International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2022, 12(3), 341-351.

Achieving Sustained Performance in the Nigerian Oil and Gas Sector Despite Exchange Rate Fluctuations: A VAR Approach

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Received: 16 December 2021 **Accepted:** 13 April 2022 **DOI:** https://doi.org/10.32479/ijeep.12787

ABSTRACT

The issue of sustaining performance in the Nigerian oil and gas sector is one issue that is of concern to the present government of President Muhammadu Buhari and is in line with the UN's Sustainable Development Goal (SDG) 7 of Clean Energy. The study examined the relationship between exchange rate fluctuations and Nigerian oil and gas sector performance with respect to achieving a sustainable economic growth. The three models used for the study are OBOP = f(OILE, OILI); OILO = f(EXR); and OILE = f(EXR). Secondary data were gathered and analyzed using the vector autoregression (VAR). The unit root test showed that all the variables were stationary at first difference while the Johansen cointegration proved the presence of a long run relationship among the variables in the model. The VAR result revealed that both oil export (OILE(-1)) and oil imports (OILI(-1)) were significant both positively and negatively respectively with overall balance of payments (OBOP). Also, nominal exchange rate (EXR(-1)) was positively significant with OILE while EXR(-1) was negatively significant with OILO. The study therefore recommended amongst others that more refineries should be built in Nigeria, so more products are extracted from crude oil and can be exported to boost revenue.

Keywords: Nigerian Oil and Gas, Exchange Rate, Balance of Payment, Oil Exports, VAR
JEL Classifications: F31; K32; Q43

1. INTRODUCTION

The relevance of the oil and gas sector is dependent on the functions it plays on the exchange rate, trade and industry growth. The petroleum industry is enormous, and its activities extend over all regions of the world (Enitan, 2017). Over the years, the oil and gas industry have been seen as an important part of the world financial system that plays a significant role in economic activities. Its main goal is to meet the population's need for the products of petroleum. Hence, Nigeria's oil industry is critical for the nation's progression. A country's oil industry is seen as driving force to achieving economic growth while a major player in the country's operations is the rate of exchange (Uyiosa, 2019). The foreign exchange determines the value of a nation's currency.

In Nigeria, oil and gas revenues accounted for over 98% of export profits and over 83% of federal government income as of 2000, as well as generating more than 14% of GDP. It also generated 95 percent of foreign exchange earnings and about 65 percent of budgetary revenue for the government apart from revenue gotten from agriculture (Ogundipe and Ogundipe, 2013). Oil and gas have been a viable means of achieving and sustaining economic growth. It creates room for employment, which reduces poverty and therefore increases the economic growth of an economy. Nigeria was once rated a main seller of oil, and studies have shown that the earnings from these oil and gas products contributed well to Nigeria's GDP (Ogundipe and Ogundipe, 2013).

The United States Energy Information Administration (2018) estimated Nigeria's oil reserves to be between 16-22 billion barrels.

Nigeria, producing 2.2 million barrels per day, became the most prosperous petroleum country in Africa as at mid-2015. Based on an average benchmark oil price of $85 - $90 per barrel, it is expected that the industry will continue to be lucrative (United States Energy Information Administration, 2018). Almost all of the primary reserves of the nation are concentrated in and around the Niger-Delta oil region, but off-shore rigs are also prominent in the well-endowed coastal region (Michael, 2008). Unlike most of the other Organization of Petroleum Exporting Countries (OPEC) countries, Nigeria is one of the few major oil-producing nations with the capacity to increase its oil output (OPEC, 2019). Over the years, despite the re-discovery of agriculture as a driving force of the economy, oil exploration and exports is still on the increase in the oil and gas sector.

A higher exchange rate is better as it translates to more foreign currency for Naira. When selling currency, a lower exchange rate is preferable so the currency has a prominent value, but the exchange rate in Nigeria is highly fluctuating and has negatively impacted the value of the Nigerian Naira over the years (Ogundipe et al., 2013). The exchange rate of a country is always best if it is stable for a fair period of time as foreign investors tend to have confidence. However, over the years, the Nigerian exchange rate has been unstable and this has driven many foreign investors away and still driving local and foreign investors away from the nation (Isibor et al., 2018). So the stability of the exchange rate is a necessity for the oil and gas sector to perform effectively and efficiently in Nigeria (Omankhanlen et al., 2021).

In March 2015, a dollar was ₦200; failing oil prices affected the currency negatively causing a dollar to equal ₦305 in May of the same year. At this point, some measures were taken concerning the exchange rate such as the implementation of dollar-access tariffs from the Central Bank of Nigeria (CBN), limiting the amount of dollar which could be withdrawn overseas, and lowering dollar sums offered weekly by the bank to the operators of the Bureau de Change. Amid these measures taken in 2015, the Nigerian Naira still faces a lot of turbulence till date (Nnadi, 2016).

Traditional economists consider that devaluation improves the market competitiveness of domestic goods and thus helps the economy to achieve a higher level of economic activity as consumers turn to local produces to satisfy their wants because of price hike on foreign goods in domestic currency. This also leads to higher exports as the goods sold in the country that devalues its currency appears to be cheaper in the global market immediately after sudden currency devaluation (Isibor et al., 2018).

Recently, increase in world crude oil prices have also negatively impacted the Nigeria exchange rate since oil and gas earnings has been Nigeria's major source of income. Due to the COVID-19 lockdown in 2020, there was a decline in the purchase of oil by several consumers globally, which in fact led to negative oil prices for the month of May 2020 (-$37 per barrel) because producers did not have enough place to store barrels of oil, causing negative prices. This means that the seller pays the buyer to take oil. As consumption of oil reduced in the COVID-19 crisis, the export of oil in Nigeria reduced drastically leading to a higher exchange rate of ₦450 to $1 as at April 2020. This trend has continued in the post-pandemic era as oil export was 1 million per barrel and the exchange rate was still high and was ₦470 to $1 as at July 2021.

The relationship between demand and supply is the major determinant of the exchange rate in a free market environment (Nwafor, 2018). The various changes in the exchange rate have an intense effect on export, especially when it comes to the exportation of oil. Arguments have been made by different economists on how the exchange rate simplifies the manufacturing activities and growth of the economy, and it was also agreed that a real exchange that is not in accordance could hinder the production services and negatively affect the export growth and generate macroeconomic instability (Nwafor, 2018). This simply shows that the exchange rate is for the national growth. This study thus wants to examine how Nigeria could achieve and sustain performance in the oil and gas sector despite the exchange rate fluctuation challenges.

Research Hypotheses are as follow:

H_0: There is no significant relationship between oil and gas imports and exports and the country's balance of payment.

H_0: There is no significant relationship between the exchange rate and petroleum exports in Nigeria.

H_0: There is no significant relationship between the currency value and the Oil Industry evolution.

In the view of this research, section one introduces the topic, the objectives, and Hypothesis. Section two goes ahead to review a number of works of literature related to the topic and the chapter contained an empirical framework, conceptual framework, and theoretical framework. Section three examined the research methodology, section four explores the analysis of the data obtained from the CBN Statistical Bulletin and finally, section five presented the conclusion and recommendation.

2. LITERATURE REVIEW

2.1. Exchange Rate in Nigeria

Exchange rate is the rate at which one currency will be changed for another (Jhingan, 2003). It discloses the worth of a nation's currency compared to the currency of other countries. It is the compulsory ration of components of cash that could purchase other measures of units of money. Adekanye (2010) stated that an upsurge in the exchange rate would result in a rise in trade and a decrease in exports, while a decrease in the exchange rate would extend trade and bring down imports. The exchange rate is divided into two categories; the nominal exchange rate calculates the comparative price of two sums of money, while the real exchange rate calculates the comparative charge or goods of different country's products.

Various researches have been conducted on the exchange rate, for example, Adibi and Okunmadawa (1999) believed that the Nigerian economy was positively affected by the conversion rate but Akpan (2008) believed that it is the negative effects of the real value that shrinks the growth of the Economy. Ewa and Asher (2012) carried out a study on exchange rate and its effects on output in Nigeria from 1980 to 2010 and found no direct relationship between conversion and economic progress in Nigeria.

Not long after the liberalization in 1960, the exchange rate routine was actualized alongside the introduction of the Exchange Control Act in 1962, where the Central Bank of Nigeria had an obligation to gain and disseminate remote exchange in the nation (Asher, 2012). From 1977 to 1981, a decrease from weight in the outside segment was to be accomplished by a strict exchange control organization; however, it was abandoned to accomplish this and was substituted for exchange rate routine. At the point when the economic adjustment demonstration of 1982 was set up, the exchange rate was made to be progressively adaptable to put a stop to trivial interest for the exchange rate (Adeniran et al., 2014). This went on until the structural adjustment programme (SAP) was presented in 1986. The presentation of the second-tier foreign exchange market (SFEM) with this program realized a market-driven routine (Adeniran et al., 2014). There was no type of progress after this routine in the authoritative administration of exchange rate of the Naira (Oloyede, 2002) at that point there were different routine framed later on.

2.1.1. Oil prices

Since the ending of the 1940s to the beginning 1970s, the international oil price was very steady having only small changes. Then from the early 1970 to the early 1980s, the price of oil increased beyond expectation with respect to the rise of OPEC and the disruption in the supply of crude oil. OPEC first experienced the power it had over oil during Yom Kippor War which started in 1973 (Adeniyi, 2011). OPEC imposed an oil restriction on western countries as a result of US and the Europe support for Israel. Production of Oil was reduced by five million barrels a day. The cut back amounted to about seven percent of the world production and the price of oil increased 400 percent in 6 months (Adeniyi, 2011).

From 1974 to 1978, crude oil prices were relatively stable ranging from $12 to $14 per barrel. Then between 1979 and 1980 during the Iranian revolution and Iraq war world oil production fell by 10% and caused the rise of crude oil from $14 to $35 per barrel. Oil prices were leading consumers and firms to adopt a more conserve energy. People purchased cars that could manage fuel and organizations purchased machine that were more fuel efficient (Al-Ezzee, 2011). Increased oil price also enlarged search and production by nations that were not members of OPEC. Beginning from 1982 to 1985 OPEC wanted to steady the price of oil through production of quotas, but safeguarding efforts, global economic meltdown and wrongful quotas produced by OPEC participant countries contributed to the plunging of oil prices beneath $10 per barrel. From the Mid – 1980s the fluctuations in the price of oil has occurred more frequent than the past. OPEC has continually been trying to influence oil price to ensure its stability through allocation of production quotas to its member countries but has been unable to stabilize it. OPEC share of the world oil production has fallen from 55 percent in 1976 to 42% today (Al-Ezzee, 2011).

Oil prices matter in the economy in various ways. Changes in oil price directly affect transportation costs, heating bills and the prices of goods made with petroleum products. Oil price spikes induce greater uncertainty about the future, which affects households and firms spending and investments decisions. Also changes in oil prices leads to reallocations of labor and capital between energy intensive sectors of the economy and those that are non-energy intensive sector (Al-Ezzee, 2011).

Oil price shocks can be defined as the unanticipated elements that cause changes in the price of oil. It is the difference between the expected and realized oil price (Baumeister and Kilian, 2016).

Oil price shocks has been a global phenomenon including the oil price shock of 1970s caused by Arab oil producers to cut supply in the wake of the Yom Kippur war with Israel in 1973 which saw the oil prices to soar from US$3 a barrel to close to US$20 virtually overnight. There is also the 2007 global financial crisis which caused increase in oil price, increased inflation, and lowered economic growth.

Oil price shocks negatively and directly affect the prices of goods made with petroleum products which negatively impact the economy. It could also depress the supply of other goods as it increases production costs. The continuous fall in oil price has been associated with the economic impacts of the coronavirus pandemic (Covid-19) and the subsequent shutdown of economic activity across the world. This has drastically reduced the global demand for oil even as producers keep pumping out near-record volumes.

2.1.2. Oil price shocks in Nigeria

Nigeria's experiences with oil price shocks have led to many monetary and fiscal policies in shaping her economy. The collapse of the global oil prices as a result of the global economic meltdown negatively affected the oil price. Oil price volatility since 1999, caused by OPEC restricted crude oil production and high oil demand from Asian countries, have continued to posed several challenges to the CBN. With the global financial crisis, the CBN began promoting economic growth using price stability, monetary policies, and different fiscal plans due to Nigeria's oil dependent nature.

The 2007 global oil price caused by housing bubble schemes in the USA caused the Nigerian oil revenue from oil importation to be ₦4.46 billion in 2007 and ₦6.53 billion in 2008. The increase in revenue was attributed to oil price increase, as there was an evidence of slight cut in oil production from 26.4 million barrels in 2007 to 25.2 million barrels in 2008 (CBN, 2020).

During these periods under consideration, Nigeria experienced continual growth in the supply of broad money in the economy and the inflation rate response started at a high rate and falls within the period of 2006 which was contrary to the influence of oil prices increase to higher revenue to the government.

The inflation rate response was severe compared to the exchange rate response which was stable within the period of 2006 to 2014. The exchange rate was stable overtime before a surge at the end of 2015 to a higher rate due to high import dependent consumption of commodities even in the middle of oil price volatility.

The covid pandemic in year 2020 also saw a reduction in the price of Nigerian oil as demand was low due to the lockdown.

Exchange rate was however high due to dependence of the Nigerian government on foreign aid to assist in the pandemic. In year 2022, there was fuel shortage due to the importation of fake fuel (fuel with high methanol content in it). This led to fuel scarcity in Nigeria as demand was very high but supply of oil was cut short to address the fake oil importation challenges. This however had little impact on the already high and fluctuating exchange rate.

2.1.3. Structure of Nigeria's foreign exchange market

There are various sectors in the foreign exchange they consist; the parallel, the autonomous, and the official. Because of improvements in the Economy, these different segments advance (Adekanye, 2010). The 1986 foreign trade liberalization presentation achieved a change in the remote foreign market, and the official fair was amalgamated in 1987 when the business exchange rate was lined up with the exchange rate for open division transactions. The CBN converged the Foreign exchange in 1962 (Ojo, 1976). It is where banks stretch out credit offices so as to meet short term liquidity obligations (Eze and Okpala, 2014). The market has the depiction of a quick broadcast of information on rates to all individuals, yet is coordinated by some leaders who impact the acquiring quotient.

Market determines the exchange rate in bureau de. A dual exchange rate from a solitary to a dual exchange rate was developed by the official in 1995 framework whereby open part was connected by a fixed exchange rate, and for the private, a market-based exchange rate through the Autonomous Foreign Exchange Markets segment (AFEM) (Eze and Okpala, 2014). There was a perception that banks were allowed to take part in bank trading after the presentation of AFEM in 1995 (Eze and Okpala, 2014). In any case, they neglected to meet what they went for. A few changes were presented after the ascent of demand weight that prompted the Naira to depreciate at the outside exchange market.

In 1999, the official rate for need division exchanges was managed at the AFEM market (Azeez et al., 2012). In that year, the Autonomous Foreign Exchange Market was substituted by the bank outside the exchange market through the dynamic contribution of different members. The CBN shouldn't go about as the real provider of remote exchange yet should be associated with the purchasing and moving of outside exchange. The members of the outside exchange market change; they include individuals that are keen on remote trade in any structure.

The case of an invested individual is the CBN and the Finance Ministry since they control the market. Another cause of an invested individual is The Bureau de Change. There are different components influencing the estimation of a nation's money, a portion of these elements includes the volume of fares, equalization of installments, the dimension of household generation, condition of the economy.

2.2. Theoretical Framework

2.2.1. Purchasing power parity

This suggests the trade between two fiscal structures that compare the two pertinent national value levels at whatever point conveyed in general cash at that rate, with the objective that in two economies the purchasing power of a unit of money would be similar (Alessandro, 2017). This could be seen as the complete PPP. Exactly when the rate of depreciation of cash is incomparable to another modifies the alteration in total value inflation between two countries concerned.

The idea of PPP relies upon the trade of items costs transversely over countries; anyway trade impediments or environmental divisions in the midst of countries may make exchange charges irrationally extreme for trade to be beneficial (Alessandro, 2017). Deprived of trade, there will be an absence demand for remote cash, and without advancement in foreign exchange.

Exchange rate speculates the purchasing power parity which takes a gander at the ordinary costs of stock and undertakings between countries (Ogundipe et al., 2013), it recommended that if unclear things are organizations sold in two particular markets at two one of a kind cost, the exchange rate would be to such a degree, that the value of the organization is so far the proportional paying little heed to whether thing/organization may be communicated in two one of a kind monetary structures. By the day's end, the exchange rate between the money set is equalization when purchasing power is the same (Ogundipe et al., 2013). Purchasing Power Parity demonstrated that two countries and exchange rates should be identical to the extent of equivalent stock and adventures in the two countries. It relies upon the possibility of "Law of one price", which demonstrates that unclear stock/organizations should move at a comparable expense in two different markets when there is the absence of transportation costs and different obligation rates occur in the two markets if there is a difference in the cost. The "Law of one price" is significant if these conditions are satisfied:

- Presence of centered market for the products and adventures in the two countries
- Transportation costs, limits to exchange, and other exchange costs are insignificant
- The "Law of one price" applies just to trade able stock; it is not material to stable products, for instance, houses and various organizations that are neighborhood.

2.3. Empirical Framework

Various studies have been taken to see the linkage between oil and gas sector and exchange rate.

Kamaldeen et al. (2021) examined the asymmetric effect of oil price on the exchange rate and stock price in Nigeria. They found out that oil price had a significant impact on the workings of the exchange rate and a lesser impact on the workings of the stock price movement in Nigeria.

Umaid et al. (2020) using Pakistan as study case investigated the relationship between oil prices, gold prices, exchange rate, and stock prices during global financial crisis 2008. They found out that oil prices and exchange rate was negatively impacted during the 2008 financial crises while stock and gold prices were insignificant during the same period.

Hammed (2020) studied monetary policy shock and how it has impacted manufacturing output in Nigeria. Using secondary

data from 1981 till 2018 and analyzing such with regression technique, it was found that exchange rate was positively significant in boosting the manufacturing output in Nigeria. It was also discussed in the study how the manufacturing output runs concurrently with the oil sector. Thus, it was concluded that exchange rate and inflation in oil prices significantly boost the manufacturing sector.

Chen et al. (2019) expressed that oil price shocks indirectly impact the industrial economic growth in China. This was because the Chinese economy largely depends on technology and human capita.

Abdulaziz et al. (2019) examined the effect of oil shocks on food prices in Nigeria. Analyzing secondary data with autoregressive distributed lags econometric analysis; it was found out that there existed a significant relationship between both variables.

According to Uyiosa (2019), the oil industry has become an ever-changing arena and will continue to be. This is because oil is so important to the world economy that it is present in the everyday lives of all, and its demand is truly global.

Adeniyi (2011) stated that when exchange rate appreciates there would be a rise in imports and a fall in exports but when exchange rate depreciates, there would be a movement from goods produced outside the country to goods produced domestically, this results to the deviation of pay from countries that import to countries that exports and this is likely to influence the foreign countries' growth in economy.

Chen and Chen (2007) reached a resolution that the conversion rate makes a connection between the value structures of distinct nations by causing it workable for global trade and, moreover, impacts the number of imports and exports just as a nation's parity of installments position.

In order to gain equilibrium both domestically and internationally, Nigeria, like other low-income nations, has introduced two major exchange rate regimes. The purpose of this different practice is to keep the exchange rate steady (Ogundipe and Ogundipe, 2013). The non-oil market, capital growth, and per capita income are affected by a fluctuating real exchange rate resulting from volatile oil prices (Ogundipe and Ogundipe, 2013). The effects of exchange rate misalignments will result in a production shortages and widespread economic hardship. There is relatively conclusive proof that exchange-rate alignment has considerable effect on the per capita output growth rate in low-income countries (Jin, 2008).

It was revealed by Michael (2008) that rising crude oil prices in oil exporting countries trigger real exchange rate appreciation, this is not surprising as they earn a significant amount from oil exports. A vital relationship also exists between real oil prices and real exchange rates for oil importing countries; evidence for Spain has been shown (Micheal, 2008).

For the period from 1980 to 2010, Asher (2012) analyzed the effect of exchange rate volatility on the economy of Nigeria. The result has demonstrated that real exchange rate positively impacted sectoral economic development.

In a similar article, Akpan (2008) assessed the foreign exchange market and economic growth in Nigeria from 1970-2003. He found that the exchange rate and economic growth have a positive relationship.

The relationship between the exchange rate and economic development in Nigeria between 1970 and 2010 was also explored by Obansa et al. (2013). The outcome suggested a strong effect of the exchange rate on economic development. They concluded that exchange rate liberalization was good to the Nigerian Economy as it promotes economic growth.

The influence of the exchange rate on currency value and expansion was probed by Isibor et al. (2018). The outcome revealed that the exchange rate had a favorable effect.

The effect of exchange rate fluctuations on macroeconomic performance in Nigeria from 1986-2010 was also explored by Azeez et al. (2012). They discovered that Gross Domestic Product was positively linked to the exchange rate.

Using the error correction model, Nnadi (2016) argued that trade liberalization encouraged growth in the Nigerian manufacturing sector and balanced the exchange rate market between 1970 and 2006. To him, the relationship between the index of industrial output and real exports was positive and significant. The index of industrial output rises by 12.2 percent as real exports grow by one percent. It suggests, by definition, that the deregulation strategy had a positive effect on exports by exchange rate depreciation.

4. DATA AND ESTIMATION TECHNIQUES

4.1. Data

The secondary data used in undertaking this research was from 1986 to 2020 and was gotten from the CBN Statistical Bulletin and the method of analysis includes:

Unit root test – This checks the constancy of all the variables. This test to be carried out is the (ADF) unit root test. This is to check the consistency of all the variables in the model

Johansen Cointegration – This is used to test if there is a lastingbond in these variables (first research question) and if there will be an effect from the long-run relationship or if it can stand in the long run. This is done after the unit root test has been tried.

VAR – This is used when there is no long-run relationship

Granger causality- It is a way of studying causality in a time series of two variables. The approach is a probabilistic account of causality; uses analytical data sets to identify correlation patterns. Causality is close to the concept of cause and effect, even though it is not precisely the same.

4.2. Model Specification

The model used in the study was adopted and modified from the study of Enitan (2017).

The implicit form of the model is:

OBOP = f(OILE, OILI)

OILO = f(EXR)

OILE = f(EXR)

The explicit form of the model is:

$$OBOP = \beta_0 + \beta_1 OILE + \beta_2 OILI + \mu_t$$

$$OILO = \beta_0 + \beta_1 EXR + \mu$$

$$OILE = \beta_0 + \beta_1 EXR + \mu_t$$

Where:
OBOP – Overall Balance of Payments as a percentage of GDP
OILE – Oil exports
OILI – Oil imports
EXR – Nominal Exchange rate
OILO – Oil and gas sector output
β_0: Constant
β_1: Coefficient of Oil exports and Exchange rate
β_2: Coefficient of Oil imports
μ_t: Error term

4.3. VAR Model

The dependent variable is a function of its insulated values and the lagged values of other variables in the model.

The first set of equations:

$$OBOP_t = \alpha + \sum_{i=1}^{k} \beta_i OBOP_{t-1} + \sum_{j=1}^{k} \phi_j OILE_{t-j} + \sum_{m=1}^{k} \varphi_m OILI_{t-m} + \mu_{1t}$$

$$OILE_t = \sigma + \sum_{i=1}^{k} \beta_i OBOP_{t-1} + \sum_{j=1}^{k} \phi_j OILE_{t-j} + \sum_{m=1}^{k} \varphi_m OILI_{t-m} + \mu_{1t}$$

$$OILI_t = \vartheta + \sum_{i=1}^{k} \beta_i OBOP_{t-1} + \sum_{j=1}^{k} \phi_j OILE_{t-j} + \sum_{m=1}^{k} \varphi_m OILI_{t-m} + \mu_{1t}$$

Where:
$OBOP_{t-1}$: OBOP lagged by one period
$OILE_{t-j}$: OILE lagged by one period
$OILI_{t-m}$: OILI lagged by one period
α, σ and ϑ: Constants
β, ϕ, and ϕ: Coefficients of the variables lagged by one period
μ: Error term

The second set of equations:

$$OILO_t = \alpha + \sum_{i=1}^{k} \beta_i OILO_{t-1} + \sum_{j=1}^{k} \phi_j EXR_{t-j} + \mu_{1t}$$

$$EXR_t = \sigma + \sum_{i=1}^{k} \beta_i OILO_{t-1} + \sum_{j=1}^{k} \phi_j EXR_{t-j} + \mu_{1t}$$

Where:
$OILO_{t-1}$: OILO lagged by one period
EXR_{t-j}: EXR lagged by one period.

The third set of equations:

$$OILE_t = \alpha + \sum_{i=1}^{k} \beta_i OILE_{t-1} + \sum_{j=1}^{k} \phi_j EXR_{t-j} + \mu_{1t}$$

$$EXR_t = \sigma + \sum_{i=1}^{k} \beta_i OILE_{t-1} + \sum_{j=1}^{k} \phi_j EXR_{t-j} + \mu_{1t}$$

Where:
$OILE_{t-1}$: OILE lagged by one period
EXR_{t-j}: EXR lagged by one period

5. EMPIRICAL RESULTS

This sub-section provides a succinct description of the used variables. These concise figures display the pattern and average values of the variables used in this analysis.

The summary of the various descriptive statistics of all the variables used for this study are displayed in the Table 1.

The mean as revealed indicates what to expect by chance from the variables and it is shown that the average of Overall Balance of Payments is −0.381998 while oil export averages at ₦4546.476. Oil import on the other hand, has a mean of ₦792.6461bn while oil and gas sector output over the 38 years has a mean of ₦6711.798bn. Exchange rate which has varied sporadically over the years has an average of ₦88.66243. The standard deviation was also revealed in the descriptive summary and it shows how much the data set varies from the mean. As shown in Table 1, the variability of the Overall Balance of Payments was revealed at a value of ₦4.337972bn and the oil export has a variability of ₦5427.844bn. The standard deviation of oil imports, oil and gas sector output and exchange rate were revealed to be ₦1078.317bn, ₦1455.856bn, and ₦87.19264 respectively.

Skewness measures the asymmetry of data distribution. The skewness value of a normal distribution is zero. Thus any value greater than zero reveals positive skewness with a long right tail and values less than zero reveal negative skewness with long left tail, that being said all variables are positively skewed. The kurtosis measures the peak or flatness of the distribution. Overall Balance of Payments and oil imports are mesokurtic, while oil and gas sector output, oil exports and exchange rate are platykurtic. The JB statistic is an indication of the distribution deviation of 0 (skewness and kurtosis if it was truly a normal distribution). Since the p-values of the variables are significantly greater than the level of significance of 5 percent. We do not reject the null hypothesis for normality for all the variables.

5.1. Unit Root Test

This shows the nature of the variables stationarity as inferred using Augmented Dickey-Fuller root unit test T-statistics and P-value.

The product of unit root check displayed in Table 2 is produced using Augmented Dickey-fuller unit root test. A variable is said to be integrated of order d, [I(d)] if it attained stationarity after differencing d times (Ogundipe and Ogundipe, 2013). The null hypothesis states that there is unit root in the model. The decision criterion for unit root is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. The result shows that all variables are stationary after first difference. This makes the use of Johansen Cointegration test appropriate for the study.

5.2. Johansen Cointegration Test

Co-integration is a quantitative feature of a set of variables in time series. Before any work can be done all of the series must be integrated. The Johansen cointegration test was employed since the series are all integrated of the same order.

1. The liaison relating oil trade in and exports and balance of payments

The Hypothesis for this result is specified below:

H_0: There is an absence cointegrating equation or relationship among the integrated variables.

H_1: H_0 is not true.

From the Table 3, the major indicators adopted in making decisions are the Max-Eigen value, the Trace Statistics. Thus, when the Max-Eigen statistics and Trace statistics are more than the 0.05 critical values, then the H_0 is rejected. From this result, the H_0 is rejected. Hence, there is a sustainable relationship between the variables.

The conclusion from the Trace statistics shows that two cointegrating equations exist, although the Max-Eigen test also indicates that two cointegrating equations exist. One co-integrating equation, however, is adopted as this study aims to analyze the relationship between the balance of payments with oil imports and oil exports.

The long-run normalized cointegrating coefficients can be conveyed explicitly as follows;

OBOP = −0.002368OILE+0.007626OILI

From the outcomes in Table 4, there is a positive link between oil exports and the balance of payments. The long run coefficient of oil exports is 0.002368, and it is statistically significant with a T-statistic of |4.154386|. A one percent increase in oil exports in Nigeria will increase the balance of payments by 0.23 percent. Oil exports are a key factor that contributes to the balance of payments.

There is a negative link between oil imports and the balance of payments in Nigeria. The coefficient of oil exports overtime is −0.007626, and it is statistically key with a T-statistic of |2.91297|. A one percent increase in oil imports in Nigeria will cause a decrease in the BOP in Nigeria after a while.

2. The relationship between exchange rate and petroleum exports

The Hypothesis for this result is specified below:

H_0: There is an absence cointegrating equation or relationship among the integrated variables.

H_1: H_0 is not true.

From the Table 5, the major indicators adopted in making decisions are the Max-Eigen value, the Trace Statistics. Thus, when the Max-Eigen statistics and Trace statistics are more than the 0.05 critical values, then the H_0 is rejected. From this result, the H_0 is accepted. Hence, there is no lasting link between the variables. The findings from the Trace statistics show that co-integrating equations do not

Table 1: Descriptive analysis of variables

	OBOP	OILE	OILI	OILO	EXR
Mean	−0.381998	4546.476	792.6461	6711.798	88.66243
Median	−0.283731	1467.831	216.2397	6730.866	97.39928
Maximum	9.990883	17845.87	3686.178	9294.051	306.0802
Minimum	−9.700000	7.201200	0.051800	4052.978	0.610025
Std. Dev.	4.337972	5427.844	1078.317	1455.856	87.19264
Skewness	0.611199	0.895864	1.268096	0.027103	0.799107
Kurtosis	3.944778	2.429175	3.267557	2.082934	2.964197
Jarque−Bera	3.779203	5.598867	10.29777	1.336251	4.046318
Probability	0.151132	0.060845	0.005806	0.512669	0.132237
Sum	−14.51592	172766.1	30120.55	255048.3	3369.172
Sum Sq. Dev.	696.2660	1.09E+09	43022412	78422102	281294.6
Observations	38	38	38	38	38

Source: Author's Computation using Eviews 9

Table 2: Unit root test table

Variable	At Levels		First Difference		Order	Remark
	ADF Statistic	5% Critical Value	ADF Statistic	5% Critical Value		
OBOP	3.672198	2.943427	6.991179	2.948404	I (1), I (0)	Stationary
OILO	1.427057	2.943427	5.590978	2.945842	I (1)	Stationary
OILE	1.573030	2.954021	5.059893	2.954021	I (1)	Stationary
OILI	0.754964	2.943427	4.422721	2.945842	I (1)	Stationary
EXR	1.728342	2.943427	4.216834	2.945842	I (1)	Stationary

Source: Author's Computation using Eviews 9 (2022)

Table 3: Johansen cointegration result

Trace statistics				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.538117	55.46315	42.91525	0.0018
At most 1 *	0.466765	28.42765	25.87211	0.0235
At most 2	0.167586	6.419899	12.51798	0.4089
Maximum eigenvalue statistics				
Hypothesized No. of C.E. (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.538117	27.03551	25.82321	0.0345
At most 1 *	0.466765	22.00775	19.38704	0.0203
At most 2	0.167586	6.419899	12.51798	0.4089

Source: Author's Computation using Eviews 9 (2022)

Table 4: Result of normalized long-run cointegrating coefficients

Normalized Long-Run Cointegrating Coefficients			
OBOP	OILE	OIL	@TREND (82)
1.000000	−0.002368	0.007626	0.318849
T-statistic	−4.154386	2.899619	2.912927
Standard Error	0.00057	0.00263	0.10946

Source: Author's Computation using Eviews 9 (2022)

exist, although the Max-Eigen test also indicates that there are no co-integrating equations.

The long run normalised cointegrating coefficients can be conveyed explicitly as follows;

OILE = –79.00386EXR

From the above findings in Table 6, there was a positive relation between oil exports and exchange rates. The long-term exchange-rate value is 0.002368, and it is of statistical importance with a T-statistic of |2.00043|. A 1% rise in the conversion rate in Nigeria will increase oil exports by 7900 percent in due course. The exchange rate is an important factor that contributes to oil exports overtime.

3. The relationship between currency value and Nigeria oil and gas sector

The Hypothesis for this result is specified below:

H_0: There is an absence cointegrating equation or relationship among the integrated variables.

H_1: H_0 is not true.

From the Table 7, the major indicators adopted in making decisions are the Max-Eigen value, the Trace Statistics. Thus, when the Max-Eigen statistics and Trace statistics are more than the 0.05 critical values then the H_0 is rejected. From this result, the H_0 is accepted. Hence, there is no long-run relationship between the variables.

The result from the Trace statistics shows that no cointegrating equations exist, while the Max-Eigen test also shows that no cointegrating equations exist.

From the results in Table 8, a negative relation exists between oil production and foreign exchange. The long-run factor multiplier of the exchange rate is –39.01157, and it is statistically significant with a T-statistic of (2.594837). A 1% increase in the exchange rate will decrease oil output by 3900 percent overtime. The exchange rate is an important factor that contributes to oil output in the long run.

5.3. Vector Autoregression

These are used for multivariate time series. The structure is that each variable is a linear function of past lags of itself and past lags of the other variables. The linear interdependencies between multiple time series are captured using it. Error terms are white noise disturbances with a constant variance. Error terms are not correlated serially. The result showed that both OILE(-1) and OILI(–1) were significant both positively and negatively respectively with OBOP and with values 0.000104 and –-0.000378 respectively. Also, EXR(–1) was positively significant with OILE with value of 0.036067. Finally, EXR(–1) was negatively significant with OILO with value of -0.039783 (Table 9).

5.4 Diagnostic Test

The link between oil exports and imports and the balance of payments.

The Table 10 concludes using the Prob Chi-square (2) value of 0.0099 which is less than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no autocorrelation. The decision criteria for autocorrelation is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. We reject the null hypothesis (H_0) at a 95 percent confidence level as stated by the decision rule.

5.4.1. Heteroskedasticity test

This is used in a linear regression model to check for heteroscedasticity, which implies that the error terms are normally distributed. It tests if the variance of the regression errors is dependent on the values of the independent variables.

The Table 11 concludes using the Prob Chi-square (5) value of 0.0698 which is greater than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no heteroscedasticity. The decision criteria for heteroscedasticity is, if the probability

Table 5: Johansen cointegration result

Trace Statistics				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.200460	9.850928	18.39771	0.4949
At most 1	0.048693	1.797068	3.841466	0.1801
Maximum Eigenvalue Statistics				
Hypothesized No. of C.E. (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.200460	8.053860	17.14769	0.5970
At most 1	0.048693	1.797068	3.841466	0.1801

Source: Author's Computation using Eviews 9 (2022)

Table 6: Result of normalized cointegrating coefficients

Normalized cointegrating coefficients	
OILE	EXR
1.000000	–79.00386
T-stat	–2.00043
Standard Error	(39.4934)

Source: Author's Computation using Eviews 9 (2022)

value is less than 0.05 (5%) then you reject the null hypothesis. We do not reject the null hypothesis (H_0) at a 95 percent confidence level as the decision rule states.

The relationship between oil exports and exchange rate.

5.4.2. Serial correlation test

The Table 12 concluded using the Prob Chi-square (2) value of 0.000 which is less than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no autocorrelation. The decision criteria for autocorrelation is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. We reject the null hypothesis (H_0) at a 95 percent confidence level as stated by the decision rule.

5.4.3. Heteroscedasticity test

This is used in a linear regression model to check for heteroscedasticity, which implies that the error terms are normally distributed. It tests if the variance of the regression errors is dependent on the values of the independent variables.

The Table 13 concluded using the Prob Chi-square (5) value of 0.0009 which is less than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no heteroscedasticity. The decision criteria for heteroscedasticity is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. We reject the null hypothesis (H_0) at a 95 percent confidence level as the decision rule states.

1. The relationship between currency value and oil and gas output

5.4.4. Serial correlation test

Table 14 concluded using the Prob Chi-square (2) value of 0.000 which is less than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no autocorrelation. The decision criteria for autocorrelation is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. We reject the null hypothesis (H_0) at a 95 percent confidence level as stated by the decision rule.

5.4.5. Heteroscedasticity test

This is used in a linear regression model to check for heteroscedasticity, which implies that the error terms are normally distributed. It tests if the variance of the regression errors is dependent on the values of the independent variables.

Table 15 concluded using the Prob Chi-square (5) value of 0.0015 which is less than the 5 percent level of significance. The null hypothesis; (H_0) states that there is no heteroscedasticity. The decision criterion for heteroscedasticity is, if the probability value is less than 0.05 (5%) then you reject the null hypothesis. We reject the null hypothesis (H_0) at a 95 percent confidence level as the decision rule states.

5.5. Hypothesis Testing

H_0: There is no significant relationship between oil and gas imports and exports and the country's balance of payment.

From the result above, we reject the null hypothesis because there is a significant relationship between oil and gas imports and exports and the country's balance of payment.

H_0: There is no significant relationship between the exchange rate and petroleum exports in Nigeria.

From the result above, we reject the null Hypothesis because there is a significant relationship between exchange rate and petroleum exports in Nigeria.

H_0: There is no significant relationship between the currency value and the Oil Industry evolution.

From the result above, we reject the null hypothesis because there is a key relationship between the currency value and the development of The Nigeria oil and gas sector.

5.6. Discussion of Result

The exchange rate is seen as significant. It also indicates that in the Economy, the exchange rate is a key macro-economic variable in pushing for development in Nigeria; hence, the exchange rate will affect our imports and exports. Nigeria's oil and gas industry is seen as one of the key features influencing the country's rate, the currency value of the nation and contributes vastly to the national income.

Table 7: Johansen cointegration result

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.231971	9.520758	18.39771	0.5274
At most 1	0.000537	0.019353	3.841466	0.8892
Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized No. of C.E. (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.231971	9.501405	17.14769	0.4448
At most 1	0.000537	0.019353	3.841466	0.8892

Source: Author's Computation using Eviews 9 (2022)

Table 8: Normalized long run cointegrating coefficients

Normalized long run cointegrating coefficients	
OILO	EXR
1.000000	39.01157
T-Stat	2.594837
Standard	(15.0343)

Source: Author's Computation using Eviews 9 (2022)

Table 9: VAR table

	OBOP	OILE	OILI
OBOP(−1)	0.424214	43.84685	-4.357306
Standard Error	(0.17488)	(71.4229)	(15.5425)
T-statistic	[2.42567]	[0.61390]	[-0.28035]
OILE(-1)	0.000104	0.872444	0.057453
Standard Error	(0.00050)	(0.20494)	(0.04460)
T-statistic	[0.20731]	[4.25702]	[1.28825]
OILI(-1)	−0.000378	0.832528	0.767435
Standard Error	(0.00253)	(1.03129)	(0.22442)
T−statistic	[−0.14985]	[0.80727]	[3.41962]
C	−0.376866	439.4452	23.41656
Standard Error	(0.93875)	(383.384)	(83.4291)
T−statistic	[−0.40146]	[1.14623]	[0.28068]
	OILE	**EXR**	
OILE(−1)	0.020888	−0.000942	
Standard Error	(0.07702)	(0.00105)	
T−statistic	[9.35928]	[−0.89805]	
EXR(−1)	0.036067	1.111502	
Standard Error	(4.81202)	(0.06557)	
T−statistic	[4.89621]	[16.9524]	
C	−299.8179	2.971362	
Standard Error	(304.860)	(4.15387)	
T−statistic	[−0.98346]	[0.71532]	
	OILO	**EXR**	
OILO(−1)	0.917300	−0.002538	
Standard Error	(0.07534)	(0.00233)	
T−Statistic	[12.1754]	[−1.09078]	
EXR(−1)	−0.039783	1.087176	
Standard Error	(1.37842)	(0.04257)	
T−statistic	[−0.17395]	[25.5372]	
C	604.2947	18.12251	
Standard Error	(465.857)	(14.3879)	
T-statistic	[1.29717]	[1.25957]	

Source: Author's Computation using Eviews 9 (2022)

Table 10: Serial correlation test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	5.287691	Prob. F (2,33)	0.0102
Obs*R-squared	9.222284	Prob. Chi-Square (2)	0.0099

Source: Author's Computation using Eviews 9 (2022)

Table 11: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.852347	Prob.F(2,35)	0.0712
Obs*R-squared	5.325636	Prob.Chi-square(2)	0.0698

Source: Author's Computation using Eviews 9 (2022)

Table 12: Breusch-Godfrey serial correlation LM Test

F-statistic	35.18046	Prob.F(2,34)	0.0000
Obs*R-squared	25.61989	Prob.Chi-square(2)	0.0000

Source: Author's Computation using Eviews 9 (2022)

Table 13: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	14.66753	Prob.F(1,36)	0.0005
Obs*R-squared	11.00046	Prob.Chi-square(1)	0.0009

Source: Author's Computation using Eviews 9 (2022)

Table 14: Breusch-Godfrey Serial Correlation L.M. Test

F-statistic	63.90145	Prob. F (2,34)	0.0000
Obs*R-squared	30.01498	Prob. Chi-square (2)	0.0000

Source: Author's Computation using Eviews 9 (2022)

Table 15: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	12.99920	Prob. F (1,36)	0.0009
Obs*R-squared	10.08118	Prob. Chi-square (1)	0.0015

Source: Author's Computation using Eviews 9 (2022)

6. CONCLUDING REMARKS

This work explained how exchange rate is a key macro-economic variable in pushing for development in Nigeria; hence, the exchange rate is positively significant to the progress of the Economy. Nigeria oil and gas sector is also seen to be positively significant in the sense that it contributes up to 80% of the country's export, hence a large part of the national income.

The purchasing power parity (PPP) is based on the single price rule, which specifies that certain items have to be offered at the same price. Purchasing Power Parity implies that when commodities are priced in two distinct markets at two different rates, the exchange rate would be with the true objective that the price of the thing/organization is up 'til now the equal paying little mind to whether thing/organization may be communicated in two interesting monetary structures. In a manner of speaking, the exchange rate between money sets is in agreement when purchasing power is the same.

From the reviewed literature, most researchers like Aliyu (2011) explored the movement of Foreign Exchange Rate in Nigeria, and some other researchers like Plante (2008) looked at the exchange rate and Oil and Gas volatility. Asher (2012) explored the impact of exchange rate fluctuation on Nigeria's economic growth, but this study shows the movement of the exchange rate on Nigeria's Oil and Gas sector.

7. RECOMMENDATIONS

1. More refineries should be built in Nigeria, so more products are extracted from crude Oil and can be exported to boost revenue
2. The Government should also ensure the exchange rate is not negatively affected by oil prices at the time like during the Covid-19 Pandemic
3. Tariffs on oil exports should be removed or reduced to encourage an increase in oil exports which will lead to the development of the economy.

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