000
C	1.786041	1.675690	1.065854	0.2953
@TREND("1983")	-0.094159	0.080819	-1.165055	0.2535

R-squared	0.629919	Mean dependent var	-0.357416
Adjusted R-squared	0.604396	S.D. dependent var	6.588055
S.E. of regression	4.143692	Akaike info criterion	5.770111
Sum squared resid	497.9354	Schwarz criterion	5.907524
Log likelihood	-89.32178	Hannan-Quinn criter.	5.815660
F-statistic	24.68061	Durbin-Watson stat	2.080302
Prob(F-statistic)	0.000001		

EXCHR I(1)

Null Hypothesis: D(EXCHR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.683227	0.0378
Test critical values:	1% level	-4.262735	
	5% level	-3.552973	
	10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	267.6707
HAC corrected variance (Bartlett kernel)	266.2736

Phillips-Perron Test Equation
Dependent Variable: D(EXCHR,2)
Method: Least Squares

Date: 07/28/19 Time: 09:24
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHR(-1))	-0.684057	0.185440	-3.688829	0.0009
C	-3.137528	6.396336	-0.490520	0.6273
@TREND("1983")	0.553372	0.328367	1.685227	0.1023

R-squared	0.318112	Mean dependent var	1.583545
Adjusted R-squared	0.272653	S.D. dependent var	20.11991
S.E. of regression	17.15919	Akaike info criterion	8.609453
Sum squared resid	8833.134	Schwarz criterion	8.745499
Log likelihood	-139.0560	Hannan-Quinn criter.	8.655228
F-statistic	6.997760	Durbin-Watson stat	1.974862
Prob(F-statistic)	0.003204		

Appendix IV: ECM unit root ADF AND PP

Model One

ADF I(0)

Null Hypothesis: ECM01 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.332692	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM01)
Method: Least Squares
Date: 11/15/18 Time: 10:03
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM01(-1)	-1.263478	0.172308	-7.332692	0.0000
C	0.207652	0.689828	0.301019	0.7654

R-squared	0.634298	Mean dependent var	0.014996
Adjusted R-squared	0.622501	S.D. dependent var	6.445027
S.E. of regression	3.959887	Akaike info criterion	5.649000
Sum squared resid	486.1019	Schwarz criterion	5.739697
Log likelihood	-91.20850	Hannan-Quinn criter.	5.679517
F-statistic	53.76838	Durbin-Watson stat	1.875445
Prob(F-statistic)	0.000000		

PP I(0)

Null Hypothesis: ECM01 has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.508532	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	14.73036
HAC corrected variance (Bartlett kernel)	12.48543

Phillips-Perron Test Equation
Dependent Variable: D(ECM01)
Method: Least Squares
Date: 11/15/18 Time: 10:00
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM01(-1)	-1.263478	0.172308	-7.332692	0.0000
C	0.207652	0.689828	0.301019	0.7654

R-squared	0.634298	Mean dependent var	0.014996
Adjusted R-squared	0.622501	S.D. dependent var	6.445027
S.E. of regression	3.959887	Akaike info criterion	5.649000
Sum squared resid	486.1019	Schwarz criterion	5.739697
Log likelihood	-91.20850	Hannan-Quinn criter.	5.679517
F-statistic	53.76838	Durbin-Watson stat	1.875445
Prob(F-statistic)	0.000000		

Model Two

ADF I(0)

Null Hypothesis: ECM02 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.047387	0.0035
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM02)
Method: Least Squares
Date: 04/29/19 Time: 12:08
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

ECM02(-1)	-0.637027	0.157392	-4.047387	0.0003
C	0.190373	0.630439	0.301969	0.7646

R-squared	0.338588	Mean dependent var	0.081755
Adjusted R-squared	0.317919	S.D. dependent var	4.447038
S.E. of regression	3.672729	Akaike info criterion	5.496769
Sum squared resid	431.6460	Schwarz criterion	5.586555
Log likelihood	-91.44508	Hannan-Quinn criter.	5.527389
F-statistic	16.38134	Durbin-Watson stat	1.946265
Prob(F-statistic)	0.000307		

PP I(0)

Null Hypothesis: ECM02 has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.447387	0.0035
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	12.69547
HAC corrected variance (Bartlett kernel)	12.69547

Phillips-Perron Test Equation
Dependent Variable: D(ECM02)
Method: Least Squares
Date: 04/29/19 Time: 12:16
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM02(-1)	-0.637027	0.157392	-4.047387	0.0003
C	0.190373	0.630439	0.301969	0.7646

R-squared	0.338588	Mean dependent var	0.081755
Adjusted R-squared	0.317919	S.D. dependent var	4.447038
S.E. of regression	3.672729	Akaike info criterion	5.496769
Sum squared resid	431.6460	Schwarz criterion	5.586555
Log likelihood	-91.44508	Hannan-Quinn criter.	5.527389
F-statistic	16.38134	Durbin-Watson stat	1.946265
Prob(F-statistic)	0.000307		

Appendix V: ENGEL-GRANGER CO-INTEGRATION TEST

MODEL ONE

Date: 05/21/18 Time: 15:51
Series: NOSGR CGR LGR CEPGR CERGR PPIPGR PPICGR OCTOT ODFTOT
Sample: 1983 2017
Included observations: 35
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C
Automatic lags specification based on Schwarz criterion (maxlag=7)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
NEGR	-4.118873	0.6499	-23.00700	0.6411
CGR	-6.061111	0.0710	-35.21932	0.0677
LGR	-2.412293	0.9943	-15.70338	0.9448
CEPGR	-6.119848	0.0648	-35.40325	0.0641
CERGR	-6.462436	0.0372	-36.89796	0.0403
PPIPGR	-6.805533	0.0207	-38.92446	0.0197
PPIEGR	-6.275487	0.0505	-36.92114	0.0399
OCTOT	-3.890262	0.7406	-23.84673	0.5906
ODFTOT	-2.530695	0.9912	-14.59071	0.9645

*MacKinnon (1996) p-values.
Warning: p-values may not be accurate for fewer than 32 observations.

ntermediate Results:	NOSGR	CGR	LGR	CEPGR	CERGR	PPIPGR	PPIEGR	OCTOT	ODFTOT
Rho – 1	-0.69718	-1.06725	-0.47586	-1.07282	-1.11812	-1.17952	-1.11882	-0.72262	-0.442143
Rho S.E	0.16926	0.17608	0.19726	0.17530	0.17301	0.17331	0.17828	0.18575	0.17471
Residual variance	12.4153	1136.08	13.6595	5449.88	2852.61	302.669	110298	241166	1054988
Long-run residual variance	12.41531	1136.084	13.65952	5449.884	2852.610	302.6693	110298.6	2411663.	10549887
Number of lags	0	0	0	0	0	0	0	0	0
Number of observations	33	33	33	33	33	33	33	33	33
Number of stochastic trends**	9	9	9	9	9	9	9	9	9

MODEL TWO

Date: 04/29/19 Time: 12:46
Series: NEGR CGR LGR NOSGR $NEGR_{t-1}$ EXCHR
Sample: 1983 2017
Included observations: 35
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C
Automatic lags specification based on Schwarz criterion (maxlag=8)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
NEGR	-4.094974	0.2860	-21.59014	0.3411
CGR	-6.507234	0.0038	-37.53619	0.0043
LGR	-2.837020	0.8161	-13.76166	0.8026
NOSGR	-6.284883	0.0061	-36.67693	0.0060
$NEGR_{t-1}$	-6.102696	0.0089	-36.14956	0.0074
EXCHR	-5.525281	0.0283	-32.89804	0.0231

*MacKinnon (1996) p-values.

Intermediate Results:

	NEGR	CGR	LGR	NOSGR	$NEGR_{t-1}$	EXCHR
Rho – 1	-0.635004	-1.104006	-0.404755	-1.078733	-1.063222	-0.967589
Rho S.E.	0.155069	0.169658	0.142669	0.171639	0.174222	0.175120
Residual variance	13.11745	1060.371	25.75518	368.8188	28483.31	4669.438
Long-run residual variance	13.11745	1060.371	25.75518	368.8188	28483.31	4669.438
Number of lags	0	0	0	0	0	0
Number of observations	34	34	34	34	34	34
Number of stochastic trends**	6	6	6	6	6	6

**Number of stochastic trends in asymptotic distribution

Appendix VI: ENGEL-GRANGER LONG RUN TEST

Engel-Granger long run

MODEL ONE

Dependent Variable: D(NOSGR,1)
Method: Least Squares
Date: 11/14/18 Time: 11:37
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	-0.295820	0.344591	-3.858468	0.0088
D(LGR,1)	-2.873726	13.23180	2.217183	0.0298
D(CEPGR,1)	2.893914	0.658267	-2.357980	0.0026
D(CERGR,1)	5.032424	0.676902	-4.525220	0.0008
D(PPIPGR,1)	0.010249	0.000001	4.327442	0.0462
D(PPIEGR,1)	0.200773	0.001073	2.412492	0.0036
D(OCTOT,1)	1.000459	0.000575	1.798074	0.0327
D(ODFTOT,1)	0.403139	0.000348	5.399883	0.0028
C	1.464182	17.99937	0.081346	0.9358

R-squared	0.843114	Mean dependent var	0.185294
Adjusted R-squared	0.500911	S.D. dependent var	87.48456
S.E. of regression	87.44471	Akaike info criterion	12.00182
Sum squared resid	191164.4	Schwarz criterion	12.40585
Log likelihood	-195.0309	Hannan-Quinn criter.	12.53961
F-statistic	1.003761	Durbin-Watson stat	1.721506
Prob(F-statistic)	5.457774		

MODEL TWO

Dependent Variable: D(NEGR,1)
Method: Least Squares
Date: 04/29/19 Time: 13:35
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	-0.051215	0.416870	-4.072016	0.0431
D(LGR,1)	-2.046334	0.616836	-2.075115	0.0407
D(NOSGR,1)	0.291505	0.029498	-3.729049	0.0020
$D(NEGR_{t-1},1)$	1.500198	0.003551	-3.055710	0.0000
D(EXCHR,1)	0.401251	0.009339	-7.133968	0.0044
C	0.270676	0.934771	-2.289564	0.0043

R-squared	0.723432	Mean dependent var	0.247074
Adjusted R-squared	0.504955	S.D. dependent var	4.256769

S.E. of regression	4.566772	Akaike info criterion	6.034276
Sum squared resid	583.9514	Schwarz criterion	6.303633
Log likelihood	-96.58268	Hannan-Quinn criter.	6.126134
F-statistic	4.340067	Durbin-Watson stat	2.000783
Prob(F-statistic)	0.000040		

Appendix VII: ENGEL-GRANGER SHORT-RUN TEST

MODEL SELECTION "ELASTICITY APPROACH"

MODELONE

Engel-Granger short-run (LOG-LIN)

Dependent Variable: DLOG(NOSGR,1)
Method: Least Squares
Date: 05/21/18 Time: 05:59
Sample (adjusted): 1986 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	-2.146449	0.017772	-5.236067	0.5544
D(LGR,1)	-4.657720	0.001941	-3.145183	0.6705
D(CEPGR,1)	0.995121	0.008389	7.658067	0.0027
D(CERGR,1)	2.349029	0.011184	8.844265	0.5607
D(PPIPGR,1)	0.428050	0.000086	5.145988	0.8012
D(PPIEGR,1)	0.744065	0.000093	12.59380	0.7005
D(OCTOT,1)	1.520003	0.020556	5.827248	0.3011
D(ODFTOT,1)	0.293407	0.000341	7.229369	0.0009
ECM(-1)	-0.410842	0.008143	19.77376	0.0002
C	0.633766	0.000194	0.058668	0.0070

R-squared	0.780300	Mean dependent var	0.529842
Adjusted R-squared	0.427000	S.D. dependent var	4.294769
S.E. of regression	4.517523	Akaike info criterion	10.14111
Sum squared resid	448.9763	Schwarz criterion	10.52154
Log likelihood	-87.66578	Hannan-Quinn criter.	10.25539
F-statistic	4.000032	Durbin-Watson stat	1.538174
Prob(F-statistic)	0.000001		

Engel-Granger short-run (LOG-LOG)

Dependent Variable: DLOG(NOSGR,1)
Method: Least Squares
Date: 05/21/18 Time: 05:59
Sample (adjusted): 1986 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(CGR,1)	2.143459	0.017772	-5.236067	0.7044
DLOG(LGR,1)	4.657720	2.000941	-3.145183	0.6505
DLOG(CEPGR,1)	0.775121	0.000389	7.658067	0.8027
DLOG(CERGR,1)	0.200029	0.000184	8.844265	0.4567
DLOG(PPIPGR,1)	2.028050	0.030386	5.145988	0.0012
DLOG(PPIEGR,1)	5.044065	1.000793	12.59380	0.4005
DLOG(OCTOT,1)	1.020003	0.000556	5.827248	0.0011
DLOG(ODFTOT,1)	0.193407	0.000341	7.229369	0.3209
ECM(-1)	-0.516742	0.208143	19.77376	0.0322

C	0.633766	0.962194	0.058668	0.0169

R-squared	0.600200	Mean dependent var	0.323842
Adjusted R-squared	0.320000	S.D. dependent var	4.294769
S.E. of regression	4.517523	Akaike info criterion	11.54671
Sum squared resid	448.9763	Schwarz criterion	11.52154
Log likelihood	-87.66578	Hannan-Quinn criter.	11.00039
F-statistic	7.000000	Durbin-Watson stat	4.038174
Prob(F-statistic)	0.000001		

Engel-Granger short-run (LIN-LOG)

Dependent Variable: D(NOSGR,1)
Method: Least Squares
Date: 05/21/18 Time: 05:59
Sample (adjusted): 1985 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(CGR,1)	2.146449	0.000005	-3.236067	0.0000
DLOG(LGR,1)	2.657720	0.000781	4.145183	0.0007
DLOG(CEPGR,1)	0.775121	0.000056	4.658067	0.0322
DLOG(CERGR,1)	2.200029	0.000034	4.000547	0.0500
DLOG(PPIPGR,1)	0.223457	0.000084	3.222334	0.0200
DLOG(PPIEGR,1)	0.065062	0.000034	2.550000	0.0000
DLOG(OCTOT,1)	3.333002	0.000022	7.666000	0.0133
DLOG(ODFTOT,1)	0.144409	0.000045	2.007000	0.0223
ECM(-1)	2.000444	0.000054	7.000650	0.0222
C	0.633766	0.000097	0.258888	0.0000

R-squared	0.730000	Mean dependent var	0.620002
Adjusted R-squared	0.349222	S.D. dependent var	4.294769
S.E. of regression	6.517523	Akaike info criterion	8.104343
Sum squared resid	263.9763	Schwarz criterion	8.762000
Log likelihood	-87.66578	Hannan-Quinn criter.	8.440930
F-statistic	7.622200	Durbin-Watson stat	3.038174
Prob(F-statistic)	0.000000		

Engel-Granger short-run (LIN-LIN) (MODEL USED FOR STUDY ANALYSIS)

Dependent Variable: D(NOSGR,1)
Method: Least Squares
Date: 05/21/18 Time: 05:59
Sample (adjusted): 1986 2017
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	4.146449	0.000772	-5.236067	0.0044
D(LGR,1)	1.657720	0.001941	-3.145183	0.0005
D(CEPGR,1)	2.775121	0.000389	7.658067	0.0027

D(CERGR,1)	4.219029	0.000104	8.844265	0.0007
D(PPIPGR,1)	0.028050	0.000380	5.145988	0.0012
D(PPIEGR,1)	0.044065	0.001093	12.59380	0.0005
D(OCTOT,1)	1.020003	0.000556	5.827248	0.0011
D(ODFTOT,1)	1.193407	0.000341	7.229369	0.0009
ECM(-1)	-0.210842	0.200043	19.77376	0.0022
C	0.633766	0.000194	0.058668	0.0169

R-squared	0.680300	Mean dependent var	0.323842
Adjusted R-squared	0.527000	S.D. dependent var	4.294769
S.E. of regression	4.517523	Akaike info criterion	6.104111
Sum squared resid	448.9763	Schwarz criterion	6.562154
Log likelihood	-87.66578	Hannan-Quinn criter.	6.255939
F-statistic	6.200032	Durbin-Watson stat	2.038174
Prob(F-statistic)	0.000001		

MODEL TWO

LOG-LIN

Dependent Variable: DLOG(NEGR,1)
Method: Least Squares
Date: 04/29/19 Time: 13:36
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	-2.103840	0.714161	-2.271128	0.0004
D(LGR,1)	-4.032412	0.515283	-2.062902	0.0503
D(NOSGR,1)	0.102342	0.424770	-3.498262	0.0023
$D(NEGR_{t-1},1)$	-0.967399	0.042967	-4.134640	0.0039
D(EXCHR,1)	-3.555171	0.007807	-3.021913	0.0020
ECM02(-1)	-0.598779	0.165270	-3.623042	0.0012
C	0.364167	0.781279	0.466116	0.6449

R-squared	0.642893	Mean dependent var	0.247074
Adjusted R-squared	0.196870	S.D. dependent var	4.256769
S.E. of regression	3.814812	Akaike info criterion	15.696901
Sum squared resid	392.9253	Schwarz criterion	16.011151
Log likelihood	-89.84731	Hannan-Quinn criter.	16.804069
F-statistic	2.348205	Durbin-Watson stat	1.003047
Prob(F-statistic)	0.059158		

LOG-LOG

Dependent Variable: DLOG(NEGR,1)
Method: Least Squares
Date: 04/29/19 Time: 13:36
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

DLOG(CGR,1)	2.003840	0.014161	-0.271128	0.7884
DLOG(LGR,1)	3.032412	0.515283	-4.062902	0.0503
DLOG(NOSGR,1)	0.412342	0.024770	-2.498262	0.0223
DLOG($NEGR_{t-1}$,1)	-2.543399	0.002967	3.134640	0.0039
D(EXCHR,1)	-2.990171	0.007807	-7.021913	0.0027
ECM02(-1)	-0.598779	0.165270	-3.623042	0.0012
C	0.364167	0.781279	0.466116	0.6449

R-squared	0.742893	Mean dependent var	0.247074
Adjusted R-squared	0.596870	S.D. dependent var	4.256769
S.E. of regression	3.814812	Akaike info criterion	25.696901
Sum squared resid	392.9253	Schwarz criterion	26.011151
Log likelihood	-89.84731	Hannan-Quinn criter.	25.804069
F-statistic	2.000005	Durbin-Watson stat	1.009087
Prob(F-statistic)	0.022008		

LIN-LOG

Dependent Variable: D(NEGR,1)
Method: Least Squares
Date: 04/29/19 Time: 13:36
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(CGR,1)	-2.907733	0.065741	0.554328	0.9800
DLOG(LGR,1)	-3.000654	0.562343	-0.085322	0.9500
DLOG(NOSGR,1)	-0.712342	0.983270	-3.923452	0.0206
DLOG($NEGR_{t-1}$,1)	0.400399	0.429867	2.762310	0.0032
D(EXCHR,1)	-3.900171	0.567324	-4.111343	0.0020
ECM02(-1)	-0.777779	0.698400	-3.541122	0.0092
C	0.084982	0.543200	0.678916	0.6000

R-squared	0.652320	Mean dependent var	0.343426
Adjusted R-squared	0.556034	S.D. dependent var	4.786920
S.E. of regression	6.000567	Akaike info criterion	12.600001
Sum squared resid	352.4567	Schwarz criterion	13.044451
Log likelihood	-97.09451	Hannan-Quinn criter.	13.804069
F-statistic	2.348205	Durbin-Watson stat	1.007777
Prob(F-statistic)	0.000008		

LIN-LIN (MODEL USED FOR ANALYSIS)

Dependent Variable: D(NEGR,1)
Method: Least Squares
Date: 04/29/19 Time: 13:36
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGR,1)	1.306000	2.265000	3.000333	0.0000
D(LGR,1)	0.365423	0.765800	0.067542	0.7755
D(NOSGR,1)	2.812342	0.344220	2.999567	0.0110
$D(NEGR_{t-1},1)$	0.602399	0.552900	3.134640	0.0040
D(EXCHR,1)	1.555232	0.907877	-4.561111	0.0200
ECM02(-1)	-0.463489	0.165270	-3.987200	0.0000
C	0.788222	0.781279	0.700800	0.9452

R-squared	0.752004	Mean dependent var	0.567308
Adjusted R-squared	0.562233	S.D. dependent var	6.874666
S.E. of regression	4.998702	Akaike info criterion	5.008300
Sum squared resid	433.6700	Schwarz criterion	6.567851
Log likelihood	-72.84731	Hannan-Quinn criter.	5.673460
F-statistic	2.940000	Durbin-Watson stat	1.807000
Prob(F-statistic)	0.000000		

Appendix VIII: GRANGER CAUSALITY TESTS BETWEEN

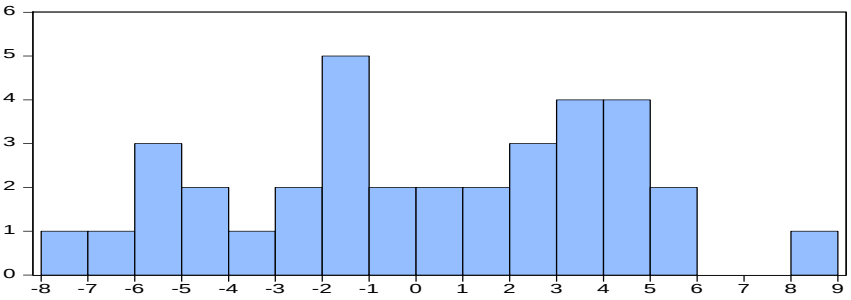
NOSGR AND CEPGR, CERGR, PPIPGR, PPIEGR, OCTOT, ODFTOT

Pairwise Granger Causality Tests
Date: 04/12/18 Time: 15:40
Sample: 1983 2017
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CEPGR does not Granger Cause NOSGR	33	0.00097	0.0055
NOSGR does not Granger Cause CEPGR		0.21344	0.8091
CERGR does not Granger Cause NOSGR	33	0.00035	0.0001
NOSGR does not Granger Cause CERGR		0.87240	0.4294
PPIPGR does not Granger Cause NOSGR	33	0.46141	0.6353
NOSGR does not Granger Cause PPIPGR		0.00023	0.0028
PPIEGR does not Granger Cause NOSGR	33	0.00379	0.0272
NOSGR does not Granger Cause PPIEGR		0.00420	0.0024
OCTOT does not Granger Cause NOSGR	33	0.00497	0.0024
NOSGR does not Granger Cause OCTOT		1.21402	0.3127
ODFTOT does not Granger Cause NOSGR	33	0.00289	0.0007
NOSGR does not Granger Cause ODFTOT		0.34242	0.9996

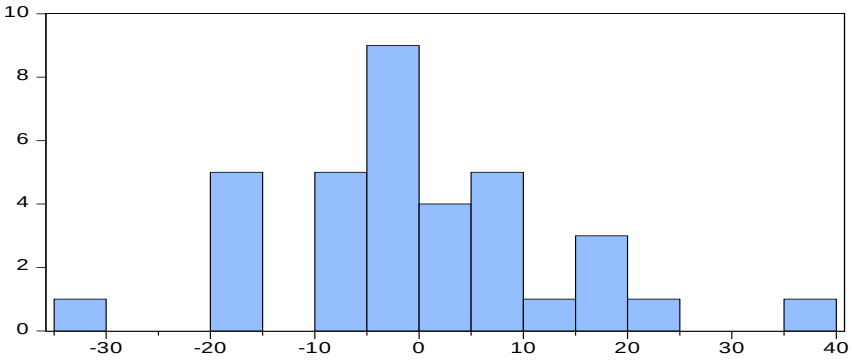
Appendix X: NORMALITY TEST

MODEL ONE



Series: Residuals	
Sample 1983 2017	
Observations 35	
Mean	-2.92e-15
Median	0.093174
Maximum	8.822552
Minimum	-7.720804
Std. Dev.	4.095466
Skewness	-0.075167
Kurtosis	2.166458
Jarque-Bera	1.046196
Probability	0.592681

MODEL TWO



Series: Residuals	
Sample 1983 2017	
Observations 35	
Mean	-8.14e-14
Median	-1.554643
Maximum	39.61776
Minimum	-32.29930
Std. Dev.	13.53107
Skewness	0.343382
Kurtosis	4.111984
Jarque-Bera	2.491056
Probability	0.287789

Appendix XI: MULTICOLLINEARLITY TEST

MODEL ONE

	NOSGR	CGR	LGR	CEPGR	CERGR	PPIPGR	PPIEGR	OCTOT	ODFTOT
NOSGR	1.000000	0.064623	0.484590	-0.117701	0.034481	-0.208373	-0.005398	0.367991	0.301045
CGR	0.064623	1.000000	-0.126418	0.159107	0.094078	0.171915	-0.118014	-0.236291	0.093963
LGR	0.484590	-0.126418	1.000000	-0.094871	-0.171834	-0.437489	0.192463	0.710719	0.403491
CEPGR	-0.117701	0.159107	-0.094871	1.000000	0.332755	0.266138	-0.042123	-0.006089	0.203297
CERGR	0.034481	0.094078	-0.171834	0.332755	1.000000	0.328923	-0.046773	-0.040485	0.189142
PPIPGR	-0.208373	0.171915	-0.437489	0.266138	0.328923	1.000000	-0.078982	-0.484578	-0.053224
PPIEGR	-0.005398	-0.118014	0.192463	-0.042123	-0.046773	-0.078982	1.000000	0.273964	-0.201815
OCTOT	0.367991	-0.236291	0.710719	-0.006089	-0.040485	-0.484578	0.273964	1.000000	0.048100
ODFTOT	0.301045	0.093963	0.403491	0.203297	0.189142	-0.053224	-0.201815	0.048100	1.000000

MODEL TWO

	NEGR	CGR	LGR	NOSGR	$NEGR_{t-1}$	EXCHR
NEGR	1.0000	0.0882	0.2877	-0.0792	-0.0075	0.0538
CGR	0.0882	1.0000	-0.2199	0.2315	-0.2058	-0.0113
LGR	0.2877	-0.2199	1.0000	-0.5040	0.0859	0.2379
NOSGR	-0.0792	0.2315	-0.5040	1.0000	0.1163	-0.1432
$NEGR_{t-1}$	-0.0075	-0.2058	0.0859	0.1163	1.0000	-0.0915
EXCHR	0.0538	-0.0113	0.2379	-0.1432	-0.0915	1.0000

Appendix XII:

Heteroskedasticity Test

MODEL ONE

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.400336	Prob. F(8,25)	0.8853
Obs*R-squared	4.400095	Prob. Chi-Square(8)	0.6320
Scaled explained SS	**2.534554**	Prob. Chi-Square(8)	0.6937

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/14/18 Time: 11:37
Sample: 1983 2017
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	54.32073	33.64965	1.614303	0.1190
CGR	4.113074	0.130416	-0.867030	0.3942
LGR	4.435285	1.030919	-0.422230	0.6765
CEPGR	0.010350	0.059064	-0.175242	0.8623
CERGR	0.027781	0.081250	0.341919	0.7353
PECOS	-0.287463	0.252233	-1.139672	0.2652

R-squared	0.156747	Mean dependent var	13.04220
Adjusted R-squared	-0.113094	S.D. dependent var	24.02811
S.E. of regression	25.35045	Akaike info criterion	9.525397
Sum squared resid	16066.13	Schwarz criterion	9.929434
Log likelihood	-152.9317	Hannan-Quinn criter.	9.663185
F-statistic	0.580886	Durbin-Watson stat	2.159015
Prob(F-statistic)	0.783815		

MODEL TWO

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.138789	Prob. F(5,29)	0.3625
Obs*R-squared	2.244176	Prob. Chi-Square(5)	0.3319
Scaled explained SS	**2.338904**	Prob. Chi-Square(5)	0.5017

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/29/19 Time: 17:29
Sample: 1983 2017
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	60.51300	30.01354	2.016190	0.0531
CGR	-0.207078	0.127058	-1.629787	0.1140
LGR	-0.783673	0.629836	-1.244249	0.2234
PPIPGR	-0.205156	0.219581	-0.934306	0.3579
PPIEGR	-0.021125	0.025363	-0.832917	0.4117
PEPPD	-0.038302	0.062728	-0.610600	0.5462

R-squared	0.164119	Mean dependent var	16.54609
Adjusted R-squared	0.020002	S.D. dependent var	24.90296
S.E. of regression	24.65265	Akaike info criterion	9.402451
Sum squared resid	17624.84	Schwarz criterion	9.669082
Log likelihood	-158.5429	Hannan-Quinn criter.	9.494492
F-statistic	1.138789	Durbin-Watson stat	1.973045
Prob(F-statistic)	0.362512		

Appendix XIII: Income elasticity of refined petroleum import, price elasticity of crude oil supply (export) and price elasticity of refined petroleum import (year-by-year point elasticity approach)

YEAR	INERPIM	PECOS	PEPPD	YEAR	INERPIM	PECOS	PEPPD
1983	0.6754	0.0131	-0.4012	2001	-2.1918	-1.5011	1.8826
1984	-1.1696	-6.4887	2.3454	2002	0.0826	-4.0747	0.5086
1985	-0.5797	-3.8889	-0.7116	2003	3.3355	1.3214	1.5791
1986	3.3209	0.0358	0	2004	-0.3185	0.3076	1.0302
1987	0.1453	-0.4213	1.5987	2005	-0.184	-0.0652	1.7732
1988	-0.4647	-0.2466	1.2644	2006	0.1892	-0.2006	0
1989	0.06	1.5976	-0.5956	2007	0.6507	-0.2407	18.4789
1990	0.0849	0.0544	2.5317	2008	-1.2182	-0.251	12.7014
1991	1.6045	-0.2654	1.5899	2009	2.2939	-0.1662	0.7586
1992	-0.3024	0.526	0.3725	2010	-0.3113	0.4407	8.8496
1993	-0.3644	0.1017	0.3133	2011	-5.7795	-0.1207	4.0948
1994	-0.2961	1.6955	-0.9221	2012	68.0865	-2.4625	-6.5686
1995	-0.2997	0.6367	-31.882	2013	-1.3849	4.0881	410.5894
1996	1.0334	0.0845	0	2014	4.1354	-2.2477	21.1865
1997	-5.3936	-2.4516	0.5493	2015	-4.114	-14.0486	53.1081
1998	3.1758	0.2337	-0.4332	2016	1.5363	6.0722	3.0239
1999	-1.8265	-0.0086	-1.3558	2017	1.9547	4.6789	3.7397
2000	5.845	-0.0839	2.3798	TOTAL	67.3011	-17.3461	513.3795