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Oil price shocks and Nigeria's economic activity: evidence from ARDL co-integration and VECM analysis.

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Oil Price Shocks and Nigeria's Economic Activity: Evidence from ARDL Co-integration and VECM Analysis

[1]Nathaniel A. Babajide and [1]Ismail O. Soile

[1] Centre for Energy, Petroleum and Mineral Law and Policy, University of Dundee, UK

Corresponding Author: babajidenathaniel@yahoo.com

Phone Number: +2347066673214

ABSTRACT: This study examines the impact of oil price shocks and their transmission channels to selected macroeconomic variables which serve as proxies for economic activities in Nigeria using quarterly data from 1980Q1 to 2011Q4. Empirical analysis was carried out using VAR framework. Further the Impulse response function (IRF) and the variance decomposition (VDC) were carried out to trace the impact of oil shocks to the Nigerian economy. The result shows 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 illustrates that oil price decreases affects most of the macroeconomic indicators than increases. Specifically, oil price decrease affects trade balance, inflation, government revenue and exchange rate. The implications are that oil price decreases affects macroeconomic activity in Nigeria than increases as most of the variables except inflation did not respond to increases. Based on the findings it was recommended that a relaxation of monetary policy during an oil price fluctuation era as the government has already through the central bank adopted a inflation targeting policy in order to protect the economy from possible outcome of a full blown stagflation amongst others.

KEYWORDS*: Microeconomic Variables, Monetary Policy, Oil Price Shock, VAR*

INTRODUCTION

The role of oil since its discovery in the 19th century in the world economy cannot be overemphasized. Oil is the 'backbone' of many economies of the world representing over 40 per cent of government revenue in advanced countries and more than 80 per cent of revenue in some less developed countries. In Nigeria the oil sector contributes more than 60 per cent to Nigeria's GDP, 85 per cent to export earnings and over 70 per cent of government revenue (National Bureau of Statistics 2010).

The global boom that began in the early 20th century saw hikes in prices of oil to the extent that its impact on macroeconomic variables became a source of veritable concern amongst

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policy makers, investors and researchers (Chisadza Dlamini Gupta & Modise 2013); for instance, the West Texas Intermediate (WTI – a reference price used in the United States and globally) increased from US$12.23 per barrel in 1976 to US$31.07 in 2003. In 2004, it reached US$41.49 and in 2005 it went up to US$56.59 per barrel and continued increasing, exceeding US$66 in 2006 and finally recorded its highest of US$100.06 in 2008 (World Energy Report, 2011).

The economic significance of oil price shocks has been examined by many researchers especially in both net oil importing and net exporting economies (Garratt 2003, Mehrara 2006, Anzumi 2007, Aliyu & Porter 2009, Chuku, Effiong & Sam 2010, Asgari 2013). The fluctuations in oil prices have created a host of varied reactions from the standpoint of macroeconomic variables. For instance a robust relationship has been identified between oil price increases and subsequent economic downturns for many economies. This persistent oil price shocks also makes it difficult for many countries to execute effective policy making thus making it essential to "empirically understand their effects on economic activity" (Tweneboah & Adam 2008). Furthermore, such influence has been found to vary from country to country due to differences in economic structure, energy intensity, energy mix and dependence on international energy market (Akpan 2009).

Nigeria, a net-exporter country and a major producer of oil relies heavily on crude oil windfalls. Nigeria is the largest exporter of crude oil in West Africa, the second largest in the West African continent and the eleventh largest in the world with an estimated 32.6 billion barrels of oil reserve (Aliyu 2009) and a production capacity of 2 million barrels of crude oil per day. Oil accounts for over 90 per cent of export earnings and over 80 percent of government revenue. Over time, empirical findings (Aliyu a&b 2009; Chuku Effiong and Sam 2010; Umar & Abdulhakeem 2010) have shown that Nigeria's GDP has recorded many fluctuations due to changes in oil prices. Since the first oil shock in 1973-1974 to 2003-2008, Nigerian economy has suffered shocks attributed to oil prices especially during recessions culminating into an escalation in the rate of unemployment and inflation, aggravation in the budget deficit problems especially as the economy is a major oil exporter and major importer of crude and other commodities from other countries; this marked dependence on oil has further doubled the vulnerability of the nation.

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The country is exposed to varied oil price shocks through massive importation of refined petroleum products; since the collapse of local refineries in the late 1980s, Nigeria imports about 85 per cent of refined products for its local consumption (Aliyu 2009). Fluctuations in oil price changes globally and internally are associated with increase in inflation. When the oil price increases, it causes a sudden increase in liquidity, this increase cash flow culminates into increased inflation level (Al-mulali & Che-Sab, 2010).

Literature have adduced that fluctuations in oil prices tend to have positive effects on macroeconomic and vice versa for decreases. Ability to forecast prices of oil or the behaviour macroeconomic variables to oil can provide a firm ground for macroeconomic appraisal and effective planning (Chuku Effiong & Sam 2010). The case of Nigeria is especially unique as it is both a major exporter and importer of crude oil; besides, Nigeria also stands out as a special case because of its peculiar economic structure, the size of its population and market, high energy intensity, energy mix and its dependence on international energy markets (Chuku Effiong & Sam 2010).

Against this background, the paper attempts to empirically examine the impact of oil price shocks on economic activity utilizing the linear and non-linear approaches based on theoretical principles and research methodology and finally procure practical solutions for Nigeria.

Study Questions

Against the above background the study seek answers to the main research question which is "what is the impact of oil price shocks on key macroeconomic variables in the Nigerian economy?" Sub-research questions are as follows:

1. What is the impact of oil price shocks on other macroeconomic variables like inflation rate, exchange rate, trade balance, money supply, interest rate, and government expenditure and government revenue?
2. Does oil price shocks have asymmetric effects on macroeconomic variables in Nigeria
3. How vulnerable is the Nigerian economy to changes in world energy (especially oil) market?

Research Hypotheses

Hypothesis 1:

H_0: Oil price shocks do not significantly affect macroeconomic activity in Nigeria

H_1: Oil price shocks significantly affect macroeconomic activity in Nigeria

Hypothesis 2:

H_0: Oil price shocks do not have asymmetric effects on the Nigerian economy.

H_1: Oil price shocks do have asymmetric effects on the Nigerian economy.

Hypothesis 3:

H_0: Nigeria is not vulnerable to fluctuations in international oil prices.

H_1: Nigeria is highly vulnerable to fluctuations in international oil prices **Research**

Significance of the Study

Estimating the consequences of oil price shocks on the macro-economy is particularly relevant in the case of Nigeria since, as a small open economy, it has no real influence on the world price of oil, the results of this research which covers the short run and long run effects of world oil price is expected to be useful for government as a policy maker to regularise policy in terms of the movements on oil prices. Also, the results of this study will contribute to the dearth of empirical literature existing on this subject.

LITERATURE REVIEW

Oil Shocks and the Macroeconomies of Oil Exporting Countries

One of the earliest studies on oil-price-shocks-macroeconomy relationship was carried out on a net oil-exporting economy the United States (an oil exporter occupying the 10th position in oil exports as at 2010 (EIA, 2010) economy by Darby (1982). Darby (1982) estimated the economic effects of oil shocks on the United States to determine what had caused the 1973-1975 recessions in the US; he found that oil price shocks do not only have a significant effects on the economy but caused a decrease in the country's GNP to the tune off 2.5 percent.

According to Hamilton (1983) cited in Aliyu (2009) study on the US economy also showed a negative relationship between oil prices fluctuations and economic growth. This findings was also corroborated by a study for the same country by Hooker (1994) who demonstrated that between 1948 and 1972, oil price variability exerted negative influence on GDP growth for the US; specifically, it was adduced that an increase of 10% in oil prices led to a reduction in GDP growth of roughly 0.6% in the third and fourth quarters after the shock.

Another study conducted on the United States by Anzumi (2007) showed that an oil price shock was found to have inflationary effects on the United States.

Further study by Baumeister & Peersman (2008) showed that oil production does not only have a significant impact on oil price but impacted significantly the GDP and consumer prices (a proxy for inflation rate) of the US economy. Still on the US economy, findings by Cavallo and Wu (2006) using a VAR model containing three variables (oil prices, GDP and inflation rate) in order to determine the effects of oil price shocks on output for the US economy showed that following an oil-price shock, output declined and prices increased.

The volatility of oil prices affects the majority of less developed oil producing countries given their dependence on oil exports with a host of empirical assertions claiming that oil prices increases are associated with positive impacts on these economies and vice versa for negative impacts. Oil price shocks was found to have a significant impact on the economies of Iran and Saudi-Arabia but no significant impact was found between shocks from oil prices and economies of Indonesia and Kuwait (Mehrara 2006). Corroborating the findings of Mehrara (2006) for Iran, Reza (2011) found that oil price shocks increases industrial output and government expenditure in Iran and also leads to high inflationary pressure for the Iranian economy.

In support of the above findings Farzanegan (2007) for Iran found a positive linkage between oil price increases and industrial growth they identified a marginal effect of oil price changes on government expenditures. Furthermore, Dutch disease syndrome was identified through appreciation of real effective exchange rate. Using annual data from 1970 to 2007 for Indonesia Rosyadi (2009) analyzes the effects of oil price on output using the VAR modelling approach showed that there is a cointegration vector which indicated a long run relationship between oil price and key macroeconomic variables – real gross domestic product (constant 2000), real oil price, general government final consumption expenditure (constant 2000) and trade value (the value of export and import). The result showed oil prices influence GDP significantly in the short run but negatively in the long run.

A study conducted for Kuwait by Eltony & Al-wadi (2001) find that linear oil price shocks are significant in explaining fluctuations in macroeconomic variables. The result also showed the importance of oil price shocks on government expenditures which are the major determinants of the level of economic activity in Kuwait. On determining the relationship between effects of oil price shocks on real economic activity, analysis of OECD economies by Jimenez-Rodriguez and Sanchez (2005) using a multivariate Vector Auto Regressive Modelling technique found that oil price increases have a significant impact on the growth of GDP when compared to declines in oil prices.

Cunado & de Gracia (2003) analyzed the effect of oil price fluctuations looking at the asymmetric effect of oil price changes on output for a set of European countries; following earliest literature, they measure oil prices in four different ways. These four methods: oil price growth from four quarters earlier; only the positive of these growths; maximum growth level of oil prices compared to one, two, three and four years prior and the positive standardized oil price shocks with the conditional standard deviation that comes from GARCH (1,1) specification; they provide evidence that oil price increases lowers output but the effects for oil price decreases could not be established and output was more stable during oil price stability than volatility. Finally, they conclude that a non-linear relationship was found between oil prices and output.

Another study by Ito (2008) to investigate the effects of oil price shocks on real GDP and inflation for Russia found that oil price shocks lead to increase of real GDP in the following 12 quarters using Vector Autoregressive methods with time series between 1997Q1 to 2007Q4. Park & Ratti (2008) estimated this relationship using multivariate vector autoregressive approach using time series data from 1986:1 to 2005:12 for Norway; findings reveal that oil price fluctuations account for a six percent volatility in stocks returns.

Oil Price Shocks and the Macroeconomy of Nigeria

Having relevant and factual understanding of the behaviour of oil prices is crucial for an appropriate assessment of the results as well as for policy implications. This section highlights existing research for oil-price-shocks-macroeconomy relationship for Nigeria in order to develop academic stance to support the subsequent empirical investigation using Nigerian data. Recognizing the significance of oil prices to the Nigerian economy, several researchers have investigated the correlates between oil price fluctuations and macro-economy of Nigeria; this section reviews the literature specifically on oil-price shocks-macroeconomic relationship for Nigeria.

Ayadi et al (2000) conducted a study on using a standard VAR model which include 6 variables oil production, output, the real exchange rate and inflation over the period 1975-

1992; findings from the impulse response function showed that a positive oil production shock was followed by a rise in output, reduction in inflation and depreciation of the domestic currency. Olomola (2006) examined the effects of oil price shocks on output, inflation and, real exchange rate and money supply for Nigeria within a VAR framework. They found no substantial role for oil price shocks in explaining movements in output and inflation; however only the long run money supply and the real exchange rate were found to be significantly affected following oil price shocks.

Omisakan (2008) found that oil prices have a sustainable impact on Nigeria's money supply, government consumptions expenditure and the consumer price index; however no negative relationship was deduced between oil price shocks and the level of inflation for Nigeria. Also for Nigeria, Akpan (2009) studied the asymmetric effects of oil price shocks on the Nigerian economy, the findings from her study showed a positive and significant relationship between positive oil price changes and real government expenditure. Also, the impact of oil price shocks on industrial output growth was found to be marginal with observed significant appreciation of the real exchange rate.

Recently, Aliyu (2009) used a non-linear approach to investigate the oil-price-shock-macroeconomy relationship. Aliyu (2009) extended the literature on the subjects for Nigeria by examining the effect of oil price shocks on macroeconomic activity for the Nigerian economy. Using both linear (asymmetric and net specifications) and non-linear specifications of oil price shocks – various test (Wald tests, granger causality and VAR) the paper finds evidence for both shocks on real GDP. The debate on the influence of oil prices on the real exchange rate motivated Adeniyi et al (2011) to examine the relationship that exist between oil price shocks and economic growth using threshold autoregressive model with a quarterly data spanning 1985-2008 and estimate the non-linear model. The result shows that oil price shocks do not account for a significant proportion on the movement in macroeconomic variables, despite introducing the threshold effects.

Due to the evidence that oil is widely used across all sectors of the Nigerian economy with no effective cost-beneficial substitute available and taken into account that its price variables has been remarkably volatile in recent years, I therefore investigate if the conventional postulation by Hamilton (1983) that oil price fluctuations may adversely affect country's macroeconomic performance holds for Nigeria. The variables of interest (i.e. endogenous variables) are seasonally adjusted real GDP, nominal foreign exchange rate, interest rate, broad monetary aggregate, government expenditure, government revenue, trade balance and inflationary level.

RESEARCH METHODOLOGY

Data Sources

This work uses quarterly data from 1980Q1 to 2011Q4 to capture both the long run and short run effects of oil price shocks on eight (8) variables GDP, exchange rate, inflation rate, trade balance, interest rate, money supply, government expenditure and government revenue for Nigeria. The rationale behind selecting this period is to capture all the effects of price distortions that have been experienced in Nigeria. Our primary focus is to examine the impacts of oil price shocks on various facets of the economy. Annual time series data were obtained from the International Financial Statistics (IFS) yearbook, the World Bank World Development Indicators and the Central Bank of Nigeria Statistical Bulletin (2011). All data series were transformed into logarithms besides the trade balance inflation series. With respect to the independent variable – Oil price shock, we estimate the effects of oil price changes on macroeconomic indicators for Nigeria a net oil exporter adopting two measures of oil price shocks the linear and asymmetric oil price shocks. Log difference of real oil price ($O_t^* = \max(0, \Delta Oil_t)$ proposed by Hamilton (1983) and the Mork (1989) assymetic specification in which increases and decreases in the price of oil are considered as separate variables.

Model Specification

The VAR Autogression model

A number of studied cited made use of the vector autoregression models. This technique treats all variables in the system as endogenous and regresses each current (non-lagged) variables in the model on all the variables in the model lagged a certain number of times. The model specification for the current study is denoted as:

$$\text{yt} = A_0 + \sum_{k=1}^{P} A_k + y_t - k + e_t \text{ ------------------ (1)}$$

Where y_t is an *n x1* vector of non-stationary 1(1) variables, n is the number of variables in the system, in this study four in each case. A_0 is nx1 vector of constant terms, A_k is an *n x n* matrix of coefficient, e_t is an *n x1* vector of error terms, which is independent and identically distributed, and p is the order of autoregression or number of lags. In this study, we used quarterly frequency data for real market analysis.

The Akaike Information Criterion (AIC) will be used to compare the performance of the VAR with various lag length specifications. Both the variance decomposition and the impulse response will be utilized to assess the relationship between oil price shocks and aggregate economic activity. Variance decomposition provides the variance of forecast error in a given variable to its own shocks and allows us to assess the relative importance of oil price shocks to the volatility of the other variables. Impulse response functions on the other hand allows us to examine the dynamic effects of oil price shocks on Nigerian economy as its traces over time the expected responses of current and future values of each of the variables to a shock in one of the VRA equations.

Unit Root Tests

The justification for applying the VAR in establishing the relationship among variables is conditional on the assumption of stationarity of the variables constituting the VAR. According to Chuku, Effiong & Sam (2010) "if the time series are non-stationary, the stability condition of VAR will not be met, implying that the usual statistical techniques of coefficient evaluation will not be valid; In this case it is recommended that the cointegration and Vector Error Correction Modelling be utilized in examining the multivariate relationship among the set of non-stationary variables (Wooldridge 2006).

Based on the foregoing we conduct preliminary diagnostics on the time series properties of the variables before further evaluation. We test for the presence of unit-roots using two standard tests: the augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979, 1981) and the Philip-Peron Test. The rationale of the use of multi-unit root tests is for triangulation analysis. Triangulation is paramount because in many empirical analyses, it has been found that the ADF unit root test fails to reject the null hypothesis of a unit root for many series; this weakness has been attributed by Maddala & Kim (2001) to "the size distortion and lower power in the ADF tests". The tests estimation procedure takes the following forms:

ADF Test:

$$\Delta y_t = a_0 + a_1 t + \delta_1 y_{t-1} + a_j \sum_{i=1}^{n} \Delta y_{t=1} + e_t \quad \text{------------------ (2)}$$

PP Test:

$$y_t = \beta_0 + \beta_1 t + \delta_2 y_{t-1} + e_t \text{ ------------------ ------------------ ----- } (3)$$

Where y_t denotes lag difference of the variable under consideration. M is the number of lags and ε_t is the error term. The stationarity of the variables is tested using the hypothesis:

ADF: H_0: $\delta_1 = 0$ (null Hypothesis)

H_0: $\delta_1 < 0$ (Alternative Hypothesis)

PP: H_0: $\delta_2 = 0$ (null Hypothesis)

H_0: $\delta_2 < 0$ (Alternative Hypothesis)

Where: $\delta_1 = \rho - 1 = 0$

Based on the critical values of the respective statistics, if null hypothesis cannot be rejected, then the time series are non-stationary at the level and thus needs to be differenced to achieve stationarity to find the order of integration. The test will be applied to each of the variable in the model.

Cointegration – ARDL-Bounds Testing Procedure

The next step in applying VAR based analytical technique is to determine the order of integration of the variables. However, depending on the power of the unit root tests, different test yields different results; as a result of this uncertainty, especially when some variables in the model are at their levels and some at difference. Also it has been established in literature that cointegration methodologies such as Engle and Granger (1987) and the maximum likelihood tests associated with Johansen (1988) and Johansen and Juselius (1990) to examine the long-run relationship between oil prices and economic activity may not be appropriate when the sample size is small (Nerayan and Smyth 2005).

This study avoids this bias by adopting the recently developed Autoregressive distributed lag (ARDL) – bounds testing approach to examine the relationship between oil prices, oil consumption and economic activity. Pesaran and Shin (1995) and Pesaran et al (2001) introduce the Autoregressive Distributed Lag (ARDL) approach for testing for cointegration. The approach has the advantage of avoiding the classification of variables into 1(1) or 1(0) and unlike standard cointegration tests there might be no needs for unit root pretesting of the ARDL model.

Two steps are involved in the ARDL conintegration approach. First the null hypothesis of no cointegration as against the alternative hypothesis is as follows; H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ and H_1:

$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ by the means of the F-tests. The bounds test is a computed Wald test (F-test) in which the joint significance of coefficient for lagged variables is tested with F-statistics calculated against the null. The computed Wald F-statistics is compared with the critical values. If the calculated F-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If on the other hand the calculated F-statistics lies below the lower level band, the null is rejected indicating lack of cointegration. If however, it falls within the upper and lower band, the result is termed ‘inconclusive’. Once cointegration has been established among the variables, the finishing step of the ARDL study involved estimating the coefficients of the long-run and relations and making inferences about their values.

Variance Decomposition, Impulse Response Functions and Granger Causality Tests

Next we conduct innovation accounting to determine the dynamic responses of the variables using the Impulse response functions (IRFs) which traces the responsiveness of each of the dependent variables in the VAR (VECM) framework to a unit shock in the error terms. Following that this work will then examine the short-run impacts of oil price shocks on the Nigerian economic activity as proxies by major economic indicators using the variance decompositions tests. The variance decomposition provides information on the proportion of the movements in the dependent variables accounted for by their own shocks vis-à-vis the shocks to other factors.

Finally, the study employs the granger-causality tests developed by Granger (1969). This tests seeks to ascertain whether or not the inclusion of past values of a variables say X_{t-z} do or do not help in the prediction of present values of another variable Y. if Y is better predicted by including past values of X, than by not including them, then X is said to granger cause Y (Gujarati & Porter 2009).

DATA PRESENTATION AND ANALYSIS

This chapter presents the empirical results obtained from the estimated VAR models using linear and asymmetric specifications of oil price shocks. The impulse response functions as well as the variance decomposition obtained from the estimated VAR models are also examined. The analysis begins with ascertaining the order of integration of the variables. The procedure adopted in this study involves the use of the Augmented Dickey Fuller (ADF) and

Phillip-Peron (1988) tests. The null hypothesis of the ADF and the PP tests is stationarity, thus failure with respect to rejection implies unit root in the series. Following these the ARDL bounds tests for cointegration is employed to examine the presence of long run cointegration among their variables. The existence of cointegration among a series indicates that the linear combination of the series is stationary. Following this, two diagnostic views in the VAR framework - the variance decomposition and impulse response function are used to analyse the long-run relationships between oil price and macroeconomic activity indicators.

Descriptive Analysis of the Series

Table 1: Descriptive Statistics of Economic Variables and Oil Prices

	DLROP	DLROPDEC	DLROPINC
DLROP	1	0.85968543423768	0.757188005080767
DLROPDEC	0.85968543423768	1	0.320525508666276
DLROPINC	0.757188005080767	0.320525508666276	1
INF	0.14203667811999	0.0328335625212319	0.222733327291483
LEXCH	0.189893951961357	0.0388224646683538	0.310978801673374
LGDP	0.100451335284652	-0.037093469770114	0.235435570694602
LGEXP	0.163212801453443	0.0257985283691797	0.275352783474504
LMRR	0.053794672797096	-0.0251154604769025	0.13466366359012
LMS	0.14786295863655	0.0176462336304999	0.256789460049226
LREV	0.17029802911914	0.0449819805905828	0.265649128968406
TRADE	0.122966739442796	0.0180360023899296	0.20518578426087

Source: Author's Interpolation with EViews

Table 1 shows the correlation coefficient among the two proxies of oil price shocks and the other variables. One can easily note that these proxies are highly correlated. However, the measures of oil price shows reveals low correlations between the different measures of oil price shocks and the dependent variables.

Unit Root Tests' Results

This study utilized the Augmented-Dicker-Fuller (ADF) and the Philip Peron (PP) tests to investigate the nature of the series. Two specifications of the test are conducted: intercept with no trend, intercept with trend. The results are show in table 2 and 3 below.

Table 2: Test of Stationarity at Levels

	ADF		**PP**		**Decision**
	Intercept with no trend	**Intercept with trend**	**Intercept with no trend**	**Intercept with trend**	

DLROP	-9.537860**	-9.872708**	-8.794570**	-9.444172**	1(0)
DLROPDEC	-9.323180**	-9.288131**	-9.220161**	-9.181660**	1(0)
DLROPINC	-8.374520**	-8.852167**	-8.346993**	8.584973**	1(0)
INF	2.625998	0.955032	8.057523**	1.776732	NS
LEXCH	-1.500183	-0.939452	-1.500183	-1.081353	1(0)
LGDP	1.247069	-1.822282	-2.960570	-5.176158**	1(0)
LGEXP	-1.231628	-1.262642	0.176831	-2.805982	NS
LMRR	-2.189638	-2.060197	-2.074718	-2.186577	NS
LMS	0.100820	-3.452465**	0.706187	-2.360342	1(0)
LREV	-0.353022	-2.781627	0.217457	-2.713049	NS
TRADE	1.078230	-2.328973	-0.538432	-1.894341	NS

Note: ** and * indicate significance at 5% and 10% levels respectively.

The ADF and PP statistics in Table 2 suggest that six variables (DLROP, DLROPDEC, DLROPINC, LEXCH, LGDP and LMS) are stationary at levels. All the variables were difference once (in order to exhibit stationarity, indicating that the mean, variance and covariance of the time series are independent of time) and the results as presented in table 3 show that the non-stationary series became stationary. Thus for consistency, all the series were considered as 1(1) and taken at their first differences in the analysis.

Table 3: Test of Stationarity at Difference

	ADF		**PP**		**Decision**
	Intercept with no trend	**Intercept with trend**	**Intercept with no trend**	**Intercept with trend**	
DLROP	-9.424505**	-9.385202**	-28.55163**	-28.37993**	1(1)
DLROPDEC	-14.13152**	-14.07720**	-37.26309**	-37.26602**	1(1)
DLROPINC	-9.262201**	-9.223147**	-51.62288**	-52.27699**	1(1)
INF	-0.841685	-2.870339	-9.938535**	-11.59093	1(1)
LEXCH	-9. 699591**	-9.785174**	-9.701114**	-9.763859**	1(1)
LGDP	-12.52536	-12.09245**	-11.06151**	-11.07482**	1(1)
LGEXP	-2.861326*	-2.922063**	-6.076696**	-6.033732**	1(1)
LMRR	-3.289492	-3.549411**	-5.387089**	-5.155599**	1(1)
LMS	-2.797202*	2.773205	-4.666179**	-4.709667**	1(1)

LREV	-4.605331**	-4.580621**	-5.658535**	-5.680424**	1(1)
TRADE	2.671055**	2.661293	-5.320302**	-5.282453**	1(1)

Note: ** and * indicate significance at 5% and 10% levels respectively.

Cointegration Results

Results of the bounds test procedure for co-integration analysis between nominal exchange rate and its determinants are presented in the table below.

Table 4: Bounds Test for Cointegration Relationship

Critical value bounds of the F-Statistics: intercept and no trend (case II)						
K	**90% level**		**95% level**		**99% level**	
9	**1(0)**	**1(1)**	**1(0)**	**1(1)**	**1(0)**	**1(1)**
	2.75	**3.79**	**3.14**	**3.30**	**3.93**	**5.23**
Calculated Statistics: F_{lp}(GDP|DLROP, DLROPINC,DLROPDEC, MRR, MS, EXCH, INF, TRADE, GEXP, REV)					**5.543011**	

***Source*:** critical values are obtained from Pesaran and Shin (2001);

Notes: ** denotes statistical significance at the 5% level; k is the number of regressors

From Table 4 above, the F-statistic that the joint null hypothesis of significant variables (i.e. variable addition test) of the coefficients is zero is rejected at the 5% significance level. Further, since the calculated F-statistic for F_{Ip}(.)=5.54 exceeds the upper bound of the critical value band, the null hypothesis of no cointegration (i.e. long-run relationship) between the variables is rejected at the 5% and 10% significance level. This result indicates that there is a unique cointegration relationship among the variables in Nigeria and that all the variables can be treated as the "long-run forcing" variables for the explanation of macroeconomic activity in Nigeria.

Granger Causality Tests

Table 10 and 11 (appendix) presents the pair wise granger causality tests among the macroeconomic indicators and oil price shock; the Granger (1969) approach assesses whether past information on one variable helps in the prediction of the outcomes of some other variables given past information on the latter. These result shows that the null hypotheses that oil price shocks do not granger-cause real GDP could be safely accepted at 5 per cent level – no directional relationship was found for both the linear and asymmetric specification of oil price shock to real GDP. This is consistent with expectations and the realities of the Nigerian economy (Aliyu 2009); furthermore it is also observed from the tables that between 1980 and 2011, unidirectional causality runs from EXCH to DLROP, MS to DLROP and INF to DLROP; other unidirectional causality was found between the dependent variables in the model as EXCH to MS, INF to MS, INF to TRADE, EXCH to TRADE, MRR to GDP, GEXP to REV and MS to TRADE. The only bidirectional causality was found between TRADE to DLROP and REV to DLROP.

For the case of the asymmetric specification the result shows that the hypothesis that asymmetric relationship exist between GDP and the Nigerian economy can also be safely rejected for the Nigerian economy. Bi-directional causality could only be established in the model TRADE to DLROPDEC and REV to DLROPDEC for oil price decreases and INF to DLROPINC for oil price increases. Unidirectional causality between the asymmetric specification of oil price shocks and the variables of the model could only be found between oil price increases (DLOPDEC) and EXCH; others were from the dependent macroeconomic indicators to DLOPINC and DLOPDEC. These were as follows: REV to DLOPINC, GEXP to DLOPINC and MS to DLOPINC for oil price increases while causality for oil price decreases was established between TRADE to DLOPDEC and MS to DLOPDEC.

Other unidirectional causality found within the asymmetric framework were from EXCH to MS, EXCH to GDP, EXCH to INF, EXCH to REV, INF to MS, INF to TRADE, MS to TRADE, REV to MS, MRR to GDP and GEXP to REV. Based on the results of the tests it can be confirmed that asymmetric oil price changes forecast movements in inflation; while, past movements of oil price changes and oil price decreases forecast movement in trade balance and revenue that accrue to the federal government. Thus for the Nigerian economy, oil price shocks have significant influence on trade balance, revenue that accrue to the government and the rate of inflation.

4.5 Vector Autoregressive Model

Having established the presence of long-run relationship between the variables, the next step is to test for the causality between the variables used by incorporating the lagged error-correction terms into equations. The empirical results of the long run and short run models are presented in tables 5 to 9.

Table 5: Short run VAR for Linear Specification

	LGDP	INF	LEXCH	DLROP	LGEXP	LMRR	LMS	LREV	TRADE
DLROP(-1)	0.039964	-0.733905	-0.411431	0.054384	-0.026453	-0.082387	0.044228	0.190418	556069.9
	(0.06400)	(1.08623)	(0.12564)	(0.10206)	(0.06899)	(0.06003)	(0.01980)	(0.09951)	(131865.)
	[0.62444]	[-0.67564]	[-3.27460]	[0.53284]	[-0.38345]	[-1.37245]	[2.23366]	[1.91357]	[4.21698]
DLROP(-2)	-0.020529	-1.317495	-0.375196	-0.558140	-0.088074	-0.113160	0.015473	-0.118138	-174509.0
	(0.07220)	(1.22545)	(0.14175)	(0.11514)	(0.07783)	(0.06772)	(0.02234)	(0.11226)	(148765.)
	[-0.28432]	[-1.07512]	[-2.64696]	[-4.84732]	[-1.13164]	[-1.67094]	[0.69267]	[-1.05234]	[-1.17306]
DLROP(-3)	-0.114496	-1.622978	-0.216165	0.024788	0.012327	-0.100185	0.028429	0.112341	276620.2
	(0.06764)	(1.14795)	(0.13278)	(0.10786)	(0.07291)	(0.06344)	(0.02093)	(0.10516)	(139357.)
	[-1.69281]	[-1.41380]	[-1.62796]	[0.22981]	[0.16908]	[-1.57920]	[1.35855]	[1.06825]	[1.98497]
DLROP(-4)	-0.135690	0.476206	-0.429887	-0.234716	-0.031946	-0.139060	-0.002240	-0.216840	-242559.1
	(0.06458)	(1.09616)	(0.12679)	(0.10300)	(0.06962)	(0.06058)	(0.01998)	(0.10042)	(133070.)
	[-2.10095]	[0.43443]	[-3.39050]	[-2.27887]	[-0.45888]	[-2.29556]	[-0.11210]	[-2.15936]	[-1.82279]
R-squared	0.983177	0.999111	0.995783	0.550480	0.998908	0.970482	0.999921	0.998319	0.994265

Adj. R-squared	0.976215	0.998743	0.994038	0.364471	0.998456	0.958267	0.999888	0.997623	0.991892
Sum sq. resids	0.493057	142.0312	1.900275	1.253942	0.572891	0.433773	0.047196	1.191965	2.09E+12
S.E. equation	0.075282	1.277710	0.147791	0.120055	0.081148	0.070611	0.023291	0.117050	155109.3
F-statistic	141.2320	2714.655	570.6827	2.959435	2210.434	79.45300	30433.80	1434.817	418.9713
Log likelihood	166.7512	-184.3658	83.10517	108.8790	157.4468	174.6936	312.2231	112.0217	-1636.011
Akaike AIC	-2.092761	3.570417	-0.743632	-1.159338	-1.942690	-2.220865	-4.439082	-1.210027	26.98405
Schwarz SC	-1.251225	4.411952	0.097904	-0.317803	-1.101154	-1.379329	-3.597546	-0.368492	27.82558
Mean dependent	11.34364	32.89161	2.981184	0.000992	12.36191	2.507442	12.71473	12.52152	1174492.
S.D. dependent	0.488133	36.03144	1.914090	0.150595	2.065148	0.345646	2.198294	2.400681	1722573.

(**)* indicate significance at 10 and 5 percent respectively

Table 6: Short run VAR for Asymmetric Specification

	DLROPDEC	DLROPINC	LEXCH	LGDP	LGEXP	LMRR	LMS	LREV	TRADE	INF
DLROPDEC(-1)	0.092800	0.030732	-0.631673	-0.057583	0.009163	-0.056950	0.054885	0.356067	853386.9	-2.714023
	(0.10200)	(0.07152)	(0.16238)	(0.08457)	(0.09409)	(0.08207)	(0.02705)	(0.13064)	(170362.)	(1.42342)
	[0.90979]	[0.42971]	[-3.89006]	[-0.68090]	[0.09739]	[-0.69391]	[2.02900]	[2.72556]	[5.00926]	[-1.90669]
DLROPDEC(-2)	-0.291112	-0.219511	-0.720997	-0.107154	-0.012527	-0.133176	0.007402	-0.294382	-398823.4	-2.002709
	(0.12615)	(0.08845)	(0.20083)	(0.10459)	(0.11637)	(0.10150)	(0.03345)	(0.16157)	(210698.)	(1.76045)
	[-2.30763]	[-2.48175]	[-3.59012]	[-1.02450]	[-0.10765]	[-1.31205]	[0.22124]	[-1.82199]	[-1.89287]	[-1.13761]

DLROPDEC(-3)	0.032463	0.030876	-0.336145	-0.119702	-0.019203	-0.115526	0.040526	-0.100960	30478.19	-2.133522
	(0.12385)	(0.08684)	(0.19717)	(0.10269)	(0.11425)	(0.09965)	(0.03284)	(0.15863)	(206856.)	(1.72835)
	[0.26211]	[0.35556]	[-1.70488]	[-1.16572]	[-0.16809]	[-1.15930]	[1.23385]	[-0.63647]	[0.14734]	[-1.23443]
DLROPDEC(-4)	0.017227	-0.092983	-0.699397	-0.280513	-0.120646	-0.180064	0.009537	-0.215596	-238061.4	-2.233990
	(0.11776)	(0.08256)	(0.18746)	(0.09763)	(0.10862)	(0.09475)	(0.03123)	(0.15082)	(196676.)	(1.64329)
	[0.14629]	[-1.12620]	[-3.73086]	[-2.87319]	[-1.11069]	[-1.90047]	[0.30541]	[-1.42950]	[-1.21042]	[-1.35947]
DLROPINC(-1)	-0.229877	0.068180	-0.015714	0.218125	-0.068519	-0.144382	0.012562	-0.226984	-149595.5	3.594472
	(0.16031)	(0.11240)	(0.25520)	(0.13291)	(0.14787)	(0.12898)	(0.04251)	(0.20532)	(267746.)	(2.23710)
	[-1.43396]	[0.60659]	[-0.06158]	[1.64114]	[-0.46336]	[-1.11937]	[0.29549]	[-1.10552]	[-0.55872]	[1.60676]
DLROPINC(-2)	-0.520368	-0.075976	0.041563	0.082713	-0.153820	-0.088766	0.039335	0.083841	65813.32	-0.653822
	(0.14456)	(0.10135)	(0.23013)	(0.11985)	(0.13334)	(0.11631)	(0.03834)	(0.18514)	(241435.)	(2.01727)
	[-3.59978]	[-0.74961]	[0.18061]	[0.69013]	[-1.15356]	[-0.76318]	[1.02608]	[0.45285]	[0.27259]	[-0.32411]
DLROPINC(-3)	0.144328	-0.141897	-0.247837	-0.180004	0.030554	-0.109386	0.008763	0.301480	497439.4	-1.729117
	(0.13431)	(0.09417)	(0.21382)	(0.11136)	(0.12389)	(0.10807)	(0.03562)	(0.17202)	(224327.)	(1.87432)
	[1.07457]	[-1.50680]	[-1.15910]	[-1.61645]	[0.24662]	[-1.01219]	[0.24603]	[1.75256]	[2.21748]	[-0.92253]

DLROPINC(-4)	-0.298647	-0.094385	-0.190389	0.011598	0.085161	-0.105291	-0.016798	-0.315493	-388015.8	3.725271
	(0.13595)	(0.09532)	(0.21643)	(0.11272)	(0.12540)	(0.10939)	(0.03605)	(0.17412)	(227062.)	(1.89717)
	[-2.19675]	[-0.99019]	[-0.87970]	[0.10290]	[0.67908]	[-0.96257]	[-0.46592]	[-1.81193]	[-1.70885]	[1.96359]
R-squared	0.505346	0.593378	0.996292	0.984534	0.998930	0.970950	0.999922	0.998474	0.994960	0.999196
Adj. R-squared	0.266959	0.397416	0.994505	0.977081	0.998415	0.956950	0.999884	0.997739	0.992531	0.998808
Sum sq. resids	0.659397	0.324157	1.671121	0.453270	0.561074	0.426885	0.046375	1.081657	1.84E+12	128.4117
S.E. equation	0.089132	0.062494	0.141894	0.073899	0.082219	0.071716	0.023637	0.114158	148867.9	1.243836
F-statistic	2.119852	3.028023	557.4762	132.0912	1937.940	69.35414	26593.80	1357.811	409.6411	2578.294
Log likelihood	148.7277	192.7539	91.07241	171.9676	158.7390	175.6860	313.3112	118.0425	-1628.000	-178.1159
Akaike AIC	-1.737544	-2.447643	-0.807619	-2.112381	-1.899016	-2.172354	-4.392117	-1.242621	26.91936	3.534127
Schwarz SC	-0.805031	-1.515130	0.124893	-1.179869	-0.966504	-1.239842	-3.459604	-0.310108	27.85187	4.466640
Mean dependent	-0.050995	0.052655	2.981184	11.34364	12.36191	2.507442	12.71473	12.52152	1174492.	32.89161
S.D. dependent	0.104105	0.080506	1.914090	0.488133	2.065148	0.345646	2.198294	2.400681	1722573.	36.03144

(**)* indicate significance at 10 and 5 percent respectively

The estimated coefficient of the short-run relationship of the effects of global economic shocks on domestic macroeconomic policy management produced mixed result in line with divergence of literature on the subject. The result for the log-difference (($\Delta O_t = \ln O_t - \ln O_{t-1}$) linear measure of oil price shocks (Table 5) indicates negative relationships with all the variables except the Money Supply. Specifically, the result showed that negative but significant relationship was found between oil price shocks and MRR, TRADE, EXCH and REV; negative and insignificant relationship was also deduced between oil price shock and INF and GEXP; a negative and insignificant relationship was also found between DLROP and GDP but this turned out to be significant in the 4th quarter. Finally, positive relationship was only found between DLROP and MS in the 1st quarter but these effect weakened in the next three quarters. These findings corroborate the findings by Olomola (2006) for Nigeria who investigated "Oil price shocks and aggregate economic activity in Nigeria" using quarterly data from 1970 to 2003 which revealed contrary results to other studies that oil price shocks do not significantly affect output in Nigeria but do have effects on exchange rate, interest rate, trade balance and revenue that accrue to the government.

Table 6 gives the results of the short-run dynamic coefficients associated with the asymmetric specification in which increases and decreases in the price of oil are considered as separate variables of oil price shocks obtained from the VAR analysis. The result shows that GDP, INF and MS had a positive but not significant relationship with DLOPINC; while a negative but significant relationship was found between EXCH, GEXP and MRR. Finally for oil price increases a negative but not significant relationship was established between oil price shocks except 2^{nd} and 3^{rd} quarters of REV and TRADE. In the case of oil price decreases, he result shows DLOPDEC was negatively but significantly related to EXCH, GEXP and MRR; negatively but insignificantly except in the 4^{th} quarters for GDP and MS; positive and significant in the 1^{st} quarter for REV and TRADE but losses its effects in the next three quarters and finally negative and significant in the 1^{st} quarter for INF but losses its effects also in the next three quarters.

The R" shows the models of these equations explain about 97% and 50% of the variations in macroeconomic activity. Specifications problems associated with serial correlation, functional form, normality and heteroscedasticity were checked with respective diagnostic tests, including the test for serial correlation (LM tests), ARCH test and Jarque-Bera statistics. The results as presented in appendix tables 5-8 shows normality, homoscedaticity and no autocorrelation was found among the variables of the model. In line with previous findings for other countries, our results suggest that the Nigerian economy is more responsive to decreases in oil prices than unexpected increases.

Impulse response and variance decomposition test

Impulse response test

The impulse response function (IRF) was computed from the coefficient of the Vector regression using orthogonalized set of residuals. The IRF traces the effects of one standard deviation shocks to one of the innovations on current and future values of each of the endogenous variables in the system.

The chart of the impulse response function for the linear oil price shocks specification (Table 5) shows that most of the variables show a decrease to oil price fluctuations during the first few quarters with the exception of real MS, REV and TRADE. On monetary policy stance, the figure indicates that interest rates declined initially indicating that the stance of monetary policy is eased in response to the shocks but increased quickly to curtail further inflationary consequences. The result for the asymmetric specification however depicts that positive oil price shocks lead to decline in all the variables except INF.

The response of macroeconomic variables to oil price shocks confirms the findings from the VAR estimates as most of the variables declined in response to oil price decreases except revenue and trade which increased for three consecutive periods. However such increases were not sustained as the variables went back to pre-shock levels between the third and fourth quarters. Furthermore, the impulse response function graph reveals that one positive standard shock on oil price will decline the GDP until period two; the GDP increase in the following period unlit period 5. However, in the next period the movements of GDP in response to oil price is fluctuated; but the movements is insignificant based on value shown in the graph.

Variance Decomposition Test

Variance decomposition represents the VAR system dynamics by giving information about the relative importance of each random innovation to the variables in the model. It shows how much of the unanticipated changes or variations of the variables in the model are explained by the different shocks. The VDC provides a tool of analysis to determine the relative importance of the dependent variable in explaining the variations in the explanatory variables.

The result of variance decomposition over a 10-quarter time horizon is summarily displayed in Tables 7 to 9.

Table 7 presents the forecast error variance decomposition when the linear measure of oil shocks is used. The results show gradual effects of oil price shocks on inflation from 0.0 per cent in quarter one to about 0.5 per cent in the tenth quarter. The response of real GDP to oil price shocks is clearly positive and steady till the end of the period significantly. This confirms the expectations that oil price shocks influences real GDP an also verifies the findings of Olomola (2006) and that oil price shocks had marginal effects on output. The greatest impact of oil price shocks was deduced on MRR, EXCH, TRADE and REV. Money supply shows an initial increase but declined gradually after the 6^{th} quarter.

On the asymmetric specifications, the price shocks as per increases on the other hand influence inflation drastically, moving from 0.1 per cent in quarter one to 8.24 per cent in the tenth quarter. However this impact could not be established for the other variables in the model except GDP which showed a mild but stead increase from 6.01 in 1^{st} quarter to 11.72 in the 10^{th} quarter. The findings for oil prices decreases showed that nearly all the variables in the model responded to a decreases in oil prices. The result show that shocks from oil prices decreases contributed 2.28 per cent to the shocks in nominal exchange rate in the 1^{st} quarter and increased drastically to 17.24 by the 10^{th} quarter. Oil price decreases also had significant effects on TRADE and REV; TRADE and REV decreased from 15.74 and 18.1 in the 5^{th} and 2^{nd} quarters respectively to 10.91 and 9.09 in the 10^{th} quarters. Response of GDP to oil price shocks was minimal as expected. In contrast, the contribution of oil price shocks decreases to inflation rate was reduction from 2.99 in the 1^{st} quarter to about 0.81 in the 10^{th} quarter.

Table 7: Variance Decomposition of DLROP to Selected Macroeconomic Variables: Linear Specification

Period	LGDP	DLROP	REV	INF	MS	EXCH	MRR	GEXP	TRADE
1	0.000000	96.28231	11.78282	0.000000	0.218223	0.000000	2.424668	1.204355	5.325496
2	0.980829	82.44820	17.87804	0.117251	1.950535	1.487070	1.272393	0.999316	15.79955

3	1.001189	71.33146	16.92193	0.181085	2.779265	5.180610	0.834332	0.624545	16.31796
4	2.123041	62.58945	15.61775	0.178463	3.287473	6.224543	1.096056	0.487886	16.17885
5	3.241324	60.40535	13.59463	0.360544	3.428815	8.373062	2.705698	0.403845	15.25155
6	3.091631	59.98487	11.76248	0.475585	3.183109	9.554628	4.317944	0.357053	13.88893
7	3.002712	59.30317	10.61582	0.407858	2.920472	9.290025	5.363523	0.348872	12.90563
8	3.612046	58.86487	9.965873	0.487387	2.701515	8.983393	6.335738	0.353959	12.19165
9	5.023908	58.35847	9.601275	0.547508	2.529851	8.820693	7.136274	0.383329	11.69600
10	6.165668	57.94727	9.309556	0.565514	2.433290	8.737267	7.820199	0.448581	11.40379

Cholesky Ordering: LGDP INF LEXCH DLROP LGEXP LMRR LMS LREV TRADE

Table 8: Variance Decomposition of DLROPINC to Selected Macroeconomic Variables: Asymmetric Specification

Period	DLROPDEC	DLROPINC	LEXCH	LGDP	LGEXP	LMRR	LMS	LREV	TRADE	INF
1	0.000000	93.50033	1.993079	6.018029	0.479555	0.264723	0.238421	0.421331	0.034541	0.107156
2	1.466553	76.05196	1.344066	9.730451	0.853000	0.213780	0.213559	0.245235	0.052982	2.853378
3	11.78511	57.14925	1.005409	10.60327	1.857972	0.722718	0.279818	0.342634	0.132645	3.703561
4	9.761739	53.90704	0.748065	10.64874	2.400294	1.341176	0.187067	0.258828	0.188371	3.749687
5	9.477293	51.12310	0.616781	9.757895	2.310921	1.727290	0.145380	0.332590	0.417370	5.432714
6	9.295568	48.53020	0.606081	10.51523	2.063324	1.603526	0.258018	0.339780	0.618100	7.464160

7	9.097140	47.42827	1.132839	12.50320	1.925145	1.640213	0.431448	0.307439	0.698528	8.699768
8	9.287967	47.19395	1.307041	11.87928	1.864663	1.996363	0.600715	0.280791	0.736980	8.639188
9	9.333805	46.54399	1.343922	11.47821	1.794904	2.679511	0.702249	0.274333	0.714543	8.429788
10	9.274820	46.09792	1.373243	11.72733	1.688631	3.418931	0.735032	0.293247	0.677725	8.241263

Cholesky Ordering: DLROPDEC DLROPINC LEXCH LGDP LGEXP LMRR LMS LREV TRADE INF

Table 9: Variance Decomposition of DLROPDEC to Selected Macroeconomic Variables: Asymmetric Specification

Period	DLROPDEC	DLROPINC	LEXCH	LGDP	LGEXP	LMRR	LMS	LREV	TRADE	INF
1	100.0000	6.499669	0.284173	1.577025	0.930557	1.105234	0.005501	10.72795	4.498118	2.992245
2	90.10054	5.287591	4.147383	1.641279	0.913047	0.503814	0.565436	18.31838	17.39095	1.940367
3	73.75897	12.91478	11.09017	1.527799	0.720859	0.536731	0.749460	15.97266	16.67615	1.515570
4	61.12610	12.35315	13.38681	2.092057	0.600467	1.141876	0.915953	13.21741	15.74955	1.359574
5	59.75742	11.89307	16.96112	3.306356	0.490327	3.298743	0.996621	10.97421	14.63449	1.315347
6	59.88607	11.58137	18.59336	3.041827	0.489977	5.780153	0.914650	9.443307	13.28806	1.200428
7	58.85154	11.29648	18.22713	2.854356	0.512745	7.891165	0.821537	8.811760	12.39116	1.021666
8	58.06696	11.48272	17.75234	3.940406	0.554143	9.988401	0.745688	8.735470	11.72886	0.980591
9	57.45464	11.38034	17.47536	6.088017	0.557156	11.75496	0.676271	8.928752	11.22657	0.910930
10	57.09874	11.27716	17.24666	7.695264	0.523173	13.09126	0.621463	9.092511	10.91676	0.816095

Cholesky Ordering: DLROPDEC DLROPINC LEXCH LGDP LGEXP LMRR LMS LREV TRADE INF

SUMMARY, RECOMMENDATIONS AND CONCLUSION

Summary

The work examined in detail the effects of oil prices shocks on various macroeconomic indicators used as proxy for significant macroeconomic activities for the Nigerian economy from 1980 to 2011. Examination of the literature reviewed showed that majority of the empirical studies have adopted cross sectional analysis which may not satisfactorily address issues that are specific to individual countries. Secondly, the majority of studies have adopted the residual based measures of cointegration such as Engle and Granger (1987) and the maximum likelihood test by Johansson (1988) and Johansson and Juselius (1990) which may not appropriate when the sample size under consideration is small. In this study we adopted the ARDL-Bounds testing approach to cointegration to examine the cointegration relationship between oil price shocks, economic growth as proxied by gross domestic product, exchange rate, inflation, money supply, interest rate, trade balance. As a first step the ADF and PP tests showed that majority of the variables were stationary at levels while all the nine variables including the oil price shock proxies were all stationary when differenced once. Our empirical analysis yields interest findings. Result from the granger causality test confirmed that asymmetric oil price changes forecast movements in inflation; while, past movements of oil price changes and oil price decreases forecast movement in trade balance and revenue that accrue to the federal government. Thus for the Nigerian economy, oil price shocks have significant influence on trade balance, revenue that accrue to the government and the rate of inflation.

Analysis from the VAR framework reported that all the macroeconomic variables considered for this study exhibit a negative response to oil price shocks. This clearly indicates that the Nigerian economy is considerably vulnerable to oil price decreases. Specifically, the short run result shows that the increase of oil price contributes to a lesser GDP but insignificant. This is relevant to the theory and previous studies that the oil importer country will suffer with the increase of oil price. The accumulated impulse response obtained from the linear oil price specification indicates that oil price movements lead to a decline in all the variables ; however, only marginal impact were seen in broad money supply rate. The variance decomposition analysis on the other hand shows that oil price fluctuations significantly contributes to the variability of Inflation, trade balance, government revenue, interest rate and the exchange rate. Specifications problems associated with serial correlation, functional form, normality and heteroscedasticity were checked with respective diagnostic tests, including the test for serial correlation (LM tests), ARCH test and Jarque-Bera statistics. The results as presented in appendix tables 5-8 shows normality, homoscedaticity and no autocorrelation was found among the variables of the model. In line with previous findings for other countries, our results suggest that the Nigerian economy is more responsive to decreases in oil prices than unexpected increases.

Recommendations

Based on the findings of the study re recommend the following as follows:

Given that the general price level (inflation) is greatly affected by the world crude oil price for Nigerian economy, we recommend in line with Odhiambo (2010) for South Africa a relaxation of monetary policy during an oil price fluctuation era as the government has already through the central bank adopted a inflation targeting policy in order to protect the economy from possible outcome of a full blown stagflation. Secondly any effort invested in reducing the dependence of the Nigerian economy from oil is considered more than justified. Nigeria is country stated to be blessed with both human and natural resources, thus a look always into other natural resources especially land for agriculture would lead to a less fragile economic growth. Thirdly, the recent subsidy removal was a good step in the right direction. The elimination of the subsidy would keep the sustainability of the domestic oil source; however the fund obtained from the subsidy removal should be reinvested into high growth impact sectors like health and education programmes.

Conclusion

This study aimed to examine the impact of oil price shocks on Nigeria gross domestic product and other macroeconomic variables which were choosen as indicators of economic activity. The study studies stems from other studies that have been done in focusing on how oil prices affects the economy of the country. Based on the analysis described here, the following conclusions were arrived at: oil price shocks decreases impact the Nigerian economy than increases which virtually do not have any effects on most of the macroeconomic indicators including growth. Based on the foregoing we recommend that for triangulation further study should be carried out including other variables like subsidy and unemployment as proxy for development.

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APPENDIX

Table 11: Granger Causality Tests (ASSYMETRIC)

Pairwise Granger Causality Tests
Date: 14/07/14 Time: 06:03
Sample: 1980Q1 2011Q4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
INF does not Granger Cause DLROP	124	2.74614	0.03170
DLROP does not Granger Cause INF		0.77628	0.54281
LEXCH does not Granger Cause DLROP	124	4.14079	0.00360
DLROP does not Granger Cause LEXCH		3.97437	0.00466
LGDP does not Granger Cause DLROP	124	1.24888	0.29432
DLROP does not Granger Cause LGDP		0.94729	0.43942
LGEXP does not Granger Cause DLROP	124	1.30214	0.27343
DLROP does not Granger Cause LGEXP		0.34593	0.84639

LMRR does not Granger Cause DLROP	124	0.73638	0.56901
DLROP does not Granger Cause LMRR		0.78126	0.53959
LMS does not Granger Cause DLROP	124	4.96017	0.00100
DLROP does not Granger Cause LMS		1.36076	0.25194
LREV does not Granger Cause DLROP	124	4.27671	0.00291
DLROP does not Granger Cause LREV		3.25981	0.01425
TRADE does not Granger Cause DLROP	124	2.26893	0.06601
DLROP does not Granger Cause TRADE		6.02512	0.00019
LEXCH does not Granger Cause INF	124	2.43605	0.05113
INF does not Granger Cause LEXCH		0.25203	0.90791
LGDP does not Granger Cause INF	124	0.76037	0.55317
INF does not Granger Cause LGDP		61.5404	1.1E-27
LGEXP does not Granger Cause INF	124	1.15104	0.33627
INF does not Granger Cause LGEXP		0.40511	0.80464
LMRR does not Granger Cause INF	124	1.52879	0.19844
INF does not Granger Cause LMRR		0.38103	0.82181
LMS does not Granger Cause INF	124	1.41488	0.23345
INF does not Granger Cause LMS		2.31779	0.06127
LREV does not Granger Cause INF	124	1.16358	0.33062
INF does not Granger Cause LREV		0.73681	0.56872
TRADE does not Granger Cause INF	124	1.28073	0.28167
INF does not Granger Cause TRADE		3.98964	0.00455
LGDP does not Granger Cause LEXCH	124	0.09262	0.98462
LEXCH does not Granger Cause LGDP		5.24664	0.00064
LGEXP does not Granger Cause LEXCH	124	0.64477	0.63168
LEXCH does not Granger Cause LGEXP		1.02593	0.39702
LMRR does not Granger Cause LEXCH	124	0.31948	0.86444
LEXCH does not Granger Cause LMRR		0.30065	0.87699
LMS does not Granger Cause LEXCH	124	0.05660	0.99397
LEXCH does not Granger Cause LMS		2.62197	0.03840
LREV does not Granger Cause LEXCH	124	1.89007	0.11688
LEXCH does not Granger Cause LREV		4.33238	0.00267

TRADE does not Granger Cause LEXCH	124	0.19947	0.93818
LEXCH does not Granger Cause TRADE		0.88423	0.47580
LGEXP does not Granger Cause LGDP	124	14.7588	9.2E-10
LGDP does not Granger Cause LGEXP		0.36403	0.83379
LMRR does not Granger Cause LGDP	124	2.49034	0.04704
LGDP does not Granger Cause LMRR		0.16124	0.95750
LMS does not Granger Cause LGDP	124	25.2015	5.3E-15
LGDP does not Granger Cause LMS		0.16823	0.95416
LREV does not Granger Cause LGDP	124	13.4977	4.7E-09
LGDP does not Granger Cause LREV		0.57168	0.68371
TRADE does not Granger Cause LGDP	124	10.3290	3.5E-07
LGDP does not Granger Cause TRADE		1.24087	0.29758
LMRR does not Granger Cause LGEXP	124	0.50580	0.73154
LGEXP does not Granger Cause LMRR		0.18327	0.94668
LMS does not Granger Cause LGEXP	124	0.47777	0.75198
LGEXP does not Granger Cause LMS		1.56129	0.18937
LREV does not Granger Cause LGEXP	124	0.54378	0.70390
LGEXP does not Granger Cause LREV		3.04103	0.02005
TRADE does not Granger Cause LGEXP	124	0.13943	0.96728
LGEXP does not Granger Cause TRADE		0.92029	0.45474
LMS does not Granger Cause LMRR	124	0.21165	0.93151
LMRR does not Granger Cause LMS		1.62775	0.17199
LREV does not Granger Cause LMRR	124	0.35658	0.83899
LMRR does not Granger Cause LREV		0.56948	0.68530
TRADE does not Granger Cause LMRR	124	0.89552	0.46913
LMRR does not Granger Cause TRADE		0.36493	0.83316
LREV does not Granger Cause LMS	124	2.02500	0.09551
LMS does not Granger Cause LREV		1.35181	0.25512
TRADE does not Granger Cause LMS	124	0.09584	0.98361
LMS does not Granger Cause TRADE		2.18144	0.07541
TRADE does not Granger Cause LREV	124	0.49710	0.73788
LREV does not Granger Cause TRADE		0.99275	0.41451

Table 12: Granger Causality Tests (ASSYMETRIC)

Pairwise Granger Causality Tests
Date: 14/07/14 Time: 06:22
Sample: 1980Q1 2011Q4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
LEXCH does not Granger Cause INF	124	2.43605	0.05113
INF does not Granger Cause LEXCH		0.25203	0.90791
LGDP does not Granger Cause INF	124	0.76037	0.55317
INF does not Granger Cause LGDP		61.5404	1.1E-27
LGEXP does not Granger Cause INF	124	1.15104	0.33627
INF does not Granger Cause LGEXP		0.40511	0.80464
LMRR does not Granger Cause INF	124	1.52879	0.19844
INF does not Granger Cause LMRR		0.38103	0.82181
LMS does not Granger Cause INF	124	1.41488	0.23345
INF does not Granger Cause LMS		2.31779	0.06127
LREV does not Granger Cause INF	124	1.16358	0.33062
INF does not Granger Cause LREV		0.73681	0.56872
TRADE does not Granger Cause INF	124	1.28073	0.28167
INF does not Granger Cause TRADE		3.98964	0.00455
DLROPDEC does not Granger Cause INF	124	0.10614	0.98017
INF does not Granger Cause DLROPDEC		0.89728	0.46810
DLROPINC does not Granger Cause INF	124	2.26812	0.06609
INF does not Granger Cause DLROPINC		4.80162	0.00128
LGDP does not Granger Cause LEXCH	124	0.09262	0.98462
LEXCH does not Granger Cause LGDP		5.24664	0.00064
LGEXP does not Granger Cause LEXCH	124	0.64477	0.63168
LEXCH does not Granger Cause LGEXP		1.02593	0.39702
LMRR does not Granger Cause LEXCH	124	0.31948	0.86444
LEXCH does not Granger Cause LMRR		0.30065	0.87699

LMS does not Granger Cause LEXCH	124	0.05660	0.99397
LEXCH does not Granger Cause LMS		2.62197	0.03840
LREV does not Granger Cause LEXCH	124	1.89007	0.11688
LEXCH does not Granger Cause LREV		4.33238	0.00267
TRADE does not Granger Cause LEXCH	124	0.19947	0.93818
LEXCH does not Granger Cause TRADE		0.88423	0.47580
DLROPDEC does not Granger Cause LEXCH	124	4.51230	0.00201
LEXCH does not Granger Cause DLROPDEC		0.39218	0.81389
DLROPINC does not Granger Cause LEXCH	124	0.55507	0.69571
LEXCH does not Granger Cause DLROPINC		9.24737	1.6E-06
LGEXP does not Granger Cause LGDP	124	14.7588	9.2E-10
LGDP does not Granger Cause LGEXP		0.36403	0.83379
LMRR does not Granger Cause LGDP	124	2.49034	0.04704
LGDP does not Granger Cause LMRR		0.16124	0.95750
LMS does not Granger Cause LGDP	124	25.2015	5.3E-15
LGDP does not Granger Cause LMS		0.16823	0.95416
LREV does not Granger Cause LGDP	124	13.4977	4.7E-09
LGDP does not Granger Cause LREV		0.57168	0.68371
TRADE does not Granger Cause LGDP	124	10.3290	3.5E-07
LGDP does not Granger Cause TRADE		1.24087	0.29758
DLROPDEC does not Granger Cause LGDP	124	0.70620	0.58928
LGDP does not Granger Cause DLROPDEC		0.84245	0.50104
DLROPINC does not Granger Cause LGDP	124	0.69831	0.59465
LGDP does not Granger Cause DLROPINC		1.60378	0.17808
LMRR does not Granger Cause LGEXP	124	0.50580	0.73154
LGEXP does not Granger Cause LMRR		0.18327	0.94668
LMS does not Granger Cause LGEXP	124	0.47777	0.75198
LGEXP does not Granger Cause LMS		1.56129	0.18937
LREV does not Granger Cause LGEXP	124	0.54378	0.70390
LGEXP does not Granger Cause LREV		3.04103	0.02005
TRADE does not Granger Cause LGEXP	124	0.13943	0.96728
LGEXP does not Granger Cause TRADE		0.92029	0.45474

DLROPDEC does not Granger Cause LGEXP	124	0.45540	0.76828
LGEXP does not Granger Cause DLROPDEC		0.52161	0.72002
DLROPINC does not Granger Cause LGEXP	124	0.29088	0.88339
LGEXP does not Granger Cause DLROPINC		2.61908	0.03858
LMS does not Granger Cause LMRR	124	0.21165	0.93151
LMRR does not Granger Cause LMS		1.62775	0.17199
LREV does not Granger Cause LMRR	124	0.35658	0.83899
LMRR does not Granger Cause LREV		0.56948	0.68530
TRADE does not Granger Cause LMRR	124	0.89552	0.46913
LMRR does not Granger Cause TRADE		0.36493	0.83316
DLROPDEC does not Granger Cause LMRR	124	0.39344	0.81299
LMRR does not Granger Cause DLROPDEC		0.97757	0.42270
DLROPINC does not Granger Cause LMRR	124	0.89778	0.46781
LMRR does not Granger Cause DLROPINC		0.52518	0.71742
LREV does not Granger Cause LMS	124	2.02500	0.09551
LMS does not Granger Cause LREV		1.35181	0.25512
TRADE does not Granger Cause LMS	124	0.09584	0.98361
LMS does not Granger Cause TRADE		2.18144	0.07541
DLROPDEC does not Granger Cause LMS	124	0.86353	0.48819
LMS does not Granger Cause DLROPDEC		4.07865	0.00396
DLROPINC does not Granger Cause LMS	124	1.44823	0.22266
LMS does not Granger Cause DLROPINC		2.68887	0.03463
TRADE does not Granger Cause LREV	124	0.49710	0.73788
LREV does not Granger Cause TRADE		0.99275	0.41451
DLROPDEC does not Granger Cause LREV	124	4.14618	0.00357
LREV does not Granger Cause DLROPDEC		2.23816	0.06918
DLROPINC does not Granger Cause LREV	124	1.13586	0.34321
LREV does not Granger Cause DLROPINC		2.31090	0.06192
DLROPDEC does not Granger Cause TRADE	124	7.56317	1.9E-05
TRADE does not Granger Cause DLROPDEC		2.09578	0.08585
DLROPINC does not Granger Cause TRADE	124	0.88642	0.47450
TRADE does not Granger Cause DLROPINC		1.29383	0.27660

DLROPINC does not Granger Cause DLROPDEC	124	2.81985	0.02827
DLROPDEC does not Granger Cause DLROPINC		3.46511	0.01034