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# Oil Price Volatility and Nigeria'seconomic Growth: A Case for Diversification of Nigerian Economy

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## ABSTRACT

*The study examined the effects of oil price shocks on growth of Nigerian economy from 1980 to 2017. The study used the vector Auto Regression (VAR) approach to examine how Nigeria's gross domestic product (GDP) responds to shocks from international oil price. The analysis revealed that oil price shocks, the average, transmitted negative shock to the gross domestic product in Nigeria. The forecast variance decomposition revealed that oil price shocks accounted for about 53% variation in the level of the gross domestic product during the period under reviewed. It was therefore recommended that the government intensity effort at diversifying the energy mix and sources of fiscal revenue to reduce the effect of oil price shocks in Nigerian economy and stimulate sustainable economic growth.*

*Keywords: Diversification, Energy mix, Economic growth, Sustainable Development, Oil price volatility.*

## *1 INTRODUCTION*

Nigeria has made huge earnings from the sale of crude oil over the years. Yet, country being challenged by diverse problems such as high unemployment rate, high inflation rates, unfavourable balance of payment, sluggish economic growth.

The characteristics of the country's economic performance suggest that Nigerian economy is susceptible to international oil price volatility. It is worthy to note that Nigeria's second national development plan (1970-1974) had a capital budget of ₦4.9 billion but the increase in international oil prices caused an upward review of the budget to ₦5.4b. similarly, the third national development plan (1975-1980) had a planned capital budget of ₦30 billion. Again, there was an upward review to ₦43.3 billion as a result of continuing inflow of oil revenue (Fattouh, 2009). Ukwu (1999) say that the 4$^{th}$ national development plan (1981-1985) had a different fate as the international oil market glut led to a fall in oil price in 1981. The initial budget of ₦82.2 billion was slashed to ₦73.8 billion.

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The oil windfall which occurred in the 1970s and early 2000s were not efficiently utilized to enhance economic development. this has kept Nigeria as one of the less developed countries of the world. Nigeria is a mono-product country who depends solely on oil as a major source of revenue. Nigerian economy is therefore susceptible to shocks created by unstable oil prices. Nigeria has undergone several episodes of oil shock which always exert an impact on key macro-economic variables. For instance in July 2008 oil price of $147 per barrel dropped to $41.4 per barrel in December 2008. Also, there was a collapse of oil market in 1986 to 1998, and the 2000 to 2001 Middle East energy crisis. All these episodes contribute to the volatility in oil price and oil revenue.

The fact that the Nigerian budget for the last two decades is crude oil laden implies that changes in the price of crude oil will have a significant effect on macro-economic indices of Nigerian Economy and its development. The 2017 budget expects about 70% of the revenue from crude oil at $43.00 per barrel. This makes the country very vulnerable to fluctuation in international oil price. Despite the important role international oil price plays in Nigerian economy, very little has attention been paid to its effect on the macro-economic stability of Nigerian economy and on the overall development of the economy. Empirical studies on the relationship between oil price and economic growth are very few, especially in Nigeria and in the sub-Saharan African region. Equally, findings of empirical studies on the relationship between crude oil price and economic growth are divergent. While Akpan (2009), Uriakhi and Osaze (2013) find a positive relationship between international crude oil price and economic growth in Nigeria, others such as Wakford (2006) and Bouzid (2012) found negative relationship between crude oil price and economic growth in Tunisia and South Africa respectively.

There is the need to understand how volatility in crude oil price and oil revenue affect growth of Nigeria's Economy. The understanding of how oil price and revenue variations affects the performance of Nigerian economy will assist in formulating appropriate policies to deal with the negative and undesirable effects of oil price volatility in Nigerian economy

It is in the light of this that this study seeks to examine the effect of international oil price variations on growth of Nigerian economy between 1980 to 2017.

The study has significance in Nigeria economy. The findings of the will inform concerned authorities of the need to diversify Nigerian economy away from oil. The remaining part of the study will be organized into four sections as follows. section two is the literature review, section three deals with the method of the study, section four presents and discusses the empirical results; while section five is devoted the summary and conclusion from the study

## 2 Literature Review

The issue of oil and oil reveue in Nigerian economy is best explained by the Resource Curse Theorem.The term "resource curse" was first used by Auty (1993) to describe a situation in which nations endowed with the abundance of mineral resources were unable to utilize the

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revenue accrued to boost their economy and how surprisingly such countries had lower economic growth/development when compared to other countries with lesser endowment of natural resources. A popular study by Sachs and Warner (2001) observed a strong correlation between natural resources abundance and poor economic growth.

The International Monetary Fund (IMF) classifies 51 countries as "resource-rich". These are countries which derive at least 20% of exports or 20% of fiscal revenue from non-renewable natural resources. 29 of these countries are low and lower-middle income countries. Common characteristic of these 29 countries are i. extreme dependence on resource wealth for fiscal revenues ii) Poor growth performance (iii) low savings rate (iv) highly volatile resources revenues. Resources curse thesis claims that resource wealth is linked to poor economic growth and other economic problems.

Like Dutch Disease effects, poor performance of the agricultural and manufacturing sectors, insufficient degree of diversification and extreme vulnerability to external shocks, are characteristics of resource curse economies. A further branch of the resource curse thesis shows the link between natural resources and violent conflicts (Collier & Hoeffler, 2001).

The central hypothesis is that resource-dependent countries are more likely to experience internal instability and violent conflicts than non-resource countries. The causes assumed to be responsible for this is the fact that natural resources can be the motive for violent conflicts as parts of a population may feel that they are deprived of the financial benefits of the resource revenue while possibly suffering from the social and ecological impacts of the production of that resource. Resource curse theory is more applicable to the Nigerian economy because Nigerian has shown signs of a country plagued with a resource curse. Natural resources abundance has been associated with slow economic growth, greater inequality and poverty for a larger majority of a country's population (Sachs and Warner, 1995).

## 2.2 Empirical Literature

There is a plethora of empirical studies on the relationship between oil and economic growth within and outside Nigeria..

Omolola and Adesumo (2006) investigated the relationship between international oil price shock and output, inflation, real exchange rate, and broad money supply in Nigerian Economy. they applied Vector Autoregressive (VAR) Model and data from 1980 to 2005.

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They observed that international oil price shocks have no significant effect on output and inflation, but the impact was significant on exchange rate, and broad money supply.

Sadorsky (1999) examined the effect of oil price shocks on stock exchange. In the United States of America, His model had interest rate, industrial output, and selected shock index. He employed the VAR and GARCH method of analysis. The result revealed that international oil price had a negative and significant effect on stock prices.

Papapetrau (2001) studied the relationship between oil price shocks, stock exchange, interest rate, and employment. He used GARCH method and data from 1972 to 2000. The result showed that oil price shocks had negative impact on output, employment and stock market performance.

Empirical study of the impact of international oil price shocks on eight (8) industrialized countries by Imen *et al* (2004) using panel data from 1980 to 2002 and panel data analysis is techniques revealed that oil price shocks have significantly negative effect on economic growth in the eight countries.

Mohammad (2012) investigated the relationship between oil price fluctuations and export earnings in four (4) oil exporting countries. He used quarterly data from 1977 to 2010 and VECM. The study highlighted that there is a significant relationship among oil price fluctuations GDP growth, standard of living, and broad money supply. He recommended setting up a butter account to absorb the shocks form oil price variability.

Farzanegan and Markwardt (2009) studied the relationship oil price variations and macro-economic variables in iron's economy for the period of 1975 to 2006. They used annual time series data and VAR model. The result shows that there is a asymmetric impact of oils shocks on macro-economic variables. Positive and negative shock has significant effect on inflation. Also, there is a positive and significant relationship between oil price shock and industrial sector output.

Berument *et al* (2010) examined the impact of oil price shocks on the GDP of selected NEMA countries, which are either net exporter or importer of oil. They used vector Autoregressive model and decimal data form 1952 to 2004. The study suggested that oil price movement does not have any significant impact on the GDP of oil importing countries, but have significant impact on oil exporting countries.

Akas *et al* (2010) who investigated the short term effects of oil price shock on the GNP of Turkey form 02:1991 to 02:2008 using VAR model. They found that increase in oil price have opposite and significant effect on unemployment and terms of trade.

Aydn and Acar (2011) studied the effect of oil price fluctuations on Turkey's economy from 1990 to 2010. The study examined the effect of oil price on Turkey's GDP, trade balance, inflation, tax revenue and carbon emission by using the Turk-GEM-D method of analysis.

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The result shows that low and rising oil price has large and significant impact on Turkey's economy.

Abdalla (2013) investigated the effect of oil price shocks on stock returns in Saudi Arabia. The results from the daily returns index shows that stock returns volatility increases as a result of oil price fluctuations during the period under review.

Alley *et al* (2014) studied the effect of oil price fluctuations on Nigerian economy from 1981 to 2012. He used VECM and annual time series data. The result shows that oil price stock has negative and significant effects on economic growth in Nigeria. This means that fall in oil price has negative impact on Nigeria's economic growth.

Negi (2015) examined the effect on oil price shocks on the gross domestic production of Brazil, Russia, India and China (BRIC) from 1987 to 2014. The result shows that oil price increase has negative relationship with GDP in China and India and positive relationship with GDP in Brazil Russia.

Wei and Guo (2016) empirically analysed the relationship between oil price and China's Macro-economic variables between 1996 and 2014. They used VECM method and quality data. The study revealed that interest rate and output responds significant to change in oil price.

Rahma, *et al* (2016) estimated the impact of oil price on Sudan's GDP growth rate and unemployment. The study applied the CAR model and used annual data from 2000 to 2014. They observed that decrease in oil price has positive and significant effect on GDP growth, and also, fall in oil price has a significant positive effect on unemployment rate.

Al Rasaki and Yilmaz (2016) investigated the effect of oil price volatility on economic growth, exchange rate and inflation in Turkey between 1$^{st}$ quarter 1987 and 1$^{st}$ quarter 2015 and the VAR techniques. Their result shows that oil price fluctuation has negative effect on economic growth and raising oil price has positive effect on inflation, and depreciation of the exchange rate.

From the literature reviewed above, it is important to note that there is no consensus on the effect of oil price shocks on the economic growth and development. The impact is different from country to country, depending on whether the country is an oil importer or exporter. Study by Negi (2015), Al Rasaki and Yicmaz (2016) found negative relationship between oil price shock and economic growth in China, India and Sudan respectively, while Swidies by Akley *et al* (2014) found positive relationships in Nigerian economy. Thisis what the present study seek to resolve by applying the VAR model to a longer duration of thirty seven years.

## 3 Method of the Study

This section explains the method employed in the collection and analysis of the study data

### 3.1 Model Specification

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Contemporary literature on oil price volatility builds on models using Vector Autoregressive (VAR) model to trace the effect of oil price volatility on macroeconomic variables. The present study follows the same approach and therefore adopted a modified model of Omo and Basher (2015).

Generally, the choice of the VAR model rests on its simplicity and on its high predictive power. Again, the VAR model enables the research to view the interaction among the variables, trace the time path of the variables through the impulse response function, as well as relieves the researcher of the need to specify endogenous and exogenous variables since all variables are taken as endogenous.

The VAR frame work for the analysis is

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + V_t \quad \text{.....3.1}$$

Where:

$$Y_t = \begin{bmatrix} RGDP \\ Oil\ Price \\ Oil\ Rev \\ EXCH \end{bmatrix} \quad \beta_0 = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \\ \beta_{40} \end{bmatrix} \quad \beta_1 = \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} \\ \beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} \\ \beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} \end{bmatrix} \quad Y_{t-1} \begin{bmatrix} \Delta RGDP_{t-1} \\ \Delta Oil\ Price_{t-1} \\ \Delta Oil\ Rev_{t-1} \\ \Delta EXCH_{t-1} \end{bmatrix}$$

This is indeed an unrestricted VAR model: there is interaction and effect of all the variables on other variables.

### 3.2 Data Required and Sources

The data required for this study are annual time series data of the following variables:

i. Average crude oil price (Bonny Light) (Oilprice)
ii. Average Revenue from Crude Oil (OIL REX)
iii. Nominal Exchange rate of naira to dollar (EXCH)
iv. Real Gross Domestic Product (RGDP)

All data are secondary in nature and were collected from 1980 to 2017. The main sources of the data are as follows:

Data for the Real GDP were collected from the Central Bank of Nigeria Statistical Bulletin (various issue). Data for the nominal exchange rate of naira to the dollar was collected from the World Bank World Development Indicator (WDI) on the Internet. Crude oil revenue data was collected from the Central Bank of Nigeria Bulletin. Annual average price of crude oil (Brent crude) were collected from International Energy Agency (IEA) and the Bloombery database on the internet. Supplementary materials were taken from text books, journals, published and unpublished works of other researchers.

### 3.3 Estimation Techniques

The data was analysed using VAR regression analysis techniques. The VAR regression analysis techniques proceeded in the following order:

i. **Unit Root Test:** According to Maddala (2004) time series data are fraught with unit root. Unit root phenomenon in variable data occasions spurious regression. Hence, the data analysis began by examining the unit root stationarity property of the variable. Augumented Dickey Fuller (ADF) method was adopted

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ii. **Co-integration Analysis:** The difference variables were examined for co-integration; that is, examine whether there is any fixed long term relationship in the model. The Johansen (1998) co-integration approach was employed, using both the Trace and Maximum Eigen Value statistics.

iii. **Impulse Response Function:** The Impulse response function depicts the direction of effect of shocks in the exogenous variable on the endogenous variable and the level of this effect within some specified period. It was used to examine the level and direction of effect of oil price volatility on economic growth.

iv. **Variance Decomposition:** The variance decomposition was employed to analyze the percentage contribution of the various exogenous shocks on the endogenous variable.

v. **Granger Causality:** Granger Causality test was carried out identifies the direction of causality and test the stated hypothesis

## 4 Empirical Results and Discussion of Findings

This sections presents the result from the empirical data analysis and discussed the findings from the study. The section is structure as follows:

### 4.1 unit root analysis results

Test of unit root examined the variable data for unit root, or what is the same, for stationary. Stationary is important for the use of time series data for analysis. The unit root test was conducted using the augmented dickey-fuller (ADF) approach. The results are presented in table 4.1 below.

Table4.1 Augmented Dickey Fuller Test Result

| Variables | Level | 1st difference | Order |
|---|---|---|---|
| **GDP** | -2.7949 | -5.6327 | 1(1) |
| **OILP** | -1.3112 | -5.1270 | (1) |
| **OILREV** | -1.4418 | -6.6355 | 1(1) |

| | | | |
|---|---|---|---|
| **EXCHR** | -1.2648 | -3.6595 | 1(1) |

1% =-3.6394 5%= -2.9511, 10% = -2.6143

From the ADF test result presented above, it shows that the variables have unit root at level. Therefore they are not stationary at levels. After 1st differences, all the variables become stationary. They are therefore stationary at 1st diff4erenceb or they are 1(1) series

**Co-integration analysis**

Co-integration analysis examined the integrated variables for co-integration that is, weather the variables can stay together in a lorry run relationship and whether any meaningful model can be estimated from the integrated variables. A Johansen co-integration analysis technique was employed (johansen, 1988). The results are shown in table 4.2 and 4.3 below.

Table 4.2 unrestricted cointegrattion rank test. Maximum sign value

| **Hypothesis No,CFS** | **r =0** | ***r* ≤ 1** | **r ≤ 2** | **r ≤ 3** |
|---|---|---|---|---|
| **Maximum Eigen value** | 119.9400* | 68.6130* | 32.0288* | 1.2848 |
| **5% critical value** | 47.8561 | 29.7990 | 15.4947 | 3.814 |

Table 4.3 unrestricted co-integration rank test. Maximum sign value

| Hypothesis No,CFS | r =0 | $r \leq 1$ | r ≤ 2 | r ≤ 3 |
|---|---|---|---|---|
| **Maximum Eigen value** | 51.3268* | 36.5841* | 30.7440* | 1.2848 |
| **5% critical value** | 27.5843 | 21.1316 | 14.2646 | 3.8416 |

The result of the johansen co-integration 1st presented above show that there is a stable lorry run relationship in the model. Both the trace and maximum sign value statistic show at least 3 co-integration rank equations in the model. thus, the integrated variables can be combined in model and estimated.

### 4.3 lag order selection

In estimating a VAR model, the order of the lag in the model is very important more than optimal lag length will take more degree of freedom and bias the result. Less than optional lag length will Standard has order selection criteria were applied for selecting the lag length in model. The result of the lag order selection criteria is presented thus:

## Table 4.4: VAR Order Selection Criteria

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -1005.557 | NA | 4.39e+21 | 61.18529 | 61.36668 | 61.24632 |
| 1 | -899.3367 | 180.2530* | 1.87e+19* | 55.71738* | 56.62435* | 56.02255* |
| 2 | -883.7833 | 22.62310 | 2.01e+19 | 55.74444 | 57.37700 | 56.29375 |
| 3 | -872.9035 | 13.18770 | 3.11e+19 | 56.05476 | 58.41289 | 56.84820 |

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

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The result of the lag order selection criteria shows that the optimal lag order for the model is 1. This impulse that the best model for the empirical analysis is the one that include only 1 lag of each of the independent variables. The VAR model was estimated and the impulse response (IR) and Forecast Variance Decomposition graphs and table presented below respectively.

## Impulse Response Function

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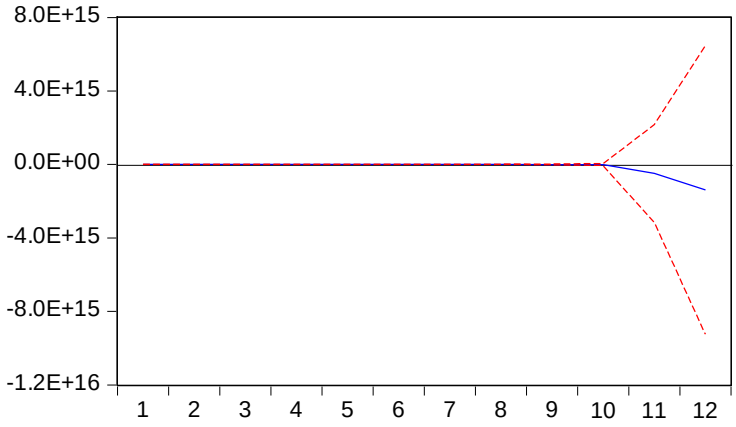
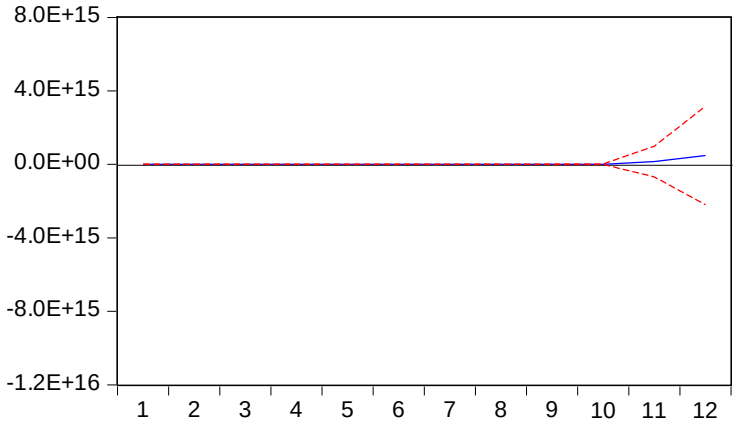
Response to Cholesky One S.D. Innovations ± 2 S.E.

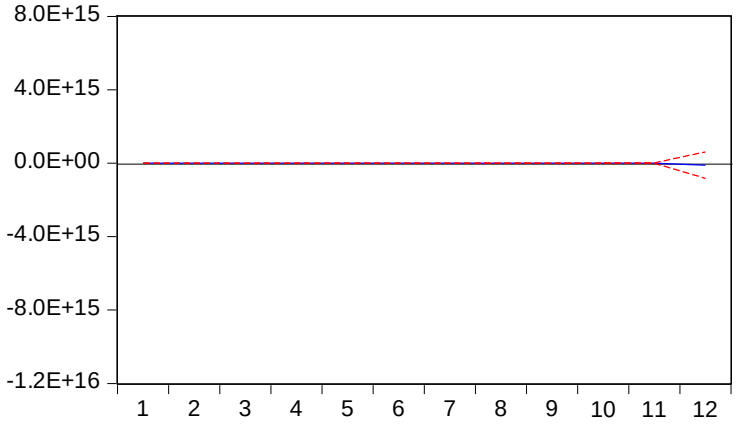
Response of GDP to OILPRICE




Response of GDP to OILREV




Response of GDP to EXCH



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The impulse response function shows the response of GDP to 1 standard deviation in oil price, oil revenue, and exchange rate of naira to the United States dollars. Figure 4.1 shows the response of gross domestic product to shocks or innovations in the international oil price. The figure reveals that the GDP responds negatives to the shocks arising from international oil price. This implies that oil price volatility has negative influence on the growth of the domestic economy.

The response of GDP to oil revenue shock is positive, however, very insignificant. The figure, figure 4.2 shows that the GDP starts responding to change on oil revenue after nine period's lags in the same direction. Thus, increase in oil revenue automatically leads to increase in the GDP, but the influence is very insignificant.

The response of the GDP to the exchange rate volatility is not discernible. The GDP has very passive response to exchange rate variation. This reveals an important characteristic of Nigerian. The Nigerian does not have significant proportion of external trade. The economy is mainly exporting primary resources.

**Forecast Variance Decomposition**

The variance decomposition shown in Table 4.5 repeats exactly what has been explained from the impulse response function graphs.

**Table 4.6: Variance Decomposition of Real GDP Shock**

| Period | S.E. | OILPRICE | OILREV | GDP | EXCH |
|---|---|---|---|---|---|
| 1 | 13.85924 | 43.29793 | 4.179691 | 52.52238 | 0.000000 |
| 2 | 18.71140 | 54.68845 | 7.646193 | 36.27691 | 1.388448 |
| 3 | 51.97040 | 43.59422 | 4.126282 | 52.27917 | 0.000324 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 113.0592 | 56.13370 | 7.479720 | 35.39691 | 0.989670 |
| 5 | 4205.779 | 43.69393 | 4.146643 | 52.15896 | 0.000467 |
| 6 | 12070.92 | 55.74052 | 7.174972 | 36.37600 | 0.708504 |
| 7 | 447642.7 | 43.79292 | 4.167044 | 52.03938 | 0.000662 |
| 8 | 1430002. | 54.80804 | 6.834107 | 37.83759 | 0.520272 |
| 9 | 47768408 | 43.89072 | 4.187240 | 51.92113 | 0.000908 |
| 10 | 1.68E+08 | 53.79675 | 6.526637 | 39.28252 | 0.394094 |
| 11 | 5.10E+09 | 43.98709 | 4.207182 | 51.80453 | 0.001203 |
| 12 | 1.95E+10 | 52.86235 | 6.266484 | 40.56365 | 0.307516 |

Cholesky Ordering: OILPRICE OILREV GDP EXCH

The forecast variance decomposition shows that oil price variation accounted for about 43.9% variance in the value of economic growth in Nigeria during the period under review. This is the same pattern depicted by the impulse response function.

## 5 Summary and Conclusion

The study examined the effect of oil price variation on the growth of Nigerian from 1980 to 2017. The study used Vector Autoregressive model approach to estimate the response of gross national domestic product to oil price shock, and the forecast variance of gross domestic product due to volatility in the oil price. The results from the impulse response function shows that volatility of international price have negative effect on the growth of the gross domestic product. Oil price shocks have negative effect on the growth of the domestic economy. The influence of oil revenue on the domestic economy is positive but insignificant, this implies that increase in revenue does not translate to growth of the domestic economy. This once again, has confirmed the presence of resources course syndrome in Nigerian economy: The revenue from the national resources has not been translated into economic growth and development. There is nothing to show for the huge oil revenue. Unemployment and infrastructure deficit are the main characteristics of the Nigerian economy. There is lack in the mist of plenty.

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The fact that the oil price volatility contributes about 53% variation in the level of change of the GDP and the negative influence of oil price volatility on the growth of the domestic economy implies that volatility in the oil price is directly and negatively transmitted to volatility in economic growth. An economy built on oil revenue will always experience macro-economic instability. Government finances that

The results shows that oil price shocks accounts for about 52% variation in the level of economic growth after 12 months. Oil revenue shocks accounted for 6% variations in GDP, while exchange rate shocks accounted for the least change influence in GDP during the period under reviewed. The influence of past GDP level is highly significant.

The results from the analysis of impulse and the fore cost variance decomposition have revealed that oil price volatility has significant negative influence on the growth of Nigerian economy. Oil revenue has little influence on the growth of the economy. Exchange rate volatility has significant effect on the growth of the economy. Belles henrily on all revenue are bound to fail fluctuation in oil price has been responsible for poor budget performance and budget failure in Nigerian economy. Oil price fluctuation is also responsible for most failed projects in Nigeria.

Growing Nigeria economy out the resources course needs a shift from reliance on oil revenue to a more reliable source of revenue. This enfacts diversifying the economy away from oil to another source of revenue. Saving excess revenue from the crude oil earning, in the form the current Excess crude Account is a welcome development. However, there is the need to invest the excess crude oil revenue in project that has substantial background and linkage in the economy rather than sharing another three tiers of government. Fluctuations in oil price has important and negative effect on output in Nagsia, especially the manufacturing sector

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Belles heavily on all revenue are bound to fail. Fluctuations in all prise have been responsible for poor budget performance and budget failure in Nigerian economy. Oil price fluctuation is also responsible for most failed project in Nigeria Growing Nigeria economy out the resource course needs a shift from reliance on oil revenue to a more reliable source of revenue. This entaits diversifying the economy away from oil to another sources of revenue. Saving excess revenue from the crude oil earning, in the form current excess crude account is a welcome development. However, there is the need to invest the excess crude oil revenue in projects that have substantial background and linkage in the economy rather than sharing another three tiers of government. Fluctuations in oil price have important and negative effect on output in Nigeria, especially, the manufacturing sector. Reducing output fluctuations is critical to economic growth. Energy diversification is necessary to stabilizing output and economic growth. Diversifying the energy base of the energy from oil to renewable and leaper energy resources will pay off in the lorry run form of stable and sustainable economic growth. For the economy to achieve sustainable growth, diversification of both energy and revenue resources away from oil is critical.