Oil price volatility and economic growth in Nigeria

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Abstract

One of the main causes of economic crisis in the world is Oil Price Volatility (OPV). This makes it necessary to examine the effect of oil price volatility on economic growth in an oil exporting country like Nigeria and this has a special significance. Therefore, this paper has examined empirically the effect of oil price volatility on economic growth in Nigeria using annual time series data from 1985 – 2016. The findings revealed that OPV has a negative and insignificant effect on economic growth in Nigeria. It was also found that the variables used in the study have a long-run relationship and finally no evidence of causality was found between oil price volatility and economic growth in Nigeria. The study recommends that exploring other alternatives has the potential to make the Nigerian economy stronger to face volatility crisis.

1. Introduction

Crude oil is one of the most critical macroeconomic factors in the world economy and the crude oil market is the biggest commodity market in the world. As a distinction from other commodities oil is likely one of the few or the only production input that can positively and negatively influence economic growth, to a degree that may even prompt a recession (González and Nabiyev, 2009).
Since the 1970s, the international crude oil price has been going up and down. González and Nabiyev (2009) opined that oil prices are not just rising; however, the volatility is also worsening-fluctuations are more pronounced than they were

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in the 1990s, and thereby creating unpredictable outcomes.

Crude oil price volatility from 1970s to 2011 has been progressively inconsistent with the fluctuation being more inconsistent since 2002. Oil price volatility houses growth through various channels, from an increase in production cost to inflation expectations. Plus, oil price increments can convert into higher transportation, production, and heating costs, which can put a delay on corporate earnings. It can likewise influence price stability, firm profitability and the financial system stability of a nation (Li and Zhao, 2011).

Crude oil is a major asset of oil exporting countries like Nigeria. Oil price volatility has become a major issue for the country. Therefore, the objective of this paper is to examine the effect of oil price volatility on economic growth in Nigeria.

2. Literature Review

Narayan and Narayan (2007) modelled the volatility of daily oil prices by using Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. They showed that asymmetric impacts are obvious, persistent, and perpetual in the oil price series.

Olowe (2009) analyzed weekly oil price volatility of all countries average spot price using EGARCH (1, 1) over the period January 3, 1997 to March 6, 2009. He found that the oil Price return series show high persistence of volatility, volatility clustering and asymmetric properties.

Adeniyi, Oyinlola, and Omisakin (2011) applied the Multivariate Threshold Autoregressive Model (MTAM) and found that oil price volatility does not significantly influence movement of macroeconomic aggregates in Nigeria.

Jamali et al (2011) explained the Pakistan economy and the impacts of oil price on the economy. They inferred that because of increased oil prices all other variables like inflation rate, interest rate, exchange rate movements, unemployment, low investment, low economic activities, low GDP and low economic growth are unfavorably influenced.

Taiwo, Abayomi and Damilare (2012) used Johasen Cointegration Test and Error Correction Model, as a result they found that crude oil price, stock price and exchange rate have significant influence on economic growth in Nigeria.

Oriakhi and Osaze (2013) analyzed the consequences of oil price volatility on economic growth in Nigeria for the period 1970 to 2010. They used the VAR model and found that oil price volatility has direct influence on government expenditure, real exchange rate, and real import while real GDP and inflation are indirectly affected by the oil price volatility. However, the study shows that changes in oil price determines government spending which thus affects the growth of the Nigerian economy.

Also, by utilizing monthly data, Apere and Ijomah (2013) found a unidirectional relationship between interest rate, exchange rate and oil price with direction of

causality running from oil prices. They also found that oil price has no significant impact on real GDP. This conclusion was reached with the use of EGARCH model, Impulse Response Function and Lag-Augmented VAR for the investigation of the macroeconomic impact of oil price levels and volatility in Nigeria amid the period 1970-2009.

Jawad (2013) contended that oil price shocks also has an effect on the economic development while they influence the oil exporting nations and oil importing nations in a different way. Based on the results the GDP and economic growth will be affected. Wilson, David, Inyiama and Eneje (2014) examined the relationship between oil price volatility and economic development in Nigeria. They Applied Ordinary Least Square and Granger Causality Test, the results show that there is no significant relationship between oil price volatility and key macroeconomic variables (Real GDP, inflation, interest rate and exchange rate).

Siddiqui (2014) clarified that investment in oil influence significantly the economic development, economic growth and GDP growth. He additionally proposed that oil price increment will influence all these variables and furthermore the stock and exchange market.

Ebrahim, Inderwidi and King (2014) carried out a theoretical examination of macroeconomic impact of oil price volatility. They found that oil price volatility imposes a crucial hindrance to economic growth by harming and destabilizing effect on the macro economy. Furthermore, they demonstrated that oil price volatility adversely influences aggregate consumption, investment, industrial production, unemployment and inflation especially in non-OECD countries.

Katircioglu et al. (2015) analyzed the association and the changes in oil prices and macroeconomic variables (GDP, CPI and unemployment) among 26 OECD economies from 1980 to 2011. The authors concluded by econometrics test (durbin-h panel co-integration) that changes in oil price has an inverse influence on macroeconomic indicators.

Abdulkareem and Abdulkareem (2016) gave a diagnostic insight on macroeconomic modelling and oil price volatility in Nigeria. They used GARCH model and its variants (GARCH-M, EGARCH and TGARCH) with daily, monthly and quarterly data. They found that the macroeconomic variables included in the model in terms of (real gross domestic product, interest rate, exchange rate and oil price) are exceptionally unstable; the asymmetric models (TGARCH and EGARCH) outperform the symmetric models (GARCH (1 1) and GARCH – M); and oil price is a noteworthy source of macroeconomic fluctuation in Nigeria. By suggestion, the Nigerian economy is vulnerable to both internal shocks (interest rate volatility, real GDP volatility) and external shocks (exchange rate volatility and oil price volatility). In this way, it is reasoned that more assurance ought to be given to symmetric models in dealing with macroeconomic volatility in Nigeria and oil price volatility should be considered as pertinent variable in examining macroeconomic fluctuations in Nigeria.

Jawad and Niazi (2017) analyzed the effect of oil price volatility and macroeconomic variables (Trade balance, private sector investment and

public-sector investment) on economic growth in Pakistan. They employed linear regression model, Johannsen cointegration test, Vector Autoregression, impulse response function and variance decomposition. The findings showed that the Public-sector investment and Trade Balance has significant effect and oil price volatility and private sector investment has insignificant effect on gross domestic production of Pakistan. Consequently, they conclude that the effect of variables was stable within 10 years and the major part on the variable is due to itself rather than other variables.
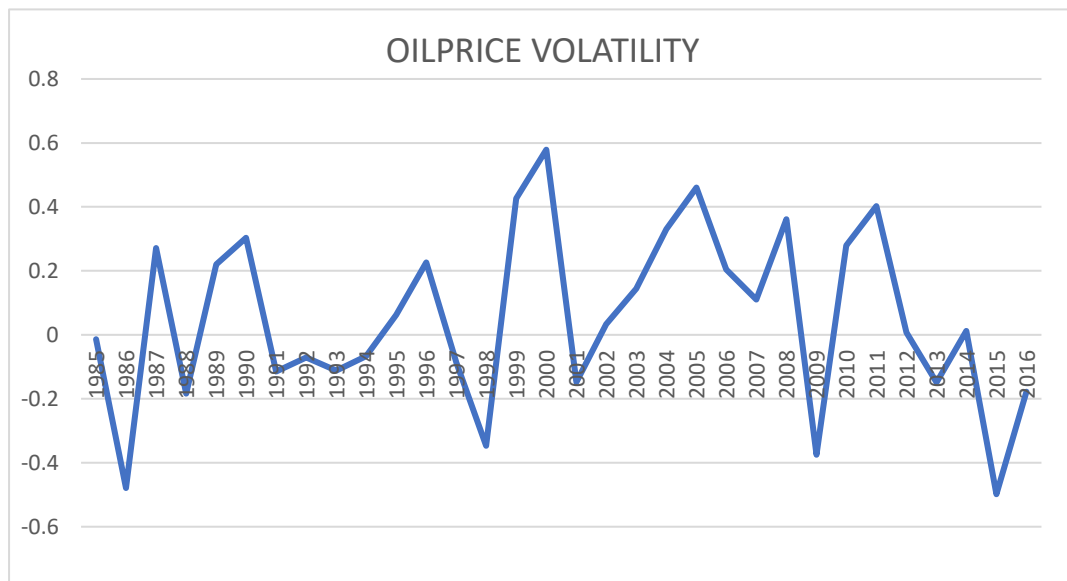

Figure 1: Trends in Oil Price Volatility in Nigeria from 1985 – 2016

Source: Microsoft Excel, 2016

Clear evidence of volatility clustering is indicated in the figure above and the oil price volatility experiences sharp increases mostly followed by sharp declines. This indicates that oil price has not been stable during the period under review.

3. Methodology

The data used for this study are basically annual time series data covering 1985 to 2016. The data used for both dependent (real gross domestic product) and independent (degree of openness, foreign exchange rate, inflation rate and oil price) variables were obtained from World Bank data outlook, and Central Bank of Nigeria Statistical Bulletin. This study adopts the econometric method of multiple linear regression approach using Ordinary Least Square (OLS) to

examine the effect of oil price volatility on RGDP in Nigeria. Furthermore, volatility was defined through standard deviation in order to examine the effect of oil price volatility on economic growth in Nigeria following Jawad and Niazi (2017).

3.1   Model Specification

The model that seeks to examine the effect of oil price volatility on economic growth in Nigeria is specified following Jawad and Niazi (2017) thus:

$$RGDP = f(OPV, DOP, EXR, INF) \tag{1}$$

The linear form of the model is presented below:

$$LogRGDP_t = \beta_0 + \beta_1 OPV_t + \beta_2 DOP_t + \beta_3 EXR_t + \beta_4 INF_t + \varepsilon_t \tag{2}$$

Where:
RGDP = Real Gross Domestic Product at time t
OPV= Oil Price Volatility at time t
DOP = Degree of Openness at time t
EXR= Exchange rate and at time t
INF = Inflation Rate at time t
$\beta_1, \beta_2, \beta_3, \beta_4$ = The parameters to be estimated
ε_t = Stochastic term or error term at time t
t = time or scope of the study ranging from $1985 - 2016$.

4. Data Analysis and Results

When using time series data, it is necessary that the series are tested for stationarity, to achieve this the Augmented Dickey Fuller test was employed to check the stationarity of the variables and the result of the test is presented in the table below:

Table 1: ADF Unit Root Test for the Variables used in the Study

Variables	Order of Integration	Remark
RGDP	I (1)	Stationary at 1st difference
OPV	I (1)	Stationary at 1st difference
DOP	I (1)	Stationary at 1st difference
EXR	I (1)	Stationary at 1st difference
INF	I (1)	Stationary at 1st difference

Source: Author's computation

From table 1 above it can be clearly seen that the variables are stationary at first

difference, which implies that the variables are integrated of the same order.

Table 2: Results of the Estimated Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.746582	0.063250	154.0956	0.0000
OPV	-0.307221	0.162054	-1.895792	0.0687
DOP	0.019475	0.002564	7.594217	0.0000
EXR	0.003479	0.000533	6.524304	0.0000
INF	0.000495	0.001188	0.417010	0.6800
R-squared 0.962772				
Adjusted R-squared 0.957256				
F-statistic 174.5633				
Prob(F-statistic) 0.000000				

Source: E-views 9.0

From the result above the equation shows the constant value of 9.746582 which implies that without any change in the explanatory variables included in the model, the constant independently changes the RGDP by 9.746.

Furthermore, oil price volatility has the coefficient value of -0.307221 this means that OPV negatively impacted on the dependent variable during the period of study and also shows that a change in oil price volatility will negatively change GDP of Nigeria by -0.307 unit. The result also shows that degree of openness has a positive and significant effect on GDP of Nigeria and one-unit change in DOP would change GDP of Nigeria by 0.019 units. Consequently, the analysis on exchange rate means that, it has positive and significant impact on GDP of Nigeria and one-unit change in EXR may change the GDP of Nigeria by 0.003 units. In contrast the coefficient of inflation is positive but statistically insignificant.

The R squared value in the multiple linear regression equation above shows that the explanatory variables in terms of OPV, DOP, EXR and INF describe the dependent variable Gross domestic product of Nigeria by 96 %. The remaining portion cannot be explained by the model as it attributed to other macroeconomic variables outside the model which is only 4 %.

Looking at the F-statistic 174.5 and the probability value of 0.0000 we can conclude that the overall model is statistically significant i.e. the explanatory variables are jointly significant to explain the dependent variable, this is because the probability value of 0.0000 is less than 0.05% level of significance.

Johansen Cointegration

Table 3: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.717767	86.60587	69.81889	0.0013
At most 1 *	0.534310	48.65519	47.85613	0.0420
At most 2	0.483552	25.72814	29.79707	0.1371
At most 3	0.159533	5.904744	15.49471	0.7068
At most 4	0.022764	0.690806	3.841466	0.4059
Trace test indicates 2 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: E-views 9.0

From the above; the trace test indicates two cointegrating equations since the trace statistic of 86.6 and 48.6 are more than the critical values of 69.8 and 47.8 respectively.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.717767	37.95067	33.87687	0.0154
At most 1	0.534310	22.92706	27.58434	0.1766
At most 2	0.483552	19.82339	21.13162	0.0754
At most 3	0.159533	5.213938	14.26460	0.7147
At most 4	0.022764	0.690806	3.841466	0.4059
Max-eigenvalue 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				

Here the Max-Eigen statistic indicates 1 cointegrating equation since the Max-Eigen statistic of 37.9 is more than the critical vale of 33.8.
With this result we conclude that the variables used in the study have a long-run relationship, this implies that they move together in the long-run.

Granger Causality

Table 4: Granger Causality Test

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
OPV does not Granger Cause RGDP	30	2.51797	0.1009
RGDP does not Granger Cause OPV		0.56007	0.5782
DOP does not Granger Cause RGDP	30	2.00008	0.1564
RGDP does not Granger Cause DOP		2.26251	0.1250
EXR does not Granger Cause RGDP	30	4.93643	0.0156
RGDP does not Granger Cause EXR		1.43793	0.2564
INF does not Granger Cause RGDP	30	1.77840	0.1896
RGDP does not Granger Cause INF		3.62832	0.0414
DOP does not Granger Cause OPV	30	0.09346	0.9111
OPV does not Granger Cause DOP		1.18653	0.3219
EXR does not Granger Cause OPV	30	0.71374	0.4995
OPV does not Granger Cause EXR		0.28521	0.7543
INF does not Granger Cause OPV	30	1.46279	0.2507
OPV does not Granger Cause INF		0.36052	0.7009
EXR does not Granger Cause DOP	30	2.06192	0.1483
DOP does not Granger Cause EXR		1.31243	0.2871
INF does not Granger Cause DOP	30	0.03330	0.9673
DOP does not Granger Cause INF		3.09737	0.0628
INF does not Granger Cause EXR	30	0.79211	0.4639
EXR does not Granger Cause INF		2.65872	0.0898

Source: E-views 9.0

From the findings there is no causality between oil price volatility and economic growth for the period under review. But causality was found from exchange rate to GDP and from GDP to inflation.

5. Conclusion

The findings based on the time series data in terms of oil price volatility, degree of openness, exchange rate, inflation and gross domestic product of Nigeria from 1985 to 2016. Data analysis reveals that oil price volatility has a negative and insignificant effect on economic growth in Nigeria while positive and significant relationship exist between degree of openness, exchange rate and economic growth for the period under review. The model showed that the explanatory variables defined 96% variability in the dependent variable. the remaining 4%

could not be explained by the model. Furthermore, Johansen cointegration test revealed that there is long-run relationship between the variables used in the study. And no evidence of causality was found between oil price volatility and economic growth in Nigeria.

6. Recommendation

Based on the findings of the study it is a clear indication that Nigeria has a special case of Dutch Disease and this makes it necessary to diversify the Nigerian economy, we should be less dependent on crude oil and explore other sectors such as agricultural and manufacturing sectors in order to decrease the effect of oil price volatility in the economy. Exploring other alternatives has the potential to make the Nigerian economy stronger to face volatility crisis.

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