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Macroeconomic Impact of Oil Price Shocks on Government Expenditure and Economic Growth in Nigeria#

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Abstract

The Nigerian economy depends on over 90% oil exports revenue to drive government expenditure aimed at supporting growth-enhancing fiscal investments. Oil price has therefore become the standard benchmark for estimating aggregate annual revenue projections for all fiscal budgets and overall prospects of budgetary success. Over the years, growth in oil exports revenue and associated growth in government expenditure supported by macroeconomic policy reforms have failed to diversify the economy away from its mono-cultural revenue base. This paper investigated the nexus between oil price shocks, government expenditure and economic growth in Nigeria for the period 1986 to 2018, an era marked by bold market reforms. Generalized Methods of Moments (GMM) and Vector Error Correction (VECM) techniques are used for the empirical examination of the relationship between the study variables. The results indicate a direct and significant relationship between oil price and both government expenditure and economic growth. The exchange rate and exports channels are the intermediaries that transmit oil price shocks to the economy. Similarly, findings have confirmed evidence of the Dutch Disease in Nigeria. Given the ongoing decarbonization of global energy, the study provides recommendations for an urgent shift in growth policy focus away from dependence on oil revenue to bold reforms that will fast-track fiscal and exports revenue diversification and sustainability, anchored on private sector initiatives.

Keywords: Oil Price, Government Expenditure, Economic Growth, Generalised Method of Moment, Dutch Disease

1. Introduction

Crude oil is one of the most critical energy sources in modern industrial economies. Oil prices therefore affect production, domestic and global investment flows, aggregate income, and the economic growth conditions of both oil exporting and importing countries. The impact of oil price shocks on the macroeconomic performance of these countries has therefore remained a subject of research interest since the first oil price shock of 1973. The subsequent negative oil price shock of 1979 (and others thereafter) caused by the reduction in oil supply further amplified the significance of oil price shocks to the health of the macroeconomy and to policy makers globally (Alekhina and Yoshino, 2018). To date, volatility in global oil prices has remained a permanent feature of the international oil market, often transmitting regular macroeconomic shocks (Omotosho, 2019).

While daily changes in oil price can be attributed to market forces of demand and supply, the specific causes of oil price shocks can be traced to economic factors such as oil cartel collusion, supply disruptions, and oil production level. They can also be traced to political factors such as wars and social unrest (Giraud, 1995), as well as expectations of future aggregate oil supply and demand (Fueki *et al.*, 2018). The effectiveness

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of policy responses by individual countries aimed at containing the impact of such fluctuations depends largely on whether the country is an oil exporter or importer, a clear understanding of the resulting macroeconomic dynamics created by oil price shocks, and the domestic and global economic conditions.

In general, oil revenue dependent developing economies are also found to be import-dependent and the frequency of these fluctuations in their macroeconomic fundamentals increase rapidly in the presence of oil price shocks (Raouf, 2021). The economies are similarly characterised by the prevalence of the "Dutch Disease" which is caused by the pooling of production factors to the booming export commodity sector (oil sector) at the expense of other economic and production sectors (agriculture, manufacturing). The consequence is a boost in marginal productivity in the former and its losses in the later. When these outcomes interact with large increases in the marginal propensity to import using the huge oil exports revenue windfalls, production and output in both the other tradable and non-tradable sectors experience rapid decline. As the world's major source of energy, oil price shocks significantly contributed to the global recessions of 1973–75, 1978–79, 1980–81, 1990–91, 2001, 2008–2009 and 2015–2016 and 2020 (Kettle, S, 2021).

The Nigerian economy is dependent on crude oil exports for 60 percent of fiscal revenue and over 90 percent of exports revenue to drive government expenditure aimed at supporting growth-enhancing fiscal investments and spending (Okunoye and Hammed, 2020). This is evidenced by the adoption of oil price as the key benchmark for projecting aggregate annual revenue for all fiscal budgets. However, growth in oil-revenue driven government expenditure supported by macroeconomic policy reforms have however failed to diversify the economy away from its mono-cultural oil revenue dependent base.

Observed evidence from the Nigerian economy on the relationship between oil price shocks and RGDP growth and other fundamentals has not been monotonic. The decline in the growth rate of real GDP following various positive and negative spikes in crude oil price from the 70's did not necessarily follow a proportional correlation, confirming the asymmetry of GDP growth to oil price movements. Thus, the observed jump in oil price from US$3.7 per barrel of crude oil (1970–1974) to US$15.3 (1975–1979) did not translate into proportionate percentage GDP growth within the period. Rather, the economy suffered reverses in GDP growth at different points within the period. This was evidenced by the fact that even though oil price rose persistently in the next four periods, the GDP growth rate declined gradually to negative peaking at 3.1% in 1991, evidencing the likely onset of the effects of the Dutch Disease. For the period 1985-1999 when crude oil prices did not rise, the Naira official exchange rate however rose consistently (Kanu and Nwadiubu, 2020).

Anecdotal evidence shows that oil price shocks have dual microeconomic impact in spite of their asymmetric effects on many microeconomic aggregates. These effects are transmitted through the fiscal and export channels (Raouf, 2021). Recent evidence on the response of key macroeconomic variables such as GDP growth, employment, exchange rate, inflation, and poverty to the 2015/2016 as well as the 2020 oil price shocks played out along the same negative trends. However, uncertainty still surround the exact nature of this impact as evidenced by findings from empirical research. While results from some empirical studies point to a significant relationship between oil price shocks and key macroeconomic variable (Raouf, 2021; Okunoye and Hammed, 2020), other results reveal the absence of any relationship between the shocks and macroeconomic variables (Alley *et al.*, 2014). This underlies the need for continuing empirical investigation into this phenomenon.

The research problem of this study is therefore to examine the fiscal impact of oil price shocks on macroeconomic performance with particular reference to government expenditure and real GDP growth. Many extant studies on the impact of oil price shock have focused on individual fiscal and monetary policy variables without examining the overall impact on economic growth (Orhewere and Ogbeide-Osaretin, 2020; Omotosho, 2019). Thus, primary objective of this study is therefore to evaluate the impact of oil price shocks (positive and negative) on Nigeria's government expenditure and macroeconomic growth as reflected in per capita income growth.

Two research hypotheses are tested in their null form: (1) Oil price shocks have no impact on government expenditure (2) Oil price shocks have no impact on Nigeria's economic growth. The results of this evaluation will provide additional insight into the effective utilisation of crude oil exports revenue as well as the causes of failure of Nigeria's macroeconomic policies to lay the required foundation for economic diversification, economic stability, and rapid growth, after four decades of huge oil export revenue receipts. This is with a view to improving future macroeconomic policy effectiveness. Section 2 provides an overview of the extant literature on the study. Section 3 summarises the data set, its sources and measurement, together with the methodology for the empirical estimation and model specification. Section 4 discusses findings from the model regression estimates and their policy implications. Section 5 provides the summary, conclusion and policy recommendations from the findings.

2. Literature Review and Theoretical Framework

Raouf (2021) investigated the relationship between oil price shocks and government expenditure (with focus on current and capital expenditure) for both oil exporting and oil importing countries from 1980 to 2018 deploying Vector Autoregressive (VAR) model with Impulse Response Function and Variance Decomposition. Findings from the study showed a positive relationship between oil price shocks and government spending within the two group of countries. However, it has a positive effect on capital expenditure for oil exporting countries and a negative effect in oil importing countries.

Gylych *et al.* (2020) examined the impact of oil price fluctuations on the Nigerian economy using Toda and Yamamoto (TY) model and Modified Wald test (MWALD) for the period 1995 to 2018. The results showed a positive and significant relationship between oil price and exchange rate, interest rate, and inflation rate. They recommended diversification of the economy to avoid the "Dutch Disease" syndrome in the Nigerian economy. This implies that oil revenue plays a growth-enhancing role through enhanced budgetary expenditure which promotes economic growth and development.

Okunoye and Hammed (2020) deployed Structural VAR (SVAR) to investigate the effect of oil price shocks on fiscal-monetary policy variables in Nigeria with annual time series data from 1981 to 2019. The study found a significant impact of oil price shock on inflation rate, oil revenue, and government expenditure, with government revenue having less innovations (less error term) compared to oil revenue and interest rate. Oil price shocks caused larger variations in inflation than the monetary policy rate. They recommended complementary fiscal and monetary policy to reduce distortion in economic stabilization policies. Government expenditure should be tailored to non-oil revenue rather than oil exports revenue.

Using vector autoregressive (VAR) model, Nwosu *et al.* (2020) analysed the effect of oil price shocks on the real sectors (agriculture, industrial output, manufacturing, and money supply) of the Nigerian economy between 1981 to 2018. Findings from the study showed that there is a negative impact of shocks on the real sector of the Nigerian economy which negatively affects long-run economic growth. Government is recommended to invest oil export receipts in the real sectors to diversify the economy away from oil revenue dependence.

Orhewere and Ogbeide-Osaretin (2020) deployed Vector Error Correction (VECM) to assess the impact of oil price shocks on capital expenditure in Nigeria using annual time series data for the period 1970 to 2018. The study found a negative and significant relationship between capital expenditure and oil price shocks, and variations in capital expenditure was found to be largely accounted for by shocks in oil prices in the short run and government revenue in the long-run. Diversification of the revenue sources was recommended as a counter strategy to oil revenue dependence.

Patrick (2020) explored the macroeconomic impact of oil price shock on the Nigerian economy between 2015 and 2019 employing VAR technique. The result shows that oil price shocks do not have direct effects on GDP but on macroeconomic variables such as exchange rate. The study also confirmed the presence of the Dutch Disease. It therefore recommended economic diversification to minimize its impact.

Kanu and Nwadiubu (2020) studied the effects of global oil price shocks on Nigeria's economic growth for the period 1990 to 2019 using OLS with ARCH/GARCH technique. The study found volatility clustering of oil price on Nigeria's economic growth. It recommends a paradigm shift from reliance on primary products exports to boosting the manufacturing sector.

Omotosho (2019) analysed the impact of oil price shocks, fuel subsidies and macroeconomic instability in Nigeria for the period 2000Q2–2018Q2 using a New-Keynesian DSGE model with fuel subsidies. The results show that oil price generate persistent and significant impacts on output, accounting for 25 percent of output variation up to the fourth year. Fuel subsidies however moderate the contractionary effects of a negative oil price shock, with decrease in headline inflation and short-run exchange rate depreciation. Further, fuel subsidy removal creates higher macroeconomic instability requiring well-targeted safety nets and other sustainable adjustments to enhance monetary policy effectiveness.

Omolade *et al.* (2019) examined the effect of crude oil price shocks on macroeconomic performance in Africa's oil-producing countries using panel-SVAR for the period 1980 to 2016. The results show sharp changes in domestic output arising from oil price shocks. Associated with the oil price shock is prevalence of the Dutch Disease accompanied by a rise in structural inflation following a significant decline in output and investment induced by a sharp decline in oil price. The study recommends economic diversification through higher investment in both the tradeable and non-tradeable sectors to overcome the Dutch Disease and overreliance on the oil sector.

Adedokun (2018) analysed the effects of oil shocks on government expenditure and government revenues nexus in Nigeria from 1981 to 2014 using SVAR, unrestricted VAR and Vector Error Correction (VECM) techniques. Results from the SVAR estimates showed that oil price shocks could not predict the variations in government expenditure in the short-run, while oil revenue shocks have a strong predictive power in both the short-run and long-run. This indicates that short-run fiscal synchronisation hypothesis is evidenced between oil revenue and total expenditure, while spend-tax hypothesis exists in the long-run between total expenditure and total revenue. The study recommended a redirection of the Nigerian economy from oil revenue dependence to economic diversification along less volatile sources of revenue in order to prevent the transmission effects of oil price shocks to broader macroeconomic variables.

Olanipekun (2016) investigated the effect of oil price shocks on foreign reserves, exchange rate and economic growth in Nigeria. The results of the regression estimates found that negative oil price shocks had negative and significant effects on foreign reserves, exchange rate and economic growth in Nigeria especially in the long run. He recommended effective macroeconomic policy formulation and implementation to minimize the negative effect of such shocks on growth and economic stability.

Alley *et al.* (2014) found an insignificant relationship between oil price shocks and economic growth in Nigeria deploying Generalised Method of Moment (GMM) in their examination of the impact of oil price shocks on the Nigerian economy. Oil price itself was found to have a significant positive effect on economic growth, confirming the beneficial effect of higher oil prices to oil exporting countries. Oil price shocks however create uncertainty and undermine effective fiscal management of crude oil revenue. Diversification of Nigeria's export revenue base was recommended for minimising reliance on crude oil revenue and shielding the economy from the impact of oil price shocks.

This study extends the application of the four-sector, three-market Keynesian income and output determination as its theoretical framework. In this model the transmission mechanism of shocks to the explanatory variables is both on the demand and supply sides. The four macroeconomic sectors of the Keynesian Theory include (1) the household sector which undertake consumption expenditure and owes all production resources (2) the business sector made up of all institutions which buy capital goods for investment in the production of goods and services (3) the government sector which regulates economic activities, collects taxes, and buys a part of national output as government expenditure, and (4) the foreign sector which interacts with the domestic sector in the conduct of international trade in goods and services. The three markets include (1) the goods or product market that exchanges final output of goods and services of the GDP (2) the factor market that exchanges the services of the factors of production namely: land, labour, capital and entrepreneurship, and (3) the financial or money market where owners and savers of financial assets buy claims over their borrowers and users. Equilibrium is achieved by the equality of aggregate demand and aggregate supply in the three markets. The four-sector Keynesian Theory of income and output determination is specified based on the functional equality of total expenditure or output (Y, oil and non-oil) with the sum of Consumption expenditure (C), Domestic investment expenditure (I), Savings (S), Government spending (G), and net exports ($X – M$), reflecting both the domestic and external sector dynamics as:

$$Y = C+I+G+X–M \tag{2.1}$$

The Keynesian Theory of income and employment (Keynes, 1936) is a short-run Theory that assumes a given price level with fixed or relative short-run price inflexibility resulting in a horizontal supply curve. Within this framework, output is determined by the forces of demand and supply in the goods, factor and money markets, driven mainly by short-run changes in income, money supply and the demand for money. An increase in the consumption demand for goods and services leads to an increase in domestic output, and vice versa. Since prices are fixed in the short-run, changes in demand do not increase prices but affect output of tradables and non-tradables, just as changes in the aggregate income are reflected in the changes in aggregate expenditure. The conclusion of the Keynesian Theory is that in the short run, a BOP surplus (from huge oil earnings, for example) leads to currency appreciation, an appreciation in interest rate and a fall in output of non-tradables as foreign goods become cheaper, while a BOP deficit has the opposite effect.

3. Data and Methodology

3.1 Data Sources and Measurement

Data analysis is based on annual time series data between 1986 – 2018, a 33-year period. Data on Government Expenditure (*GEXP*), Money Supply (*MS*), Inflation Rate (*INFL*), and Interest Rate (*INTR*) is sourced from the Central Bank of Nigeria (CBN) Annual Reports and Economic and Financial Review. Data on Nominal and Real Exchange Rate (*RER)*, and Real GDP per capita (*RGDP*), Terms of Trade (*TOT*), and Exports (*XP*) is sourced from the World Bank World Development Indicators (WDI), while data on Oil Price (*OILP*) is sourced from the Organisation of Petroleum Exporting Countries (OPEC) Annual Statistical Bulletin.

Real GDP Per Capita *(RGDP)* is a proxy for economic growth and it is computed in percentage terms as (nominal GDP/base year)/Total Population, with year 2000 as the base year. Real Exchange Rate (*RER*) is the nominal rate adjusted for inflation measures in both the domestic and foreign country. Purchasing Power Parity (*PPP*) values of the real exchange rate are adopted in the study. Oil Price *(OILP)* is the benchmark spot price of a barrel Nigeria's Bonny Light crude oil based on the OPEC Reference Basket spot price per barrel for buyers and sellers at the international oil market measured in US dollars. Terms of Trade *(TOT)* is the net barter terms of trade index using year 2000 as base year for imports and exports. It is measured as the percentage ratio of annual export unit value indexes to import unit value indexes, relative to year 2000 as the base year. Interest Rate *(INTR)* is measured as an annual percentage rate of the total amount borrowed. It is proxied by the domestic Monetary Policy Rate (MPR) in the study. Money Supply *(MS)* is measured annually in billions of Naira and proxied by the ratio of broad money (M_2) to GDP divided by the CPI using year 2000 as base year for this study.

3.2 Methodology

The study employs descriptive statistics and econometric techniques to empirically test hypotheses. The estimation process begins with a test of the time series properties of the data variables such as data stationary and their cointegration properties. This is followed by a test of causality between the variables once found to have a unit root and are cointegrated. These preliminarily tests are design to ensure that the data conforms with the requirements of ordinary least Squares estimation and to avoid spurious regression between the data variables.

A baseline model specified to estimate the variable relationships. The inclusion of lag dependent variables in the equation for estimating real GDP response to oil price shock pose potential endogeneity problems, hence this is addressed by Arellano and Bower's (1995) Generalized Method of Moments (GMM).

Further, Vector Error Correction Model (VECM) is used to examine the relationship between oil price shocks and government expenditure. The relationship between the variables is largely contemporaneous without any endogeneity problem associated with lagged variables. VECM technique supports dynamic analysis of cointegrated time series variables without specific theoretical relationships, just as it facilitates the isolation of the short-run from the long-run impact of shocks to the regressors on the regressands. It also reveals the speed of adjustment of the regressands to shocks to the regressors. Impulse Response Functions and Variance Decomposition are also utilised to examine the contribution of the of each the regressors to shocks to the regressands. Finally, diagnostic tests on model estimates are carried out to confirm their reliability and validity.

3.3 Model Specification

This study adapts the model of Sloman and Hinde (2008) for the examination of the relationship between the study variables within the Keynesian framework of income and output determination captured by the equation (1):

$$Y = C + I + G + (X - M) \quad (1)$$

where, Y = total expenditure; C = Consumption expenditure; I = Domestic investment expenditure; S = Savings; G = Government spending; and $X - M$ = net exports.

As per Sloman and Hinde (2008), the baseline model is therefore specified as in equation (2).

$$Xt = \alpha + \sum_{j=1}^{p} X\ t - j\beta j + Ut \quad (2)$$

X_t is an n×1 vector of endogenous variables of the models at time t and for uncorrelated structural innovations.

The key policy variables expected to influence real GDP per capita growth and government expenditure in Nigeria are represented by: (i) external sector - Oil Price (*OILP*), Real Exchange Rate (*RER*), and terms of trade (*TOT*); (ii) fiscal policy - Government Expenditure (*GEXP*); and (iii) monetary policy - Interest Rate (*INTR*) and Money Supply (*MS*). As earlier stated *RGDP*, *GEXP* and *OILP* are the core study variables, while *RER, INTR*, *GEXP*, *MS*, and *TOT*, (in addition to *XP*, and *INFL* as applied in the transformations) are control variables. For empirical estimation, therefore, we first specify the structural equation for the model in its linear functional form with initial growth condition ($RGDP_{t-1}$) supported by the relevant control variables. Thus,

GMM model as in equation (3).

$$RGDPt = f(RGDPt\text{-}1, RERt, OILPt, INTRt, GEXPt, MSt, TOTt) \quad (3)$$

VECM model is presented in equation (4).

$$GEXPt = f(RGDPt, RGDPt\text{-}1, RERt, OILPt, INTRt,, MSt, TOTt) \quad (4)$$

Where the variables are as defined above.

The behavioural form of the two equations is specified and natural logarithm employed to transform them for estimation with their appropriate lag lengths as in equation (5) and Equation (6).

$$ln\Delta RGDP_{jt} = \alpha_0 + \sum_{j=0}^{n} \alpha_{1j}\, ln\Delta RGDP_{t-j} + \sum_{j=1}^{n} \alpha_{2j}\, ln\Delta RER_{t-j} + \sum_{j=1}^{n} \alpha_{3j}\, ln\Delta OILP_{t-j} + \sum_{j=1}^{n} \alpha_{4j}\, ln\Delta INTR_{t-j} + \sum_{j=1}^{n} \alpha_{5j}\, ln\Delta GEXP_{t-j} + \sum_{j=1}^{n} \alpha_{6j}\, ln\Delta MS_{t-j} + \sum_{j=1}^{n} \alpha_{7j}\, ln\Delta TOT_{t-1} + \mu_t \quad \text{.....(5)}$$

$$ln\Delta GEXP_{jt} = \beta_0 + \sum_{j=0}^{n} \beta_{1j}\, ln\Delta RGDP_{t} + \sum_{j=1}^{n} \beta_{2j}\, ln\Delta RER_{t-j} + \sum_{j=1}^{n} \beta_{3j}\, ln\Delta OILP_{t-j} + \sum_{j=1}^{n} \beta_{4j}\, ln\Delta INTR_{t-j} + \sum_{j=1}^{n} \beta_{5j}\, ln\Delta MS_{t-j} + \sum_{j=1}^{n} \beta_{6j}\, ln\Delta TOT_{t-1} + \mu_t \quad \text{......(6)}$$

Three restrictions imposed on the models are that: (i) Crude oil price is not affected by fiscal and monetary policy variables, which are endogenous to the Nigerian economy (ii) Monetary policy target variable do not affect monetary policy rate (MPR) as they exogenous monetary policy instruments which are affected by MPR at any lags contemporaneously (iii) While government expenditure influences revenue, MPR does not influence oil revenue.

4. Analysis and Discussion of Results

4.1 Descriptive Statistics

The descriptive statistics derived through *E*-views 10.0 are presented in Table 1.

Table 1 shows that all the variables are positively skewed. However, the kurtosis of *RGDP, GEXP, MS, TOT* and *XP* show proximity to a normally distributed series, being below 3. The mean value of GEXP is N2,094.751 trillion, while the standard deviation is N2,247.140 trillion. Oil price has a mean of US$44.41 and a standard deviation of US$29.04. Both evidence a high degree of variability of the variables. *RGDP, MS, TOT, INFL* and *XP also* shows similar price variability. These are general indicators of macroeconomic instability.

4.2 Unit Root Test

The results of the Unit Root tests using Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests are presented in Table 2.

The results from the Table 2 show that the model variables which are found to be non-stationary at levels become stationary at first difference *I*(1) at the conventional one, five, and ten percent significance levels as shown above. Therefore, we reject the null hypothesis (H_0) of a unit root in the data series used for the study. It follows that cointegration test should be carried out to confirm whether or not there is any long-run relationships between the variables.

Table 1. Descriptive statistic of variables

Statistic	RGDP	GEXP	INTR	MS	OILP	TOT	INFL	XP	RER
Mean	4.767048	2,094.751	18.64292	6,326.766	44.41294	129.6194	19.16485	5,548.953	109.7621
Median	5.307924	1018.178	17.95000	1505.964	30.38000	99.60000	12.90000	1945.723	92.14000
Maximum	14.60438	7813.741	29.80000	25079.72	99.67000	269.6800	72.80000	19280.04	272.5200
Minimum	-- 1.583065	16.22370	10.50000	23.80640	11.30500	43.88000	5.400000	8.920600	49.78000
Std. Dev.	3.907805	2247.140	3.811635	8,374.384	29.04618	73.54021	17.07353	5,912.535	56.80709
Skewness	0.408579	0.874500	0.945949	1.095853	0.625461	0.732377	1.765814	0.730262	1.797959
Kurtosis	2.631937	2.560879	4.514941	2.715893	1.926919	2.144639	5.095073	2.188421	5.323506
Jarque-Bera	1.104424	4.471260	8.077192	6.715902	3.734926	3.956079	23.18488	3.838715	25.20280
Probability	0.575675	0.106925	0.017622	0.034807	0.154515	0.138340	0.000009	0.146701	0.000003
Sum	157.3126	69126.79	615.2163	208783.3	1465.627	4277.440	632.4400	183115.4	3622.150
Sum Sq. Dev.	488.6702	1.62E+08	464.9140	2.24E+09	26997.79	173061.2	9328.177	1.12E+09	103265.4
Observations	33	33	33	33	33	33	33	33	33

Source: Author's computations

Table 2. Unit root test results

Variables	ADF Statistic	PP Statistic	Critical Values*	Stationarity Status
RGDP	-7.809316	-7.809316	-4.284580(1%) -3.562882(5%) -3.215267(10%)	I(1)
RER	-6.497562	-6.497562	-4.284580(1%) -3.562882(5%) -3.215267(10%)	I(1)
OILP	-5.960682	-5.960682	-4.284580(1%) -3.562882(5%) -3.215267(10%)	I(1)
INTR	-4.105309	-9.267661	-3.752946 (1%) -2.998064 (5%) -2.638752 (10%)	I(1)
GEXP	-5.795533	-4.837627	-4.339330 (1%) -3.587527 (5%) -3.229230 (10%)	I(1)
MS	-5.891249	-5.891249	-4.284580(1%) -3.562882(5%) -3.215267(10%)	I(1)
TOT	-4.702446	-4.702446	-4.284580(1%) -3.562882(5%) -3.215267(10%)	I(1)
INFL	-7.048361	-4.834975	-4.416345 (1%) -3.622033 (5%) -3.248592 (10%)	I(1)
EXP	-5.397836	-2.674679	-4.323979 (1%) -3.580623 (5%) -3.225334 (10%)	I(1)

Source: Author's computations
*The critical values for rejection of the null hypothesis (H_o) of Unit Root are from Mackinnon (1991) as reported in *E*-Views 10.0.

Table 3. Cointegration test

(I) - Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.964603	356.6872	197.3709	0.0000
At most 1 *	0.887547	253.1120	159.5297	0.0000
At most 2 *	0.800663	185.3700	125.6154	0.0000
At most 3 *	0.784823	135.3746	95.75366	0.0000
At most 4 *	0.652128	87.74948	69.81889	0.0010
At most 5 *	0.591671	55.01597	47.85613	0.0092
At most 6	0.340578	27.24984	29.79707	0.0957
At most 7	0.323932	14.34172	15.49471	0.0740
At most 8	0.068700	2.206397	3.841466	0.1374

Source: Author's computation

(II) -Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.964603	103.5752	58.43354	None *
At most 1 *	0.887547	67.74194	52.36261	At most 1 *
At most 2 *	0.800663	49.99545	46.23142	At most 2 *
At most 3 *	0.784823	47.62510	40.07757	At most 3 *
At most 4	0.652128	32.73351	33.87687	At most 4
At most 5 *	0.591671	27.76613	27.58434	At most 5 *
At most 6	0.340578	12.90812	21.13162	At most 6
At most 7	0.323932	12.13532	14.26460	At most 7
At most 8	0.068700	2.206397	3.841466	At most 8

Source: Author's computations
Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) *p*-values

Table 4. GMM Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(RGDP(-1)))	-0.315606	0.072564	-4.349345	0.0002*
D(LOG(RER))	1.731324	0.579148	2.989433	0.0064*
D(LOG(OILP))	2.695625	1.499072	1.798197	0.0847**
D(LOG(INTR))	2.098796	0.745788	2.814199	0.0096*
D(LOG(GEXP))	1.434812	0.777616	1.845143	0.0774**
D(LOG(MS))	-1.310552	0.918800	-1.426374	0.1666
D(LOG(TOT))	-0.584253	0.972811	-0.600583	0.5537
R-squared	0.386504	Mean dependent var	0.045608	R-squared
Adjusted R-squared	0.233130	S.D. dependent var	1.203391	Adjusted R-squared
S.E. of regression	1.053823	Sum squared resid	26.65304	S.E. of regression
Durbin-Watson stat	1.850711	J-statistic	2.874464	Durbin-Watson stat
Instrument rank	10	Prob(J-statistic)	0.411388	Instrument rank

Source: Author's computation
Significant at 5%; ** Significant at 10%

Table 5. Impulse response function result

Period	LOG(RER)	LOG(RGDP)	LOG(OILP)	LOG(INTR)	LOG(GEXP)	LOG(MS)	LOG(TOT)
1	0.305970	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.320302	0.010140	0.057627	-0.078960	0.009735	0.012814	0.035346
3	0.294636	0.040979	0.093498	-0.027100	0.043743	-0.028705	0.014902
4	0.266745	-0.008186	0.122661	0.001348	0.075449	0.016195	-0.016054
5	0.253725	-0.012492	0.111225	-0.019697	0.068640	0.037670	-0.001775
6	0.262890	0.003903	0.103023	-0.022172	0.065145	0.023931	0.001514
7	0.259385	-0.000623	0.111331	-0.014482	0.069050	0.026691	-0.003660
8	0.255143	-0.004602	0.111981	-0.016562	0.070504	0.030628	-0.003488
9	0.256339	-0.002246	0.109808	-0.016762	0.069522	0.029230	-0.002674
10	0.256615	-0.002644	0.110409	-0.016464	0.069700	0.029555	-0.003098

Source: Author's computation

4.3 Cointegration Test

Based on a lag length of 1 selected using AIC, the results of the cointegration test conducted using Johansen and Juselius (1990) cointegration tests using Rank Test (Trace) statistic and the characteristic root or Maximum Eigen value test statistics are shown in the Table 3.

Results of the Trace Test in Table 3 (I) shows data combinations with a rank of $r = 5$ or at least 6 values of the Trace statistic are significant or higher than their critical values at 5% level of significance, showing at least 6 cointegrating equations.

Similarly, the characteristic root test based on the Eigen values in Table 3 (II) indicate a rank $r = 4$ or at least 5 values of the Maximum Eigen value statistic are significant or higher than their critical values at 5% level of significance, showing at least 5 cointegrating equations. Based on the results of Table 2, both test statistics reject the null hypothesis of no cointegration between the variables of the series, hence we conclude that all variables of the study are cointegrated.

4.4 Impact of Oil Price Shocks on Government Expenditure

The VECM Short run results in Table 4 shown in Appendix 1 indicate that there is a positive but insignificant short-run relationship between oil price shock and *GEXP* as well as *MS*, and *TOT*. Except *MS*, the relationship with the other variables is in line with a priori expectations. There is a negative and significant long run relationship between oil price shock and *GEXP,* but a positive but insignificant relationship between *RER* and *RGDP, MS,* and *TOT.* This is also in line with a priori expectations.

4.5 Impact of Oil Price Shocks on Real Gross Domestic Product Growth

The GMM estimates of the relationship between *RGDP* and *OILP* and the control variables in Table 4 show a positive and significant relationship between *RGDP* with *RER, OILP, INTR,* and *GEXP,* while it is negative for *MS* and *TOT*. The positive relationship between *RGDP* and *OILP* and *GEXP* is in line with a priori expectations, while *MS* and *TOT* contrary to a priori expectations. Specifically, a one-unit change in oil price results in a 2.26956-unit change in RGDP, while a 1-unit change in *GEXP* will generate 1.43 units change in *RGDP*. This indicates that both *OILP* and have significant influence on the direction of economic growth in Nigeria. Except for *INTR*, a positive *OILP* shock, a depreciation in the value of the Naira exchange rate, and an increase in *GEXP* will lead to a more than proportionate growth in Nigeria's *RGDP*. Therefore, the null hypothesis (H_0) of no significant impact of *RER* and *OILP* on RGDP growth is rejected.

Whereas, *OILP* shocks have only a short-run positive relationship with the *RGDP* depending on whether the shock is positive or negative. This finding agrees with that of Olanipekun (2016) and Patrick (2020).

4.6 Impulse Response Functions and Variance Decomposition

Values of the IRF within a specified time horizon (*i*) as shown in Table 5 are then derived from the sequence of the moving average coefficients of the dynamic multiplier functions. The Impulse Response Function (IRF) graphs for the variables in ten periods derived from the VECM estimates are presented in Figure 1.

The IRF in Table 5 and graphs in Figure 1 show that real GDP is mean-reverting and quick reversion revert to its equilibrium position in period 5 after an initial positive or negative response to an oil price shock or impulse while oscillating slightly above and below its equilibrium value. *OILP* shocks however create a sharp negative or positive reaction in the other variables in the short-run (average of 1 – 6 periods) before returning to equilibrium after an initial short-run adjustment, with no evidence of any symmetry between the two variables. Changes in real *OILP also* leave the GEXP oscillating slightly above and below its equilibrium value, with a gradual tendency towards a long-run declining impact on government expenditure.

4.7 Variance Decompositions

Variance decomposition estimates in Table 6 shows the contribution of each variable to oil price shocks relative to the other variables in the estimated model. It indicates how much of the forecast error variance of the

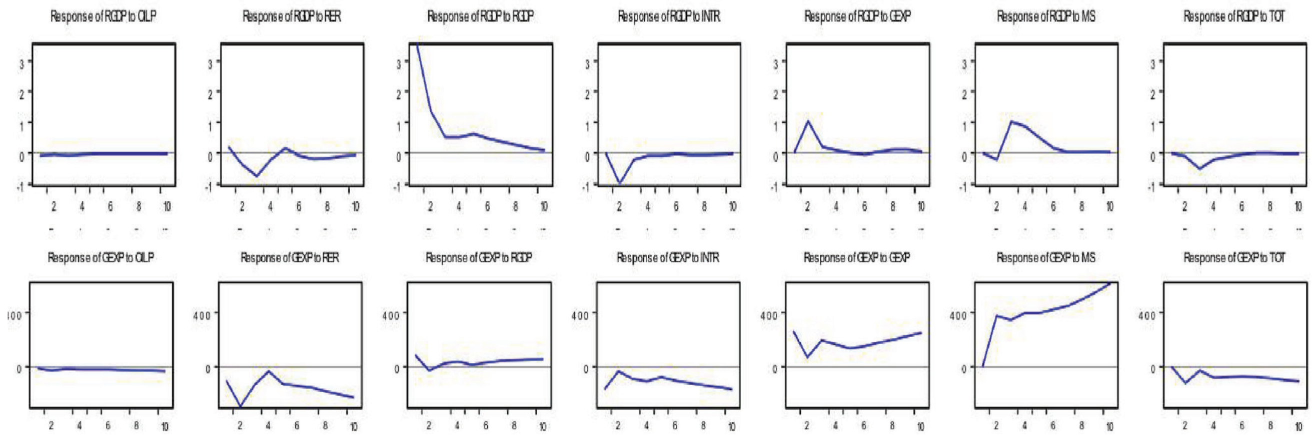

Figure 1. Impulse response function graphs (Author Computed)

Table 6. VECM variance decomposition (GEXP)

Period	S.E.	LOG(RGDP)	LOG(OILP)	LOG(INTR)	LOG(GEXP)	LOG(MS)	LOG(TOT)
1	0.305970	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.455388	0.049584	1.601379	3.006466	0.045698	0.079173	0.602433
3	0.555251	0.578036	3.912658	2.260485	0.651374	0.320520	0.477249
4	0.633075	0.461375	6.763907	1.739336	1.921442	0.312003	0.431430
5	0.695851	0.414115	8.153422	1.519787	2.563424	0.551303	0.357749
6	0.754493	0.354920	8.799742	1.379080	2.925948	0.569542	0.304702
7	0.809097	0.308690	9.545424	1.231254	3.272665	0.604084	0.267008
8	0.859356	0.276507	10.15958	1.128592	3.574156	0.662520	0.238337
9	0.906775	0.248957	10.59126	1.047813	3.797930	0.698951	0.214931
10	0.951998	0.226637	10.95394	0.980535	3.981701	0.730503	0.196055
Av. % Contribution.	-	0.291482	7.0481312	1.418834	2.273968	0.453312	0.308989

Source: Author's computation

variable can be explained by exogenous shocks to the other variables. Like the IRF, it is also generated from the VECM estimates. The percentage contribution of each variable to shocks in the GEXP fluctuations are: *RGDP* (0.29%), *OILP* (7.05%), *INTR* (1.42%), *GEXP* (2.27%), *MS* (0.45%), *TOT* (0.31%). The results show that the *OILP* account for the largest proportion of *RER* shocks, accounting for 7.048%. The impacts of the shocks are higher in the medium to long run due to the effects on lags in macroeconomic responses.

4.8 Policy Implications

The above findings imply that oil price shocks have a significant impact on both Nigeria's RGDP growth in terms of per capita income, and by extension the level of poverty. RGDP is however, mean-reverting given the oscillation between positive and negative oil price shocks. Growth and poverty reduction policies must build in the fiscal revenue variations caused by oil price shocks. Similarly, oil price shocks have a significant negative impact on long-run government expenditure when not supported by complimentary fiscal and monetary policy stabilisation pillars to drive economic and revenue diversification. This implies the need for policy reforms to ramp up non-oil revenue such as taxes and non-oil exports in order to achieve sustainable government expenditure level. The long-run decline in government expenditure as a result of the impact of oil price shocks evidences the onset of the "Dutch Disease" which induce medium to long-run decline in marginal productivity and government revenue as a result of growth in import elasticities and the absence of economic and revenue diversification.

5. Conclusion, Policy Recommendations and Scope for Further Study

5.1 Conclusion

This study employs Generalised Method of Moments (GMM) and Vector Error Correction Method (VECM) to examines how real GDP and government expenditure respond to shocks in oil prices in Nigeria. Impulse response function and Variance Decomposition were further carried out to provide additional insight into the nature of the responses and contribution of shocks from the regressors to changes in the regressands. The results from the combined estimates show a positive and significant relationship between oil price shocks and real GDP growth as well as with government expenditure. Although findings show that real GDP growth is mean reverting as it returns to equilibrium value in the long run, oil price shocks tend to have a persistent negative impact on government expenditure in the long run due to the absence of economic diversification, and the resultant decline in other productive sectors due to the "Dutch Disease", coupled with the high import inelasticities of demand in the Nigerian economy.

5.2 Policy Recommendations

Given the recurring nature of oil price shocks and their negative impact on government expenditure and real GDP growth, there is the need for a shift in stabilization and growth policy focus from dependence on crude oil export revenues and exchange rate management policies to more aggressive pursuit of economic diversification with emphasis on the promotion of non-oil export revenue growth and reduction of import dependence leveraging counter-cyclical stabilisation policies. This can be achieved through development and effective plan implementation.

There is also the imperative for the Nigerian government to hold a significant proportion of accrued oil exports revenue in international reserves and Stabilisation Fund of the Nigerian Sovereign Investment Authority using excess crude oil sales above budget benchmarks during times of positive oil price shocks. These reserves can be utilized to stabilize government expenditure, the exchange rate and external sector balances during periods of negative oil price shock. The remaining portion of oil exports earnings can be invested into growth-enhancing productive national assets such as Nigeria's deficit infrastructural stock in order to boost output, revenue diversification, employment and poverty alleviation, fiscal structures and incentives for the improvement of the business operating environment, as well as high-yield international financial assets to achieve revenue growth.

In view of the wide revenue and expenditure gap as well as the low tax to GDP ratio of 8 percent, the fiscal authorities should focus on significant growth in tax revenue to optimize potential tax revenue streams and reduce tax gap as well as meet the African average bench mark tax-to-GDP ratio of 15 percent to enhance aggregate fiscal space. Nigeria's growing budget deficit and public debt has to be reduced to sustainable levels as a precondition for unlocking fiscal resources from huge annual debt service commitments for investment in growth-enhancing sectors such as infrastructure in order to bridge Nigeria's infrastructural gap. This can be achieved by a recourse to non-debt infrastructural financing and delivery vehicles such as Public Private Partnerships (PPPs), Concessions, the pooling of funds through and Infrastructural Finance Company, Tax Credits, and privatisation or outright sale of redundant public assets among many others such vehicles. Finally, structural policies and reforms are needed to remove the prevailing structural rigidities and unfavourable business environment. This will reposition the economy for a market-led and private sector driven economic transformation attractive enough for large foreign and domestic investment flows. This will lay the foundation for long term economic growth and sustainability of the Nigerian economy.

5.3 Areas for Further Research

In order to enhance empirical outcomes of future studies, future researchers may need to complement the analysis with panel data from other countries at comparative stages of economic development to further enhance insight into the nature of monetary, fiscal and growth policy responses to oil price shocks. In addition, such studies should capture the impact of fuel subsidies on government expenditure and economic growth.

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Appendix

Appendix 1. VECM Short-run and Long-run Results for RER

Vector Error Correction Estimates							
Sample (adjusted): 1988 2018							
Included observations: 31 after adjustments							
Standard errors in ( ) & t-statistics in [ ]							
CointegratingEq:	CointEq1						
LOG(RER(-1))	1.000000						
LOG(RGDP(-1))	0.054285						
	(0.10314)						
	[0.52630]						
LOG(OILP(-1))	-4.024081						
	(0.57241)						
	[-7.03002]						
LOG(INTR(-1))	-0.401782						
	(0.53585)						
	[-0.74980]						
LOG(GEXP(-1))	-1.387247						
	(0.35618)						
	[-3.89477]						
LOG(MS(-1))	1.506137						
	(0.33033)						
	[4.55947]						
LOG(TOT(-1))	3.247992						
	(0.64951)						
	[5.00064]						
C	-5.930471						
Error Correction:	D(LOG(RER))	D(LOG(RGDP))	D(LOG(OILP))	D(LOG(INTR))	D(LOG(GEXP))	D(LOG(MS))	D(LOG(TOT))
CointEq1	-0.004929	0.553034	0.038876	0.089100	0.001080	-0.030753	-0.159067
	(0.09521)	(0.29669)	(0.07149)	(0.05369)	(0.05288)	(0.03412)	(0.07291)
	[-0.05177]	[1.86400]	[0.54379]	[1.65951]	[0.02043]	[-0.90145]	[-2.18167]

D(LOG(RER(-1)))	0.073993	-0.615328	-0.099301	-0.021154	0.214020	-0.064949	0.051423
	(0.21205)	(0.66078)	(0.15922)	(0.11958)	(0.11776)	(0.07598)	(0.16238)
	[0.34894]	[-0.93121]	[-0.62366]	[-0.17691]	[1.81740]	[-0.85482]	[0.31668]
D(LOG(RGDP(-1)))	-0.006888	-0.492126	-0.054900	-0.022970	0.008447	-0.002641	0.000613
	(0.05852)	(0.18234)	(0.04394)	(0.03300)	(0.03250)	(0.02097)	(0.04481)
	[-0.11771]	[-2.69890]	[-1.24949]	[-0.69613]	[0.25993]	[-0.12596]	[0.01367]
D(LOG(OILP(-1)))	-0.218598	2.533611	0.221328	0.401406	0.233833	-0.108196	0.162596
	(0.41452)	(1.29171)	(0.31125)	(0.23375)	(0.23020)	(0.14853)	(0.31743)
	[-0.52735]	[1.96144]	[0.71109]	[1.71724]	[1.01577]	[-0.72846]	[0.51222]
D(LOG(INTR(-1)))	-0.428739	2.076254	0.490848	-0.342634	0.634599	-0.008283	0.429818
	(0.31849)	(0.99244)	(0.23914)	(0.17960)	(0.17687)	(0.11412)	(0.24389)
	[-1.34618]	[2.09207]	[2.05254]	[-1.90781]	[3.58795]	[-0.07259]	[1.76236]
D(LOG(GEXP(-1)))	0.168719	-0.063940	0.247396	-0.021061	-0.209317	0.027181	0.201795
	(0.32013)	(0.99757)	(0.24038)	(0.18052)	(0.17778)	(0.11471)	(0.24515)
	[0.52703]	[-0.06410]	[1.02920]	[-0.11667]	[-1.17737]	[0.23696]	[0.82315]
D(LOG(MS(-1)))	0.351842	4.285577	-0.228083	0.662205	0.516206	0.405836	-0.652796
	(0.53930)	(1.68053)	(0.40495)	(0.30411)	(0.29950)	(0.19324)	(0.41298)
	[0.65240]	[2.55013]	[-0.56324]	[2.17749]	[1.72357]	[2.10022]	[-1.58069]
D(LOG(TOT(-1)))	0.496013	-0.394126	-0.049791	-0.502818	-0.253221	0.181110	-0.201592
	(0.31820)	(0.99155)	(0.23893)	(0.17943)	(0.17671)	(0.11401)	(0.24367)
	[1.55881]	[-0.39749]	[-0.20840]	[-2.80225]	[-1.43297]	[1.58850]	[-0.82732]
C	-0.093897	-1.088621	0.039739	-0.160875	0.102019	0.125294	0.122470
	(0.15624)	(0.48686)	(0.11732)	(0.08810)	(0.08677)	(0.05598)	(0.11964)
	[-0.60098]	[-2.23601]	[0.33874]	[-1.82598]	[1.17578]	[2.23814]	[1.02362]
R-squared	0.248620	0.539667	0.406322	0.487869	0.539086	0.396145	0.400187
Adj. R-squared	-0.024609	0.372273	0.190439	0.301640	0.371480	0.176561	0.182073
Sum sq. resids	2.059587	19.99894	1.161202	0.654918	0.635188	0.264416	1.207751
S.E. equation	0.305970	0.953437	0.229743	0.172537	0.169918	0.109631	0.234303
F-statistic	0.909932	3.223937	1.882139	2.619725	3.216401	1.804073	1.834764
Log likelihood	-1.959129	-37.19332	6.923146	15.80000	16.27413	29.85832	6.313931
Akaike AIC	0.707041	2.980214	0.133991	-0.438710	-0.469298	-1.345698	0.173295
Schwarz SC	1.123359	3.396533	0.550309	-0.022391	-0.052980	-0.929380	0.589614
Mean dependent	0.002538	0.045608	0.059960	-0.007198	0.189411	0.219773	0.027141
S.D. dependent	0.302273	1.203391	0.255339	0.206463	0.214329	0.120814	0.259072

Determinant resid covariance (dof adj.)	7.81E-11					
Determinant resid covariance	7.08E-12					
Log likelihood	90.04054					
Akaike information criterion	-1.292938					
Schwarz criterion	1.945098					