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A Study on Oil Price Asymmetry, Exchange Rate and External Balances in Nigeria

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A Study on Oil Price Asymmetry, Exchange Rate and External Balances in Nigeria

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이 논문을 공학석사 학위 논문으로 제출함

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먼데이의 공학석사 학위논문을 인준함

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Abstract

Crude oil also known as black gold is a crucial macroeconomic indicator as far as the global market is concerned and the crude oil international market without doubt is one of the biggest commodity market in the world. At present, the Nigerian economy depends on crude oil production and export as its main foreign exchange earner. In our study, an empirical analysis was carried out geared towards establishing how asymmetric oil price movements and exchange rate affect Nigeria's external balances. Information on trade balances, oil production and export, asymmetric oil price shocks, exchange rate amongst other things will enable the Government and policy makers to be proactive in decision-making. The ARDL cointegration approach was employed to establish the short term and long-term relationship between variables in our model. The variables used in the empirical analysis include positive oil price movements, negative oil price movements, exchange rate, real oil trade balance, real non-oil trade balance and total trade balance. The results obtained from empirical analysis show that positive oil price shocks was beneficial to Nigeria's oil trade balance and total trade balance in the short run. However, this short run positive impact did not translate to the long run. This effect can be attributable to revenue effect

as a result of increases in proceeds from oil export. Negative oil price movements was discovered to be beneficial to Nigeria's total trade balance and oil trade balance in the long term. The reason for this is due to the demand effect (quantity effect) from countries that import oil. The negative revenue effect occasioned by decreases in oil prices is being overshadowed by increasing demand from those nations that depend on oil import. The implication of this for policy making is that the Nigerian government have to encourage investors to develop more oil fields in order to maximize production, which can help grow the oil trade balance and total trade balance in times of oil boom since we saw from empirical analysis that Nigeria's total balance and real oil trade balance are both responsive to positive oil price movements in the short term. On the contrary, during the period of bust in oil prices; in order for the economy not be trapped in the problem of revenue shortages in terms of foreign exchange earnings which is evident during periods of low oil prices (and can linger for a very long time), resource rich nations like Nigeria should have policies in place that will make it expedient for any Government in power to pursue the diversification of the economy by investing in and developing other areas of our economy; for instance, like manufacturing, agriculture, services, infrastructural development etc. which can help

cushion the effect of low foreign exchange earnings from oil export in times of low oil prices. For it to be possible for the government to diversify the economy, It will be plausible and wise for saving funds to be created (like the Sovereign wealth fund, natural resources fund and the stabilization fund) which should be used for immediate investment in the real sector with a view to minimizing the negative economic effects of bust in oil prices.

Keywords: Asymmetric Oil Price Shocks, ARDL, External Balances, Long Run Relationship.

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Chapter 1. Introduction

1.1 Background

Crude oil is very vital to Nigeria sources of foreign exchange earnings. The Nigerian balance of trade depends mainly on the foreign exchange earnings accruing from crude oil export. It should be noted that oil price shocks have a strong potential as regards its effect on major indicators of the macro-economy for nations' that export crude oil such as its current account balance. Movements in the price of Crude oil basically affects the current account of an oil-exporting nation by misrepresenting the country's identity in terms of savings and investment. For an oil-exporting country like Nigeria, it increases the aggregate volume of savings, which is available for increased investment and sustainable growth (Chuku, Akpan, Sam & Effiong, 2011).

The first breakthrough for oil prospecting in Nigeria was recorded at Oloibiri in 1956 in the South –South geopolitical zone of Nigeria after about fifty years (50years) of oil exploration. This great feat of the discovery of oil was achieved by Shell-BP at that time being the sole licensee (Nigeria National Petroleum Corporation – nnpc group). Nigeria entered the league of crude oil producers when its first oil well

commenced the production of approximately 5100 bpd of oil in 1958. Nigeria got her independence from Great Britain in 1960. After 1960, crude oil prospecting license in the land and coastal waters of the southern region of Nigeria was granted to other numerous international companies. The oil industry in Nigeria has undergone huge expansion over the years. Understanding the dynamics of the growth in balance of trade in relation to crude oil production and export is important. Nigeria belongs to the group of top twelve crude oil producers in the world[1]. Changes in the prices of crude oil is expected to affect Nigeria's US Dollar reserves and in return affects the purchasing power of her local currency relative to the US dollars. Since crude oil is responsible for over ninety percent of foreign currency earnings in Nigeria, oil price variations in relation to the quantity of crude oil produced and exported will have serious implications on Nigeria's macro economy (Afees & Hakeem, 2013).

Information on the performance level of Nigeria's trade balance, oil production and price amongst other things will enable Nigeria government and policy makers to be proactive in decision-making. Various researchers globally while trying to establish the nexus between

[1] www.indexmundi.com/g/r.aspx?v=88

trade balance, real exchange rate and real oil prices have formulated several models. This relationship is being examined from the angle of an oil exporter. Mork, Olson and Mysen (1994) in their research on the consequences of an oil shock on GDP growth (a proxy for total trade balance) discovered that its relationship with positive oil price movements were negative and statistically significant for most countries except Norway while its relationship with decreases in the prices of crude oil were positive but insignificant for most countries except the United states of America and Canada. Since crude oil is very vital to the performance of the world economy; its production, its price and other variables can affect various economies either positively or negatively.

The unpredictability of crude oil prices and its consequences on economic performance is an issue in the front burner, which is facing several world economies as of today. The nexus between the prices of crude oil and the performance level of various economic activities have been the major subject matter of discourse for a period of time now. This subject above have been thoroughly discussed in both qualitative and quantitative literatures for the past decades. Some studies concluded that several of the economic recessions experienced before now were heralded by a huge upward movement in the prices of crude oil.

However, this notion weakened over the years as subsequent empirical researches show that the unpredictability of crude oil prices has a lesser influence on economic output. Despite several interesting lines of research to ascertain the impact of crude oil price on the growth of the economy, the nexus between the uncertainty of oil price and growth of the economy is still very controversial (Akinlo & Apanisile, 2015).

Exchange rate maybe explained as the worth of the currency of any country in relation to another currency (United States dollars is the base currency in Nigeria's case). Exchange rate plays a significant role in stabilizing any economy. The performance of an economy is boosted through a stable currency, which in turn helps to reduce the prices of goods and services to a minimal level (Omoniyi & Olawale, 2015). Quite a number of studies on this subject matter have been carried out towards ascertaining the impact of the price of crude on the growth of the Nigerian economy (Odularu, 2008).

In this study, an attempt was made to expand the scope of the variables with the decomposition of the price of oil into positive oil price movements and negative oil price movements and also an extensive qualitative analysis on the political instability in the Southern oil

producing part of Nigeria with a view to establishing its impact on oil exploration and production activities in Nigeria which is quite different from previous studies.

1.2 Motivation

Considering the Nigerian economy being a kind of mono-cultural economy, there is this problem of excessive reliance on crude oil export as a significant source of forex. It is pertinent for the government to know if a short term and a long-term relationship do exist between oil export and economic transformation so that policies can be put in place to grow the economy from all fronts. In addition, political crises in the Southern oil producing communities of Nigeria should bother the government and those in charge of policymaking. Another issue worthy of note is the slow pace of government proactiveness in diversifying the economy due to her over-confidence on oil revenue.

1.3 Research Questions

I. What are the impacts of asymmetric oil price movements and exchange rates on Nigeria's external balances?

II. What is the impact of political instability in the oil-producing Southern region on Nigeria's crude oil production and export?

1.4 Thesis Objective

I. To ascertain empirically the nexus between asymmetric oil price movements, exchange rates and Nigeria's external balances.

II. To use the results obtained from empirical analysis for policy making by the government and policy makers.

1.5 Thesis Outline

In order to expatiate on the subject matter elaborately, this study had to be structured in the following manner; Chapter 2 will focus on the general overview of the oil and gas sector in Nigeria. Chapter 3 will examine relevant literature review. Chapter 4 will center on methodology, data and the model. Empirical analysis will be outlined in chapter 5 while chapter 6 will succinctly harp on policy implication and conclusion.

Chapter 2. General Overview of the Oil and Gas Industry in Nigeria

2.1 The Petroleum Industry in Nigeria

The Nigerian petroleum industry is the largest on the African continent. Nigeria is situated in the Sub-Sahara African region with an aggregate land mass of about 923,768.64 sqkm and has border with the gulf of Guinea in the South-South region, Niger and Chad Republic in the North, Cameroun in the east and Benin Republic in the west. Nigeria has a whooping population of over 180 million people and as at 2016, the confirmed reserve of crude oil in Nigeria is about 37.5 billion barrels while natural gas reserve is about 5,475.2 billion cubic metres[2]

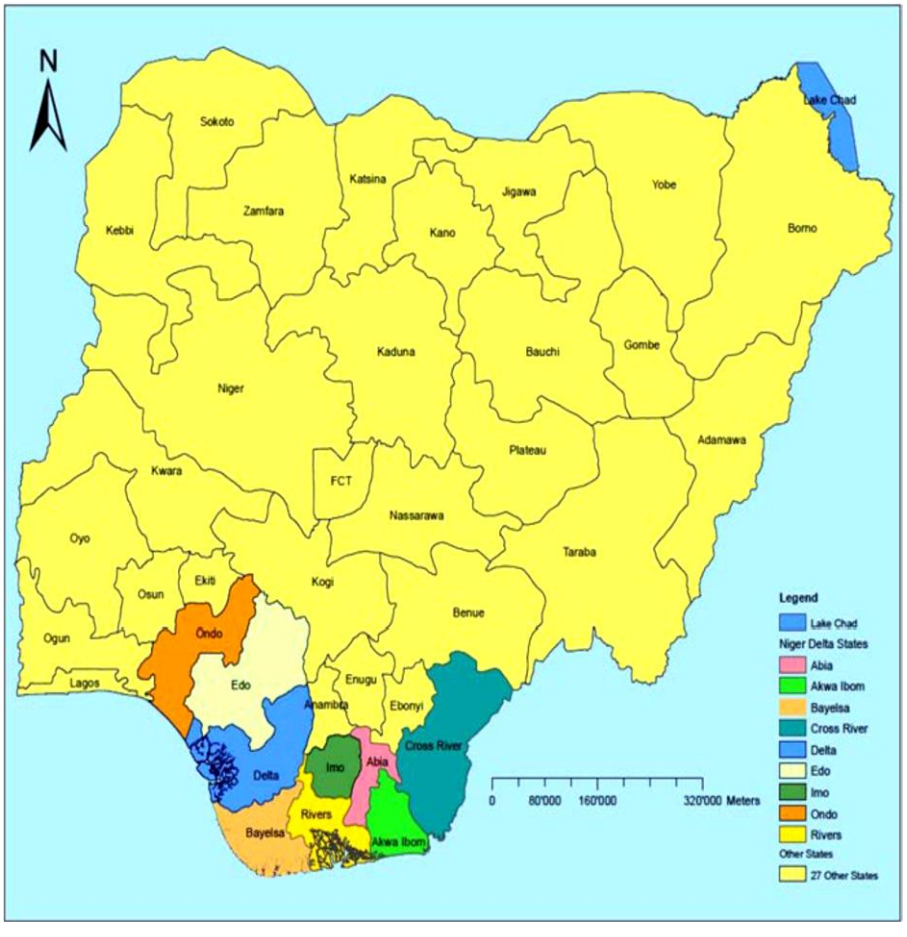
Out of the thirty-six constituent states that make up Nigeria, nine of the states which are in the Southern geopolitical zone of the country is responsible for the onshore oil and gas production, while the production from Nigerian coastal waters is sourced from crude oil wells located in the Gulf of Guinea, Bight of Benin and the Bight of Bonny. Data record from the United States EIA shows that Nigeria as at 2011

[2] OPEC – Annual statistical bulletin 2017.

produced about 2.53 million barrels per day (bbl/d) of crude oil and 1 trillion cubic feet (Tcf) of dry gas. From these figures, Nigeria exported about 2.3 million bbl/d of crude oil and 17.97 million metric tons of liquefied natural gas (LNG). These export figures made Nigeria the fifth (5th) largest exporter of LNG in the world. It is also pertinent to note that in 2011, 33 percent of Nigeria's crude oil export, which is approximately (767,000 bbl/d), was sent to the United States of America. Shown in figure 2.1 below is the map of Nigeria with the oil producing states in the Niger Delta region;

Figure 2.1 Map of Nigeria showing the oil producing states in the Niger Delta region excluding offshore oil production

Source: Google Image



The Nigerian economy is significantly an oil economy; where foreign exchange revenues from oil export is well over 90%. In addition to that figure, the export of crude oil also accounts for approximately 40% if not more of Nigeria's GDP and about 75% of the federation's

entire revenue. Specifically, in the year 2000 over 98% of Nigeria earnings came from crude oil export and this amounted to about 83% of the federation's revenue (Odularu, 2008). As a result of these exports earnings, the Nigerian federal government can put in place regulations and policy framework with a view to attracting more investment, guaranteed increased production capacity and also to ensure sustainable environment[3]. Petroleum; a natural resource, which has contributed immensely and will continue to be a catalyst to the economic growth of nations across the globe is a mixture of hydrocarbon compounds. Some of its constituent components include; oxygen, Sulphur, nitrogen with little amount of vanadium, nickel and other elements. Hydrocarbon compounds may occur either in the solid form such as asphalt, liquid form such as crude oil or as gas like the abundant natural gas resources in some countries.

Petroleum, a hydrocarbon compound can be sub-divided into four major groups. These groups include;

[3] IMF country report No. 12/194. "2011 Article IV consultation report on Nigeria". July 2012

- The resins (for example the sulfoxides and amides, pyridines, quinolines, carbazoles etc.)
- The asphaltenes (such as ketones, fatty acids, phenols, esters and porphyrins)
- The aromatics (which include benzene, phenanthrene, naphthalene, pyrene etc.)
- The saturates (for example cyclohexane, octacosane, hexadecane and pentane) (Ite, Ibok, Ite, & Petters 2013).

Table 2.1 below shows Nigeria oil data as at 2016.

Table 2.1 Nigeria oil data as at 2016

Source: OPEC – Annual Statistical bulletin 2017.

Monetary Value of exports of petroleum in (million $)	***27,788***
Nigeria's Current account balance in (million $)	***2,722***
Present reserves of crude oil in (million barrels)	***37,453***
Present reserves of natural gas in (million cu.m.)	***5,475.2***
Production capacity of crude oil in (1000 bpd)	***1,427.3***
Natural gas production in (million cu.m.)	***42,562.4***
Capacity of our Refinery in (1000 b/cd)	***446.0***
Refined petroleum products output in (1000 b/d)	***53.5***
Export of crude oil in (1000 b/d)	***1738.0***
Total demand for oil in (1000 b/d)	***393.1***

Petroleum Products export in (1000 b/d)	***17.9***
Export of Natural gas in (million cu.m.)	***25,146.5***

NOTE

Barrels per day – b/d

Cubic metres – cu.m.

Barrels per calendar day – b/cd

2.2 Historical Events in the Nigerian Oil and Gas Industry

Significant events in the timeline of the oil industry in Nigeria are enumerated in table 2.2 below;

Table 2.2 Historical Events in the Nigerian Oil Industry

Source: NNPC group

Events	***Year***
⇒ *The colonial petroleum company of Britain and the Bitumen Company of Nigeria came on stream in Okitipupa in present day Ondo State.*	***1908***
⇒ *The license to prospect for oil in Nigeria was given to Shell D'Arcy.*	***1938***
⇒ *Mobil Oil Corporation commenced their business in Nigeria.*	***1955***

⇒ *Shell D'Arcy became the first company to successfully drill an oil well in Nigeria in Oloibiri.*	***1956***
⇒ *Shell D'Arcy had a change of name to Shell-BP.*	***1956***
⇒ *Nigeria witnessed the first ever-crude oil shipment.*	***1958***
⇒ *Bonny terminal belonging to Shell-BP came on stream.* ⇒ *Texaco overseas commenced their business in Nigeria.*	***1961*** ***1961***
⇒ *Elf commenced their business activities as Safrap in Nigeria.* ⇒ *Nigeria Agip Oil Company commenced their business activities in Nigeria.*	***1962*** ***1962***
⇒ *Ubata gas field and Obagi field was discovered by Elf.* ⇒ *The first production by Gulf was recorded.*	***1963*** ***1963***
⇒ *Ebocha oil field was discovered by Agip.* ⇒ *Phillips Oil Company commenced their oil business activities in old Bendel state (now Edo & Delta states).*	***1965*** ***1965***
⇒ *12,000 b/d was successfully produced by Elf in Rivers State.*	***1966***
⇒ *The first dry oil well was drilled at Osari-1 by Phillips.*	***1967***

⇒ *The first discovery of oil well in Gilli-Gilli-1 was recorded by Phillips.*	***1967***
⇒ *The creation of MPNL - Mobil producing Nigeria limited.* ⇒ *Escravos Gulf terminal came on stream.*	***1968*** ***1968***
⇒ *Idoho field made up of four oil wells owned by Mobil commenced production.* ⇒ *Agip became an oil producer in Nigeria.* ⇒ *The creation of DPR - Department of Petroleum Resources (oil Inspectorate).*	***1970*** ***1970*** ***1970***
⇒ *Forcados terminal belonging to Shell came on stream.* ⇒ *Qua Iboe terminal belonging to Mobil came on stream.*	***1971*** ***1971***
⇒ *Government of the federation began to participate in oil business and its first share as a stakeholder was 35%.* ⇒ *Nigerian national oil company (NNOC) which is presently Nigerian national petroleum corporation (NNPC) began production-sharing contract with Ashland.* ⇒ *First oil well was discovered in Ogharefe-1 by Pan-ocean.*	***1973*** ***1973*** ***1973*** ***1973***
⇒ *Government of the federation increased its equity participation to 55%.*	***1974***

⇒ *Safrap became the formal name for Elf.* ⇒ *The first oil well was discovered at Ossu-1 by Ashland.*	***1974*** ***1974***
⇒ *Brass terminal belonging to Agip recorded its first oil shipment.* ⇒ *The upgrading of DPR to the MPR (ministry of petroleum Resources).*	***1975*** ***1975***
⇒ *Shell-BP's oil pipeline was being used by Pan Ocean for the production of 10,800 bpd.*	***1976***
⇒ *Decree number 33 was used by the government of the federation for the establishment of NNPC.*	***1977***
⇒ *Government increased its equity participation to 60% through the NNPC.* ⇒ *Government (Represented by NNPC) again increased its equity participation to 80% leaving Shell with 20% stake.* ⇒ *SPDC became the official name for Shell-BP.*	***1979*** ***1979*** ***1979***
⇒ *Shell/NNPC joint venture was consolidated via agreements.*	***1984***
⇒ *MOU was signed between Shell and NNPC*	***1986***
⇒ *Re-negotiation in terms of equity participation as follows: NNPC = 60%, Shell = 30%, Elf = 5%, Agip = 5%.*	***1989***
⇒ *MOU & Joint venture operating agreement (JOA) was signed.*	***1991***

⇒ *Again, equity participation was re-negotiated as follows: NNPC = 55%, Shell = 30%, Elf = 10%, Agip = 5%.*	***1993***
⇒ *Elf's off-shore OML 100 (Odudu blend) came on stream.*	***1993***
⇒ *NLNG (Nigeria Liquefied Natural gas) invested in Gas Business.*	***1995***
⇒ *First oil prospecting well was drilled by SNEPCO (Shell Nigeria Exploration and Production Company).*	***1995***
⇒ *NLNG shipped its first gas from Bonny Terminal.*	***1999***
⇒ *Service contract agreement was signed by Nigerian Petroleum Development Company and Nigerian Agip Oil Company.*	***2000***
⇒ *Okono offshore field commenced production*	***2001***
⇒ *The signing of new PSCs agreements.*	***2002***
⇒ *The Downstream oil sector was liberalized.*	***2002***
⇒ *NNPC started retail outlets throughout the country.*	***2002***

2.3 Crude Oil Production, Export and Nigeria's Macro Economy

As it had been established in the beginning of this chapter, oil is being produced in the southern part of Nigeria. Having the wherewithal to produce about 2.5 million bpd of crude oil, Nigeria tops the list as Africa's largest crude oil producer[4] and number 12 in the world[5]. The Nigerian oil and gas industry exported almost 1,000,000 bpd of crude oil to the US in the year 2010. This figure represents about 9% of the United States aggregate of petroleum product imports and over 40% of Nigerian's total oil exports. The Nigerian light sweet crude; which is a nice characteristic of its crude oil makes it preferable in terms of gasoline feedstock. In recent times, Nigerian crudes have been considered as a suitable substitute with regards to the lost volumes of Libyan crude thereby increasing their price premium in the international markets. Nigeria being a member of the Organization of Petroleum Exporting Countries (OPEC) has crude oil production limits or quotas that has undergone variation over the years but which are currently set at about 1.673 million bpd. However, Nigeria OPEC's quota limitation does not

[4] www.nnpcgroup.com/nnpcbusiness/upstreamventures/oilproduction.aspx
[5] www.cia.gov (2014)

seem to have much negative impact on production output or expansion of investment as much as the communal crises and civil unrest in the Southern oil producing region of Nigeria.

Nigeria's crude oil production is usually below the US energy information administration's 2.9 million bpd estimate of the country's nameplate crude oil production capacity due to the ceaseless and incessant attack on oil and gas production facilities in the oil-producing region. Nigeria produced an average of 2.15 million bbl/d of crude oil in the year 2010. Pipeline vandalism, communal crises, kidnappings and militant attack on oil facilities in the Niger Delta region have increased tremendously since 2005. Furthermore, oil workers most especially from the international oil companies (IOCs) have been kidnapped for ransom and also piracy is on the increase in the Gulf of Guinea. Crises in the Niger Delta region has affected crude oil production in Nigeria in terms of volumes, though exports to the United States have been stable in recent years[6]

[6] https://www.eia.gov/todayinenergy/detail.php?id=3050

The estimate of Nigeria proven crude oil reserve is about 37.5 billion barrels. Different new offshore projects are expected to come on stream and because of this; Nigeria's crude oil production will definitely be on the increase in the medium-term. The successful kick-off of these new projects will depend significantly on the successful implementation of the Petroleum Industry Governance Bill (PIGB), which was passed into law by the national assembly of Nigeria recently. In terms of revenue, it is very important for the Nigerian government to acknowledge the fact that crude oil export has contributed significantly to its revenue generation. Oil revenue accounted for about 71% to 89% of its total revenue between 1999 and 2008 (Adeniyi, 2012). Table 2.3 below provides an insight into government's total revenue, total oil export revenue and total government expenditure from 1999 to 2008.

Table 2.3 Total Government Revenue, Total Oil Export Revenue and Total Government Expenditure (1999-2008) in ₦ million

Source: Central Bank of Nigeria (CBN) Statistical Bulletin 2008

Year	Total Government Revenue	Total Oil Export Revenue	Total Government Expenditure	Percentage of Oil Export in Total Govt. Revenue
1999	949,188	724,423	947,690	**76**
2000	1,906,160	1,591,676	701,059	**84**
2001	2,231,600	1,707,563	1,018,026	**77**
2002	1,731,838	1,230,851	1,018,156	**71**
2003	2,575,096	2,074,281	1,225,966	**81**
2004	3,920,500	3,354,800	1,426,200	**86**
2005	5,547,500	4,762,400	1,822,100	**86**
2006	5,965,102	5,287,567	1,938,003	**89**
2007	5,715,600	4,462,910	2,450,897	**78**
2008	7,866,590	6,530,630	3,240,820	**83**

Figure 2.2 below shows the graphical representation of the trend of Nigeria's total trade balance (TTB), real oil trade balance (OB), real non-oil trade balance (NOB), exchange rates (ER), positive oil price shocks (PS) and negative oil price shocks (NS) respectively;

Figure 2.2 Trends of Nigeria trade balances, exchange rates and oil Price shocks

Source: Author

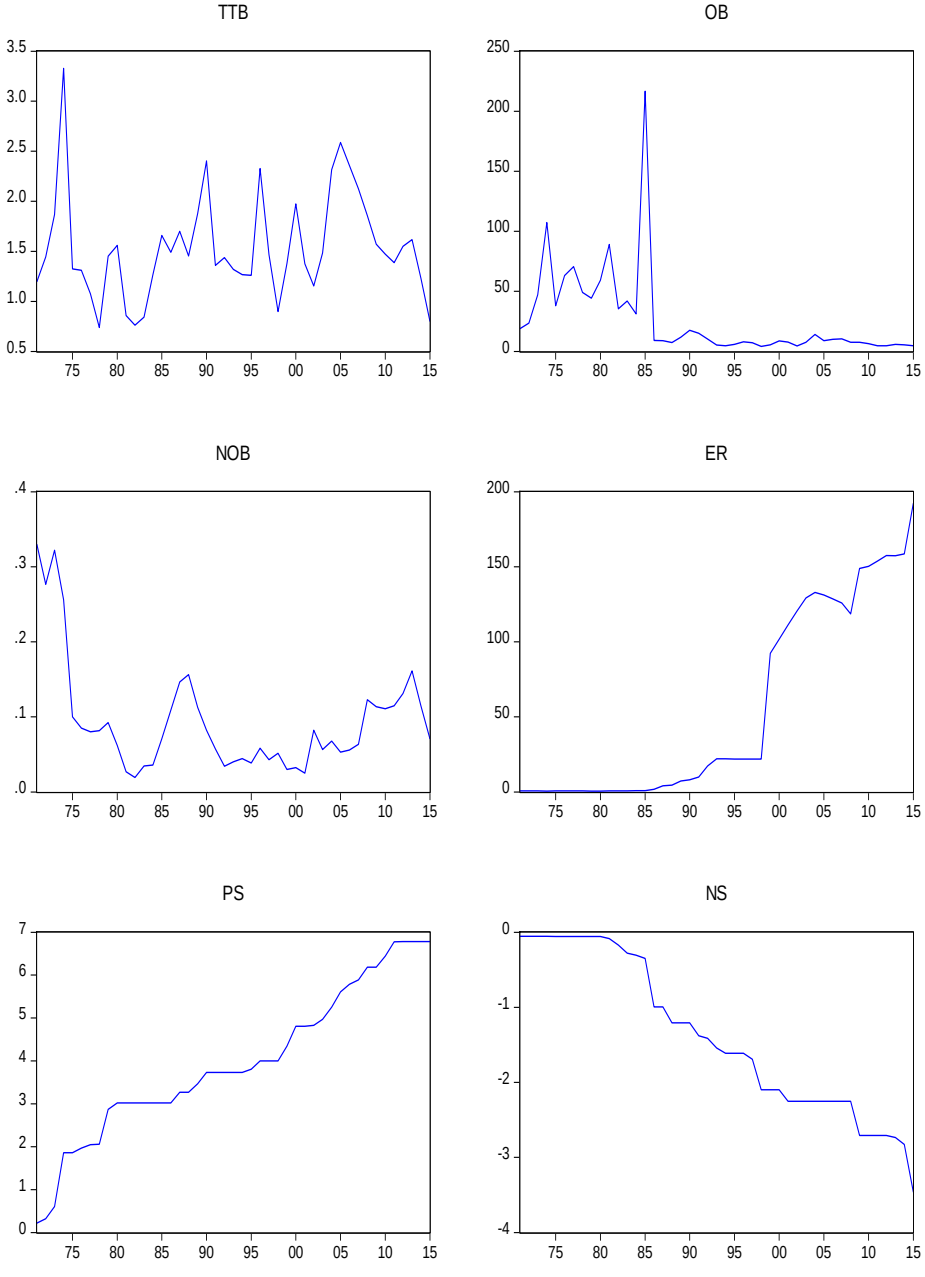
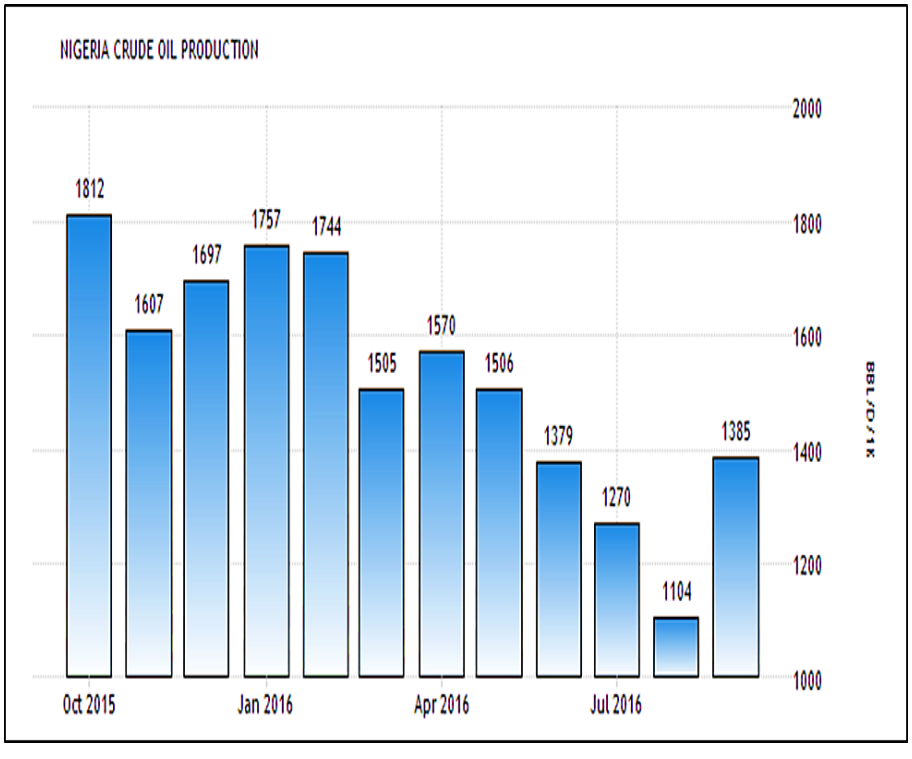


Figure 2.3 below shows the current oil production level in Nigeria in Million barrels per day.

Figure 2.3 Nigeria Crude Oil Production

Source: OPEC



2.4 The Nigerian National Petroleum Corporation (NNPC)

The state owned oil firm; the Nigerian National Petroleum Corporation (NNPC) was established on April 1, 1977. The NNPC has crude oil exploration and production capabilities. NNPC was also given

the enabling power and operational capability in refining, petrochemicals & products transportation and also in marketing. NNPC constructed the Warri refinery, Kaduna refinery and Port Harcourt refinery between the year 1978 until around 1989. In addition to these refineries that were constructed; NNPC also took over the management of the 35,000-barrel Shell refinery, which came on stream in 1965 at Port Harcourt. In 1988, NNPC was re-organized into twelve special commercial business units, which covers the entirety of the oil industry operations in Nigeria. The operational areas include; exploration and production, gas development, refining, distribution, petrochemicals, engineering, and commercial investments. Currently, NNPC subsidiary companies include:

- HYSON – Hydrocarbon Services Nigeria Ltd
- IDSL – Integrated Data Services Ltd
- NPDC – Nigeria Petroleum Development Company.
- PPMC – Products and Pipelines Marketing Company.
- NGC – Nigeria gas company
- WRPC – Warri Refinery and Petrochemical Co. Ltd
- NETCO – National Engineering and Technical Co. Ltd
- KRPC – Kaduna Refinery and Petrochemical Co. Ltd

- PHRC – Port Harcourt Refining Co. Ltd
- NAPIMS – National Petroleum Investment services
- Duke Oil
- NNPC Retail

NNPC business activities include the following;

- Upstream ventures
- Midstream ventures
- Downstream ventures
- Its twelve (12) subsidiaries, which are listed above.

Nigeria National Petroleum Corporation (NNPC) upstream activities has to do with joint venture partnership with some major international oil companies (IOCs). These multinational ***E&P*** firms operate majorly in the on-shore, deep offshore and coastal offshore of the Southern region of Nigeria. The type of agreement between the NNPC and the IOCs is the joint operating agreements (JOAs) which may also be referred to as the production-sharing contract (PSCs). The mode of operation between the Nigerian indigenous companies and the IOCs is captured under the sole risk or as independent producers[7]. The crude oil that is being

[7] nnpcgroup.com

produced in Nigeria has low Sulphur content. This low content of Sulphur of Nigeria crude makes it very competitive in the international market. The different categories of Nigeria crude are as follows;

- Pennington Light
- Bonny Light
- Antan Blend
- Qua-iboe Light
- Escravos Light
- Bonny Medium
- Odudu Blend
- Brass Blend
- Forcados Blend et cetera.

In the early 1960s in Nigeria, agriculture was the main foreign exchange earner. As at then, the contribution to GDP from agriculture was 67 percent while crude oil accounted for 0.6 percent. In 1970, the contribution to Nigeria GDP (a proxy for trade balance) from agriculture stood at 23.4 percent while oil contributed 45.5 percent.

2.5 NNPC Upstream Ventures

JOAs – Joint operating agreements; is the fundamental operational synergy between NNPC and the IOCs. It outlines the rules and processes for the coordination of the various operations. It is not the same as memorandum of understanding (MOU). The JOA consists of the mutual agreement concerning the joint Venture, while the MOU is the outcome of specifics concerning fiscal incentives. NNPC Upstream ventures activities include the following;

1. Oil Exploration
2. Oil production
3. Gas production
4. Joint ventures activities

2.5.1 Oil Exploration

From 1937 until about 1993, crude oil exploration and production business was carried out basically in the land and swampy areas of the Southern region of Nigeria. At that time, offshore oil prospecting activities was done in areas less than 200m in terms of water depth. The Nigerian government in 1993 started a new frontier in the exploration business, which brought about a very bright future for the Nigerian oil industry. The government did this by allowing production from offshore

oil blocks in deep waters as far as 2500m. The operation of deep-water oil blocks has a lot of challenges technically and it is also capital intensive. Deep offshore operators in Nigeria achieved the following great feats as at the end of 1998.

- 21,000 kilometers 2D Seismal Lines acquisition
- 21,500 kilometers 3D Seismal Lines acquisition
- Successful drilling of 33 exploration wells whose depth range is between 300m -1460m.

2.5.2 Oil Production

NNPC upstream activities involves partnership with international oil firms. These IOCs in Nigeria operates under the concession system. In this arrangement, the NNPC is the concessionaire. The operators are the international oil firms. The management and control of the crude oil bidding exercise is the responsibility of NNPC. Nigeria has made significant successes in oil exploration. Presently, Nigeria crude oil reserve is about 37,453 million barrels[8]. IDSL is virtually responsible for the success story of NNPC's oil exploration activities. IDSL is a very

[8] OPEC – Annual Statistical bulletin 2017

large subsidiary company of the NNPC. Oil field data is normally analyzed and processed by IDSL technical officials via the use of sophisticated computer network. Most of Nigeria's crude oil discoveries is attributable to the highly dedicated members of staff of IDSL.

2.6 NNPC Midstream Enterprises

The Midstream enterprises are enumerated below:

- The Green field refinery concept
- Gas initiatives and Power
- The Renewable Energy initiative
- Recent Technology and Engineering
- Refining and Petrochemicals
- The Nigerian Gas Master Plan

2.7 NNPC Downstream Enterprises

This branch of NNPC business in Nigeria is very well organized. The four refineries in Nigeria have an aggregate capacity of approximately 445,000 bpd. The four refineries include; Warri, Kaduna and the two in port Harcourt. These refineries are interconnected by a superb pipeline network and depots, which are located in choice places across the length and breadth of Nigeria. The PPMC; another subsidiary

of the NNPC is the bulk supplier of petroleum products to its numerous customers. Some of the various products that are traded by PPMC include;

- PMS
- AGO
- LPG
- Fuel oil

2.8 The Mode of Operation of the Joint Operating Agreement (JOA)

Under this arrangement, one member of the partnership is assigned as the operator. It is pertinent to note that the NNPC has the prerogative right of becoming the operator. The cost of operations is distributed amongst the partners. It may become obligatory for partners in the agreement to dispose off; of their production interest share after the payment of royalties and petroleum profit tax. Budgeting, work programme and other anticipated expenses are normally prepared by the operator on a yearly basis. These various costs proposals are usually shared between the shareholders of the company. Other matters are

tabled and decided upon at operations committee meeting where there is a representative of each partner.

2.9 Joint Venture Contracts

The JVC is a business agreement between two parties. The terms and conditions of the business are stated expressly in the agreement documents. A single legal entity is constituted for the purpose of the contract. The running of the partnership, profit/losses sharing are based on the terms of agreement which is articulated in the JV contract[9]

The contract will specifically highlight the commercial responsibilities, technical inputs and duties of the different partners in the project.

Highlights of the JV Contracts are as follows:

- The level of involvement of each partner is succinctly spelt out in the participation agreement.
- Duties and the varied interests of the partners are stated in the agreement.
- The ownership consent of production infrastructures and assets.

[9] http://www.globalnegotiator.com/international-trade/dictionary/contractual-joint-venture/

The NNPC is into joint ventures with six (6) international firms. The firms include SPDC, CNL, MPNU, NAOC, EPNL and TOPCON respectively.

2.9.1 Shell Petroleum Development Company of Nigeria Limited (SPDC)

SPDC is responsible for the running of this JV agreement. About forty percent (40%) of Nigeria's aggregate crude oil output, which was equivalent to 899,000 bpd in 1997, came from this JVC. It is made up of NNPC (55%), Shell (30%), Elf (10%) and Agip (5%). It operates majorly on onshore (dry land) and also in the swampy area.

2.9.2 Chevron Nigeria Limited (CNL)

CNL is responsible for the operation of this JVC. The contract is composed thus: 60% NNPC and 40% Chevron. It has been reputed to be the second biggest producer in recent past. The CNL JVC confidently boasts of about 400,000 bpd. Its oil fields are located in the Southern region of Nigeria. Its target is to increase production to around 600,000 barrels per day.

2.9.3 Mobil Producing Nigeria Unlimited (MPNU)

MPNU is in charge of the running of this JVC. The participants are NNPC whose stake is 60% and Mobil whose stake is 40%. It is operated

in the shallow waters of Akwa-Ibom state in the southern oil producing part of Nigeria. In 1997, its production rate was about 632,000 barrels per day. MPNU also have a 50% stake in a deep offshore oil block. From the year 2000 till date, the average production output from this deep offshore oil well is approximately 900,000 barrels per day.

2.9.4 Nigerian Agip Oil Company Limited (NAOC)

The NAOC takes charge of the operation of this JVC. The participants are NNPC whose stake is 60%, Agip which have a stake of 20% and Phillips Petroleum with a stake of 20%. The production rate is around 150,000 barrels per day. The oil wells are located mostly onshore and they are quite small.

2.9.5 ELF Petroleum Nigeria Limited (EPNL)

EPNL takes charge of the operation of this JVC. The participants consists of the following: NNPC – 60% and Elf – 40%. In 1997, this JVC produced about 125,000 barrels per day.

2.9.6 Texaco Overseas Petroleum Company of Nigeria Unlimited (TOPCON)

TOPCON is responsible for the running of this JVC. It is made up of the following participants thus: NNPC – 60%, Texaco – 20% and Chevron

– 20%. The total production from this JVC is approximately 60,000 barrels per day from five (5) oil wells, which are located in the offshore.

2.10 Regulations and Laws of the Oil Sector in Nigeria

Regulations are integral components of the contemporary business sector of various economies globally as they help in shielding businesses, workers, and the general populace from needless dangers just as they also guide against the pollution and degradation of the environment. Government policies and anticipated goals are achieved through various rules and regulations. The regulatory environment is made up of all government stipulations, rules and guidelines, which set out the modus operandi of various businesses. The regulatory environment includes the set of rules, financial administrations, tax systems, ownership and management style amongst other things (Aigboduwa & Oisamoje, 2013)

The laws governing the oil sector in Nigeria are a system of norms, rules and regulations; which has to do with the corporate management that set out the duties, punishment and corresponding rights as regards the continued operation of such business enterprise in the

country. Various governments in Nigeria have had cause to enact suitable laws, which take charge of the changing preferences, goals and objectives as outlined by both local and global politics (Duru, 2012). The Nigerian federal government in 1969 enacted the ***Petroleum Act***, which is the primary law that governs the Nigerian oil sector. The law specifies thus:

"That the proprietorship, administration and authority over every petroleum resources in, under or upon any lands which this section of the law applies shall be entrusted to the federal government[10]***"***

Again, another law; "***the Exclusive Economic Zone Act of 1978***" was promulgated in the same respect. The law stipulates thus;

*"…**the ultimate and exclusive propriety regarding the Prospecting and production of natural mineral resources in the sea bed, sub-oil and superjacent waters of the exclusive zone shall be entrusted to the nation Nigeria and such powers shall be duely carried out by the government of the federation**… "*[11]

[10] Section 1(I). It should be noted that the Petroleum Act has undergone series of amendments, the latest of which was in 1998 by the Petroleum Amendment Decree No. 22 of 1998.

[11] Section 2 (1). It should be noted that the said sovereign and exclusive exploitation of the living resources in the exclusive Zone is subject to the provisions of any treaty to which Nigeria is a party

Furthermore, the proprietorship of all natural mineral resources was vested on the government of the federation in both 1979 and 1999 Constitutions. The law stipulates that:

"…***the total control and propriety of every mineral, mineral resources such as crude oil and natural gas, in any land in Nigeria or inside the geographical waters and the economic zone which is exclusive to Nigeria shall be entrusted to the federal government of Nigeria and shall be controlled in such a way as outlined by the Nigerian national assembly*.**"[12]

From the foregoing, it is very clear thus; that the proprietorship of every mineral and mineral resources such as crude oil and others belongs to the government of the Nigerian federation. The pathetic aspect of this narration is that different people on whose ancestral lands these natural resources are discovered cannot claim ownership of these abundant resources. This is the same problem different states, local governments and various oil-producing villages are faced with. It is however crucially important to note that the federation government's taking over of ownership was not arrived at overnight. The enactment by

[12] Sections 40 (3) and 44 (3) respectively.

government of the offshore oil law brought to bear this seemingly contentious matter.

Nevertheless, there is little or nothing these states, local governments and villages/communities can do about this issue. Again, going by the revenue decree number nine (9) which was promulgated in 1971; the claim of ownership by the states, local governments and villages of the mineral resources in their geographical locations throughout the entire nation was annulled and the proprietorship of territorial waters, relatively shallow seabed (approximately up to 200meters), commissions/royalties, rents and various incomes accruable from mineral resources production in the various states were transferred to the federal government. An interesting characteristic of this kind of arrangement as regards the sole and centralized proprietorship of crude oil resources in Nigeria is the way the industry is managed. According to Section 2, subsections (1), (3) and (4) of the Nigerian Petroleum Act; it is only the petroleum minister or the Presidency going by the policies of the Nigerian government federation that may award or withdraw a license or lease as the case maybe. The Petroleum minister is entrusted with humongous powers by the petroleum act of the government. All the operations going on in the oil sector of Nigeria must be approved by the

petroleum minister by way of granting of prospecting and production licenses. The building of refineries, the laying of oil pipelines, marketing and importation of petroleum products are at the instance of the Honourable minister of petroleum. The minister through other sub-divisions in his ministry like the petroleum products pricing regulatory agency (PPPRA) fixes the sales price of various petroleum products[13].

Nigeria became a member of OPEC in 1971. OPEC as an international body encourages its member countries to take full charge of their petroleum industry by way of participation via the establishment of their own national oil companies (NOCs). As a result of this, the NNOC came on stream in 1971. Thereafter, the Ministry of Petroleum Resources (MPR) was created in 1975. Unlike the national oil companies of other OPEC member nations, which took charge of the happenings in the oil sub-sector of their different economies, international oil firms were given such responsibilities in Nigeria. They accomplished this through the joint venture contract.

The MPR and NNOC of Nigeria were merged together in 1977. This merging metamorphosed into the establishment of the Nigerian

[13] Section 6 of the Petroleum Act.

National Petroleum Corporation (NNPC). Since then until now, NNPC crude oil Production has continued in the Southern oil-producing region of Nigeria with its participation in about 78 out of the 159 oil fields. The peculiar high quality of the Nigerian crude distinguishes it from other OPEC nations' product. Nigeria crude is only comparable to that from the North Sea oil (Khan, 1994).

2.10.1 The Federal Ministry of Petroleum Resources (FMPR)

The establishment of the FMPR was due to the urgent need to pursue and actualize government policies, which were geared towards the immediate development of the flourishing oil and gas sector as at then. The FMPR is responsible for the drafting, administration, execution and control of government policies in the Nigerian oil and gas industry. The ministry also plays the role of supervision over indigenous and international oil firms with a view to making sure that everyone comply with the set out laws and rules of the oil sector in Nigeria[14].

The ministry also makes sure that there is the enforcement of international best practices in the nation's oil industry. The regulation

[14] http://petroleumresources.gov.ng/index.php/about-us/about-mpr

duties of the FMPR is being accomplished through its technical arm which is the DPR – Department of Petroleum Resources. The everyday supervision of happenings and operations in the entire oil industry is done by the DPR. The DPR makes sure that every firm operating in the industry have their license permit and leases. This is very crucial in order to ensure that every firm complies with oil fields international standards and best practices all over the world.

In the FMPR, there is the DGR – Department of Gas resources. The DGR undertakes the articulation of laws and supervision of the Nigerian gas sub-sector of the industry in line with the nation's gas master plan. The DGR is also involved in gas resources development, utilization, treatment as well as processing. Other responsibilities of the DGR include the granting of permits and operational licenses in the gas sub-sector. The DPR and DGR amongst other functions undertake;

- The granting of oil mining licenses (OMLs), oil exploration licenses (OELs), and oil prospecting licenses (OPLs) in line with international best practices.

- They are also involved in issues that have to do with service contracts (SCs), production sharing contracts and other various contract agreements.
- The DPR and DGR will have to also agree to contracts interest and assignment of licenses of the nation's oil & gas assets.

The oil exploration licence (OEL) is usually awarded for a one-year period. It can be extended for another period of one year if some conditions are met. The oil-prospecting license (OPL) can be issued for a five-year period, which is suitable for JVCs in the onshore, shallow offshore production sharing contracts (PSCs) and other PSCs. The length of any OPL for offshore oil wells and those in the inland basins can vary between five to ten years. This depends on whether the offshore is very deep. Concerning OML**,** its term covers a period of about 20 years. The company that holds an OML may wish to go on with its production and it has the privilege of renewal if the terms and conditions of the current OML that is about to expire have been fulfilled. Such companies are free to apply to the Petroleum minister[15].

[15] https://uk.practicallaw.thomsonreuters.com/5-523-4794?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1

Other government parastatals and firms, which have oversight functions over the production of mineral resources such as oil and gas with respect to international best practices, include:

- **The FME - Federal Ministry of Environment**. The FME is duty bound to administer environmental impact assessments (EIAs) in relation to projects whether private or public which affect the general populace with oil and gas resources projects inclusive.
- **NOSDRA.** The acronym stands for the national oil spill detection and response agency. NOSDRA is obligated by law to be engaged in surveillance activities with respect to oil production. The reason for this is to ensure that all companies comply with international environmental laws in general and also those that have to do with oil spills in particular. NOSDRA has to also prepare reports, detects and respond to oil spillage in any part of the oil-producing environment.
- **NESREA**. NESREA stands for National environmental standards and regulations enforcement agency. The duty of NESREA is to ensure that all companies comply strictly with best

practices and international standards as it concerns the environment whenever they carry out their operations.

The key legislations/Acts underpinning the Nigerian oil and gas industry include the following:

- Petroleum Profits Tax Act of 1958.
- Mineral Oils (Safety) Regulations of 1963
- Oil Pipelines Act of 1965.
- Oil in Navigable Waters Act of 1968.
- Petroleum Act of 1969 including all its updated versions.
- Affiliate Gas Reinjection Act of 1979.
- The EIA Act of 1992.

These laws enumerated above play a vital role in everyday running of the industry in Nigeria. Furthermore, they give the legal backing to all government agencies, which are responsible for regulation and the rightful implementation of government policies and programmes. Details on some of these legislations are highlighted below;

- **Mineral Oils (Safety) Regulations of 1963**. This particular law outlines all measures that must be taken by companies to ensure

maximum safety. It also imposes safety duties regarding operational safety for companies that hold OMLs and OPLs.

- **Oil in Navigable Waters Act of 1968**. This very law forbids the Pollution of the Nigerian waterways. Heavy automotive gas oil, high pour fuel oil, low pour fuel oil, crude oil and lubricating oil should never be seen as pollutants on the Nigerian water. Oil vessels and ships are expected to have in place oil pollution preventing facilities.
- **EGASPIN –** This abbreviation stands for Environmental Guidelines and Standards for the Petroleum Industry**.** The DPR is responsible for the issuance of these guidelines. This set of laws are responsible for ensuring compliance with environmental quality control by oil companies in Nigeria.
- **Petroleum Refining Regulations of 1974**. This set of regulations highlights the necessary steps that are to be taken in order to avoid environmental pollution during petroleum refining operations. The regulations also stipulates that all officials on site must be properly kitted in terms of personal protective equipment (PPEs) which must have been approved by the DPR.

- **NOSDRA (Establishment) Act of 2006.** This act succinctly harps on what is expected to be done concerning waste, which is part of the end product of crude oil exploration and production. This is vitally important because of the harmful effects of these waste products if they are allowed into the environment.
- **EIA Act**. Before the commencement of any project in the industry, the EIA act makes it compulsory for an EIA work to be carried out. The purpose of this is to ensure maximum safety and also to determine the impact that particular project might have on the environment.
- **Affiliate Gas Re-Injection Act**: The flaring of associated gas, which is a long time norm of the industry in Nigeria, is being regulated by this very Act.
- **Harmful Waste Act**: This act ***does not allow*** any entity or company to carry, discharge or dump any dangerous waste or chemicals on Nigeria territorial water.
- **The Oil Pipeline Act**: This law was promulgated by the oil and gas pipelines regulations. The law does not allow any company; a pipeline licensee in this case to carry out pipeline construction work at a fifty yards distance from all roads, building

(commercial or residential), dams, water reservoir either for irrigation or domestic purposes. What this law entails is that, pipeline infrastructure must be installed with a barest minimum disturbance impact on the environment. Companies must also have emergency plans in place in case of any unforeseen contingency in order to safeguard the environment.

- **Regulations for Crude Oil Shipment and Transportation**: This set of regulations does not allow topping of trucks or vessels that are being deployed for transporting crude oil. These regulations make it compulsory also for safety checks to be carried out on vessels that are used for oil transportation. Topping means additional loading of oil into empty spaces in a vessel after the completion of loading of the official nominated quantity at a loading terminal.

2.10.2 The Department of Petroleum Resources (DPR)

The DPR is a branch of the petroleum ministry that is saddled with the technical responsibilities of the industry. The officials of DPR are engaged with everyday supervision of operations in the oil sector. A brief history of the DPR has it that; at the outset of oil exploration and

production in Nigeria, the section on hydrocarbon at the Lagos affairs ministry was solely responsible for issues that has to do with petroleum. The head of that section was answerable to the governor general at that time. They kept all the records then that have to do with oil exploration/production and also concerning the distribution and importation of petroleum products. It also handled safety issues and resolved all the problems arising therewith then. However, as the petroleum sub-sector began to grow bigger, that section that normally handles hydrocarbon matters was transformed into a petroleum division in the ministry of power and mines then[16].

The continuous growth of the Petroleum Division led to the creation of the DPR in 1970. The NNOC was also created in 1971 to help the government of the federation take charge of operational and commercial activities in the oil sub-sector. The DPR in 1975 metamorphosed into the ministry of petroleum and energy. But the name of this new ministry was later changed to the ministry of petroleum resources.

[16] https://dpr.gov.ng/index/history-of-dpr/

NNOC and the ministry of petroleum resources were collapsed into one in 1977 by Decree number 33. This merger gave birth to the NNPC – The Nigerian national petroleum corporation. The intention of the merger was to assist the government of the day make do with the limited qualified manpower in the oil industry then. This decree number 33 again created the petroleum inspectorate which was a significant component part of the then NNPC. The specific duty of the petroleum inspectorate was to regulate and supervise the operations of the oil sub-sector. There was a re-establishment of the petroleum ministry in 1985 while the petroleum inspectorate was still part of the NNPC. Nevertheless, there was a complete re-organization of the NNPC in March 1988. As a result of the restructuring of NNPC, the petroleum inspectorate was moved out of the NNPC to the petroleum resources ministry and it was again subsequently named DPR where it was expected to serve as the technical division.

The fundamental duties of the DPR is to make sure that there is total industry compliance by the various oil companies in terms of guidelines, petroleum laws and regulations. The DPR accomplishes it numerous duties via operations monitoring at drilling platforms, flow

stations, government and private depots, export terminals for crude oil amongst others. The major functions of the DPR include:

- The issuance of leases and licenses, which enable different oil companies (both indigenous and international) to operate in the industry in Nigeria.
- To supervise closely the daily happenings' in the industry which is aimed at achieving the set out objectives of the government and policy makers. Some of these government objectives include drastic reduction of gas flaring and also meeting the important obligations of domestic gas supply.
- To make sure that our HSE standards meet up with international best practices the world over in relation to field operations.
- The keeping of up to date industry records in terms of the nation's crude oil reserves, export & import figures of petroleum products, the total number of leases and licenses amongst others.
- Giving government and other relevant parastatals in the industry up to date technical advice with a view to maintaining harmonious operations and also geared towards the achievements of national goals.

- The DPR also endeavour to make sure that royalties, rents and other revenues due the government of the federation are paid into the treasury single account (TSA) promptly and adequately.
- National data repository maintenance and administration.

2.11 Political Instability in the Oil Producing Southern Region of Nigeria

The chaotic operating atmosphere that do envelope some countries that have a lot of mineral resources such as crude oil are not restricted to Nigeria alone. Political and economic crises seems to be the hallmark of the chaos associated with natural mineral oil rich countries. There is this tendency of rental pursuits and political instability in many resource rich nations of the world (Auty, 2001). Violent crises between the southern part of Nigeria and the Nigerian state itself have been traced continuously to the presence of abundant oil and gas wealth in that region. Nigeria have had several occasions where the armed forces of the federation were unleashed on the Niger delta villages and communities because of agitations for oil resources control. The regrettable civil war that broke out in Nigerian between 1967 and 1970; was partly caused by

deep ethnic misunderstandings between the Igbo speaking southeastern part of Nigeria and the Nigerian state itself. These misunderstandings had been ongoing after Nigeria gained independence in October 1st 1960. Truth be told, the presence of abundant oil wealth in the southern part of Nigeria contributed immensely to the wanton destruction of lives and properties, which took place during the civil war in Nigeria.

The Niger Delta region ab initio was under the political control of the old eastern region. There was this school of thought in some quarters that Biafra (a complete Igbo speaking state) would be prosperous since there is this humongous oil mineral resources in the southern part of the nation. The then political leader of the old eastern region colonel Odumegwu Ojukwu; in 1967 gave instruction to his cabinet to begin to collect the entire revenues accruing from oil from his state instead of the usual remittance to the government of the federation. Instability and problems in the political leadership has been a significant source of worry for the Africa continent. Various empirical studies recently have shown that instability in political leadership in the African sub-region have distorted economic growth and monetary savings (Frynas, 1998).

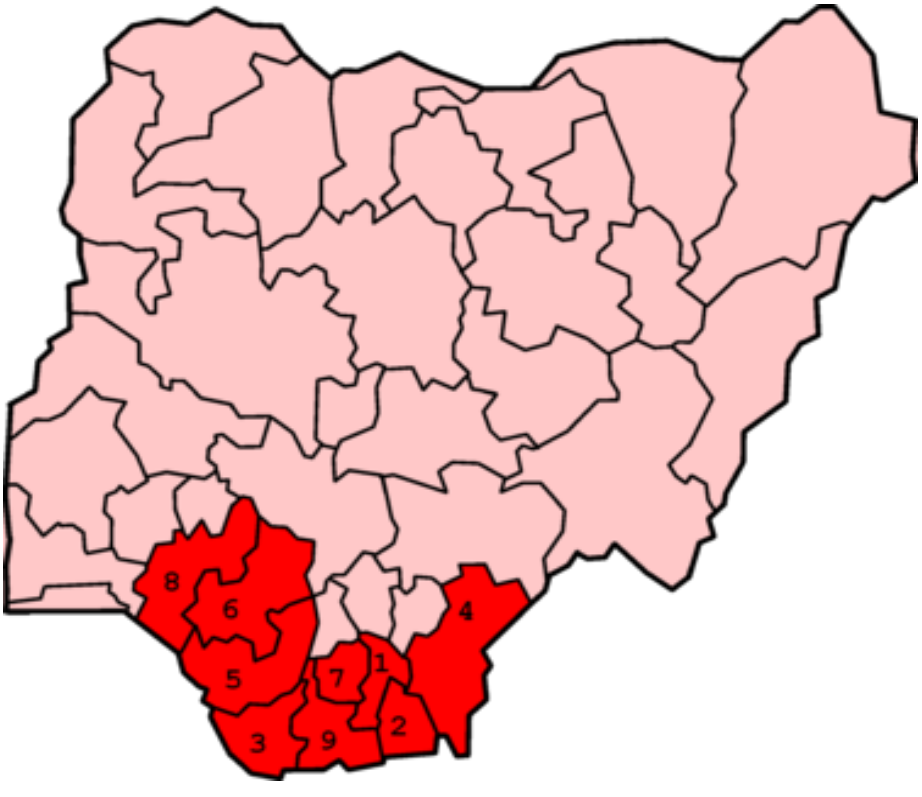
What the government of the federation did then was to respond to Ojukwu's action by the creation of additional three states in the southern part of the country. This action was taken to a kind of pacify the minority tribes in the region and to also guarantee an expansion of wealth creation and regional autonomy. However, to the amazement of all, not too long after the action of the federation government; Colonel Ojukwu declared Biafra's independence and that singular action by Ojukwu marked the commencement of the Nigerian civil war (Ross, 2003). Violent and communal crises in the Delta region which is a way of showing their grievances against the government by the indigenes of the oil bearing communities is attributable to this enormous mineral resources in their region. The region is dominated by so many minority tribes and their feelings are that, they have been shortchanged by the government due to the lack of visible oil wealth amongst its populace. The people of the region are living in extreme poverty that ought not to be. The area-shaded red in the map of Nigeria in figure 2.4 below represents the Niger delta region, which consists of nine states namely;

- Rivers State – Number 9
- Ondo State – Number 8
- Imo State – Number 7

- Edo State – Number 6
- Delta State – Number 5
- Cross River State – Number 4
- Bayelsa State – Number 3
- Akwa-Ibom State – Number 2
- Abia State – Number 1

Figure 2.4 The Niger Delta Region of the Federal Republic of Nigeria

Source: Google Image



The region, coloured red as we can see in the map where the oil is being produced is situated in the Southern geopolitical zone of Nigeria. Though the region is made up of nine states, the core Niger delta states which are hot beds for civil disturbances include Delta state, Bayelsa state and Rivers state. The different ethnic nationalities in the delta region is well over thirty (30). Initially, the Delta region comprised of Edo, Akwa-Ibom, Rivers, Bayelsa, Cross-river and delta states respectively. However, the administration of former president Olusegun Obasanjo extended Niger delta to include all oil producing states in 2004 (The Nigerian Voice, 2010)[17] with the inclusion of Ondo, Abia and Imo states respectively.

During the colonial period specifically from 1939 to 1951, the old Nigerian Eastern region was created as part of the three regions in Nigeria (Western, Eastern and Northern regions). There was no Southern region and the minority ethnic groups from the South became agitated. The government of the day back then was not willing to create a separate region for the Niger delta and this was perceived as grave injustice. As a result, Isaac Jaspa Adaka Boro (1938-1968) was offended and thereafter,

[17] https://www.thenigerianvoice.com/news/16219/topic-niger-delta-oil-conflict-the-reason-current-status-the-demands-and-western-influence-etc.html

he formed a rebel group in 1966 and declared Niger Delta republic from the country. Isaac Boro was arrested by federal troops but was later released and sent to the war front during the Nigerian civil war (1967-1970) where he was killed.

There have been many crises in the delta region dating back from 1990. Some of the ethnic groups that have been involved in these misunderstandings with the government include the Ijaws', the Ogonis', the Itsekiris', the Urhobos' etc. The Ogoni people which include about 500,000 people if not more than are made up of six (6) clans which is divided into three sub-ethnic groups. These people live in about 111 communities in the Southern part of Nigeria (Ross, 2003). The development of crude oil started in 1958 in Ogoni land. Serious violent conflicts between the indigent communities, oil firms and the government became rampant since the 1990s. The formation of the Movement for the Survival of Ogoni People (MOSOP); a non-profit organization by Kenule Beeson Saro Wiwa aggravated the problem. Ken Saro Wiwa as he was fondly called was a Nigerian activist and writer. He spoke vehemently against the Nigerian state (the military Junta then) and the Royal Dutch Shell for its contribution to the environmental

degradation of the Ogoni peoples land, the pollution of their fishing rivers and other serious health issues in Rivers State.

While these problems rage, MOSOP in 1990 submitted a bill to the government of the federation titled "***The Ogoni Bill of Rights***". Their demand was quite clear. They wanted an equitable share of the abundant mineral resources domiciled in their geographical territory. Many other allied groups became sympathetic to the Ogoni struggle and the agitations began to take a more dangerous dimension. At a point in time, they wanted to take full control of their geographical territory and all the resources found there in.

The leadership of MOSOP 1992 requested the international oil companies operating in their ancestral lands to pay them the sum of ten billion US dollars ($10 Billion), clean up the mess on the environment amongst other demands. MOSOP vowed that if the companies refused to heed their request within thirty (30) days; they would make sure that their productions are disrupted. Due to these threats, the government of Nigeria sent military troops to Ogoni land. After sometime, there was a communal crisis between the Andonis' and the Ogonis'. It was as if the government was taking side with the Andonis' (Osaghae, 1995).

In 1994 to be precise, Ken Saro Wiwa was apprehended. He was accused of complicity as a result of the death of four Ogoni elders after a rally, which had political undertone. A military tribunal tried him, which some international human rights crusaders were not comfortable with. Thereafter, he was declared guilty for purported complicity regarding the murder of the Ogoni elders and he was subsequently murdered by hanging (Encyclopedia Britannica)[18].

The various minority ethnic nationalities in the southern region of Nigeria are still very upset because of the death of their people including MOSOP leaders due to this struggle. There seems to be no end in sight to the agitations in the region. The government have been trying to find long lasting solutions to the endemic poverty in the region. Between 1993 and 1999, the government established the Niger delta development board. Examples of such boards is the OMPADEC – The oil minerals producing and development commission and NDDC - Niger delta development commission. In all fairness, the government has also committed huge funds to the development of this region where this oil revenue is coming from. However, the irony is that there is virtually nothing to show for when this Southern part of Nigeria is held in

[18] https://encyclopedia.thefreedictionary.com/Ken+Saro-Wiwa

comparison with other regions in the world that also produce oil. The final resolution of these communities is that all they want is the total control of their resources.

Angered by the injustices, poverty and killings; Mujahid Dokubo Asari in 2004 formed the Niger delta people volunteered force (NDPVF). They fought with arms, guns and other dangerous weapons threatening to bring crude oil output in the southern region down to zero. Other groups of agitators' that emerged in the region who also fought the central Government in a bid to controlling oil resources include MEND - the movement for the emancipation of Niger delta, NDLF - the Niger delta liberation front, NDV - Niger delta vigilante etc. There has been violent conflicts in Southern Nigeria for more than four decades now. Before the coming of the colonial masters, there was violence in the region which was traceable to injustices and more recently the desire to take full control of their resources (Adebanjoko, 2017). These civil disturbances / protest by indigent communities in the oil producing areas peaked during the period 2000 to 2008. During these periods, there was a huge loss in terms of revenue accruing from oil export to the national coffers. Their agitations was usually a threat to the continuous production of crude oil in those areas.

The activities of these various groups impacted negatively on crude oil production in Nigeria. Their activities included oil bunkering, oil pipeline vandalization, hostage taking and kidnapping. The operation of these various agitating groups almost brought oil business in Nigeria to a halt and made Angola overtook Nigeria as a substantial force to reckon with in terms of oil export in the whole of Africa in 2009. A study carried out by the international center for reconciliation (ICR), Coventry cathedral estimated a whopping 14 trillion Naira (approximately 111.8 Billion Dollars) as oil revenue losses due to oil bunkering (crude oil that is stolen) and distorted oil production in Nigeria from 2003 to 2008 (Paki & Ebienfa, 2011). Table 2.4 shows the losses incurred by the Nigerian government as a result of these violent agitations.

Table 2.4 Estimated value of Nigeria's stolen and shut-in oil production from Jan. 2000 to Sep. 2008

Source: Paki and Ebienfa, (2011).

Year	Average price of Bonny light (USD/bbl)	Volume of Oil stolen per day (in bbl)	Value of Oil stolen per annum (Billion USD)	Volume of Oil shut-in per day (in bbl)	Value of Oil shut-in per annum (Billion USD)	Total value of oil shut-in/stolen (Billion USD)
2000	28.49	140,000	1.5	250,000	2.6	**4.1**
2001	24.50	724,171	6.5	200,000	1.8	**8.3**
2002	25.15	699,763	3.2	370,000	3.4	**6.6**
2003	28.76	200,000	3.2	350,000	3.4	**6.6**
2004	38.27	300,000	4.2	230,000	3.2	**7.4**
2005	55.67	250,000	5.1	180,000	3.7	**8.8**
2006	66.84	100,000	2.4	600,000	14.6	**17.0**
2007	75.14	100,000	2.7	600,000	16.5	**19.2**
2008	115.81	150,000	6.3	650,000	27.5	**33.8**
Total		**2,663,934**	**35.1**	**3,430,000**	**76.7**	**111.8**

Environmental issues as a result of oil prospecting and exploitation activities of these international oil firms is also amongst the pertinent factors' that are fueling violent agitations in the Southern part of Nigeria. Table 2.5 below gives an insight into the problems of environmental pollution in the oil region;

Table 2.5 Degradation of the environment due to upstream and downstream petroleum activities.

Source: Ite, Ibok, Ite, and Petters, (2013).

Activities	Potential associated risks	Environmental, health and safety issues
Exploration operations		
• Geological survey • Aerial survey • Seismic survey • Gravimetric and magnetic survey • Exploratory drilling • Appraisal	a. Noise pollution b. Habitat destruction and acoustic emission c. Drilling discharges e.g. drilling fluids (water based and oil based muds) and drill cuttings d. Atmospheric emission e. Accidental spills/ blowout f. Solid waste disposal	Ecosystem destruction and interference with land use to access onshore sites and marines resource areas; environmental pollution (air, soil and controlled water) and safety problems associated with the use of explosives; land pollution which affects plants and pose human health risks; groundwater contamination and adverse effects on ecological biodiversity.
Development and production		
• Development drilling • Processing: separation and treatment • Initial storage	a. Discharges of effluents (solids, liquids and gases) b. Operation discharges c. Atmospheric emission d. Accidental oil spills e. Deck drainage f. Sanitary waste disposal g. Noise pollution h. Transportation problems i. Socio–economic/ cultural issues	Ecosystem destruction and interference; contamination of soils and sediments with petroleum–derived wastes; atmospheric emissions from fuel combustion and gas flaring/venting; environmental pollution (air, soil and sediments, controlled waters) and groundwater contamination; ecological problems in the host communities, adverse human health risks; safety related risks and interference with socio–cultural systems.
Decommissioning and rehabilitation		
• Well plugging • Removal of installations and equipment • Site restoration	a. Physical closure/removal b. Petroleum-contaminated waste disposal c. Leave in situ (partial or total) d. Dumping at sea	Environmental pollution and human safety; pollution related to onshore and offshore operations; hazard to other human activities such as fishing and navigation; marine pollution, fishing and navigation hazards
Refining of petroleum products		
	a. Atmospheric emissions and air pollution b. Discharges of petroleum-derived wastes	Atmospheric emissions and air pollution; oil spillages; water effluents and production discharges.
Transportation and distribution		
• Pipelines • Barges, ships, tankers and FPSOs • Road tankers and trucks	a. Emissions and accidental discharges b. Discharges from transporting vessels e.g. ballast, bilge and cleaning waters	Air emissions (hydrocarbons from loading racks and oil spills); accidental discharges and operational failures; disposal of sanitary wastes; contamination of soils and sediments.
Marketing operations		
• Product importation • Storage	a. Operational discharges b. Wastes disposal	Spillage; contamination of soils and sediments; emission of organic contaminants and environmental pollution.

Having seen the problems arising from the endowment of abundant natural mineral resources in Nigeria; it will be imperative to

add to the narrative from a global perspective by borrowing a leaf from other studies as outlined from the next paragraph below;

Considering industries were mineral resources are extractable like the oil industry; the jobs created and the economic transformation it is capable of generating when compared with the real sector such as the service industries and manufacturing industries may not be as high as initially expected. Extractable industries in many cases have been responsible for poor economic performance, chaotic administrations, absence of good governance and the hampering of national economic growth. The economic scenario described above is usually termed **"*The Resource Curse*"** and quite a number of crude oil producers have suffered immensely from this avoidable economic crises. Military crises, poor political administration and lack of expected economic growth are some of the indicators evident in majority of nations that are so blessed with natural resources (Frynas, 2010). The principal negative economic impact associated with the export of natural mineral resources like crude oil include:

- ***Economic Impact***. The exchange rate of a nation's currency will definitely appreciate as a result of the huge foreign exchange

earnings that is accruing from the export of the products of the extractable industry like the oil industry. The export of products from the real sector such as manufacturing and agriculture will become nearly impossible because of this problem posed by the appreciation of exchange rate. This concept that we just illustrated above is termed "***The Dutch Disease***". *This disease is a situation in which a resource rich nation concentrates all its efforts on the development of the natural resource sector of its economy while other sectors are neglected*. Another dangerous impact of this extractable industry is that the nation's capital, skills of entrepreneurship and the country's labour force tend to be drifted away from other sectors of the economy. The attention of the work force is being focused on the temporal gains from the extractive industry. The resultant effect of this, is that there will be very little or no development of the other sectors. There are undisputable proofs that resource rich nations' do experience sluggish economic transformation when compared with nations' that are a bit unfortunate in terms of natural mineral resources endowment. (Sachs & Warner, 1999, 2001.)

- ***Effect on Governance***. The export of products from the extractable industry may hinder the benefits of good governance that the populace are yearning for and political office holders from some of these nations' find it difficult to be accountable to their people. Because of the over concentration on the earnings from the extractable industry, the government tend to forget to collect tax from other products' which are not mineral resources. Corruption is seen to be endemic in mineral resources rich nations than those countries that have little or none. Resource rich nations are seen to also be suffering from low quality education (Leite & Weidmann, 1999).
- ***Effects on Conflict***. The exploitation of products from the extractable industry may not be significantly hampered by avoidable conflicts when compared with the service or manufacturing industry. The reason for this seemingly added advantage for the extractable industry is because most of the international firms operating in this industry are able to contribute to the infrastructural growth of their host communities. They have their own superb security architecture and there is little or no interaction with local businesses. Because of this, the

government of resource-endowed nations have little to worry about in terms of political and economic stability. The area that will definitely give the government a bit of concern is the quest by the indigent communities to want to control the financial resources (monetary gains) that is coming in due to the exploitation of these resources in their geographical domains. This will definitely lead to the creation of various separatists' groups and serious rebellious uprising. Violent armed conflicts have been proved to be the offshoot of a nations excessive reliance on natural mineral resources (Elbadawi & Sambanis, 2000; Keen, 1998)

2.12 Oil Price Shocks

Oil price shocks refers to changes in crude oil prices, which is at variance to the price of oil that consumers and other users expected. It may also be referred to as movements in the price of oil, which cannot be explained based on past data[19]. In a non-professionals' language, the terminology "oil price shocks" represents episodes of unusually high (or

[19] Energy price shocks – university of Michigan. www-personal.umich.edu/~ikilian/energypriceshocks.pdf

in some instances unusually low) oil prices. More formally, it is the unanticipated change in crude-oil prices with its attendant impact on the economy. For example, the first point of call regarding its impact on the economy is its effect on aggregate supply[20]

Examining the mathematical production function, which consists of the output (Y) from a particular company, L which stands for input labour, K which represents capital, and E which is energy consumption. mathematically;

Y = f (L, K, E). Now, if K and L are held constant and energy prices rises, there is this tendency for firms to cut down on their usage of energy which means there is going to be reduction in output that will be obtained from a certain amount of capital and labour. Because of the reduction in productivity, real wages will also decline and if rising oil prices last for a long time, some employees' may voluntarily withdraw from the work force and their action will definitely lead to increased rate of unemployment.

[20] Revisiting history: The macroeconomics of oil prices and economic shocks – south Asian voice. https://southasianvoices.org>revisiting-history.

2.13 Asymmetric Oil Price Shocks

This specification of crude-oil price shock decomposes the percentage variations in crude-oil prices into two variables namely; positive price shocks and negative price shocks. There are four various categories of impacts which arise from the effects of oil price asymmetry on trade. They are as follows; positive oil shocks effects on net oil exporters, positive oil shocks effects on net oil importers, negative oil shocks effects on net oil exporters, and negative oil shocks effects on net oil importers. Following Umekwe and Baek (2017), the definition of oil price asymmetry with a distinction between negative and positive changes in the price of oil is proposed as explained below;

To start with, a variable $\Delta lnOP_t$ is obtained from changes in the $lnOP_t$. Using this new time series variable ($\Delta lnOP_t$) which includes zero values, negative values and positive values; the partial sum of negative and positive values are constructed and represented as;

$$lnOP_t^+ = \sum_{j=1}^{t} \Delta lnOP_t^+ = \sum_{j=1}^{t} \max(\Delta lnOP_j, 0) \quad (1)$$

$$lnOP_t^- = \sum_{j=1}^{t} \Delta lnOP_t^- = \sum_{j=1}^{t} \min(\Delta lnOP_j, 0) \quad (2)$$

Where $lnOP_t^-$ and $lnOP_t^+$ represent the cumulative partial sum process of negative and positive changes in *lnop* respectively.

Where OP_t is real oil price, OP_t^+ is positive oil shocks and OP_t^- is negative oil shocks.

2.14 Balance of Trade (Trade Balance)

Trade balance otherwise known as balance of trade (BOT) is the differential in the account balance of a country's aggregate exports and imports for a given period. BOT is the largest component of a country's balance of payment. Balance of payment is a statement, which summarizes the transactions between a country and other economies the world over for a particular time frame. Economists use BOT as a statistical tool, which help them in understanding the relative strength of a country's economy in relation to other countries. A country whose imports of services/goods is more than its export will definitely have a trade deficit. Conversely, any country whose's exports of services/goods exceed its imports will have a trade surplus.

The measures of trade balance used in this study include the following;

- Real total trade balance
- Real oil trade balance
- Real non-oil trade balance

Following the studies of Bahmani-Oskooee and Malixi (1992); Haynes and Stone (1982) and Bahmani-Oskooee (1991), we expressed trade balance, as a ratio of Nigeria's export to import be it oil trade and/or non-oil trade. There are a number of advantages inherent in expressing trade balance in ratio form. These advantages include;

- The ratio is insensitive to the currency units whether foreign or domestic used to measure both exports and imports (Bahmani Oskooee, 1991)
- The ratio does not bother if the trade balance is measured in real or nominal terms and therefore it is also not sensitive to the price index used to deflate it
- The ratio enables us to estimate the trade balance in natural logarithm form.

The mathematical expression is shown below;

$$\text{Total trade balance} = \frac{Total\ Export}{Total\ Import} =$$

$$\frac{Total\ Oil\ Export + Total\ nonoil\ Export}{Total\ Oil\ Import + Total\ nonoil\ Import}$$

2.15 Real Oil Trade Balance

Variations in the prices of crude oil have been somewhat responsible for a kind of wealth transfer between countries that import oil and their exporting counterparts. Increasing growth in demand, military and geographical events have been the drivers of price asymmetry. In recent times, significant technological advancement in shale production in the United States have a kind of caused a revolution in terms of movements in price in the crude oil international market. The positive balances in current account may become stronger as oil export bills continue to grow in oil exporting nations (Huntington, 2015). Nigeria's real oil trade balance is expressed as a ratio of its total oil export to its total oil import

$$\text{Oil trade balance} = \frac{Total\ Oil\ Export}{Total\ Oil\ Import}$$

2.16 Real Non-oil Trade Balance

Nigeria's real non-oil trade balance is expressed as a ratio of its total non-oil export to its total non-oil import.

Non-oil trade balance = $\frac{Total\ nonoil\ Export}{Total\ nonoil\ Import}$

Chapter 3. Literature Review

3.1 Previous Studies and Existing Literature

There is no doubt that there is a relationship between increase in a nations export activities and economic growth. Development economists are so much interested in this aspect of macroeconomics. As a result, economists' have been classified into two groups which include those that could not reject the assertion that the growth in a country's export do positively affect the growth of such economy and other researchers' who rejected the assertion that the growth in a country's export activities and its economic growth does not have any relationship. The growth of a country's economy is traceable to the robust performance from its exports sub-sector. Some of the advantages from a well performing export sector include increases in specialization, export growth sub-sector spillover effects, increases in capacity utilization, industrialization, the dynamic impact of technological advancement amongst others (Vohra, 2001). These arguments notwithstanding, export activities remain the growth engine of many economies globally.

Saeed Moshiri (2015); studied the effects of crude oil price variations in two groups of countries that export oil (six developing

countries and three developed countries). The VAR model and the GARCH technique were used in estimating changes in the price of crude. The various oil exporting countries were seen not to possess the same response to price variations. For developing countries, oil price shock was discovered to have an asymmetric effect. Decreases in price gave rise to a significant cut in revenue with a stagnation effect on economic growth while increases in the price of crude led to higher revenues although it did not result to economic growth. For oil exporting developed countries, higher revenues accruing from high oil prices was seen not to have any meaning impact on economic growth.

Rafiq, Sgro and Apergis (2016); applied FMOLS (fully modified ordinary least squares) empirical technique in studying the nexus between oil price asymmetry and the external balances of many oil importing and oil exporting nations'. They established that oil price increases for major oil exporting nations' led to an increased oil trade balance while its impact was a disadvantage to total trade and non-oil trade balance. This may not be unconnected with expenditure effect, which arises from increased oil proceeds. Conversely, a reduction in the price of crude was an advantage to both total trade and oil trade balances. For oil importing nations, they seem to be shielded from positive oil price

shock. However, a reduction in oil price had a negative effect on both real oil trade balance and total trade balance.

Mohsen Mehrara (2008); studied the asymmetric relationship between economic activities and crude oil revenues in oil exporting nations. They established that output growth was negatively affected by reductions in the price of crude while positive oil shocks played an insignificant role in improving the growth of the economy. Bjornland (2009); analyzed booms in the stock market and oil price variations in an oil exporting nation using the VAR model. They reported that the economy of Norway responded to increases in the price of crude by way of increasing demand and a robust wealth aggregation.

Alessandro and Matteo (2009); while using the markov-switching techniques in studying the impact of oil price asymmetry on output growth in G-7 countries; posited that the upward movement in the price of crude and its uncertainty were responsible for the explanation of the effect of oil on the growth of output. Adeniyi (2012); show that variations in the price of crude was seen as the significant factor responsible for revenue increase in Nigeria's international trade of oil irrespective of the barrels of crude oil export. For instance, foreign reserve figures of

Nigeria dropped drastically because of the bust in oil prices from $53 Billion in 2008 to $46 Billion in 2009 and then $33 Billion in 2010. The movement in the prices of oil determines the direction of movement as regards oil revenue.

Aliyu (2009); discovered that variations in the price of crude and an upward movement in exchange rates were advantageous to real economic growth in Nigeria. Aliyu in his research using the VECM model discovered that there was causality running from crude oil prices to real GDP (proxy for trade balance) and also that, which runs bi-directionally from real GDP to real exchange rate and vice-versa.

Akin and Babajide (2011); established that the variations in the price of crude do not have a significant effect on most of the macro-economic indicators in Nigeria. In their findings, downward movement in the price of crude was largely responsible for an increase in exchange rate and output. Olugbenga and Oluwole (2008); using VECM cointegration technique revealed that an upward trend in the volatility of exchange rate aided the uncertainty regarding the expected level of profit. As a result, export activities were negatively impacted in the short term and long term respectively.

In statistics and econometrics, a high value of correlation coefficients between export growth and economic growth may not necessarily imply causality. Recent studies have been focusing on causality between economic transformation and increase in the volume of export activities. Ugwuegbe and Uruakpa (2013) in their study also established a unidirectional causality between oil export and GDP growth (a proxy for trade balance).

In this study, asymmetric oil prices were specifically examined with a view to exploring its effects/outcome on Nigeria's economic transformation, which is part of the academic implication of our study (our contribution to knowledge). Another contribution of this study is the extensive qualitative analysis on political instability in the oil rich Southern part of Nigeria to see the possible effect it is having on crude oil production vis-à-vis oil export. During these periods of civil disturbances, oil firms engaged in oil production in Southern Nigeria were forced temporarily to either cut down their production rates or in some instances, an outright shut down of oil wells due to these communal crises. However, the Nigerian government was always quick in responding to and managing the situation.

Empirical studies in development economies in the 20th century show that economies which tend to depend on natural resources were seen to have experienced lower growth than those economies that are not too buoyant in terms of natural resource endowment. Resource abundant economies tend to lag behind those economies where natural resources are fewer. Due attention had been given to export performance and economic growth by economists who engage in development studies.

It is worthy of note that since 1965, economic growth seems to have inverse variation with share of natural capital in the natural wealth of countries globally. Four main indices of stunted economic growth due to the presence of natural resources in countries include the ***Dutch Disease, Rent seeking, over confidence and the neglect of education*** (Gylfason, 2001). Among Sixty-five natural mineral resource rich economies, about four of them were able to accomplish the following;

I. Have long-term investment in excess of 25% of its GDP on the average from 1965 - 1998 which equals that of industrialized nations who do not have natural resources.

II. Their average annual per capital economic growth rate is in excess of 4% at this same time period. These four countries include Thailand, Indonesia, Malaysia and Botswana.

Another major problem for resource rich countries is the overdependence on revenues accruing from export by those in leadership position. The country leaders and the general populace are tempted to take with levity the vital need for productive economic policies as well as proper investment on quality education and robust infrastructure. These nations may be too confident of mineral resources capital, which can jeopardize other aspects of the economy (Gylfason, 2001)

These countries were able to achieve this great feat through economic diversification and industrialization except Botswana. Crude oil export from Nigeria accounted for about $390 Billion Dollars in fiscal revenue from 1971 to 2005. But the Nigerian economy had witnessed sustained underdevelopment from various economic indices such as poor human capital development, poor income distribution, civil disturbances in the oil rich Niger delta region, increasing unemployment, relative poverty et cetera (Baghebo & Atima, 2013).

Chapter 4. Methodology

In chapter 4, the methodology that was utilized in this dissertation will be examined. Specifically, the issue of stationarity, cointegration, the autoregressive distributed lag (ARDL), the vector error correction form will be highlighted all geared towards achieving the purpose of this dissertation.

4.1 Stationarity in Time Series and Integration

The concept of a process that is stationary has been very influential in the empirical analysis of time series data. A stationary time series process may be defined as that whose probability distribution does not change with time. For instance, if we have a collection of stochastic (random) variables in a sequence and then move that particular sequence ahead ***h*** number of times, it is expected that the collective probability distribution must remain unchanged (Wooldridge, 2016). Mathematically, the stochastic (random) process $\{x_t : t = 1, 2, \ldots\}$ is stationary if in the consideration of the time indices $1 \leq t_1 < t_2 < \ldots < t_m$, the collective probability distribution of $(x_{t1}, x_{t2}, \ldots, x_{tm})$ is the same

as the collective probability distribution of $(x_{t1+h}, x_{t2+h}, \dots, x_{tm+h})$ for all integers $h \geq 1$.

The statistical properties of a stationary time series like the variance, the mean, autocorrelation etc. are supposed ***NOT*** to change with time. Various methods of forecasting in statistics are based on the presumption that a time series can be made approximately stationary. That is to say, it can be ***stationarized*** by applying different mathematical transformation techniques. It is somewhat easy to predict a time series that had been rendered stationary through mathematical methods. It will be assumed that the underlying statistical properties in the future will remain unchanged just as they have been before. A time series can be stationarized through differencing (where needed)[21]. A series x_t is said to be non-stationary if it has a non-constant mean $E(x_t)$, and the variance $\mathrm{Var}(x_t)$ appears to be systematically changed over time. When a non-stationary time series becomes stationary after differentiation, then such series is considered to be integrated i.e. $I(1)$. If we carry out differentiation on a non-stationary series ***d times*** with a view to achieving

[21] https://people.duke.edu/~rnau/411diff.htm

stationarity, then the series is considered to be integrated of *d* order i.e. *I(d)* (Niyazmuradov, 2013)

When there is the confirmation of unit root in a series, the OLS - ordinary least squares estimation technique will no longer be suitable because it will not be normally distributed. The limiting distribution of OLS estimation of the autoregressive models was examined by Dickey (1976), Dickey and Fuller (1979) for a time series with unit root. Also, Dickey, Hasza, and Fuller (1984) came up with the limiting distribution for a time series that has seasonal unit root. The degree of integration of different variables in a model is assessed by performing the popular Augmented Dickey-Fuller (ADF) test. Wayne Fuller and David Dickey; renowned American statisticians developed the Dickey-Fuller (DF) test in 1979. Their work is very famous in statistics and econometrics. The determination of the presence of unit root in a statistical data is by performing the Dickey-Fuller test. The presence of a unit root (otherwise known as ***structural break***) in any series will make it extremely difficult for us to draw statistical inference from our analysis. What this means is that our statistical inference will not be reliable.

The Dickey-Fuller test can be easily applied to trending time series such as asset prices. It is the basic technique for testing for unit

root. It is very important to state at this point that so many financial and economic time series have structures that are a bit complicated. In this case, it will be most appropriate to use the ADF – Augmented Dickey Fuller test.

The hypotheses for unit root test include;

- Null Hypothesis, which states the presence of a unit root.
- Alternate Hypothesis, which states the absence of a unit root.

To conduct this test, we need to choose a lag length. The lag length should be chosen so that the residuals will not have serial correlation. In our study, the DFGLS - Dickey fuller generalized least squares test was carried out with a view to ascertaining the optimal lag-length for each of the variables in the model. You have several options for choosing lag-length. The BIC – Bayesian information criteria or AIC – Akaike information criteria can be used[22].

[22] http://www.statisticshowto.com/adf-augmented-dickey-fuller-test/

4.2 Cointegration

From the study of Engle and Granger (1987); assuming X_t and Y_t are two different series that have unit roots, they can be made to become stationary by differentiation. Such a series is said to be integrated say of order 1. A good example is the random walk process. If a combination say X_t and Y_t is stationary, then we can assert that they both are cointegrated. That is to say, even if none of X_t and Y_t seem to have a non constant value, but their combination do have. Suffice it to say that the concept of cointegration has to do with long-term equilibrium relationship[23]. In essence, we cannot have cointegration unless the variables are non-stationary.

In statistics, this long-term equilibrium between non-stationary series is called cointegration. What this means is that; even though the two series have their own fluctuating features, there can be a long-term equilibrium between them as long as they are cointegrated (Niyazmuradov, 2013)

[23] https://www.quora.com/What-is-cointegration-of-time-series-data-in-statistics-How-do-you-identify-pairs-of-stocks-for-trading-Is-it-based-on-simple-correlation-analysis-or-is-there-a-more-rigorous-method

4.3 The Autoregressive Distributed Lag (ARDL)

Standard least square regressions, which incorporate both the lags of the regressand and the regressor in the estimation process are known as the autoregressive distributed lag (ARDL). ARDL cointegration technique do not need to carry out pretests to ascertain the presence of unit roots unlike other techniques. The ARDL technique is preferable when we are using variables which are integrated of different order say I(0), I(1) or mutually cointegrated and very robust in a small sample size (Nkoro & Uko, 2016; Chigusiwa *et al*, 2011). The F-statistics that we get whenever we carry out the bounds-test will become invalid if there are variables that are integrated of order 2 {I(2)} in our model since our variables were expected to either be I(0), I(1) or mutually cointegrated (Ouattara, 2004). ARDL technique has become very famous in econometrics whenever we are talking about cointegration amongst variables. This was made possible giving credence to the work of Pesaran *et al* (2001) and also Pesaran, Shin and Smith (1999). A model with a distributed lag is a peculiar model whereby the impact of the independent variable on the dependent variable happens over a period of time. A simple example of a model where we have one regressor is shown below;

$$y_t = \alpha + \beta(\mathrm{L})x_t + u_t = \alpha + \sum_{s=0}^{\infty} \beta_s \, x_{t-s} + \Phi_t \quad (3)$$

Where y_t is the regressand, L is the lag length, x_t is the regressor and Φ_t is an error term. In its basic form, an ARDL model is represented as shown below;

$$k_t = \eta_0 + \eta_1 k_{j-1} + \ldots + \eta_d k_{j-d} + \omega_0 p_y + \omega_1 p_{y-1} + \omega_2 p_{y-2} + \omega_z p_{y-z} + \lambda_t \quad (4)$$

The equation above is termed "autoregressive" due to the fact that, part of the explanation of k_t is made possible reason being that we have its own lagged values also in the equation. The "distributed lag" part of the equation is due to the presence of the consecutive lags of the regressor p_y.

Analyzing time series data that are non-stationary have been made a lot easier since the advent of the ARDL model. Before we proceed to ARDL model in details, we have to be kept abreast of the following salient facts namely;

- Having a series where all the variables are integrated of the same order say zero; that is I(0) meaning they are stationary, then the data in their levels can be modelled by applying OLS - ordinary least squares.

- When all variables do not cointegrate but their order of integration is I(1); then it will be plausible to apply differentiation and thereafter carryout our estimation by OLS.
- When there is cointegration amongst variables and they also have the same order of integration; then we can do the following viz;
  - ⇒ We can carry out our analysis on variables at levels using OLS. By so doing, we will get the long-term relationship amongst the variables.
  - ⇒ The short-term relationship amongst the variables can be estimated using the ECM - error correction model.

However, for the ARDL bounds testing technique of Pesaran *et al* (2001); Pesaran, Shin and Smith (1999), many researchers are of the opinion that they are advantageous over the regular cointegration techniques. The major characteristics of the ARDL technique include the following;

- There is this relationship of cointegration which is established by employing the ordinary least squares (OLS) and the estimation process, is accomplished after obtaining the lag order that is suitable for our equation.

- This method produces coefficients, which are statistically significant without taking into consideration whether variables are integrated of the same order or not. But there should be no I(2) variables.
- The empirical analysis using this technique is reliable for a small data size (R. A. Begum *et al*, 2015, Haug, 2002).

4.4 Data

⇒ The number of observations is 45. Annual data from 1971 to 2015 was used for this analysis

⇒ The real oil trade balance, total trade balance and real non-oil trade balance figures (in Billion Naira) were obtained from CBN – Central Bank of Nigeria statistical bulletins

⇒ Exchange rate data set (in US Dollars) is from the US EIA.

⇒ Brent Crude real oil prices (in US Dollars) for the period under investigation were taken from BP statistics.

4.5 Empirical Model

The model used for the empirical analysis in this study is specified below;

$$ln\pi_t = \beta_{0t} + \beta_{1t}\, lnOP_t + \beta_{2t}\, lnER_t + \varepsilon_t \quad (5)$$

Where π_t stands for either the oil trade balance, total trade balance and/or non-oil trade balance at the time t, OP_t is real oil prices at time t, ER_t is the exchange rate at time t, and ε_t is the error term assumed serially uncorrelated.

From various literatures such as Umekwe and Baek (2017), Verheyen (2013), Delatte and Lopez-Villavicencio (2012), Bahmani-Oskooee and Fariditavana (2014), and Bahmani-Oskooee and Bahmani (2015); we divided the fluctuations of $lnOP$ into its depreciation (negative) and appreciation (positive) cumulative partial sum as;

$$lnOP = lnOP_0 + lnOP_t^+ + lnOP_t^- \quad (6)$$

Where $LnOP_t^+$ and $LnOP_t^-$ stand for the cumulative partial summation process of positive and negative changes in *LnOP.* With these two new variables, Equation (5) then becomes;

$$ln\pi_t = \beta_{0t} + \beta_{1t}\, lnOP_t^+ + \beta_{2t}\, lnOP_t^- + \beta_{3t}\, lnER_t + \varepsilon_t \quad (7)$$

The estimation of equation (7) above only provides the long-run coefficients estimate since there are no lagged variables. In applying ARDL modelling approach; however, excluding the short-run dynamics from estimating the long-run coefficients is likely to result in some parameter instability. To avoid this problem therefore, short-run dynamic adjustment process is incorporated into estimating long-run coefficients by specifying equation (7) in an error-correction modelling (ECM) format as shown in equations (8), (9) & (10) below which represent the total trade balance (TTB), real oil trade balance (OB) and real non-oil trade balance (NOB) models respectively. These models below can also be referred to as ARDL approach to cointegration;

$$\Delta lnTTB_t = a_0 + \sum_{i=1}^{p} a_{1i}\, \Delta lnTTB_{t-i} + \sum_{i=0}^{p} a_{2i}\, \Delta lnOP_{t-i}^{+} + \sum_{i=0}^{p} a_{3i}\, \Delta lnOP_{t-i}^{-} + \sum_{i=0}^{p} a_{4i}\, \Delta lnER_{t-i} + \alpha_0 lnTTB_{t-1} + \alpha_1 lnOP_{t-1}^{+} + \alpha_2 lnOP_{t-1}^{-} + \alpha_3 lnER_{t-1} + \varepsilon_t \quad (8)$$

$$\Delta lnOB_t = b_0 + \sum_{j=1}^{p} b_{1j}\, \Delta lnOB_{t-j} + \sum_{j=0}^{p} b_{2j}\, \Delta lnOP_{t-j}^{+} + \sum_{j=0}^{p} b_{3j}\, \Delta lnOP_{t-j}^{-} + \sum_{j=0}^{p} b_{4j}\, \Delta lnER_{t-j} + \beta_0 lnOB_{t-1} + \beta_1 lnOP_{t-1}^{+} + \beta_2 lnOP_{t-1}^{-} + \beta_3 lnER_{t-1} + \mu_t \quad (9)$$

$$\Delta lnNOB_t = c_0 + \sum_{k=1}^{p} c_{1k}\, \Delta lnNOB_{t-k} + \sum_{k=0}^{p} c_{2k}\, \Delta lnOP_{t-k}^{+} + \sum_{k=0}^{p} c_{3k}\, \Delta lnOP_{t-k}^{-} + \sum_{k=0}^{p} c_{4k}\, \Delta lnER_{t-k} + \lambda_0 lnNOB_{t-1} + \lambda_1 lnOP_{t-1}^{+} + \lambda_2 lnOP_{t-1}^{-} + \lambda_3 lnER_{t-1} + \vartheta_t \quad (10)$$

Where Δ is the first difference operator; a_0, b_0, and c_0 respectively are the drift parameters (i.e. constants); p is the lag length; ε_t, μ_t and ϑ_t are the white noise which are random errors assumed to be serially uncorrelated. The various estimates of (α_0, α_1, α_2, α_3); (β_0, β_1, β_2, β_3) and (λ0, λ1, λ2 and λ3) represent the long-run (cointegration) relationship among variables in the different models (Kim & Baek, 2013)

After the establishment of a long run cointegration relationship among variables in the model and finding the long run coefficients; the short run behaviour of variables is analyzed from the short run models of total trade balance, oil trade balance and non-oil trade balance as specified below respectively;

$$\Delta lnTTB_t = a_0 + \sum_{i=1}^{p} a_{1i}\, \Delta lnTTB_{t-i} + \sum_{i=0}^{p} a_{2i}\, \Delta lnOP_{t-i}^{+} + \sum_{i=0}^{p} a_{3i}\, \Delta lnOP_{t-i}^{-} + \sum_{i=0}^{p} a_{4i}\, \Delta lnER_{t-i} + \eta ECT_{t-1} + \varphi_t \quad (11)$$

$$\Delta lnOB_t = b_0 + \sum_{j=1}^{p} b_{1j}\, \Delta lnOB_{t-j} + \sum_{j=0}^{p} b_{2j}\, \Delta lnOP_{t-j}^{+} + \sum_{j=0}^{p} b_{3j}\, \Delta lnOP_{t-j}^{-} + \sum_{j=0}^{p} b_{4j}\, \Delta lnER_{t-j} + \omega ECT_{t-1} + \sigma_t \qquad (12)$$

$$\Delta lnNOB_t = c_0 + \sum_{k=1}^{p} c_{1k}\, \Delta lnNOB_{t-k} + \sum_{k=0}^{p} c_{2k}\, \Delta lnOP_{t-k}^{+} + \sum_{k=0}^{p} c_{3k}\, \Delta lnOP_{t-k}^{-} + \sum_{k=0}^{p} c_{4k}\, \Delta lnER_{t-k} + \Psi ECT_{t-1} + \gamma_t \qquad (13)$$

Where ηECT_{t-1}, ωECT_{t-1}, and + ΨECT_{t-1} are the lagged error correction terms for the different models in which η, ω and Ψ absolute values represent the rate of adjustment of the dependent variables towards the long run equilibrium. It must be taken into cognizance that the ECT must have a coefficient that is negative and statistically significant (U Al-Mulali *et al*, 2015). These changes in the regressand (s) depends on the variations in other regressors and also the degree of disequilibrium in the cointegration relationship (Shahbaz *et al*, 2015). The negative coefficient of the ECT_{t-1} represents the deviation in the dependent variable from the short time span towards the long run equilibrium (Masih and Masih, 1997). Baek (2015) gave the opinion that the lagged error correction term (ECT_{t-1}) which has a negative coefficient and statistically significant could also be used as another way

of confirming the existence of a cointegration relationship between variables.

Chapter 5. Empirical Analysis, Results and Discussion

5.1 Unit Root Test

The augmented Dickey-Fuller test (ADF test) was employed in checking for unit root and the DFGLS test was used in determining the optimal lag length for each variable. The unit root test result is shown in table 5.1 below;

Table 5.1 Unit root tests (ADF tests) – Log of Annual data (1971-2015)
Source: Author

	Levels		First Difference		
Variables	t-statistic	p-value	t-statistic	p-value	Outcome
LTTB	-3.7020	0.0074***	-	-	Stationary(IO)
LER	-0.3390	0.9105	-5.3624	0.0001***	Stationary(I1)
LOB	-1.4571	0.5455	-9.3528	0.0000***	Stationary(I1)
LNOB	-2.7184	0.0790*	-	-	Stationary(IO)
LOP^{+}	-1.6255	0.4614	-6.1027	0.0000***	Stationary(I1)
LOP^{-}	-0.7162	0.9912	-5.8516	0.0000***	Stationary(I1)

***** & *** denote significance at 1% and 10% significance level respectively.

The purpose for the conduct of unit root test in this study was to ensure that;

I. None of the variables in this analysis exceeded the order of integration I(1) which is the requirement for the ARDL model. That is to ensure none of the variable is I(2)

II. To justify the usage of ARDL technique amongst other numerous techniques out there.

NOTE

In this study, the symbol $\boldsymbol{LOP^{+}}$ is also written as ***LPS*** (natural log of positive oil price shock) as you can see in the appendix; for easy input into the software. Also, $\boldsymbol{LOP^{-}}$ is written as ***LNS*** (natural log of negative oil price shock).

5.2 Cointegration Test

Table 5.2 Results of the bounds test (F-test or Wald test) of equations 8, 9 & 10

Source: Author

Dependent variable	AIC lag	F-statistic	Outcome
F_{LTTB}(LTTB|LOP^{+}, LOP^{-}, LER)	1	7.689***	Cointegration
F_{LOB}(LOB|LOP^{+}, LOP^{-}, LER)	1	9.183***	Cointegration
F_{LNOB}(LNOB|LOP^{+}, LOP^{-}, LER)	1	2.992	No Cointegration
Critical value, Pesaran *et al* (2001)	I(O)	I(1)	
1% Significance level	4.30	5.23	
5% Significance level	3.38	4.23	
10% Significance level	2.97	3.74	

*** denotes significance at 1% significance level.

From the work of Pesaran *et al,* 2001, it has been stated clearly that if the value of the F-statistic obtained after analyzing our data is higher than the upper critical bound value then we can conclude that cointegration exists amongst the variables. If on the other hand, the F-statistic value is smaller than the lower critical bound, then its means the variables do not cointegrate. Conversely, if this F-statistic value lies in-between the lower and upper critical values, then our analysis will be considered inconclusive.

5.3 Model Estimation

Table 5.3 in section 5.4 of this study gives a comprehensive detail of the results obtained from empirical analysis of the three models. The dependent variables used in the models include oil trade balance, non-oil trade balance and total trade balance. The independent variables for the models include; positive oil price shock (PS), negative oil price shock (NS), and exchange rate (ER).

The estimation process starts by applying OLS to equations (8), (9) and (10) so that the Wald test or F-test can determine the joint significance of coefficients of the lagged variables. The reason for this is to check the possibility of a long run relationship (cointegration) between

the different variables. From the foregoing, the null hypothesis looking at equation 9 (which is also applicable to equations 8 and 10);

$\boldsymbol{H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = 0}$ suggests that cointegration does not exist amongst the variables used in the analysis against the alternate hypothesis;

$\boldsymbol{H_1: \beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq 0}$, which suggests that cointegration do exist amongst the variables.

The F-statistic obtained from the process above is compared with the upper critical bound value and the lower critical value of the critical bounds (Pesaran *et al,* 2001).

After estimation, the coefficients estimate of the analyzed variables are economically equal to the elasticities (Dogan & Turkekul, 2016). Elasticities are shown in the next section of this study.

5.4 Results and Discussion

Table 5.3 Complete Information on the Estimation of ARDL Eqs 8, 9 & 10

Source: Author

	Dependent Variables		
	$(lnTTB_t)$	$(lnOB_t)$	$(lnNOB_T)$
(Panel A)			
Short-Run Coefficients			
$\Delta lnOP^+{}_t$	0.6317(4.8996)***	0.6742(2.3036)**	-0.1019 (-0.4671)
$\Delta lnOP^-{}_t$			
$\Delta lnER_t$			
(Panel B)			
Long-Run Coefficients			
$lnOP^+{}_t$	-0.5455(-1.6670)	0.0111 (0.0267)	-2.5059(-1.6316)
$lnOP^-{}_t$	1.2103(2.2433)**	1.9956(2.7240)***	1.5598(0.6960)
$lnER_t$	0.2098(1.4162)	-0.0786(-0.3666)	-0.9243(-1.4847)
Constant	0.2384(1.8930)*	2.6427(5.2769)***	-0.5719(-1.7201)*
Trend	0.0711(1.9662)*	0.0920(1.0968)	0.1451 (2.3324)**
(Panel C)			
Diagnostic Statistics			
F-statistics	7.689	9.183	2.992
ec_{t-1}	-0.5230 (-6.5272)***	-0.8569 (-7.1330)***	-0.2335 (-4.0716)***
LM	0.1405	0.6883	0.4390
Heteroskedasticity	0.2592	0.1909	0.6279
CUSUM (CUSUMSQ)	Stable (Stable)	Stable (Stable)	Stable (Stable)

Note: Figures in the parentheses are t-statistics. The upper critical bound value of the F-statistic at 5% significance level is 4.23. This was obtained from Pesaran *et al* (2001); Table CI (IV) case IV. LM is the Lagrange multiplier test of serial correlation. ec_{t-1} is an error correction term. ***, ** and * denote significance at 1%, 5% and 10% significance levels respectively.

For the Total trade balance model (TTB); examining the short run coefficients, positive oil price shock was found to be positive and statistically significant. What this means is that, an increase in oil price

in the short run will lead to an increase in Nigeria's total trade balance. This effect can be attributable to revenue effect as a result of increases in proceeds from oil export. Negative oil price shock was not reported by the software in the short run; meaning it is not statistically significant. From the long run coefficients, the coefficient on positive oil shock became negative and insignificant. Negative oil shock coefficient was positive and statistically significant meaning an increase in negative oil shocks will impact positively on Nigeria's total trade balance. That is to say, that negative oil price shocks is beneficial to Nigeria's total trade balance in the long run. The reason for this is due to the demand effect (quantity effect) from oil importing countries. There is increase in the demand of crude oil from oil exporting countries. The negative revenue effect occasioned by decreases in oil prices seems to be overshadowed by increasing demand from oil importing countries

For Oil trade balance model (OB), positive oil shock variable was also found to be significant in the short run. However, this positive relationship did not also translate to the long run. In the long run, the coefficient measuring the negative oil shock was statistically significant which signifies that negative oil shock will exert positive influence on Nigeria's oil trade balance. This result for both total trade balance and

oil trade balances have semblance with that obtained by Saeed Moshiri (2015) and Rafiq, Sgro and Apergis, (2016). For the Non-oil trade balance model, none of the variables were found to be statistically significant both in the short term and in the long term. The F statistics reported in table 5.3 above, help in establishing the cointegration between variables in the different models. Given the 5% upper critical bound value of 4.23; shows that cointegration exist amongst variables in the total trade balance and oil trade balance models. But there was no cointegration in the non-oil trade balance model. In addition, this study estimated the error correction model, which helps in investigating the speed of adjustment of variables towards the long run values.

This study also incorporated the test for stability of the coefficients in the models by using the CUSUM - cumulative sum of recursive residuals and CUSUMSQ - cumulative sum of squares of recursive residuals. This is because the existence of a cointegration does not necessarily implies that the estimated coefficients are stable (Tayebi & Yazdani, 2014). The variables in the three models were found to be stable. The Lagrange multiplier (LM) test for serial correlation was conducted and the values obtained from the three models suggest that there are no serial correlation problem.

The contribution of this paper, which is an effort to model the impact of asymmetric oil price shocks on Nigeria's external balances, had been achieved. Nigeria's total trade balance and oil trade balance are more responsive to negative oil price shocks. Another contribution of this study is the extensive qualitative analysis on political instability in the Niger Delta oil-producing region of Nigeria.

5.5 Elasticity

Table 5.4 Summary of functional forms involving Log

Source: Jeffrey M. Wooldridge, 2016. Introductory Econometrics, A Modern Approach. Sixth Edition.

Model	Dependent variable	Independent Variable	Interpretation of Coefficient (β)
level – level	y	x	$\Delta y = \beta \Delta x$
level – log	y	log (x)	$\Delta y = (\beta/100)\%\Delta x$
log – level	log (y)	x	$\%\Delta y = (100\beta)\Delta x$
log - log	log (y)	log (x)	$\%\Delta y = \beta\,\%\Delta x$

I. From the results obtained from analysis, the estimated elasticity of total trade balance (TTB) with respect to negative oil shocks (OP_t^-) shows that a 1% point increase in negative prices of oil will lead to about 1.210% increase in Nigeria's total trade balance

in the long run. Also, a 1% point increase in positive prices of oil (OP_t^+) will lead to about 0.632% increase in Nigeria's total trade balance in the short run.

II. The estimated elasticity of real oil trade balance (OB) with respect to negative variations in the price of oil (OP_t^-) shows that 1% point increase in negative prices of oil increases Nigeria's oil trade balance by about 1.996% in the long run. Conversely, a 1% point increase in positive prices of oil (OP_t^+) will lead to about 0.674% increase in Nigeria's real oil trade balance in the short run.

Chapter 6. Conclusion and Policy Implication

6.1 Conclusion

In conclusion, an asymmetric effect of the variations in the prices of Crude oil on Nigeria's external balances had been established. Nigeria's total trade balance and oil trade balance were more impacted upon positively by virtue of the reductions in the price of crude oil in the long-run. The negative revenue effects due to reduction in oil prices are seen to be overshadowed by the growth in oil exports, which was occasioned by increases in crude oil demand from oil importing countries. Nigeria total balance of trade and real oil trade balance benefit from positive oil shock in the short run. This was expected because of revenue effect, which arises from increased proceeds from oil export. However, this positive impact did not translate into the long run. Political instability in the oil-producing region of Nigeria is also affecting the prospecting for oil and exploitation activities in the southern region of Nigeria as seen from qualitative analysis. The southern region of Nigeria is otherwise known as the Niger delta region

Crude oil is one of the principal sources of income for Nigeria. The Nigerian balance of trade depends mainly on the foreign exchange

earnings accruing from crude oil export. The Nigerian oil sector has undergone huge expansion over the years. Understanding the dynamics of the growth in balance of trade in relation to crude oil production and export is important. Nigeria is rated amongst the top twelve oil producers in the entire globe. Movements in crude-oil prices is expected to affect Nigeria's US Dollar reserves and in return affects the purchasing power of her local currency relative to the US dollars. Since crude oil is responsible for over 90 percent of Nigeria's entire revenue, oil price variations in relation to the quantity of crude oil produced and exported will definitely have serious implications on Nigeria's macro economy.

6.2 Policy Implication

Policy actions should be taken by the Nigerian government to encourage investors to develop more oil fields in order to maximize production, which can help grow the oil trade balance and total trade balance in times of oil boom since we saw from empirical analysis that Nigeria's total balance and real oil trade balance are both responsive to positive oil price movements in the short run. On the contrary, during the period of bust in oil prices; in order for the economy not be trapped in the problem of revenue shortages in terms of foreign exchange earnings

which is evident during periods of low oil prices (and can linger for a very long time), resource rich nations like Nigeria should have policies in place that will make it expedient for any Government in power to pursue the diversification of the economy by investing in and developing the real sectors of our economy which include agriculture, manufacturing, services, infrastructural development etc. which can help cushion the effect of low foreign exchange earnings from oil export in times of low oil prices.

For it to be possible for the government to diversify the economy, It will be plausible and wise for saving funds to be created (like the Sovereign wealth fund, natural resources fund and the stabilization fund) which should be used for immediate investment in the real sector with a view to minimizing the negative economic effects of bust in oil prices**.** The Nigerian government should endeavour to address the problem of violent communal crises and agitations by indigent communities of the oil producing Niger Delta region. Those responsible for Policymaking must *utilize Institutional procedures* in managing the booms and busts in the price of oil by the reduction of *expenditure* and engagement in *self-insurance*. For sustainable growth to be feasible in the future there should be policy measures in place that will enable the substantial enlargement

and diversification of our economic base. Furthermore, the government should endeavour to protect the economy from the uncertainties associated with revenues accruing from oil export, which is aimed at de-linking current revenue from fiscal expenditure.

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Appendix

Results from Empirical Analysis

1. Results of DFGLS test used in defining the number of lags for unit root test

```
. dfgls lob, ers

DF-GLS for  lob                                          Number of obs =     35
Maxlag =  9 chosen by Schwert criterion

               DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic        Value             Value             Value
---------------------------------------------------------------------------
    9            -2.329           -3.770            -3.190            -2.890
    8            -2.090           -3.770            -3.190            -2.890
    7            -1.912           -3.770            -3.190            -2.890
    6            -1.757           -3.770            -3.190            -2.890
    5            -1.850           -3.770            -3.190            -2.890
    4            -1.822           -3.770            -3.190            -2.890
    3            -1.929           -3.770            -3.190            -2.890
    2            -2.552           -3.770            -3.190            -2.890
    1            -2.843           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) =    3 with RMSE   .5644854
Min SC   =  -.8422853 at lag   1 with RMSE   .5929033
Min MAIC =  -.5341538 at lag   3 with RMSE   .5644854
```

```
. dfgls lttb, ers

DF-GLS for  lttb                                         Number of obs =     35
Maxlag =  9 chosen by Schwert criterion

               DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic        Value             Value             Value
---------------------------------------------------------------------------
    9            -2.061           -3.770            -3.190            -2.890
    8            -2.666           -3.770            -3.190            -2.890
    7            -2.560           -3.770            -3.190            -2.890
    6            -2.306           -3.770            -3.190            -2.890
    5            -1.876           -3.770            -3.190            -2.890
    4            -1.794           -3.770            -3.190            -2.890
    3            -1.920           -3.770            -3.190            -2.890
    2            -1.987           -3.770            -3.190            -2.890
    1            -3.484           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) =    2 with RMSE   .2359472
Min SC   =   -2.58355 at lag   2 with RMSE   .2359472
Min MAIC =  -2.328696 at lag   2 with RMSE   .2359472
```

```
. dfgls ler, ers

DF-GLS for ler                                          Number of obs =    35
Maxlag = 9 chosen by Schwert criterion

                 DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]       Test Statistic       Value             Value             Value
---------------------------------------------------------------------------------
    9             -1.636           -3.770            -3.190            -2.890
    8             -1.923           -3.770            -3.190            -2.890
    7             -2.153           -3.770            -3.190            -2.890
    6             -1.989           -3.770            -3.190            -2.890
    5             -1.830           -3.770            -3.190            -2.890
    4             -1.796           -3.770            -3.190            -2.890
    3             -1.875           -3.770            -3.190            -2.890
    2             -1.823           -3.770            -3.190            -2.890
    1             -1.773           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -2.328333 at lag  1 with RMSE  .2820282
Min MAIC = -2.269423 at lag  1 with RMSE  .2820282
```

```
. dfgls lnob, ers

DF-GLS for lnob                                         Number of obs =    35
Maxlag =  9 chosen by Schwert criterion

                 DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]       Test Statistic       Value             Value             Value
---------------------------------------------------------------------------------
    9             -1.556           -3.770            -3.190            -2.890
    8             -1.259           -3.770            -3.190            -2.890
    7             -1.582           -3.770            -3.190            -2.890
    6             -1.717           -3.770            -3.190            -2.890
    5             -1.461           -3.770            -3.190            -2.890
    4             -1.696           -3.770            -3.190            -2.890
    3             -1.773           -3.770            -3.190            -2.890
    2             -2.498           -3.770            -3.190            -2.890
    1             -1.830           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) =    2 with RMSE   .3795467
Min SC   =  -1.632811 at lag  2 with RMSE   .3795467
Min MAIC =   -1.53022 at lag  3 with RMSE   .3680197
```

```
. dfgls lps, ers

DF-GLS for lps                                          Number of obs =     35
Maxlag =  9 chosen by Schwert criterion

              DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic       Value             Value             Value
---------------------------------------------------------------------------
    9            -2.158           -3.770            -3.190            -2.890
    8            -2.505           -3.770            -3.190            -2.890
    7            -2.482           -3.770            -3.190            -2.890
    6            -2.542           -3.770            -3.190            -2.890
    5            -2.583           -3.770            -3.190            -2.890
    4            -2.529           -3.770            -3.190            -2.890
    3            -2.639           -3.770            -3.190            -2.890
    2            -2.570           -3.770            -3.190            -2.890
    1            -2.962           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) = 0   [use maxlag(0)]
Min SC   =  -3.972326 at lag  1 with RMSE   .1239664
Min MAIC =  -3.512225 at lag  2 with RMSE    .123131


. dfgls lns, ers

DF-GLS for lns                                          Number of obs =     35
Maxlag =  9 chosen by Schwert criterion

              DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic       Value             Value             Value
---------------------------------------------------------------------------
    9            -1.878           -3.770            -3.190            -2.890
    8            -2.289           -3.770            -3.190            -2.890
    7            -2.372           -3.770            -3.190            -2.890
    6            -2.354           -3.770            -3.190            -2.890
    5            -1.947           -3.770            -3.190            -2.890
    4            -1.930           -3.770            -3.190            -2.890
    3            -2.150           -3.770            -3.190            -2.890
    2            -2.239           -3.770            -3.190            -2.890
    1            -2.330           -3.770            -3.190            -2.890

Opt Lag (Ng-Perron seq t) = 0   [use maxlag(0)]
Min SC   =  -3.475844 at lag  1 with RMSE   .1588964
Min MAIC =   -3.24102 at lag  1 with RMSE   .1588964
```

2. ADF unit root test results

Summary Table of unit root tests (ADF tests). Log of Annual Data (1971-2015)

Source: Author

	Levels		First Difference		
Variables	**t-statistic**	**p-value**	**t-statistic**	**p-value**	**Outcome**
LTTB	**-3.7020**	**0.0074*** **	**-**	**-**	**Stationary(IO)**
LER	**-0.3390**	**0.9105**	**-5.3624**	**0.0001*** **	**Stationary(I1)**
LOB	**-1.4571**	**0.5455**	**-9.3528**	**0.0000*** **	**Stationary(I1)**
LNOB	**-2.7184**	**0.0790***	**-**	**-**	**Stationary(IO)**
LPS	**-1.6255**	**0.4614**	**-6.1027**	**0.0000*** **	**Stationary(I1)**
LNS	**-0.7162**	**0.9912**	**-5.8516**	**0.0000*** **	**Stationary(I1)**

***** & *** denote significance at 1% and 10% significance level respectively.

3. Lag length selection criteria for cointegration

MODEL 1 (LTTB as the Dependent Variable)

VAR Lag Order Selection Criteria
Endogenous variables: LTTB LPS LNS LER
Exogenous variables: C
Sample: 1971 2015
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-120.6066	NA	0.005128	6.078370	6.245547	6.139247
1	54.56732	307.6225*	2.19e-06*	-1.686211*	-0.850322*	-1.381826*
2	64.04788	14.79892	3.08e-06	-1.368189	0.136411	-0.820297
3	71.95978	10.80651	4.86e-06	-0.973648	1.199663	-0.182248
4	85.81722	16.22334	6.09e-06	-0.869133	1.972889	0.165775

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

MODEL 2 (LOB as the Dependent Variable)

VAR Lag Order Selection Criteria
Endogenous variables: LOB LPS LNS LER
Exogenous variables: C
Sample: 1971 2015
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-143.0870	NA	0.015352	7.174976	7.342154	7.235853
1	24.75857	294.7532*	9.36e-06*	-0.232126*	0.603763*	0.072259*
2	31.34978	10.28872	1.52e-05	0.226840	1.731440	0.774732
3	35.70344	5.946463	2.85e-05	0.794954	2.968265	1.586354
4	45.85261	11.88194	4.28e-05	1.080361	3.922383	2.115268

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

MODEL 3 (LNOB as the Dependent Variable)

VAR Lag Order Selection Criteria
Endogenous variables: LNOB LPS LNS LER
Exogenous variables: C
Sample: 1971 2015
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-147.5415	NA	0.019078	7.392266	7.559444	7.453143
1	32.75007	316.6095*	6.34e-06*	-0.621955*	0.213934*	-0.317570*
2	41.07890	13.00110	9.44e-06	-0.247751	1.256849	0.300141
3	48.58112	10.24694	1.52e-05	0.166774	2.340085	0.958174
4	62.34503	16.11385	1.92e-05	0.275852	3.117874	1.310760

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4. Summary table of bounds test (F-test or Wald test) of models 8, 9 & 10 respectively – Cointegration Test

Source: Author

Dependent variable	AIC lag	F-statistic	Outcome
F_{LTTB}(LTTB|LPS, LNS, LER)	1	7.689***	Cointegration
F_{LOB}(LOB|LPS, LNS, LER)	1	9.183***	Cointegration
F_{LNOB}(LNOB|LPS, LNS, LER)	1	2.992	No Cointegration
Critical value, Pesaran *et al* (2001)	I(O)	I(1)	
1% Significance level	4.30	5.23	
5% Significance level	3.38	4.23	
10% Significance level	2.97	3.74	

*** denote significance at 1% significance level.

5. Complete Information on the Estimation of ARDL Eqs 8, 9 &10.That is TTB, OB & NOB models respectively

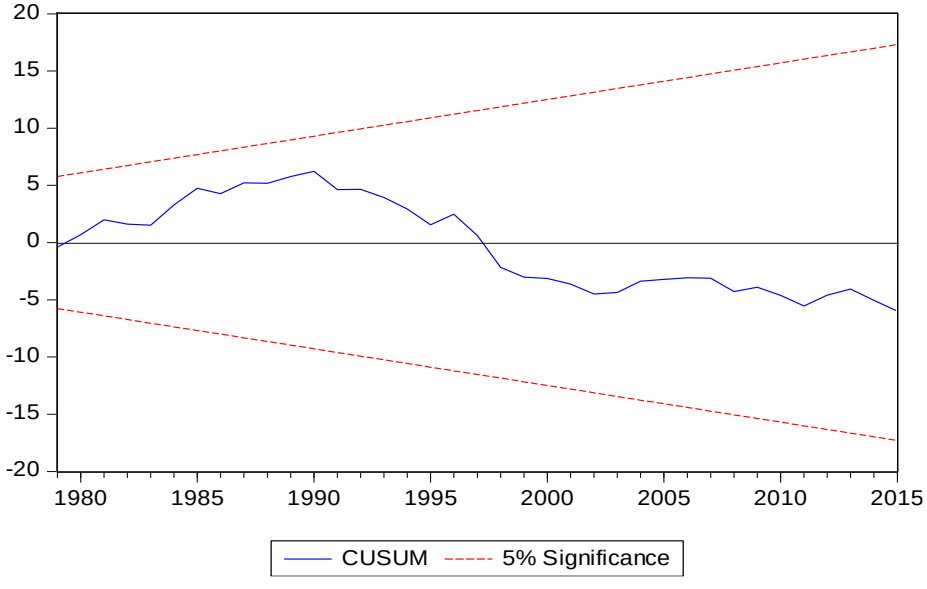
Source: Author

	Dependent Variables		
	$(lnTTB_t)$	$(lnOB_t)$	$(lnNOB_T)$
(PANEL A) **Short-Run Coefficients**			
$\Delta lnOP_t^+$	0.6317(4.8996)***	0.6742(2.3036)**	-0.1019 (-0.4671)
$\Delta lnOP_t^-$			
$\Delta lnER_t$			
(PANEL B) **Long-Run Coefficients**			
$lnOP_t^+$	-0.5455(-1.6670)	0.0111(0.0267)	-2.5059(-1.6316)
$lnOP_t^-$	1.2103(2.2433)**	1.9956(2.7240)***	1.5598(0.6960)
$lnER_t$	0.2098(1.0606)	-0.0786(-0.3666)	-0.9243(-1.4847)
Constant	0.2384(1.8930)*	2.6427(5.2769)***	-0.5719(1.7201)*
Trend	0.0711(1.6916)*	0.0920(1.0968)	0.1451(2.3324)**
(PANEL C) **Diagnostic Statistics**			
F-statistics	7.689	9.183	2.992
ec_{t-1}	-0.5230 (-6.5272)***	-0.8569 (-7.1330)***	-0.2335 (-4.0716)***
LM	0.1405	0.6883	0.4390
Heteroskedasticity	0.2592	0.1909	0.6279
CUSUM (CUSUMSQ)	Stable (Stable)	Stable (Stable)	Stable (Stable)

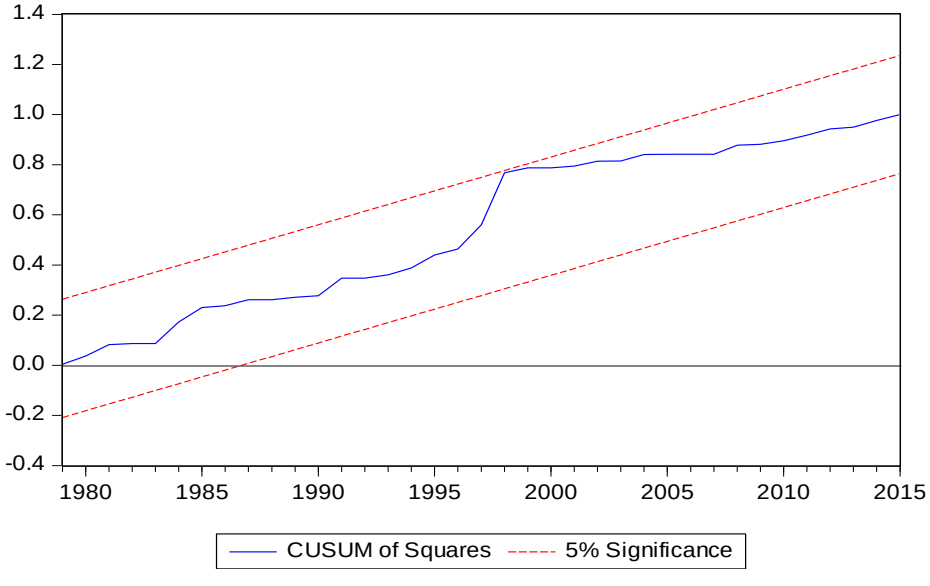
Note: Figures in the parentheses are t-statistics. The upper critical bound value of the F-statistic at 5% significance level is 4.23. This was obtained from Pesaran *et al* (2001); Table CI (IV) case IV. LM is the Lagrange multiplier test of serial correlation. ec_{t-1} is an error correction term. ***, ** and * denote significance at 1%, 5% and 10% significance levels respectively.

6 STABILITY TEST RESULTS

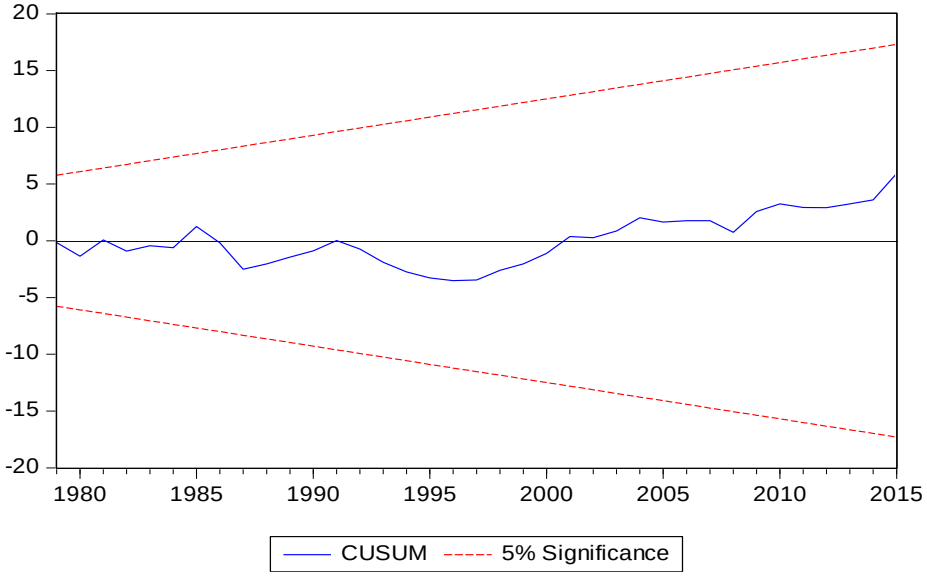
6.1 CUSUM test for LTTB Model



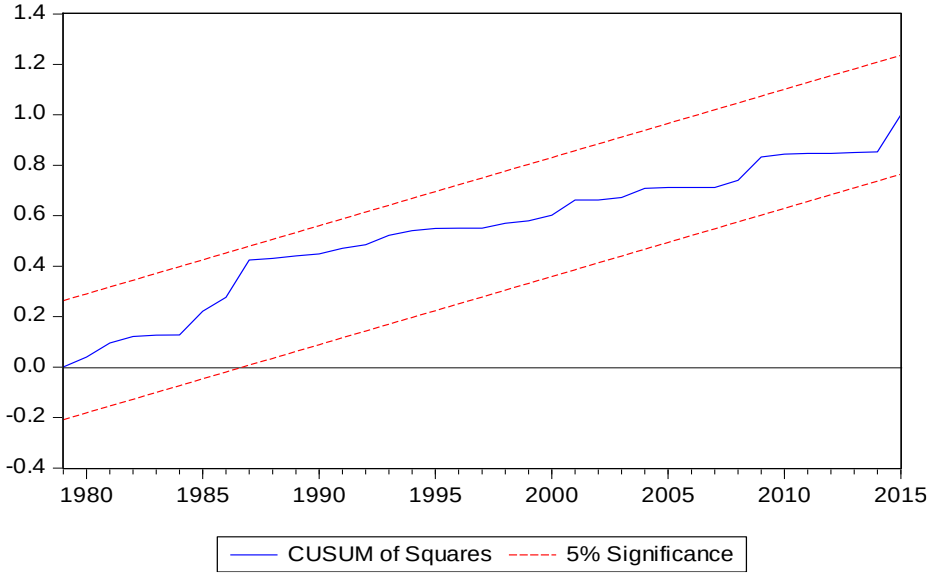
6.2 CUSUMSQ test for LTTB Model



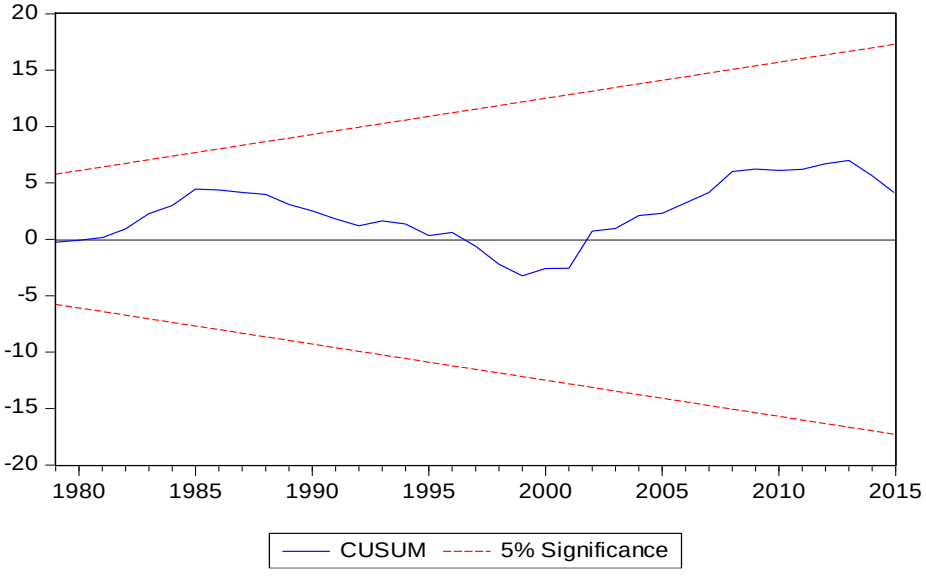
6.3 CUSUM test for LOB Model



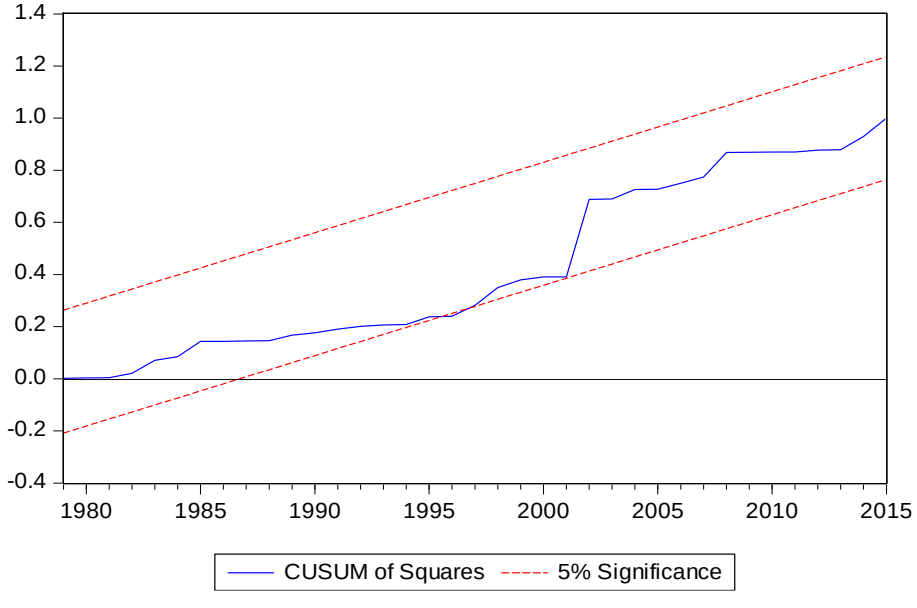
6.4 CUSUMSQ test for LOB Model



6.5 CUSUM test for LNOB Model



6.6 CUSUMSQ test for LNOB Model



국문초록

원유수급은 세계경제에서 가장 중요한 거시 경제 지표 중 하나이며 원유 시장은 세계에서 가장 큰 원자재 시장이다. 현재 나이지리아의 경제는 원유 생산량에 의존하고 있으며 특히 원유 수출을 통한 외화 획득에 크게 영향을 받고 있다. 본 논문은 비대칭적인 유가 충격과 환율의 나이지리아국제(무역)수지에 대한 영향을 분석하기 위한 실증 연구이다. 무역 수지, 석유 생산 및 수출, 유가 증권의 가격, 환율 변동에 대한 정보는 정부와 정책 입안자들의 의사 결정에 중요한 변수가 된다. 본 논문에서는 유가 충격, 환율, 총 무역 수지 및 석유와 비석유의 실물 무역수지를 활용하였으며, 모델 내 변수 간의 단기 및 장기 관계를 확인하기 위해 자기회귀시차분포(ARDL)분석법이 채택되었다. 실증분석에서 얻어진 결과는 양(+)의 고유가가 나이지리아의 총 무역수지와 단기 무역수지에긍정적으로 작용했다는 것을 보여 준다. 반면, 장기적 관계에서는 동일한 효과가 발견되지 않았으며, 이는 석유 수출의 수익 증가가 기여한 것으로 해석할 수 있다. 음(-)의 고유가는 나이지리아의 총 무역 수지와석유 무역 수지에긍정적으로 작용한

것으로 밝혀졌으며, 원유수입 국가의 수요 효과(수량 효과)에 의한 것으로 해석할 수 있다. 따라서, 양(+)의 유가 인상의 긍정적인 영향이 장기적인 무역수지흑자로 직결되지는 않는다는 점을 감안할 때 나이지리아의 국가 발전 전략은 예상되는 유가 상승에 전적으로 의존하는 것을 지양해야 할 것이다.

주요어: 비대칭 유가 충격 , ARDL, 외부 균형, 장기간의 관계.

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