

## **Econometric Analysis of External Shock Variables and Nigeria Economy, 1981-2019**

**NATHAN, Emmanuel and ENDURANCE, Keyamo**

*Department of Economics, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria PMB 071, Yenagoa, Bayelsa State*

---

### **ABSTRACT**

External shocks can quickly disrupt a country's growth as they are often not factored into planning because of their volatility. Thus, there is need to constantly study these external shocks in order to ascertain how they affect the domestic economy and how they can be properly managed through macroeconomic policies. This paper therefore investigate the impact of three key external shock variables namely; international oil price (OP), terms of trade (TOT) and real foreign exchange rate (RFER) on real gross domestic product (RGDP) in Nigeria. The authors used Vector Error Correction (VEC) method alongside its Generalized Impulse Response Function (GIRF) and Variance Decomposition to analyze data for the study. Preliminary tests of data were conducted using the Augmented Dickey-Fuller statistic for stationarity and the Johansen cointegration test to establish the existence of long-run relationship as well as the Granger Causality Test for direction of causality. Granger Causality Test showed a unidirectional relationship from shock variables to real gross domestic product (RGDP). Short run results show that all shock variables except RFER have a positive link with RGDP. However, the GIRF which captures long-run relationship reveals that a positive one standard deviation innovation to terms of trade (TOT) caused a positive but not very high response in RGDP. The same is true of the response of RGDP to a positive one standard deviation innovation in international oil price (OP). One standard deviation innovation to RFER caused a very high and positive response in RGDP. The Variance Decomposition estimates showed an upward trend in the impact of shock variables on RGDP. TOT had an impact of 0.26 percent and rose to 4.17 percent in the thirtieth year. In the same vein, the impact of international oil price (OP) shock and real foreign exchange rate (RFER) shock increased from 0.56 percent and 20.54 percent in the fifth year to approximately 3 percent and 57 percent respectively in the thirtieth year. The paper recommended among others boosting the productive base of the domestic economy so that the economy becomes less reliant on foreign goods as a way of cushioning the effects of external shocks.

**KEYWORDS: Real Gross Domestic Product, International Oil Price, Terms of Trade and Real Foreign Exchange Rate**

---

Date of Submission: 20-06-2021

Date of Acceptance: 05-07-2021

---

### **I. INTRODUCTION**

No country is immune to the vagaries of external economic variables that are not totally under her control and that can affect her economic performance. Even countries, such as North Korea, that display the closest semblance to a closed economy remain prone to the effects of fluctuations in external economic factors that they can hardly predict let alone control. For instance, when Nigeria drew her 2020 budget, the oil price benchmark was put at fifty-seven dollars (\$57) per barrel which was initially viewed by analysts as a very modest benchmark. Unfortunately, the rivalry in the international oil market between Russia and Saudi Arabia and the effect it would have in pushing downwards the international oil price was never envisaged. Also not envisaged was the outbreak of the coronavirus (Covid-19) pandemic and how it would cause oil price to slump and shut down economic activities around the world. Confronted with this ugly reality, the N10.59 trillion 2020 budget signed by President Buhari in December 2019 was cut down by a whopping N320billion as at April 2020 following a slash in revenue projection by 40 percent which saw the budget reduced to N10.27trillion with a new oil benchmark of Thirty dollars per barrel. These changes would go on to have a profound effect on the economic performance of Nigeria as well as the wellbeing of Nigerians.

The foregoing is a factual picture of what is termed external shocks in economic literature. Basically, external shocks refer to fundamental changes in macroeconomic variables or their relationships that can substantially impact on a country's overall economic performance or the performance of specific sectors of the economy. While external shocks may be expected, they are usually unpredictable and they occur as a result of events not under the purview of normal economic transactions. Oyelami and Omolola (2016) point out that

while it is true that oil price change and its volatility is the major source of external shock in the Nigerian economy, all macroeconomic fluctuations in the Nigerian economy cannot be attributed to oil price volatility alone. Numerous studies have identified several other sources of external shocks such as terms of trade, exchange rate fluctuation, world price of raw materials, capital importation, foreign direct investment (FDI) and many more. Rattso and Torvik (1998) point out that the degree of openness of an economy determines to a large extent the severity of the impact of external shocks on a country's economy. However, exposure to external shocks in whatever form if not properly managed can create difficulties for the Nigerian economy. Such difficulties may include fiscal and monetary disequilibria and inflation, weakened decision making process as a result of lobbying for sudden windfall brought by shocks, lower private investments and private capital flight.

The Nigerian economy is a very open economy and her major source of revenue remains the sale of crude oil in the international market. Thus the sale of crude oil is a fundamental consideration of the country's terms of trade. It is on this basis that crude oil prices, terms of trade and exchange rate which determines how much Nigeria actually earns from the sale of her crude oil will constitute the three external shocks that will be investigated in this work to see how they affect the economy of Nigeria.

#### **A. Crude Oil Price and Its Drivers**

Nigeria became part of the international market for crude oil in 1956 when crude oil was first discovered in commercial quantity in Oloibiri in Bayelsa State. Today, this international crude oil market is divided into two categories namely the Organization of Petroleum Exporting Countries (OPEC) and non-OPEC countries also known as competitive fringe countries. Established 1960 in Baghdad-Iraq, OPEC has twelve countries as members namely: Saudi Arabia, the United Arab Emirates, Venezuela, Iraq, Iran, Kuwait, Nigeria, Angola, Ecuador, Algeria, Qatar and Libya. Prominent competitive fringe countries are Russia, The United States, Norway, Brazil, Mexico, China and Canada. Soh and Ancel (2013) describe OPEC as a cartel that seeks to restrict output with the goal of raising prices above the competitive level. OPEC therefore plays a fundamental role in determining the price of crude oil internationally. This is despite the fact that the competitive fringe countries or non-OPEC countries produce some sixty percent of the world's total oil production. OPEC member countries have over eighty percent of the world's oil reserve hence her ability to largely determine the international price of crude oil. OPEC meets twice annually, and each member country is represented by her oil minister. At such meetings or conferences, oil production quotas are decided for member countries and this is a major factor in determining crude oil price. According to the U.S Energy Information Administration (EIA), European countries are the largest importers of Nigeria's quota of total world crude oil production. In 2015, European countries imported forty one percent of Nigerian crude oil followed by Asia with importation of twenty eight percent, the Americas (16%) and Africa (15%). Generally, the importation of crude oil is very high in developed countries of the world. Dunlap, Swan and Fowler (2009) suggest that factors such as industrialization, rapid urbanization and a general higher standard of living increase the importation or demand for crude oil in such countries. Developed countries rely heavily on oil for transportation, power generation and industrialization.

Apart from OPEC and the foregoing considerations that influence the international price of crude oil, there are a number of other factors that also affect crude oil price. Such factors may take the form of weather, strikes and conflicts. For instance, the Iranian Revolution coupled with the Iran-Iraq war skyrocketed oil price from Fourteen dollars per barrel in 1978 to Thirty-five dollars per barrel in 1981. Similarly, the Iraqi invasion of Kuwait in 1991 resulted in an increase in oil price from Twenty-one dollars per barrel to Forty-four dollars per barrel within a space of five months. Shortly before the U.S invasion of Iraq in 2003, oil price stood at about Seventeen dollars (\$17) per barrel but it rose to Twenty-six dollars (\$26) per barrel during the Afghanistan war.

#### **B. Terms of Trade**

Carbaugh (2013) considers terms of trade as a measure of the relationship between the prices a nation gets for her exports and the prices she pays for her imports. It is also often described as the ratio of an index of a country's export prices to an index of her import prices. It is therefore evident that an improvement of a country's terms of trade is as a result of a rise in the prices of exports relative to the prices of imports over a given period of time. Such improvement implies an increase in export revenues and a rise in the country's national income while the reverse is the case if the country's terms of trade deteriorates.

Prior to the 1980s, Nigeria's exports were basically non-oil agricultural produce such as cocoa, cotton, palm produce and groundnut. However, the scenario changed as a result of the growing exportation of crude oil in the international market. The CBN (2015) reports that crude oil export accounted for an average of 96.7 percent and 97.3 percent during the periods of 1981-1985 and 1986-1998 respectively. In the period of 1999-2004, the share of crude oil in total export increased to 97.4 percent. However, following the discovery in commercial quantity and the subsequent gradual exportation of natural gas in 1999, the share of crude oil in total export began to decline slightly. In the 2005-2010 period, the share of crude oil in total export reduced to 88

percent and it dropped further to 81.1 percent in the 2011-2015 period. The rise in the exportation of natural gas and the continued dominance of crude oil in Nigeria's export basket negatively affected non-oil exports. The share of non-oil exports in total exports stood at an average of 3.3 percent and 0.9 percent in the periods of 1981-1985 and 1986-1998 respectively and became an average of 2.1 percent in the period of 1999-2006. Tijani (2014) points out that in an effort to salvage the non-oil sector and increase its share in total export, the government embarked on several strategic initiatives to enhance the value added in domestic production for export. The result was an improved production, processing and packaging of semi-manufactured products. Thus CBN (2015) reports that the share of non-oil exports in total exports increased to 4.9 percent and 6.6 percent in the periods of 2007-2010 and 2011-2014 respectively and rose to 7.5 percent as at 2015. Despite these improvements, non-oil exports in total exports remain insignificant.

Egwaikhide (1999) posits that non-oil imports remain dominant in Nigeria over the years and there has not been any significant shift in the composition or structure of Nigeria's imports in recent times. CBN (2010) reports that non-oil imports accounted for an average of 85 percent of total imports from 1960 through the year 2000. That percentage however declined slightly to 78.5 percent and 75.9 percent in the periods of 2001-2010 and 2011-2015 respectively. While the share of oil imports in total imports has been very low over the years, the collapse of Nigeria's refineries as a result of lack of maintenance resulted in an increase in oil imports beginning from the 1980s. For instance, the share of oil imports in total imports stood at 1.9 percent in the period of 1980-1985. This increased to an average of 19.8 percent and 22.2 percent in the periods of 1986-1995 and 1996-2006 respectively. As the problem of poor refineries persisted, the percentage of oil imports in total imports rose to 24.4 percent in the 2006-2014 period. Generally, total imports increased in 1981 as against what was obtainable in the 1970s because the increased revenue from the sale of crude oil increased the preference for foreign goods by Nigeria from an annual average of N1,121.3 million and N5,922.9 million in the 1970-1974 and 1975-1979 periods respectively, the total value of imports rose to N11,726.8million in 1981. This upward trend in importation was curtailed to some extent by the implementation of restrictive demand management measures under the economic stabilization policy of 1982 which resulted in the decline of the value of imports to N5,476.6 million in 1986. In recent times, however, there has been a new rise in the value of imports in Nigeria. As at December 2019, the value of imports stood at N1,759 billion. Imoughele and Ismaila (2015) suggest that the upward trend in the value of imports especially after Nigeria's return to democracy in 1999 is as a result of the rehabilitation and construction of infrastructure in the country as well as increased domestic demand for both producer and consumer goods from abroad.

### **C. Exchange Rate**

Exchange rate is the ratio of currency prices. Lawal, Atunde and Ahmed (2016) explain exchange rate as reflecting the ratio at which one currency can be exchanged for another. It can also be seen as the value of a foreign country's currency in terms of a home country's currency. Thus, it is the worth of a currency in terms of another. Regular fluctuations in exchange rate or inappropriate exchange rate regime have been identified as a major obstacle to the economic growth of many African countries including Nigeria. However, Nsofor, Takon and Ngwuegbe (2017) argue that exchange rates variations could have both positive and adverse impacts in the short-run and long run of economic activities and living standard of the public depending on the prevailing economic conditions and preference basically because of the international trade and finance involving exchange of currencies of trading partners. As a result, the Central Bank tends to adopt from time to time certain policies to strengthen domestic currency. Nigeria for instance, has experienced exchange rate variation over the decade. Since independence in 1960, direct control of exchange rate policy has been used to manage Nigeria's foreign exchange until 1986 when the country changed from fixed exchange rate to a flexible exchange rate system. Since then, exchange rate was allowed to float and its value determined by market forces of demand and supply.

In 1986, dual exchange rate system of 1st and 2nd Tier (SFEM) was adopted, but transformed into the Foreign Exchange Market (FEM) in 1987. In 1994 reform, naira exchange rate was pegged again. In 1995 the Foreign Exchange Market was liberalized with the consequent introduction of an Autonomous Foreign Exchange Market (AFEM) for the sale of foreign exchange to end-users by the monetary authority through selected authorized dealers at market determined exchange rate. In 1999, the Inter-bank Foreign Exchange Market (IFEM) was introduced. The retail Dutch Applied System was introduced which allows end users to bid through authorized dealers who acted as intermediaries in the bidding process. The Dutch Auction System (DAS) was again introduced in 2002 as a result of the intensification of the demand pressure in the foreign exchange market and the persistence incessant depletion of the country's external reserves. In 2006, the wholesale DAS was introduced at a permitted margin.

Between 2015 and 2016 the domestic economy witness an adverse volatility in exchange rate against the US Dollar. This however is partly attributable to the impression created by President Mohammadu Buhari who within the first two years of his assumption of office traveled to more than 8 countries, making speeches that suggests to the international community that Nigerians are systematically corrupt people. This negative

impression spurred international investors to divest from Nigerian economy leading to huge withdrawal of foreign currencies from the economy creating a short fall in the demand and supply of foreign currencies in relation to Nigerian naira. The increasing cost of doing business in Nigeria, preference of foreign goods to domestic goods by Nigerians, fall in the international oil price as well as the insecurity in Niger Delta which resulted to significant reduction in crude oil output made it difficult to attract sufficient foreign currencies to meet with the ever increasing demand for foreign currency especially the US Dollar. The increasing demand for US Dollar and the devaluation of Nigerian Naira resulted to a total collapse in the value of the Naira against the US Dollar from N180 per \$1 to about N500 per \$1. These created untold hardship to Nigerian population as inflation rate enters high double digits, crashing the purchasing power of the Naira.

Whether in the form of oil price volatility, terms of trade or exchange rates, external shocks are capable of having a profound effect on the Nigerian economy. This is largely due to the fact that the Nigeria economy is very open and depended much on foreign trade. Generally, external shocks can cause a departure of actual revenues from budgeted revenues in the Nigerian economy. Whether actual revenues fall above or below budgeted revenues, the effect could be positive or negative depending on the macroeconomic actions adopted by the managers of the economy. For instance, a fall in actual revenue below budgeted revenue will make it difficult to meet financial obligations as it was the case in 2016 when Nigeria fell into recession as a result of slump in oil prices. Thus, because States were unable to meet up basic obligations such as the payment of salaries, the Federal Government had to intervene by way of bailouts to the States. On the other hand, a rise in actual revenue above budgeted revenue emanating from external shocks may lead to massive looting and wastage of public funds if not well managed. It can also lead to unprecedented growth of the economy if well managed.

Dayo (2016) stresses that since the 1970s, there have been numerous episodes of fluctuation in crude oil prices in the international market. These recurrent fluctuations in oil prices have significant implications on the exchange rate and external reserves of Nigeria. Akpan (2018) adds that because international crude oil prices, terms of trade and other external economic variables are highly volatile and unpredictable Nigeria's economic performance mimics the development in the behavior of these external variables. It is therefore crucial to develop mechanisms to cushion the effects of fluctuations in these external variables. Because of the possible profound effects of external shocks on the Nigerian economy, it is vital to keep regular track of how external shock variables affect macroeconomic variables in Nigeria. This is a major focus of this paper as attempt is made to ascertain the link between oil price, terms of trade and exchange rate on Gross Domestic Product (GDP) in Nigeria.

## **II. LITERATURE REVIEW**

### **A. Theoretical Literature**

The effect of fluctuations in certain economic variables on the long-term pattern of another economic variable can be discussed in economic literature with the aid of business cycle theories. Business cycles are also known as economic cycles and they describe fluctuations which may be expansions, contractions or recoveries in an economy. They are usually tracked using the movements of major macroeconomic variables such as Gross Domestic Product (GDP) around their long-term growth trend. Business cycles can also be referred to as booms and bursts cycles. Bormotov (2009) stresses that business cycles may result in a rise in output and decrease in unemployment over time during periods of rapid economic growth as well as contractions or recessions during periods of stagnation or low economic growth.

While numerous business cycle theories abound, the Real Business Cycle (RBC) Theory constitutes the theoretical basis for this paper. Proponents of the Real Business Cycle (RBC) theory are guided by the work of Kydland and Prescott (1982). Rebelo (2005) points out that Real Business Theorists contend that it is external shocks such as innovation and technological progress that drive booms in cycles while issues such as excessive overcapacity can cause downturns. They believe that macroeconomic fluctuations do not emanate from monetary shocks but only from external shocks such as innovations. The RBC Theory is based on a number of fundamental assumptions prominent among which is the assumption that business cycles are driven entirely by technological shocks rather than monetary shocks or changes in expectations. However, while it is true that the RBC Theory focused specifically on technological development as the major external shock, over the years other scholars have investigated the effect of many other external shocks, the mechanisms that propagate them as well as their policy implications. These scholars were able to incorporate many other external shock variables into the baseline RBC model to understand their effects on macroeconomic variables. For instance, Finn (2000) as well as Barsky and Kilian (2004) studied the effect of oil and energy price shocks using the RBC baseline model. Their results show that oil or energy price shocks are not the major prompters of output fluctuations. Christiano and Eichenbaum (1992) examined fiscal shocks through the effect of tax rate and government spending shocks in RBC models. They concluded that cyclical movements in tax rate and government spending were not enough to account for fiscal shocks as a huge driver of business fluctuations. Mendoza (1995) assessed

the effect of productivity and terms of trade shocks in an international business cycle model. The results of the study showed that responses of real exchange rates to these shocks are quite different both qualitatively and quantitatively. On their part, Friedman and Schwartz (1963) carried out a detailed empirical investigation and pointed out that monetary shocks are the major economic cause of business cycle fluctuations. They observed that sharp declines in the money stock occurred prior to severe economic downturns.

## **B. Empirical Literature**

Adeniyi et al (2011) made use of alternative measures of oil price shocks to determine the impact of oil price shocks on economic growth in Nigeria. Their alternative measures of oil price shocks were obtained using a number of nonlinear transformations which capture the key aspects of the departure of the oil price-output interaction from the standard linear view. Their findings differed from the popular opinion that oil price shocks have a significant impact on Nigeria's economic growth. They pointed out that oil price shocks do not account for a significant amount of observed movements in macroeconomic aggregates. Similarly, Omojolaibi (2013) in his study assess the effects of crude oil price changes on economic activity in an oil-dependent economy such as Nigeria, pointed out from his findings that domestic shocks were to be blamed for the perceived behavior of economic activities in the economy and not oil price shocks. On the contrary, Ekeseobi et al (2016) in their study examine the relationship between external shocks and government revenue in Nigeria and found that external shocks exert substantial pressure and uncertainty on government revenue in Nigeria.

Akinleye and Ekpo (2013) evaluated the symmetric and asymmetric oil price and oil revenue shocks on Nigeria's macroeconomic performance. They found that in the long run both positive and negative oil price shocks impact on real government expenditure through external reserves. They also discovered that oil price shocks can prompt inflationary pressure as well as domestic currency depreciation as importation increases through its short and long run effect on real GDP. Based on their findings, they concluded that in the long run, oil price shocks could hinder economic growth while at the same time causing inflation in the short run. Audu et al (2015) investigate the impact of crude oil shocks on a host of macroeconomic variables in Nigeria and found that oil price shocks did not constitute any inflationary threat in the economy in the short run. Instead, it boosted the performance of the Gross Domestic Product (GDP) and money supply. They further observed that oil price shocks negatively impacted on external reserves and international trade as a result of fall in oil price.

Umar and Kilishi (2010) examined the impact of oil price shocks on the Nigerian economy. They discovered that oil prices cause enormous distortions in real GDP, money supply and unemployment. However, they found no significant effect of oil price shocks on the consumer price index. In the same vein, Omisakin (2008) in his paper also showed that oil price shocks caused significant variations in oil revenue and output but with no significant effect on money supply, inflation and government expenditure in Nigeria. In a huge departure from other studies, Alley et al (2014) in their study found that oil price shocks had an insignificant impact on economic growth, but economic growth is significantly improved by oil price. They also pointed out that the negative impact of oil price shocks is as a result of the uncertainty it creates and the extent to which it undermines the effectiveness of managing the proceeds from crude oil.

Ikenna (2016), using quarterly time series data examined the impact of terms of trade shocks on the volatility of three selected macroeconomic variables namely output, inflation and exchange rate. He estimated the impact of terms of trade shocks by applying the traditional GARCH (1.1) model. Prominent among his findings is that terms of trade shocks have a permanent effect and positive impact on output volatility, inflation volatility and exchange rate volatility. Ezema and Amakom also investigated the nexus between terms of trade shocks and macroeconomic performance in Nigeria. Their study showed that terms of trade shocks are very high following the pattern of booms and bursts in Nigeria and have impacted negatively on macroeconomic performance.

Osterholm and Zettelmeyer (2007) examined the sensitivity of Latin American GDP growth to external factors. Their findings reveal that external shocks namely financing, external growth and commodity price explain over fifty percent of variance in growth of the aggregate Latin American output index at standard medium term horizons. Out of the external shocks, financing shocks turned out to be the most important explaining more than half of the contribution of external shocks. On their part, Sosa and Cashin (2013) did an assessment of how exogenous factors affect business cycles in the Eastern Caribbean. Their study revealed that external shocks such as climate, oil price, external demand and world real interest rate shocks play a significant role in explaining over a half of macroeconomic fluctuations in the region. They pointed out that domestic business cycles are particularly susceptible to changes in climatic conditions and natural disaster can lead to a sudden fall in output the effect of which may not be persistent. Monacelli and Sala (2009) investigated the contribution of common international factors to the dynamics of price inflation rates of a cross-section of CPI products in France, Germany, United Kingdom and the United States. Their findings showed that on the average one international factor explained some fifteen to thirty percent of the total variance depending on the precise form of the index whether monthly or annual and the transformation applied to the data. They also discovered a

strong positive and statistically significant relationship between exposure of consumer inflation to international shocks and trade openness at the sectoral level.

There are quite a number of studies highlighting the relationship between external shock variables and macroeconomic variables. Some of such studies focused on Nigeria while others shed light on other countries. In general, the results have been mixed with some indicating a positive relationship between external shocks and macroeconomic variables while others see a negative relationship. While the external shock studies in Nigeria have focused much on oil price shocks as the empirical literature review has revealed, this study is unique because it goes a step further to look at terms of trade and exchange rate shocks alongside oil price shocks as they affect real Gross Domestic Product (GDP) of Nigeria.

### III. METHODOLOGY

Three preliminary tests (Unit Root Test, Johansen-Juselius Co-integration Test and Granger Causality Test) were conducted on the data collected for the study. The Unit Root Test established stationarity of data for the study. Granger and Newbold (1974) emphasize that using non-stationary data in economic analysis can make results spurious thus making the parameters biased and not a true reflection of the relationship between variables. Johansen-Juselius Co-integration Test determined the long-run relationship between the chosen variables. Granger Causality Test established the causal relationship between the variables with particular emphasis on the direction of causality. Gujarati (2004) stresses that Granger Causality Test seeks to ascertain to what extent the changes in the past values of a variable  $K_t$  accounts for the variations in the contemporaneous values of another variable  $X_t$ . Therefore, Granger causality exists between variables  $K_t$  and  $Z_t$ , if by including the past values of  $K_t$ ,  $Z_t$  we can make a much better prediction with much accuracy, otherwise it is said that  $K_t$  does not Granger-cause  $Z_t$ .

#### A. Model Specification and Estimation Technique

The study adopted Vector Error Correction Model (VECM) which is a variant of the Vector Autoregressive (VAR) approach. Ang and McKibbin (2007) recommend VECM because once there is co-integration among the study variables, the short-run dynamics and long-run causality are quite easy to distinguish. VECM is used for multivariate time series and each variable is a linear function of past lags of itself and past lags of the other variables. The VECM structure is split into two main parts namely; the Generalized Impulse Response Function (GIRF) and the Variance Decomposition (VDC) analysis. The Generalized Impulse Response Function (GIRF) is designed to identify the interrelationship among the variables of this study while the Variance Decomposition (VDC) give a breakdown of the percentage of impact contributed by each variable to other variables in the model. It should be noted that the VECM model is particularly useful for describing the dynamic behaviour of economic time series and for forecasting. It often provides superior forecasts than univariate time series models and elaborate theory-based simultaneous equations models.

In specifying the model for this study, it is important to note that the distinction between exogenous and endogenous variables is not a prerequisite. Sims (1980) points out that in a VECM model, the distinction between exogenous and endogenous variables is adjudged to be subjective, hence, they are treated similarly. The VECM model for this study is as stated below:

$$\Delta Y_t = \beta_0 + \sum_{i=1} \beta_1 \Delta RGDP_{t-1} + \sum_{i=1} \beta_2 \Delta OP_{t-1} + \sum_{i=1} \beta_3 \Delta TOT_{t-1} + \sum_{i=1} \beta_4 \Delta ER_{t-1} + \beta_5 ECT_{t-1} + U_t$$

Where,  $Y_t$  is a vector of the variables in the model.  $\beta_0$ ,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$  and  $\beta_5$  are all parameters to be estimated, RGDP is Real Gross Domestic Product, OP is oil price, TOT is Terms of Trade, ER is Exchange Rate, ECT is the error correction term and  $U_t$  is the error term. It should be noted that each variable is expressed as a past lag of itself.

#### B. Description of Variables

**Real Gross Domestic Product (RGDP):** This is a measure of Nigeria's economic growth or output performance. It is measured in real terms at 2010 constant prices in Naira. This means that it accounts for price level changes or inflation. RGDP is a macroeconomic variable that reflects the value of all goods and services produced by all the economic sectors in the country within a year.

**International Crude Oil Price (OP) Shock:** Nigeria's economy is heavily reliant on the sale of crude oil and it is generally known that fluctuations in international crude oil price impacts heavily on government revenue in Nigeria. It is on this basis that international crude oil price is a very important variable included in this study.

**Terms of Trade (TOT) Shock:** Trade is central in explaining economic fluctuations in developing countries like Nigeria, and terms of trade volatility affect the income of countries through trade openness. It is on this basis that terms of trade is included as a variable in this study.

**Real Foreign Exchange Rate (RFER) Shock:** Exchange rate can significantly affect the value of a country when trading with other countries and the implication is that volatility in exchange rate can cause fluctuations in a country's income. This informs the inclusion of exchange rate in this paper.

#### IV. DATA ANALYSIS, RESULTS AND INTERPRETATION

##### A. Unit root test

**Table 1: ADF Unit Root Test at 5% level of significance**

Variables	Levels	1 <sup>st</sup> Difference	Remarks
RGDP	3.456416	3.455239	1(1)
OP	1.294251	-6.216565	1(1)
RFER	1.813617	-4.253877	1(1)
TOT	-1.567818	-5.630283	1(1)

Source: Author's computation with Eviews 9

Table 1 clearly shows that all the variables are stationary at first difference. It is this order of integration that forms the basis of the use of VAR in econometric studies. However, to determine the appropriateness of the use of the VECM (variant of VAR) in this study, the Johansen Co-integration Test was carried out as shown in table 2. When there is at least one co-integrating equation, the VECM is deemed suitable for establishing the relationship between the variables under consideration.

##### B. Test for long-run relationship

**Table 2: Johansen Co-integration Test**

Sample (adjusted): 3 39

Included observations: 37 after adjustments

Trend assumption: Linear deterministic trend

Series: RGDP TOT OP RFER

Lags interval: 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.596150	58.37224	47.85613	0.0038
At most 1	0.291276	24.82393	29.79707	0.1678
At most 2	0.199103	12.08522	15.49471	0.1529
At most 3 *	0.099319	3.870357	3.841466	0.0491

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Source: Author's computation with Eviews 9

From Table 2, it can be deduced that at both the Trace and the Eigenvalue criteria, there is at least one co-integrating equation in the model. This shows that there is a long-run relationship between the variables and it is therefore a basis to apply the VECM to establish the actual nature of their relationship.

**C. Causality Test**

Vector error correction (VEC), Granger Causality/Block Exogeneity Wald test results are presented in table 3.

**Table 3: VEC, Granger Causality/Block Exogeneity Wald Tests**

Sample: 1 39

Included observations: 37

Dependent variable: RGDP

Excluded	Chi-sq	Df	Prob.
TOT	0.005747	1	0.0496
OP	0.732549	1	0.0221
RFER	5.441387	1	0.0197
All	7.304635	3	0.0428

Source: Author's computation with Eviews 9

The VEC, Granger Causality/Block Exogeneity Wald Test is interpreted on the basis of the p-values. If the p-values are less than the conventional 0.05, it indicates that there is a unidirectional causality from independent variable to dependent variable. Table 3 shows that there is unidirectional causality from terms of trade (TOT), international oil price (OP), real foreign exchange rate (RFER) to real gross domestic product (RGDP). In other words, TOT, OP and RFER Granger cause RGDP.

**D. Short-run estimates**

Short run Vector Error Correction test results are presented in table 4.

**Table 4: Vector Error Correction Estimates**

Sample (adjusted): 3 39

Included observations: 37 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Error Correction:	D(RGDP)	D(TOT)	D(OP)	D(RFER)
D(RGDP(-1))	0.564470 (0.27200) [ 2.07528]	1.02E-11 (4.2E-12) [ 2.40436]	5.98E-12 (2.0E-12) [ 3.00293]	-5.63E-12 (2.7E-12) [-2.07369]
D(TOT(-1))	1.30E+09 (1.7E+10) [ 0.07581]	-0.283761 (0.26710) [-1.06236]	-0.058410 (0.12547) [-0.46552]	-0.077706 (0.17088) [-0.45474]
D(OP(-1))	-3.40E+10 (4.0E+10) [-0.85589]	0.383801 (0.62012) [ 0.61891]	-0.219828 (0.29131) [-0.75462]	0.059554 (0.39673) [ 0.15011]
D(RFER(-1))	4.15E+10 (1.8E+10) [ 2.33268]	0.986115 (0.27770) [ 3.55107]	0.394274 (0.13045) [ 3.02243]	0.018029 (0.17766) [ 0.10148]
C	1.41E+12 (9.4E+11) [ 1.50356]	-40.88740 (14.5889) [-2.80264]	-20.95448 (6.85323) [-3.05761]	25.46956 (9.33332) [ 2.72888]
R-squared	0.873138	0.328734	0.314852	0.337379
Adj. R-squared	0.852677	0.220465	0.204344	0.230505
F-statistic	42.67208	3.036280	2.849141	3.156787
Akaike AIC	59.15311	9.385143	7.874065	8.491807

Source: Author's computation with Eviews 9

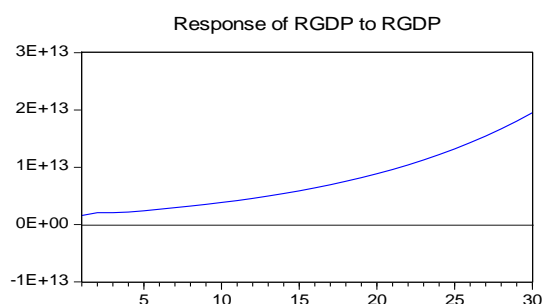


The short run results in table 4 show the impact of shock variables (terms of trade, international oil price and real foreign exchange rate) on real gross domestic product in Nigeria. Terms of trade (TOT) shocks impact positively on real Gross Domestic Products (RGDP) between 1981 and 2019. This result is in line with the findings of Easterly and Kraay (2000) as well as Giovanni and Levchenko (2009). The authors in their cross-country studies found a positive link between terms of trade and a country's income. It is important to state here that a developing country like Nigeria should exercise caution in pursuing economic growth through trade openness as terms of trade shocks become more potent in open economies. The short run results in table 4 also show that international oil price (OP) shocks caused positive and significant impact on Nigeria RGDP during the study period. This result is similar to the findings of Eltony and Al- Awadi (2001), and Sosa and Cashin (2013). The authors in their study found that international oil price and RGDP moves in the same direction in Nigeria. Table 4 further showed that real foreign exchange rate (RFER) shocks impact negatively and significantly on real gross domestic product (RGDP). Similar result was found by Rautava (2004). When a country's exchange rate appreciates it might cause her trading partners to seek alternative trading partners with lower exchange rates to do business with, which can have negative effect on the country's income.

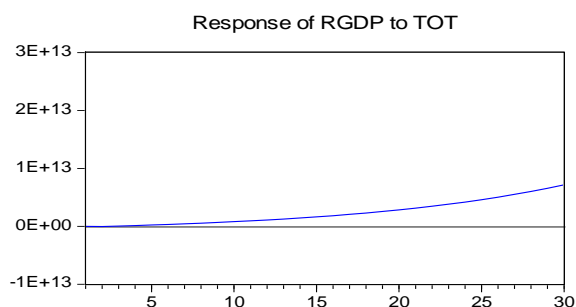
**E. Generalized Impulse Response Function (GIRF)**

Generalized Impulse Response Function (GIRF) captures interrelationships among the variables in the model. The results of GIRF test are presented in figure 1.

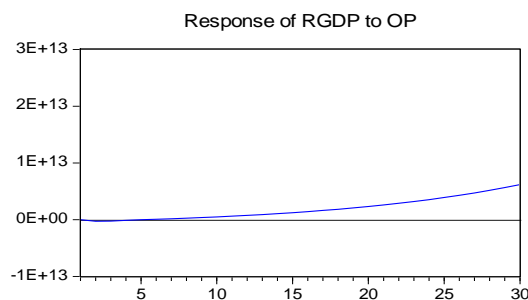
Response to Cholesky One S.D. Innovations



Response to Cholesky One S.D. Innovations



Response to Cholesky One S.D. Innovations



Response to Cholesky One S.D. Innovations

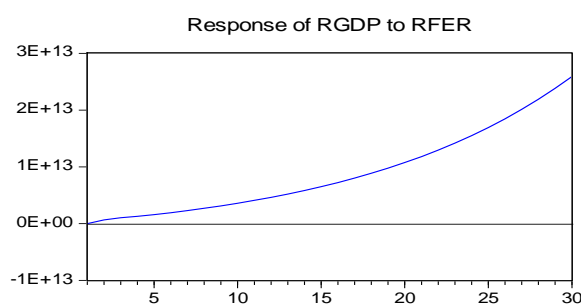


Figure 1: Generalized Impulse Response Function

Source: Author’s computation from Eviews9

Figure 1 presents the Generalized Impulse Response Function (GIRF) estimates. The figure clearly showed a very huge response of RGDP over the forecast horizon of thirty years due to its own shock. The figure also showed that one standard deviation innovation in terms of trade (TOT) results in a positive but not very high response in RGDP. In other words, RGDP responded positively but not significantly to one standard deviation innovation of TOT over the forecast horizon of thirty years. The same is true of the response of RGDP to a positive one standard deviation innovation in international oil price (OP). The low response of RGDP to TOT and OP may be as a result of the neutralizing effects of their transmission mechanisms. For instance, the actual effect of the proceeds of crude oil in Nigeria may not actually reflect on RGDP because the financing of most other sectors of the Nigerian economy depends on oil. Thus, if those other sectors do not perform well after getting finance from oil proceeds, the response of RGDP may not be a true reflection of crude oil proceeds.

A positive one standard deviation innovation in real foreign exchange rate (RFER) caused a very high positive response of RGDP. This result is contrary to the short-run result obtained earlier, but may not be contrary to a priori expectation as high exchange rate (currency devaluation) can have the effect of reducing export prices and provoke high demand for export commodities in the domestic economy. Similar result was found by Owolabi and Adebite (2013). The authors in their research on the effect of exchange rate volatility on Nigeria economy found that there is a positive relationship between exchange rate and GDP. Specifically, their results show that if exchange rate increases by one percent, GDP will increase by 4.898 percent. Similarly, Iyeli and Clement (2017) in their study of Exchange Rate Volatility and Economic Growth in Nigeria, found that a 5 percent increase in exchange rate stimulates an increase of 5.511 percent in GDP.

**F. Variance Decomposition**

The Variance Decomposition estimates shows the amount of impact each shock variable has on GDP. The results of VDC test are presented in table 6.

Table 6: Variance Decomposition for RGDP

Period	S.E.	RGDP	TOT	OP	RFER
5	5.23E+12	78.64120	0.264547	0.555687	20.53857
10	1.10E+13	61.47335	1.423406	0.507792	36.59545
15	2.01E+13	50.09536	2.507515	1.242564	46.15456
20	3.38E+13	43.07605	3.282738	1.975252	51.66596
25	5.44E+13	38.68457	3.810453	2.548911	54.95607
30	8.47E+13	35.86245	4.168546	2.969408	56.99960

Source: Author’s computation with Eviews 9

The Variance Decomposition summarized in table 6 depicts an upward trend in impact of shock variables on RGDP. For instance, in the fifth year, TOT had an impact of just 0.26 percent which rose to 4.17 percent in the thirtieth year. In the same vein, the impact of international oil price (OP) and real foreign exchange rate (RFER) increased from 0.56 percent and 20.54 percent in the fifth year to approximately 3 percent and 57 percent respectively in the thirtieth year.

**G. Diagnostic Tests**

**Serial Correlation Test**

VEC Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation

Sample: 1 39

Included observations: 37

Lags	LM-Stat	Prob
1	15.71116	0.4733

Probs from chi-square with 16 df.

Source: Author's computation with Eviews9

Table 7 presents the serial or autocorrelation test for the variables that constitutes the model. The results show that there is no serial correlation as the p-value of 0.4733 is greater than the conventional 5 percent

**H. Heteroscedasticity Test**

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Sample: 1 39

Included observations: 37

Joint test:

Chi-sq	Df	Prob.
128.4188	100	0.0793

Source: Author's computation with Eviews9

The VEC Residual Heteroskedasticity Test results in table 7 show p-value of 0.0793 which is greater than 5 percent. This means that the model is homoscedastic.

**V. SUMMARY AND CONCLUSION**

We examined the impact of three external shock variables (international oil price, terms of trade and real foreign exchange rate) on economic growth in Nigeria. Vector Error Correction (VEC) model which is a variant of the Vector Autoregressive (VAR) model was used to estimate the impact of the shock variables on RGDP. The short-run results show a positive relationship between the shock variables and RGDP with the exception of real foreign exchange rate (RFER) which impacts negatively on RGDP. The Generalized Impulse Response Function (GIRF) for all the shock variables also showed a positive link with RGDP, and the Variance Decomposition estimates indicate a growing impact of shock variables on RGDP. This calls for government to put in place appropriate policies to cushion the growing effects of the external shock variables.

**A. Recommendations**

Openness of an economy is a major source of external shocks, and it is obvious that the Nigerian economy is very open and dependent on foreign goods. It is therefore important to boost the productive capacity of the domestic economy so that the country becomes less reliant on foreign goods. Government should match words with action by actually revamping refineries across the country so that we do not have to import refined petroleum products after sending out crude oil. In addition, there is the need to diversify the Nigerian economy away from oil as fluctuations in oil price constitute a huge channel through which external shocks affect the domestic economy. There should be deliberate effort on the part of government to subsidize the production of non-oil export commodities in order to protect the economy from oil price shocks that may cause negative effect on the nation's economy.

## REFERENCES

- [1]. Adeniyi, O., Oyinlola, A. and Omisakin, O. (2011) Oil price shocks and economic growth in Nigeria: Are thresholds important?. *OPEC energy review* 35(4), 308-333.
- [2]. Akinleye, S. O. and Ekpo, S. (2013) Oil price shocks and macroeconomic performance in Nigeria. *Economía mexicana nueva época* 2, 565-624.
- [3]. Akpan, N. (2018). "The impact of external shocks on Nigeria's GDP performance within the context of the global financial crisis". University of Bradford, retrieved from <http://hdl.handle.net/10454/17454>
- [4]. Alley, I., Asekomeh, A., Mobolaji, H. and Adeniran, Y. A. (2014) Oil price shocks and Nigerian economic growth. *European scientific journal* 10(19), 375-391.
- [5]. Ang, B. & McKibbin, J. (2007). "Financial liberalisation, financial sector development and growth: evidence from Malaysia". *Journal of development economics* 84(1), 215-233
- [6]. Asika, N. (2006). *Research Methodology in the Behavioural Sciences*. Lagos: Longman Publishers
- [7]. Audu, I., Hussein, G. D. and Ejiemenu, S. C. (2015) Modeling the impact of crude oil price shocks on some macroeconomic variables in Nigeria using GARCH and VAR models. *American Journal of theoretical and applied statistics* 4(5), 359-367.
- [8]. Ayadi, O. F., Chatterjee, A. and Obi, C. P. (2000) A vector autoregressive analysis of an oil-dependent emerging economy-Nigeria. *OPEC review* 24(4), 329-349.
- [9]. Barsky, R. and Kilian, L. (2004). "Oil and the macroeconomy since the 1970s". *Journal of economic perspectives* 18(4), 115-134.
- [10]. Bormotov, M. (2009). "Economic cycles: historical evidence, classification and explication". Munich personal RePEc archive. Retrieved from: [https://mpra.ub.uni-muenchen.de/19660/2/MPRA\\_paper\\_19660.pdf](https://mpra.ub.uni-muenchen.de/19660/2/MPRA_paper_19660.pdf)
- [11]. Carbaugh, R. (2013). "International Economics", 14<sup>th</sup> Edition, Central Washington University.
- [12]. Central Bank of Nigeria (2010). "The changing structure of the Nigerian economy", in Mordi, C. N. O., Englama, A. and Adebusi, B. S. (ed.). Central Bank of Nigeria, Nigeria.
- [13]. Central Bank of Nigeria (2015) Annual Statistical Bulletin. Central Bank of Nigeria, Nigeria.
- [14]. Christiano, L. & Eichenbaum, M. (1992). "Current real-business-cycle theories and aggregate labor-market fluctuations". *The American economic review* 82(3), 430-450
- [15]. Dayo, B. (2016). "Oil price shocks, exchange rate and the Nigerian economy". *International Journal of Economics, Commerce and Management*, Vol 4, 8, United Kingdom
- [16]. Dunlap, A., Swan, P., & Fowler, J. (2009). "Economic Implications and surface disturbance mitigation of oil and gas development on Otero Mesa". Range Improvement Task Force Report 79. New Mexico State University, Las Cruces, NM
- [17]. Easterly, W. and Kraay, A. (2000) Small states, small problems? income, growth, and volatility in small states. *World development* 28(11), 2013-2027.
- [18]. Egwaikhide, F. O. (1999). "Determinants of imports in Nigeria: A dynamic specification". AERC Research paper 91, African Economic Research Consortium (AERC), Nairobi, 1-32.
- [19]. Ekesiobi, C. S., Oguanobi, C. R., Mgbemena, E. M., Ugwunna, O. T. (2016) An examination of external shocks and government revenue in Nigeria. *Developing country studies* 6(6), 119-125.
- [20]. Eltony, M. N. and Al-Awadi, M. (2001) Oil price fluctuations and their impact on the macroeconomic variables of Kuwait: A case study using a VAR model. *International Journal of energy research*, 25(11), 939-959.
- [21]. Energy Information Administration; Annual Energy Outlook 2012-2013
- [22]. Ezema, B. I. and Amakom, U. (2011) Terms of trade shocks: a major cause of distortion in the Nigerian economy. *Asian Journal of business and management sciences* 1(1), 25-38.
- [23]. Finn, M. (2000). "Perfect competition and the effects of energy price increases on economic activity". *Journal of money, credit and banking* 32(3), part 1, 400-416. 238
- [24]. Friedman, M. & Schwartz, A. (1963). "A monetary history of the United States, 1867-1960". Princeton University Press. <http://www.eh.net/?s=a+monetary+history+of+the+united>
- [25]. Giovanni, J. D. and Levchenko, A. A. (2009) Trade openness and volatility. *The review of economics and statistics* 91(3), 558-585.
- [26]. Granger, C. & Newbold, P. (1974). "Spurious regressions in econometrics". *Journal of econometrics* 2(2), 111-120.
- [27]. Gujarati, D. (2004). *Basic Econometrics*. 4th ed. New York: McGraw-Hill Higher Education.
- [28]. Ikenna, M. (2016). "The impact of terms of trade shocks on the volatility of selected macroeconomic variables in Nigeria". Msc Thesis retrieved from: <https://www.researchgate.net/publication/315683505>
- [29]. Imougehele, L. E. and Ismaila, M. (2015). "Monetary policy and balance of payments stability in Nigeria". *International Journal of academic research in public policy and governance*, 2(1), 1-15.

- [30]. Iyeli, I & Clement, U. (2017). "Exchange Rate Volatility and Economic Growth in Nigeria". *International Journal of Economics, Commerce and Management*, Vol. 5, Issue 7
- [31]. Kydland, F. & Prescott E. (1982). "Time to build and aggregate fluctuations". *Econometrica* 50(6), 1345-1370.
- [32]. Lawal, A., Atunde, I., & Ahmed, V. (2016). "Exchange Rate Fluctuation and the Nigeria Economic Growth". *EuroEconomica*, Vol 35, No 2
- [33]. Mendoza, E. (1995). "The terms of trade, the real exchange rate, and economic fluctuations". *Journal of international economic review* 36(1), 101-37.
- [34]. Monacelli, T. and Sala, L. (2009) The international dimension of inflation: evidence from disaggregated consumer price data. *Journal of money, credit and banking* 41(s1), 101-120.
- [35]. Nsofor, E., Takon, S., & Ugwuegbe, S. (2017). "Modeling Exchange Rate Volatility and Economic Growth in Nigeria". *Noble International Journal of Economics and Financial Research*, Vol. 02, No. 06, pp: 88-97
- [36]. Omisakin, O. A. (2008) Oil price shocks and the Nigerian economy: a forecast error variance decomposition analysis. *Journal of economic theory* 2(4), 124-130.
- [37]. Omojolaibi, J. A. (2013) Does volatility in crude oil price precipitate macroeconomic performance in Nigeria?. *International Journal of energy economics and policy* 3(2), 143-152.
- [38]. Osterholm, P. and Zettelmeyer, J. (2008) The effect of external conditions on growth in Latin America. *IMF economic review* 55(4), 595-623. Washington, DC: International Monetary Fund.
- [39]. Owolabi, A & Adegbite, T. (2013). "Effect of Exchange Rate Volatility on Nigeria Economy (1991-2010)". *International Journal of Academic Research in Economics and Management Sciences*, Vol 2, No. 6
- [40]. Oyelami, L.O., & Olomola, P.A. (2016). "External shocks and macroeconomic responses in Nigeria: A global VAR approach". *Cogent Economics & Finance*, 4(1). 1239317
- [41]. Rattsø, J. and Torvik, R. (1998). "Economic openness, trade restrictions and external shocks: modelling short run effects in Sub-Saharan Africa". *Economic modelling* 15(2), 257-286.
- [42]. Rautava, J. (2004) The role of oil prices and the real exchange rate in Russia's economy- a cointegration approach. *Journal of comparative economics* 32(2), 315- 327.
- [43]. Rebelo, S. (2005). "Real business cycle models: Past, present and future". *Scandinavian Journal of economics* 107(2), 217-238.
- [44]. Sims, C. (1980). "Macroeconomics and reality". *Econometrica: Journal of the econometric society* 48(1), 1-48
- [45]. Soh, F., & Ancel, R. (2013). "Impact of Oil Prices Fluctuations on Economies in the Age of Globalization". *Applied Economics Thesis Paper* 7.
- [46]. Sosa, S. and Cashin, P. (2013) Macroeconomic fluctuations in the caribbean: the role of climatic and external shocks. *The Journal of international trade and economic development* 22(5), 729-748.
- [47]. Tijani, J. O. (2014). "Empirical analysis of balance of payment adjustment mechanisms: Monetary channel in Nigeria, 1970–2010". *Mediterranean Journal of social sciences*, 5(14), 67-76.
- [48]. Umar, G. and Kilishi, A. A. (2010) Oil price shocks and the Nigeria economy: a variance autoregressive (VAR) model. *International Journal of business and management* 5(8), 39-49.
- [49]. Yusuf, M. (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.