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ASYMMETRIC RESPONSE OF OIL PRICE CHANGE ON THE NIGERIAN ECONOMY

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Abstract

Shock in crude oil prices the world over has had adverse effected on the world economy, especially in the areas of general price (inflation), exchange rate, foreign reserves, currencies crisis, declining government revenue, and ultimately, threat in terms of ability to meet financial obligations as at when due. In Nigeria for example, in 2014, oil price declined by 24 per cent to a four-year low of 81 dollar by the last quarter of 2014. The price further falls from USD114.91 on January 31 to USD102.12 on May 31, and stood at USD57.8 and 67.6 by the first quarter of 2015. The resultant effect has been a large out pour of policies among policy makers and contributions from the academia. However, none of these policy measures could not be said to have put the Nigerian economy on the path of sustainable growth. It is against this backdrop that this study examines the asymmetric impacts of oil price on the Nigerian economy using monthly data covering a period of 457 months from January, 1980 – January, 2018. Data for the study were collected from the database of World Bank Development Indicators (WDI) and international financial statistics (IFS). The variables on which data were collected are oil prices (OILP), inflation (INFL), exchange rate (EXCR) and gross domestic product (RGDP). OILP was decomposed into maximum, minimum and recovery prices to allow for estimation of asymmetric response of GDP to oil price shock. The data were analyzed using the Robust Least Square (RLS) regression model and the maximum likelihood estimation method. Findings from the study show that GDP in Nigeria respond positively to symmetric oil price change but negatively to asymmetric oil price change. While the impact of symmetric oil price on EXCH is negative, it is positive for INFL. However, asymmetric oil price has positive impact on both EXCH and INFL. The implication is that the economic growth of the Nigeria is driven by external forces, since crude oil prices are determine by exogenous factors. This means that, if crude oil prices decline the GDP of the country is not likely going to increase. Based on the findings, the study recommends the need for the diversification of the Nigeria's revenue sources to make the economy less oil dependent.

Keywords: Economy, Oil price, Symmetric, Asymmetric

JEL Classification: O4; Q4

1. Introduction

The relationship between oil prices and the growth of an economy has received considerable attention especially in the developed countries (Guo and Kliesen, 2005, Hamilton (1983). One explanation for such a relationship is that oil prices increases lower future GDP growth by raising production costs. Thus, the impact of both symmetric and asymmetric oil price changes on economic growth has continued to attract attention of scholars since the early works of Hamilton (1983) appear in the literature. Although empirical evidence presented by the authors suggest that exogenous shocks to oil prices has significant effect on economic growth, this evidence seem not to hold in the mid-1980s when serious decline in oil prices do not result in output boom in the period. This phenomenon has engaged many scholars in series of debates over the years.

The impact of increasing oil prices on the economic activities of a country and the extent of such impact depends largely on whether the country is an importer or

exporter of oil. For example, exporter of oil like Nigeria, Kuwait, Saudi Arabia and Libya are on the gaining side because the receipt from exports add to their foreign reserves and improve their balance of payments positions. This is more so when receipt form oil exports are greater than the expenditures on imports and other merchandize. However, importers of oil are likely to suffer high cost of production, unemployment, balance of payment disequilibrium and drain of resources.

On the other hand, a fall in oil prices tends to benefit the importers and put the exporters on the losing side. The trends of oil price in the global market reveal that price of oil dropped precariously from a peak of $104 per barrel by the third quarter of 2014. Specifically, the OPEC average monthly basket price of oil peaked at $107.89 per barrel in second quarter of 2014 dwindled very sharply to $59 per barrel at the last quarter of 2014. It further decelerated to $54.4 by the first quarter of 2015, resulting in Nigeria experiencing a sudden and significant drop in revenue inflow from oil sales (Gumi, Buhari & Muhammad, 2016).

Oil price affects different economies differently depending on whether the economy is oil importing or oil exporting economy and depending on the structures and the patterns of demand for and supply of energy in the economy. For example, Jimenez-Rodriguez and Sanchez (2004) argue that an oil price increase should be considered good news in oil exporting countries and bad news in oil importing countries. However, there are studies such as Gelb (1988) and Gyl-fason et al. (1999) which establish a strong negative correlation between oil abundance and economic growth. These outcomes negate normal macroeconomic expectations.

However, the extent to which a country responds to oil price fluctuation depends on whether or not the country has a high net imports of oil per GDP, high ratio of exports as a portion of GDP and the marginal propensity (high or low) to consume, invest and import. This is similar to the opinion of Aleksandrova (2014) that the effect of oil prices depends on various factors including economic development, economic vulnerability, openness and economic structural characteristics of a country. This shows that there are no common opinions for the oil price impact on macroeconomic variables.

Nevertheless, most economists agree that oil price movements affect the economy through the supply and demand side. In Nigeria, persistent increases and decreases in oil prices have affected the economy through their impacts on external balances, inflation, monetary and exchange rate policies, and fiscal balances in the past few years. Although, the rise in oil prices since early 2000s has led to improvements in the external balances in Nigeria, it appears to have triggered inflation and real exchange rate volatility. Since 2011 however, the external performance of the country has started to deteriorate, which appears to be partly related to the further increase in oil prices.

In Nigeria, like in Kuwait, Libya and Saudi Arabia, the effect of oil price increase over the years on macroeconomic variables had been very severe since 1970 to date. The economy had been battling with the problem of inflation, exchange rate volatility and low economic growth potentials. For example, inflation increases from an average of 15.5 per cent in 2015 to an average of 18.3 per cent in the middle of 2017. The increase, among other factors, has been attributed to increase in oil prices, exchange rate volatility and failure of monetary policy measures (Arinze, 2017). This is simply suggests that whenever petroleum prices increases, the inflation rate also increases.

In addition, Nigeria, despite being an oil abundant economy, the country has misused the opportunity and as a result, had a turbulent and disappointing economic growth record and remains significantly oil-dependent. Most of the economic and political decisions are influenced by oil sector; national budgets are tagged on the vagaries of international oil prices and loans are contracted in anticipation of revenues from oil sales and big projects are embarked upon in expectation of rise in oil revenues.

Available records in Nigeria reveals that during the last four years, the shock in crude oil prices which started in the second quarter of 2014 has adversely affected Nigerian economy, especially in the areas of general price (inflation), exchange rate, foreign reserves, currencies crisis, declining government revenue, and ultimately, threat in terms of ability to meet financial obligations as at when due. Within this period, oil price declined by 24 per cent to a four-year low of 81 dollar by the last quarter of 2014. The price further falls from USD114.91 on January 31 to USD102.12 on May 31, and stood at USD57.8 and 67.6 by the first quarter of 2015 (Nwanna & Eyedayi, 2016). The resultant effect has been a large out pour of policies among policy makers and contributions from the academia. These policy prescriptions have spurred the need to diversify the economy towards once thriving sectors in the economy, removal of subsidy, the war on corruption and reduction of government activities and government related cost. However, none of these policy measures could not be said to have put the Nigerian economy on the path of sustainable growth. It is against this backdrop

that this study examines the effect of oil price fluctuation and volatility on the economy of Nigeria.

2. Literature Review

There are plethora of research in oil prices and economic growth nexus. Empirically, Ishmael, Matthew and Park (2017) examine the impact of changes in crude oil prices on economic growth in Nigeria from 1986 to 2015. Times series data on crude oil price, inflation rate, real effective exchange rate, fuel pump price and GDP growth rate were gathered from secondary sources for the study. Ng-Perron and Zivot-Andrews Tests, Johansen's co-integration Test, Granger Causality Test and the Error Correction Model (ECM) were employed as techniques of analysis. The time series property examined showed the existence of co-integration among the variables while the empirical results suggest that the ECM coefficients have negative signs and are statistically significant in all ECMs. The study finds that a positive and unidirectional relationship that runs from crude oil prices to GDP growth rates exists. However, the study does not adequately justify the reason for the time frame of 1986 - 2015. There is the need to extend the time frame backward from 1986 and beyond 2015 to add to the robustness of the findings of the study.

Chikwe, Ujah & Akaeze (2016) used ordinary least square (OLS) multiple regression technique to analyze the impact of oil price on the Nigerian macroeconomic variables from 1990 to 2015. The macroeconomic variables investigated were inflation rate, exchange rate, real GDP, unemployment rate and interest rate. Findings from the result of the study reveal that there is significant relationship between international oil price and macroeconomic all the variables. Further analysis based on the individual test shows that unemployment rate contributes positively to international oil price, while interest rate contributes negatively to international oil price. Again, the result showed that inflation rate, exchange rate, and RGDP do not have any effect on international oil price. A major limitation of this study lies in the methodology. The OLS multiple regression method is based on plausible assumptions. If these assumptions are not met, the estimated results from OLS cannot be reliable.

Umar, Aliyu & Ahmad (2016) study the relationship between oil price and economic growth in Nigeria using annual time series data for the period 1974-2014. The study uses co-integration and Granger causality test to examine the relationship among the variables of the study. The findings indicate that there is no long-run relationship among the variables of the study. However, Granger causality test indicates a significant unidirectional causality running from oil price to economic growth in the short run. In addition, there is a significant positive unidirectional causality running from human capital to economic growth in Nigeria. Also, the findings indicate a significant positive unidirectional causality running from oil price to total exports in Nigeria. However, the finding of the study that there is no long-run relationship among the variables of the study contradicts findings of most previous studies on a related topic.

Arinze (2011) investigates the impact of oil price on the Nigerian economy over 1978-2007. The study uses simple regression analysis and Chow test of structural stability. Findings show the relationship between the inflation rate and the price of petrol is significant. The study further finds that upward adjustments of petroleum products prices have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria. Between 1978 and 2007, the various Nigerian regimes increased fuel prices a total of 18 times. Most of the increase occurred in the 1990-2007 period when prices were adjusted, sometimes twice a year. The study further reveals that whenever petroleum increases, the inflation rate also increases.

Offiong Atsu, Ajaude & Ibor (2016) carry out a study on the Impact of Oil Price Shocks on the Economic Growth and Development of Cross River State, Nigeria. Annual data on gross State product (GSP), average crude oil price (ACOP) and average crude oil production quota (ACOPQ) for the country, the State's allocation from the federation accounts (FAAC), total internally generated revenue (TIGR) as well as total expenditure (TEXP) were collected and were analyzed using multiple regression method. The study found that international oil price shocks affected the State's economy inversely, while a positive but insignificant relationship existed between the other model variables and the economic growth of the State.

Ifeayi and Ayenajeh (2016) examine the impact of crude oil price volatility on economic growth in Nigeria over the period 1980 -2014. Multiple regressions were used as a tool for data analysis and the findings reveal that there is a positive and significant relationship between oil price and economic growth. Based on the findings the researchers conclude that oil price volatility does not have a positive impact on the economy (contrary to the findings of some earlier studies) but oil price itself does.

Babajide and Soile (2015) study the relationship between oil price shocks and Nigeria's economic activity using quarterly data from 1980:Q1 to 2011: Q4. Autoregressive Distributed Lag (ARDL), Vector autoregressive model (VAR) analyses as well as Impulse Response Function

(IRF) and the Variance Decomposition (VDC) were used to examined the impact of oil price shocks and their transmission channels to selected macroeconomic variables which served as proxies for economic activities in Nigeria using quarterly data from 1980 in Quarter 1 to 2011 in Quarter 4. The result show that oil price shocks have negative impact on nearly all the variables used in the analysis; furthermore the asymmetric relationship between oil price shocks and GDP was not established as the effects was found to be minimal in all the tests results. The result clearly illustrated that oil price decreases affected most of the macroeconomic indicators than increases. Specifically, oil price decrease affected trade balance, inflation, government revenue and exchange rate.

Ebele (2015) investigates the impact of crude oil price volatility on economic growth in Nigeria from 1970 to 2014. The study uses the Engel-Granger co-integration test and Granger Representation theorem in testing the long run and short run relationships between crude oil volatility and economic growth in Nigeria. The study found that oil price volatility (OPV) has negative impact on the economic growth while other variables such as crude oil price, oil revenue and oil reserves have positive impact on the Nigerian economy.

Oluwatoyin (2014) assesses the impact of oil price shock and real exchange rate instability on real economic growth in Nigeria by using annual data from 1986 to 2012. Time series data was used to examine the nature of causality among the variables. The Johansen Vector Autoregressive (VAR)-based co-integration technique was applied to examine the sensitivity of real economic growth to changes in oil prices and real exchange rate volatility in the long-run while the short run dynamics was checked using a Vector Error Correction Model (VECM). Results from Granger pairwise causality test reveal unidirectional causality from oil prices to real Gross Domestic Product (GOP). The findings of the study further show that oil price shock and appreciation in the level of exchange rate exert positive impact on real economic growth in Nigeria.

Oriakhi and Osazel (2013) examined the consequences of oil price volatility on the growth of the Nigerian economy within the period 1970 to 2010, using the VAR methodology. The study found that, of the six variables employed, oil price volatility impacted directly on real government expenditure, real exchange rate and real import, while impacting on real GDP, real money supply and inflation through other variables, notably real government expenditure. This implied that oil price changes determine government expenditure level, which in turn determines the growth of the Nigerian economy.

Berument and Ceylan (2005) study the effect of oil price shocks on economic growth in MENA region covering 1960-2003. They applied dynamic vector autoregressive (DVAR) model to investigate this relationship, the results show a positive effect on Iran, Iraq, Algeria, Jordan, Kuwait, Oman, Syria, Tunisia and United Arab Emirate, while on other case including Bahrain, Djibouti, Egypt, Morocco and Yemen, there was no significant relation statistically. In the same vein, the studies established significant relationship among the variables using econometric analyses based on long-run and short-run frameworks.

Ayadi, Chatterjee and Obi (2000) examine the effect of oil production shocks on the net-exporting country using a standard VAR on variables which includes oil production, output, real exchange rate and inflation over 1975-1995 periods. The impact response show that a positive oil shock (high oil price) is followed by rise in output, reduction in inflation and a depreciation of the domestic currency. These results tally with the findings of Olomola and Adejumo(2006).

Olusegun(2008) investigates the impact of oil price shocks on the macroeconomic performance in Nigeria using seven key Nigeria's macroeconomic variables which are Real GDP, consumer price index (CPI), real oil revenue, real money supply, real government recurrent expenditure, real government capital expenditure and real oil price. An annual data on the variables for the periods 1970-2005 were collected and were analyzed using Johansen co-integration test and forecast error variance decomposition estimated from the VAR model. The Johansen co-integration result indicates at least four co-integrating vectors among the variables, the forecast error variance decomposition estimated from the VAR model shows that oil price shocks significantly contributes to the variability of oil revenue and output. The study also reveals that the variability in the price level apart from its own shock is explained substantially by output and money supply shocks. Also, the variability in money supply is equally explained by price level and output.

Ogbonna and Ebimobowei (2012) examine the impact of oil revenue on the Nigerian economy during the period of 1970-2009. The study uses Pearson correlation to analyze primary and secondary and descriptive statistics to explain evidence and events. The results of the analysis show that oil revenue positively affects the gross domestic product and per capita income of Nigeria. However, the relationship between petroleum revenue and inflation rate was negative. They suggested proper utilization and management of oil revenue to achieve long-run growth and development of the country.

Mhamad and Saeed (2016) investigate the Impact of oil price on economic growth of Iraq. The study uses secondary data was for the period of 2000-2015 and the data were analyzed by employing the OLS technique of multiple regression. Findings show that oil price and oil export were very important determinants of economic growth in Iraq. For instance, for each unit increasing of oil price, the economic growth will increase by 36.9% after holding all other variable constant. However, they found that exchange variable has no impact on the participations of increasing the economic growth because of corruption in public banks in Iraq

Torben and Mideksa (2012) investigate the economic impact of oil resource endowment on the Norwegian economy, using quantitative comparative method and focusing. The study's results indicate that on average, about 20% of the growth in GDP per capita since 1974 has been due to the petroleum endowment. In Sudan, a few studies examine the impact of oil production in economic growth. Hassan (2010) highlighted the case of Oil, Peace and Development. The author attempted to describe how oil is a core player on the national economy, peace and development issue.

Istemi and Berna (2012) investigate the impacts of crude oil price variations on the Turkish stock market returns. The study employs vector autoregressive (VAR) model using daily observations of Brent crude oil prices and Istanbul Stock Exchange National Index (ISE- 100) returns for the period between January 2, 1990 and November 1, 2011. The study also tested the relationship between oil prices and stock market returns under global liquidity conditions by incorporating a liquidity proxy variable, Chicago Board of Exchange's (CBOE) S&P 500 market volatility index (VIX), into the model. Variance decomposition test results suggest little empirical evidence that crude oil price shocks have been rationally evaluated in the Turkish stock market. Rather, it was global liquidity conditions that were found to account for the greatest amount of variation in stock market returns.

Huang and Guo (2007), in a structural VAR model, use Chinese monthly time series data from January 1990 to October 2005 to investigate the dynamic link between real oil prices, relative industrial production, relative CPI, and relative real effective exchange rate in China. They discovered that a rise in real oil price leads to a 3% appreciation of the real exchange rate in the long-run.

Narayan (2008) uses GARCH and EGARCH models to study the long run relationship between oil price and the Fiji–US dollar exchange rate, using daily data for the period 2000–2006. The result of the study found positive relationships between the two; a rise in oil prices leads to an appreciation of the Fijian dollar vis-à-vis the US dollar. More specifically a 10% increase in oil price leads to a 0.2% appreciation of the Fijian dollar

Cun˜ado and Gracia (2003) analyze the oil price and macroeconomic relationship by means of analyzing the impact of oil prices on inflation and industrial `production indexes for selected European countries using quarterly data for the period 1960–1999. First, the test for co-integration, allowing for structural breaks among the variables; second, and in order to account for the possible non-linear relationships, it uses different transformation of oil price data. The main results suggest that oil prices have permanent effects on inflation and short run but asymmetric effects on production growth rates. Furthermore, significant differences are found among the responses of the countries to these shocks.

Al-Mulali (2010) examines the impact of oil shocks on the real exchange rate and the gross domestic product in Norway using time series data from 1975 to 2008. The study uses co-integration, Granger causality test and vector autoregressive model to analyze the dynamic interaction among the variables of the study. The results of the study show that the increase in oil price is the reason behind Norway's GDP increase and the increase of its competitiveness to trade. The increase in Norway's trade competitiveness is due to its real exchange rate depreciation brought about by the increase in the price of oil. Hence, oil price shocks in the case of Norway are a blessing, due to a number of reasons. First, Norway uses the floating exchange rate regime which is a good shock absorber; it increases the freedom of the monetary authority and makes the adjustment smoother and less expensive. A second reason is that Norway has more flexible labor markets.

Papapetrou (2001), using a multivariate vector-auto regression (VAR) approach, attempts examines the dynamic relationship among oil prices, real stock prices, interest rates, real economic activity and employment for Greece. The empirical analysis was carried out using monthly data for the period 1989:1 to 1999:6. Evidence from the result suggests that oil price changes affect real economic activity and employment. Oil prices are important in explaining stock price movements. Stock returns do not lead to changes in real activity and employment.

3. Methodology

3.1 Type and Method of Data Collection

This study uses annual time series secondary data. The data were collected from the online database of World

Bank Development Indicators and international financial statistics (IFS). The variables on which data were collected are oil prices (OILP), inflation (INFL), exchange rate (EXCH) and gross domestic product (RGDP). Data on all the variables covers the period of January, 1980 to January, 2018. The choice of 1980 was based on the basis that it was in the early 1980s that the Nigerian economy experiences tremendous increase in oil revenue as result of oil boom at the international oil market at that period. The period 2018 was selected to enable the study incorporate current issues in oil price volatility in Nigeria.

3.2 Model Specification

3.2.1 Symmetric Model

Following Rafiq, Sgro and Apergis (2015), the symmetric model for the study is a single equation model but differs from Rafiq, Sgro and Apergis (2015) in the choices of variables. The model is specify as:

$$\mathbf{GDP = \beta_0 + \beta_1 OILP + \beta_2 EXCH + \beta_3 INFL + \mu_1} \quad \text{..... (1)}$$

Where GDP = gross domestic product, OILP = oil price, EXCH = exchange rate, INFL = inflation rate

3.2.2 Asymmetric Model

Following Rafiq, Sgro and Apergis (2015) and Hatemi (2012), this study decomposes oil prices into maximum price, minimum price and oil price recovery. This is dissimilar from those of Hatemi (2012) who decomposes oil prices into their cumulative sums of positive and negative oil shocks. This method, unlike symmetric estimation which does not allow for asymmetric causal inferences arising from asymmetric market information, recognizes the separation between causal impacts of positive and negative shocks of oil prices (Togcu, 2012).Thus, the asymmetric model is specify as:

$$\mathbf{GDP = \alpha_0 + \alpha_1 OILPmax + \alpha_2 OILPmin + \alpha_3 OILPrec + \alpha_4 EXCH + \alpha_5 INFL + \mu_2} \quad \text{..... (2)}$$

Where OILPmin = maximum price; OILPmin = minimum price; OILPrec =oil price recovery. Other variables are as defined earlier.

3.3 Estimation Procedure

3.3.1 Robust Least Square (RLS) *Regression Model*

The robust least square (RLS) model was used to estimate model 1 and model 2. The RLS model was developed by Hmapel (1986) to circumvent some limitations of the traditional the ordinary least square (OLS) technique. The OLS method of showing a linear relationship among stochastic variables was considered as not robust because it was based on some underlying assumptions and when those assumptions are not met, the OLS method tends to give misleading results. The RLS was so designed in a way that it will not be overly affected by violations of assumptions underlying data generating process. It uses the M-estimation technique (that is the maximum-likely hood type). The model is stated as follows:

$$\mathbf{\Delta ln\ GDPt = \alpha + \beta\ \Delta ln\ OILPt + \gamma\ \Delta ln\ EXCt + \lambda\ \Delta ln\ INFLt + \mu_i} \quad \text{..... (1)}$$

Where

Δ = difference operator; α = intercept parameter; β, γ, and λ = partial slope parameters.

μi = error term. Other variables are as defined earlier.

4. Result and Discussion of Findings

Table 1: Summary Statistics

	EXCH	INFL	OILP	RGDP
Mean	2.550	1.932	1.514	0.866
Median	7.715	12.55	122.2	0.921
Maximum	133.5	72.84	429.5	1.997
Minimum	0.546	5.380	36.07	0.004

Std. Dev.	46.42	1.728	1.028	0.645
Skewness	1.082	1.736	1.095	-0.044
Kurtosis	2.475	4.819	3.164	1.950
Jarque-Bera	7.855	24.31	7.629	1.757
Probability	0.019	0.000	0.022	0.415
Observations	457	457	457	457

Source: E-views 9 Output

Table 1 shows the summary of statistics for the secondary data used in the study. All the variables (OIPL, EXCH, INFL and RGDP) have very small mean values, suggesting a fairly robust distribution. Also, the respective standard deviations for all the variables, except EXCH, are very small, suggesting that the estimated values of the variables are as close as possible to their true values. Furthermore, the skewness of the distribution for all the variables, except are within the acceptable limit of -3 to +3. Also, the skewness measures suggest that all the variables, except RGDP, are positively skewed (to the right). This implies that the data sets used in this study are asymptotically normally distributed.

Table 2: Result of Unit Root Test of Stationarity

H_0: The data is not stationary

Variables	**ADF Levels**	**ADF Difference**	**PP Levels**	**PP Difference**	**Remarks**
OILP	-2.678	-17.12	-1.746	-17.10	**I (1)**
OILPmax	-1.369	-14.41	-0.297	-16.54	**I (1)**
OILPmin	-0.719	-17.62	-0.588	-17.41	**I (1)**
OILPrec	-0.380	-16.67	-0.358	-16.76	**I (1)**
EXHC	-1.885	-18.41	-1.841	-21.12	**I (1)**
INFL	-1.257	-18.16	-1.775	-20.34	**I (1)**
GDP	-2.291	-20.78	-2.453	-20.79	**I (1)**
ADF Critical Value at 5% = 3.540			**PP Critical Value at 5% = 3.540**		

**** denotes stationary at 5%***
Source: E-views 9 Output

Table 2 shows the result of the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) unit root test of stationarity. The test was conducted with trend and intercept and without lag included in the optimal lag selection option. Results of the test show that all the variables of the study are not stationary at levels because their calculated values, in absolute term, are less than critical values at 5 per cent level of significance. However, when the variables are differenced once, they became stationary, suggesting that they are integrated of the same order and the of integration is order one I(1). Hence, the model in not spurious and as such, the interpretation of the result will not be misleading.

Table 3: Result of RLS Model

Variables	**GDP**		**EXCH**		**INFL**	
	Model 1	***Model 2***	***Model 1***	***Model 2***	***Model 1***	***Model 2***
OILP	0.2472***		-0.2813*		0.1097*	
	(1.831)		(8.374)		(5.033)	
	[0.067]		[0.000]		[0.000]	
$OILP_{max}$		0.1200**		0.5479*		0.4919
		(2.576)		(14.45)		(1.283)
		[0.007]		[0.000]		[0.199]
$OILP_{min}$		-0.1971*		0.1959*		0.1871*
		(6.537)		(8.225)		(7.892)

		[0.000]		[0.000]		[0.000]
$OILP_{rec}$		0.8081**		0.7742**		0.1019*
		(2.636)		(3.187)		(4.205)
		[0.008]		[0.001]		[0.000]
Diagnostics	$R^2 = 0.08$	$R^2 = 0.58$	$R^2 = 0.04$	$R^2 = 0.84$	$R^2 = 0.0002$	$R^2 = 0.60$

() denotes the Z-values
[] denotes probability values
* Significant at 1%
** Significant at 5%
*** Significant at 10%

Table 3 shows the result of robust least square (RLS) model of the symmetric and asymmetric relationship between oil price (OILP) and GDP, EXCH and INFL specified in equation 1 and equation 2. The RLS model was specified using the Bi-square objective specification method and the Huber Type II covariance, and was estimated using the maximum-likelihood estimation (M-estimation) procedure. The advantage of M-estimation procedure is that it not overly affected by violations of assumptions underlying data generating process (Hmapel, 1986).

The result of the symmetric model (model 1) shows that oil price (OILP)has positive and significant impact on GDP and inflation (INFL) but negative and significant impact on exchange rate (EXCH).A one per cent increase in OILP increases GDP and INFL by about 24.7 per cent and 11.0 per cent respectively but decreases EXCH by about 28.1 per cent.

The positive relationship between oil price and GDP in Nigeria may imply that the revenue from oil, when injected into the economy through effective government expenditure, will translate into high GDP growth rates. This finding agrees with Alley, Asekomeh, Mobolaji and Adeniran (2014) and Ogboru, Rivi and Idisi (2017) that an increase in oil price increased government revenue which is line with the conventional wisdom that oil price increase is beneficial to oil-exporting countries.

Furthermore, looking at the asymmetric model results (Model 2), the findings are quite remarkable. Increases in maximum oil prices and oil price recovery increase GDP, EXCH and INF while an increase in minimum oil price decreases GDP but increases EXCH and INF. The positive relationship between the maximum oil prices, oil price recovery and GDP satisfies the *apriori* expectation while the negative relationship between minimum oil price and GDP does not. Maximum oil price and oil price recovery increase GDP by about 12 per cent and 81 per cent respectively while minimum oil price decrease GDP by about 20 per cent. When the estimated symmetric and asymmetric results are compared, we see that they differ only in magnitude but similar in signs of the estimated coefficients, as well as in robustness, as shown by the R-squares. This finding equally suggests that when oil price is decomposed into sub-components, it gives improved results that conform to the apriori expectation. The positive relationship between oil price and GDP is consistent with economic theory of supply. For example, increase in oil prices increase the supply of oil thereby increasing the revenue from oil exports as well as GDP.

With respect to exchange rate and inflation however, the symmetric model of oil price has a negative but significant impact on exchange rate with an estimated coefficient of -0.28, while the impacts of asymmetric model on EXCH are positive and significant and are 0.55, 0.20 and 0.77 for maximum oil price, minimum oil price and oil price recovery respectively. Like EXCH, INFL has positive relationship with OILP, OILPmax, OILPmin and OILPrec but insignificant for OILPmax. The insignificant relation between crude oil prices and INFL implies that crude oil prices have no significant influence on consumer price index in Nigeria. This is not surprising because the computation of consumer price index in Nigeria does not include crude oil prices.

Table 4: Post Estimations

Serial Correlation LM Test; H_0: No autocorrelation

F-statistic	2.949	Prob. F(2,32)	0.1210
Obs*R-squared	2.182	Prob. Chi-Square(2)	0.2010
Heteroskedasticity Test;			
F-statistic	5.678	Prob. F(10,17)	0.3100
Obs*R-squared	2.261	Prob. Chi-Square(10)	0.1149

Source: E-views 9 Output

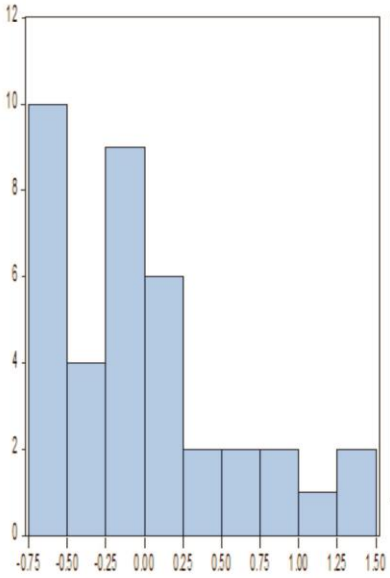

Figure 1: Normality plot

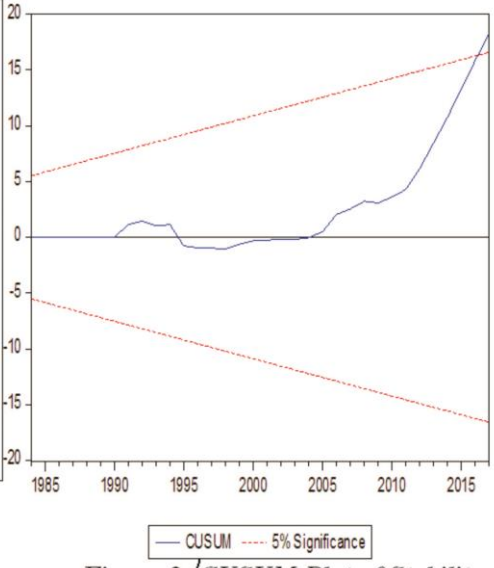

Figure 2: CUSUM Plot of Stability

Source: E-views 9 Output

Table 4 shows the post estimations statistics. The serial correlation LM test has a probability value of 0.2010 which is greater than 0.05. This suggests that the null hypothesis of absence of autocorrelation in the model cannot be rejected. Similarly, the probability value for the test of heteroskedasticity is 0.1149 implying that the null hypothesis of absence of heteroskedasticity in the model cannot be rejected. Furthermore, the normality plot reported in figure 1 shows that the Jarque-Bera value and its probability are 5.380 and 0.0678 respectively. Hence, the null hypothesis that the error terms of the data used in the study are normally distributed cannot be rejected. However, the result failed the test of stability. This is because the CUSUM plot reported in Figure 4 crosses one of the 5% critical lines. Therefore, it could be concluded that the estimated parameters for the study are not stable for the period under investigation.

5. Conclusion and Recommendations

The study uses monthly data covering a period of 457 months from January, 1980 – January, 2018 to examine the symmetric and the asymmetric impact of oil price on the Nigerian economy.

The response of gross domestic product (GDP), exchange rate (EXCH) and inflation (INFL) to oil price change were estimated using the Robust Least Square (RLS).Findings from the study show that GDP in Nigeria respond positively to symmetric oil price change but negatively to asymmetric oil price change.

While the impact of symmetric oil price on EXCH is negative, it is positive for INFL. However, asymmetric oil price has positive impact on both EXCH and INFL. The implication is that the economic growth of the Nigeria is driven by external forces, since crude oil prices are determine by exogenous factors. This means that, if crude oil prices decline the GDP of the country is not likely going to increase.

Based on the findings, there is the need for diversification of the Nigeria's revenue sources to make the economy less oil dependent. Furthermore, the degree of sensitivity of the Nigerian economy to changes in oil prices underscores the need for buffers to be built during the era of rising oil prices.

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