OIL PRICE SHOCKS AND NIGERIA'S MACRO ECONOMY

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Abstract

A steep upward trend in the price of crude oil in recent years, reaching a record nominal high in mid-2008, has led to increasing concern about its macroeconomic implications, both abroad and in Nigeria given that the Nigerian economy is highly vulnerable to oil price fluctuations. This paper analyses the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying a VAR approach. The study points out the asymmetric effects of oil price shocks; for instance, positive as well as negative oil price shocks significantly increase inflation and also directly increases real national income through higher export earnings, though part of this gain is seen to be offset by losses from lower demand for exports generally due to the economic recession suffered by trading partners. The findings of the study show a strong positive relationship between positive oil price changes and real government expenditures. Unexpectedly, the result identifies a marginal impact of oil price fluctuations on industrial output growth. Furthermore, the "Dutch Disease" syndrome is observed through significant real effective exchange rate appreciation.

Key words: macroeconomic fluctuations, oil price shocks, developing economies, Nigeria VAR modeling

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1. Introduction

Oil prices have risen significantly over the last several years. Crude oil prices have increased on average from US $25 per barrel in 2002 to US $55 per barrel in 2005. An increase in petroleum prices tends to have a contractionary impact on world demand and growth in the short term. Higher crude oil prices raise inflation, with the magnitude depending in part on the extent of labor market flexibility (wage-cost push inflation) and the ability of producers to pass on cost increases to consumers. Over time, the impact of rising oil prices on activity and inflation depends also on policy responses and supply side effects (IMF, 2005).

This steep upward trend in the price of crude oil in recent years, reaching a record nominal high of US $147 in mid-2008 and a sharp drop to US $46 a barrel, has led to increasing concern about its macroeconomic implications, both abroad and in Nigeria. Nigeria is highly vulnerable to fluctuations in the international oil market despite being the 6th largest producer of oil in the world. This is given the fragile nature of the Nigerian macro economy and the heavy dependence on crude oil proceeds.

Theoretically, an oil-price increase leads to a transfer of income from importing to exporting countries through a shift in the terms of trade. The magnitude of the direct effect of a given price increase depends on the share of the cost of oil in national income, the degree of dependence on imported oil and the ability of end-users to reduce their consumption and switch away from oil. It also depends on the extent to which gas prices rise in response to an oil-price increase, the gas-intensity of the economy and the impact of higher prices on other forms of energy that compete with or, in the case of electricity, are generated from oil and gas. Naturally, the bigger the oil-price increase and the longer higher prices are sustained, the bigger the macroeconomic impact (Majidi, 2006).

It is generally argued that for net oil-exporting countries, a price increase directly increases real national income through higher export earnings, though part of this gain would be later offset by losses from lower demand for exports

generally due to the economic recession suffered by trading partners. Whereas in net oil-importing countries, higher oil prices lead to inflation, increased input costs, reduced non-oil demand and lower investment. Tax revenues fall and the budget deficit increases, due to rigidities in government expenditure, which drives interest rates up. Because of resistance to real declines in wages, an oil price increase typically leads to upward pressure on nominal wage levels. Wage pressures together with reduced demand tend to lead to higher unemployment, at least in the short term. These effects are greater the more sudden and the more pronounced the price increase and are magnified by the impact of higher prices on consumer and business confidence (Wakeford, 2006, Majidi, 2006).

The present study is motivated by the fact that Nigeria relies heavily on crude oil export revenues, representing about 90 per cent of total export earnings and on average about 70 per cent of government revenues in annual budgets. [2] This has severe implications for the Nigerian economy given the current, wide swings in oil prices in the international oil market. It is therefore vital to analyse the effect of these fluctuations on the Nigerian macro economy and possibly trace the channels of transmission of oil price shocks to the Nigerian economy. Consequently, the specific objective of this study is to analyse the impacts of oil price shocks on key macro economic variables in Nigeria and measure the magnitude of such impacts. It draws implications for macroeconomic policy, and the government's vision 2020 agenda. The paper adopts a Vector Autoregressive (VAR) Model and quarterly series from 1970-2007 for the estimation.

2. Oil Price Shocks in Nigeria

Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Hamilton, 1983; Wakeford, 2006). These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas,

[2] In fact annual budgets are formulated in Nigeria based on oil prices. The 2009 budget was revised in line with the prevailing market price of oil indicative of huge dependence of Nigeria on oil proceeds.

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)[3]. Two issues are identified regarding the shocks; first is the magnitude of the price increase which can be quantified in absolute terms or as percentage changes, second is the timing of the shock, that is, the speed and persistence of the price increase.

Going by the foregoing, four oil shocks can be 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, and 2003-2006 periods were associated with price increases while the oil market collapse of 1986 is an episode of price decrease. During the first oil shock in Nigeria (1973-74), the value of Nigeria's export measured in US dollars rose by about 600 per cent with the terms of trade rising from 18.9 in 1982 to 65.3 by 1974. Government revenue which stood at 8 per cent of GDP in 1972 rose to about 20 per cent in 1975. This resulted in increased government expenditure owing largely from the need to monetize the crude oil receipts. Investment was largely in favour of education, public health, transport, and import substituting industries (Nnanna and Masha, 2003).

During the oil price shock of 2003-2006, Nigeria recorded increases in the share of oil in GDP from about 80 per cent in 2003 to 82.6 per cent in 2005. The shock was gradual and persisted for a while. This could be regarded as a permanent shock. The result of the shock was a favourable investment climate, increased national income within the period although a slight decline was observed in the growth rate of the GDP.

Despite this perceived benefit of oil price change, the macroeconomic environment in Nigeria during the booms was undesirable. For instance inflation was mostly double digit in the 1970s; money supply grew steeply, while huge fiscal deficits were also recorded. Reported in Table 1 are selected macroeconomic indicators in Nigeria. A plausible explanation for the dismal performance of the indicators is the inefficient management of crude oil receipts

[3] This study is concerned primarily with positive oil price shocks.

by the government. It has been observed that there were weak institutions which were ill-equipped to conceive and implement major investment projects with the proceeds of the windfall.

From the turn of this century, events seem to point towards improved economic management. The external reserve position improved from $5.5 billion in 1999 to about $2.8 in 2005, while the huge gross public debt was reduced following protracted negotiations which resulted in a debt relief by the Paris club. The fiscal reforms involving saving part of the windfall appear to have contributed to the improvements. The ongoing reforms, fiscal restraint, budget preparation process, efforts to check corruption among others if sustained should enable Nigeria benefit immensely from positive oil price shocks.

Table 1: Selected Macroeconomic Indicators in Nigeria (1970-2006)

Year	Inflation Rate (%)	Money Growth(%)	Real Interest Rate(%)	Deficit/GDP Ratio(Nm)	GDP Growth(%)
1970	13.8	43.7	-6.3	-8.7	25
1975	33.9	52.1	-24.9	-2	-5.2
1980	10	50.1	-0.4	-3.9	4.2
1985	5.5	8.4	6.25	-2.1	9.7
1990	7.4	29.5	13.2	-4.4	-8.2
1995	72.8	16.3	52.01	0	-2.5
1998	10.8	17.2	11	-3.3	-1.9
2000	6.9	13.3	23.1	-1.5	3.8
2002	20.2	21.6	3.8	-3.8	1.5
2003	14.0	24.1	7.6	-2	10.7
2004	10.0	26.6	5.4	-1.5	6.58
2005	11.6	30.8	1.6	-1.1	6.51
2006	8.6	27.82	10.1	-0.6	5.63

Source: Central Bank of Nigeria: Statistical Bulletin and Annual Report and Statement of Accounts various issues.

3. Literature Review

Over the past twenty years, dozens of scholars have explored the relationships between oil price shocks and the macroeconomic performance of national economies. Different methods of analysis have yielded different results, sometimes sharply different, sometimes modestly.

The empirical literature on the macroeconomic impacts of oil supply shocks evolved as the new state of the oil market revealed itself gradually after 1973. One of the initial beliefs following the 1973-74 price shock was that the new, higher price of oil might be a permanent feature of a changed natural resource regime. Accordingly, one recurrent theme was the aggregate economy's response to a sudden, permanent price shock. How would an economy adjust to the new circumstances? This assumption underlies Rasche and Tatom's (1977, 1981) application of the potential GNP concept to the oil price shock problem and continues as late as the work of Bruno and Sachs (1982, 1985) on adjustment to supply shocks. Even Eastwood's (1992) investigation of the implicit substructure of some oil-macro simulation models assumes a single, permanent price shock.

Another theme in the empirical macroeconomic studies of the oil price shocks has been what could be called the attribution issue: to what extent was recession caused by the oil price shocks, government policies, or other events? Rasche and Tatom's estimate of a 7% long-run reduction in real GNP due to the 1973-74 oil price increase appeared suspiciously high to a number of macro economists who focused on the share of oil in GNP.[4]

Darby (1982) estimated the impact of the 1973-74 oil price shock on real income in eight OECD countries. He was unsatisfied with the ability of the available data to distinguish among three factors that may have contributed to the recession: the oil price shocks; a largely independent course of monetary policy fighting inflation in the wake of the 1973 collapse of the Bretton Woods system; and a partly statistical partly real effect of the imposition and subsequent elimination of price controls over the period 1971-75. Darby looked forward to the

[4] See for example, Tobin, 1980, pp. 31-34.

availability of internationally comparable data which would permit similar investigation of the 1979-80 oil price shock, but this line of research has not been pursued consistently since the early 1980s.

James Hamilton's (1983) study of the role of oil price shocks in United States business cycles has had considerable influence on research on the macroeconomics of oil price shocks. As Mork's (1994) review paper outlines, economists worked for nearly a decade on methods of incorporating oil price shocks into macroeconomic models before a synergy developed between real business cycle (RBC) models and oil price shocks. An oil price shock proved to be a believable mechanism which yielded the unanticipated, temporary supply shocks needed by the RBC models. The subsequent decline of the real oil price, despite the two shocks of the 1970s, appeared to put a new light on the origins and the probable future of oil price shocks. To the extent that the oil market had undergone a permanent change in the fall of 1973, that change seemed to be more one of moderately effective cartel power centered in a politically unstable part of the world than one of a permanent shift into escalating scarcity of minerals. Subsequent research on OPEC supply behavior (Griffin, 1985; Jones 1991; Dahl and Yücel, 1991; Wirl, 1990) and on the predictive capability of the Hotelling exhaustible resource model in the oil market (Watkins 1992) has reinforced this unfolding interpretation of the events of oil market events of the 1970s and 1980s. Hamilton (1983) shifted the macroeconomic analysis of oil shocks from demand-side phenomena to the supply side, a movement which Rasche and Tatom's supply oriented analyses had not entirely accomplished, and relied on the statistical concept of Granger causality to test for directions of effect in a business cycle setting of recurrent shocks.

In a more recent study, Wakeford (2006) assessed the impact of oil price shocks on the South African macro economy. The study traced the history of oil shocks and their impact on South Africa. The findings reveal that while commodity exports-especially gold-provided an initial buffer, the economy was not immune to sustained price shocks. The paper considered the outlook for future oil shocks and their possible impact, given South Africa's strengths and

vulnerabilities. The study concludes that while there are several short-run supply risks, the major threat is the inevitable peaking of oil production which may occur within 5 to 10 years. This, the study argues will result in recurrent oil shocks and greater volatility and recommended governments' accelerated action on the shared growth initiative to cushion the effect of the shocks.

Similarly, Bartleet and Gounder (2007) examined oil price shocks and economic growth in Venezuela using the Vector Autoregressive (VAR) methodology based on quarterly data. Three oil price measures were considered, following the various theoretical implications that oil price shocks have on economic growth. The authors analysed the short-run impact of oil price shocks in a multivariate framework which traced the direct economic impact of oil price shocks on economic growth as well as indirect linkages. Furthermore, the models employed the linear oil price and two leading nonlinear oil price transformations to examine various short-run impacts. A Wald and Likelihood Ratio tests of Granger Causality, was utilized and the results indicated that linear price change, the asymmetric price increase and the net oil price variables were significant for the system as a whole, whereas the asymmetric price variables was not. Following the causality analysis of oil price nexus, the generalized impulse responses and error variance decompositions the authors reaffirmed the direct link between the net oil price shock and growth, as well as the indirect linkages. They concluded that since oil consumption continued to increase in New Zealand, there is a need for policy-makers to consider oil price shocks as a major source of volatility for many variables in the economy.

The literature on the impact of oil price shocks on developing oil producing/supplying countries is scant. The main focus of research has been on net oil importers and developed countries. Some limited studies have been conducted on the effects of oil price changes on the macro economy of developing countries. In these studies, net oil exporters are the centre of focus.

Eltony and Al-Awadi (2001) in a study on Kuwait find that linear oil price shocks are significant in explaining fluctuations in macro economic variables in Kuwait. The results reveal the importance of oil price shocks in government

expenditures which are the major determinants of the level of economic activity in Kuwait.

Raguindin and Reyes (2005) examined the effects of oil price shocks on the Philippine economy over the period 1981 to 2003. Their impulse response functions for the symmetric transformation of oil prices showed that an oil price shock leads to a prolonged reduction in the real GDP of the Philippines. Conversely, in their asymmetric VAR model, oil price decreases play a greater role in each variable's fluctuations than oil price increases.

In a related study, Anshasy *et al.* (2005) assessed the effects of oil price shocks on Venezuela's economic performance over a longer period (1950 to 2001). The study adopted a general to specific modeling VAR and VECM technique to investigate the relationship between oil prices, governmental revenues, government consumption spending, GDP and investment. The results found two long-run relationships consistent with economic growth and fiscal balance. Furthermore, they found that this relationship is important not only for the long-run performance but also for short-term fluctuations.

Olomola (2006) investigated the impact of oil price shocks on aggregate economic activity (output, inflation, the real exchange rate and money supply) in Nigeria using quarterly data from 1970 to 2003. The findings revealed that contrary to previous empirical findings, oil price shocks do not affect output and inflation in Nigeria significantly. However, oil price shocks were found to significantly influence the real exchange rate. The author argues that oil price shocks may give rise to wealth effect that appreciates the real exchange rate and may squeeze the tradable sector, giving rise to the "Dutch-Disease". The present study differs from Olomola (2006) by introducing more variables into the VAR model such as government expenditure and real imports. This is considering the fact that about oil proceeds account for about 90 per cent of total government revenue in Nigeria. In addition, Nigeria is an import dependent country implying that oil price shocks do have implications for imports and government expenditure in Nigeria. It also uses industrial output as a measure of output as against GDP.

From the foregoing, most of the empirical studies carried out have focused on the oil importing economies, particularly the developed economies. Few studies exist yet on the effect of oil price shock on key macroeconomic variables for an oil exporting country as Nigeria. This study intends to fill this gap. The paper, thus, overlaps with, and draws on relevant aspects of the foregoing studies but defines its scope somewhat differently as earlier stated in the objective of the study.

4. Data and Methodology

The study adopts quarterly observations for the period 1970 to 2007. This period is chosen to capture the first and second oil boom periods of the 70s and mid-2000s respectively. Data for the study are quarterly series and are obtained from the IFS CD Rom 2007. Quarterly series are preferred as it increases the data points and provides greater degrees of freedom. All variables except inflation are in logarithmic terms. A proper definition of oil prices is a difficult task. Here oil prices are used in real terms, taking the ratio of the average world nominal oil price in US dollars to the US Consumer Price Index extracted from IFS database. The definition of oil prices adopted for the study is symmetric oil price growth rates as well as Mork's asymmetric definition of oil price changes.

Other variables are defined as follows;

- Real industrial production (rgdpi) measures industrial value added per capita. The variable is measured at 1990 constant prices and is obtained from the central bank of Nigeria statement of accounts various issues.
- Real effective exchange rate (reex) is the nominal effective exchange rate adjusted for inflation rate differentials with the US price index as the main trading partner of Nigeria. The definition of real exchange rate is such that an increase means a real appreciation of the naira. An appreciation is meant to hurt the economy's external competitiveness and vice versa for a decrease. Data on (reex) is obtained from the IFS CD Rom database.

- Real Public Expenditure (rgex) is total government expenditure based on 1990 constant prices, adjusted for inflation.
- Real oil price (roilp) is the quarterly nominal average world oil prices deflated by the US consumer price index. Data is obtained from the IFS CD Rom.
- Inflation (inf) is defined as the annual changes in CPI of the Nigerian economy obtained from the IFS CDRom.

5. Empirical Methodology

To investigate the response of macroeconomic variables to asymmetric and innovations in oil prices, an unrestricted Vector Autoregressive model (VAR) is adopted. The VAR model provides a multivariate framework where changes in a particular variable (oil price) are related to changes in its own lags and to changes in other variables and the lags of those variables. The VAR treats all variables as endogenous and does not impose *a priori* restrictions on structural relationships. Since the VAR expresses the dependent variables in terms of predetermined lagged variables, it is a reduced-form model. Once the VAR has been estimated, the relative importance of a variable in generating variations in its own value and in the value of other variables can be assessed (Forecast Error Variance Decomposition (VDC)). VDC assesses the relative importance of oil shocks in the volatility of other variables in the system. The dynamic response of macroeconomic variables to innovations in a particular variable can also be traced out using the simulated responses of the estimated VAR system (Impulse Response Functions (IRF)). Thus, the IRF enables the determination of the dynamic effects of oil price shocks on the Nigerian macro economy. The unrestricted VAR model of order p is presented in equation (1)

$$y_t = A_1 y_t + \ldots + A_p y_{t-p} + B z_t + \varepsilon_t \qquad (1)$$

Where yt is a vector of endogenous variables, zt is a vector of exogenous variables, Ai and B are coefficient matrices and p is the lag length. The innovation process et is an unobservable zero-mean white noise process with a

time invariant positive-definitive variance –covariance matrix. The VAR system can be transformed into its moving average representation in order to analyse the system's response to real oil price shock, that is:

$$y_t = \mu \sum_{i=0}^{\infty} \gamma_i \varepsilon_{t-1} \qquad (2)$$

Where γ_0 is the identity matrix, μ is the mean of the process. The moving average representation is used to obtain the forecast error variance decomposition and impulse response function.

In the restricted VAR models, the vector of endogenous variables, according to our first Cholesky ordering, consists of real oil price (roilp,), real government expenditures (rgex), real industrial GDP per capita (rgdpi)., inflation (inf), real effective exchange rate (reex), and real import (rimp):

$$y_t = [roilp, rgex, rgdpi, \inf, reex, rimp] \qquad (3)$$

The innovations of current and past one-step ahead forecast errors are orthogonalised using Cholesky decomposition so that the resulting covariance matrix is diagonal. This assumes that the first variable in a pre-specified ordering has an immediate impact on all variables in the system, excluding the first variable and so on. In fact, pre-specified ordering of variables is important and can change the dynamics of a VAR system. The vector of exogenous variables is given by:

$$z_t = [constant, D1, D2, D3, D4, D5] \qquad (3)$$

where D1-D5 refers to all other important exogenous variables during the period 1970-2006.

In the ordering of the variables, the real oil price changes are ranked as a largely exogenous variable, especially for the case of the Nigerian economy. Although Nigeria is one of the major suppliers of crude oil to the global markets, its production and export quota are predetermined by the OPEC criteria, domestic consumption and investment in oil fields. In addition, demand for crude oil is largely determined by global economic growth, energy intensity within industrialized economies, speculator operations in oil markets, the policy of key oil consumers on strategic petroleum reserves, among others. Hence, oil prices are regarded as exogenous for the Nigerian economy. It is expected that significant shocks in oil markets affect contemporaneously the other key macro economic variables in the system.

The second variable in the ordering is government expenditures. Government expenditures can broadly be defined as recurrent and capital consumptions. Recurrent expenditures include expenditures on government employees, subsidies, etc, while capital expenditures aim to add rather than maintain the physical and material assets of an economy. A pattern observed for Nigeria since 1970 is the large growing wage bill, which reflects the trend and magnitude of government spending. The role of government has also been on the increase since 1970 reflected in the expansion in total government spending. This is owing to the fact that the government is the main recipient of oil rents and tries to distribute them through increase in salaries and subsidies which blow up government spending. These implicit subsidies cover consumption of petroleum products and long-term loans. Another measure of increased government activities is the sustained budget deficit witnessed by the Nigerian economy for about 30 out of the 38years under review. These rank government expenditure as an exogenous variable in the first ordering.

Industrial production is also affected instantly by the level of government demand. The industry production per capita as a proxy for real per capita income feeds into changes in inflation. The positive development in oil prices, which results in higher levels of government expenditures and income per capita, pushes the effective demand upward. In addition, the limited capacity of domestic

supply and inefficiencies as well as time lags in response to increased demand may push the general consumer prices upward, fuelling inflation.

The increase in inflation results in real effective exchange rate appreciation. The real effective exchange rate measures the relative prices of non-tradable goods to tradable goods and is a measure of the competitiveness of an economy. The real effective exchange is defined as a weighted real exchange rate index, with the weights assigned to trading partners of the local economy. If domestic prices increase, while prices abroad remain unchanged, this would increase the relative prices of non-tradable leading to a fall in the competitiveness of an economy. In this study, we assume that a shock in real effective exchange rate contemporaneously affects real imports in Nigeria. As indicated earlier, any significant developments in exchange rate markets will affect the competitiveness of Nigerian products in the international market as well as foreign trade.

6. Empirical results

This section presents the empirical results of the analysis beginning with the time series properties of the variables used for the estimation. This is meant to ascertain the appropriateness of the specification and determine the underlying properties of the data generating process. Following this, the empirical results are presented.

6.1 Unit Root Results

The analysis is based on time series data. This therefore requires some specific approaches to the analysis. It is generally known that the econometric estimation of a model based on time series data demands that the series be stationary as non-stationary series usually result in misleading inferences. Engle and Granger (1987) provide a standard technique to deal with this problem. This involves testing the variables of an equation for stationarity. The estimation therefore begins by conducting stationarity test to ascertain the stationarity or otherwise of the variables and the appropriateness of the specification for VAR

estimation. Thus, both the Augmented Dickey and Fuller (1979) and the Phillips and Perron (1988) tests are employed. The ADF- tests and PP-tests are reported in Table 1. The results show that the variables expressed in logs are non-stationary. When all variables are first differenced, there is evidence that all variables are stationary. Since the variables in the model follow an I (1) process, the second step is to test if a long run relationship (cointegration) exists among the variables. To test this, the study adopts Johansen maximum-likelihood approach[5] Harris (1995) raises the issue of intercept and trend being included in the short- and/or long- run model. To ascertain this, all five deterministic trend models considered Johansen (1995) were adopted. The number of cointegrating relations from all five models, on the basis of trace statistics and the maximal eigenvalue statistics using critical values from Osterwald –lenum (1992) at 5% level, are summarized in tables 2 and 3 below.

Table 1: Unit Root Test

Variable	ADF				PP			
	Without Trend		With Trend		Without Trend		With Trend	
	Level	First Diff	Level	First Diff	Level	First Diff	level	First Diff
rgdpi	-0.76	-4.62***	-2.00	-6.13***	-0.81	-16.43***	-2.01	-17.6***
rgdp	-2.65*	-4.05***	-2.16	-6.34***	-2.01*	-15.45***	-2.03	-15.6***
reex	-1.21	-11.69***	-2.01	-11.6***	-1.34	-11.23***	-3.43	-11.5***
inf	-3..06**	-6.32***	-3.01*	-8.26***	-3.30	-8.76***	-2.03	-9.12***
rgex	-1.05	-18.13***	-1.32	-16.3***	-1.23*	-35.8***	-4.12*	-42.51***
rms	-0.68	-6.42***	-2.45	-7.6***	-0.76	-30.7***	-8.72**	-28.34***
rimp	-2.04	-14.14***	-1.65	-8.45***	-8.53***	-25.6***	-8.56***	-31.31***
roilp	-8.76***	-10.04***	-6.98***	-15.4***	-7.82***	-25.7***	-9.5**	-28.65***

Source: Compiled by author

*Note: *, **, *** represent significance at 10, 5 and 1 per cent respectively.*

[5] See Johansen (1991,1995) for details.

Table 2: Cointegration Results

Maximal eigenvalue statistic			Trace Statistic		
Rank	H+	H	Rank	H+	H
r=0	118.44***	121.23***	r=0	150.34***	130.41***
r=	75.98***	82.32***	r≤1	120.23***	84.23***
r=2	24.93	28.87	r≤2	41.10	23.18
r=3	6.76	11.25	r≤3	6.78	8.65
r=4	0.84	2.63	r≤4	0.69	1.89

Note *** indicates 1 per cent confidence level.

Source: Compiled by author.

The results of the maximal eigenvalues and trace test statistics for the two models are presented in Table 3. The procedure adopted to determine the number of cointegrating vectors begins with the hypothesis that there are no cointegrating vectors and with trends, H+. A rejection of the hypothesis would lead to testing the alternative hypothesis of no cointegrating vectors, and no trend, H. The testing procedure continues until the hypothesis cannot be rejected.

The result of the test statistics indicate that the hypothesis of no cointegration among the variables can be rejected for Nigeria the results reveal that at least two cointegrating vectors exist among the variables of interest. Considering the existence of long-term equilibrium relationships among non-stationary variables in the system the analysis employs an unrestricted VAR system in levels. The optimal lag length is 4. In addition, since the variables are cointegrated, the equations of the VAR also include the lagged values of the variables in levels to capture their long-run relationships.

6.2 Variance Decomposition

The results are summarized in Table 3. Following Table 3, analyses of the variance decomposition are provided. The essence of the variance decomposition is that it measures the proportion of forecast error variance in one variable explained by innovations in itself and the other variables. But it should be noted that the VAR was estimated with the sets of contemporaneous structural restrictions specified in the equations. First, the result of the likelihood ratio test on the adequacy of the identifying restrictions on the model was 27.45.

Table 3: Variance Decomposition of roilp

Quarter	roilp	rgex	rgdpi	inf	reex	rimp	rms
Variance decompositions for rgex							
1	0.76	90.27	0.01	0.02	0.02	0.00	0.00
4	2.64	76.15	7.94	3.71	4.72	3.48	1.23
8	5.47	65.42	11.21	2.36	12.68	12.45	2.34
12	6.98	58.56	15.05	2.75	12.81	10.60	0.65
Variance decomposition for rgdpi							
1	0.01	6.31	95.34	0.01	0.02	0.01	0.08
4	2.51	5.05	81.51	5.23	7.05	6.54	9.07
8	6.21	4.54	76.56	5.12	6.51	5.23	14.34
12	6.08	3.47	82.13	4.04	5.24	3.42	17.32
Variance decomposition for inf							
1	2.43	2.45	0.01	97.27	0.01	0.00	5.34
4	2.01	7.18	4.45	87.57	1.24	0.78	23.43
8	1.85	11.21	20.65	55.56	7.04	1.90	26.56
12	1.34	10.34	23.69	45.71	10.62	4.35	15.34
Variance decomposition for reex							
1	49.21	2.93	0.23	1.24	95.12	0.00	0.01
4	42.13	4.76	0.34	4.64	87.23	6.51	5.12
8	34.02	4.18	0.43	5.07	71.24	4.67	6.01
12	33.06	3.67	0.78	5.86	72.81	4.80	1.43
Variance decomposition for rimp							
1	1.23	1.76	4.80	1.46	0.01	77.23	0.13

4	9.87	3.23	3.23	8.23	8.67	65.32	1.23
8	9.78	3.78	2.34	13.24	13.23	54.87	1.34
12	10.46	3.98	2.35	14.23	15.34	46.23	2.43
Variance decomposition for rms							
1	0.01	2.12	0.00	0.03	4.34	0.01	98.78
4	10.01	10.23	0.24	0.01	6.31	2.23	90.45
8	19.87	12.23	0.54	0.02	10.98	4.34	78.42
12	20.21	24.12	0.76	0.07	14.07	3.10	75.12

Source: compiled by author

- **Government Expenditure**

The variance decomposition shows that the response of real government expenditure to a one standard deviation shock to positive oil price changes was significantly different from zero. This result confirms the huge monetization of crude oil receipts and subsequent increase in government expenditure as explained earlier. However, with the introduction of an oil stabilization fund by the central bank to save some part of oil windfalls, the picture may differ in future. This result contradicts that of Farzanegan and Markwardt (2008) where positive oil shocks accounted for an insignificant variation in government revenue.

- **Real Imports**

Real import response to a shock in real oil prices is positive and lasts until the end period. The increasing response of real import for the first quarters after initial shock is significantly different from zero. The positive response of real imports to positive shocks act as a built-in stabilizer, mitigating the inflationary effects of increased money supply after positive oil price shocks. The long-run decreasing trend, albeit not statistically significant, of CPI inflation may be due to increased import volumes. In Nigeria, import volume has increased significantly over the years.

- **Real Exchange Rate**

The variance decomposition suggests that shocks to oil price as presented in table 4 accounted for about 49 per cent of shocks to real exchange rate in the 1st

quarter declining in effects to about 34 per cent in the 8th quarter, and further to about 33 per cent in the 12th quarter. Money supply shocks contributed about 5 per cent of the shocks to real exchange rate in the 4th quarter rising marginally to about 6 per cent in the 12th quarter. The contribution of output shocks to the shocks in the real exchange rate is not very significant. The result shows a less than 1 per cent contribution over a twelve-month period. Shocks to inflation contributed an average of 5 per cent to real exchange rate shocks over the 4th quarter to the 12th quarter. This finding is consistent with Amano and Van Norden, 1998 and Olomola, 2006). On the whole, a high oil price may have given rise to wealth effects that appreciates the exchange rate. This squeezed the tradable sector and resulted in the "Dutch-disease syndrome in Nigeria.

- **Money Supply**

An interesting aspect of the result is that both oil price shocks and shocks to the real exchange rates affected domestic money supply at long lags. This supports earlier studies that monetary policy responds to oil price shocks with a lag (Bernanke et al. 1997; Bohi, 1989). For instance, the result shows that in the first quarter, oil price shocks did not contribute to the shocks in money supply until the 4th, 8th and 12th quarters where oil shocks contributed about 10, 19 and 20 per cent respectively to variations in domestic money supply. On the other hand, the effect of real exchange rate shock averaged about 4 per cent in the first period, rising to about 6 per cent in the fourth quarter, 11 per cent in the 8th quarter and 14 per cent in the 12th quarter. Real output shock accounted for about 0.4 per cent over the entire 12 quarters. Similarly, the contribution of inflation rate shocks to shocks in money supply was 0.03 per cent for the first quarter, rising to a marginal figure of 0.7 per cent in the tenth quarter.

- **Output**

The result of the study indicates that oil price shocks do not significantly affect industrial output in Nigeria. This contradicts the expectations that oil price shocks tend to lower GDP (Gordon, 1989); impacts significantly on industrial

output growth Farzanegan and Markwardt, 2008) and confirms the findings of (Barsky and Kilian, 2004 and Olomola, 2006) and that oil price shocks had marginal impact on output. Specifically, the empirical result indicates that money supply accounted for the largest variations in output. For instance, about 0.08 per cent of the shocks in the output in the first quarter were as a result of variations in money supply. This rose to about 9 per cent in the fourth quarter, 14 per cent in the eighth quarter and about 17 per cent in the twelfth quarter. The oil price shocks contributed about 2.5 per cent to shocks in output in the fourth quarter, and averaged about 6 per cent over the eighth and tenth quarters. For inflation rate shocks, the contribution to output declined from about 5 per cent in the fourth quarter through 5 per cent in the eighth quarter to about 4 per cent in the twelfth quarter.

- **Inflation**

The inflationary effects of oil price shocks on the Nigerian economy can be explained through the AD-AS model. Increasing oil revenues contribute to higher levels of government expenditure. Considering the dominant role of the government in the domestic economy, which is beyond the budgetary expenditures and includes great implicit expenditures (e.g various oil subsidies, salaries and wage bills of government employees e.t.c), current and capital expenditures of the government will rise as oil revenue rises. In addition, given that net foreign reserves of the central bank increases, the money supply will increase. The increased money supply and government expenditures will shift the demand curve upward. Output changes accounts for the largest share of shock inflation rate, while oil price shock explained relatively little. Output changes contributed about 45 per cent to changes in commodity price level in the first quarter, declining through 35 per cent in the tenth quarter. Real exchange rate contributed about 10 per cent to changes in inflation rate in the first quarter, rising through 15 per cent in the fourth quarter to about 20 per cent in the tenth quarter. However, oil price explained only 0.3 per cent of changes in inflation rate in the first quarter, rising to about 6 per cent in the eighth quarter and 10 per cent

in the tenth quarter. This finding confirms that oil price may not be necessarily inflationary contrary to findings by Barsky and Kilian (2004) and Rotemberg and Woodford (1996).

In the same vein, increasing oil prices and foreign exchange revenues lead to higher volumes of imports. As the Nigerian industrial output is highly dependent on imported raw materials and capital intermediaries, the volume of domestic production will rise, shifting the supply curve to the right. However, limited capacity of domestic industries and inefficiency of production technology impede the rapid adjustment of supply section to increased demand. Thus, the combination of movements of supply and demand curves will increase the level of production and prices in the economy.

Another explanation for inflationary effects of positive oil price changes in Nigeria is through the Dutch disease phenomenon and within the “spending effects” as suggested by Corden (1984). The “spending effect” happens because higher oil prices lead to higher wages or profits in the oil related sectors, thus increasing aggregate effective purchasing power and demand in the economy. While the price of the tradable sector (oil and manufacturing) is exogenously determined in the international market, the price of the non-tradable sector which includes services and the agricultural sector is determined within the domestic market. A component of increased demand is shifted to the non-tradable sector, causing demand-push inflation in these sectors. In this case, if the assumption is that there is mobility between tradable and non-tradable sections. Therefore, there will be movement of workers toward the booming oil and manufacturing sectors leading to a neglect of the agricultural sector and subsequent decline in output of the sector. This phenomenon is often described as the Dutch disease syndrome.

7. Conclusion

The Nigerian economy is very vulnerable to oil price shocks. The real effective exchange rate falls significantly (domestic currency depreciates) for the entire period. This is worrisome and calls for concern by policy-makers. The

implication of this finding is that there is likelihood for potential currency crisis after a shock occurs especially negative shock in the international oil market. This depreciation increases the price of imports, and despite the traditional belief that this should boost the non-oil sector; the findings from the study are different. On the contrary, the result shows the opposite. For real output, which depends heavily on imported raw material and intermediary, will face a down turn and may be forced to downsize. Due to increased imports in the Nigerian economy, inflationary pressures are inevitable and are pronounced. Government expenditures fall at the onset but increase significantly by the fourth quarter owing to the sticky nature of government expenditures in Nigeria.

On the whole, the picture paints an unstable future for the Nigerian economy following oil price shocks. There is a strong need for policy makers to focus on policy that will strengthen/stabilize the macroeconomic structure of the Nigerian economy with specific focus on; alternative sources of government revenue (reduction of dependence on oil proceeds), reduction in monetization of crude oil receipts (fiscal discipline), aggressive saving of proceeds from oil booms in future in order to withstand vicissitudes of oil shocks in future.

REFERENCES

Anashasy, E.A., *et al*. (2005); “Evidence on the role of oil prices in Venezuela’s economic Performance: 1950-2001” *Working Paper*, University of Washington.

Barsky, R. B., and L. Kilian. (2004): Oil and the Macro economy Since the 1970s. *NBER Working Paper* 10855. Retrieved from http://www.nber.org/papers/w10855

Bernanke, B. S., Gertler, M, and Watson, M. W. (1997): Systematic Monetary Policy and the Effects of Oil Price Shocks. *Brookings Papers on Economic Activity*, 1: 91-148

Bohi, Douglas R. (1991): *Energy Price Shocks and Macroeconomic Performance*. Washington, D.C.: Resources for the Future.

Blanchard,O.J and J.Gali (2007): “The macroeconomic effects of Oil Price Shocks: Why are the 2000s different from the 1970s?, *MIT department of Economics Working Paper* No.07-21.

Central Bank of Nigeria Statistical Bulletin various issues.

Corden, M.W. (19840: Booming sector and Dutch disease Economics: Survey and Consolidation, *Oxford Economic papers* 36, 359-380.

Dahl, C. A., and M. Yücel. (1991) "Testing Alternative Hypotheses of Oil Producer Behavior," *Energy Journal* 12(4): 117-138.

Darby, M.R. (1982): “The price of Oil and World Inflation and Recessions”, *American Economic Review* 72, 738-751.

Dickey, D.A. and Fuller W.A. (1979): “Distribution of the Estimators for Autoregressive Time series with a Unit Root”, *Journal of the American Statistical Association* 74, 427-431.

Eastwood, R. K. (1992): "Macroeconomic Impacts of Energy Shocks," *Oxford Economic Papers* 44: 403-425.

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

Farzanegan M. R and Markwardt G (2007): “The Effects of Oil price Shocks on the Iranian Economy”, Faculty of Business, Dresden University of Technology, D-01062, Dreden, Germany.

Gordon, Robert J. (1984): “Supply Shocks and Monetary Policy Revisited”. *American Economic Review*. May, 74(2): 38-43.

Granger, C.W.J (1969): “Investigating Causal Relations by Econometric Models and Cross-Spectral Methods, *Econometrica* 37, 424-438.

Griffin, J. M. (1985) "OPEC Behavior: A Test of Alternative Hypotheses," *American Economic Review* 75, pp. 954-963.

Gounder, R and Bartleet M. (2007): “Oil Price Shocks and Economic Growth: Evidence for New Zealand, 1989-2006” *Paper Presented at New Zealand Association of Economist Annual Conference,* Christchurch, 27th to 29th June, 2007.

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

Harris, R.I.D. (1995): *Using Cointegration Analysis in econometric Modeling*, New York, Prentice-Hall.

International Monetary Fund (IMF). 2006. *International Financial Statistics*. Washington, D.C.: IMF.

Johansen, S. (1991): “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, *Econometrica* 59, 1551-1580.

Johansen, S. (1995): *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*, Oxford, Oxford University Press.

Jones, C. T. (1991): "OPEC Behavior under Falling Prices: Implications for Cartel Stability," *Energy Journal* 11(3): 117-129.
Majidi, M.(2006) “Impact of Oil on International economy” International Economics Course, Centre for Science and Innovation Studies.

Mork (1994): “Business Cycles and the Oil Market”, *The Energy Journal*, 15 (Special Issue), *The changing World petroleum Market*, 39-67.

Nnnanna, O.J and I. Masha (2003) “Oil price Fluctuation, macroeconomic behaviour and Policy Response in Nigeria: A VAR Specification”, *West African Journal of Monetary and Economic Integration.* Vol. 3, No. 1, pp. 85-113.

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

Osterwald-lenum, m. (1992): “A Note with quantiles of the asymptotic Distribution of the maximum Likelihood Cointegration rank Test statistics”, O*xford Bulletin of Economics and Statistics* 54,481-472.
Phillips, P.C.B. and P.Perron (1988): Testing for a unit Root in Time Series regression, *Biometrika* 75, 335-346.

Raguindin, C.E. and R.G. Reyes (2005): “The effects of Oil price shocks on the Philippine economy: A VAR Approach”, *Working paper*, University of the Philippines School of Economics.

Rasche, R., and Tatom, J. (1981). Energy Price Shocks, Aggregate Supply and Monetary Policy: The Theory and International Evidence”, in Brunner, K., and Meltzer, A. H. (eds). *Supply Shocks, Incentives and National Wealth,* Canergie-Rochester Conference series on Public Policy, 4: 9-93.

Rotemberg, J.J. and M.Woodford (1996): Imperfect Competition and the Effects of energy prices, *Journal of Money, Credit and Banking* 28, 549-577.

Tobin, J. (1980): "Stabilization Policy Ten Years After," *Brookings Papers on Economic Activity* 19-71.

Van Wijenbergen (194): “Inflation, Employment, and the Dutch disease in Oil-exporting Countries: A short-run Disequilibrium Analysis, *Quarterly Journal of Economis* 99, 233-250.

Wakeford J. (2006): “The impact of oil price Shocks on the South African Macroeconomy: History and Prospects”, in *Accelerated and Shared Growth in South Africa: Determinants, constraints and opportunities*. 18-20 October, 2006.

Watkins, G. C. (1992): "The Hotelling Principle: Autobahn or Cul de Sac?" *Energy Journal* 3(1):1-24.

Wirl, F. (1990) "Dynamic Demand and OPEC Pricing," *Energy Economics* 12: 174-177.