MACROECONOMICS OF OIL PRICE VOLATILITY

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Abstract
Nigeria has a long history with oil. Among the challenges associated with oil, frequent changes in the prices of oil have produced macro-fiscal risk for the country. This study attempts to verity the direct and indirect impact of oil price volatility on Nigeria's economy. The indirect impact attempts to trace the impact of oil price volatility on selected macroeconomic variables through public expenditure, while the direct impacts tied the same selected macroeconomic variables directly on oil price volatility. This study utilized the methodology of Vector Autoregression and dynamic simulations of forecasting error variance decomposition. In addition, the pair wise Granger causality is also deployed. The study finds out that oil price volatility significantly stimulate most of the macroeconomic variables and Nigeria's public expenditure. Furthermore, public expenditure impacts on most of the macroeconomic variables. The study recommends that efforts should be made to safeguard both the quantity and quality of public expenditure through appropriate revenue policy measure, promoting sound fiscal institutions, promote budget flexibility and diversification of the revenue base.
Keywords: Price volatility, public expenditure, macroeconomy, variance decomposition

Introduction

The consequential place of oil to the Nigeria's economy is well established. Since its discovery in commercial quantities during the years 1973/74, it has grown to assume a pivotal place in the Nigeria's economy; constituting the main source of export earnings, foreign exchange and public generated revenue (Obadan, 2014; Odusola, 2006). By the year 1985, the country produced a total of 1.9 million barrels of oil, and that generated a total of ₦1.78 million as export earnings. By the year 1980, the production of oil rose to 760.1 million barrels and that trickled in a total of N13, 306.93 million as export earnings, constituting 96.8% of total export earnings (CBN, 2012). Oil revenue stood at ₦167 million in the year 1970, which constituted only 26.3% of totally federal collected revenue. By the year 1974, oil revenue constituted 82.1% of public generated revenue. Though, the proportion of oil revenue has been unsteady, but it has never fallen short of sixty five percent (Orubu, 2003).

The discovery of oil has brought both blessings and curses to Nigeria as a nation. One major disadvantage of oil is the volatility in its prices and the attendant macroeconomics implication. The price of oil has experienced great fluctuation since the 70s. The price of oil which has stayed between $2.50 and $3.0 per barrel since 1948 quadrupled from $3 per barrel in 1972 to $12 per barrel by the end of 1974, and from $14 per barrel in 1978 to $35 per barrel in 1981. The price of oil however plummeted between $10 per barrel in the year 1956, but surged again to between $18 and $ 23 in the 90s. it oscillated between $ 17 per barrel and $26 at different times in the year 2002 and about $ 53 per barrel by Oct. 2004 and rose to $60 by 2005 (Philip and Akintoye, 2006). During the summer of 2007, the price of one barrel of crude oil jumped to above $ 70 and even crossed $ 145 mark in July, 2008. The price staggered between $61.73 per barrel in October, 2009 and remained at an average of $ 75 per barrel till August, 2010 (Hassan & Zahid, 2011).

Oil price variation plays a crucial role in macroeconomic performance of Nigeria because of its impact on the country's public generated revenue and foreign exchange reserves. In the light of the pivotal place of oil to the Nigeria's economy and the macroeconomic implications of its frequent

changes in price, it is pertinent we identify the role and the impact of oil price volatility on the Nigeria's economy, with a research gap that attempt to trace the indirect impact of oil price volatility on Nigeria's macro economy via public expenditure. This study is structured into five sections. Section 1 introduces the study, section II review both theoretical and empirical literature, section III presents the theoretical framework and method of analysis, section IV analyses the estimated model and finally section v summarizes the study and thereafter proffer necessary recommendations.

Theoretical literature

Macroeconomics of oil price volatility gained increased attention since the first oil embargo by the organization of Arab petroleum exporting countries (OAPEC). Ever since then, Myriads of empirical research has attempted to unravel the impact which frequency changes in the price of oil will have on the level of macroeconomic activities. Studies on macroeconomic implication of oil price volatility have yielded conflicting conclusions. Studies such as Akpan (2009) and Olomola (2006) remark that oil price volatility has the potential to enhance economic growth while studies such as Darby (1982) position that frequent changes in oil price will hurt the growth process.

An interesting issue in the discourse of oil price volatility is the causal factors. Osije (1983) posits that oil prices like any other commodity is subjected to changes consequent upon the interactions between demand and supply. Ademan (2000) note that between 1948 and 1970 the nominal price of oil gyrated between $2.50 and $3 per barrel, and that between 1998 and March 2000, international oil price rose from $10 to $31 per barrel, and further rose to $37 in September 2000 before nose diving to less than $18 per barrel in November 2001. Several scholars have proffer several factors as the cause of oil price volatility. Some of the factors adduce by the writers are: reduction in the productive capacity of oil, the slow rate of discovery of new oil wells and the dearth of infrastructural investment in the oil sector in most oil producing countries (Ebrahim et al. 2014; Konrad, 2012); inelastic nature of the demand and supply of oil (Ebrahim et al; 2014); fixation of price by collusion in OPEC cartel, political unrest in the oil rich middle East (Adelman, 2000; Kolawole, 2002); Geographical uncertainties, supply constraints, high refinery utilization and high demand growth (Sajah and Kakali, 2010; Kesicki, 2009).

It is further argued that higher oil prices will better the lot of net-oil exporting countries while worsen the state of net-oil importing countries and vice-versa (Golub, 1983; Ayadi, 2005). Nigeria however maintain peculiar position being both oil exporter and importer. Nigeria export crude oil and import refined petroleum (Duncan, 2008; Oriakhi and Iyoha, 2013). Because the country both export crude oil and import refined petroleum, no conclusive and authoritative statement can be made on the impact of oil price volatility on Nigeria's macroeconomic performance, hence this study is imperative.

Oil price shocks in Nigeria

Since the discovery of oil in commercial quantities in Nigeria, the country has experienced five major oil price shocks. They are the oil price Shocks of 1973-74; 1979-80; 1986; 2003-2006 and 2008-2009. Most of the oil price shocks were positive in a sense that the price of oil per barrel increased and more petrol dollar trickled into the government's treasury. The oil price shock of 1973-74, 1979-80 and 2003-2006 saw higher prices of oil per barrel, but those of 1986 and 2008-2009 saw the prices per barrel of oil plummet. During the first oil price shock in Nigeria (1973-74), the price of oil quadrupled as the price of oil per barrel rose from $2.19 in 1971 to $11.58 in 1974 consequently, share of oil export that was 73.7% rose to 92.6% in the year 1974, the value of terms of trade rose from 18.9 in 1972 to 65.3 in 1974. The increased petrodollar boosted public generated revenue and greased government expenditure. The share of the government in Nigeria's economy grew as the government ventured into all the sectors of the economy. By the end of the second national plan (1970-74), there were a total of 1,500 public enterprices (Obadan, 2010; Anyanwu, 1997).

The second oil shocks of 1979-80 also experienced positive change in the price of oil. The price of oil that was $14.12 per barrel by December, 1978 rose to $29.97 per barrel by December, 1979 and further rose to $38.82 per barrel in 1980.

Consequently, the share of oil in public revenue that was 61.8% rose to 81.4%, further expanding the size of the public sector. However, the positive oil price shock was cut short by the plummetation of oil price during the 80s. The price of oil that was 130 per barrel in 1983 fell drastically to 14.16 per barrel by the year 1986. The huge fall in public generated revenue and the attendant fiscal insustainability compelled the government to adopt the IMF-world Bank structural Adjustment programme (SAP) with the attendant consequence of fiscal retrenchment under the ambit of private sector-led development paradigm.

Empirical literature

Macroeconomics of oil price volatility gained increased attention since the first oil embargo in 1973 (Ebrahim et al; 2014). Ever since then, several empirical research had attempted to unravel the impact which frequent oil price gyration will have on the level of macroeconomic activities. Pioneering works in this regard were championed by Darby (1982) and Hamilton (1983), based on the U.S.A economy. Hamilton Linear Model (1983) was later extended to non-linear model by mork (1989), Hamilton (1986) and Lee et al (1995). Most studies on the macroeconomic implication of oil price volatility focus on either advanced industrialized countries or the emerging economies. Some of the studies on developed countries on this issue are: Gisser and Goodwin (1986) mork and Olsen (1994), Guo and Khensen (2005), Lardic and mignon (2006), Chen and Chen (2007), Cologne and Manera (2008) and Jimenez – Rodriguez (2008). However, empirical works on oil price volatility on developing countries are yet evolving. Some of these studies and the countries are: Philippine (Raquindun and Reyes, 2005) Venezuala (El-Anashashy, 2005) Nigeria (Iwayemi and Fowowe, 2005) etc.

In Nigeria, a good deal of studies has beamed their search light on the macroeconomics of oil price volatility. Ayadi et al (2000) studied the effects of oil production shocks for Nigeria as a net exporter of oil over the period (1975-1992). The study reveals the positive response of output after a positive oil production shock. Moreover, the impact response of output is less than one fifth of that of oil production, but the response of output after a year is slightly larger than that of oil production. Conclusively, the study reveal that higher oil price will stimulate out put, depress inflation rate and erode the value of the naira.

Hodo, Akpan and Offiong (2013) employing annual time series data spanning the years (1970-2010) and the methodology of VAR examine the asymmetric effect of oil price shocks on exchange rate volatility and domestic investment in Nigeria. The study reveal that government expenditure exhibited immediate positive response to oil price shock, but public investment, private investment and industrial production exhibited negative response to oil price shock, further confirming the evidence of a "dutch disease" in Nigeria. The variance decomposition analysis further reveal that exchange rate, government expenditure and domestic investment are mainly affected by oil price shock, particularly in the short-run. Englama et al (2010) in an empirical work designed to examine the oil price-exchange rate nexus, employed monthly data for the period 1999:1 to 2009:12 and utilize the methodology of VECM. The study discover that both oil price volatility and the demand for foreign exchange impact on exchange rate volatility both in the short-run and the long-run. Essentially, the study discover that the demand for foreign reserves put more pressure on exchange rate than oil price volatility.

Theoretical framework

The standard growth theories only built a nexus between primary inputs and output. While undermining energy inputs such as oil gas, fossil fuel etc. However, natural scientists and ecological economists have made effort at developing some theories that attempt to capture the role of oil price volatility on economic growth, thereby incorporating linkage between energy resources, its availability, volatility and economic growth (Oriakhi and Iyoha, 2013). Theories on oil price volatility are basically divided in two. They are theories explaining the channels through which oil price volatility impacts on macro-economy and theories explaining the causes of volatility in the international oil market. This study employs both the linear / symmetric relationship theory of growth and the Dutch disease model as its theoretical framework.

Linear / symmetric relationship theory of growth

This theory attempts to explain the link through which oil price volatility impact on the macroeconomy. Propounders of this theory are Hamilton (1983), Gisser (1985), Good Win (1985), Hooker (1986) and Lasser (1987). This theory posits that fluctuation in GNP is occasioned by frequent fluctuation in oil prices. Hooker (2002) after rigorous empirical studies demonstrated that between 1948 and 1972, change in oil price exerted immense impact on the GDP growth rate.

The Dutch-Disease Model

The Dutch-Disease is a concept that is used to explain the potentially harmful effect which a natural resource boom will have on the manufacturing sector of natural resource–rich country. Corden and Neary (1982) pioneered the use and theoretical analysis of the Dutch disease syndrome in their study of how small open country could suffer from de-industrialization following a natural resource boom. Their analysis is based on the assumption that the natural resource country has two sectors i.e the tradable and non-tradable sectors. Natural resource boom will affect the natural resource-rich country via the resource movement effect and the spending effect. The resource movement effect is the tendency for the booming sector to draw labour away from the non-tradable sector, thereby reducing output in that sector. The spending effect entails increase in government expenditure occasion by boom, which increase domestic absorption and concomitantly exchange rate appreciation (Neary and Van Wijinbergen, 1986)

Data and data sources

Secondary source of data is used in the study because of the nature of the study, which focus on the macroeconomics implications of oil price volatility. The study will utilize quarterly time series data covering the period 1985: 1 to 2012: Q4. The data is obtained from central Bank of Nigeria statistical bulletin for various years, world development indicators CD-Rom, 2012 and OPEC statistical bulletin for 2012. The study will utilize the E-view 7.0 software package for model estimation and analysis.

Model specification

This study utilize VAR methodology which is expressed below as:

$$Xt = \alpha \sum_{J=1}^{p} \chi_{t-j}\phi_j + Ut, Ut \quad IID \ (O, \Sigma) \ -- \ -(3.1)$$

Where:

Xt = Vector of Endogeneous variables in the system at time t, the current period

α = vector of constant term

Xt-j = Lagged endogenems variables. This captures the effect of the variables in the system as suggested by Sim.

Øj = The matrix o f the coefficients of the variables in the system

Ut = The vector of random disturbance error term, which are assume to be independently and identically distributed error term with zero mean and finite variance.

Instructively, this study employ a six variables VAR model comprising of public expenditure (PE), oil price volatility (OPV), Norminal exchange rate (EXRT), Broad money supply (M_2), the growth rate of the GDP (GDPGR) and inflation rate (INFL). Thus, the VAR models can be specified below.

$$\text{PEt} = \beta_0 + \beta_1 \sum_{i=l}^{\infty} PE_{t-i} + \beta_2 \sum_{t=1}^{\infty} OPV_{t-i} + \beta_3 \sum_{i=1}^{\infty} M_{2\,t-i} + \beta_4 \sum_{i=`1}^{\infty} EXRT_{t-i} + \beta_5 \sum_{i-1}^{\infty} GDPGR_{t-i} + \beta_6 \sum_{i=1}^{\infty} INFL_{t-i} + U_{it} \ (3.2)$$

$$\text{OPvt} = \alpha_0 + \beta_1 \sum_{i=1}^{\infty} OPV_{t-i} + \beta_2 \sum_{i=1}^{\infty} PE_{t-i} + \beta_3 \sum_{i=1}^{\infty} M_{2t-i} + \beta_t \sum_{i=1}^{\infty} EXRT_{t-i} + \beta_5 \sum_{i=1}^{\infty} GDPGR_{t-i} + \beta_6 \sum_{i=1}^{\infty} INFL_{t-i} + U_{2t} (3.3)$$

$$M_{2t} = \gamma_0 + \beta_1 \sum_{i=1}^{\infty} M2_{t-i} + \beta_2 \sum_{i=1}^{\infty} PE_{t-i} + {}_3 \sum_{i=1}^{\infty} OPV_{t-i} + \beta_4 \sum_{i=1}^{\infty} EXRT_{t-i} + \beta_5 \sum_{i=1}^{\infty} GDPGR_{t-i} + \beta_6 \sum_{I=1}^{\infty} INFL_{t-i} + U_{3t} \ (3.4))$$

$$EXRT_t = M_0 + \beta_1 \sum_{i=1}^{\infty} EXRT_{t-i} + \beta_2 \sum_{i=1}^{\infty} PE_{t-i} + \beta_3 \sum_{i=1}^{\infty} OPV_{t-i} + \beta_4 \sum_{i=1}^{\infty} M_{2t-i} + \beta_5 \sum_{i=1}^{\infty} GDPGR_{t-i} + \beta_6 \sum_{i=1}^{\infty} INFL_{t-i} + U_{4t} \ (3.5)$$

$$GDPGR_t = T_0 + \beta_1 \sum_{i=1}^{\infty} GDPGR_{t-i} + \beta_2 \sum_{i=1}^{\infty} PE_{t-i} + \beta_3 \sum_{i=1}^{\infty} OPV_{t-i} + \beta_4 \sum_{i=1}^{\infty} M_{2t-i} + \beta_5 \sum_{i=1}^{\infty} EXRT_{t-i} + \beta_6 \sum_{i=1}^{\infty} INFL_{t-i} + U_{5t} \quad (3.6)$$

$$INFL_t = Z_0 + \beta_1 \sum_{i=1}^{\infty} INFL_{t-i} + \beta_2 \sum_{i=1}^{\infty} PE_{t-i} + \beta_3 \sum_{i=1}^{\infty} OPV_{t-i} + \beta_4 \sum_{i=1}^{\infty} M_{2t-i} + \beta_5 \sum_{i=1}^{\infty} EXRT_{t-i} + \beta_6 \sum_{I=i}^{\infty} GDPGR_{t-i} + U_{6t} \quad (3.7)$$

In the VAR models specified above, β_0, α_0, γ_0, M_0, T_0, Z_0 are constant parameters, β_1, β_2, β_3, β_4, β_5 and β_6 are Coefficients to be estimated, and U_{it} ---------- U_{6t} are the Gaussian white noise that are independently and identi cally distributed random variable.

Empirical analysis
Unit Root Test

This study utilizes the Augmented Dickey – fuller test to examine the statistical properties of the quarterly time series variables. This test is imperative since we are ignorant of the data generating process and conscious of the well established knowledge that most time series variables are non-stationary at levels (Iyoha, 2006; Akpan, Hodo and Offiong, 2013). In addition, the use of non-station any time series variables will produce undesirable outcome (Yule, 2006). The unit root results are show in table 4.1 and subsequently analyse.

Table 1: Summary of Unit Root test at 5%

Variables	ADF stat. at levels	Critical value	ADF stat. at first difference	Critical value	Remark
OPV	- 0.2529	- 2.8882	- 8.9729	- 2.8882	I(1)
PE	- 1.8240	- 2.8879	- 6.6987	- 2.8879	I (1)
MR	- 0.3288	- 2.8877	- 11.0724	- 2.8879	I (1)
EXRT	- 2.8485	- 2.9312	- 9.0673	- 2.8879	I(1)
INFL	- 1.4667	- 1.9437	- 9.9579	- 1.9438	I (1)
GDPGR	- 1.2146	- 1.9439	- 9.1704	- 1.9439	I (1)

Sources Author's Computation using E-view 7.0

The unit root results depicted in table 1, it can be seen that at levels all the variables have their ADF statistics fall short of the Mckinnon (1996) critical value at 5% hence the variables are non-stationary at levels, but at first difference the reverse is the case, hence all the variables are homogeneous of order one written as I (1). Thus, it becomes imperative to conduct the colntegration test.

Cointegration test

Since the variables are non-stationary at levels, we utilize the Johansen's trace statistics and the maximum Eigen statistics to examine whether a common stochastic drift exist among our variables. The results are presented below and subsequently analyse.

Table 2: Johansen's Co-Integration Test

Hypothesised No. of CE(s)	Trace		Maxiumum Eigen Value	
	Trace Statistics	0.05 critical value	Trace statistics	0.05 critical value
None *	169.64	95.75	64.12	40.08
At Most 1*	105-52	69.82	36.14	33.88
At most 2 *	69.38	47.86	31.08	27.58
At Most 3*	38.29	29.99	24.08	21.13
At Most 4	14.22	15.59	10.51	14.26
At Most 5	3.70	3.84	3.70	3.84

Sources: Author's Computation (2015)

- Denotes rejection of the hypothesis at the 0.05 level

** Mackinnon – Haug – Michelis (1999) p – values

Both trace test and maximum Eigen value indicates 4 cointegrating equations at the 0.05 level, hence the variables are cointegrated and a long-run meaningful relationship exist among them.

Pairwise Granger Causality

The pairwise Granger causality was computed to help us examine the nature of causality flowing between our variables.

Table 3: Pair wise Granger Causality

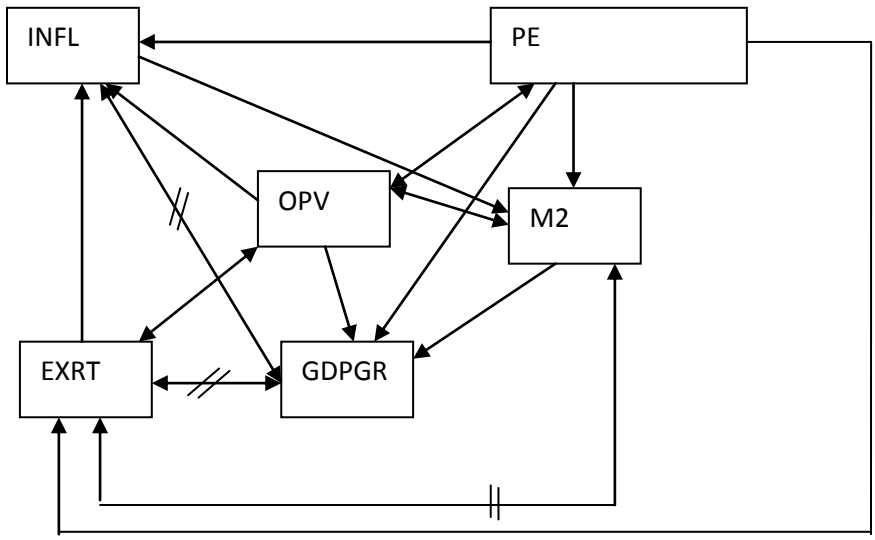
Null Hypothesis	Obs	F-Statistics	Prob
PE doesnot granger cause OPV	107	0.8646	0.5079
OPV doesnot Granger cause PE		0.5517	0.0024
M2 doesnot Granger cause OPV	107	2.8696	0.0185
OPV doesnot Granger cause M2		2.2952	0.04
EXRT doesnot Granger cause OPV	107	2.8696	0.0185
OPV doesnot Granger cause EXRT		2.2952	0.0412
INFL doesnot Granger cause OPV	107	1.8975	0.1018
OPV doesnot Granger cause INFL		0.9341	0.0463
GDPGR doesnot Granger cause OPV	107	1.1105	0.3600
OPV doesnot Granger cause GDPGR		3.5738	0.0052
M2 doesnot Granges cause PE	107	0.1519	0.9790
PE doesnot Granger cause M2		1.7005	0.0142
EXRT doesnot Granger cause PE	107	0.7269	0.6049
PE doesnot Granger cause EXRT		2.7533	0.0228
INFL doesnot Granger cause PE	107	1.5954	0.1687
PE doesnot Granger cause INFL		1.7853	0.0123
GDPGR doesnot Granger cause pe	107	0.0730	0.9961
PE doesnot Granger cause GDPGR		0.9123	0.0477
EXRT doesnot Granger cause M2	107	2.1537	0.0656
M2 doesnot Granger cause EXRT		1.2521	0.2911
GDPGR doesnot Granger cause M2	107	0.1380	0.9831
M2 doesnot Granger cause GDPGR		3.3095	0.0084

INFL doesnot Granger cause M2	107	3.5451	0.0055
M2 doesnot Granger cause INFL		1.5722	0.1752
INFL doesnot cause EXRT	107	1.3536	0.2487
EXRT doesnot Granger cause INFL		4.0022	0.0024
GDPGR doesnot Granger cause EXRT	107	0.0425	0.9989
EXRT doesnot Granger cause GDPGR		1.4513	0.2131
GDPGR doesnot Granger cause INFL	107	0.1779	0.9703
INFL doesnot Granger cause GDPGR		1.2081	0.3112

Source: Author's computation using E – view 7.0

Instructively, the pair wise granger causality show in table 3 shows that oil price volatility granger cause public expenditure and all the macroeconomic variables. However, public expenditure doesnot granger cause oil price volatility, but both broad money supply and the nominal exchange rate granger cause oil price volatility. Further more, public expenditure granger caused most of the macroeconomic variables. Finally, the pair wise granger causality can be showed schematically below.

Fig 1: Schematic Expression of pair wise Granger causality



Source: Authors Expression (2015)

Note: unidirectional causality

Bidirectional causality

No causality

Forecasting Error Variance Decomposition

Inorder to investigate the short – run properties of oil price volatility and Nigeria's public expenditure, we examine the variance decomposition. By definition, the variance decomposition shows the proportion of forecast error variance for each variables that is attributable to its own innovation and innovations in the other endogeneous variables. The VDC for sixteen quarters is computed and we present it in synopsis below.

Table 4: Nigeria Variance Decomposition

Horizon (rs.)	OPV	GDPGR	EXRT	INFL	PE	M2
Shock to OPV explained by innovation in :						
1	100.00	0.000	0.00	0.00	0.00	0..0
5	62.14	2.23	23.46	10.23	0.25	1.69
10	51.97	8.02	22.89	14.29	1.19	1.63
16	42.45	7.42	25.54	18.24	4.27	2.08
Shock to PE explained by innovation in:						
1	1.98	93.61	0.00	0.00	93.61	4.40
5	18.53	25.32	1.74	4.76	46.39	20.65
10	45.44	22.13	4.89	4.72	22.13	18.56
16	51.08	17.27	5.97	5.64	12.93	14.74
shock to INFL explained by innovation in:						
1	4.65	0.00	0.004	94.93	0.42	00.0
5	3.33	7.20	11.03	59.71	11.05	7.67
10	3.24	13.86	18.85	46.74	12.37	6.44
16	3.72	13.42	19.17	43.74	13.40	6.55
Shock to EXRT Explained by Innovation in:						
1	0.03	0.00	96.12	0.00	2.66	1.19
5	9.16	2.58	62.45	1.32	19.81	4.23
10	18.91	1.89	43.33	3.19	29.25	3.41
16	18.04	2.47	32.38	2.66	41.92	2.54
Shock to GDPGR Explained by Innovation in:						
1	0.67	93.43	0.28	5.56	0.03	0.03
5	6.63	85.41	1.87	3.33	0.56	2.22
10	6.69	80.92	2.42	2.78	0.44	6.44
16	7.27	98.03	1.66	1.93	0.36	10.76
Shock the M_2 Explained by Innovation in:						
1	2.32	2.31	1.82	2.72	0.41	90.42
5	6.23	0.89	0.21	0.14	4.21	88.32
10	4.51	1.36	2.31	1.98	11.32	78.48
16	18.89	0.72	0.21	1.21	23.48	73.52

Variance decomposition is useful in detecting linear relationship among variables in a VAR model. The variance decomposition for each of the six variables is represented in table 4 above. Oil price volatility (OPV) plays significant role in the variation of Nigeria's public expenditure. In the first year, OPV contributes 1.98% to the variation in public expenditure. This however rose to stand at 45.44% by the tenth year, and further surged and peaked at 51.08%. on the other hand, OPV

significantly drives exchange rate, inflation rate and broad money supply. The contribution of OPV to the variation of EXRT, INFL and M_2 by the 16th quarter is respectively 18.04%, 3.72% and 18.89%. Nigeria public expenditure was found playing significant role in the variation of inflation rate, exchange rate, and broad money supply. However, public expenditure was not effective in stimulating the growth rate of the GDP, showing that public expenditure is ineffective within the period of the study. On the whole, both public expenditure and oil price volatility significantly and remarkably stimulate Nigeria's macro-economy.

Policy implications

Based on the Estimated and analysed results, we can deduce policy implications for this study. Instructively, oil price volatility stimulate Nigeria's public expenditure by constituting significant proportion of its variance decomposition and also granger causes it this justifies the undue reliance of public expenditure on oil generated revenue. Okonjo Iweala (2012) remark that in Nigeria, public expenditure trends with oil generated revenue, so that slight upheavals in the international oil market is transmitted domestically through unplanned changes in both the quantity and quality of public expenditure. This finding corroborate findings by Farzanegan and Markwadt (2007), Richne (2009), Auty (2001), Gelb (1986 $1988) and Richard and Ronald (1980). However, it opposes findings by Olusegun (2008). Furthermore, OPV stimulates Nigeria's exchanges rate, inflation rate and broad money supply. The impact of OPV on exchange rate corroborates findings by chen and Rogoff (2003), cashin et al. (2004), chen and chen (2007) and Englama et al. (2010). Hence, this study has showed that Nigeria's naira is commodity currency, that co-moves with the price of oil. Hodo et al. (2013) remark that positive oil prices are connected to exchange rate appreciation in Nigeria. Oil price volatility impacts on broad money supply with lags. This supports the claim by Bermanke et al. (2003) and Olomola and Adejumo (2006). Oriakhi and Iyoha (2013) remarked that oil price volatility only impacts on broad money supply when crude oil sales proceed is monetized. Furthermore, the impact of oil price volatility on inflation rate at the outset is anemic but it rises gradually confirming the time lag through which positive oil boom will impact on Nigeria's inflation rate via money supply. Nigeria's public expenditure impact on all the macro economic variables saved the growth rate of the GDP. This confirms the domineering and pivotal place of the public sector in the economy. However, Nigeria's public expenditure insignificantly impact on the growth rate of the GDP because of the ravaging culture of looting state treasury, so that while public expenditure expands the effect is not felt, since a large proportion of budgetary allocation is frittered away on the altar of political aggrandizement.

Conclusion

In this study, an attempt is made to examine both the direct and indirect effect of oil price volatility on Nigeria's macro-economy. The indirect impact was trace through Nigeria's public expenditure. The study find both the direct and the indirect effect. Instructively, oil price volatility significantly impact on Nigeria's public expenditure and the macroeconomic variables, white on the other hand, public expenditure significantly impact on Nigeria's macro-economy. On the whole, Nigeria's economy was found vulnerable to upheavals in the international oil market and frequent gyration in oil prices was found culpable for Nigeria's macro-economic instability (Okonju, 2012).

The recommendations that are proffer in this study will help hedge the Nigeria's economy from upheavals in the international oil market, achieve macroeconomic stability, fiscal sustainability and contain the macro-fiscal risk associated with unplanned changes in both quality and quantity of public expenditure (Zakharova and Medas, 2009).

Recommendations

The recommendations are provided below.

- Effort should be made to delink public expenditure from happenings in the international oil market. This can be achieved by diversifying the revenue base from oil. While Odusola (2006) recommend the use of tax handle (see Oriakhi and Rolle, 2014), other writers recommend the boosting of the Agriculture and solid minerals as alternative revenue source.

- Effort should be made to improve fiscal institutions. It is true that Nigeria has already established fiscal institutions such as oil based fiscal rule, fiscal responsibility act of 2007, EFCC etc. However, in order to improve the management of oil revenue and promote accountability in the sector, there is need to improve fiscal institutions in Nigeria. It is well established that sound public policies appear to be more determinant in ensuring effective use of oil revenue.

Refernces

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