Oil Price Fluctuations and Output performance in Nigeria : a Var Approach

Ismail O. Fasanya[1]
Adegbemi B.O Onakoya[2]

This paper examines the impact of oil price movements on real output growth in Nigeria during the period 1970 to 2011 making use of annual time series data. The empirical analysis rests on dynamic VAR analytical framework. To capture the possible channels reflecting the fluctuations in the oil prices, the model includes money supply, real exchange rate, government spending and inflation. Our findings indicate the lagged effects of the VAR model are not able to capture any significant impact of changes in oil prices, and oil price shocks are therefore not found to contribute directly to output, exchange rate or inflation in the short run but show a positive significant relationship to output growth in the long run. Following the VAR model results, the generalized impulse responses reaffirm the direct link between the net oil price shock and growth, as well as the indirect linkages.
Keywords: Oil Price Shocks, GDP, Vector Autoregressive
JEL Classifications: C22, O40

[1] **Ismail O. Fasanya,** Department of Economics and Financial Studies, Fountain University, Osogbo, Osun State, Nigeria; e-mail: fascojnr@yahoo.com; Mobile: (+234) 8053148920
[2] **Adegbemi B.O Onakoya,** Department of Economics, College of Management Sciences, Tai Solarin University of Education, Ijagun, Ijebu-Ode, Nigeria; e-mail adegbemionakoya@yahoo.com

1.Introduction

One of the major challenges of policy makers all over the world is increased variations in oil prices. Since the major oil shock of 1973, there have been marked fluctuations in the world price of oil. Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Hamilton, 1983; Wakeford, 2006). As an oil exporter and importer of refined petroleum products, Nigeria is potentially vulnerable to oil price volatility. These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil-rich Middle East, activities of militant groups in the Niger Delta region of Nigeria and global economic meltdown of late 2007. This shocks could be positive (a rise) or negative (a fall) that is oil price volatility tends to exert a positive effect on the GDP growth for a net oil exporting country and a negative effect on net oil importing countries. Despite main focus on oil price shocks and the macroeconomy analyses directed towards oil importing developed countries, some recent studies have examined the same for developing countries like Philippine (Raguindin and Reyes, 2005), Venezuela (El-Anashasy et al., 2005), Nigeria (Iwayemi and Fowowe, 2011), Iran (Farzanehan and Markwardt, 2009), Thailand (Rafiq et al., 2009), Tunisia (Jbir and Zouari-Ghorbel, 2008) and China (Cong et al., 2008; Tang et, al., 2010; Du et al., 2010). Earlier studies focusing on the United States have suggested that on one hand, rising oil prices led to reduction in output and higher inflation in the 1970s and early 1980s and that oil price declines on the other had an exactly opposite effect (Adeniyi, 2009). Rafiq et al (2009) while summarizing previous studies revealed that oil price shocks have significant asymmetric impact on macroeconomic fundamentals; the negative shocks having much larger impact than the positive ones.

The role of oil price shocks experienced by net oil-exporting developing countries has not been sufficiently covered in the literature.

Specifically, studies are rare, as far as we know, on Nigeria that have taken explicit account of potential non-linearities in the oil price-macroeconomy relationship. However, the preponderance of extant studies in Nigeria (see Olomola and Adejumo (2006); Aliyu (2009); Iwayemi and Fowowe, (2011)) have examined this linkage without measuring both the linearity and non-linearity characteristics of oil price movements. This study therefore would contribute immensely to knowledge and total understanding of the workings of the economy in Nigeria, as it relates to the natural resource (crude oil). Through the macroeconomic variables that would be considered in this work, it will help the government and the general public to know the trend of oil price shocks and policy instruments required to stabilize the oil price changes and hence economic growth in Nigeria. Against this background, a research work of this nature to evaluate the impact of oil price shocks on GDP growth is considered inevitable at this time. For the purpose of this study, the research work answers the questions; (i).How does a change in oil price affect the Real Gross Domestic Product (GDP) in Nigeria? (ii) What are the factors responsible for the fluctuations of Nigeria's oil prices?

This paper is, therefore, aimed at filling this gap as it analysed the impact of changes in the oil price on GDP growth in Nigeria during the period 1970-2011. This research would thereby enrich the existing literature as it provides empirical evidence in the context of Nigeria.

The rest of the paper is organized into four sections. Section two provides the review of relevant literature. The methodological approach to the study is laid out in section three. Section four discusses the empirical results obtained, while section five provides the conclusion.

2. Review of Relevant Literatures

There seems to be extensive work examining the direction between oil price shocks and the macroeconomy. As earlier mentioned, the results from these various studies are mixed (while some suggest a negative relationship, some others suggest a positive association). Under this section of the study, we provide a review of the findings of the major studies including the recent dimension into the relationship between oil price shocks and the macroeconomy.

Hamilton (1983) studies the impact of oil price shocks on the US economy by using a seven-variable VAR system. He finds that all but one economic recession are preceded by dramatic oil price increases after World War II. This does not mean that an oil price increase causes recessions, but there exists a statistically significant correlation between oil price shocks and economic recessions. Hooker (1996) finds somewhat different results that in data up to 1973, Granger causality from oil price shocks to US macroeconomic variable exists, but if the data is extended to the mid 1990's the relationship is not robust His analysis concludes that the oil price macro economy relationship has changed in a way which can't be well represented by simple oil price increases and decreases.

Odularu (2008) through Ordinary Least Squares (OLS) estimation method revealed that crude oil, consumption and export have contributed to the improvement of the Nigerian economy and that government should implement policies that would encourage the private sector to participate actively in the crude oil sector. Eltony (2006) also used the VECM along with the Structural Vector Autoregression (VAR) Model to estimate the key macroeconomic variables for Kuwait. The study found that oil prices (oil revenues) to be very important in explaining most of the forecast errors variance of the Kuwait government expenditure and the government development expenditure has been more responsive to oil shocks than current expenditure. The government fiscal stimuli are the main determinant of domestic prices and fiscal policy can be used more effectively to stabilize the domestic economy after an oil shock. Jiménez- Rodríguez and Sánchez (2004), Akpan (2009), Farzanegan and Markwardt (2007) and Adebiyi et al (2009) used multivariate VAR analysis on linear and non- linear models along with Granger causality tests. Jiménez-Rodríguez and Sánchez (2004) showed that in oil importing countries, oil price increases have a negative impact on economic activity in all cases but Japan. Farzanegan and Markwardt (2007) also show that oil price increases have a significant positive impact on industrial output and oil price decreases have significant negative impact on industrial output of Iran. Aliyu (2009) revealed that oil price shock and appreciation in the level of exchange rate exert positive impact on real economic growth in Nigeria. The findings of Akpan (2009) show a strong positive relationship between positive oil price changes and real government expenditures. The results of Adebiyi et al (2009) show an immediate and significant negative real stock returns to oil price shock and Agbede (2013) investigates the growth implications of crude oil price shock in Nigeria by applying the multiple regression of the ordinary least square technique and revealed that a little shock in the price of crude oil in the global oil market in the current period will produce a long–term effect on economic growth in Nigeria. The results obtained in Al-Fayoumi (2009) showed that the local macroeconomic variables had more important effects on the changes in stock market returns than that of oil prices and changes in oil price do not adversely affect Turkish, Tunisian and Jordanian stock markets. Jin (2008) also showed that oil price increases gives a negative impact on economic growth in Japan and China and a positive impact on economic growth of Russia. In a related study, EL-Anshasy *et al.* (2005) assessed the effects of oil price shocks on Venezuela's economic performance over a longer period (1950 to 2001), the results found two long-run relationships consistent with economic growth and fiscal balance. Furthermore, they found that this relationship is important not only for the long-run performance but also for short-term fluctuations. Olomola and Adejumo (2006) showed that it is not the oil price itself but rather its manifestation in real exchange rates and money supply that affects the fluctuations of the GDP.

Wakeford (2006) reveal that while commodity exports-especially gold-provided an initial buffer, the economy was not immune to sustained price shocks. The study concludes that while there are several short-run supply risks, the major threat is the inevitable peaking of oil production which may occur within 5 to 10 years. This, the study argues will result in recurrent oil shocks and greater volatility and recommended governments' accelerated action on the shared growth initiative to cushion the effect of the shocks. A Wald and Likelihood Ratio tests of Granger Causality, was utilized and the results indicated that linear price change, the asymmetric price increase and the net oil price variables were significant for the system as a whole, whereas the asymmetric price variables was not. Following the causality analysis of oil price nexus, the generalized impulse responses and error variance decompositions the authors reaffirmed the direct link between the net oil price shock and growth, as well as the indirect linkages. They concluded that since oil consumption continued to increase in New Zealand, there is a need for policy-makers to consider oil price shocks as a major source of volatility for many variables in the economy. Amaira (2012) investigates the causal relationship between oil prices and economic growth in Tunisia over a period from 1960 to 2009 through a Granger pairwise causality test which revealed unidirectional causality from real GDP to oil prices.

Eltony and Al-Awadi (2001) in a study on Kuwait find that linear oil price shocks are significant in explaining fluctuations in macro-economic variables in Kuwait. The results reveal the importance of oil price shocks in government expenditures which are the major determinants of the level of economic activity in Kuwait. Raguindin and Reyes (2005) examined the effects of oil price shocks on the Philippine economy over the period 1981 to 2003. Their impulse response functions for the symmetric transformation of oil prices showed that an oil price shock leads to a prolonged reduction in the real GDP of the Philippines. Conversely, in their asymmetric VAR model, oil price decreases play a greater role in each variable's fluctuations than oil price increases. Olomola (2006) investigated the impact of oil price shocks on aggregate economic activity (output, inflation, the real exchange rate and money supply) in Nigeria using quarterly data from 1970 to 2003. The findings revealed that contrary to previous empirical findings, oil price shocks do not affect output and inflation in Nigeria significantly. However, oil price shocks were found to significantly influence the real exchange rate. The author argues that oil price shocks may give rise to wealth effect that appreciates the real exchange rate and may squeeze the tradable sector, giving rise to the "Dutch-Disease".

Hajko (2012) applied the Bayesian VAR method to analyse the relationship between oil price movements and GDP in the Czech Republic. Three specifications for the oil prices are used to identify whether changes in oil price contribute significantly either in linear, linear asymmetric or nonlinear asymmetric way and the results indicate the lagged effects of the reduced VAR model are not able to capture any significant impact of changes in oil prices, and oil prices are therefore not found to contribute directly to inflation, GDP or money base. Gökçe (2013) investigates the dynamic effects of a structural crude oil volatility shock on real economic growth for Turkish economy. To estimate the volatility, the study made use of the exponential GARCH(p,q) model to estimate the dynamic structural relationships between oil price volatility and economic growth through a structural VAR model. Empirical results suggest that the long-run response of accumulated economic growth to a structural shock in real crude oil price volatility is −0.0164 points. This means that quarterly economic growth decreases by 0.0164 points and this finding is of strong statistical significance but Oksuzler & Ipek (2011) investigated the causal effects of world oil price changes on inflation and growth in Turkey. Granger causality analysis obtained from VAR model confirmed a unidirectional causality from oil prices to economic growth; however, no significant causal relationship between oil prices and inflation was found.

In short, the results of research on the relation between oil price shocks and the macroeconomy vary depending upon the models, data and countries of analysis. Therefore, the debate over the impact of oil price shocks on the macroeconomy is on-going and left open to further study.

3. Methodology and Data

3.1 Model Specification

This study applies the vector error correction model (VECM) framework (with particular attention given to causality) through Granger's representation theorem (Engel and Granger 1987). The linear constructions of these variables are interpreted as long run static equilibrium relationships (Johansen and Juselius 1990). Each equation is the estimated with an error correction term, which represents the speed of adjustment to out of equilibrium movements in any of the GDP variable[3].

$$RGDP = f\{OPS, INF, REER, GEXP, MS\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

It must be noted that in case where each variable is non-stationary and integrated of the same order, typically 1(1), this interdependent relationship can then be estimated using the VECM framework (Hamilton 1965).

[3] The larger the coefficient, the greater the adjustment of the dependent variable to the deviation from long run equilibrium in the previous period (Dolado, et al 2001).

$$\Delta RGDP_t = \beta_{10} + \sum_{k=1}^{r} \alpha_k \; \varphi k_{t-1} + \sum_{i=1}^{n} \alpha_{1i} \, \Delta RGDP_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \, \Delta Y_{t-i} + \varepsilon RGDP_t \ldots\ldots\ldots \textbf{(2)}$$

$$\Delta OPS = \beta_{20} + \sum_{k=1}^{r} \alpha_k \, \varphi_{k\,t-1} + \sum_{i=1}^{n} \alpha_{3i} \Delta OPS_{t-1} + \sum_{i=1}^{n} \alpha_{4i} \, \Delta Y_{t-1} + \varepsilon OP_t \ldots \ldots . . \textbf{(3)}$$

$$\Delta INF_t = \beta_{30} + \sum_{k=1}^{r} \alpha_k \, \varphi_{k\,t-1} + \sum_{i=1}^{n} \alpha_{5i} \, \Delta INF_{t-1} + \sum_{i=1}^{n} \alpha_{6i} \, \Delta Y_{t-1} + \varepsilon INF_t \ldots \ldots . . \textbf{(4)}$$

$$\Delta GEXP_t = \beta_{40} + \sum_{k=1}^{r} \alpha_k \, \varphi_{k\,t-1} + \sum_{i=1}^{n} \alpha_{7i} \, \Delta GEXP_{t-1} + \sum_{i-1}^{n} \alpha_{8i} \Delta Y_{t-1} + \varepsilon GEXP_t \ldots\ldots\ldots \textbf{(5)}$$

$$\Delta MS_t = \beta_{50} + \sum_{k=1}^{r} \alpha_k \, \varphi_{k\,t-1} + \sum_{i=1}^{n} \alpha_{9i} \Delta GEXP_{t-1} + \sum_{i=1}^{n} \alpha_{10i} \Delta Y_{t-1} + \varepsilon MS_t \ldots\ldots\ldots\ldots \textbf{(6)}$$

$$\Delta REER_t = \beta_{60} + \sum_{k=1}^{r} \alpha_k \, \varphi_{k\,t-1} + \sum_{i=1}^{n} \alpha_{11i} \Delta REER_{t-1} + \sum_{i=1}^{n} \alpha_{12i} \Delta Y_{t-1} + \varepsilon REER_t \ldots.. \textbf{(7)}$$

Where:

RGDP is the real gross domestic product; OPS is Oil Price Shocks; CPI is Consumer Price Index; GEXP is Government Expenditure and MS is Money Supply. For expositional simplicity in equation (2)[4], Y_{t-i} = OPS_t, INF_t, $GEXP_{(t)}$, $MS_{(t)}$ and $REER_{(t)}$ where i is the number of lags chosen for the model. The $\varphi_{k,t-1}$ term represents the co-integrating equation residuals so that α_k term represents each of the adjustment coefficients. The optimal lag lengths of the model are shown by (r) and (n) and chosen by standard diagnostic tests. Each of the error term is assumed to have the normal white noise features.

[4] This is also applicable to all other equations from 3-7

Also, in order to avoid a spurious regression, we subject each of the variables used to unit root (or stationary) test so as to determine their orders of integration, since unit root problem is a common feature of most time-series data.

3.2 Measurement of Oil Price Shocks

The traditional, also linear, measure of oil price shocks in the literature as popularized by Hamilton (1983) is the quarterly changes in real oil prices which is constructed as the first log differences of the oil price variable viz:

$\Delta o_t = ln\, o_t - \; lno_{t-1}$………………….. **(8)**

Where o_t is the real oil price in period t and *ln* represents the logarithm of the same variable.

Hamilton (1996) proposed a Net Oil Price Increase (NOPI) measure which is defined as the maximum between the log of the current price and the maximum value of the log of the oil price during the preceeding year. Hamilton argues, further, that a measure of how an oil increase alters the spending decisions of households and firms would be a comparison of the current oil price to its historical path. Such reluctance to respond to small oil price changes could be as a result of high costs of monitoring energy expenditures and frictions with regard to adjusting consumption (Goldberg, 1998). Hence, the amount by which the log real oil price in quarter t exceeds its maximum over the previous year (i.e last four quarters) is used while oil price increases less than this benchmark are assumed to have no effect. This transformed oil price variable is;

NOPI 4 = max [0,(lno_t) – ln (max ($o_{t-1,} o_{t-2}, o_{t-3,} o_{t-4}$))]………….. **(9)**

To capture sluggish adjustment mechanisms due to rigidities specific to particular economic settings, Hamilton (1996) proposes a variant of the above measure which covers the amount by which the log of oil prices in quarter t exceeds the maximum over the previous 12 quarters (3 years) as;

NOPI12= max [0,(lno_t) – ln (max (o_{t-1} ..... o_{t-12}))]................. **(10)**

With the above variables, it is possible to examine the causal relationship between "important" oil price increases and macroeconomic indicators. The macroeconomic environment also matters for an objective assessment of the impact of oil price shocks.

4. The Empirical Results

4.1 Result of Unit Root Test

Time series properties of all variables used in estimation were examined in order to obtain reliable results. Thus this exercise was carried out through Dickey Fuller - Generalized Least Square (DF-GLS) test and Phillip-Perron (PP test). This development arises from the prevalence of substantial co-movements among most economic time series data, which has been argued in the literature as undermining the policy implications that could be inferred from such modeling constructs (Engel and Granger, 1987). The DF-GLS and PP test are used to determine the order of integration. That is, the number of times a variable has to be differenced before it becomes stationary.

In this analysis, the model was considered viz, with constant, constant and linear trend and none (with no constant and trend). The null hypothesis in both DF-GLS and PP test is that there is the presence of unit root. Table 1 and 2 report the results of DF-GLS and PP test respectively.

Table 1

Dickey Fuller - Generalized Least Square Test (DF-GLS)

Variable		***Level form***		***First difference***		***Decision***
		Model 1	Model 2	Model 1	Model 2	
ln(RGDP)		-0.382478	-2.797446***	-9.057755*	-8.764859*	I(1)
OPS		-5.852453*	-6.155909*	-9.997607*	-10.00222*	I(0)
ln(MS)		0.063874	-2.938149***	-3.497139*	-3.544872**	I(1)
ln(GEXP)		0.987482	-4.759745*	-0.776508	-3.813749*	I(1)
ln(REER)		0.734145	-1.534052	-4.971960*	-4.971960*	I(1)
INF		-3.223347*	-3.223347**	-6.526776**	-6.602583*	I(0)
CRITICAL VALUES	**1%**	**-2.622585**	**-3.770000**	**-2.624057**	**-3.770000**	
	5%	**-1.949097**	**-3.190000**	**-1.949319**	**-3.190000**	
	10%	**-1.611824**	**-2.890000**	**-1.611711**	**-2.890000**	

Source: Compiled by the Authors, 2013

*The null Hypothesis is the presence of unit root. Model 1 includes a constant; Model 2 includes a constant and a linear time trend. Lags were selected based on Modified Schwartz Information Criterion for all variables. *,** and *** denote significance at 1%, 5% and 10% respectively.*

The above result i.e. DF-GLS test at levels shows that model one (only constant) show that only oil price shocks and inflation are significant at one percent while in model two (constant and a linear time trend) all the variables are significant except for real exchange rate. Similarly all the variables are significant except for GEXP in model one of the first difference and the entire are stationary in the model two of the first difference form. This means all the variables are integrated of order 1.

Table 2

Phillip Perron Test (PP)

Variable		*Level form*		*First difference*		*Decision*
		Model 1	*Model 2*	*Model 1*	*Model 2*	
ln(RGDP)		-2.318439***	-2.917880	-9.558319*	-14.52133*	I(1)
OPS		-5.927123*	-6.193812*	-22.76894*	-21.58999*	I(1)
ln(MS)		-0.038009	-1.869925	-3.201159**	-3.125245	I(1)
ln(GEXP)		-0.875217	-2.885363	-8.437880*	-8.305521*	I(1)
ln(REER)		-0.179089	-2.149710	-5.154796*	-5.092430*	I(1)
INF		-3.070372**	-3.011759	-12.40220*	-13.17494*	I(1)
Critical values	**1%**	**-3.600987**	**-4.198503**	**-3.605593**	**-4.205004**	
	5%	**-2.935001**	**-3.523623**	**-2.936942**	**-3.526609**	
	10 %	**-2.605836**	**-3.192902**	**-2.606857**	**-3.194611**	

Source: Computed by the Authors, 2013

*The null Hypothesis is the presence of unit root. Model 1 includes a constant, Model 2 includes a constant and a linear trend. The Bandwith was chosen using Newey-West method with Barttlet Kernel spectral estimation. *, **, *** denotes significance at 1%, 5% and 10% respectively.*

Phillip-Perron test shows the variable are stationary at first difference in the two models at different levels. This means all the variables are integrated of order 1. The two tests produce supporting results. The results show that all most all the variables are found to be stationary at 99 percent significance level in their first difference from with the assumption of constant and trend and. Therefore, all variables are non stationary and integrated of order 1, 1(1). Therefore, we can safely conclude that first differencing is sufficient for modeling the time series adopted in this research work. It is appropriate to estimate models that include variables in their first differenced form through the VECM procedure.

4.2 The Cointegration Analysis Results and Interpretation

The Johansen and Juselius (1990) method is adopted in testing for cointegration. According to the approach, we must first determine the lag length of the VAR which must be small enough to ensure that errors are approximately of white noise. Thus, the result of the lag length test is presented in table 3 considering the results from the five different information criteria used namely Akaike Information Criteria (AIC), Schwartz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ), Final Prediction Error (FPE) and Sequential Modified LR test Statistic (LR), the optimal lag length for the models are one.

Table 3

Lag Length Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-313.6649	NA	0.530400	16.39307	16.64900	16.48490
1	-110.3532	333.6397*	0.000102*	7.812984*	9.604512*	8.455768*
2	-79.89513	40.61073	0.000155	8.097186	11.42431	9.290930
3	-52.62119	27.97328	0.000356	8.544676	13.40740	10.28938

SOURCE: Computed by the Authors, 2013
**indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information
HQ: Hannan-Quinn information criterion

In determining the number of cointegrating vectors, trace test and maximum eigenvalue test using the more recent critical values of Mackinon-Haug-Michelis (1999) was applied. The assumption of no deterministic trend and restricted constant are used for all variables. The choice was tested using Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC). The result for both trace test and maximum eigenvalue for unrestricted cointegration rank test are presented in table 4.

Table 4
Johansen-Juselius Maximum Likelihood Cointegration Test Results

Hypothesized No. of CE(s)	Eigen value	Max-Eigen value	Critical value 5 percent	Trace statistic	Critical value 5percent
None *	0.716650	50.44289*	40.07757	110.4717*	95.75366
At most 1	0.429173	22.42680	33.87687	60.02885	69.81889
At most 2	0.375510	18.83282	27.58434	37.60205	47.85613
At most 3	0.241205	11.04092	21.13162	18.76923	29.79707
At most 4	0.171718	7.536047	14.26460	7.728308	15.49471
At most 5	0.004795	0.192261	3.841466	0.192261	3.841466

Source: Computed by the Authors, 2013
**denotes rejection of the hypothesis at the 5% level*

From table 4 above, it is observed that both trace test statistic and the Max-Eigenvalue test indicate one cointegrating equation at 5% level of significance. Based on the evidence above, we can safely reject the null hypothesis (H_o) which says that there are no cointegrating vectors and conveniently accept hypothesis of the presence of cointegrating vectors. Thus, we can conclude that a long run relationship exists among the variables. This result means that in Nigeria's case, the hypothesis of no cointegrating among the variables (RGDP, OPS, MS, GEXP, REER and INF) should be rejected. Thus, we can conclude that a long run relationship exists among the variables.

4.3 Model Estimation Issues and Discussion of Results

The result of our cointegration test revels that one cointegrating vector still exist among the variables of interest. This means that we can estimate the Vector Error Correction Model. A Vector Error Correction Model is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The use of the methodology of cointegration and VECM add more quality, flexibility and versatility to the econometric modeling of dynamic systems and the integration of short run dynamics with the long-run equilibrium. The Vector Error Correction Models were evaluated using the conventional diagnostic tests and the Akaike Information Criterion (AIC) was adopted in choosing the appropriate lag length. The model with the lowest (AIC) was adopted. The results are of the cointegrating relationship amongst the variables within the VECM framework are presented in Table 5.

Table 5

Static Relationship for the Base Line Model

Normalized on LRGDP	Coefficients
LRGDP(-1)	1.000000
OPS(-1)	5.500985 [2.21403]**
LMS(-1)	-1.031983 [-1.51189]
LREER(-1)	-0.472972 [-1.40092]
LGEXP(-1)	1.317429 [1.43895]
INF(-1)	0.015706 [1.25286]

Source: Computed by the Authors, 2013

, **, * denotes significance at 1%, 5% and 10% respectively.*

In accordance with the VECM procedure the cointegrating relationship is normalized, in this case with real gross domestic product. The table above shows the impact of oil price shocks on RGDP growth in Nigeria. Where RGDP – Real Gross Domestic Product, OPS- Oil Price Shocks, MS- Money Supply, REER- Real Exchange Rate, GEXP- Government Expenditure, INF- Inflation. An oil price shock which is the focus of this study has positive relationship to the economic growth of the Nigerian economy which is also significant at 5%. From the table above, a unit increase in oil price shock will lead to 5.50 percent increase in the growth rate of output of the Nigerian economy.

4.4 Vector Error Correction Estimates

Table 6 presents the results of the VECM coefficients. The estimated coefficients for the error correction term reveal which of the variables adjust to correct imbalance in the economic situation whilst the variables coefficients shows the short-run effects of the changes in the explanatory variables on the dependent variable.

Table 6

Vector Error Correction Estimates

Equation for:	D(LOG(RGDP))	D(OPS)	D(LOG(MS))	D(LOG(REER))	D(LOG(GEXP))	D(INF)
Variable						
D(LRGDP(-1))	-0.234421 [-1.29403]	0.056987 [1.07003]	0.025380 [0.77704]	-0.069852 [-0.70404]	0.17317** [1.96328]	4.400237 [1.00923]
D(LRGDP(-2))	-0.164226 [-0.96197]	0.021120 [0.42080]	-0.000206 [-0.00668]	-0.059908 [-0.64072]	-0.072146 [-0.86794]	-4.953257 [-1.20552]
D(OPS(-1))	0.493969 [0.79500]	-0.373055 [-2.04226]	0.219611** [1.96032]	-0.281988 [-0.82864]	0.026858 [0.08878]	11.91591 [0.79682
D(OPS(-2))	-0.34962 [-0.61473]	- 0.28323*** [-1.69410]	0.20688*** [2.01748]	-0.20393 [-0.65470]	0.65712* [2.37296]	2.36372 [0.17268]
D(LMS(-2))	-0.429794 [-0.35265]	0.329794 [0.92045]	0.128308 [0.58391]	-0.602708 [-0.90295]	0.444099 [0.74839]	-1.020803 [-0.03480]
D(LREER(-1))	-0.80222** [-2.21634]	0.11947 [1.12274]	0.03137 [0.48077]	0.04570 [0.23057]	-0.11661 [-0.66171]	7.07157 [0.81175]
D(LREER(-2))	0.09129 [0.24464]	0.07807 [0.71167]	0.09740 [1.44776]	-0.03453 [-0.16895]	0.24029 [1.32253]	20.0287** [2.23005]
D(LGEXP(-1))	0.96287** [2.13238]	-0.06615 [-0.49833]	0.14973*** [1.83915]	0.11246 [0.45476]	0.15097 [0.68671]	8.01773 [0.73775]
D(INF(-1))	0.00024 [0.03380]	-0.00165 [-0.78725]	-0.00091 [-0.71412]	0.00435 [1.11498]	0.00259 [0.74730	-0.09904 [-0.57652]
D(INF(-2))	0.00345 [0.48500]	-0.00169 [-0.81166]	-0.00186 [-1.45440]	-0.00461 [-1.18264	-0.00257 [-0.74327]	-0.45383* [-2.64804]
ECM (-1)	-0.25431** [-2.23091]	-0.08428* [-2.51484]	-0.04321* [-2.10242]	0.05596 [0.89632]	-0.06303 [-1.13560]	-5.2805*** [-1.92468]

Source: Computed by the Authors, 2013
, **, * denotes significance at 1%, 5% and 10% respectively*
Note: t-statistic in [ ]

The table above shows the relation between the variables in terms of simultaneous equations in which each variable influences one another. In table 6, other things constant, oil price shocks has positive but insignificant relationship with output in the short run as compared to the significance importance it shows to output growth in the long run. The non-significance impact of oil price shocks in the short run could be as a result of the influence of the policy variables in stimulating growth in the short run, hence re-directing the impact of oil price shocks in Nigeria. However, taking output as the dependent variable and other variable as an independent variable when considering the t-statistics, it can be observed than when RGDP increases by 49 percent, it is not significant in determining the oil price shocks, money supply is also not significant to real gross domestic product but it causes it to reduce by 42 percent, real exchange rate is significant and causes RGDP to also reduce by 8 percent, government expenditure is significant and causes the RGDP to increase by 96 percent and lastly inflation is not significant but causes the RGDP to increase by 0.02 percent.

Whereas considering oil price shocks as the dependent variable, real gross domestic product, money supply, real exchange rate is not significant but causes oil price shocks to increase by 5 percent, 32 percent, 12 percent respectively, while government expenditure and inflation are also insignificant but causes reduction in oil price shocks by 6 percent and 2 percent respectively. Adjustment to economic imbalances has occurred primarily through changes in the model. In this case, lagged error correction terms, is significant, whereas real exchange rate and government expenditure are insignificant at a 90 percent confidence level. As discussed, these variables capture the adjustment of the relevant variables towards the long-run equilibrium. Hence in this presentation, real gross domestic product, oil price shocks, inflation and money supply are the key variables which adjust in the short term to correct imbalances in the economy. As shall be discussed, this is an intuitive result with inflation and money supply being the most flexible and easily adjustable monetary instruments at the government's disposal. The lagged money supply variable is also significant and positively signed to oil price shocks. The impact of oil price shocks on RGDP of the economy is assessed in the regression. The coefficient of oil price shocks is positive but statistically insignificant implying that oil price shocks bears only a weak relationship to RGDP unlike what is obtainable in the long run which was also confirmed by the long run relationship of cointegration technique. The result of the study indicates that oil price shocks do not significantly affect output in Nigeria. This contradicts the expectations that oil price shocks impacts significantly on industrial output growth (Farzanegan and Markwardt (2009); Barsky and Kilian, (2004); Olomola, (2006); Akpan, (2009)) and confirms the findings of Iwayemi and Fowowe, (2011), Hajko (2012) and Agbede (2013).

Table 7

Vector Diagnostic Tests Results

TEST	RESULT
Vector Portmanteau (5)	347.8554*
Vector Normality test	Chi^2(12) = 38.97867*
Vector hetero test	Chi^2(546) = 526.5060*

Source: Computed by the Authors, 2013

, **, * denotes significance at 1%, 5% and 10% respectively*

To corroborate the estimation process, the following tests are considered as diagnostics checks for the purpose of confirming the normality as well as the stability of the model. The Vector Portmanteau test is used to capture any sign of autocorrelation in the model. The calculated value of 347.8 shows that the model has no sign of serial correlation that is the assumption of the linearity of the model has not been violated because of the superiority of the autocorrelation test in accepting of alternative hypothesis. Also, the Vector Normality test is also considered to show if the model is normally distributed. From the estimation result the chi-square value of 38.9 which is significant at 1 percent also corroborates the normality assumption of the specified model. Another test considered by this study is the vector heteroskedasticity test which has a value of 526.5 which confirms each of the specified equations has a constant variance.

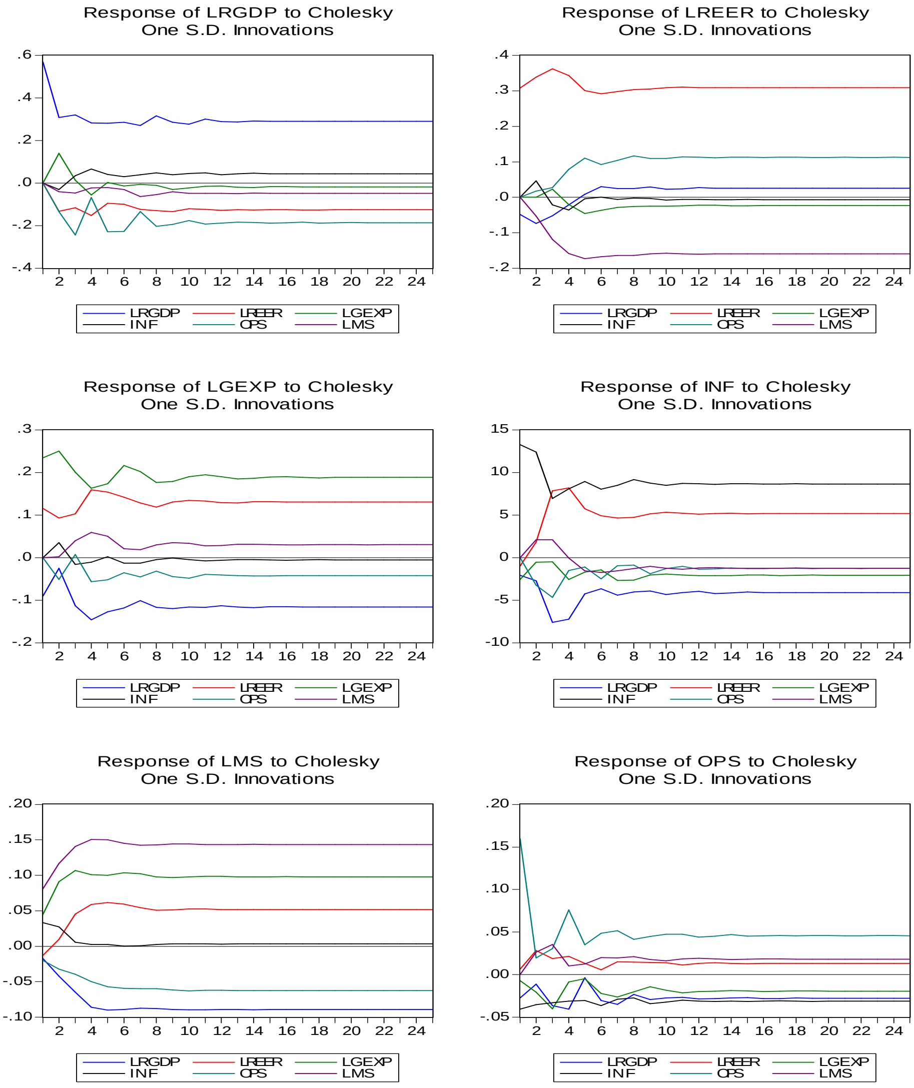
4.5 Impulse Response Functions (IRFs)

Whilst VECM results estimate the direct impacts between each of these variables, in practice, there are likely to be important flow on effects occurring within the variation in oil price. The total long term impact of an increase in oil price shocks is now assessed with the use of IRF analysis. This approach captures both the direct and indirect effects as well as those attributed to the error correction mechanism.

To measure the time profile of the effect of shocks at a given point in time on the expected future values of variables in a dynamic system, we have used the generalized impulse response function. Since all the variables under study are found to be I(1), we proceed with our analysis in the context of a cointegrated VECM model with unrestricted intercepts and restricted trend coefficients. Figure 1 below indicates the generalized impulse response over a 25-year period. The graph indicates the impact of an increase in the oil price on real gross domestic product, government expenditure, real exchange rate, inflation and money supply. Here, the one standard deviation shock to oil price leads to a first instance to a unanimous decline in inflation and real gross domestic product while it is the opposite in government expenditure, real exchange rate and money supply. Following this the effect of the oil price impulse continues to have a sustained positive impact on levels of government expenditure. This suggests that increase in the price of oil automatically leads to increase in money supply, government expenditure and real exchange rate. The negative impact on inflation further leads to worsening of the gross domestic product of that economy.

Figure 1

Generalized Impulse Response Function of each variable to a One-Standard-Deviation Net Oil Price Shock



5. Conclusion

The empirical analysis followed an extensive literature review and showed that the variables used in this study have a unit root. On the basis of this findings, the cointegrating analysis has been used suggested by Johansen and Juselius (1990) and a long run equilibrium have occurred among the variables under study. Furthermore, the methodology of VECM was applied in order to estimate the short run and long run dynamics.

As discussed, the VECM approach has a number of limitations including the potential to over-parametize the model which can lead to sensitive results in terms of lag length. This is particularly the case of the model in this study which included six endogenous variables each interacting contemporaneously and with a one lags for a 25-year sample.

The results are illuminating. In the short run oil price shocks has a positive but insignificant relationship with RGDP, but it is both positive and significant in the long run. However this is the dynamism in the VECM, it is adjusting its long run effect on economic growth. Therefore it can be concluded that since OPS has a positive and significant long run relationship with RGDP, government should embark on long run activities that will cater for oil price shocks in other to increase the real gross domestic product of the domestic economy.

References

Adebiyi, M. A., Adenuga, A. O., Abeng, M. O., & Omanukwue, P. N., (2009) "*Oil Price Shocks, Exchange Rate and Stock Market Behavior: Empirical Evidence from Nigeria*". A Paper Presented at the 15th Annual African Econometric Society (AES) Conference on Econometric Modeling for Africa Held in Abuja from July 07-09.

Adeniyi, O., (2009). "Oil price fluctuations and macroeconomic performance in Nigeria" A Ph.D Proposal presented at the AERC

Biannual Research Workshop held at Entebbe, Uganda: May 31- June 5, 2008.
Agbede, M. O., "The Growth Implications of Oil Price Shock in Nigeria" *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)* 4(3):343-349.
Amaira, B., (2012) "The Relationship of Oil Prices and Economic Growth in Tunisia: A Vector Error Correction Model Analysis" *The Romanian Economic Journal*, Vol. XV no. 43, p.p. 3-22
Akpan, E. O., (2009). "Oil Price Shocks and Nigeria's Macro Economy" Retrieved from: http://www.csae.ox.ac.uk/conferences/2009-EDiA/papers/252-Akpan.pdf
Al-Fayoumi, N. A. (2009). Oil Prices and Stock Market Returns in Oil Importing Countries: The Case Turkey, Tunisia and Jordan. *European Journal of Economics, Finance and Administrative Sciences*, 16, 86-101.
Aliyu, S.U.R. (2009) "Impact of Oil Price Shock and Exchange Rate Volatility on Economic Growth in Nigeria: An Empirical Investigation", *Research Journal of International Studies*, Issue 11, pp. 4-15.
Barsky, R. B., and Kilian. L., (2004): Oil and the Macro economy Since the 1970s. *NBER Working Paper* 10855. Retrieved from http://www.nber.org/papers /w10855
Central Bank of Nigeria Statistical Bulletin 2011
Cong, R-G., Wei, Yi-M., Jiao, J-L., Fan, Y. (2008) "Relationships between oil price shocks and stock market: An empirical analysis from China". *Energy Policy* 36 (9): 3544-3553
Dolado, J., Gonzales, J., and Marmol, F., (2001) "Cointegration' in Baltagi, D., (ed), A Companion to Theoretical Econometrics"; *Blackwell Publishing, Oxford: United Kingdom.*
Du, L., Yanan, H., Wei, C. (2010) "The relationship between oil price shocks and China's macro-economy: An empirical analysis". *Energy Policy* 38 (8): 4142-4151

El Anshasy, A., Bradley, M., Joutz, F. (2005) "Evidence on the Role of Oil Prices in Venezuela's Economic performance", *the 25th Annual North American Conference Proceedings of the International Association of Energy Economics*, Denver: September 18-21.

Engle; R.F., and Granger; C.W.J (1987), "Cointegration and error correction: representation, estimation, and testing", *Econometrica*, Vol. 55, n° 2, pp: 251-76.

Eltony, M.N. and Al-Awadi, M., (2001): "Oil price fluctuations and their impact on the macroeconomic variables of Kuwait: a case study using a VAR model", *International Journal of Energy Research* 25 (11), 939-959.

Eltony, M. Nagy (2006) "**"**Industrial Energy Policy: A Case Study of the Demand in Kuwait" *OPEC Energy Review*, Vol. 30, No. 1, pp. 1-12

Farzanegan, M. R., and Markwardt, G., (2007) "The Effects of Oil Price Shocks on the Iranian Economy" *Faculty of Business and Economics, Dresden University of Technology,* Dresden, Germany.

Farzanegan, M. R., and Markwardt, G., (2009) "The effect of oil price shocks on the Iranian economy". Energy Economics 31: 134-151.

Gökçe, A., (2013) "The Dynamic Impacts of Oil Price Shocks on Turkey's Economic Growth" Journal of Economics and Sustainable Development, Vol.4, No.8, p.p.181-192

Goldberg, P., (1998). "The effects of the corporate average fuel economy standards in the automobile industry". *Journal of Industrial Economics*, 46: 1-33.

Hajko, V., (2012) "Does the oil price matter? Case of the Czech Republic" Department of Economics, Faculty of Economics and Administration, Masaryk University, Lipová 507/41a, Brno, Czech Republic

Hamilton, J.D. (1983): "Oil and the Macro economy since World War 11, *The Journal of Political Economy* 91, 228-248.

Hamilton, J. D. (1996). "This is What Happened to the Oil Price-Macroeconomy Relationship," *Journal of Monetary Economics* 38: 215-220.
Hooker, M. (1996), "What Happened to the Oil Price-Macroeconomy Relationship?", *Journal of*
Monetary Economics, 38: 195-213.
Iwayemi, A., Fowowe, B. (2011) "Impact of oil price shocks on selected macroeconomic variables in Nigeria". *Energy Policy 39 (2): 603-612*
Jbir, R. and Zouari-Ghorbel, S. (2008) "Recent Oil Price Shock and Tunisian Economy", *Energy*
Policy, doi:10.1016/j.enpol.2008.10.044
Jiménez-Rodríguez, R., and Sánchez, M., (2004) "Oil Price Shocks Empirical Evidence for Some OECD Countries" *European Central Bank,* Working Paper Series No 362/May
Jin, G., (2008) "The Impact of Oil Price Shock and Exchange Rate Volatility on Economic Growth: A Comparative Analysis for Russia Japan and China" *Research Journal of International Studies* - Issue 8 (November).
Johansen, S. and Juselius, K. (1990), "Maximum Likelihood Estimation and Inference on Cointegration –With Application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, 52(2): 169-211.
MacKinnon J.G, M.A Haug, L. Michelis (1999) "Numerical distribution functions of likelihood ratio tests for cointegration" *Journal of Applied Econometrics,*14:563-577: ftp://dept.econ.yorku.ca/pub/working_papers/96-07.ps
Odularu, G.O. (2008). "Crude oil and the Nigerian Economic performance" *Department of Economics and Development Studies,* College of Business and Social Sciences, Covenant University

Oksuzler O, Ipek E. (2011). Dunya Petrol Fiyatlarındaki Degişmenin Buyume ve Enflasyon Uzerindeki Etkisi:Türkiye Ornegi (in Turkish). *ZKU Sosyal Bilimler Dergisi*, 7: 14.

Olomola, P.A. (2006) "Oil Price shock and aggregate Economic activity in Nigeria" *African Economic and Business Review* Vol.4No.2, fall 2006

Olomola P.A., and Adejumo, A.V. (2006) "Oil price shock and macroeconomic activities in Nigeria" *International Research Journal of Finance and Economics 3:28-34.*

Rafiq S., Salim R. & Bloch H. (2009) "Impact of Crude Oil Price Volatility on Economic Activities: An Empirical Investigation in the Thai Economy". *Resources Policy*, 34: 121–32.

Raguindin, C. E., Reyes, R. G. (2005) "The effects of oil price shocks on the Philippine economy: A VAR approach". *Working Paper,* University of the Philippines School of Economics

Tang, W., Wu, L., and Zhang, Z-X., (2010) **"**Oil price shocks and their short- and long-term effects on the Chinese economy" *Energy Economics* 32: 3-14

Wakeford, Jeremy (2006) "The Impact of Oil Price Shocks on the South African Macroeconomy: History and Prospects" Paper prepared for the TIPS/DPRU Forum: "Accelerated and Shared Growth in South Africa: Determinants, Constraints and Opportunities" Johannesburg, 18-20 October.