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The Impact of Changes in Crude Oil Prices on Economic Growth in Nigeria: 1986 – 2015

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Abstract
The study empirically examined 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 that include World Bank Development Indicators, BP Statistics and Central Bank of Nigeria (CBN) Statistical Bulletin. Ng-Perron and Zivot-Andrews Tests, Johansen's co-integration Test, Granger Causality Test and the Vector Error Correction Model (VECM) 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 ECT coefficients have negative signs and are statistically significant in all VECMs. In addition to that, the significance of ECT also exhibits that if the system is exposed to shock, it will converge to the long-run equilibrium at the following speed: for GDP (-0.8002), inflation (-0.6714) and real effective exchange rate (-0.5715) VECMs compare to the convergence speed of fuel pump price (-0.6047) and crude oil price (-0.0436), VECMs. The study found out that a positive and unidirectional relationship that runs from crude oil prices to GDP growth rates exists. The value of R^2 and that of adjusted R^2 stood at 0.6177 and 0.5085 respectively. The value of F-statistic is 5.6570 and it is greater than the tabulated value of 2.76. The study concluded that crude oil price exert positive influence on the economic growth of Nigeria. The study recommends the need for diversification, building of buffers, more refineries and overhaul of the existing ones as well as the adoption of floating exchange rate policy.
Keywords: Crude Oil Prices, Economic Growth.

1. Introduction

Fluctuation in price of crude is a common phenomenon in the global oil market as the world economy has witnessed a number of changes in the price of crude oil at different times. These price changes, often referred to as oil price shocks are usually described by the events that herald their occurrences. As Hamilton (2011) puts it, the major post-World-War-II oil shocks are the Suez Crisis of 1956-57, the OPEC oil embargo of 1973-1974, the Iranian revolution of 1978-1979, the Iran-Iraq War initiated in 1980, the first Persian Gulf War in 1990-91, and the oil price spike of 2007-2008. Oil price surged to a historic height in 2008 when it was sold at $140 per barrel; this was about the highest price recorded in the oil market in recent times (Sanya, 2015).

However, the second half of 2014 marked the beginning of another oil price shock. By the year 2015 Crude oil price has dropped by more than half of its price in the previous year with its attendant consequences on countries of the world. The immediate cause of this fall was the market imbalance sparked by excess supply of crude oil to the market by oil producing countries. Maugeri (2016) noted that the significant output growth experienced by major oil producers like the United States and Iraq as well as the imposition of the policy of no production cutbacks by Saudi Arabia on the Organization of Petroleum Exporting Countries (OPEC) created an output level that could not be absorbed by demand.

Nigeria's resource endowment is not disputable; the country is ranked as the largest oil producer in Africa and occupies the 13th position in the world. It has a proven crude oil reserve of 37,062 million barrels, natural gas reserve of 5,284.3 billion cu m (OPEC Annual Statistical Bulletin, 2016) Thus, its reserve base is ranked the 10th in the world and 2nd largest in Africa. Following the rebasing of the country's GDP, it became the largest economy in Africa.

Despite Nigeria's richness in both human and material resources, the country still grapples with myriad of economic challenges that have continued to impede her journey on the path of economic growth. Presently, the country is highly dependent on crude oil for export and as major revenue source consequently annual budgets are usually prepared and tied to a given expected price and production level of crude oil. This has put the economy in a vulnerable position and exposes it to the vagaries of changes in crude oil prices. In an attempt to mitigate the negative impact of such exposure on the Nigerian economy, the Obasanjo's administration in 2004 introduced the Excess Crude Account to protect planned budgets against short-falls arising from changes in crude oil prices. Although this initiative helped to cushion the effects of falling oil prices during the global financial crisis of the 2007-2009 when the price of crude oil dropped drastically, the package could not be sustained. Successive governments continued to spend even when oil prices improved leading to the depletion of excess crude account with no savings left for rainy days.

The recent crash in oil prices undoubtedly plunged the largest economy in Africa into an economic

quagmire with debilitating effects on some of her major macroeconomic variables. Inflation rates began a steady rise while the exchange rate continued to depreciate, causing enormous economic difficulties among the populace. Interesting, as crude oil price is falling at the global market, domestic pump price of petrol in Nigeria suffered distortion and upward review.

A survey of related work revealed three strands of thoughts, depending on the country of research, method of analysis and period of study. While some argued that changes in crude oil prices have positive impact on economic growth, others opined that the effect is a negative one. The third category of researchers saw no link between the two. The combination of these factors provoked many questions than answers and stimulates the need for this paper. Consequently, the paper seeks to examine the impact of changes in crude oil prices on economic growth in Nigeria within the period under study. Other specific objectives of the paper include: to investigate the effect of changes in crude oil prices on GDP growth in Nigeria; to examine whether inflation rates in Nigeria are associated with changes in crude oil prices; and to ascertain if any causal relation exists between crude oil price and fuel pump price in Nigeria.

2. Literature Review

2.1 Clarification of Concepts

Crude Oil Price:

Crude oil prices measure the spot price of various barrels of oil quoted in the global oil market. These oil barrels include West Texas Intermediate (WTI), Brent Blend, OPEC basket price and the New York Mercantile Exchange (NYMEX) futures price among others. The Nigerian crude belongs to the OPEC Basket Price category which is the mean value of prices obtained from Nigeria and other countries like Algeria, Indonesia, Saudi Arabia, Dubai, Venezuela and Mexico. Due to the lower quality of oil from these countries, it commands lower price than both WTI and Brent Blend.

Economic Growth:

For the purpose of this paper, economic growth refers to an increase in the Gross Domestic Product (GDP) of a country brought about by changes in major macroeconomic variables. The GDP simply measures the market value of final goods and service produced in a country within a year. In this paper Therefore, GDP annual growth rate is used as a proxy for economic growth. It is a measure of the annual percentage growth rate of GDP at market prices based on constant local currency but aggregated on constant 2010 U.S. dollars

2.2 Theoretical Framework

Theories abound in economic literature on the relationship between crude oil prices and economic growth. In this section, attempt is made to briefly review related theories with the view to give the research a theoretical base. Four theories were examined and these include the linear/symmetric relationship theory of growth, asymmetry-in-effects theory of economic growth, mainstream theory of economic growth, and renaissance growth theory.

The linear/symmetric relationship theory of growth contends that there is a negative and significant relation between oil price changes and GDP growth. Hamilton (1983) confirmed this in his study on the impact of oil price on the economy of U.S. since World War II using a data set of between 1948 and 1972. However, Mark, Olsen and Mysen (1994) of the asymmetry-in-effects theory of economic growth school of thought confirmed the asymmetry effect of oil price on economic growth in Africa. According to this theory an oil price increase has a negative effect on future GDP growth while the effect of an oil price decrease is ambiguous. The mainstream theory considers price of crude oil to be proportional to its marginal product which is an important input in determining economic growth. But proponents of the Renaissance growth model opine that both oil price changes and its volatility have negative effects on economic growth, though in different ways (Lee, 1998 in Oriakhi and Iyoha, 2013).

Proponents of the aforementioned theories concurred to the fact that a relationship exists between crude oil prices and economic growth in both the developed and developing economies. Although, the effects have been proven with empirical evidences to be different even among these nations. In the same way, both the exporting and importing countries experience the impact of changes in oil prices in diverse ways, depending on the internal mechanism for stabilisation.

This research is therefore anchored on the Renaissance growth model of economic growth. The choice of this theory is informed by the close relationship it bears with the subject matter of this study. For it specifies a link between changes in crude oil prices and its impact on economic growth which this study seeks to investigate. In addition, the theory was developed from symmetric and asymmetry in effect theories and this confirms it superiority over the two theories.

2.3 Empirical Review

Evidences from related studies around the world show divergent outcomes with results from Russia (Izatov,

2015), Norway (Al-mulali, 2010) and Qatar (Al-mulali and Sab, 2010) showing that oil prices exert positive impact on economic activities of these nations. But in Turkey (Kargi, 2014), Pakistan (Malik, 2008) and India (Aparna, 2014) oil prices exhibit negative influence of GDP levels.

Based on the empirical review of related literature, the study is therefore anchored on the evidences put forward by Al-mulali and Sab (2010) and Ogundipe and Ogundipe (2013). In a study on the effect of oil shock on Qatar's GDP growth, Al-mulali and Sab found that a positive link exists between crude oil price and GDP. The study employed Vector Error Correction Model (VECM) to examine the impact of total trade value, oil price, and inflation rate on Qatar's GDP. In a related study of the Nigerian economy, Ogundipe and Ogundipe (2013) examined the relationship between oil price and exchange rate volatility in Nigeria. The study modeled exchange rate as a function of oil price, external reserves and interest rate. Employing the Vector Error Correction Model (VECM), results show that exchange rate is negatively related to crude oil price.

The justification for the choice of these studies is hinged on the fact that the two studies are centered on countries that are both developing and exporters of crude oil. Qatar, like Nigeria, depends largely on the production and export of crude oil. It is one of the oil rich countries in the Middle-East and a member of the Organisation of Petroleum Exporting Countries (OPEC). Oil accounts for more than 60% of Qatar's GDP, 85% of its exports earnings and 70% of government revenue (Al-mulali and Sab, 2010). In addition, the two studies employed Vector Error Correction Model (VECM), a technique of analysis adopted for this study.

Although this study is anchored on studies that are related to it in some respects, the difference however, lies in the data sources, choice of variables, the span of time covered and the area of study. Therefore, there is need to verify the results obtained from Qatar using related tools but with data that reflects the realities of the Nigerian economy and covers a more recent time period. Unlike the one undertaken by Al-mulali and Sab, this study covers the period from 1986 to 2015 as well as incorporates exchange rate and fuel pump price that were not captured by the previous study. In the same way, the evidence obtained by Ogundipe and Ogundipe needs to be tested with a more holistic approach that includes GDP growth rate, inflation rate and fuel pump price that were not part of the variables used in their study. Specifically, this paper seeks to bridge the gaps identified in the previous studies above by extending the period covered to 2015 and introduce a new variable like the fuel pump price that was hitherto not captured.

3. Changes in Crude Oil Prices and Economic Growth in Nigeria

Within the period of thirty (30) years covered by this research the spot crude prices of the Nigerian Forcados averaged at $44.50 per barrel with the lowest price of $12.62 recorded in 1998. Oil prices attained its peak in 2012 at $114.21; this rise was succeeded by a downward trend that pushed the price to drop to $54.41 per barrel in the year 2015 (BP Statistical Review of World Energy, 2015)

Trends in annual growth rate of GDP in Nigeria which measures economic growth revealed within the span of years covered in this paper an average rate of 11.78%. The lowest rate was recorded in 1987 at -10.75% which is attributed to the spillover effect of the Structural Adjustment Programme (SAP). In 2004, the rate of growth in GDP rose to its highest level of 33.74% within the period and slumped to 2.65% in 2015. This drop in the annual growth rate of GDP is no doubt a consequence of the falling prices of crude at the international market (World Development Indicators, last updated in October 8, 2016.)

Studies on the relationship between changes in crude oil prices and economic growth show a mixed result. In Nigeria, oil price was found to have positive, negative or no impact on the economy. For example, while the works of Ebele (2015), Yusuf (2015), and Alley, Asekomeh, Mobolaji and Adeniran (2014) suggested that crude oil price is positively related to the level of economic activities in Nigeria, Okoro (2014) and Iyke (2016) maintained that the influence is negative. But Ani, Ugwunta and Eneje (2014) found that oil prices have no impact on real GDP and exchange rate in Nigeria. These results point to the fact that there is lack of consensus by scholars on the impact of changes in crude oil prices on economic growth in Nigeria.

4. Methodology

This study adopted a quantitative method of analysis and specifically employed the Vector Error Correction Model (VECM) using the econometric software, EViews 9. The reason for the choice of this method is drawn from the result of the preliminary test of the series which revealed evidence of cointegration. Engle and Granger (1991), argued that when variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The ECT is expected to be statistically significant with a negative sign, implying that any shock that occurs in the short-run will be corrected in the long-run. If the ECT is greater in absolute value, the rate of convergence to equilibrium will be faster. Other complementary econometric techniques employed are Ng-Perron and Zivot-Andrews tests, Johansen co-integration Test and Granger Causality Test.

4.1 Model Specification

The mathematical form of the model is specified as:

GDP = f (INF, REER, COP, FPP)……..….(1)

Where:

GDP = GDP Growth Rate

INF = Inflation Rate

REER = Real Effective Exchange Rate

COP = Crude Oil Price

FPP = Fuel Pump Price

In an econometric form, the model can be expressed as:

$GDP = \beta_0 + \beta_1 INF + \beta_2 REER + \beta_3 COP + \beta_4 FPP + \upsilon$ ……..... (2)

Where: υ = Error term, β_0 = Intercept

β_0, β_1, β_2, β_3 and β_4 are the parameters.

In a more explicit form, the models can be rewritten in a log-linear form to transform the variables into the same unit and base. Thus:

$\ln GDP = \beta_0 + \beta_1 \ln INF + \beta_2 \ln REER + \beta_3 \ln COP + \beta_4 \ln FPP + \upsilon$ ……..……...….(3)

Where $\beta_1, \beta_3, \beta_4 > 0$ while $\beta_3 < 0$

From the equations above, the conditional VECM can be specified as follows:

$$\Delta \ln GDP_t = a_1 + \sum_{i=1}^{p} \beta_i \Delta \ln GDP_{t-i} + \sum_{i=1}^{p} \kappa_i \Delta \ln INF_{t-i} + \sum_{i=1}^{p} \varpi_i \Delta \ln REER_{ti} + \sum_{i=1}^{p} \varphi_i \Delta \ln COP_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta \ln FPP_{t-i} + \delta_1 ECM_{t-1} + v_{1t} \text{..... .....} .(4)$$

$$\Delta \ln INF_t = a_1 + \sum_{i=1}^{p} \kappa_i \Delta \ln INF_{t-i} + \sum_{i=1}^{p} \beta_i \Delta \ln GDP_{ti} + \sum_{i=1}^{p} \varpi_i \Delta \ln REER_{ti} + \sum_{i=1}^{p} \varphi_i \Delta \ln COP_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta \ln FPP_{t-i} + \delta_2 ECM_{t-1} + v_{2t} \text{..... .....} (5)$$

$$\Delta \ln REER_t = a_1 + \sum_{i=1}^{p} \varpi_i \Delta \ln REER_{ti} + \sum_{i=1}^{p} \beta_i \Delta \ln GDP_{ti} + \sum_{i=1}^{p} \kappa_i \Delta \ln INF_{t-i} + \sum_{i=1}^{p} \varphi_i \Delta \ln COP_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta \ln FPP_{t-i} + \delta_3 ECM_{t-1} + v_{3t} \text{..... .....} (6)$$

$$\Delta \ln COP_t = a_1 + \sum_{i=1}^{p} \varphi_i \Delta \ln COP_{t-i} + \sum_{i=1}^{p} \beta_i \Delta \ln GDP_{ti} + \sum_{i=1}^{p} \kappa_i \Delta \ln INF_{t-i} + \sum_{i=1}^{p} \varpi_i \Delta \ln REER_{ti} + \sum_{i=1}^{p} \gamma_i \Delta \ln FPP_{t-i} + \delta_4 ECM_{t-1} + v_{4t} \text{..... .....} (7)$$

$$\Delta \ln FPP_t = a_1 + \sum_{i=1}^{p} \gamma_i \Delta \ln FPP_{ti} + \sum_{i=1}^{p} \beta_i \Delta \ln GDP_{ti} + \sum_{i=1}^{p} \kappa_i \Delta \ln INF_{ti} + \sum_{i=1}^{p} \varpi_i \Delta \ln REER_{ti} + \sum_{i=1}^{p} \varphi_i \Delta \ln COPP_{t-i} + \delta_5 ECM_{t-1} + v_{1t} \text{..... .....} .(8)$$

Where: Δ is the first difference operator and $\ln$ is the natural logarithm.

The residuals υ_{it} are assumed to be normally distributed and white noise is the one period lagged error-correction term derived from the cointegration equation.

4.2 Data Source

The paper used annual time-series data obtained from secondary sources. Data on annual growth rate of GDP and real effective exchange rate were sourced from World Development Indicators; inflation rates and fuel pump prices were obtained from Central Bank of Nigeria Statistics, 2015 while spot crude prices were sourced from BP Statistical Review of World Energy, 2015.

5. Data Analysis

5.1 Unit Root Test

To examine the stationarity process of the variables, the study began with the examination of trends of the variables to identify the structural breaks inherent in the data. The result showed that structural breaks are present in the series of GDP growth rate, crude oil price, inflation rate, real effective exchange rate, and fuel pump price in 2004, 2003, 2000, 1998, and 1997 respectively at levels. But after the first difference, the structural breaks occur in 2014 for crude oil price, 2004 for GDP growth, 2002 for fuel pump price and 1999 for inflation and real effective exchange rate.

The study proceeds to conduct unit root tests on the variables included in the regression by employing both the Ng-Perron and Zivot-Andrews tests at 1%, 5% and 10% levels of significance. The results of the ZA unit root tests as reported in the lower portion of Table 5.1 suggest that all the variables have a unit root problem at level with intercept and trend. But after the first difference, all the variables were found to be stationary. This confirms that all the series are integrated at I (1).

Table 5.1: Ng-Perron Unit Root Test

Variable	MZa	MZt	MSt	MPt
LGDP	-11.0073	-2.34427	0.2128	2.2384
L INFR	-7.8448	-1.9710	0.25123	11.639
LREER	-6.0162	-1.7218	0.2862	4.1171
LCOP	-1.2782	-0.6941	0.5430	16.1156
LFPP	-9.6889	-2.0996	0.2167	9.8210
ΔLGDP	-11.7496*	-2.4276	0.2057	2.1090
ΔL INFR	-12.2927*	-2.4742	0.2012	7.4392
ΔLREER	-8.6838**	-2.0523	0.2363	2.9390
ΔLCOP	-13.6795**	-2.2847	0.1670	2.9672
ΔLFPP	-25.5297*	-3.5617	0.1395	3.6337
Zivot-Andrews Structural Breaks Unit Root Test				
Variable	At levels	Time break	At Difference	Time Break
LGDP	-7.6811	2004	-10.7224*	2004
L INFR	-3.7692	2000	-9.7460*	1999
LREER	-6.8094	1998	13.9092*	1999
LCOP	-3.6541	2003	-5.1745**	2014
LFPP	-2.0357	1997	-6.7761**	2002

Note: *, ** and * indicate significance at 1% 5% and 10% level respectively**

5.2 Lag Selection Criteria

The selection criteria result shows that the whole criteria selected lag 1. The likelihood ratio, the final prediction error, the Akaike information, the Schwarz and Hannan criteria selected lag 1 as shown by the asterisk at 5% significance level.

Table 5.2: Lag Selection Criteria Result

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-192.9084	NA	35.82597*	14.92203*	15.68329*	15.15476*
2	-180.3221	17.98041	48.41414	15.16587	16.68839	15.63132

Endogeneous: lnGDP, lnINF, lnREER, lnCOP, lnFPP; Exogeneous: Constant; Note: * indicates lag selection by the criteria

5.3 Co-integration Test

It can be seen from Table 5.3 that both the trace statistic and the maximum Eigen value statistic indicate the presence of two co-integrations among the variables. This confirms the existence of a stable long-run relationship among GDP growth rate as the dependent variable, inflation rate, real effective exchange rate, crude oil price and fuel pump price as the independent variables.

Table 5.3: Co-integration Tests Result

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.834333	109.8347	69.81889	0.0000
At most 1*	0.753958	61.29479	47.85613	0.0017
At most 2	0.352777	23.43393	29.79707	0.2254
At most 3	0.242664	11.68718	15.49471	0.1726
At most 4*	0.143508	4.182575	3.841466	0.0408
Unrestricted Co-integration Rank Test (Maximum Eigen-value)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.834333	48.53988	33.87687	0.0005
At most 1*	0.753958	37.86086	27.58434	0.0017
At most 2	0.352777	11.74675	21.13162	0.5728
At most 3	0.242664	7.504605	14.26460	0.4313
At most 4*	0.143508	4.182575	3.841466	0.0408

Both Trace test and Maximum Eigen values indicate 2 Co integrating Equation(s) at the 0.05 level.
*** denotes rejection of the hypothesis at the 0.05 level.**

5.4 Estimation of Vector Error Correction Model (VECM) Coefficients

Since the existence of long run relationship among the variables has been established, the short and long run coefficients of the variables are estimated. The result is presented in table 5.4 below:

Table 5.4: Vector Error Correction Estimates (Short-run and Long-run Coefficients)

VECM Short-run Coefficients and Error Correction Mechanism				
Variable	**Coefficient**	**Std error**	**t-stat**	**Probability**
D(LGDP(-1))	-0.1163	0.1545	-0.7531	0.6231
D(LINF(-1))	0.2803***	0.1505	1.8619	0.0892
D(LREER(-1))	-0.0171	0.0350	0.9466	0.5677
D(LCOP(-1))	4.4079	5.9980	0.7348	0.8754
D(LFPP(-1))	0.5338	4.5089	0.1330	0.9976
ECT(-1)	-0.8002*	0.2077	-3.8520	0.0023
C	0.0362	1.5089	0.0240	0.9325
VECM Long-run Coefficients				
LINF	0.6461**	0.2380	2.7142	0.013
LREER	-0.0529	0.03671	-1.4432	0.4625
LCOP	6. 6347***	3.6383	1.8235	0.0829
LFPP	-0.4216	1.0580	-0.3984	0.6517
C	-35.0783*	17.2136	-2.4767	0.0041
R^2 = 0.6177	**Adj. R^2 = 0.5085**	**F-stat = 5.6570**		

Note: *, **, * indicate significance at 1%, 5% and 10% level respectively**

Beginning with the long-run causality; the empirical results suggest that the ECT_{t-1} coefficients are negatively signed and statistically significant in all VECMs, implying that there is long run causality between the variables of interest. In addition to that, the significance of ECT_{t-1} also exhibits that if the system exposes to shock it will converge to the long-run equilibrium at a relatively slow speed for GDP (–0.8002), inflation (-0.6714) and real effective exchange rate (-0.5715) VECMs compare to the convergence speed of fuel pump price (–0.6047) and crude oil price (–0.0436), VECMs.

The short run Granger causality displays some interesting relationship. The equation of GDP shows that crude oil price and fuel pump price uni-directionally granger cause GDP without a feedback effects. The equation of inflation on the other hand shows no Granger causal relationship in the short-run. However, there is a one-way causal relationship running from inflation to real effective exchange rate. Bidirectional causality is detected between crude oil price and fuel pump price indicating a feedback hypothesis. Though crude oil price and fuel pump price do not Granger cause inflation in the short-run, long-run analysis validate the assumption of crude oil price-inflation hypothesis. In addition, real effective exchange rate Granger causes fuel pump price implying that exchange rate hypothesis pass-through.

The positive coefficient of LCOP which represents crude oil price is consistent with economic theory. An increase in crude oil price of an oil-dependent economy like Nigeria is another way of saying there is an increase in revenue derivable from the sale of crude. Injecting the proceeds from oil into the economy through effective government expenditure will translate into high GDP growth rates. In a related study of the Nigerian economy, Alley, Asekomeh, Mobolaji and Adeniran (2014) reported 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. Conversely, when crude oil price falls the result will be dampening the economy. A decrease in crude oil price reduces government's earnings and consequently her capacity to influence positive economic growth.

Results of the coefficient of determination (R^2) imply a good fit. The R^2 value is 0.6177 which indicates that 62% variation in GDP is jointly explained by independent variables while the remaining 38% is caused by unexplained factors captured by the error term. The value of adjusted R^2 is 0.5085, indicating that 51% of the variation in GDP growth rates is explained by the independent variable with 49% accounted for by the error term. The value of F-statistic is 5.6570 and it is greater than the tabulated value of 2.76 ($F^*=5.6570>F_{0.05}=2.76$) implying that the overall model is statistically significant.

5.5 Granger Causality Test

The study applies the Likelihood Ratio (LR) statistics to ascertain the direction of Granger causality between the variables of interest. In this regard, the following hypotheses were tested using the VECM equations (4-8):

$H0: \kappa_1 = \kappa_2 = ... = \kappa_p = 0$, implying that lnINFt does not Granger-cause lnGDPt,

$H0: \varpi_1 = \varpi_2 = ... = \varpi_p = 0$ implying that lnREERt does not Granger-cause lnGDPt,

$H0: \varphi_1 = \varphi_2 = ... = \varphi_p = 0$ implying that lnCOPt does not Granger-cause lnGDPt,

$H0: \gamma_1 = \gamma_2 = ... = \gamma_p = 0$ implying that lnFPPt does not Granger-cause lnGDPt,

Similar analyses can be done with equation (3-6) to ascertain the direction of causality of the remaining variables (lnINF, lnREER, lnCOP and lnFPP). The result is presented in Table 5.5.

Table 5.5: VECM Granger Causality Test Results

Variable	**Direction of Granger Causality**					
	Short run					**Long run**
	$lnGDP_{t-i}$	$lnINF_{t-i}$	$lnREER_{t-i}$	$lnCOP_{t-i}$	$lnFPP_{t-i}$	$ECT_{(t-1)}$
$lnGDP_{t-i}$	-	2.4208 [0.1695]	2.7450 [0.1424]	4.8156** [0.0488]	5.3518** [0.0393]	-0.8002* [-6.1223]
$lnINF_{t-i}$	0.2700 [0.8447]	-	3.3794 [0.0351]	0.8448 [0.5629]	1.3331 [0.3813]	-0.6714** [-1.9683]
$lnREER_{t-i}$	2.5601 [0.2809]	10.1520*** [0.0910]	-	2.8914 [0.2674]	0.5575 0.6926]	-0.5715** [-2.7410]
$lnCOP_{t-i}$	10.6606** [0.0220]	7.4930 [0.2609]	0.3717 [0.8005]	-	9.5496** [0.0235]	-0.0436** [-2.1409]
$lnFPP_{t-i}$	11.2467*** [0.0828]	3.1257 [0.2517]	16.0796** [0.0485]	10.7998*** [0.0859]	-	-0.6047** [-3.6157]

Note: The asterisks *, ** and * denote the significance at the 1, 5 and 10 per cent level, respectively.**

Since the variables are co-integrated, the study employed the Granger causality in the VECM framework to determine the direction of causality between the variables. The results of Granger causality are presented in Table 5.5. The direction of causality was further divided into short- and long-run causation. The t-significance of the one period lagged error-correction term ECT_{t-1}, represents the long-run causality, and while the joint significance LR tests of the lagged explanatory variables represents the short-run causality.

5.6 Evaluation of the Model

Diagnostic Test

Table 5.6 shows the diagnostic results of the underlying ARDL model for long-run elasticities and supporting statistics. The results signify that the long-run model successfully passed all tests of normality, serial correlation, conditional heteroscedasticity, and functioning form. The robust results of the diagnostic tests imply that the result of the VECM model can be trusted and relied upon for policy modeling on the energy price, inflation, exchange rate and economic growth nexus.

Table 5.6: Diagnostic Test

	Diagnostic	**Statistic**	**Conclusion**
A	Ramsey Reset	F-stat = 2.0572 (0.2400) Log-likelihood = 2.0786 (0.2423)	Equation is correctly specified
B	ARCH Test	F-stat=1.4953(0.2338) Obs*R-sq =1.5261 (0.1267)	There is no ARCH element in the residual
C	Breusch-Godfrey serial Correlation LM Test	F-stat=3.6522 (0.1252) Obs*R-sq= 1.6800 (0.2314)	No serial correlation
D	Normality Test	Jarqu-Bera=1.1104 P-value = (0.5739)	Residuals are normal

A: Ramsey's RESET test using the square of the fitted values; B: Based on autoregressive conditional heteroscedasticity; C: Lagrange multiplier test of residual serial correlation and D: Based on Jarque-Bera normality test (regression of squared residuals on squared fitted values).

Model Stability Test of Cumulative Sum of Square Residuals:

The two straight lines in figures 5.1 and 5.2 show critical bounds at 5% level of significance respectively. The lines within the critical bounds represent the results of both the short-run and long-run analysis. These imply that the coefficients of error correction model are free from autoregressive conditional heteroscedasticity and serial correlation. Hence, the model is stable, and results can be trusted for policy use. As indicated in both figures, tests are within critical limits (represented by two straight lines).

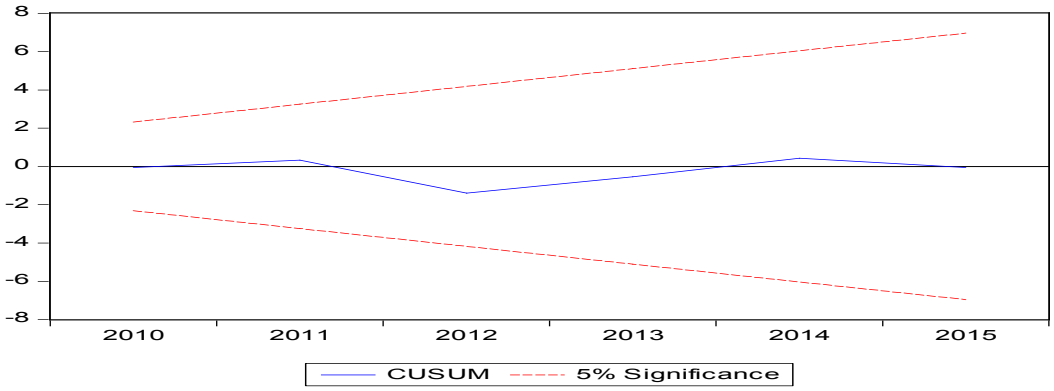

Figure 5.1: Model stability test of Cumulative sum of square residuals (Short-run)

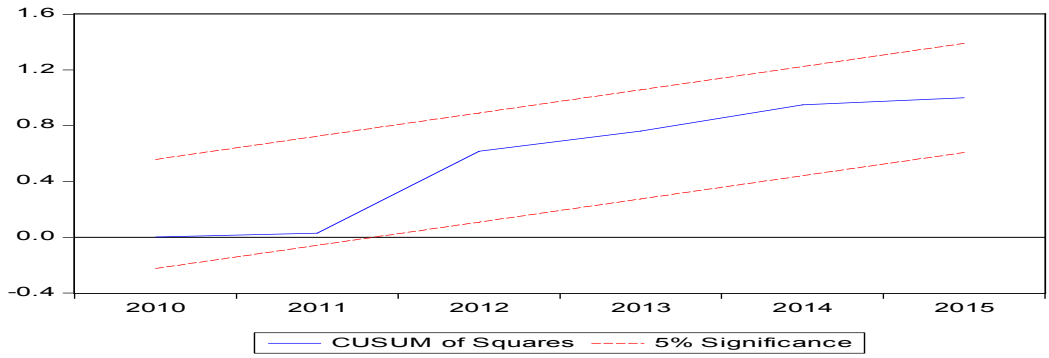

Figure 5.2: Model stability test of Cumulative sum of square residuals (Long-run)

6. Findings

In line with the objectives of this paper, it is evident that changes in crude oil prices exert influence on the economic growth of Nigeria. When crude oil prices are high, economic activities would be boosted through both capital and recurrent expenditure of the government. Falling crude oil price does no good to the Nigerian economy since it results in lower revenue collection to the national treasury. This confirms the link between the recent drop in crude oil price and debilitating nature of the Nigerian economy since then.

Crude oil price was found to Granger cause inflation in the long run which validates the crude oil price-inflation hypothesis. This means that changes in crude oil price is responsible for the rising inflation rates in Nigeria. The drop in crude oil price caused fall in exchange rate thereby causing inflationary pressure on the economy.

The VECM Granger Causality Test Results shows bidirectional causality between crude oil price and fuel pump price. This implies that the two variables have influence on one another, as crude oil price causes changes in fuel pump price; fuel pump price also influence crude oil price. For example, a decrease in crude oil price leads to an increase in fuel pump price and vice-versa. The bi-directional causal relationship indicates that the feedback hypothesis holds, suggesting that crude oil price and fuel pump price are interrelated. However, the reality in Nigeria shows that as crude oil price began to decline in the middle of 2014, the Nigerian government reviewed upward the cost of fuel per litre. This indicates that the cost of crude oil at the international market exert but a minimal influence on the domestic price of fuel as the country relies heavily on imported petroleum products. In other words, fuel pump price in Nigeria is not wholly a reflection of the realities in the oil market but a product of government control.

7. Conclusion

Changes in crude oil price have proven to have significant impact on the level of economic activities in Nigeria. This implies that falling crude oil prices dampens the prospect of economic growth in Nigeria, it manifests in deteriorating exchange rate, skyrocketing inflation rates and eroding purchasing power. But when crude prices are high, it sends boom signals to the economy by boosting its revenue base as well as the ability to execute national budgets.

It can therefore be concluded that economic growth in Nigeria depends on changes in crude oil prices among other things. This validates the Renaissance growth model and lends support to empirical evidences obtained from related works of Ebele (2015), Yusuf (2015), and Alley, Asekomeh, Mobolaji and Adeniran (2014). Crude oil remains the driving force behind any growth prospects that the country may envisage. Due to

the country's over-reliance on crude oil, any changes in crude oil price cause serious distortions to some of the major macroeconomic variables of the economy. Inflation in Nigeria is induced by changes in oil price while evidence of causality was established between crude oil price the price pump price of fuel in Nigeria.

8. Recommendations

Based on the findings of this study, the following recommendations were advanced:

i. The need for diversification of the Nigeria's revenue sources is more glaring now than ever and needs to be pursued with renewed vigour. The country is endowed with vast land for cultivation, a favourable weather condition for crops and livestock to thrive as well as large population size to man the agricultural sector. Government should therefore take advantage of these areas of strength to diversify in that direction. Policies should be redirected towards revitalising the agricultural sector by injecting funds through means that are easy to be accessed by farmers. Research and development efforts should be intensified towards the production new improved yields crops. In addition, investment should be directed to developing sound storage facilities to encourage the production of perishable crops. A developed agricultural sector has the tendency of providing alternative revenue source to absorb the shocks arising from changes in crude oil prices that the country has come to depend on so heavily.

ii. 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. The idea of excess of crude account introduced by the Obasanjo's administration in 2004 should be revisited, rebuilt and maintained when prices of crude improves.

iii. The existence of a bi-directional link between crude oil and fuel pump indicates that falling oil prices leads to upwards adjustment in fuel pump price through depreciating exchange rates. Building of new and renovating the existing refineries should go beyond the normal rhetoric of the government as this would help check the rising import bills for refined petroleum products which accounts for the increase in fuel pump price. Government should deregulate the downstream sector of the petroleum industry to allow for the participation of private individual who has the wherewithal to invest in the establishment of refineries. This can be done by ensuring the passage into law of Petroleum Industry Bill (PIB) by the eighth National Assembly, which has among other objectives the deregulation of downstream sector. The existence of more functional refineries would increase the supply of petroleum products and check the arbitrary increase in price especially by the operators of black markets.

iv. There is need for a robust import-substitution strategy to check the vulnerability of exchange rate to external factors. The country's over-dependence on foreign goods at the expense of locally made accounts for undue pressure on foreign exchange that often leads to the depreciation of naira against major international currencies. Government should therefore intensify efforts at reducing the country's obsession with imported goods by establishing industries that can produce such products in Nigeria and emphasize the need for economic patriotism among Nigerians. Part of the recovered looted funds should be used to augment budgetary provisions for industrialisation.

v. In view of the sensitive nature of exchange rate to oil price and the interconnection of Nigerian economy with rest of the world, the adoption of a floating exchange rate is necessary to absorb shocks arising from oil prices. The floating exchange policy allows the forces of demand and supply to determine exchange rate and discourages hoarding of international currencies especially by the operators of Bureau de change. In doing this, the government needs to expand her production base in order to increase the range of goods available for export.

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Appendix A

Data for Analysis

Year	GDP	INF	REER	COP	FPP
1986	-8.80	7.60	267.47	14.46	0.40
1987	-10.80	13.90	85.21	18.39	0.40
1988	7.50	16.00	85.63	15.00	0.42
1989	6.50	33.90	76.25	18.30	0.60
1990	12.80	20.40	70.75	23.85	0.60
1991	-0.60	22.50	59.97	20.11	0.70
1992	0.40	21.40	49.74	19.61	0.70
1993	2.10	23.20	54.50	17.41	1.34
1994	0.90	28.50	100.79	16.25	5.19
1995	-0.30	25.30	160.13	17.26	11.00
1996	5.00	40.70	207.63	21.16	11.00
1997	2.80	44.50	235.92	19.33	11.00
1998	2.70	50.30	272.34	12.62	12.17
1999	0.50	20.60	70.15	18.00	20.00
2000	5.30	29.30	69.87	28.42	21.17
2001	4.40	18.90	77.84	24.33	22.00
2002	3.80	12.90	78.08	25.04	26.00
2003	10.40	14.00	73.20	28.66	34.17
2004	33.70	15.10	74.91	38.13	40.00
2005	3.40	17.80	85.55	55.69	40.00
2006	8.20	8.20	91.5	67.07	40.00
2007	6.80	5.40	89.65	74.48	40.00
2008	6.30	11.60	99.13	101.43	40.00
2009	6.90	12.50	92.14	63.35	57.08
2010	7.80	13.70	100.00	81.05	65.00
2011	4.90	10.80	100.31	113.65	65.00
2012	4.30	12.30	111.39	114.21	98.83
2013	5.40	8.50	118.81	111.95	97.00
2014	6.30	8.40	127.09	101.35	97.00
2015	2.70	8.80	126.06	54.41	87.83

Sources: World Bank Development Indicators; BP Statistics 2016; Central Bank of Nigeria (CBN) Statistical Bulletin 2014

Appendix B

Trends of GDP, INF, REER, COP and FPP in their logarithm form.