academicJournals

Vol. 9(3), pp. 103-115, 14 February, 2015
DOI: 10.5897/AJBM2014.7458
Article Number: C93E0AF50533
ISSN 1993-8233

http://www.academicjournals.org/AJBM

African Journal of Business Management

Full Length Research Paper

An analysis of the impact of oil price shocks on the growth of the Nigerian economy: 1970-2011

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Received 29 April, 2014; Accepted 6 February, 2015

This paper examines the impact of oil price shocks on Nigerian economic growth while controlling the effects of unrest in the international oil market, exchange rate and agriculture output using quarterly time series data from 1970:q1-20011:q4.The broad objective of the study is to evaluate the long run relationship among the variables namely; oil price, exchange rate, agriculture output, unrest and economic growth. The research applied ADF unit root tests to ascertain the stationary of the series and also employed Johansen and Juselius (1990) trace and maximal eigenvalue tests to ensure long-run relationship among the variables under the study. In addition, structural Vector Autoregression (SVAR) is also applied in examining the link between the shocks emanating from oil price, unrest and their impacts on economic growth. The finding from ADF revealed that all the series at level are not stationary but stationary at first difference with constant. Moreover, the findings from SVAR using the Impulse response functions (IRFs) and variance decompositions (VDCs) indicated that the response of oil price shocks and unrest to (rGDP) economic growth depicts both positive and negative impact, i.e. long-run impact on economic growth exists. The study concludes that oil price, exchange rate, agriculture output and unrest contained some useful information in predicting the future path of economic growth in Nigeria. It, therefore, recommends that government should diversified the economy from oil to non oil sectors base and to improving the security situation in the Niger Delta with a view to boosting oil output, hence leading to increased revenue and by implication growth of the economy.

Key words: GDP, Exchange rate, agriculture output, oil prices, unrest, VAR, SVAR.

INTRODUCTION

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 (Wakeford, 2006). These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil rich Middle East and activities of militant groups in the Niger Delta Region of Nigeria. The shocks could be positive (a rise) or negative (a fall).

In Nigeria, oil plays a critical role in the conduct of fiscal and monetary policies because it accounts for an average of 80 percent of government revenue, 90-95

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percent of foreign exchange earnings and 12 percent of the real gross domestic product (Anyanwu, 1997).

Historically, the price of oil had been fairly stable until 1973. Since then, the impact of oil price shocks on the world economy has been larger (Hamilton, 2003). In the past three decades, the price of oil has been volatile and given the role of oil in the Nigerian economy, the effects of oil price shocks have been very significant and dis-stabilizing.

Nigeria has been the major oil producer in African continent together with Libya. Indeed, attacks on the oil refineries and the kidnapping of foreign engineers by the movement for the emancipation of the Niger Delta in the Niger Delta region was reported to have been one of the causes of international oil price increase from 2006-2007. This notwithstanding, in general, Nigeria's production can be considered to be not enough to affect the international oil price, thus this assumption is appropriate (CBN, 2008).

As an oil exporter and importer of refined petroleum products, any volatility or fluctuations in oil prices will adversely affect the Nigerian economy either positively or negatively. Several empirical studies have been undertaken to investigate the effect of oil price volatility on macroeconomic variables in different economies. Although the literatures are mixed on the causality between the oil price volatility and the macroeconomic variables, most empirical studies show that oil price directly impacts on macroeconomic variables (Joseph, 2013; Aliyu, 2009).

As a mono-product economy, Nigeria remains susceptible to the movements in international crude oil prices. During periods of favorable oil price shocks triggered by conflicts in oil-producing areas of the world, the surge in the demand for the commodity by consuming nations, seasonality factors, trading positions, etc; the country experiences favorable terms-of-trade quantified in terms of a robust current account surplus and exchange rate appreciation. On the converse, when crude oil prices are low, occasioned by factors such as low demand, seasonality factors, excess supply and exchange rate appreciation, the Nigerian economy experiences significant drop in the level of foreign exchange inflows that often result in budget deficit and or slower growth. A recent example was the dramatic drop in the price of crude oil in the wake of the global financial and economic crises. The price of oil fell by about two thirds from its peak of $147.0 per barrel in July 2008 to $41.4 at end-December 2008.

However, various episodes of oil shock have been observed in Nigeria. Each of the shocks had connections with some movements in key macroeconomic variables in Nigeria. For instance, the 1973-74, 1979-80, 1990, 1999-2000, 2003-2006, 2007-2008 and 2011 periods were associated with price increases while the oil market collapse of 1986, the Iranian revolution of 1991-1992, the East Asian Crisis of 1997-1998, Energy Crisis and tension from Middle East of 2000-2001were an episode of price decrease.

Theoretically, oil price increases translate to higher production costs, leading to commodity price increases at which firms sell their products in the market. Higher commodity prices then translate to lower demand for goods and services, therefore shrinking aggregate output and employment level. Furthermore, higher oil prices affect aggregate demand and consumption in the economy.

The transfer of income and resources from an oil-importing to oil-exporting economies is projected to reduce worldwide demand as demand in the former is likely to decline more than it will rise in the latter [Hunt et al., 2001]. The resulting lower purchasing power of the oil-importing economy translates to a lower demand. Also, oil price shocks pose economic uncertainty on future performance of the Macroeconomy. People may postpone consumption and investment decisions until they see an improvement in the economic situation.

It is against this background, the study finds a gap to fill. i.e. by considering the effects of unrest asa variable that potentially affects oil output which in turn leads to revenueleakages which is assumed to have implications on the economic growth of both oil exporting and importing countries (especially Nigeria). Therefore, given the above scenario, the research paper seeks to address the following questions: Do all the variables under study have a long run relationship? What are the impacts of these different shocks to the growth of Nigerian economy? The broad objective of this paper is to examine the impact of oil price shocks on the growth of Nigerian economy. It thereby adds to the scanty existing empirical literatures on the impact of oil price shocks on macroeconomic variables in both oil exporting and importing developing countries (more specifically Nigeria).

Following the introductory section of the paper, the study focuses on the review of related literatures on the oil prices-macroeconomic variables relationship in section 2. Data Descriptions and econometric model specifications used in section 3. Section 4 would be the data presentation and interpretations of estimation results. While conclusions and recommendations and policy implications of the findings are presented in section 5.

LITERATURE REVIEW

In this section of the study we shall consider the research work which was carried out by various researchers. Bjornland (2004), Berument and Ceylan (2005), Huang and Guo (2007) did a study on the impact of oil prices on economic growth of the following countries which include; Venezuela, China, Algeria, Iran, Iraq, Jordan, Kuwait, Oman, Qatar, Syria, Tunisia, UAE, Norway, Philippine and G7 countries by using a structural vector auto-

regressive (SVAR) framework. Their findings show that an oil price shock stimulates the economy while for countries as Bahrain, Egypt, Lebanon, Morocco and Yemen did not find any significant impact on oil price shocks on their economy.

Furthermore, studies on Nigerian economy like that of Aliyu (2009), Olomola and Adejumo (2006), Ayadi (2005), Gunu (2010), Agbede (2013) used VAR frame work to examine the effect of real exchange rate, oil price shocks, oil production shocks, money supply, net foreign assets, interest rate, inflation, and output. Empirically, the response of the real exchange rate is generally positive after a positive oil production shock, indicating a real depreciation of the naira. The impulse response of the real exchange rate is negligible relative to that of oil production, but the response of the real exchange rate after a year is about two times larger than that of oil production.

Rautava (2004) develops a small VAR model to examine these dynamics in the Russian economy and shows that oil has played a significant role in movements of Russian GDP. Higher oil price leads to higher GDP, in both the short and long run. On the other hand, in the model, a higher oil price does not lead to a stronger real exchange rate, although the author conjectures that this may be because of the estimation strategy.

Anshasy et al. (2005) examine the effects of oil price shocks on Venezuela's economic performance over 1950-2001. They investigate the relationship between oil prices, governmental revenues, government consumption spending, GDP and investment by employing a general to specific modeling (VAR and VECM). They found two long run relations consistent with economic growth and fiscal balance and that this relationship is important not only for the long run performance but also for short term fluctuations.

Jimenez-Rodriguez and Sanchez (2012) studied the role of oil price shocks in Japanese macroeconomic developments using quarterly data from Japan over the period 1976- 2008. They also use VAR framework to find the evidence of non-linear effects of oil price on both industrial output and inflation. The theory predicts that, in an oil importing economy like Japan, unexpected hikes in oil prices should lead to lower economic activity and higher inflation. The empirical findings concerning the effects of oil shocks on industrial output growth and inflation confirm the expected pattern.

Englama et al. (2010) examined the effects of oil price volatility, demand for foreign exchange, and external reserves on exchange rate volatility in Nigeria using monthly data for the period 1999:1 to 2009:12.The authors utilized cointegration technique and vector error correction model (VECM) for the long-run and the short-run analysis, respectively. The results showed that a 1.0 per cent permanent increase in oil price at the international market increases exchange rate volatility by 0.54 per cent in the long-run, while in the short-run by 0.02 per cent. Also a permanent 1.0 per cent increase in demand for foreign exchange increases exchange rate volatility by 14.8 per cent in the long-run. The study reaffirms the direct link of demand for foreign exchange and oil price volatility with exchange rate movements and, therefore, recommends that demand for foreign exchange should be closely monitored and exchange rate should move in tandem with the volatility in crude oil prices bearing in mind that Nigeria remains an oil-dependent economy.

Ayoola (2013) examines the effects of crude oil price changes on economic activity in an oil dependent economy-Nigeria. A small open economy structural vector autoregressive (SVAR) technique is employed to study the macroeconomic dynamics of domestic price level, economic output, money supply and oil price in Nigeria. The study covers the period between 1985:q1 to 2010:q4. The results of the Impulse Response Functions (IRFs) and the Forecast Error Variance Decompositions (FEVDs) suggest that domestic policies, instead of oil-boom should be blamed for inflation. Also, oil price variations are driven mostly by oil shocks; however, domestic shocks are responsible for a reasonable portion of oil price variations. The study concludes that oil still has very important indirect impact on the Nigerian economy and the monetary policy is the channel through which this indirect impact transmits.

However, from the above strand of literature we will come to observe more especially most of the study frequencies were too scanty. To this end, studying ‘shocks’ and ‘relationships’ using these frequencies the clustering effect is gone- some vital information will be lost. The study finds this interesting to re-estimate these shocks using structural VAR framework on Nigerian data from 1970q1 to 2011q4 so as to filter through.

Datadescriptions and econometric model specifications

This study relies heavily on secondary data; variables including real GDP, exchange rate, agriculture output are sourced from Central Bank of Nigeria (CBN) statistical bulletin, average world oil price from Energy Intelligence Agency (EIA) and unrest(dummy) is sourced from both International Crisis Group (ICG) and Nigerian National Petroleum Corporation (NNPC statistical Bulletin). The trend of the data would be analyzed by the use of unit root test (Augmented Dickey Fuller ADF) test for stationary, for the accessing of the long run relationship among the variables Johansen Cointegration test is to be employed while for examining the long run impact of the shocks Structural VAR (Blanchard and Quah, 1989) Long run restriction pattern on the basis of impulse response functions and forecast error variance decomposition

would be employed. Finally quarterly data will be used for the period between 1970-2011 (i.e. 168 observations), which is the period that represents occurrence of the oil shocks in international oil market.

Econometricsmodel specification

The general econometric specificationof the model to be estimated is as follows:

$$GDP = f(OP, EX, UN, OA)$$

$$GDP_t = \beta_0 + \beta_1 OILP_t + \beta_2 EXR_t + \beta_3 UNRST_t + \beta_4 AGR_t + \varepsilon_t$$

Where:
GDP =Gross Domestic Product
OILP = Crude oil prices
EXR = Nominal foreign exchange rate
UNRST=Unrest (oil shocks)
AGR= Output of Agriculture

Stationarity test and study variables

The variables of interest (i.e. endogenous variables) are seasonally adjusted real GDP and nominal foreign exchange rate, agriculture output, oil price and unrest (dummy variable). The choice of variables is mainly driven by similar studies, in particular Aliyu (2009) and is used as a benchmark, which is been conducted in Nigeria and is in accord with economic theory. Since it is a time series data, the regressions involving unit root processes may give spurious results and the naive application of regression analysis may yield nonsense results.

Therefore, distinction between whether the levels or differences of a series is stationary leads to substantially different conclusions and hence test of non-stationarity, that is, unit roots are the usual practice today.

Therefore, the study applies the commonly used augmented Dickey-Fuller (ADF) unit root tests to determine the variables' stationarity properties or integration order. Before estimating the VAR model, we would use the most recommended Akaike information criterion (AIC) test to determine the lag length of the VAR system to make sure the model is well specified.

The test estimation procedure takes the following forms;

$$\text{(ADF-test):} \quad \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{t-1}^{m} \Delta Y_{t-i} + \varepsilon_t$$

Where Δy_t denotes lag difference of the variable under consideration. m is the number of lags and εt is the error term. The stationarity of the variables is tested using the hypothesis;

For ADF:
Ho: δ 1 = 0 (Null hypothesis), [where $\delta 1 = \rho - 1 = 0$]
Ho: δ 1 < 0 (Alternative Hypothesis)

Based on the critical values of respective statistics, if null hypothesis cannot be rejected, then the time series are non-stationary at the level and need to go through first or higher order differencing process to achieve stationarity and to find the order of integration. The test is applied to each variable used in the model.

Johansen and Juselius 1990 Test for Cointegration

The VAR model is specified as follows;

$$Y_t = A_O + \alpha_i \sum_{k-1}^{p} A_k + y_{t-k} + \varepsilon_t \quad \text{..... (I)}$$

Where y_t is a (n× 1) vector of non-stationary *I (*I*)* variables, n is the number of variables in the system, in this study four in each case. A_0Is (n× 1) vector of constant terms, A_k is a (n×n) matrix of coefficients, e_t is a (n × 1) vector of error terms, which is independent and identically distributed, and p is the order of auto regression or number of lags. In this study weuse quarterly frequency data for all analysis.

$$Y_t = B + \sum_{k-O}^{\infty} B_k \ell_{t-k} \quad \text{..... (II)}$$

Thus, $y_t$is expressed as a linear combination of current and past innovations. Based on (2), impulse response functions are simulated for assessing dynamic effects of oil price shocks on output rGDP, exchange rate, output of agric and oil price. To test for cointegration, we employ a VAR-based approach of Johansen and Juselius (1990). In particular, the Johansen and Juselius (JJ) test for cointegration is based on evaluating the rank of coefficient matrix of level variables in the regression of changes in a vector of variables on its own lags and lagged level variables. The rank of the matrix, which depends on the number of its characteristic roots (eigenvalues) that differ from zero, indicates the number of cointegrating vectors governing the relationships among variables.

Johansen and Juselius (1990) develop two test statistics to determine the number of cointegrating vectors –the Trace and the Maximal Eigenvalues (M.E) statistics;

$$\lambda Trace: \quad (r) = -T \sum_{i=r+1}^{k} log(1-\lambda)$$
$$\lambda Maxeigenvalues: \quad (r, r+1) = -Tlog(1-\lambda_{r+1})$$
..... (III)

Where T is the number of effective observations and λs are estimated eigenvalues. For our analysis although our sample size is 168, in case of handling sample size of less than 100, we adjust the trace and M.E statistics by a factor (T=np)/T, where Tis the effective number of observations, nis the number of variables and p is the lag order. This is to correct bias towards finding evidence for cointegration in finite or small sample. The adjusted Trace statistic tests the null hypothesis that, the number of distinct cointegrating relationships is less than or equal to r against the alternative hypothesis of more than rcointegrating relationships. Meanwhile, the adjusted M.E test statistic tests the null hypothesis that the number of cointegrating relationships is less than or equal to ragainst the alternative of r+ 1 cointegrating relationships.

Structural VAR model

The advantage of the SVAR approach is that the system dynamics can be easily investigated via impulse response analysis, and the statistical significance of the various shocks can be evaluated with confidence intervals. Moreover, the relative importance of stochastic shocks can be examined by forecast error variance decomposition. The different structural shocks are identified by means of long-run restrictions, whereby certain shocks are allowed to have long-run impacts on all or some of the system variables.

However, after we might ascertain the relationship among the variables using VAR, then we follow the discussion on the SVAR approach. The starting point is a reduced form *K*-dimensional VAR model

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathrm{I})$$

In (I) above, is a vector of (K× 1) endogenous variables, five system variables among them are real GDP(y_t), oil price (oil price) and unrest(un_t). They are fixed (k× k) coefficient matrices which means bivariate model (2 × 2) using SVAR to examine the impact of oil price shocks and unrest on economic growth following Blanchard and Quah (1989), and we assume that follows a -dimensional white noise process with:

$$E(\varepsilon_t) = 0, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathrm{II})$$

Therefore, reformulate (I)

$$\Delta y_t = A_1 \Delta y_{t-p} + \ldots\ldots A_p \, \Delta y_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathrm{III})$$

Theequation Ⅲ and following the Blanchard and Quah (1989), the model is expressed as an infinite moving average representation of the variables such that:

$$\Delta yt = A_1 \varepsilon_t + A_1 \varepsilon_t + \ldots + \sum_{i=0}^{\infty} A \varepsilon_{t-1} = \mathrm{A(L)}\varepsilon_t \ldots\ldots\ldots\ldots\ldots (\mathrm{IV})$$

$$\Delta yt = \begin{pmatrix} \Delta LrGDP \\ \Delta oilprice \end{pmatrix} \quad \Delta\varepsilon_t = \begin{pmatrix} \varepsilon 1t \\ \varepsilon 2t \end{pmatrix}$$

and

$$\begin{pmatrix} \Delta \mathrm{LrGDP} \\ \Delta \mathrm{un} \end{pmatrix} \quad \Delta\varepsilon_t = \begin{pmatrix} \varepsilon 1t \\ \varepsilon 2t \end{pmatrix}$$

Where;

Changes in (ΔLrGDP, Δoilprice) and (ΔLrGDP, Δunrest) are all assumed to be stationary while permanent and transitory errors ε, are uncorrelated white noise disturbances. The ε_{1t} and ε_{2t} are the demand shocks and supply shocks respectively. It is assumed that demand shocks have temporary effect on the level of GDP. The identity matrix is obtained by normalizing the variance of the structural shocks such that: $E(\varepsilon_1 \varepsilon_2) = I$ that is, these shocks are orthogonal and serially uncorrelated.

The reduced form of the model in the moving average representation is:

$$\Delta_{xt} = e_t + C_1 e_{t-1} + \ldots + \sum_{i-0}^{\infty} C1e\, t - 1 = C(L)e_t \ldots\ldots\ldots\ldots (\mathrm{V})$$

This can be represented as follows:

$$\begin{pmatrix} \Delta \mathrm{LrGDP} \\ \Delta \mathrm{Loilprice} \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \quad \text{and}$$

$$\begin{pmatrix} \Delta \mathrm{LrGDP} \\ \Delta \mathrm{un} \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \ldots\ldots\ldots\ldots (\mathrm{VI})$$

Where e_t is a vector of estimated reduced-form residuals with variance $E(e_t\, e_t) = \Omega$ and matrices C_i represent the impulse response function of shocks to ΔLrGDP, ΔLoilprice and Δun (dummy) respectively and C(L) is an infinite polynomial in the lag operator $A(L) = C(L)^{-1}$.

From equations (Ⅳ) and (Ⅴ), It can be shown that the

reduced form residuals are related to the structural residuals as; $e_t = A(0)\ \varepsilon_t$…… (Ⅶ)

Where A(0) is a matrix of the contemporaneous effect of the structural innovations, it follows that: $E(e_t\ e_t) = A(0)\ E(e_t\ e_t)A(0)$ …… (Ⅷ)

Since $E(e_t\ e_t) =$ I then $A(0)A(0)' = \Omega$

DATA PRESENTATION AND ESTIMATION OF RESULTS

Introduction

This section of the paper deals with the presentation and analysis of the estimated results arrived at, i.e. it shows the estimated results which include; unit root tests of the variables on the time series, cointegration results and impulse response analysis with forecast error variance decomposition results are presented here.

Table 1a. Unit root test at level with constant.

Variables	ADF	Integration
RGDP	2.07	-
OIL PRICE	-2.55	-
EXC RATE	0.39	-
AGR	3.26	-

Source: researchers' computations, E-views, 7.1, 2015. *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. With constants only: Mckinnon (1996) critical values are; -3.470(1%), -2.879(5%) and -2.576(10%).

Table 1b. Unit root test at 1st difference with constant.

Variables	ADF	Integration
RGDP	-17.87*	I (1)
OIL PRICE	-10.25*	I (1)
EXC RATE	-15.56*	I (1)
AGR	-14.08*	I (1)

Unit root test

The study conducts unit root tests on the variables with Augmented Dickey Fuller (ADF). Outcomes of the tests are presented in Table 1. According to ADF test statistics at level, there is enough evidence to infer that the null hypothesis is true and the alternative hypothesis is false. On the other hand, at first difference with constant, there is enough evidence to infer that the null hypothesis is false and the alternative hypothesis is true. The study therefore, rejects the null hypothesis of unit root at first difference and not rejects the alternative hypothesis. However, the paper adopts ADF Test as the statistic that produces first difference stationary of all the series at 1% level of significance. In conclusion, there is enough empirical evidence to infer that, all series at first difference appears to be I (1) processes.Therefore, this allows us to conduct co-integration tests among the variables.

VAR based on Johansen and Juselius 1990 Cointegration test

To achieve objective one, the study accessed long run relationship among the variables using VAR based Johansen and Juselius (1990). Since oil price, exchange rate, agriculture output, and real GDP contain unit root at level test but stationary at first difference, the study would now conduct cointegration test as suggested through by Johansen and Juselius to see whether if either (1) GDP and Oil Price have common relationship or (2) GDP and Unrest have common relationship or (3) the above mentioned Five (5) macroeconomic variables (GDP, Oil price, Agr output, Exchange rate and Unrest) have a common long run relationship in Nigerian economy. The results of cointegration tests are shown in Tables 2(a and b) to 3(a and b).

From Tables 2(a and b) and 3(a and b), the normal criterion to find the result of trace test, is to compare the trace value with the critical value. If the trace value is higher than the critical value it means there is cointegration. This method of analysis suggests that there is the existence of long run relationship between GDP, as dependent variable and OILP and UNRST as independent variables. This shows thatboth the trace and maximum eigenvalue tests indicate that there are two cointegrating equations at the 5% significance level among the volatility of oil price, unrest and GDP.

From Table 4(a and b), this method of analysis suggests that there is the existence of long run relationship between GDP, as dependent variable and OILP, EXR, AGR, and UNRST as independent variables. This suggests that there are only two cointegrating equation at 5% level of significance i.e. the above table indicates two cointegrating equations at 5% level of significance. Therefore,Table 4(a and b) test statistics indicates that the null hypothesis stated that all variables under study do not have long run relationship can be safely rejected at all levels of significance and not reject the alternative hypothesis by concluding that there is enough empirical evidence to infer that the alternative hypothesis is true. Therefore, these series do have common long run relationship in Nigeria considering the period under review.

Table 2a. Unrestricted cointegration test (trace statistics) between GDP and oil price.

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None *	0.1559	38.063	15.495	0.000
At most 1 *	0.0607	10.263	3.8415	0.001

Source: Researchers computation, E-views 7.1, 2015.

Table 2b. Unrestricted cointegration test (Maximum Eigen Value Statistics) between GDP and oil price.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 critical value	Prob.**
None *	0.1559	27.800	14.265	0.000
At most 1 *	0.0607	10.263	3.8415	0.001

Source: Researchers computation, E-views 7.1, 2015.

Table 3a. Unrestricted cointegration test (trace statistics) between GDP and unrest.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 critical value	Prob.**
None *	0.1445	44.324	15.495	0.000
At most 1 *	0.1079	18.719	3.8415	0.000

Source: Researchers computation, E-views 7.1, 2015

Table 3b. Unrestricted cointegration test maximum Eigen value statistics between GDP and unrest.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 critical value	Prob.**
None *	0.1446	25.605	14.265	0.000
At most 1 *	0.1079	18.719	3.8415	0.000

Source: Researchers computation, E-views 7.1, 2015

Blanchard and Quah (1989) Long run Pattern (SVAR Model)

To achieve the second objective, the study has detailed discussion on Structural vector autoregressive framework by which restrictions are based and supported by economic theory. As already explained for just-identified restrictions to be achieved, we need at least one restriction i.e. n (n +1) / 2 restrictions and following Blanchard and Quah (1989) framework, to test the null hypothesis that oil price shocks and unrest both do have long-run impact on economic growth.

The unrest is regarded to have temporary effect being the research gap; therefore, all the temporary effects are restricted to zero. After estimating the just identified restrictions, the results generated from impulse responses are reported in Figure 1 (a and b). The estimation of SVAR is carried out in a multivariate VAR model. The results of the unit root tests indicate that all the series are I(1) and lag 3 is used which suggests absence of serial correlation.

Figure (1a) presents the impulse responses from an oil

Table 4a. Unrestricted cointegration test (trace statistics).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 critical value	Prob.**
None *	0.6044	222.50	69.819	0.000
At most 1 *	0.2272	70.413	47.856	0.000
At most 2	0.1353	28.145	29.798	0.077
At most 3	0.0257	4.3108	15.495	0.877
At most 4	0.0003	0.0486	3.8415	0.826

Source: Researchers computation, E-views 7.1, 2015

Table 4b. Unrestricted cointegration test maximum eigen value statistics.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 critical value	Prob.**
None *	0.6044	152.09	33.877	0.000
At most 1 *	0.2272	42.268	27.584	0.000
At most 2 *	0.1353	23.834	21.132	0.020
At most 3	0.0257	4.2623	14.265	0.840
At most 4	0.0003	0.0486	3.8415	0.826

Source: Researchers computation, E-views 7.1, 2015

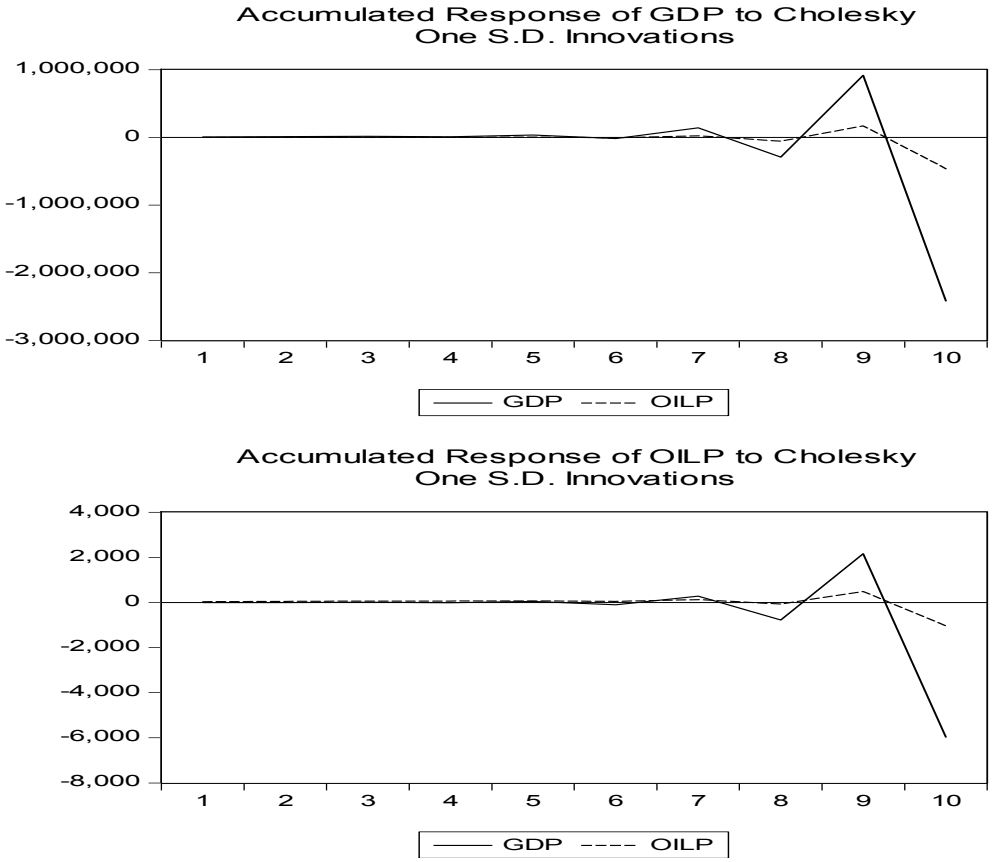

Figure 1a. Impulse responses.

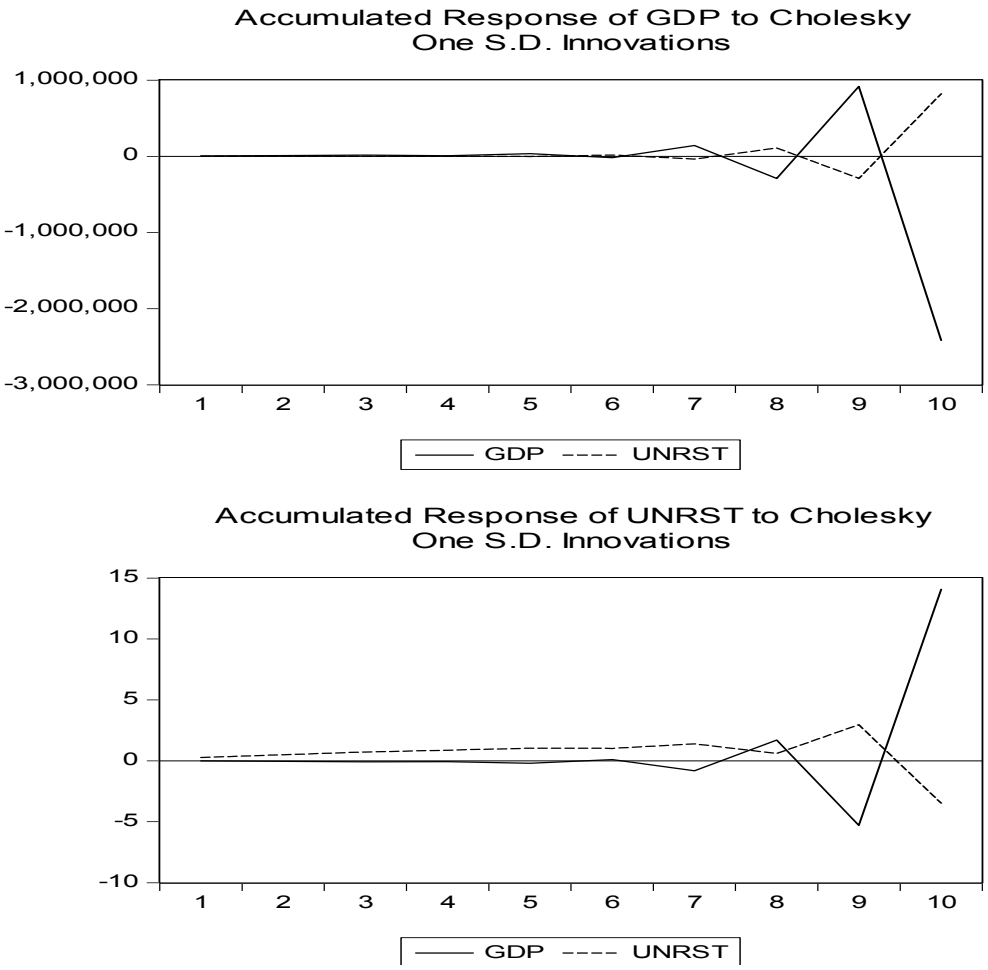

Figure 1b. The bivariate model for *rgdp*and *unrest*.

price to *rgdp*in the bivariate model for *rgdp*and *oil price* variable. It shows that the level of *rgdp* increases to about 0.2% from 1st quarter up to 7th quarters, i.e. the resultant shocks due to *oil price* positively responses which lead to appreciation in the rGDP innovation. Meanwhile, in Figure (1b) shows the bivariate model for *rgdp*and *unrest*. It indicates a negative response of *unrest* to *rgdp* innovations from 1st to 7th quarters but from that quarter it dwindles up to last quarter of the innovations. The results indicate that oil price shocks and unrest in international oil market do have impacts on the economic growth in Nigeria considering the period under review.

More so, the study rejects the null hypothesis that states oil price shocks and unrest do not have long run impact on the economic growth considering the period under review by stating that, there is enough evidence to infer that the null hypothesis is false and that the alternative hypothesis is true. The study concludes that there are enough empirical evidences to infer that the alternative hypothesis is true and these variables have impacts on the economic growth in the long-run.

However, both impulse responses analysis for oil price and unrest depict positive and inverse implications with the level of real GDP respectively. This is consistent with prior expectation of the theory. And also consistent with the VAR results in Aliyu (2009), that positive relationship for both an oil importing and exporting country like Nigeria. In similar findings, there is a need for policy-makers to consider unrest as another source of shocks before oil price shocks being a major source of shocks or fluctuations for many variables in the Nigerian economy as similar prescriptions for New Zealand in the study by Grounder and Bartleet (2007). Looking critically at Figures (1a) impulse responses, we can now have an overwhelming feature of Dutch Disease (resource curse) hypothesis in Nigeria and the same as in Olomola and Adejumo (2006).

Forecast error variance decomposition

Under this fragment, the forecast error variance decom-

Table 5a. Variance decomposition of AGR.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	4626	100.0*	0.000	0.000	0.000	0.000
2	7545	94.98*	1.129	0.405	0.743	2.743
3	2219	96.96*	0.323	0.047	0.180	2.489
4	5888	97.14*	0.321	0.132	0.253	2.155
5	1666	97.38*	0.292	0.069	0.231	2.028
6	4572	97.25*	0.312	0.082	0.239	2.122
7	1.27E	97.28*	0.305	0.073	0.234	2.120
8	3.51E	97.27*	0.307	0.076	0.236	2.110
9	9.74E	97.28*	0.306	0.075	0.235	2.107
10	2.70E	97.27*	0.308	0.076	0.235	2.109

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5b. Variance decomposition of EXR.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	21.96	3.590	96.42*	0.000	0.000	0.000
2	41.44	55.01	44.09*	0.800	0.003	0.099
3	68.45	75.66	20.68*	1.086	0.510	2.067
4	179.35	92.27	5.338*	0.169	0.136	2.096
5	4770.0	96.62	0.769*	0.162	0.298	2.149
6	1340.0	97.14	0.519*	0.071	0.214	2.060
7	3668	97.27	0.289*	0.090	0.246	2.115
8	10168	97.27	0.321*	0.075	0.232	2.110
9	28160	97.28	0.302*	0.076	0.237	2.109
10	78018	97.27	0.308*	0.075	0.235	2.108

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

position tells us exactly how much of the unanticipated changes of the variables are explained by different shocks. The variance decomposition generally suggests that oil price shocks are considerable source of volatility for most of macroeconomic variables. Tables 5(a to e) present the results of the forecast error variance decomposition of rgdp, exchange rate, oil price, agriculture output and unrest at various periods.

Table 5a shows that the variance decomposition of agriculture output accounts for a relative proportion of forecast error due to its own innovation throughout the periods. From the table, oilp, unrst and EXR contributions to agriculture output fluctuations are less than that of rGDP in the given period. I.e. exchange rate, oil price and unrest explain about 0.308, 0.076 and 0.235%, while gross domestic product explains about 2.109% fluctuations in agriculture at 10^{th} periods respectively. Contemporaneously and over the time horizon, agriculture output drives its own variance by over 100% at 1^{st} period.

Table 5b shows that the variance decomposition of exchange rate accounts for the highest proportion of forecast error due to its own innovation in the first period. Exchange rate accounts for 96.42% in the1^{st} period. Its proportion in the 2^{nd} period decreases continually until it reaches 0.308% in the 10th period. While the innovations of rgdp, agriculture output, oil price, and unrest explain about less than one percent in the1^{th}period. AGR increases from 2^{nd} to 10^{th} periods. But the contributions of rGDP, OILP and UNREST to EXR are very small because they dwindle throughout the periods.

Table 5c shows that the variance decomposition of oil price accounts for the highest proportion of forecast error due to its own innovation while the innovations of agriculture output, exchange rate, unrest and rgdp explain about 97.28, 0.306%, 0.235% and 2.109% at 10^{th} period respectively. Contemporaneously and over the time horizon, oil price drives its own variance by over

Table 5c. Variance decomposition of OILP.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	25.39	1.286	1.250	97.47*	0.000	0.000
2	35.86	19.81	5.948	72.68*	0.242	1.319
3	51.83	54.45	3.073	39.30*	0.140	3.137
4	150.3	93.25	0.635	4.661*	0.286	1.169
5	361.0	96.16	0.448	0.929*	0.277	2.183
6	1027.	97.16	0.302	0.159*	0.224	2.159
7	2812.	97.23	0.314	0.096*	0.239	2.118
8	7830.	97.29	0.303	0.075*	0.234	2.097
9	2165	97.27	0.308	0.077*	0.237	2.200
10	6000	97.28	0.306	0.075*	0.235	2.109

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5d. Variance decomposition of UNRST.

VAR DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	0.264	0.022	0.628	0.217	99.13*	0.000
2	0.356	0.235	0.354	2.373	95.79*	1.249
3	0.455	10.37	0.228	5.396	81.93*	2.076
4	0.542	27.06	0.445	5.133	65.72*	1.642
5	1.035	75.48	0.169	1.427	20.81*	2.200
6	2.444	93.55	0.400	0.350	3.713*	2.000
7	6.746	96.70	0.279	0.109	0.790*	2.129
8	18.55	97.30	0.318	0.080	0.286*	2.107
9	51.45	97.26	0.303	0.076	0.248*	2.200
10	142.5	97.27	0.307	0.076	0.236*	2.108

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5e. Variance Decomposition of GDP.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	7286	36.09	0.147	0.724	0.327	62.72*
2	1478	74.00	0.239	0.336	0.097	26.33*
3	2375	84.88	0.219	0.534	0.530	13.83*
4	5712	95.63	0.521	0.105	0.329	3.419*
5	1467	95.93	0.355	0.066	0.205	3.444*
6	4208	97.48	0.279	0.078	0.236	1.932*
7	1156.	97.24	0.309	0.080	0.236	2.140*
8	3206.	97.29	0.306	0.075	0.237	2.095*
9	8880	97.26	0.307	0.076	0.235	2.130*
10	2459	97.28	0.306	0.075	0.236	2.105*

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

97.47% at 1st period.

Table 5d shows that the variance decomposition of unrest accounts for the highest proportion of forecast error due to its own innovation while the innovations of rgdp, exchange rate, agriculture output and oil price explain about 2.108, 0.307% 97.27 and 0.076% at 10th period respectively. Contemporaneously and over the time horizon, unrest drives its own variance by over 99.13% at 1st period. After the 1st and 2nd periods, UNRST deceases drastically to 0.236% in 10th period which is less than the proportions of rGDP, EXR, and AGR in the 10th periods (i.e. 2.108, 0.307 and 97.27%).

Table 5e shows that the variance decomposition of rGDP accounts for the highest proportion of forecast error due to its own innovation. This means that the fluctuations of GDP are explained mainly by GDP shocks and other variables shocks, in the long run. Gross Domestic Product (GDP) accounts for 63.72% in the 1st period. Its proportion decreases continually until it reaches 4.04 % in the 10th period. EXR, OILP, AGR and OILP shock account for less that 1% in the1st period. But AGR proportion increases over time and reaches 94.56% in the 10th period. While, the proportion of EXR, OILP and UNRST dwindles over time from the 2nd – 10th periods. The result shows that in the long run Agriculture output shocks account for the major variation in gross domestic product.

DISCUSSIONS/POLICY IMPLICATIONS

The policy implications of the results from VAR and Structural VAR have striking issues in the forecasting performance of an estimate; estimation using Structural VAR has error band while using unrestricted VAR has no error band. The findings from this study indicated usefulness of these variables through their contributions in predicting future path of Nigerian economic growth. Jimenez-Rodreguez and Sanchez (2012), Olomola and Adejumo (2006) reported similar result with respect to oil price shocks both in the Nigerian economy and Japan economy. In the analysis, agriculture output has the highest long run contribution, followed by exchange rate then oil price. It is widely accepted that agricultural output contributes to economic growth.

Nevertheless, the result from the estimated regression output is in line with a priory expectation. In other words, it mirrors the fact that unrest has ripple effect on the economy. However, considering the research scope, unrest has inverse ripple effect on the Nigerian macroeconomic variables with its coefficient correctively signs. This suggests that, to achieve meaningful macroeconomic targets as far as Nigerian economy is concerned, emphasis should be geared towards addressing unrest.

In addition to the above, the number of cointegrating relationship has also played a key role in this line of exercise. So, to impose restrictions to recover the shocks in oil price and unrest, the study will now have to refer back to the number of cointegrating vectors. As for the broad objective, the study normalizes the coefficients of the regression, with one cointegrating equation; the theory needs only one restriction, that is, the just identified restriction.

To this end, this study examines the impact of oil price shocks on rGDP, exchange rate, agriculture output and unrest on the Nigeria's economic growth. Since Nigeria is an oil producing country, naira real exchange rate appreciates with higher oil prices leading to higher inflow of foreign exchange into the economy. Although this may sound good to the economy, unrest has ripple effect on real economic activities as it reduces the volume of oil output and this translates into less optimum revenues.

CONCLUSION AND RECOMMENDATIONS

In conclusion therefore, unrestricted VAR has been extensively used in recent empirical research to assess the evidence in support of central proposition of macroeconomics, such as the impact of oil price shocks and aggregate variables. Estimated impulse response and forecast error variance decomposition have also played a key role in these exercises. The approach has been vigorously pursued following the research of Blanchard and Quah (1989).

The study raises some important issues about what is expected to be learning from this line of empirical research. The asymptotic analysis shows that in studying shocks or volatility on frequencies of annual data the clustering effect is gone.

Some previous research as e.g. Olomola and Adejumo (2006) has shown that estimated impulse response can be very sensitive to changes in VAR model specification, such as the inclusion of trends and additional variables; and there has been debate about the robustness of the empirical findings in this line of research. This result corroborates with earlier findings on unrestricted VAR impulse response, given a clear analytical reasons why impulse responses from unrestricted VARs are unreliable even in very large samples and show that different models in the VAR class produce impulse response with very different behavior. Model like unrestricted VAR has no theory supporting it and then produces inconsistent impulse responses. It is particularly important that the cointegrating relations in a system (hence the number of unit roots) be estimated consistently.

In general, the results upon being a pioneer study for controlling the effect of unrest (systemic risk) to the study impact of oil price shocks with an approach that follows structural econometric model, while there are certainly differences in forecasting performance in time series

models, the most serious disagreements between time series model arise in policy analysis. The main conclusion is that, differing treatment of cointegration in the models plays a big role in affecting the outcomes of policy analysis. Although this issue was not investigated in the previous empirical assessment, it seems likely (by analogy to the result for structural – just identifying restriction approach) that similar effect to those had discovered come into play in structural econometric models when unit roots or near unit roots are estimated.

Therefore, the study recommends that government shoulddiversify the economic base from oil to non-oil as a necessary condition for sustainability and growth.Also government should improve the security in the Niger Delta area with a view to boosting oil output, hence leading to increase oil revenue and by implication growth of the economy.

Finally, in analyzing economic shocks we have to be careful in the choices of variables; the study recommends carrying out misspecification tests of no-serial correlation, normality and heteroscedasticity tests for the model. In this case the study recommends diagnostics test.

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