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Impact of crude oil trade on Nigeria's economy: a time series approach

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WORLD MARITIME UNIVERSITY

IMPACT OF CRUDE OIL TRADE ON NIGERIA'S ECONOMY

A TIME SERIES APPROACH

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A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of Master of Science in Maritime Affairs

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

(Signature): 

Date 26th September 2023

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Abstract

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Nigeria stands as a predominant oil-exporting nation, with approximately 90% of its foreign earnings and 6.33% of its Gross Domestic Product (GDP) either directly or indirectly reliant upon the crude oil trade. Notwithstanding this pronounced reliance on crude oil, there exists a paucity of empirical research probing the influence of crude oil trade on the nation's economic landscape. The present study endeavors to elucidate the implication of various crude oil trade determinants on Nigeria's GDP per capita, employing an Ordinary Least Square (OLS) regression model for the purpose.

Pertinent findings underscored the Brent crude oil price, the Very Large Crude Carrier (VLCC) freight rate, and India's value of crude oil imports as salient influencers on Nigeria's GDP per capita. These determinants are significant and positively related to Nigeria's GDP, with coefficients of 28.6%, 13.7%, and 6.2%, respectively. Intriguingly, the Brent crude oil price emerged as the solitary determinant maintaining a long-term association with Nigeria's GDP per capita, evidenced by an error correction term coefficient of -0.234.

In light of these findings, the study advocates for heightened interventions by governmental entities and policymakers to institute rigorous monitoring mechanisms. This would entail crafting legislative frameworks conducive to an efficacious oversight of oil price dynamics, thereby enabling astute governance of oil production, particularly during epochs characterized by low crude oil prices. Also, the imperative nature of forging a symbiotic bilateral agreement between Nigeria and its crude oil trade allies, especially India, cannot be overstated. Such strategic engagements would be instrumental in buttressing demand stability and assuring a perennial and reliable revenue stream.

Furthermore, Nigeria should diversify its economy by focusing on non-oil exports. This strategy recalibration aims to reduce economic vulnerabilities from overreliance on crude oil as the main foreign revenue route while fostering a strong and sustainable economy. Further study can look into the implication of Nigerian reliance on oil revenue and for the need for economic diversification.

KEYWORDS: Crude oil, Trade, GDP per capita, Nigeria's economy

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List of Abbreviations

AIC	-Akaike Information Criterion
ARCH	-AutoRegressive Conditional Heteroskedasticity
ARDL	-AutoRegression Distributed Lag
BIC	-Bayesian Information Criterion
BLUE	-Best Linear Unbiased Estimator
CAIC	-Corrected Akaike's Information Criterion
CLRM	-Classical Linear Regression Model
EIA	-Energy Information Administration
GDP	-Gross Domestic Product
ICE	-International Commodities Exchange
ITA	-International Trade Administration
NYME	-New York Mercantile Exchange
OECD	-Organisation for Economic Co-operation and Development
OLS	-Ordinary Least Squares
OPEC	-Organization of the Petroleum Exporting Countries
RMSE	-Root Mean Squared Error
SE	-Serial Correlation
UAE	-United Arab Emirates
UK	-United Kingdom
ULCC	-Ultra Large Crude Carriers
USA	-United States of America
VAR	-Vector AutoRegression
VLCC	-Very Large Crude Carriers
WTO	- World Trade Organization

Chapter 1 – Introduction

Crude oil is an abundant natural resource that is extracted for commercial purposes by a limited number of countries, and the global economy is highly dependent on it as a source of energy since its discovery in the 19th century (Jahangir Amuzegar, 1983; Griffiths et al., 2022). It is widely recognized as a crucial commodity in all areas of production and services, exerting a substantial influence on the industrial and transportation sectors (Shwe Sin Htay & Jatta, 2021). According to the Corporate Financial Institution (2019), crude oil holds significant importance as a source of fuel and it traditionally accounts for more than one-third of the world's energy consumption. It is an important energy source that plays a crucial role in enabling growth in society and supporting daily operations through the utilisation of its various derivatives. These derivatives serve diverse purposes in our lives, including the fuel that propels our vehicles and the plastics that impact our global environment. It is one of the most important energy sources for both exporting and importing nations (Ukemenam et al., 2018). It is also a significant source of foreign exchange revenues and, more crucially, the main source of income for the governments of the oil-exporting countries and also a crucial chemical as raw material with several uses for oil-importing countries. Despite the ongoing debate regarding the significance of alternative renewable energy sources such as water, solar, and nuclear power, it is evident that oil continues to play a significant role in the energy consumption of many countries around the globe, and its significance in bolstering a nation's economy cannot be overstated (Abdelsalam 2020).

1.1 Background of the Study

Nigeria serves as a prominent illustration of a significant economy that is dependent on crude oil. This is attributed to the country’s relies on oil revenues to finance capital public projects and cover significant overhead expenses. The predominant dependence on oil is also evident in the significant contribution of the oil sector to Nigeria's Gross Domestic Product (GDP). Nigeria is one of the major oil-producing and oil-exporting

countries in Africa (Kamer, 2023), and it is widely recognized as a significant global contributor to the production of oil and a big competitor in the global oil market. These activities of exploring, producing, and exporting crude oil have had a pivotal impact on the economy of Nigeria, which has a substantial effect on several sectors and aspects of the nation's overall development.

The primary markets for Nigerian crude oil are Europe and Asia, and in terms of value, Nigeria stands as the world's 9th biggest exporter of crude oil in 2021 (Statista, 2022). During the second quarter of 2021, crude oil exports to Europe and Asia in value are approximately ₦1.48 trillion and ₦1.46 trillion respectively. This translates to roughly 90% of the country's exporting earnings coming from crude oil (Statista, 2022). According to Kamer (2023), research published by Statista revealed that the country exported around 1.6 million barrels of oil per day to the global market in the year 2021. Odularu (2008) revealed that in 2000, oil and gas export revenues made up over 98% of total export earnings. The export income of Nigeria saw a notable surge as a result of the sharp rise in oil prices in the early 1970s, which coincided with the onset of the oil boom in the country (Odularu, 2008). The economic well-being of the country is closely tied to its large crude oil reserves and crude oil exports, which provide a larger share of its foreign exchange earnings and government expenditures and it also strengthens its local currency. Thus, countries participate in crude oil trade, in order to secure a consistent and reliable source of oil for their respective industrial sectors and the public in general.

The discovery of crude oil established Nigeria as one of the world's oil-rich countries that were recorded between 1971 and 2005 (Sani & Nwoye, 2023). Its petroleum sector constitutes around 6.33% of Nigeria's Gross Domestic Product (GDP) and contributes over 90% of the total export value (Statista, 2022). That is, the sector contributes a significant role in generating foreign exchange earnings and overall revenue, which are crucial for the socio-economic and political development of Nigeria (Bediako E et al., 2018). According to Yusuf (2015), oil is a significant factor in the implementation of Nigeria's fiscal and monetary policy. It is pertinent to know that Nigeria generated

over US$390 billion in tax revenue from the oil industry, and in 2013 she had a Gross Domestic Product (GDP) of US $522.6 billion as Africa's largest economy (Sani & Nwoye, 2023). Hence, the adverse fluctuations in global crude oil trade would have significant repercussions on Nigeria's economy, leading to a downturn in several sectors such as production, manufacturing, and transportation.

The crude oil trade is significantly impacted by the acts of prominent oil-producing nations, with some of these nations being a member of the Organization of the Petroleum Exporting Countries (OPEC, 2019). The trading of crude oil is subject to a multitude of factors, including the interplay of supply and demand dynamics, as well as geopolitical events (Song et al., 2022). Therefore any change from these factors will have a positive or Negative impact on Nigeria's economy. However, it is crucial to analyze the impact of crude oil trade on the economy of Nigeria. This would provide policymakers and key players with a broader understanding of the positive and negative effects of crude oil trade on Nigeria's economy (GDP per capita), guiding them to make well-informed decisions in order to achieve economic stability and growth. Additionally, the research will elucidate the significance of expanding into non-oil sectors as a means to reduce susceptibility to disruptions originating from the crude oil trade. The process of diversification will furthermore contribute to the increase of foreign revenues and reserves, while concurrently bolstering the stability and value of the domestic currency.

1.2 Problem Statement

Nigeria's economy is heavily reliant on crude oil, resulting in a mono-product structure where the oil industry contributes over 6.33% to the country's Gross Domestic Product and over 90% to foreign earnings (Statista, 2023). Despite the huge benefit crude oil generates to Nigeria's economy, it is observed that Nigeria's crude oil export earnings are experiencing a decrease in its value.

Previous research by Jiménez-Rodríguez & Sánchez (2005), Odularu (2008), and Musa (2015) looked into crude oil price as one of the factors of oil trade that affect the

GDP of both oil-producing/oil-exporting and oil-importing countries. However, they did not consider other elements of crude oil trade and their impact on the economy. Thus, for a mono-economy country like Nigeria, a rise in oil prices leads to GDP growth. Conversely, a decline in oil prices will have an adverse effect on the GDP as a result of a fall in revenue earnings. This fall in crude oil earnings could have adverse effects on the government's revenue, budget and expenditures and the overall economic performance. It is for these reasons this study intends to determine other factors of crude oil trade that impacts Nigeria's economy. For instance, oil production was identified as another factor that affect crude oil trade. A 2020 report by Statista revealed that Nigeria's daily oil production exceeded a volume of 2 million barrels (Statista, 2023). Subsequently, there was a decline in production, resulting in a fall of 1.14 million barrels per day in January 2021. This lowest figure recorded in 2021 daily oil output in Nigeria affected the export earnings and Nigeria's GDP per capita.

There are limited literature that has reviewed crude oil trade factors besides oil price, that affects the Nigerian GDP. Therefore, this study will focus on the impacts of other factors of crude oil trade that may significantly affect Nigeria's economy measured by GDP per capita.

1.3 Purpose of Research

The aim of this study is to determine the impacts of crude oil trade on Nigeria's economy by identifying the factors of crude oil trade that affect Nigeria's economy and the extent to which they do so. The study will also seek to ascertain the nature and degree of relationship between these factors and Nigeria's GDP per capita.

1.4 Research Questions

In pursuit of the above objectives, the following research questions have been formulated thus:

1. What are the factors of crude oil trade that affect Nigeria's GDP?
2. What is the nature of relationship between the identified factors of crude oil trade and Nigeria's GDP?

1.5 Scope of Study

This study covers crude oil sector of Nigeria's economy. The analysis will incorporate historical data on some factors of crude oil trade that are assumed to have impact on Nigeria's economy. The data for this study was secondary data sourced from relevant government agencies and intergovernmental organizations with a timeframe covering 1995 to 2021.

1.6 Significance of Study

Firstly, the study will offer insight to policymarkers and key players in the oil sectors how various factors associated with crude oil trade can impact Nigeria's economy. The study will also elucidate the nature of the correlation between these factors and Nigeria's GDP per capita. Thus, the study will prompt policy formulations and implementation strategies that can mitigate the adverse impacts of global crude oil trade volatilities as well as to promote long-term economic growth.

Secondly, the study will reveal the vulnerability of Nigeria to crude oil export trade volatilities to enable it manage economic shocks and promote sustainable growth through strategic economic diversification instead of relying on crude oil as the only revenue stream.

Thirdly, the study will deepen the understanding of the policymakers and stakeholders regarding the interaction between the Nigerian economy and its major crude oil trade allies, facilitating the formulation of more effective bilateral and multilateral trade agrements.

Finally, the study will contribute to the existing academic literature in fields such as economics, energy studies, oil investment, and development studies who have limited knowledge in this field, to enable them to establish a well-defined pattern toward economic growth.

1.7 Structure of the Research

The study is structured into five distinct chapters and these are explained as follows.

Chapter 1 gives an overview of the importance of crude oil in the global economy, background of the study, the purpose of the study, and the possible research questions to examine the impact of crude oil trade on Nigeria's economy and also the contribution of the study.

Chapter 2 offers a brief history of crude oil in Nigeria, its oil production, transportation, oil pricing and economic implications. It will review exisitng research related to the topic. It also identifies the gaps in existing research and proposes to explore how factors of crude oil trade can affect Nigeria's GDP.

Chapter 3 delves into the methods and data used in carrying out the research. It also outlines the sequential procedures undertaken to arrive at the final Classical Linear Regression Model.

Chapter 4 provides a comprehensive analysis of the empirical findings derived from the research carried out and the discussion of the findings.

Finally, chapter 5 provides a conclusion to the research findings and relevant recommendations, including diversification for the benefit of the economy.

1.8 Limitations of the Study

Some key factors that are thought to be relevant to the study were qualitative and not measurable. Thus could not be incorporated into the study. The unavailability of up-to date-data as at the time of this study limited the data source to 1995 to 2021, hence, the findings of this study will be based on the circumstances of Nigeria's crude oil trade within the timeframe of the study.

Chapter 2 - Literature Review

It is pertinent to say that energy is crucial for the sustainability of the global economy and plays a crucial role in promoting economic development. Hence, the availability of long-term energy sources that are accessible, inexpensive, and friendly to the environment will have a significant impact on future economic growth (Periwal, 2023). Nwanna & Eyedayi (2016), agreed that the significance of oil has escalated to the point where the absence of oil in the global context would result in the failure of major distribution systems, thereby causing a collapse of the world economy. Therefore this chapter intends to review statements and findings of previous researchers on topics that are related to the study.

2.1 History of Crude Oil in Nigeria

The discovery of crude oil in Nigeria occurred in 1956 at Oloibiri, located in the present-day Bayelsa State, following a century-long quest for its presence (Arinze, 2011). Prior to this discovery, the main source of revenue for Nigeria was derived from the exploitation of primary commodities, including cocoa, groundnuts, cotton, lumber, and palm goods (Asekunowo & Olaiya, 2012). They reveal that export profits in Nigeria had a significant increase during the early 1970s due to the emergence of the oil boom. Since the post-colonial era, the Nigerian economy has undergone a number of modifications and structural changes. The first shipment of Nigeria's crude oil was transported to Rotterdam in 1958 (Steyn, 2009). This discovery established Nigeria as one of the oil-richest countries in Africa making it the giant of Africa. The incorporation of crude oil into the Nigerian economy throughout the latter part of the 1950s resulted in a substantial transformation and advancement within the nation's economic sphere (Asekunowo & Olaiya, 2012).

Nigeria joined the Organization of the Petroleum Exporting Countries (OPEC) in 1971, an international organization that holds responsibility for around 78% of the global oil reserves and approximately 42% of the global oil production (Squalli, 2007). Also, the Nigerian National Petroleum Company (NNPC) was established in 1977 with a mandate to regulate and be actively involved in the nation's oil companies,

which includes major firms like Chevron, Exxon Mobil, and Shell (Statista 2023). Nigeria, as the tenth biggest global oil producer, operated a total of 18 pipelines and had an average daily output of around 1.8 million barrels in the year 2020 (Statista 2023).

During the period of 2011 to 2012, it is noteworthy that the leading 10 oil exporters in the sub-Saharan African region collectively produced a substantial amount of over USD 250 billion from the sales of oil and revenue accounted for almost 56% of their combined government income (Gillies et al., 2014). However, in the year 2014-2016, Nigeria experienced a decline in its status as the leading oil-producing nation in Africa, as Angola overtook her (Omolade et al., 2019). This shift was a result of a decrease in crude oil production by a quantity of 67,000 barrels per day. Nevertheless, a reclamation of this position to Nigeria occurred in the latter part of 2016 (Omolade et al., 2019).

2.2 Crude Oil Production

Oil production levels vary across different countries, with many countries frequently faced with a situation where their demand for energy needs surpasses their local supply (Kamyk et al., 2021). Over the past few decades, there has been a significant surge in global oil production. However, as the energy requirements of countries continue to rise as a result of industrialization coupled with the absence of sufficient alternatives to oil, there is a corresponding increase in global demand and production of oil (Tsirimokos, 2011). According to Ayhan Demirbas (2016), one barrel of crude oil (42 gallons or 159 litres) can vary greatly in cost, depending on its quality which takes into account factors like specific gravity, sulfur content, viscosity, including its geographical source.

The production levels of crude oil are influenced by OPEC's quotas, impacting both short-term and long-term periods. OPEC exerts market power through the implementation of quotas that have a direct impact on production levels and pricing dynamics, and the escalation of oil prices stimulates the production levels of individual

member states within OPEC, rather than exerting a suppressive effect on production (Kaufmann et al., 2008).

OPEC’s oil production is subject to various factors, including the price of oil, market conditions, such as the worldwide demand for oil, and the production activities of non-OPEC oil producers (Barros et al., 2011). Geopolitical events also play a role in influencing OPEC's oil production. The OPEC has demonstrated a consistent track record of effectively employing production cuts to mitigate price falls, while simultaneously counterbalancing supply disruptions and escalating oil prices through increased production (Barros et al., 2011).

The production of hydrocarbons is the primary contributor to Nigeria's economy as the country’s principal source of foreign earnings is generated from the sale of oil and natural gas. Thus, any shift in the price of crude oil has a noticeable effect on the country’s financial statue According to Odularu, (2008), as of mid-2001, its daily crude oil production stood at an average of 2.2 million barrels and the estimated quantity of Nigeria's confirmed oil reserves is approximately 35 billion barrels, while its natural gas reserves exceed 100 trillion cubic feet (2,800 cubic kilometers).

In recent years, oil Nigeria’s oil production has faced setbacks with unforeseen disruption resulting to supply shortages. According to Energy Information Administration (2023), the production of crude oil has experienced a severe drop as a result of unanticipated disruptions and a reduction in investments made in upstream development since 2020. This is due to large and lengthy disruptions brought on by crude oil theft and pipeline vandalism in the third quarter of 2022, Nigeria's crude oil production momentarily fell below one million barrels per day (EIA, 2023). Due to oil theft in the Niger Delta, Nigeria has been unable to reach its OPEC quota of 1.83 million barrels per day for the past year (Akintayo, 2023). These lead to a decrease in the production of crude oil from Nigeria's key crude oil grades, including Bonny Light, Brass River, and Forcados (EIA, 2023). This has directly affected the crude oil trade, making the country not have enough to sell to its consumers. Although Nigeria's crude oil output has fully restored to average levels by the first quarter of 2023, disruptions

continue to pose a serious and persistent threat to the country's overall production (EIA, 2023).

2.3 Crude Oil Transportation

Crude oil is one of the world's most important commodities transported via sea routes due to its economic importance. Although there are alternative means for transporting this crude oil from its source to consumers, transporting it by sea is cost-effective because of the larde quantities involved. The transportation of crude oil is primarily driven by refineries that process oil to produce diverse petroleum-based products. (Hennig et al., 2012).

According to Statista (2022) in 2021, around 1.83 billion metric tons of crude oil were transported globally via sea. Given the global growing demand for energy and crude oil being the major source, transportation services becomes important factor in facilitating crude oil trade, driving economic growth, and ensuring national security for any country (Fei et al., 2020). Hence, the disparity between the supply and demand for crude oil, according to Shi et al. (2013), underscores the need for transportation services.

Maritime transportation of crude oil began in the late 19th century and the volume of crude oil transported over water has consistently increased over time (Shwe Sin Htay & Jatta, 2021). There are diverse types of crude carriers such as the Ultra Large Crude Carriers (ULCCs) and Very Large Crude Carriers (VLCCs) which represent the largest vessels in the global tanker fleet. These vessels transport cargoes with 200,000 deadweight tonnage (dwt) or above (Merikas et al., 2013). The Suezmax and Aframax vessels are commonly classified as mid-size tankers, Suezmax tankers transport cargo of 120,000 to 200,000dwt, and Aframax vessels transport cargo of 80,000 to 120,000dwt (Merikas et al., 2013).

Oil prices have the potential to affect the tanker shipping industry. For instance, the oil embargo that the Organization of Arab Petroleum Exporting Countries (OAPEC) imposed in 1973 as a response to the involvement of the United States in the Arab-Israeli War (Shwe Sin Htay & Jatta, 2021). Another recent one is the European Union's

ban on the importation of Russian crude oil via maritime routes, which took effect on December 5, 2022 (Adolfsen et al., 2023). Due to these events, there was a sharp increase in oil prices during this period of time, which stalled the expansion of the economy. Therefore, a prolonged surge in oil prices will directly affect the oil tanker sector, resulting in reduced demand for oil transportation. Consequently, there will be an increase in the number of vessels being laid up or scrapped, along with high costs associated with vessel operations. This rise in transportation costs will disrupt the supply chain of crude oil. This might have an adverse effect on several sectors that rely heavily on oil for production and distribution.

2.4 Crude Oil and the Economy

An article titled “Oil Rules Nigeria” written by Damu and Bacon (1996) is evident in Nigeria’s heavy reliance on crude oil sales for revenue generation. Crude oil constitutes over 33% of the worldwide primary energy supply and is responsible for over 95% of energy consumption in the transportation sector (Miller & Sorrell, 2013). It is a significant commodity that functions as the predominant energy source for numerous industries and global transportation. Consequently, the trade of oil assumes a crucial role in the global economy, involving multiple key stakeholders. It is commonly held that a country's wealth in crude oil would help its economy grow (Benramdane, 2017). Leading development economists maintained that countries' endowments in natural resources would help them make the transition from being underdeveloped to industrialization, just as it had happened for some developed nations like the United States, Australia, China, and the United Kingdom (Benramdane, 2017).

Developed countries that are net importers of oil have come to rely heavily on hydrocarbon fuels for their manufacturing, transportation, and consumer goods. These nations, along with the vast majority of developing nations that import oil, depend on outside sources to meet their oil (and gas) demands (Jahangir Amuzegar, 1983).

The Eurasian region, comprising former Soviet countries, holds significant influence in the global energy market due to its dual role as a prominent oil producer and a

crucial hub for energy distribution (Bildirici & Kayıkçı, 2013). Russia was ranked as the second largest global exporter of oil, following Saudi Arabia, and approximately 25% of Russia's gross domestic product (GDP) is derived from various sources such as hydrocarbons, mining products, and other commodities(Bildirici & Kayıkçı, 2013). Nigeria has abundant crude oil. Over the past 50 years, the country's oil business has flourished and since 1958, commercial production and exports have increased considerably (Akinlo, 2012). Akinlo (2012) analysed how the change in the quantity of crude oil production rose from 395.7 million barrels in 1970 to 776.01 million barrels in 1998 and in 2006, it reached 919.3 million barrels. In 2009, it dropped to 777.5 million barrels. Crude oil exports climbed from 139.5 million barrels in 1966 to 807.7 million barrels in 1979. In 1998, crude oil shipments grew to 675.3 million barrels from 390.5 million in 1987. Akinlo (2012) revealed that hydrocarbon revenues climbed from ₦166.6 million in 1970 to ₦1,591,675.00 million in 2000 and N6,530,430.00 million in 2008. This shows why crude oil trade is a major source of government revenue, and foreign exchange, and a big contributor to Nigeria's economy.

2.5 Crude Oil Price and the Economy

The pricing of crude oil is typically based on some major benchmarks; Brent crude oil and West Texas Intermediate (WTI) which are widely recognized as the primary types of oil benchmark in their respective oil markets (Demirbas et al., 2017). These prices are based on the spot or future prices of West Texas Intermediate (WTI), which is traded on the New York Mercantile Exchange (NYME) for delivery in Cushing, Oklahoma, USA, and the price of Brent crude oil, which is traded on the International Commodities Exchange (ICE) for delivery in Sullom Voe, located in Shetland, Scotland (Demirbas et al., 2017).

Oil prices have exhibited significant changes over the course of several decades, with notable fluctuations occurring during the global crises of 1973, 1979, and 2008, as well as in response to the economic shifts in 2014 and 2015 (Planete Energies, 2021), the global meltdown due to COVID-19 in 2019, and the recent Russian-Ukraine war.

The global economy is greatly influenced by the price of crude oil, given its prominent role in the present and future. There are various means by which oil prices have significantly impacted an economy, especially in an oil-dependent country like Nigeria. An increase in oil prices has a positive impact on Nigeria's income since it is a major oil-producing and oil-exporting country. Although an increase in oil prices has a direct influence on various expenditures, including transportation costs, heating expenses, and the pricing of goods derived from petroleum-based materials (Lizardo & Mollick, 2010). At this point, the increase in oil price influences crude oil trade which in turn affects Nigeria's economy positively. While the price high oil price favors Nigeria's economy, it causes heightened levels of uncertainty for oil-importing countries, causing them their future prospects, potentially leading investors, businesses, and individuals reducing their investments and expenditures (Lizardo & Mollick, 2010).

Also, oil-importing economies are susceptible to fluctuations in oil prices due to their reliance on one particular commodity. According to the WTO (2010), there is a positive correlation between the price of crude oil and the cost of producing products that depend on it. Consequently, an escalation in crude oil prices may lead to a rise in the prices of such products. This, in turn, might potentially generate inflationary pressures, which may need the implementation of more stringent monetary policies. Therefore an upward movement in oil prices results in a transfer of wealth from countries that import oil to countries that export it and this is mostly due to changes in the terms of trade.

2.6 Empirical Research

Research by Bildirici and Kayıkçı (2013) examined the correlation between oil production and economic growth in the prominent oil-exporting nations of Eurasia, namely Azerbaijan, Kazakhstan, Russian Federation, and Turkmenistan, during the period from 1993 to 2010. The research results indicate that there is a co-integration relationship between oil production and economic growth in the examined countries. Moreover, a positive bi-directional causal relationship exists between oil production

and economic growth, both in the long term and the short term. Also, the finding provides support for policies advocating for investments in energy infrastructure.

A study by Adams and Olamide Bello (2022) utilised Descriptive Statistics, the Augmented Dickey-Fuller Unit Root test, Johansen cointegration analysis, and the ARDL cointegration statistical method to investigate the enduring impacts of crude oil production on the Nigerian economy from a period of 2006 to 2020. Based on their findings, it has been determined that the contribution of oil revenue to Nigeria's economy is significant, as evidenced by its positive impact on the country's GDP. Moreover, Nigeria has implemented measures to regulate oil revenue with the aim of achieving economic growth in various ways. Their study suggested that it would be beneficial for the Nigerian Government to enhance its export supply by engaging in downstream production and promoting increased involvement of the private sector.

In their study, Jimenez-Rodriguez and Sanchez (2005) employed Vector Autoregressive (VAR) analysis with data from 1972-2001, to examine the empirical impact of oil shocks on the real economic activity of industrialised countries within the Organization for Economic Cooperation and Development (OECD), specifically including the G-7 nations, Norway, and the Euro Area. A significant interaction was observed between oil prices and macroeconomic variables. Evidence suggests that the impact of oil prices on real GDP is non-linear, with oil price increases having a greater effect on real GDP growth compared to oil price declines. They reveal that a rise in oil prices has been predominantly associated with adverse effects on economic activity within nations that rely on oil imports (Jiménez-Rodríguez & Sánchez, 2005).

Research by Yunusa (2020) investigated the effect of exchange rate volatility on the export of Nigerian crude oil to its trade partners, including the UK, USA, Italy, France, Spain, Canada, and Brazil. The researcher utilised the GARCH model and the ARDL model to determine exchange rate volatility impact on crude oil exports, with a monthly data from January 2006 (M01) to December 2019 (M12). The GARCH

analysis reveals that the exchange rates of the trading partners exhibit a high degree of volatility while the ARDL analysis reveals that the volatility of the exchange rate between Nigeria and its trading partners is statistically significant for all trading partners, albeit with varying degrees of magnitude. This finding underscores the crucial role played by exchange rate volatility in influencing the volume of crude oil exports from Nigeria to its trading partners and the findings also indicate that there is a strong correlation between exchange rate volatility and crude oil exports in Nigeria. The study advises that the monetary authorities should strive to regularly monitor the foreign currency market and formulate policies aimed at preventing fluctuations in the value of the Naria and this is crucial for sustaining the exporting crude oil and fostering trust among Nigeria's trade partners (Yunusa, 2020).

Research by Odularu, (2008) examined the correlation between the crude oil sector and the economic performance of Nigeria. The study demonstrates that the utilisation of the Ordinary Least Square regression technique from 1970 to 2005 has revealed a positive correlation between crude oil consumption and export has contributed to the growth of the Nigerian economy. One of the key recommendations put forth by the study suggests that the government should enact policies aimed at fostering increased involvement of the private sector in the crude oil industry.

Another study by Sani & Nwoye, (2023) used the Autoregressive Distributed Lag (ARDL) estimation method to examine how oil price and its volatility affect Nigeria's economic growth. The study looked at oil price volatility's short- and long-term effects on Nigeria's real GDP with secondary data from 1985 to 2020. The indicators used were Nigeria's Real GDP, Crude Oil Price, Real Exchange Rate, and Foreign Direct Investment. Their analysis shows that short-term oil price effects on real GDP are positive and statistically significant at 1%. All other variables being equal, a 1% increase in the real exchange rate results in a 1.528% increase in the real GDP. The long-term economic impact is favourable and statistically significant, with 14.67 positive effects. It also demonstrated that oil price volatility boosts short-term

economic growth but has no statistically meaningful long-term effect. The study's conclusions showed that Nigeria's GDP is positively impacted by oil prices. Thus, maintaining a balance in Nigeria's crude oil supply is essential, and the global community should let supply and demand dynamics take their course (Sani & Nwoye, 2023).

In a study conducted by Bediako et al. (2018), the focus was on examining the economic effects of oil price volatility on developing countries: A case study of an oil-exporting country. The study examines the economic implications of oil price volatility on Nigeria's economy. The analysis utilised various macroeconomic indicators, including gross domestic product, exchange rate, interest rate, Foreign Direct Investment, and balance of payment. Data from the period of 1999-2015 was employed, using Ordinary Least Square (OLS) estimation. Their findings revealed that there is a relationship between the volatility of oil prices and the response of macroeconomic variables, although the extent of this response varies across different variables and this shows that there is a linear relationship between oil price volatility and the examined macroeconomic variables. Hence they concluded by saying it is advisable to diversify the Nigerian economy in order to ensure a reduced reliance on oil revenue as the primary source of foreign income. Additionally, it is crucial to invest in domestic production to promote exports and discourage excessive imports (Bediako E et al., 2018).

Another study by Ani et al. (2014) used a multivariate framework that includes the Granger Causality and OLS model from a time series period of 1980-2010 to investigate the causal relationship between crude oil prices and key macroeconomic variables (inflation, interest, exchange rate, real GDP) and the implication of oil prices on these macroeconomics in Nigeria. The findings from the study show that in the short term, fluctuations in oil prices do not have a significant impact on the GDP, and there is no evidence to suggest that they influence other important macroeconomic variables. Once more, the results of the study suggest that there exists a positive

correlation between oil prices and the Nigeria's GDP, although this relationship is deemed statistically insignificant, and also that the influence of oil prices on real GDP and exchange rate in Nigeria is found to be insignificant. They concluded by saying that Nigeria exhibits a unique manifestation of the Dutch Disease, whereby the apparent prosperity of a nation ultimately proves to be detrimental to its economic well-being (Ani et al., 2014).

2.7 Research Gap

Existing literatures reveal that the economies of countries involved in crude oil production, export, and import are influenced by elements related to crude oil trade. However, there is no consensus among researchers on this. The diversities of previous findings may be attributed to the various variables and methods used and also the time frames within which the studies were carried out. Notably, most prior studies emphasized the impact of crude oil prices on GDP, not considering other crude oil trade-related factors. Thus, this research seeks to bridge this knowledge gap.

2.8 Research Contribution

Based on the findings, this study will identify factors of crude oil that affect the Nigerian economy, as well as examine the nature of the relationship between these factors and Nigeria's Gross Domestic Product. This would also facilitate the awareness of policymakers and stakeholders on the economic implication of factors of crude oil trade on Nigeria's GDP per capita. Consequently, they will be equipped with the necessary knowledge to make informed decisions on how to effectively address any negative consequences that may arise from these issues, particularly in relation to Nigeria's crude oil revenues.

Chapter 3 - Method And Data

In this study, an OLS regression model will be utilised with time series approach to analyse the impact of crude oil trade on Nigeria's economy. In order to conduct this research, the empirical data will consist of a time series dataset with an annual frequency from 1995 to 2021 with a sample size of 26. The data to be used are secondary data that are sourced from the Clarkson Shipping Intelligence Network, the World Bank, and the UN Comtrade.

3.1 The Ordinary Least-Squares (OLS) Regression

The OLS regression is a prominent example of the classical linear regression models (CLRM) which is a useful tool for determining how various variables are correlated with one anotherIn regression analysis, it is customary to incorporate an error term in the regression lines to account for the uncertainty associated with the estimation process. This is due to the fact that independent variables are not perfect predictors of the dependent variables in practical contexts (Gallo, 2015). Thus, the linear equation for the model is;

$$\mathbf{Y}_t = \boldsymbol{\alpha} + \boldsymbol{\beta}_1\mathbf{X}_{1t} + \boldsymbol{\beta}_2\mathbf{X}_{2t} + \boldsymbol{\beta}_3\mathbf{X}_{3t} + \boldsymbol{\beta}_4\mathbf{X}_{4t} + \boldsymbol{\beta}_5\mathbf{X}_{5t} + \boldsymbol{\beta}_6\mathbf{X}_{6t} \ldots\ldots\ldots\ldots + \boldsymbol{\beta}_{14}\mathbf{X}_{14t} + \boldsymbol{\mu}_t$$

Where **Y** = GDP per capita of Nigeria (Dependent variable)

α = is the constant or intercept of X and Y at point zero

β = is the coefficient or slope of Xs

$\mathbf{X}_s$ = Independent variables

μ = Error term

t = time

The following set of assumptions about the unobservable error term ($\boldsymbol{\mu}_t$) is that

1. The errors terms are required to have a mean of zero - (E(μ_t)=0)

2. The homoscedasticity assumption requires that the variance of the error term remains constant and finite across all values Xs, that is, Var($\boldsymbol{\mu}_t$) = 0

3. The errors should exhibit statistical independence, meaning that they must be identically and independently distributed - Cov ($\boldsymbol{\mu}_i$,$\boldsymbol{\mu}_j$) = 0
4. The error and the corresponding variable X should not exhibit any relationship.Xs, - Cov ($\boldsymbol{\mu}_i$,$\boldsymbol{\mu}_j$) = 0
5. The error term is required to follow a normal distribution.- N (0, σ2)

According to Benoit (2012), if the constraints indicated earlier are satisfied, Ordinary Least Squares exhibits superior features. Hence, the Ordinary Least Squares can be referred to as the Best Linear Unbiased Estimator (BLUE).

The regression model will be executed using the flowchart developed by Sahoo (2023) from the World Maritime University. This study aims to examine the preliminary statistics by transforming non-linear variables into linear variables via logarithm conversion. Additionally, a unit root test for stationarity of the collected data and also a correlation test will be conducted on all variables to mitigate the skewness observed in the original data. The regression model will undergo various hypothesis test with a significant level of 0.1 (10%). These test includes diagnostic tests, including coefficient diagnostics, residual diagnostics, and stability diagnostics which will be carried out using the MATLAB R2022b program

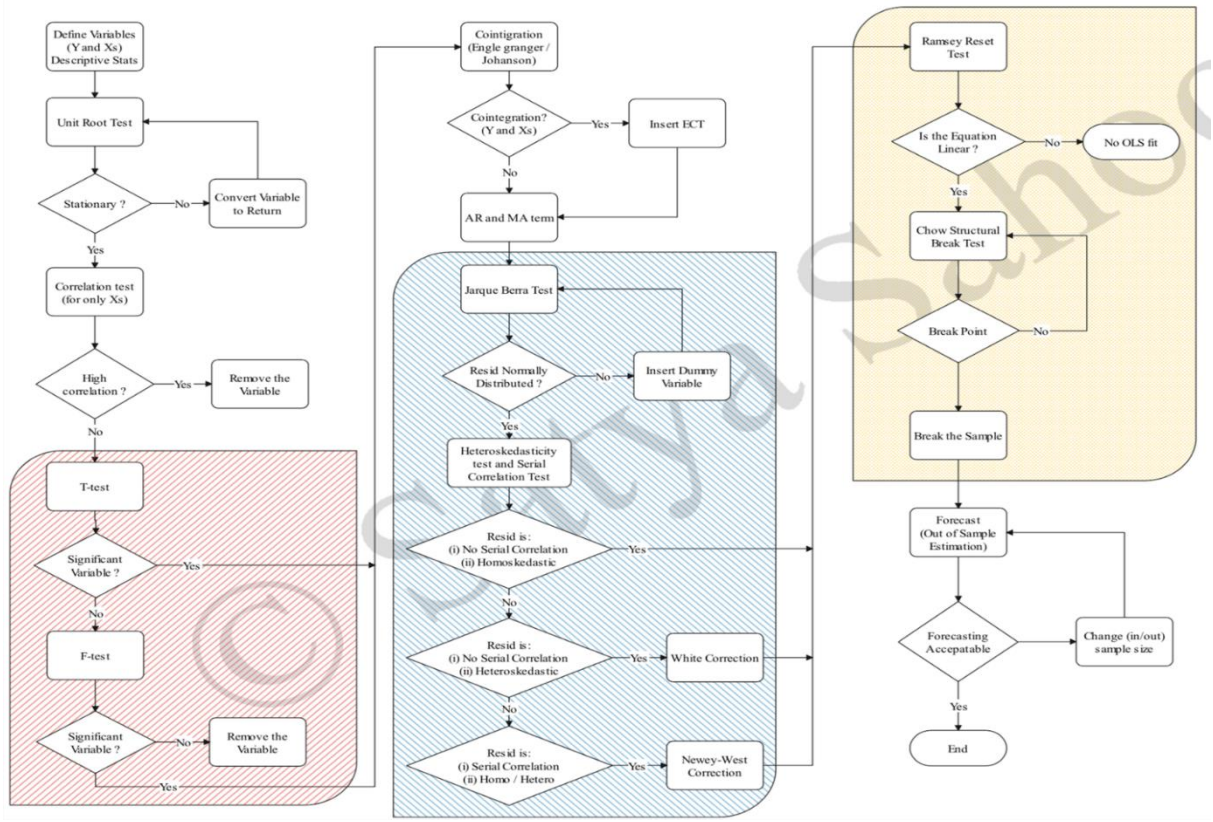

Figure 1: OLS Regression Flowchart

Source: Sahoo (2023)

3.1.1 Preliminary Statistics

The first part will begin with a descriptive analysis of the dependent variable and the independent variables. Measures of central tendency and dispersion, including skewness, are assessed in this study. This will allow the researcher to conduct a distribution analysis and to check for potential errors on each variable. If any variables show non-linear patterns, logarithmic modifications will be applied to them so that they may be used in linear regression analysis. In order to verify the validity of our statistical analysis, we need to improve the linearity between our dependent variable (Y) and our independent variables (Xs) (Htoon, 2020).

3.1.2 Stationarity of Variables (Unit Root Test)

Using a unit root test on the Y and Xs variables, we can determine whether or not the data are stable or stationary. The existence of a unit root inside a sequence is indicative of instability in the data being analyzed. A criterion of 0.1 (10%) is commonly used to evaluate the consistency of such data sets (Lv et al., 2022). To determine whether or not the variables in question are stationary, the research will use the ADF (Dickey and Fuller, 1981) and PP (Phillips and Perron, 1988) tests.

This theory proposes that;

H_0 = the variable is non-stationary

H_1 = the variable is Stationary

We accept H_0 (the null hypothesis) when P > 0.1 significance level. If the P-value is < 0.1 significance level, we accept H_1 (Alternative hypothesis)

While KPSS (Kwiatkowski, Phillips, Schmidt, & Shin, 1992) is a hypothesis test that assumes the inverse of ADF and PP.That is;

H_0 = the variable is Stationary

H_1 = the variable is non-stationary

Hence a variable is said to be stationary when

1. it remains the same at its original form $X_1 = X_t$, this is seen as **I(0)**
2. there is a change in X ($\Delta X_1 = X_{t-2}$) after first differencing becomes an **I(1)** process
3. There is a change in X ($X_1 = \Delta\Delta X_{1t-3}$) after the second differencing is seen as the I**(2)** process.

When data is said to be stationary, it means that its statistical properties have not changed over time. Properties of a variable can be altered by shocks such variations in the price of crude oil, fluctuations in exchange rates, geopolitical events, and pandemics. Therefore, a variable is considered stationary if the form of its distribution is unaffected by a change or shock at any given period. Since non-stationary data might provide a false and erroneous result that can be deceptive at the conclusion of the regression process, the stationarity of these variables is a fundamental criterion for the linear regression model.

3.1.3 Correlation

According to Shrestha (2020), the presence of multicollinearity, makes some of the relevant study statistically insignificant. Therefore in order to mitigate the issue of multicollinearity, a correlation test will be performed on the independent variables. An 80% which is a rule of thumb has been considered as a high level of correlation to conduct this test. In cases where a strong correlation exists between two variables, such as (a) and (b), it is advisable to remove one of the variables (a) as it is adequately represented by the other variable (b). Hence, neglecting the existence of multicollinearity in the regression model might result in spuriousness, leading to inflated values of the squared correlation coefficient (R^2) and adjusted R^2

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2]\ [n\sum Y^2 - (\sum Y)^2]}}$$

In the given context, the variables are represented as follows**:** ***r*** denotes the correlation coefficient, ***n*** represents the total number of observations, ***x*** signifies the first independent variable, and ***y*** denotes the second independent variable (Shrestha, 2020).

3.1.4 Coefficient Diagnostics Test

3.1.4.1 T-test

After removing correlated variables, the significance of the independent variables that have an effect on Nigeria's GDP per capita (Y) will be determined using a T-test.

A hypothesis test will be carried out stating that

H_0: = the variables are not statistically insignificant (for P-value > 0.1)

H_1: = the variables are statistically significant (for P-value < 0.1)

Thus, we accept the null hypothesis and reject the alternative hypothesis if the P-value is more than the significance level of 0.1, while the opposite holds true if the P-value is less than the significance level of 0.1. It follows that if this coefficient is non-zero,

the relevant independent variables will have an effect on the dependent variable, either positively or negatively

3.1.4.2 Engle-Granger Cointegration

The Engle-Granger approach will be utilized by the researcher to improve the models through the analysis of variables that demonstrate inseparability and feature long-term equilibrium correlations (Engle and Granger, 1987). This approach is only useful in cases when the independent variables demonstrate I(1) processes, suggesting that they possess stationarity after being differenced once. If there are variables present at this stage, an Error Correction Term (ECT) will be included in the model with a significance level of 10%.

The equation may be represented $\mathbf{\Delta Y_t = \beta_1 \Delta X_t + \beta_2 (Y_{t-1} - YX_{t-1}) + \mu_t}$.

Where the error correction term is represented by $\mathbf{Y_{t-1} - YX_{t-1}}$.

The hypothesis for the Error Correction Model (ECM) posits that

$\mathbf{H_0}$ = there is no co-integration between the dependent and independent variables (for P-value > 0.1).

$\mathbf{H_1}$ = There is a co-integrated between the dependent and independent variables (for P < 0.1)

A study by Alogoskoufis and Smith (1991) reveals that error correction models place substantial and verifiable nonlinear constraints on dynamic econometric equations and that they do not eliminate the requirement for understanding the process of expectation of the model.

3.1.4.3 ARMA Model

The most useful linear model for stationary time series is provided by ARMA models. The ARMA model improves the weakly stable stochastic time series by including two polynomials, moving average (MA) and autoregressive (AR). The ARMA model incorporates an additional component into the data-driven model in order to generate the ultimate prediction (Baptista et al., 2018).

The past value that can affect the present value of the dependent variables (lag of **Y**) is handled by the AR model which can be represented as $Y_t = Y_1 Y_{t-1} + Y_2 Y_{t-2} + Y_3 Y_{t-3}$.

The past error that can affect the present error of the dependent variables (lag of **μ**) is done by the MA model which can be represented as $Y_t = Y_1\mu_{t-1} + Y_2\mu_{t-2} + Y_3\mu_{t-3}$.

This study will employ 5 AR and 5 MA orders of lags, iteratively adjusting the number of AR and MA until statistical significance is attained at a level below 0.1 significance level. These models will assist in the endeavour to comprehend and elucidate a greater portion of the serial correlation found in the regression analysis. Furthermore, they will provide a mechanism for predicting the future implications of crude oil trade on Nigeria's economy.

3.1.5 Residual Diagnostics Test

3.1.5.1 Heteroscedasticity test and Serial correlation test

To examine whether or not heteroscedasticity and serial correlation exist in this model, we'll use a residual test. The goal of these two analyses is to determine whether or not a linear model meets the two pillars of the Classical Linear Regression Model. That is, Var (μt) = σ2 and Cov (μi, μj) = 0.

The heteroscedasticity test is employed to assess if the variability of the residuals in a regression model is affected by the values of the significant independent variables (Baltagi et al., 2010). Therefore we will deploy the ARCH test and use the Ljung-Box Q-test to test for serial correlation at a significance level of 0.1 in order to determine the presence of heteroscedasticity or homoscedasticity in our residuals.

The hypothesis for the ARCH states that

H_0 = There are no ARCH effects on the values of X_t

H_1 = There are ARCH effects on the values of X_t

While hypotheses for the Ljung-Box Q-test state that

H_0 = there is no serial correlation, that is the errors are not statistically dependent

H_1 = there is a serial correlation, that is the errors are statistically dependent

Table 1: Action required for ARCH effect and serial correlation

S/N	Residual test result		Actions
1	No ARCH effect	No serial correlation	No action is required
2	With ARCH effect	No serial correlation	White Correction
3	No ARCH effect	With serial correlation	Newey-West correction
4	With ARCH effect	With serial correlation	Newey-West correction

Sources: Sahoo (2023) Lecture note

The outcome derived from the hypothesis test will ascertain the appropriate course of action on the analysis in order to enhance the outcome in our model.

3.1.5.2 Normality Function test

The residual normality test is an additional crucial assumption utilized in the analysis of continuous data, which examines central tendency and employs statistical approaches (Gupta et al., 2019). The residuals originating from a normal distribution exhibit asymmetrical characteristics in relation to the mean value. The Jarque Bera test will be employed in this study to evaluate the normality of the residuals of our model. The hypothesis test states that;

H_0 = The residuals does not follow a normal distribution (for p-value greater than 10%)

H_1 = The residuals follow a normal distribution (for p-value less than 10%)

If the P-value is below the significance level of 10%, the null hypothesis will be rejected and the alternative accepted indicating that the residuals follow a normal distribution. Therefore, in the absence of a normal distribution of residuals, the model will be augmented by dummy variables in order to achieve normality in the residuals.

3.1.6 Stability Diagnostics Test

3.1.6.1 RESET test

The model will be subjected to the RESET test to determine the presence of linearity, specifically to determine if there is a linear relationship between the dependent variable and independent factors. The test proposed by Shukur and Mantalos (2004) is

an exhaustive evaluation for detecting potential misspecification of functional form. As we had previously presumed, the variables exhibit linearity in accordance with their respective functional forms. Nonetheless, it is essential to recognize that this assumption may not be entirely accurate, as the variables Y and Xs may exhibit a nonlinear relationship. Consequently, the test will be used to evaluate the linearity of the regression model. That is,

H_0: The model is non-linear (for P- value < 0.1)

H_1: The model is linear (for P-value > 0.1)

This implies that when the P-value greater than 10%, the alternative hypothesis is accepted and the null hypothesis is rejected. The null hypothesis is accepted and the alternative hypothesis is rejected when the P-value is below 10%. In the event that the model demonstrates nonlinearity, it is crucial to convert all variables to logarithmic form prior to commencing the regression procedure.

3.1.6.2 Structural Break Test (Chow Test)

The Chow test is a statistical and economic technique utilized for evaluating the equality of coefficients in linear regression across distinct datasets (Zach, 2021). The econometric approach in question is widely utilized for the purpose of determining the presence of a structural break within a given time series. Structural breaks in a dataset can frequently occur due to several factors, including fluctuations in crude oil prices, geopolitical occurrences, the dynamic interplay between crude oil supply and demand, or abrupt shocks such as pandemics that exert automatic impacts on the economy.

CUMSUM test will be employed to examine the presence of structural breaks within the specified time frame in the model. The full period which is = $a + bx_{1t} + cx_{t2} + \varepsilon$ will be used to test for the structural breakpoint. A hypothesis test will be done which states that

H_0 = There is a structural breakpoint

H_1 = There is no structural breakpoint

The null hypothesis is rejected if the data has a structural break point and the regression lines match a single line. Alternatively, accepting the null hypothesis implies that the data lack structural breakpoint evidence (Zach, 2021).

3.2 Data Selection

The table below indicates the list of variables collected as regards the study which includes their sources, measurement, time period and frequency which is constant for all variables. 15 variables were collected; 1 dependent variable and 14 independent variables. The GDP per capita of Nigeria will be the dependent variable (Y) while the 14 independent variables (X_n) are divided into demand factors and supply factors and some economic indicators that are preserved to be relevant to the study.

Table 2 List of Variables

S/N	Name of Variables	Sources	Unit	Period	Frequency
Y	GDP per capita of Nigeria (Nig_GDP)	WB data	USD	1995-2021	Annually
X_1	Nigeria's oil production (Nig_oilprd)	UN Comtrade	bbl/day	1995-2021	Annually
X_2	Brent crude oil price (BCOP)	Clarkson	$/bb	1995-2021	Annually
X_3	OPEC's oil production (OPEC_COP)	Clarkson	mbpd	1995-2021	Annually
X_4	VLCC freight rate (VLCC_FR)	Clarkson	$/day	1995-2021	Annually
X_5	Exchange rate (EXRATE)	WB data	US$	1995-2021	Annually
X_6	Interest rate (LIBOR)	Clarkson	%	1995-2021	Annually
X_7	India’s oil import in value (INDIA_i)	UN Comtrade	$m	1995-2021	Annually
X_8	Spain’s oil import in value (SPAIN_i)	UN Comtrade	$m	1995-2021	Annually
X_9	France’s oil import in value (FRA_i)	UN Comtrade	$m	1995-2021	Annually
X_{10}	Netherlands oil import in value (NETH_i)	UN Comtrade	$m	1995-2021	Annually
X_{11}	Saudi Arabia’s oil export in value (SAU_e)	UN Comtrade	$m	1995-2021	Annually
X_{12}	IRAQ’s oil export in value (IRAQ_e)	UN Comtrade	$m	1995-2021	Annually
X_{13}	UAE’s oil export in value (UAE_e)	UN Comtrade	$m	1995-2021	Annually
X_{14}	Nigeria’s oil export in value (NIG_e)	UN Comtrade	$m	1995-2021	Annually

Source: Compiled by author

3.3 Justification of Independent Variables

Table 3 Justification of Independent Variables

Categories	Independent variables
Supply factors	OPEC's crude oil production, Nigeria's oil production, 4 Oil-producing and oil-exporting countries (Nigeria, Saudi Arabia, UAE, and IRAQ)
Demand factors	Brent crude oil Price, Very Large Crude Carrier (VLCC) Freight rate, 4 countries buying Nigeria's crude oil (India, Spain, Netherlands, and France)
Economic indicators	Exchange rate and London Interbank Offered Rate (LIBOR)

Source: Compiled by author

3.3.1 Nigeria's GDP Per Capita (Dependent Variable)

The Gross Domestic Product (GDP) per capita serves as a fundamental metric for quantifying the value of economic output per individual, serving as macroeconomy indicator of a acountry's economy.

3.3.2 Supply Factors

Supply factors are refer to variables that impact the availability and production of crude oil from its extraction to its export and consumption stage. A disruption in the production of crude oil poses a big threat to the oil-producing and oil-exporting economy. These variables have the potential to alter the total supply, subsequently affecting supply chain process and the oil market generally.

- Nigeria's Oil Production/Oil-export

A report by EIA (2016) revealed that in May 2016, the disruptions in crude oil production in Nigeria escalated to 750,000 barrels per day (b/d), marking the highest recorded level since January 2009. Also, any reduction in oil production volume will be directly affected by the daily production quota approved by OPEC. A rise in

Nigeria’s crude oil export will indicate that Nigeria is producing more and this will directly impact the economy positively and vice versa.

- Oil-producing and Oil-exporting Countries

Nigeria significantly relies on crude oil exports, and crude oil dominant GDP and government revenue. Thus, availability of crude oil for export can directly increase the trade of crude oil and increase the revenue of the country.

The Arab nation is the largest exporter of crude oil in the world; hence, it is reasonable to believe that income from fuel exports greatly contributes to the expansion of the Arab nation's economy (Murshed, 2022). According to Schaer (2022) Oil accounts for around 40% of Saudi Arabia's gross domestic product (GDP) and generates 80% of the country's export revenue for Saudi Arabia. Therefore an increase in oil production will lead to a surplus of oil and might reduce the price of crude oil and this will directly affect Nigeria’s export earnings from the sales of its crude oil.

The United Arab Emirates (UAE) is positioned inside the top 10 global oil-producing nations. Approximately 96% of the nation's estimated 100 billion barrels of confirmed oil reserves are concentrated in the region of Abu Dhabi, positioning it as the sixth largest resource globally (ITA, 2022). The UAE has a daily average production of 3.2 million barrels of petroleum and liquid hydrocarbons. Hydrocarbons maintain a significant position within the United Arab Emirates economy, as seen by their substantial contribution of 30% to the country's Gross Domestic Product (GDP) through the oil and gas industry.

Iraq is a major oil producer and exporter and this makes the export of crude oil very crucial to the country's economy (Semih Serkant Aktuğ et al., 2019). They reveal that 90% of Iraq's budget is supported by the sales of oil.

- OPEC’s Crude Oil Production

According to the EIA (2022), OPEC member nations collectively own around 71% of the global proven reserves of crude oil. Therefore, Nigeria being a member state will be influenced by the decision made by OPEC to either decrease or raise the production quota which will have a potential impact on the availability of oil in the market, thereby exerting an effect on global oil prices.

In conclusion, the potential escalation of production by these selected oil-producing and oil-exporting countries may result in an excess supply of oil in the market, thus leading to a decrease in oil prices. This, in turn, will have an impact on crude oil trade which will directly affect Nigeria's export earnings. Also, the decision of OPEC has a great role to play in Nigeria’s crude oil production level.

3.3.3 Demand Factors

Demand factors are the variables that exert an effect on the consumption and demand of oil within the market. These variables have a substantial influence on the value of crude oil imported, thereby impacting oil prices and market dynamics. It is pertinent to note that without transportation, crude oil trade will not be possible and this will negatively affect the country’s revenue which will directly affect the economy.

- Countries buying Nigeria’s Crude Oil

India is the six-largest global consumer of crude oil and ranks, as well as the ninth-largest importer of crude oil (Venkataraman & Subramaniam, 2022). India is one of the major buyers of Nigeria’s crude oil (Wang et al., 2021). When Crude prices go up, they suffer greatly, but when oil prices go down, they benefit. As its economy grows, the country will need to import more and more crude oil to meet rising industrial and domestic needs. Research by Alkhateeb & Sultan (2019) revealed that after a sharp decline from $130 per barrel in 2012 to as low as $34 per barrel in 2017, the price of crude oil has recently shown an upward trend and is predicted to reach $70 per barrel by 2019. Such a surge in prices can significantly disrupt india’s economic operations,

influencing areas wich includes its current account balance, foreign exchange reserves, inflation rate, and the value of the native currency (Alkhateeb & Sultan, 2019)

The importation of oil and products derived from it accounted for 2.8% of Spain's GDP in 2021 and brought in 33,696 million euros, making it the most valuable category of goods that Spain brought into the country (Baquer, 2022). According to Atalayar (2022), Spain increased its crude oil imports by 8% in December 2021 compared to December 2020, acquiring 4.86 million tonnes, of which 21.8% were supplied by Nigeria.

France predominantly relies on imported oil for their energy needs. In the year 2016, France specifically reported net oil imports of 550 million barrels (Kalantzis & Ouvrard, 2018). A fluctuation of EUR 10 in the price of a barrel of oil leads to a corresponding and proportional rise in oil expenditure. They also reveal that the increase amounts to EUR 5.5 billion, representing 0.5% of consumer spending in France.

The Netherlands exhibits a significant reliance on oil imports to sustain current levels of consumption. In the year 2022, the Netherlands recorded a daily oil consumption of around 885 thousand barrels (Statista,2023c). From 2009 to 2021, the nation's oil consumption had a notable decline, culminating in a record low of 845 thousand barrels per day. Notwithstanding this decline, the nation is classified as one of the prominent consumers of oil globally (Statista,2023c). Based on data obtained from the Nigerian National Petroleum Corporation (NNPC) as reported by Thisday in 2021, it was documented that the Netherlands bought a total of 73 million barrels of crude oil from Nigeria.

These variables play a crucial role in the analysis due to their significance in analyzing the impact of crude oil trade on Nigeria’s economy. If the demand for Nigeria’s crude oil from these countries reduces, which can be attributed to either the decisions made by these countries or a transition from renewable to non-renewable energy sources, it

will pose a heavy challenge for Nigeria in selling its crude oil thereby directly affecting its economic growth.

- Very Large Crude Carrier's Freight Rate

The VLCC is an important variable for this analysis because it transports crude oil in large quantities from production region to consumption region. It is well recognized as one of the most prevalent types of vessels within the tanker market and is a kind of vessel with a gross tonnage of roughly 300,000 deadweight tons (dwt), making it one of the largest maritime vessels globally. VLCC provides significant cost advantages in the transportation of oil in situations where onshore pipelines are not a viable option. The supply and demand of VLCC affect its freight rate prices, that is, the tanker capacity shortage may raise freight rates, thereby affecting crude oil trade decisions. A fluctuation in VLCC freight rates can impact oil transportation across different regions, altering crude oil availability in different markets.

- Brent Crude Oil Price

Oil price plays a significant role in crude oil trade, therefore Brent crude oil price is mostly used for Nigeria's crude oil. The Brent crude oil price is widely recognized as a benchmark due to its extensive use as a reference point for almost two-thirds of crude oil supplies traded internationally on international markets (Gibson et al., 1990).

3.3.4 Economic Indicators

The significant dependence of Nigeria on revenue generated from the export of crude oil makes these indicators a crucial variable for examination because crude oil is traded in foreign currency (USD). Therefore, it is important to include exchange rate and LIBOR as variables that are used for crude oil trade. They are also employed for the assessment of Nigeria's economic performance.

3.4 Advantages of Simple Linear Regression

1. The coefficients from a linear regression model may be easily understood and implemented.

2. This approach is preferable to others due to its reduced complexity in situations where one knows that a linear relationship exists between the independent and dependent variables

3. While over-fitting is possible with Linear Regression, it may be prevented with the help of dimensionality reduction, regularization (L1 and L2), and cross-validation (Rout, 2020)

3.5 Limitations of the Linear Regression Model

1. Regression models tend to experience a decrease in reliability as more variables are added, as they tend to perform more effectively with a smaller number of variables (Rout, 2020).

2. Errors in the input data have the potential to significantly impact the accuracy and reliability of regression models. The regression model may become invalid if certain data preprocessing steps are not taken, such as the removal of missing values, redundant data, outliers, or addressing imbalanced data distribution (Rout, 2020)

3. Seasonality, cyclical variations, and non-stationary data have the potential to introduce spuriousness to the model if left unaddressed (Rout, 2020)

4. Although linear regression is useful for studying relationships between different variables, its oversimplification of real-world problems by assuming a linear connection between them makes it unsuitable for most practical applications (Rout, 2020).

Chapter 4 - Data Analysis

This section presents the analysis and the regression result of the data gathered on the impact of crude oil trade on Nigeria's economy. The variables will be converted into logarithms so as to make them linear for regression analysis.

4.1 Preliminary statistics

Table 4: Descriptive Statistics

	Maximum	Mimimum	Mean	Median	Std_Dev	Skewness
Y-Nig_GDP	3200.950	407.280	1626.780	1883.890	895.780	-0.050
X1-Nig_oilprd	125059.580	64337.960	105952.500	108707.330	14244.910	-1.210
X2-BCOP	111.630	12.800	55.250	54.250	31.290	0.410
X3-OPEC_COI	33.120	25.290	28.930	29.140	2.330	0.050
X4-VLCC_FR	73413.460	19836.540	36724.800	34610.580	13763.360	0.930
X5-EXRATE	401.150	21.880	160.400	132.890	101.240	0.770
X6-LIBOR	6.640	0.200	2.720	1.900	2.210	0.450
X7-INDIA_i	132009498.400	2708401.100	51097295.520	54247097.440	45795816.610	0.320
X8-SPAIN_i	41164252.120	4727689.560	20455805.000	19962899.580	11445561.340	0.300
X9-FRA_i	50275931.840	7947812.660	22664733.640	20175068.400	11612346.790	0.700
X10-NETH_i	83850596.210	7089242.570	39168869.050	41917684.880	23468750.710	0.130
X11-SAU_e	263891012.360	24468164.290	125115467.570	119900497.790	72594220.790	0.520
X12-IRAQ_e	82237271.490	28271.060	37634841.310	33548837.780	28500328.110	0.230
X13-UAE_e	98762010.240	9723051.970	43986283.070	42025061.740	28258861.630	0.480
X14-NIG_e	103901723.410	9608760.440	42232464.990	37007821.160	26648973.550	0.680

Source: Compiled by Author

The table presented above shows the descriptive analysis of the dependent variable (Y) and the independent variables (Xs). The variables were subjected to logarithmic transformation in order to attain linearity for the regression analysis. Furthermore, efforts were made to boost the linearity of the Y variable and the Xs variables in order to improve the normalcy of the initially skewed data and generate a more credible dataset for analysis.

Table 4 shows that GDP per capita income in Nigeria is 1,626.78 Dollar, on average each person among the over 200 million persons in Nigeria gets a share of 1,626.78 Dollar from 1995 to 2021. The maximum and minimum share of the GDP per capita is 3200.95 and 407.28 USD respectively.

4.2. Unit root test

Table 5: Stationarity of variables

	ADF		PP		KPSS		
Variables	**P-value**	**Stat**	**P-value**	**Stat**	**P-value**	**Stat**	**Stationarity**
Y-Nig_GDP	0.004	-3.039	0.004	-3.039	0.039	0.160	I(1)
X1-Nig_oilprd	0.001	-4.202	0.001	-4.202	0.100	0.050	I(1)
X2-BCOP	0.001	-4.525	0.001	-4.525	0.100	0.057	I(1)
X3-OPEC_COP	0.001	-4.439	0.001	-4.439	0.100	0.075	I(1)
X4-VLCC_FR	0.001	-4.705	0.001	-4.705	0.100	0.039	I(1)
X5-EXRATE	0.001	-4.334	0.001	-4.334	0.100	0.070	I(1)
X6-LIBOR	0.060	-1.862	0.060	-1.862	0.100	0.093	I(1)
X7-INDIA_i	0.001	-4.355	0.001	-4.355	0.100	0.081	I(1)
X8-SPAIN_i	0.001	-5.286	0.001	-5.286	0.100	0.040	I(1)
X9-FRA_i	0.001	-5.435	0.001	-5.435	0.100	0.038	I(1)
X10-NETH_i	0.001	-4.900	0.001	-4.900	0.100	0.056	I(1)
X11-SAU_e	0.001	-5.668	0.001	-5.668	0.100	0.036	I(1)
X12-IRAQ_e	0.001	-7.142	0.001	-7.142	0.100	0.026	I(1)
X13-UAE_e	0.001	-4.797	0.001	-4.797	0.100	0.056	I(1)
X14-NIG_e	0.001	-4.626	0.001	-4.626	0.100	0.054	I(1)

Source: Compiled by Author

The above table indicates the stationarity of Y and Xs variables. A unit root test was conducted with the use of ADF (Dickey and Fuller, 1981), PP (Phillips and Perron, 1988), and the reverse of ADF and PP which is the KPSS (Kwiatkowski, Phillips, Schmidt, and Shin 1992). The alternative hypothesis was accepted because the P-value of each variable was stationary at the first difference I(1) and they are less than 0.1 significant level. Therefore the stationarity of the Y and Xs variables shows that the data statistic characteristics remain constant at I(1) and that any shock or shift will not modify the shape of the distribution and this will enable the model not to have a spurious and false result.

4.3 Correlation between independent variables

Table 6 Multicollinearity of variables

Variables	Nig_oilprd	BCOP	OPEC_COP	VLCC_FR	EXRATE	LIBOR	INDIA_i	SPAIN_i	FRA_i	NETH_i	SAU_e	IRAQ_e	UAE_e	NIG_e
Nig_oilprd	1													
BCOP	0.28	1												
OPEC_CO	0.46	0.35	1											
VLCC_FR	0.38	-0.15	0.36	1										
EXRATE	-0.15	0.05	-0.25	-0.25	1									
LIBOR	0.24	0.13	0.57	0.29	0.02	1								
INDIA_i	-0.05	0.48	0.06	-0.29	0.13	0.11	1							
SPAIN_i	0.33	0.98	0.44	-0.07	0	0.17	0.45	1						
FRA_i	0.4	0.95	0.5	0.01	-0.05	0.19	0.43	0.97	1					
NETH_i	0.47	0.92	0.38	-0.02	0	0.18	0.45	0.91	0.88	1				
SAU_e	0.22	0.89	0.4	-0.09	0.05	0.12	0.42	0.9	0.87	0.8	1			
IRAQ_e	0.16	0.14	0.29	0.05	0.04	0.16	0	0.16	0.19	0.14	0.19	1		
UAE_e	0.33	0.92	0.49	0.11	-0.15	0.23	0.44	0.94	0.92	0.87	0.85	0.2	1	
NIG_e	0.51	0.9	0.33	0.01	-0.04	0.1	0.53	0.87	0.89	0.89	0.79	0.08	0.89	1

Source: complied by Author

The table shows variables that are above 0.80 correlated with each other. It is observed that the BCOP has a strong correlation with SPAIN_i (0.98), FRA_i (0.95), NETH_i (0.92), SAU_e (0.89), UAE_e(0.92), and NIG_e (0.90) and these values above 0.80 significant level. The oil import from Spain, France and Netherlands correlating with Brent crude oil price could be because of their heavy reliance on crude oil for their energy needs and the pricing dynamics. Consequently, fluctuations in the Brent price will have a direct impact on the pricing of imported crude oil for these countries, which in turn lead to a strong correlation. This is also applicable to Nigeria, UAE, and Saudi Arabia that heavily depend on crude oil for revenue generation in their economy. Therefore SPAIN_i, FRA_i, NETH_i, SAU_e, UAE_e, and NIG_e were removed in other to retain BCOP for the reason that Brent Crude oil price is a major element in crude oil trade that serves as a benchmark in the oil market globally. After the removal of the correlated variables, the remaining variables were correlated below 80% and this is healthy for the analysis to enable the researcher not to have a spurious or false result.

4.4. Regression Result

The regression analysis will be conducted with different models which include the Coefficient diagnostics test, Residual diagnostics test, and stability diagnostics test, where different hypotheses will be tested at a significance level of 10%. Also, a CUMSUM test will be carried out to check for structural breaks within the period of study.

4.4.1 Coefficient Diagnostics Test

4.1.1.1 T- Test

Table 7: Significant Variables

Y= Nig_GDP				
	Estimate	**SE**	**tStat**	**P value**
Intercept	0.052	0.019	2.784	0.011
BCOP	0.232	0.065	3.564	0.002
VLCC_FR	0.135	0.056	2.432	0.024
EXRATE	-0.114	0.062	-1.832	0.081
INDIA_i	0.085	0.036	2.370	0.027
Number of observations: 26 Error degree of freedom: 21 RMSE: 0.086 R-squared: 0.647		Adjusted R-squared:0.580 F- statistic vs. constant model: 9.6 P- value: 0.000139		

Source: compiled by Author

A hypothesis test using a T-test was conducted to identify the explanatory factors that are statistically significant to the dependent variable. Based on Table 7, it can be inferred that the BCOP, VLCC_FR, EXRATE and INDIA_i are the identified factors of crude oil that affects Nigeria's GDP. It is also observed that BCOP, VLCC_FR and INDIA_i exhibit a positive and statistically significant association with Nig_GDP. The variable EXRATE has a statistically significant and negative relationship with Nig_GDP. The observed P-values for the variables in the model are found to be below the significance

threshold of 0.1. Additionally, the adjusted R-squared value for the model is determined to be 58%. Furthermore, the model P-value is calculated to be 0.000139, which is lower than the specified significance level of 0.1. Therefore, the alternative hypothesis will be adopted.

4.1.1.2 Engle-Granger Cointegration

Table 8: Co-integration of variables

Y= Nig_GDP				
	Estimate	**SE**	**tStat**	**P value**
Intercept	0.039	0.012	3.379	0.003
BCOP	0.289	0.045	6.388	2.476e-06
VLCC_FR	0.094	0.038	2.427	0.024
INDIA_i	0.054	0.025	2.163	0.042
ect_BCOP	-0.277	0.049	-5.641	1.342e-05
Number of observations: 26 Error degree of freedom: 21 RMSE: 0.058 R-squared: 0.837		Adjusted R-squared:0.806 F- statistic vs constant model: 27 P- value: 5.14e-08		

Source: complied by Author

The table presented above displays the variable that demonstrates inseparability and possesses long-term equilibrium correlations at I(1) according to Engle-Granger (1987). The BCOP has been identified as the only variable that exhibits a statistically significant and negative correlation with Nigeria's GDP, as evidenced by a coefficient of -0.277 and a P-value of 1.342e-05. The model has a statistically significant P-value of 5.14e-08, indicating a high level of confidence in the relationship between the variables. Additionally, the adjusted R-squared value of 0.806 suggests that about 80.6% of the variation in the dependent variable can be explained by the independent variables in the model. Hence, the alternative hypothesis will be deemed statistically

significant at a significance level of 10%, leading to the rejection of the null hypothesis.

4.1.1.3 ARMA model

Table 9:ARMA model result

Y= Nig_GDP				
	Estimate	**SE**	**tStat**	**P value**
Intercept	0.037	0.024	1.538	0.141
BCOP	0.296	0.046	6.392	5.093e-06
VLCC_FR	0.113	0.040	2.808	0.011
INDIA_i	0.06	0.027	2.543	0.020
ect_BCOP	-0.256	0.130	-1.964	0.065
AR	0.021	0.268	0.080	0.936
MA	-0.410	0.566	-0.723	0.478
Number of observations: 25 Error degree of freedom: 18 RMSE: 0.058 R-squared: 0.860		Adjusted R-squared:0.813 F- statistic vs constant model: 18.4 P- value: 8.73e-07		

Source: complied by Author

Table 10 indicates that there is no ARMA in the analysis after using 5AR and 5MA to check if the value and the error of the dependent variable's past can affect it present value. The result shows that AR and MA variables were not significant, that is their P-values were high that the 10% significant level.

4.4.2 Residual Test Hypothesis

4.4.2.1 Heteroscedasticity and Serial correlation test

Table 10: Test for heteroskadasticity and serial correlation

Y= Nig_GDP				
	Estimate	**SE**	**tStat**	**P value**
Intercept	0.042	0.011	3.558	0.001
BCOP	0.293	0.046	6.522	2.343e-06
VLCC_FR	0.098	0.040	2.571	0.018
INDIA_i	0.06	0.024	2.282	0.033
ect_BCOP	-0.284	0.049	-5.801	1.122e-05
Number of observations: 25 Error degree of freedom:20 Root Mean Squared Error:0.0577 R-squared: 0.847			Adjusted R-squared:0.816 F- statistic vs constant model: 27.6 P- value:6.76e-08	

Source: complied by Author

Upon executing the residual test, it is observed that the model exhibits no ARCH effects and no serial correlation. The P-value of the model is determined to be 6.76e-08, which is less than the significance level of 10%. Hence, the null hypothesis will be accepted and no action is required Additionally, the adjusted R-squared value of the model is calculated to be 0.816, indicating that about 82% of the variation in the dependent variable can be explained by the independent variables. This result indicates that the variance of the error term in the regression model is constant (Stenberg & Yang, 2016) and the variable's serial correlation is measured as zero, that is, the error term is statistically independent of one another. This shows that the model is well-defined.

4.4.2.2 Normality Test

Table 11: Addition of dummy variable

Y= Nig_GDP				
	Estimate	**SE**	**tStat**	**P value**
Intercept	0.031	0.009	3.416	0.002
BCOP	0.286	0.034	8.265	7.0149e-06
VLCC_FR	0.137	0.031	4.377	0.000
INDIA_i	0.06	0.019	3.269	0.003
ect_BCOP	-0.234	0.038	-6.168	5.0136e-06
Dummy8	0.195	0.048	4.006	0.000
Number of observations: 26 Error degree of freedom: 20 Root Mean Squared Error: 0.044 R-squared: 0.910			Adjusted R-squared: 0.886 F- statistic vs constant model: 40.3 P- value: 8.97e-10	

Source: compiled by Author

Table 10 presents the results of the Jarque-Bera normality test, which was performed to incorporate dummy variables into the model. However, just a single dummy variable was included to achieve normal distribution in the residual of the model. The adjusted squared value for this model is 0.886, indicating a strong fit, and the associated P-value is 8.97e-10, indicating a very significant result.

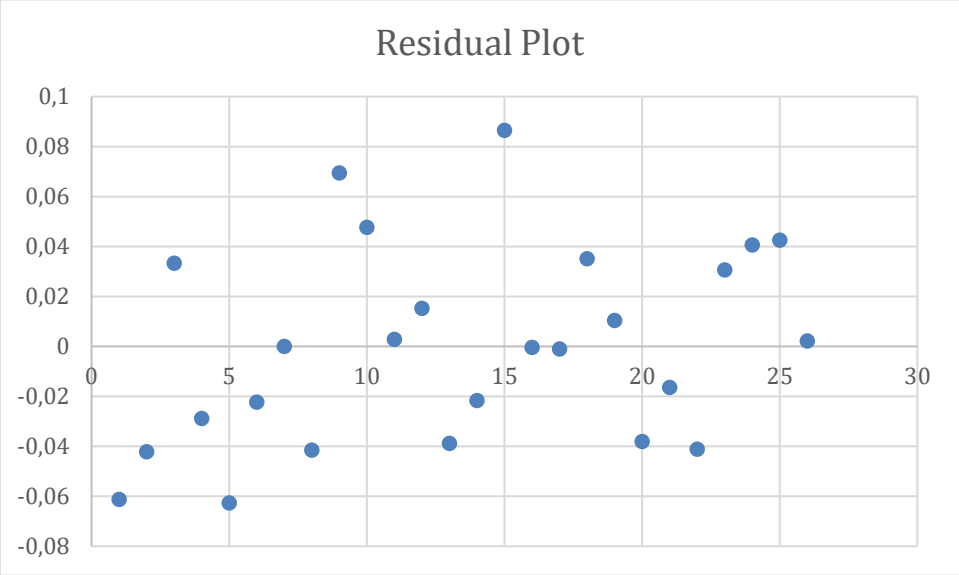

Figure 2: Residual Plot (Linearity of the Model)

Source: created by author

4.4.3 Stability Diagnostics test

4.4.3.1 RESET Test result

The stability test encompasses the use of the RESET test and the Chow test, which are employed to ascertain the presence of a structural break within the time series under investigation. The RESET test provides evidence supporting the linearity of the model, as indicated by the P-value of 0.3786, which exceeds the significance level of 0.1. Hence, the alternative hypothesis was accepte .

4.4.3.2 CUMSUM Result

There was a structural break in the time series and the highest breakpoint was in 2013. Hence the null hypothesis was accepted. and this can be seen from the graph below.

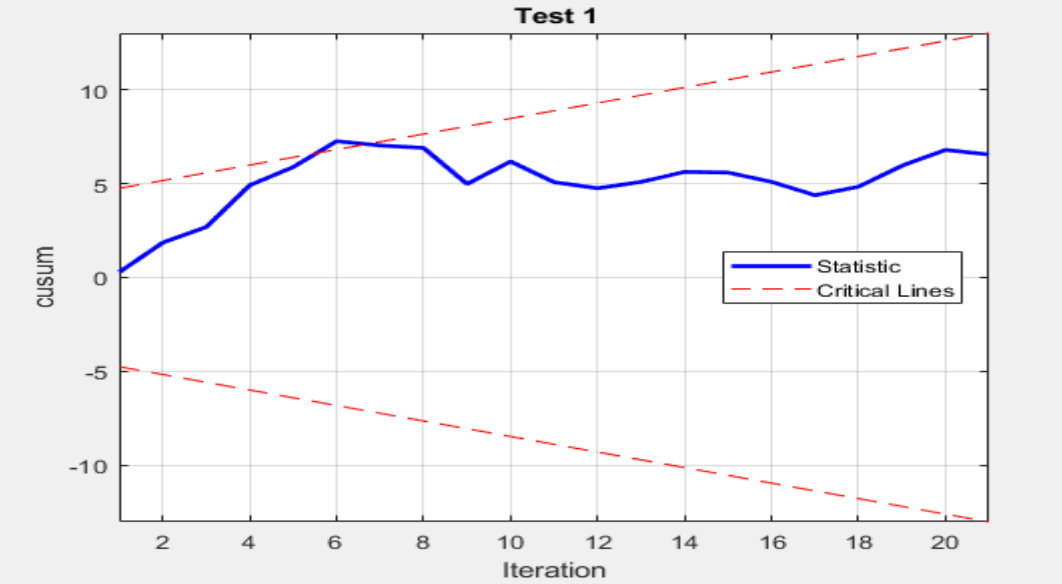

Figure 3: Structural Break

Source: MATLAB (2023)

The CUSUM result shows that Nigeria experienced a heavy shock in the crude oil trade that affected Nigeria's GDP. Crude oil is traded globally, therefore any change in its activities affects both the oil-producing/exporting and oil-importing countries. Data from Statista (2023), revealed that in 2013, there was a sharp drop in crude oil trade from $108.56 per barrel to $43.67 per barrel in 2016. According to Stocker et al. (2018), the booming shale oil production in the United States was a major factor in the drop in oil prices from mid-2014 to early 2016. The industry's efficiency improvements have reduced break-even pricing, making American shale oil the de facto marginal cost producer on the world oil market (Stocker et al. 2018). The impact of this oil drop on Nigeria's gross domestic product (GDP) was significant, particularly due to its reliance on a single product, namely crude oil. This stands in contrast to other oil-exporting nations, such as Saudi Arabia, which have diversified economies and produce a range of commodities including gold, iron ore, and copper in addition to crude oil.

After analyzing the results of the regression, the Akaike Information Criterion (AIC) was used to determine which model performed the best. The model with the lowest AIC (-82.904) is chosen as the best one (Brooks, 1989). Hence, since linear regression model satisfies the conditions of the traditional OLS linear regression model, it is considered the Best Linear Unbiased Estimator (BLUE).

This can be given as

$$Y_t = \alpha + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \mu_t$$

$$Nig\_GDP = 0.031 + 0.286BCOP + 0.137VLCC\_FR + 0.06INDIA\_i + \mu_t$$

Where: Nig_GDP = Nigeria's GDP per capita

BCOP = Brent crude oil price

VLCC_FR = Very Large Crude Carriers Freight rate

INDIA_i = India's crude oil import

The equation reveals that the Brent crude oil price exerts a significant influence of 28.6% on Nigeria's economy forn every 1% increase Brent Crude Oil Price, in contrast to the comparatively lesser impacts of the VLCC freight rate with 13.7% and India's crude oil import at 6.2%. The reason for this may be ascribed to the significant role played by the Brent crude oil price in the crude oil pricing, alongside the use of the VLCC freight rate as a determinant of the expenses incurred in carrying crude oil from its production sites to the locations where it is processed for consumption. The influence of India's crude oil import from Nigeria is relatively low even though it is a significant importer of Nigeria's crude oil.

4.5 Analysis of Findings

Crude oil trade plays a significant role in Nigeria's economic growth due to its substantial dependence on export earnings. As a result, any factor that affects the oil trade would inevitably exert either a positive or negative influence on the Nigerian economy. After the correlation analysis, a total number of 8 variables was used for the regression. Upon executing all the assumptions of the CLRM, it can be deduced from

the result of the findings that out of 8 remaining variables, only 3 variables were significant which include Brent crude oil price (BCOP), Very Large Crude Carriers freight rate (VLCC_FR), and India crude oil import (INDIA_i). These variables exhibited positive relationship which is statistically significant to Nigeria's GDP, while Nigeria crude oil production (Nig_oilprd), OPEC's crude oil production (OPEC_COP), London Interbank Offered Rate (LIBOR), and Iraq's crude oil export (IRAQ_e) were insignificant to Nigeria's GDP. The t-test of significance conducted, revealed that exchange rate (EXRATE) had a negative relationship and is statistically significant in relation to Nigeria's GDP per capita. That is, a 1% increase in the exchange rate will lead to an 8% decline in Nigeria's GDP. This can be ascribed to the weak value of Nigeria's currency against the U.S. dollar. The behavior of the exchange rate variable may be attributable to a small sample size or a large amount of random fluctuation, both of which make it difficult to identify a clear significant influence on the dependent variable even though one exists.

The Engle-Granger test reveals that BCOP has a long-term co-integration connection with Nigeria's GDP. This conforms with Xiuzhen et al. (2022), Maji et al. (2017), Hamilton (2009), and Hamilton (1983) whose findings indicate that oil price has long-term interconnectedness with GDP. This is evident in Figure 1, where both variables exhibit the same moving trend. The findings also indicate that the coefficient associated with Brent crude oil prices is both negative and statistically significant, suggesting that fluctuations in oil prices have a detrimental impact on Nigeria's economic growth. This is in line with the research by Maji et al. (2017), whose findings revealed that oil price shocks have significant effects on India's GDP. They also revealed that from year 2015 to year 2016, the drop in oil prices reduced tax revenues by 10.5%, lowered GDP by 1.9%, and raised the unemployment rate by 0.3%. thus, they advised that a steep decline in oil prices should serve as a stark warning to policymakers about the dangers of putting too much stock in oil exports and the pressing need to diversify the economy (Maji et al. 2017).

4.5.1 Brent Crude Oil Price

Benchmark crude oils serve as a point of reference for buyers and sellers in the determination of oil prices in Europe, Africa, and the Middle East (Statista, 2023b). According to Hamilton (2009), crude oil price is recognized as an important factor in the crude oil trade. Consequently, any fluctuations in the crude oil price would have a direct effect on the crude oil trade, thereby impacting Nigeria's economy. The aforementioned observation may be deduced from Table 10, wherein it was demonstrated that a 1% rise in the price of Brent crude oil is associated with a corresponding rise of 28.6% in the per capita GDP of Nigeria when all variables are held constant. The findings of Nyangarika (2018) which focused on oil-producing nations supports the notion that an increase in oil prices is positively correlated with continuous growth in the Gross Domestic Product (GDP) of both the United States and Saudi Arabia. Another research by Narayan & Narayan (2007) also agrees with these findings revealing that a continuous increase in crude oil prices can impact investments in oil inventories, as well as development and transportation facilities for oil production and exportation. Thus, the positive significance of crude oil prices has serious implication for Nigeria's economy as an oil-producing and exporting country.

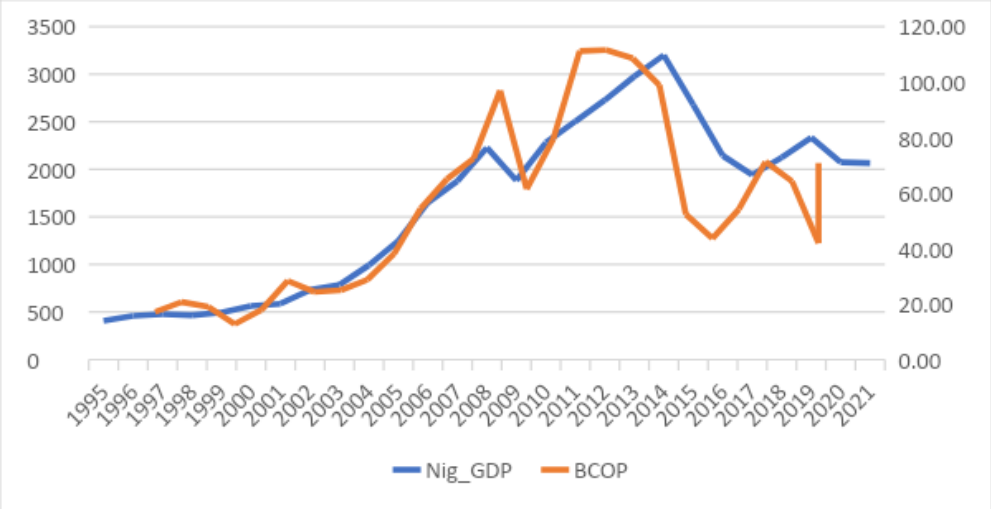

Figure 4: Nigeria's GDP per Capita and Brent Crude oil price

Source: World Bank data and Clarkson's SIN

Figure 1 shows how Brent crude oil price relates to Nigeria's GDP. It is observed that both variables are correlated.

4.5.2 VLCC Freight rate

Given that crude oil is mostly delivered by tankers, the crude oil price has a significant impact on crude tanker freight rates (Backer-Grøndahl et al., 2016), and (Mi et al., 2022). VLCC is a crucial element in the crude oil trade and they are used for transporting crude oil and its derivatives on a global scale from the area of production to the area of consumption. It is seen as a pivotal in facilitating the energy supply chain (Alizadeh et al., 2015).

The analysis in Table 10, shows that the VLCC freight rate is another factor that influences crude oil trade which directly has an impact on Nigeria's economy. The stusy reveals that a 1% increase in VLCC_FR will result in a 13.7% increase in Nigeria's GDP when other variables are held constant. These findings are consistent with the findings of Shi et al. (2013) and Backer-Grøndahl et al. (2016), which indicate that an upward movement in crude oil prices is associated with a corresponding increase in Very Large Crude Carrier (VLCC) freight rates, and vice versa. Therefore any impact on this variable will affect crude oil trade which will directly contribute to influencing Nigeria's GDP. A report published by Bloomberg (2023) revealed that the freight rate for vessels carrying around 1 million barrels of crude oil from Nigeria to Europe experienced a significant increase of over $16,000 per day to $64,000 per day and this surge is the most substantial rise observed since April 2022 that the country benefited from. According to Demirbas et al. (2017), the freight rate for VLCC has been influenced by both global economic activity and the levels of consumption and production of crude oil throughout time. This means that whenever the demand for crude oil is high there could be a corresponding limited supply of crude carriers, hence the price of oil may increase. Accordingly, a rise in price of oil supports Nigeria's economy. This increase in demand for oil and consequent rise in VLCC freight rate could be partly attributed to China and India which rank among the largest consumers of energy (Poulakidas & Joutz, 2009). Therefore a high VLCC freight rate signals oil

price increase which in turn boosts export earnings, government investment, and infrastructure initiatives which contribute to economic growth of Nigeria.

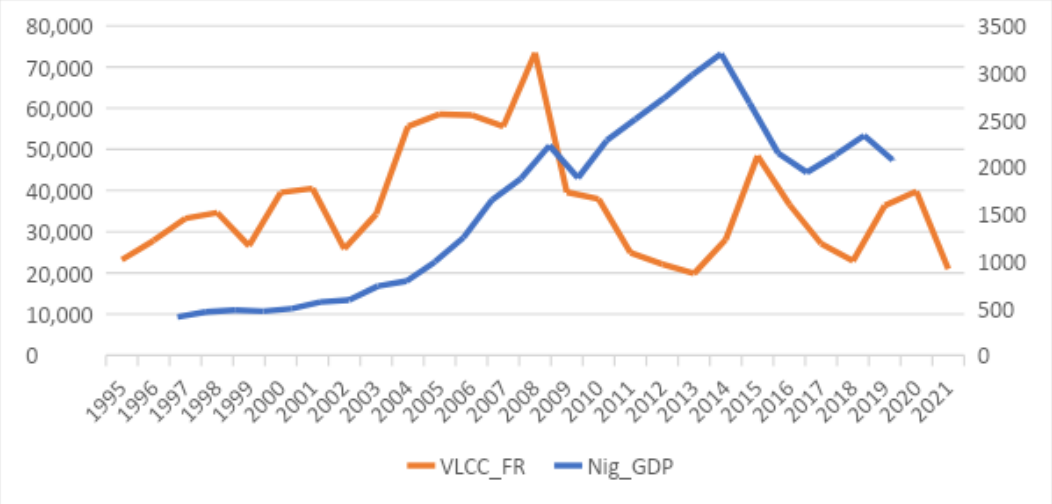

Figure 5:Nigeria's GDP per Capita and VLCC freight rate

Source: World Bank data and Clarkson's SIN

Figure 2 shows how the freight rate for a Very Large Crude Carrier (VLCC) relates to Nigeria's GDP. In 2008 and 2009, we saw a minor decline due to the worldwide economic downturn. From 2010 to 2013, the GDP continued to increase steadily, but then it had a steep decline between 2014 and 2017. This shows that crude oil is an essential commodity that impacts the global economy because it is relevant as a source of energy.

According to the findings of Mayr and Tamvakis (1999), there was a notable correlation between the rise in demand for imported crude oil, specifically Brent and Bonny, and an increase in the demand for maritime transportation. This surge in demand for sea transportation subsequently had a positive effect on freight rates (Mayr and Tamvakis, 1999). This shows a positive sign for Nigeria as it is a major exporter of crude oil in Africa because the country will sell more at a high price thereby increasing the export earnings of the country.

4.5.3 India Crude Oil Import

Table 10, indicates that India's crude oil import in value is positively and statistically significant to Nigeria's GDP. That is, a 1% increase in India's import of Nigeria's crude oil will lead to a 6.2% increase in Nigeria's per capita GDP when other variables are held constant. Research by N Dalei et al. (2017) reveals that India is a major importer of Nigeria's crude oil with about 8% to 12% of crude oil import from Nigeria. This is evident because Nigeria heavily depends on crude oil earnings of which India is a major buyer of Nigeria's oil.

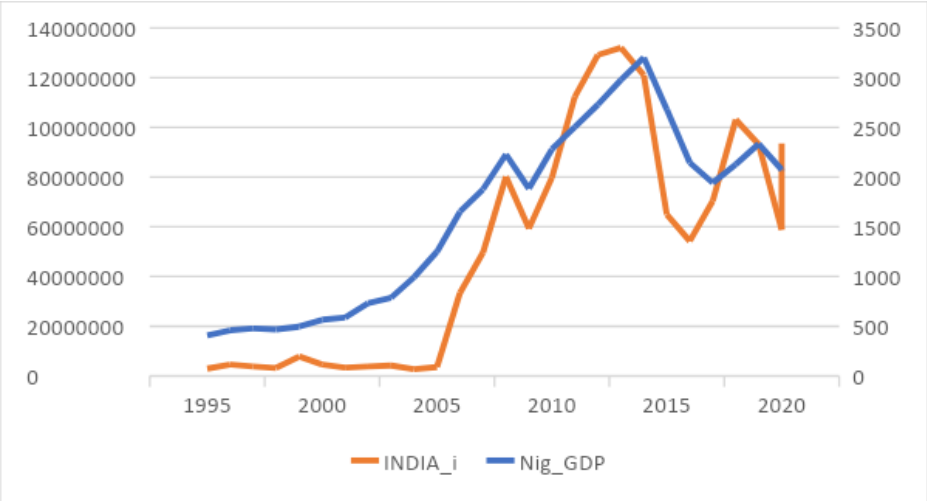

Figure 6:Nigeria's GDP Per Capita and India's crude oil import

Source: World Bank data and UN comtrade

Figure 3 illustrates a correlation between Nigeria's Gross Domestic Product (GDP) and India's crude oil import, indicating a similar pattern of movement. Consequently, the rise in India's crude oil imports leads to an increase in foreign revenues, making a significant contribution to the Nigerian economy. As a result, a drop in India's purchase will diminish Nigeria's revenue prospects from crude oil sales.

A report by Thisday (2021) revealed that India has emerged as the primary purchaser of Nigerian crude oil, following a reduction in crude oil imports by the United States on account of its significant increase in shale oil output. It also revealed that in the

2020 fiscal year, India purchased 107.89 million barrels of crude from Nigeria, followed by the Netherlands (73.5 million barrels) and Spain (70.4 million barrels). At this point, Nigeria must keep a healthy trade agreement with India to maintain a long-term relationship because it is significant to Nigeria's export earnings.

According to Asu (2021), in April, Nigeria had a significant decline in crude oil income amounting to an estimated ₦91.15bn. This decline was attributed to a reduction in imports by India, which happens to be Nigeria's largest purchaser of oil at the time. Specifically, India's imports decreased by about 30% in April 2021 when compared to the corresponding time in 2020. Asu (2021) also revealed that India's purchase of Nigerian crude oil in April 2021 amounted to 8.65 million barrels, equivalent to a daily average of 288,200 barrels. This figure represents a decrease compared to the previous year's corresponding month, wherein India had acquired 12.35 million barrels, equivalent to a daily average of 411,500 barrels. Asu went further to reveal that when the price of oil was $65 per barrel in April 2021, there was a decline of 3.7 million barrels in India's oil imports resulting in a revenue loss of $240.5 million (or ₦91.15 billion at an official exchange rate of ₦379/$1). This harms Nigeria’s economy because of its huge reliance on crude oil export earnings.

According to Sarmah & Bal, (2021), India predominantly relies on crude oil as a primary energy source for several economic sectors, including manufacturing, transportation, mining, and others. Therefore any fluctuations in the price of oil have a direct impact on the Indian economy, either favourably or negatively. It is plausible that the country may opt to transition its energy source by exploring other renewable energy, such as wind power, solar energy, and others to reduce its reliance on oil consumption (Sarmah & Bal, 2021). They also reveal that India is exhibiting indications that it might emerge as a significant beneficiary of a movement aimed at promoting renewable energy sources within the Asian nation. This rapid advancement of the global energy transition is having a more pronounced impact, presenting an additional challenge to Nigeria's oil income. As a result, the demand for Nigerian crude oil is expected to decrease in the coming years.

For instance, Sweden is more energy-efficient and uses less oil per person than many industrialised nations (Johansson & Backman, 2009). It is also thought to be one of the most forward-thinking nations when it comes to creating and utilising renewable energy sources, making it a less vulnerable country to crude oil shocks (Johansson & Backman, 2009). Other industrialised oil-importing nations, such as France, Spain, and the Netherlands, which have a history of purchasing Nigeria's crude oil, may also share the viewpoint that a complete transition from crude oil to renewable energy sources will protect their local economies from the adverse impacts of global oil price fluctuations.

Chapter 5- Summary and Conclusion

An article titled “Oil Rules Nigeria” written by Damu and Bacon (1996) is evident in Nigeria’s heavy reliance on crude oil sales for revenue generation. Consequently, the trade of crude oil plays significant role in shaping the economic dynamics of Nigeria as a major source of the country’s foreign earnings. By applying linear regression methodology on time series data, the study identified factors of crude oil trade that affect Nigeria’s GDP per capita, revealing the nature and magnitude of their impacts. The empirical results derived from this model, identified Brent crude oil price, VLCC freight rates, and India crude oil import as factors of crude oil trade that are statistically significant to Nigeria’s GDP.

This shows that crude oil price is an important factor that is significant to the economy of Nigeria, contributing up to by 28.6% for every 1% increase in crude oil price. Additionally, crude oil price is the only variable that has a long-term relationship (co-integrated) with the GDP of Nigeria, indicating that if the crude oil price increases globally, Nigeria’s GDP will increase but will decrease if the price falls.

The freight rate of Very Large Crude Carriers (VLCCs) is seen to be subject to the influence of crude oil prices. Consequently, any fluctuations in crude oil prices would inevitably impact the freight rate of VLCCs. Hence, the VLCC freight rate makes a substantial contribution of 13.7% to Nigeria's Gross Domestic Product (GDP).

India's oil import plays a significant role in Nigeria's economy. It is the only importing country that was significant out of the 4 countries considered. The reason is that its contribution in value is significant to Nigeria’s GDP compared to the contributions of the other countries (Spain, France, and the Netherlands). This is evident in the value of India's crude oil imports from Nigerians in 2022 amounted to US$7.37 billion. (Trading Economics, 2023). However, the three variables (SPAIN_i, FRA_i and NETH_i) were removed because they were correlating with BCOP at a value greater

than 80% when the correlation analysis was conducted so that the model does not give a spurious result.

In conclusion, this study elucidates the impacts of factors of crude oil trade that affect Nigeria's economy. Oil-producing and exporting nations such as Nigeria are confronted with volatilities and uncertainties of these factors, hence, the findings of this study hold considerable implications for crude oil trade policies and strategy in Nigeria.

Recommendation

Based on the results of this study, the government of Nigeria and other relevant institutions and organizations should prioritize the following policy recommendations.

First, the Nigerian government needs an oil price monitoring tool to ensure that oil prices are being tracked in an efficient and effective manner. In order to effectively oversee oil price dynamics, legal frameworks should be crafted to allow for the prudent management of oil output, even during periods of low crude oil prices..

Second, the government needs to establish policies and foster a culture that priorities the development, maintenance, and security of oil infrastructure and transportation systems. These policies will play a crucial role in promoting and stimulating economic expansion, as well as facilitating the influx of international investments and improving infrastructure that can yield benefits for industries other than the oil industry.

Third, it is crucial to emphasize the critical nature of establishing mutually beneficial bilateral agreements between Nigeria and its partners in the crude oil trade, particularly India. Initiatives that strengthen diplomatic ties and trade agreements with India should be sustained. Engaging in strategic initiatives of this nature would play a crucial role in reinforcing demand stability and ensuring a consistent and dependable source of revenue. It is important that these trade agreements should be transparent, accountable and workable.

Considering the volatilities and uncertainties inherent in crude oil trade, revenue diversification and growth is crucial for Nigeria's economic stability. Accordingly, in developing such policies, it is crucial to give precedence to the diversification of sectors such as agriculture, industry, and technology. The principal objective of this strategic approach is to strengthen non-oil exports to surpass imports, thereby reducing the vulnerabilities of the economy to crude oil trade, and consequently promoting a more resilient and sustainable economy.

Furthermore, in a publication by the Nigerian Tribune (2023), it was noted that Nigeria, as a member of the Organization of Petroleum Exporting Countries (OPEC), lacks a national carrier that represents its flag. For instance, Saudi Arabia boasts Bahri Oil (formerly Vela), a major global tanker firm under Saudi Aramco, while Iran operates the National Iranian Tanker Company (NITC) controlling its transport and exports. Hence, it is recommended that the government make investments and establish a National carrier for marine transport by means of a Public-Private Partnership (PPP). The proposed project has the potential to favourably influence Nigeria's economy by generating foreign earnings, creating job opportunities, and improving the standard of living.

Finally, future academics may explore the implication of Nigerian reliance on crude oil earnings and the for economic diversification in order to ensure a long-term economy viability and sustainability. Another potential area of research could focus on exploring strategies for Nigeria to enhance its economic resilience in the face of fluctuating global oil prices. This could involve examining the efficacy of fiscal policies and the implementation of hedging mechanisms as a means to mitigate the adverse impacts of price volatility on Nigeria's economy.

References

Abdelsalam, M. A. M. (2020). Oil price fluctuations and economic growth: the case of MENA countries. *Review of Economics and Political Science*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/reps-12-2019-0162

Adams, S. O., & Olamide Bello, J. (2022). Modeling the effect of crude oil production and other factors on Nigeria's economy: an autoregressive distributed lag approach. *Science Archives*, *03*(01), 72–79. https://doi.org/10.47587/sa.2022.3109

Adolfsen, J. F., Gerinovics, R., Manu, A.-S., & Schmith, A. (2023). Oil price developments and Russian oil flows since the EU embargo and G7 price cap. *Www.ecb.europa.eu*. https://www.ecb.europa.eu/pub/economic-bulletin/focus/2023/html/ecb.ebbox202302_02~59c965249a.en.html

Akinlo, A. E. (2012). How Important is Oil in Nigeria's Economic Growth? *Journal of Sustainable Development*, *5*(4). https://doi.org/10.5539/jsd.v5n4p165

Akintayo, O. (2023, April 6). *Nigeria's low oil production will affect OPEC+ supplies – Report*. Punch Newspapers. https://punchng.com/nigerias-low-oil-production-will-affect-opec-supplies-report/#google_vignette

Alizadeh, A. H., Huang, C.-Y., & van Dellen, S. (2015). A regime switching approach for hedging tanker shipping freight rates. *Energy Economics*, *49*, 44–59. https://doi.org/10.1016/j.eneco.2015.01.004

Alkhateeb, T. T. Y., & Sultan, Z. A. (2019). Oil Price and Economic growth: The case of Indian Economy. *International Journal of Energy Economics and Policy*, *9*(3), 274–279. https://doi.org/10.32479/ijeep.7602

Alogoskoufis, G., & Smith, R. (1991). On Error Correction Models: Specification, Interpretation, Estimation. *Journal of Economic Surveys*, *5*(1), 97–128. https://doi.org/10.1111/j.1467-6419.1991.tb00128.x

Ani, W., Ugwunta, D., Oliver, I., & Eneje, B. (2014). Oil price volatility and economic development: Stylized evidence in Nigeria. *Journal of Economics and International Finance*, *6*(6), 125–133. https://doi.org/10.5897/jeif2014.0572

Arinze, P. (2011). *The impact of oil price on the nigerian economy*. http://nairametrics.com/wp-content/uploads/2013/10/the-impact-of-oil-price-on-the-Nigerian-economy.pdf

Asekunowo, V. O., & Olaiya, S. A. (2012). Crude oil revenue and economic development in Nigeria (1974-2008). *OPEC Energy Review*, *36*(2), 138–169. https://doi.org/10.1111/j.1753-0237.2011.00205.x

Asu, F. (2021, June 19). *Nigeria lost N91bn in April as India cuts oil imports*. Punch Newspapers. https://punchng.com/nigeria-lost-n91bn-in-april-as-india-cuts-oil-imports/

Atalayar. (2022, February 10). *Nigeria, Mexico and Libya are Spain's main oil suppliers in 2021*. Atalayar. https://www.atalayar.com/en/articulo/economy-and-business/nigeria-mexico-and-libya-are-spains-main-oil-suppliers-2021/20220210113300155032.html

Ayhan Demirbas. (2016). *Deposition and flocculation of asphaltenes from crude oils*. *34*(1), 6–11. https://doi.org/10.1080/10916466.2015.1115875

Backer-Grøndahl, C., Supervisor, B., & Tenold, S. (2016). *How did the oil price influence the freight rates for VLCC crude oil tankers between 2005 and 2015?* https://openaccess.nhh.no/nhh-xmlui/bitstream/handle/11250/2432136/masterthesis.PDF?sequence=1

Baltagi, B. H., Jung, B. C., & Song, S. H. (2010). Testing for heteroskedasticity and serial correlation in a random effects panel data model. *Journal of Econometrics*, *154*(2),122–124. https://doi.org/10.1016/j.jeconom.2009.04.009

Baptista, M., Sankararaman, S., de Medeiros, Ivo. P., Nascimento, C., Prendinger, H., & Henriques, E. M. P. (2018). Forecasting fault events for predictive maintenance using data-driven techniques and ARMA modeling. *Computers & Industrial Engineering*, *115*, 41–53. https://doi.org/10.1016/j.cie.2017.10.033

Baquer, O. C. (2022, March 17). *The impact of a rise in the price of oil and gas in Spain: possible scenarios*. CaixaBank Research. https://www.caixabankresearch.com/en/economics-markets/commodities/impact-rise-price-oil-and-gas-spain-possible-scenarios

Barros, C. P., Gil-Alana, L. A., & Payne, J. E. (2011). An analysis of oil production by OPEC countries: Persistence, breaks, and outliers. *Energy Policy*, *39*(1), 442–453. https://doi.org/10.1016/j.enpol.2010.10.024

Bediako E, B., IJ, O., & KK, U. (2018). Economic Effects of Oil Price Volatility on Developing Countries: A Case Study of an Oil Exporting Country. *International Journal of Economics & Management Sciences*, *07*(02). https://doi.org/10.4172/2162-6359.1000509

Benoit, K. (2012). *The Classical Linear Regression Model ME104: Linear Regression Analysis*. https://kenbenoit.net/assets/courses/ME104/ME104_Day2_CLRM.pdf

Benramdane, A. (2017). Oil price volatility and economic growth in Algeria. *Energy Sources, Part B: Economics, Planning, and Policy*, *12*(4), 338–343. https://doi.org/10.1080/15567249.2015.1128015

Bildirici, M. E., & Kayıkçı, F. (2013). Effects of oil production on economic growth in Eurasian countries: Panel ARDL approach. *Energy*, *49*, 156–161. https://doi.org/10.1016/j.energy.2012.10.047

Bloomberg. (2023, June 16). Nigeria's Oil Shipping Costs Soar as Tanker Owners Steer Clear. *Bloomberg.com*. https://www.bloomberg.com/news/articles/2023-06-16/nigeria-s-oil-shipping-costs-soar-as-tanker-owners-steer-clear?in_source=embedded-checkout-banner

Brooks, D. G. (1989). Akaike Information Criterion Statistics. *Technometrics*, *31*(2), 270–271. https://doi.org/10.1080/00401706.1989.10488538

CFI Team. (2019, November 11). *Crude Oil Overview*. Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/economics/crude-oil-overview/

Damu, J., & Bacon, D. (1996). Oil Rules Nigeria. *The Black Scholar*, *26*(1), 51–54. https://doi.org/10.1080/00064246.1996.11430775

Demirbas, A., Omar Al-Sasi, B., & Nizami, A.-S. (2017). Recent volatility in the price of crude oil. *Energy Sources, Part B: Economics, Planning, and Policy*, *12*(5), 408–414. https://doi.org/10.1080/15567249.2016.1153751

Engle, R. F., & C. W. J. Granger. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, *55*(2), 251–276. https://doi.org/10.2307/1913236

Fei, Y., Chen, J., Wan, Z., Shu, Y., Xu, L., Li, H., Bai, Y., & Zheng, T. (2020). Crude oil maritime transportation: Market fluctuation characteristics and the impact of critical events. *Energy Reports*, *6*, 518–529. https://doi.org/10.1016/j.egyr.2020.02.017

Gallo, A. (2015, November 4). *A Refresher on Regression Analysis*. Harvard Business Review. https://hbr.org/2015/11/a-refresher-on-regression-analysis#:~:text=A%20regression%20line%20always%20has

Gillies, A., Gueniat, M., & Kummer, L. (2014). *Big Spenders: Swiss Trading Companies, African Oil and the Risks of Opacity*. Natural Resource Governance Institute. https://resourcegovernance.org/publications/big-spenders-swiss-trading-companies-african-oil-and-risks-opacity

Griffiths, S., Sovacool, B. K., Kim, J., Bazilian, M., & Uratani, J. M. (2022). Decarbonizing the oil refining industry: A systematic review of sociotechnical systems, technological innovations, and policy options. *Energy Research & Social Science*, *89*, 102542. https://doi.org/10.1016/j.erss.2022.102542

Gupta, A., Mishra, P., Pandey, C., Singh, U., Sahu, C., & Keshri, A. (2019). Descriptive Statistics and Normality Tests for Statistical Data. *Annals of Cardiac Anaesthesia*, *22*(1), 67.

Hameed T, N. S. (2015). Impact of Oil Price and Shocks on Economic Growth of Pakistan: Multivariate Analysis (Sectoral Oil Consumption). *Business and Economics Journal*, *06*(04). https://doi.org/10.4172/2151-6219.1000182

Hamilton, J. (2009). *Causes and Consequences of the Oil Shock of 2007-08*. https://doi.org/10.3386/w15002

Hamilton, J. D. (1983). Oil and the Macroeconomy since World War II. *Journal of Political Economy*, *91*(2), 228–248. https://doi.org/10.1086/261140

Hamilton, J. D. (2011). Nonlinearities and the macroeconomic effects of oil prices. *Macroeconomic Dynamics*, *15*(S3), 364–378. https://doi.org/10.1017/s1365100511000307

Hennig, F., Nygreen, B., Christiansen, M., Fagerholt, K., Furman, K. C., Song, J., Kocis, G. R., & Warrick, P. H. (2012). Maritime crude oil transportation – A split pickup and split delivery problem. *European Journal of Operational Research*, *218*(3), 764–774. https://doi.org/10.1016/j.ejor.2011.09.046

Htoon, K. S. (2020, February 29). *Log Transformation: Purpose and Interpretation*. Medium. https://medium.com/@kyawsawhtoon/log-transformation-purpose-and-interpretation-9444b4b049c9

International Trade Administration. (2022, July 26). *United Arab Emirates - Oil and Gas*. www.trade.gov. https://www.trade.gov/country-commercial-guides/united-arab-emirates-oil-and-gas

International trade administration. (2022, August 5). *Angola - Market Overview*.

Www.trade.gov.https://www.trade.gov/country-commercial-guides/angola-market-overview#

Jahangir Amuzegar. (1983). *Oil Exporters' Economic Development in an Interdependent World*. IMF. https://doi.org/10.5089/9781557750785.084

Jiménez-Rodríguez, R., & Sánchez, M. (2005). Oil price shocks and real GDP growth: empirical evidence for some OECD countries. *Applied Economics*, *37*(2), 201–228. https://doi.org/10.1080/0003684042000281561

Johansson, B., & Backman, M. (2009). *j ö n k ö p i n g i n t e r n a t i o n a l b u s i n Oil price fluctuations and its effect on GDP growth*. https://www.diva-portal.org/smash/get/diva2:202051/fulltext01.pdf

Kalantzis, Y., & Ouvrard, J.-F. (2018, February 28). *The impact of oil prices on inflation in France and the euro area*. Banque de France. https://blocnotesdeleco.banque-france.fr/en/blog-entry/impact-oil-prices-inflation-france-and-euro-area

Kamer, L. (2023, August 29). *Main oil producing countries in Africa 2019*. Statista. https://www.statista.com/statistics/1178514/main-oil-producing-countries-in-africa/

Kamyk, J., Kot-Niewiadomska, A., & Galos, K. (2021). The criticality of crude oil for energy security: A case of Poland. *Energy*, *220*, 119707. https://doi.org/10.1016/j.energy.2020.119707

Kaufmann, R. K., Bradford, A., Belanger, L. H., Mclaughlin, J. P., & Miki, Y. (2008). Determinants of OPEC production: Implications for OPEC behavior. *Energy Economics*, *30*(2), 333–351. https://doi.org/10.1016/j.eneco.2007.04.003

Lizardo, R. A., & Mollick, A. V. (2010). Oil price fluctuations and U.S. dollar exchange rates. *Energy Economics*, *32*(2), 399–408. https://doi.org/10.1016/j.eneco.2009.10.005

Maji, I. K., Saari, M. Y., Habibullah, M. S., & Utit, C. (2017). Measuring the economic impacts of recent oil price shocks on oil-dependent economy: evidence from Malaysia. *Policy Studies*, *38*(4), 375–391. https://doi.org/10.1080/01442872.2017.1320706

MAYR, T. P., & TAMVAKIS, M. N. (1999). The dynamic relationships between paper petroleum refining and physical trade of crude oil into the United States. *Maritime Policy & Management*, *26*(2), 127–136. https://doi.org/10.1080/030888399286952

Merikas, A. G., Merikas, A. A., Polemis, D., & Triantafyllou, A. (2013). The economics of concentration in shipping: Consequences for the VLCC tanker sector. *Maritime Economics & Logistics*, *16*(1), 92–110. https://doi.org/10.1057/mel.2013.19

Miller, R. G., & Sorrell, S. R. (2013). The future of oil supply. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *372*(2006), 20130179–20130179. https://doi.org/10.1098/rsta.2013.0179

Murshed, M. (2022). The impacts of fuel exports on sustainable economic growth: The importance of controlling environmental pollution in Saudi Arabia. *Energy Reports*, *8*, 13708–13722. https://doi.org/10.1016/j.egyr.2022.09.186

Musa, Y. (2015). An analysis of the impact of oil price shocks on the growth of the Nigerian economy: 1970-2011. *African Journal of Business Management*, *9*(3), 103–115. https://doi.org/10.5897/ajbm2014.7458

N Dalei, N. A. G., Roy, H., & Gupta, A. (2017). *Crude oil import of India from its major oil trade partner countries: An empirical evidence using panel data analysis. International Journal of Advanced Research and Development,*. 2(6), 726-735.

Nairametrics. (2022). *Crude oil exports fall to an average of $39 billion per annum* . Nairametrics. https://nairametrics.com/2022/04/19/nigeria-made-195-11-billion-from-crude-oil-export-over-between-2017-and-2021/

Narayan, P. K., & Narayan, S. (2007). Modelling oil price volatility. *Energy Policy*, *35*(12), 6549–6553. https://doi.org/10.1016/j.enpol.2007.07.020

Nariametrics. (2021, July 17). *Latest drop in India's oil import spells bad news for Nigeria's forex reserves*. Nairametrics. https://nairametrics.com/2021/07/17/latest-drop-in-indias-oil-import-spells-bad-news-for-nigerias-forex-reserves/#:~:

National Bureau of Statistics. (2022). *Nigerian Gross Domestic Product report Q1 2022*. Nigerianstat.gov.ng. https://www.nigerianstat.gov.ng/

Nazer, Y. .F., & Pescatori, A. (2022). OPEC and the oil market. In *www.imf.org* (pp. 1–30). International Monetary Fund. https://www.imf.org/-/media/Files/Publications/WP/2022/English/wpiea2022183-print-pdf.ashx

Nigerian Tribune. (2023, September 6). *Nigeria only OPEC country without national shipping line — Oyetola*. Tribune Online. https://tribuneonlineng.com/nigeria-only-opec-country-without-national-shipping-line-oyetola/

Nwanna , I. O., & Eyedayi, A. M. (2016). *Impact of crude oil price volatility on economic growth in Nigeria (1980–2014)*. IOSR Journal of Business and Management (IOSR-JBM), 18(6), 10-19. https://doi.org/10.9790/487X-1806011019

Nyangarika, A. M. (2018). *Correlation of oil prices and gross domestic product in oil producing countries*. Www.zbw.eu. http://hdl.handle.net/11159/2613

Odularu, G. O. (2008). *Crude oil and the Nigerian economic performance. Oil and Gas business, 2008, 1-29.* http://www.ogbus.ru/eng/

OECD. (2023). *Oil commodity trading and addressing the risk of illicit financial flows IFFs and Oil Commodity Trading Series*. https://www.oecd.org/dac/oil-commodity-trading-risk-financial-flows.pdf

Omolade, A., Ngalawa, H., & Kutu, A. (2019). Crude oil price shocks and macroeconomic performance in Africa's oil-producing countries. *Cogent Economics & Finance*, *7*(1). https://doi.org/10.1080/23322039.2019.1607431

OPEC. (2019). *Organization of the Petroleum Exporting Countries : Brief History*. Opec.org. https://www.opec.org/opec_web/en/about_us/24.htm

Periwal, A. (2023). The Impact of Crude Oil Price Fluctuations on Indian Economy. *International Journal for Research in Applied Science and Engineering Technology*, *11*(4), 3173–3202. https://doi.org/10.22214/ijraset.2023.50851

Planete Energies. (2021, March 26). *A Brief History of Oil Prices*. Www.planete-Energies.com. https://www.planete-energies.com/en/media/article/brief-

history-oil-prices
Poulakidas, A., & Joutz, F. (2009). Exploring the link between oil prices and tanker rates. *Maritime Policy & Management*, *36*(3), 215–233. https://doi.org/10.1080/03088830902861094
Rout, A. R. (2020, May 31). *ML - Advantages and Disadvantages of Linear Regression*. GeeksforGeeks. https://www.geeksforgeeks.org/ml-advantages-and-disadvantages-of-linear-regression/
Sahara Reporter. (2023, April 4). *20 Nigerian Crude Oil Ships Stranded In International Market Over Reduced Demands In France, Spain, India, Others Sahara Reporters*. Saharareporters.com. https://saharareporters.com/2023/04/04/20-nigerian-crude-oil-ships-stranded-international-market-over-reduced-demands-france
Sani, S., & Nwoye, M. I. (2023). *Effect of International Crude Oil Prices on Nigeria's Gross Domestic Product from (1985-2020)*. *11*(01), 118–137. https://doi.org/10.4236/jhrss.2023.111008
Schaer, C. (2022, November 6). *Saudi Arabia's economic shift from oil to ski slopes —fantasy or genuine? | DW | 11.06.2022*. DW.COM. https://www.dw.com/en/skiing-in-saudi-arabia-fantasy-or-genuine-economic-change/a-62090850
Semih Serkant Aktuğ, Mehmet Dağ, & Hawar Rafaat Star. (2019). *The impact of Oil Price on Economic growth: An investigation on Iraqi Economy*. *R&S - Research Studies Anatolia Journal*, *2*(6), 273–285. https://doi.org/10.33723/rs.580739
Shi, W., Yang, Z., & Li, K. X. (2013). The impact of crude oil price on the tanker market. *Maritime Policy & Management*, *40*(4), 309–322. https://doi.org/10.1080/03088839.2013.777981
Shrestha, N. (2020). Detecting Multicollinearity in Regression Analysis. *American Journal of Applied Mathematics and Statistics*, *8*(2), 39–42. https://doi.org/10.12691/ajams-8-2-1
Shukur, G., & Mantalos, P. (2004). Size and Power of the RESET Test as Applied to Systems of Equations: A Bootstrap Approach. *Journal of Modern Applied Statistical Methods*, *3*(2), 370–385. https://doi.org/10.22237/jmasm/1099267800
Shwe Sin Htay, & Jatta, F. K. (2021). *Factors affecting crude oil and VLCC market*. The Maritime Commons: Digital Repository of the World Maritime University. https://commons.wmu.se/all_dissertations/1744?utm_source=commons.wmu.se%2Fall_dissertations%2F1744&utm_medium=PDF&utm_campaign=PDFCoverPages
Song, Y., Chen, B., Hou, N., & Yang, Y. (2022). Terrorist attacks and oil prices: A time-varying causal relationship analysis. *Energy*, *246*, 123340. https://doi.org/10.1016/j.energy.2022.123340
Squalli, J. (2007). Electricity consumption and economic growth: Bounds and causality analyses of OPEC members. *Energy Economics*, *29*(6), 1192–1205. https://doi.org/10.1016/j.eneco.2006.10.001

Statista. (2022). *Topic: Oil industry in Nigeria*. Statista. https://www.statista.com/topics/6914/oil-industry-in-nigeria/

Statista. (2023a). *Average UK Brent oil price 1976-2019 | Statista*. Statista; Statista. https://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/

Statista. (2023b). *Brent monthly crude oil price 2019-2020*. Statista. https://www.statista.com/statistics/262861/uk-brent-crude-oil-monthly-price-development/

Statista. (2023c). *Netherlands: oil consumption 2022*. Statista. https://www.statista.com/statistics/264414/oil-consumption-in-the-netherlands/

Statista. (2023d). *Nigeria: contribution of oil sector to GDP 2018-2020*. Statista. https://www.statista.com/statistics/1165865/contribution-of-oil-sector-to-gdp-in-nigeria/

Stenberg, E., & Yang, Y. (2016). *On the Autoregressive Conditional Heteroskedasticity Models*. https://www.diva-portal.org/smash/get/diva2:933131/fulltext01.pdf

Steyn, P. (2009). Oil Exploration in Colonial Nigeria,c. 1903–58. *The Journal of Imperial and Commonwealth History*, *37*(2), 249–274. https://doi.org/10.1080/03086530903010376

Stocker, M., Baffes, J., & Vorisek, D. (2018, January 18). *What triggered the oil price plunge of 2014-2016 and why it failed to deliver an economic impetus in eight charts*.World Bank Blogs. https://blogs.worldbank.org/developmenttalk/what-triggered-oil-price-plunge-2014-2016-and-why-it-failed-deliver-economic-impetus-eight-charts

Thisday. (2021, September 6). *India, netherlands, spain emerge top export destinations for nigeria's crude oil - Thisdaylive*. Www.thisdaylive.com. https://www.thisdaylive.com/index.php/2021/09/06/india-netherlands-spain-emerge-top-export-destinations-for-nigerias-crude-oil

Thisday. (2022a). *Replacing Oil as Mainstay of Nigerian Economy - Thisdaylive*. Www.thisdaylive.com. https://www.thisdaylive.com/index.php/2022/08/31/replacing-oil-as-mainstay-of-nigerian-economy

Thisday. (2022b, July 1). *OPEC Faces Critical Oil Production Decision as Nigeria Gets 1.826m bpd August Quota*. Arise News. https://www.arise.tv/opec-faces-critical-oil-production-decision-as-nigeria-gets-1-826m-bpd-august-quota/

Thisday. (2023, August 3). *Nigeria's Increasing Crude Oil Production Reduces OPEC's Declining Outputs - Thisdaylive*. Www.thisdaylive.com. https://www.thisdaylive.com/index.php/2023/07/02/nigerias-increasing-crude-oil-production-reduces-opecs-declining-outputs

Trading economics. (2023). *India Imports from Nigeria of Crude Oil - 2023 Data 2024 Forecast 1991-2022 Historical*. Tradingeconomics.com. https://tradingeconomics.com/india/imports/nigeria/crude-oil-petroleum-bituminous-minerals

Tsirimokos, C. (2011). *Price and Income Elasticities of Crude Oil Demand The case*

of ten IEA countries. https://stud.epsilon.slu.se/3594/1/Master%20Thesis.pdf

U.S. Energy Information Administration. (2016, August 18). *Crude oil disruptions in Nigeria increase as a result of militant attacks*. Www.eia.gov. https://www.eia.gov/todayinenergy/detail.php?id=27572#

U.S. Energy Information Administration. (2022, February 25). *Oil prices and outlook - U.S. Energy Information Administration (EIA)*. Eia.gov. https://www.eia.gov/energyexplained/oil-and-petroleum-products/prices-and-outlook.php

U.S. Energy Information Administration. (2023). *Nigeria was the top crude oil producer in Africa, but disruptions threaten production*. Www.eia.gov. https://www.eia.gov/todayinenergy/detail.php?id=56840#

Ukemenam, A. I., Opadeji, B., Garbobiya, T. S., & Ujunwa, A. (2018). Macroeconomic Effects of Exogenous Oil Price Shock in Nigeria: Persistent or Transitory. *International Journal of Economics and Finance*, *10*(11), 28. https://doi.org/10.5539/ijef.v10n11p28

Venkataraman, P., & Subramaniam, K. (2022, June 14). *An Empirical Analysis of Financial Performance of Selected Oil Exploration and Production Companies in India*. Social Science Research Network. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4136624

Verbeek, M. (2017). Using linear regression to establish empirical relationships. *IZA World of Labor*. https://doi.org/10.15185/izawol.336

World Trade Organization. (2010). *World Trade Report Trade in natural resources*. https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report10_e.pdf

Xiuzhen, X., Zheng, W., & Umair, M. (2022). Testing the fluctuations of oil resource price volatility: A hurdle for economic recovery. *Resources Policy*, *79*, 102982. https://doi.org/10.1016/j.resourpol.2022.102982

Yunusa, L. A. (2020). Exchange rate volatility and Nigeria crude oil export market. *Scientific African*, *9*, e00538. https://doi.org/10.1016/j.sciaf.2020.e00538

Zach. (2021, January 20). *What is a Chow Test? (Explanation & Example)*. Statology. https://www.statology.org/chow-test/

Appendices

Appendix 1 Regression Analysis

>> regression_results_0

regression_results_0 =

Linear regression model:
Nig_GDP ~ 1 + Nig_oilprd + BCOP + OPEC_COP + VLCC_FR + EXRATE + LIBOR + INDIA_i + IRAQ_e

Estimated Coefficients:

	Estimate	**SE**	**tStat**	**P value**
Intercept	0.052	0.022	2.380	0.029
Nig_oilprd	0.111	0.229	0.482	0.635
BCOP	0.253	0.079	3.197	0.005
OPEC_COP	-0.502	0.518	-0.968	0.346
VLCC_FR	0.158	0.068	2.326	0.032
EXRATE	-0.128	0.070	-1.838	0.083
LIBOR	-0.008	0.041	-0.213	0.833
INDIA_i	0.089	0.038	2.293	0.034
IRAQ_e	0.004	0.017	0.263	0.795

Number of observations: 26, Error degrees of freedom: 17
Root Mean Squared Error: 0.0909
R-squared: 0.679, Adjusted R-Squared: 0.528
F-statistic vs. constant model: 4.5, p-value = 0.00443

>> regression_results_1

regression_results_1 =

Linear regression model:
Nig_GDP ~ 1 + BCOP + VLCC_FR + EXRATE + INDIA_i

Estimated Coefficients:

	Estimate	SE	tStat	P value
Intercept	0.052	0.018	2.783	0.011
BCOP	0.232	0.065	3.564	0.001
VLCC_FR	0.135	0.055	2.432	0.024
EXRATE	-0.114	0.062	-1.831	0.081
INDIA_i	-0.085	0.035	2.370	0.027

Number of observations: 26, Error degrees of freedom: 21
Root Mean Squared Error: 0.0858
R-squared: 0.647, Adjusted R-Squared: 0.58
F-statistic vs. constant model: 9.63, p-value = 0.000139

>> regression_results_3

regression_results_3 =

Linear regression model:
Nig_GDP ~ 1 + BCOP + VLCC_FR + INDIA_i + ect_BCOP

Estimated Coefficients:

	Estimate	SE	tStat	P value
Intercept	0.039	0.011	3.378	0.002
BCOP	0.289	0.045	6.388	2.4759e-06
VLCC_FR	0.093	0.038	2.427	0.024
INDIA_i	0.053	0.024	2.163	0.042
ect_BCOP	-0.277	0.049	-5.641	1.3415e-06

Number of observations: 26, Error degrees of freedom: 21
Root Mean Squared Error: 0.0583
R-squared: 0.837, Adjusted R-Squared: 0.806
F-statistic vs. constant model: 27, p-value = 5.14e-08

>> regression_results_5

regression_results_5 =

Linear regression model:
Nig_GDP ~ 1 + BCOP + VLCC_FR + INDIA_i + ect_BCOP + AR + MA

Estimated Coefficients:

	Estimate	**SE**	**tStat**	**P value**
Intercept	0.037	0.024	1.538	0.141
BCOP	0.296	0.046	6.392	5.093e-06
VLCC_FR	0.113	0.040	2.808	0.011
INDIA_i	0.069	0.027	2.543	0.020
ect_BCOP	-0.256	0.130	-1.964	0.065
AR	0.021	0.268	0.080	0.936
MA	-0.410	0.566	-0.723	0.478

Number of observations: 25, Error degrees of freedom: 18
Root Mean Squared Error: 0.0581
R-squared: 0.86, Adjusted R-Squared: 0.813
F-statistic vs. constant model: 18.4, p-value = 8.73e-07

>> regression_results_7

regression_results_7 =

Linear regression model:
Nig_GDP ~ 1 + BCOP + VLCC_FR + INDIA_i + ect_BCOP

Estimated Coefficients:

	Estimate	**SE**	**tStat**	**P value**
Intercept	0.042	0.011	3.558	0.002
BCOP	0.293	0.045	6.522	2.343e-06
VLCC_FR	0.098	0.038	2.571	0.018
INDIA_i	0.056	0.024	2.282	0.033
ect_BCOP	-0.284	0.049	-5.801	1.1221e-05

Number of observations: 25, Error degrees of freedom: 20
Root Mean Squared Error: 0.0577
R-squared: 0.847, Adjusted R-Squared: 0.816
F-statistic vs. constant model: 27.6, p-value = 6.76e-08

>> regression_results_9

regression_results_9 =

Linear regression model:
Nig_GDP ~ 1 + BCOP + VLCC_FR + INDIA_i + ect_BCOP + dummy8

Estimated Coefficients:

	Estimate	**SE**	**tStat**	**P value**
Intercept	0.031	0.009	3.146	0.002
BCOP	0.286	0.034	8.265	7.0149e-08
VLCC_FR	0.137	0.031	4.377	0.000
INDIA_i	0.062	0.019	3.269	0.003
ect_BCOP	-0.238	0.038	-6.168	5.0136e-06
dummy8	0.195	0.048	4.006	0.000

Number of observations: 26, Error degrees of freedom: 20
Root Mean Squared Error: 0.0445
R-squared: 0.91, Adjusted R-Squared: 0.887a
F-statistic vs. constant model: 40.3, p-value = 8.97e-10

Appendix 2 Criterion Model

Criterion	Regression 1 T-test	Regression 3 Co-integration test	Regression 7 ARCH/SE	Regression 9 Normality test
AIC	-49.4568	-69.5868	-65.5028	-82.9041
AICc	-46.4568	-66.5868	-58.9146	-78.4831
BIC	-43.1663	-53.2963	-56.9707	-75.3556
CAIC	-38.1663	-58.2963	-49.9707	-69.3556