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Could Oil have predicted the 2016 Nigerian Economic Recession? Evidence from a Small Macroeconomic Model

Iyabo Adeola OLANRELE*

Research Fellow, Economics and Business Policy Research Department, Nigerian Institute of Social and Economic Research (NISER), PMB 5, UI Ojoo Road Ibadan, Nigeria

***Corresponding Author:** Iyabo Adeola OLANRELE, Research Fellow, Economics and Business Policy Research Department, Nigerian Institute of Social and Economic Research (NISER), PMB 5, UI Ojoo Road Ibadan, Nigeria.Email:adeyemiyabo@yahoo.com*

ABSTRACT

This study examines the impact of oil on the Nigerian macroeconomy tracing the cause of the 2016 economic recession. A dynamic Structural Vector autoregressive model was employed to capture the negative oil price shocks-macroeconomic relationship. The first analysis employed data from 1980: Q1 to 2015: Q4, and the second analysis from 1980Q1 to 2017Q:4. The findings show that negative oil shocks impacted on real output, predicting the 2016 economic recession, a major transmission channel was through the exchange rate, total government revenue, and money supply and inflation rate. The Forecast Variance Decomposition revealed that real GDP variation was due to shocks from negative oil prices, and inflation rate. Shocks from the real GDP itself accounted for more than 60 percent variation. Findings from the pre-recession data were different from the estimation with full sample analysis, as soaring oil prices brought about a moderated effect of negative oil shocks on the Nigerian economy. Diversifying the economy is vital in curtailing negative oil price shocks effects, with the monetary policy authority free from undue executive intervention for efficient stabilization control. Structural impediments to economic growth require government capability in facilitating an enabling environment for private-sector led growth.

Keywords: *Oil price, Economic recession, Nigeria*

JEL Classification: *E1, E3, E6*

INTRODUCTION

The Nigerian economy technically went into recession in the third quarter of 2016, with output growth plunging into negative rates for three consecutive quarters. The global fall in crude oil price that began in the mid-2014 was believed to have steered the economic crisis, as these two events coincided. In the era of the oil price boom, 2011 to 2013, the average annual output growth rate was5percent, with oil at US$112.4/b average annual price. A trend reversal was recorded in the wake of oil price decline of 2014 as oil price persistently remained low in 2015 and 2016, annual economic growth equally nosedived to 2.8 percent and -1.6 percent.[1] In the same vein, other factors were concurrently at work indicating possible reasons for the recession.

Spending from government coffers for 2015 electioneering campaign and associated mismanagement of the public treasury, as well as lack of reliable sources of domestic revenue, despite the abundant natural resources at the various federating unit, were identified as plausible factors. Other schools of thought believed that the non-formation of a cabinet by the newly elected government in 2015 and the delayed assent to the country's appropriation bill in the same year led to low economic activities, which resulted to the economic recession. In an economy that is public sector driven, any form of uncertainty affects investors' confidence both at the private and public space, thus the possibility of the 2016 economic recession.

However, oil resources have remained the mainstay of the economy since its discovery. In 2016, the Nigerian economy's crude oil reserve stood at about 37 million barrels, while its production capacity at about 1.83 million barrels

[1]The selected price of crude oil is the Nigerian referenced spot price-bonny light crude oil price.

per day (NNPC, 2016). Consequently, the country is a major producer of crude oil in the world and Africa. To this effect, the role of oil cannot be undermined in the growth and development process of the country. On the average, total oil revenue from 2010 to 2016 stood at N6,039.2 billion (73.9 percent), with non-oil revenue N2,127.9 billion (26.1 percent) in the same period, a situation that explains the countries, like other oil-exporting countries heavy reliance on crude oil proceeds for budgetary allocations and other economic activities. For instance, since the last quarter of 2014, the proposed Medium Term Expenditure Framework projected at the US $ 75/b of oil price benchmark was revised three times to reflect the reality of falling crude oil prices.

At the instance of the recently exited 2016 recession, oil benchmark in the 2017 to 2020 economic growth recovery plan (EGRP) was equally pegged at US$42.5/barrel to US$52/barrel, with slight modulations to reflect movement in crude oil prices, while crude oil production is assumed to remain at 2.2million b/d.[2] Oil commodity equally dominates the country's international trade's basket, Pre the crude oil price decline era of 2014, proceed from crude oil exports accounted for about 95 percent of the country's foreign exchange earnings. The consideration of the oil export to GDP ratio further illustrates this strong oil dependency, as this ratio in 2010 and 2016 stood at about65 percent and 58 percent.

Obvious of the aforementioned, several studies have investigated the oil-macroeconomy relationship using various models under different economic condition. Notable is the study conducted by Olomola and Adejumo (2006), Akpan (2009), Iwayemi and Fowowe (2011) on the effect of oil on the Nigerian macroeconomy. Differently, this study sets out to examine the impact of oil on the Nigerian macroeconomy tracing the cause of the 2016 economic recession. Evidence-based policymaking requires the use of data and models to evaluate both current and future impacts of policies and make informed choices (Olofin et al, 2014).

Thus, the use of a small macroeconomic model becomes germane to investigating the impact of external shocks on the Nigerian macroeconomy. The choice of a macro econometric model avails the opportunity of investigating the structural relationship of oil and the macroeconomy, as such, a dynamic Structural Vector autoregressive Model (SVAR) was employed. Therefore, the study sets out to forecast the effect of the oil price decline scenario on the Nigerian economy, measured by aggregate output, and other selected macroeconomic indicators that may be affected. These other selected macroeconomic variables are exchange rate, government revenue, public expenditure, money supply, and inflation rate. Data in quarterly frequency starting from 1980: Q1 to 2015: Q4 was used for the pre-recession analysis, while full sample analysis is performed on data from 1980: Q1 to 2017: Q4. The later date covers the pre and posts economic recession period.

The remaining part of the paper is structured as follows: section 2 gives a background of some selected macroeconomic indicators; section 3 explains the theoretical framework and methodology adopted for this paper, section 4 presents the outcome of the analysis, as well as other relevant estimates, section 5 provides the conclusion

OIL AND THE NIGERIAN MACROECONOMY

This section discussed the performance of some selected macroeconomic indicators vis-à-vis the movement in crude oil prices post 2000.

Figure 2.1 displays Real GDP and oil price. Real GDP grew consistently, but with or seasonal fluctuations over the observed period. A close relationship was recorded between the series in the period 2010 to 2013, however, between the first and third quarter of 2014, there was a sharp decline in the oil price.

In Figure 2, trend analysis shows that money supply increased steadily over the last decade, though it experienced some fluctuations from 2014. In contrast, Oil price trend maintained an erratic behaviour over the period, however with sharp changes from 2014. Overall, there was little significant evidence of any correlation between the movements of the two variables.

[2]EGRP document

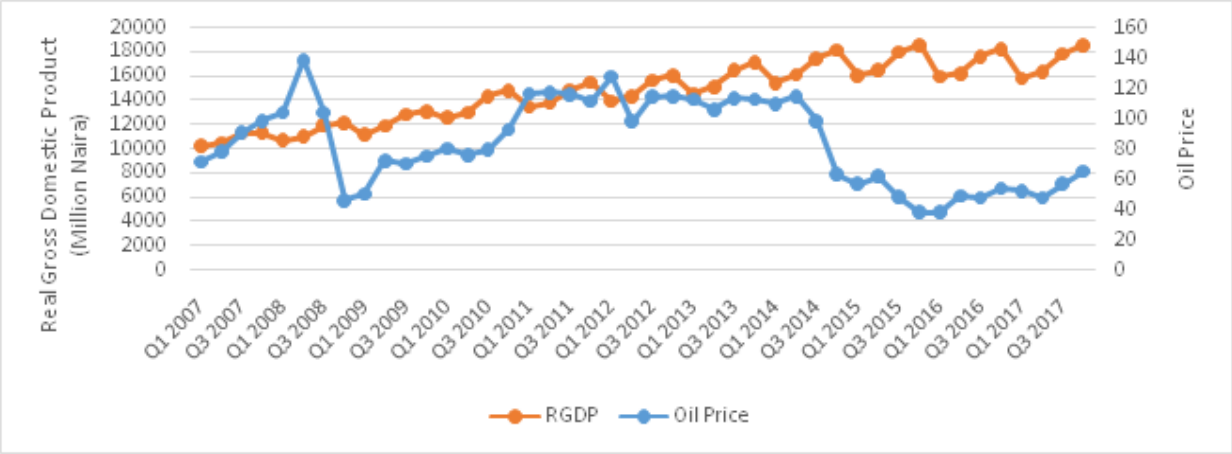

Figure2.1. *Real GDP and Oil Price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issue)*

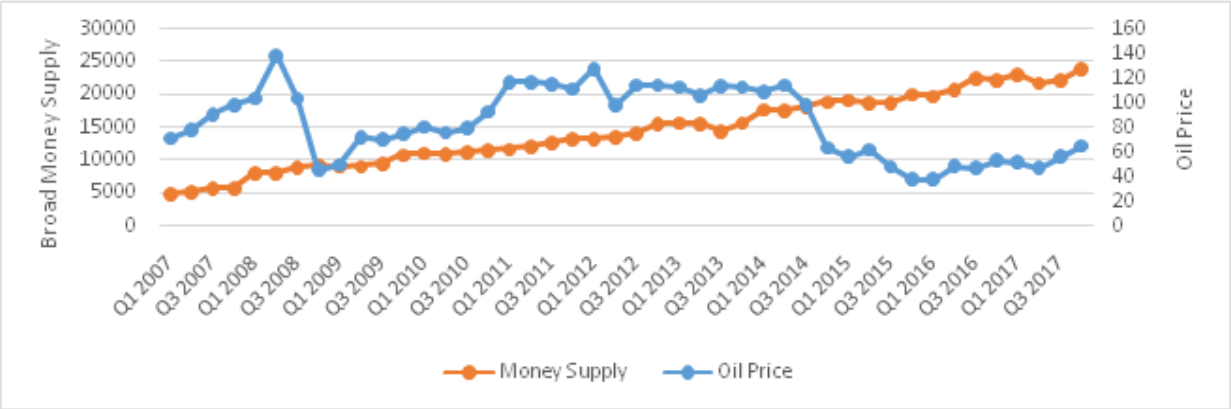

Figure2.2. *Money Supply and Oil Price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issue)*

Figure 2.3 compares the exchange rate and oil price on the left side, the graph is based on quarterly data across an eleven year period. Figure 2.3 revealed a negative relationship between the exchange rate and oil price. There was a sharp decline in oil price in the first quarter of 2009, it rose again though fluctuating then declined again in the first quarter of 2009. There was a significant steady rise in the exchange rate from 2015 as oil price declined, thus, explaining persistent depreciation of naira.

Figure2.3. *Exchange rate and Oil Price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issue)*

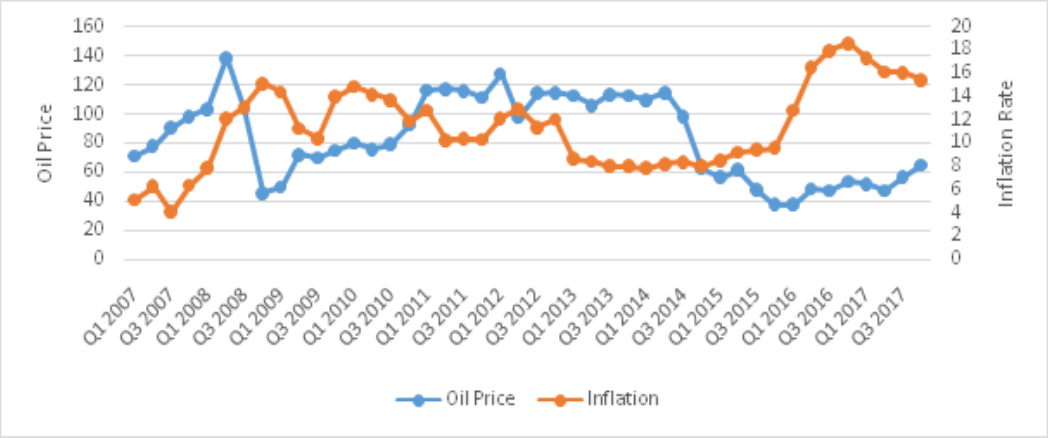

Figure2.4. *Inflation and oil price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issues)*

An inverse relationship between oil price and inflation was exhibited in Figure 2.4. A drop in the price of oil from 2008 to 2010 was accompanied by an increase in inflation rate, a similar pattern was observed in the period 2015 to 2017. Irrespective of the meandering nature of the oil price, total public expenditure grew steadily during the entire period of observation (Figure 2.5)

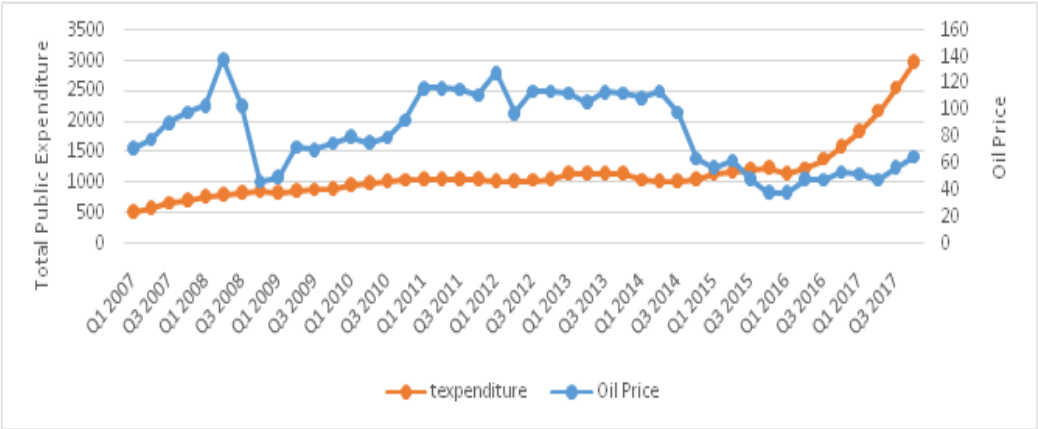

Figure2. 5. *Total expenditure and Oil Price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issues)*

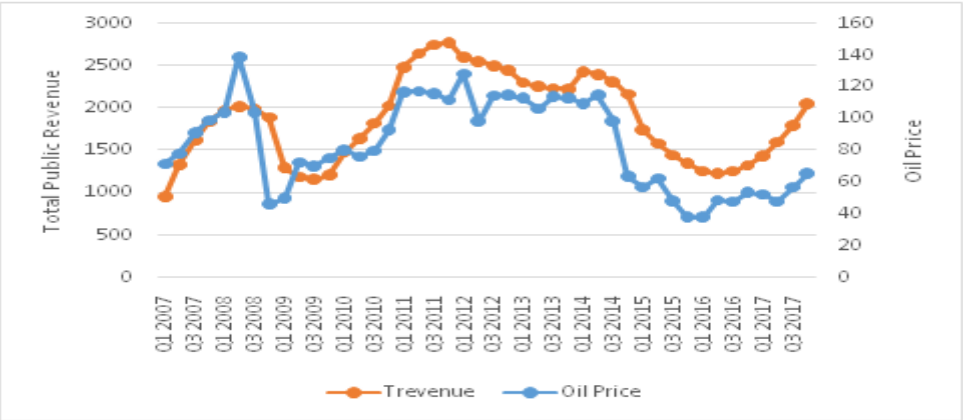

Figure2. 6. *Total Revenue and Oil Price*

Source: *Central Bank of Nigeria Statistical Bulletin (Various Issue)*

The relations between oil price and revenue could be described as exact (Figure 2.6). The positive relationship is not coming as a surprise for a net oil exporting country like Nigeria, which has over 90% of oil commodity in its total export basket.

DATA AND METHODOLOGY

This section describes the data used for analysis in this study, and then outlines the short-run Structural Vector Autoregressive (SVAR) model adopted herein. The macroeconomic variables employed are real GDP, total government revenue, total government expenditure, broad money supply, inflation rate, and nominal exchange rate. The dataset used is in quarterly series from 1980: Q1 to 2017: Q4. This period covers important oil price shocks, which can be attributed to a specific global event. For instance, an oil price change of about 35% and above has occurred since 2007. The first one in 2007 to 2008 was an oil price increase of about 35%, while the 2008-2009 price declines of about 39% was primarily accounted for by the global financial crises. The 2010-2011 price increase of about 41% was associated with the positive outlook in the global market. The latest decline in June 2014 constitutes a price fall of about 48% as a result ofexcess supply and shale revolution. Notably, the 2014-2015 constitutes the fourth and largest oil shocks since 2007, which was only surpassed by the price collapse in 1985-86.[3] In addition, the recently exited economic recession in Nigeria began in 2016: Q1, hence the first level of analysis is based on sample size from 1980: Q1 to 2015: Q4. The first period marked the era before the 2016 economic recession, providing rationale into what led to the economic crisis. The second level analysis is equally based on data from 1980: Q1 to 2017: Q4 that is the full sample analysis. This is to enable us to capture the possibility of changing impact of oil on the macroeconomy. Data were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin, and these were expressed in their natural log. It is pertinent to describe the oil shocks measure adopted since movement in oil price does not assume a linear variation. Prominent literature that has taken this into cognisance include Mork (1989) asymmetric measure of oil shocks and Hamilton (2003) non-linear of price measure.

[3]Contrary to what was obtained in the 1980s, a major shock to oil price expectations occurred when OPEC in late November 2014 announced that it would maintain current production levels despite the increase in oil production in some non-OPEC countries.

The particular interest in this paper is to consider the effect of oil price decline on the selected macroeconomic variables, hence, the adoption of Mork (1989) oil price shock measure. This measure as specified in the literature is outlined below:

$$\Delta OIP_t^{+} = \max\ (0,\ \Delta OIP_t) \geq 0 \quad (3.1)$$

$$\Delta OIP_t^{-} = \min\ (0,\ \Delta OIP_t) \leq 0 \quad (3.2)$$

Where $\Delta OIP^{+}(\Delta OIP^{-})$ is oil price increases (decreases). This measure as defined by Mork (1989) considers oil price increase or decrease and separates its effect into negative or positive changes. An increase may have a significant effect on the macroeconomic variables, but the same may not occur for oil price decreases.

Having defined the oil shock measure, we briefly described each of the selected variables. Real Gross Domestic Product (RGDP) is the total aggregate output in 2010 constant term. It represents the total naira value of all goods and services produced in Nigeria over a specific period. Total government Expenditure is the summation of current and capital expenditure in a country, while the total government revenue is the sum total of oil and non-oil revenue flow in Nigeria. Money supply (M2) is the broad money supply, which includes assets that are highly liquid but not cash. It is a broader classification of money than M1, and a key indicator used to forecast inflation. An Inflation rate is the rate growth of the consumer price index. The exchange rate is the rate is the price of naira to US dollar.

The remaining part of this section explains the SVAR approach in this paper. The model specification was based on the dynamic aggregate output equation as capture in Keynesian Aggregate Demand-Aggregate Supply (AD-AS) framework. However, the model was modified to capture the peculiarity of a small open emerging oil-exporting economy like Nigeria. The AD side of the model follows IS-LM, Mundell-Fleming framework, such that, oil shocks are allowed to transmit through export value, total government revenue, exchange rate, actual government expenditure, money supply, inflation rate, and nominal output. Accordingly, it would include the dynamics of fiscal balance-revenue and expenditure- as well as the exchange rate in the aggregate output model. Hence, the AD side of the model follows the IS-LM and Mundell-Fleming framework which shall capture

variables like total Federal Government expenditure, total Federal Government revenue, broad money supply, and exchange rate while the AS side of the model captures general price level given by Consumer Price Index inflation rate.[4]Specifically, the model has seven variables- real negative oil price, real GDP (a measure of aggregate output), government revenue, government expenditure, exchange rate, money supply, and inflation rate; which all capture fiscal, monetary and price effect. In the traditional Keynesian AD-AS framework, the interaction of these variables is conditional indicators for aggregate output outcome.

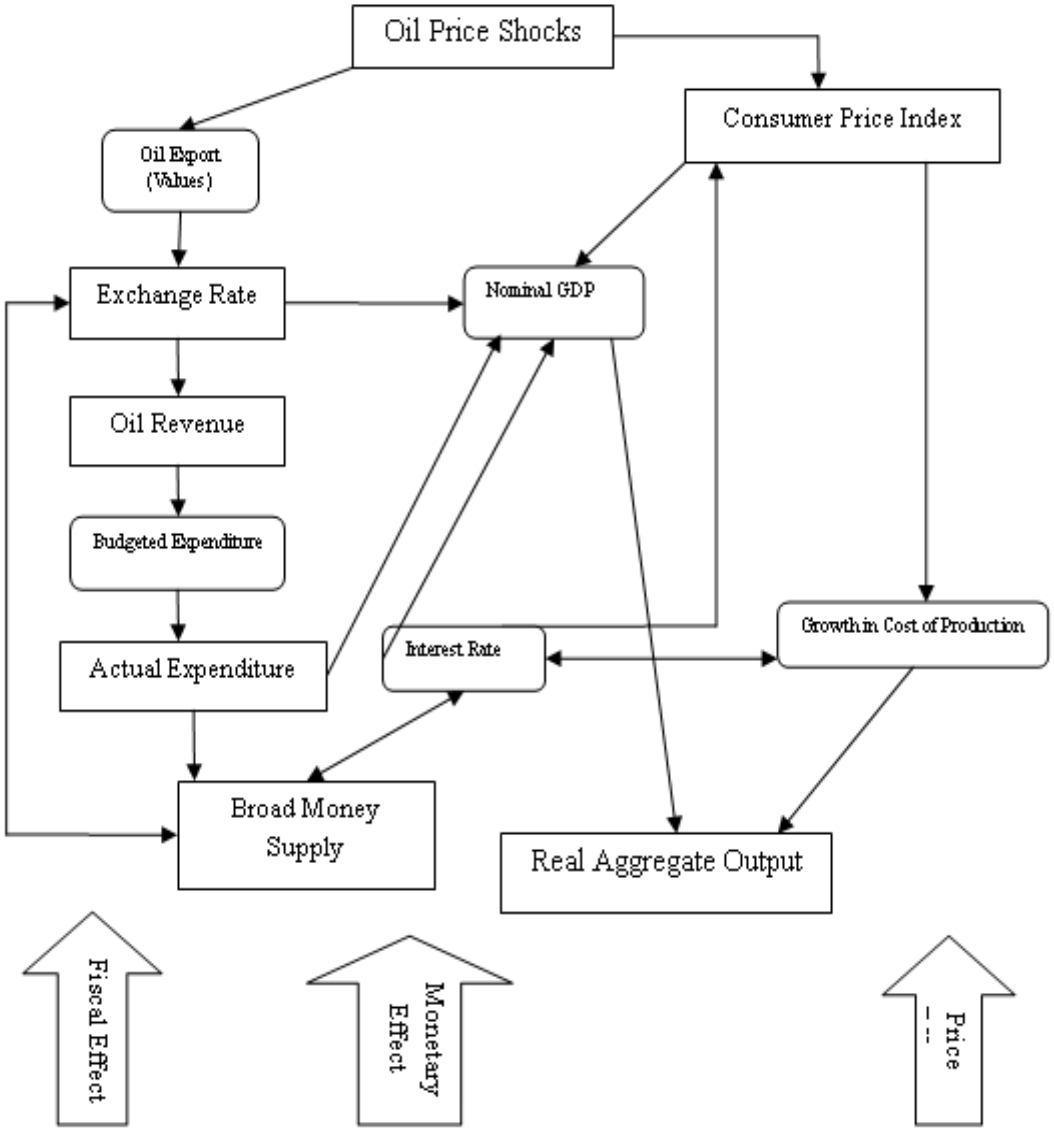

Figure3.1. *Oil Shocks Transmission to Macroeconomic Aggregates*

Author's Depiction

The flowchart in Figure 3.1 shows that oil price shocks effect on the economy is transmitted through AD-AS channels. The AD channel is in three parts-fiscal, monetary, and external sector effects-while the AS works through the price effect (inflation). On a theoretical ground, this was asserted as valid by the West African Monetary Agency-WAMA-(2008) and Lescaroux and Mignon (2008), who identified that the macroeconomic effects of oil shocks are transmitted via supply and demand-side channels and are substantially minimised by economic policy reactions.

[4]The exchange rate variable works through the AD model, capturing the effect of international trade and finances as explained by the Mundell-Fleming model.

As depicted in the flowchart, the supply side channel at the aggregate level focuses on oil as an input in the production processes, having an inflationary effect on real GDP as a result of growth in the cost of production. Crude oil is one of the most fundamental and crucial raw materials for industrial production and change in its price can affect output directly through inflation as indicated in Figure 3.1. This is referred to as the aggregate supply-side shock effect. However, oil price shocks also have a long-term effect on the output which is carried out through the cost of production/monetary transmission mechanism. Cost of production shocks in the economy can be transmitted from producers' to end users. A well-developed industrial chain can transmit inflationary shock from industries using petroleum products, leading to growth in the cost of production. This can raise the overall cost of production, thus reducing the real balance. This transmission ends up with a reduction in aggregate output.

The aggregate demand effect reflects oil price shocks through the transfer of income and resources from oil-importing to oil-exporting economies. Oil price shocks affect the exchange rate through export values, thereby impacting on oil revenue and pass down to actual expenditure, working its effect indirectly to real GDP. An increase in actual expenditure precipitates the circulation of money within the economy which also affects the real GDP indirectly through the interest rate-this is the fiscal effect. Other identified channels such as economic policy reactions occur through monetary authorities' actions toward curtailing adverse effects of an oil price shock on the cost of production and inflation. Money supply plays a role in controlling inflationary pressure, having a negative correlation between oil prices and economic activity. According to Federer (1996), real money balances channel presupposes that increase in oil price causes inflation which, in turn, reduces the number of real balances in the economy while counter-inflationary monetary policy responses to oil price shocks are considered responsible for the real output losses associated with these shocks.

The recursive identification model for the above schematic is given below as:

$A_0 \qquad\qquad\qquad \mu_t \varepsilon_t$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{11} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 1 \end{pmatrix} \begin{pmatrix} \mu_t^{NEGOIL} \\ \mu_t^{EXCR} \\ \mu_t^{TREV} \\ \mu_t^{TEXP} \\ \mu_t^{M2} \\ \mu_t^{INFL} \\ \mu_t^{RGDP} \end{pmatrix} = \begin{pmatrix} \varepsilon_t^{NEGOIL} \\ \varepsilon_t^{EXCR} \\ \varepsilon_t^{TREV} \\ \varepsilon_t^{TEXP} \\ \varepsilon_t^{M2} \\ \varepsilon_t^{INFL} \\ \varepsilon_t^{RGDP} \end{pmatrix} \tag{3.3}$$

Equations(3.3) is a recursive identification. In this case, the matrix $A_0$is restricted to a lower triangular matrix with zero above the diagonal line. A_0 is the estimable matrix;μ_t is the vector of unobserved residuals from the reduced form equations while εt is the vector of the structural disturbances. The shocks are negative oil price shocks, exchange rate shocks, total federal government revenue shocks, total federal government expenditure shocks, broad money supply shocks, inflation shocks and real Gross Domestic Product shocks. In this study, recursive identification requires that 21 restrictions are placed on A_0 for exact identification of the model. Likewise, each model is expected to contain 28 free elements. The restriction implies that an oil price shock does not respond to contemporaneous changes from other variables because it is determined exogenously. However, all other variables in the system are contemporaneously affected by changes in oil price shocks and are specified based on structural factorisation and economic relationship explained in Figure 3.1.

Empirical Results

Unit Root Test

The results of the stationary test of the variables using the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) unit root test statistics are reported in Table 4.1. The result revealed that the variables are not stationary at their levels except for negative oil price shocks, implying that all other series contains a unit root. As such, the variables are stationary and are integrated of the order I (1), thus the null hypothesis of unit

root is rejected. The SVAR models are estimated at first difference.

Table4.1. *Unit Root Results*

	Augmented Dickey-Fuller			Phillips Perron		
	Intercept	**Intercept and Trend**	**Remarks**	**Intercept**	**Intercept and Trend**	**Remarks**
EXCR	-11.120	-11.434	I(1)	-11.118	-11.408	I(1)
INFL	-10.008	-9.974	I(1)	-9.765	-9.723	I(1)
M2	-12.823	-12.78	I(1)	-12.842	-12.809	I(1)
NEGOIL	-11.322	-11.351	I(0)	-11.298	-11.332	I(0)
RGDP	-5.192	5.360	1(1)	-21.927	-23.242	I(1)
TREV	-6.609	-6.791	I(1)	-9.693	-9.692	I(1)
TEXP	-5.442	-5.433	1(1)	-9.351	-9.373	I(1)

Estimation Result -Pre Economic Recession

The estimation of the effects of oil on the Nigerian macroeconomy begins with the selection of the appropriate lag length selection. The analysis for the pre-recession period that is 1980: Q1 to 2015: Q4, based on Akaike Information Criterion (AIC) and Hannan - Quinn, was performed using two (4) as the lag length, which was the least lag at 5% level of significance. To ascertain if the SVAR model specified is stable, SVAR stability Condition Check, analogous of the Roots of Characteristic Polynomial, and the Inverse Roots of AR Characteristic Polynomial test were carried out. The results (Appendix A and C) showed that the SVAR model satisfied a stability condition.[5]

The dynamic impulse response of negative oil price (NEGOIL) effects on the exchange rate (EXCR), total government revenue (TREV), total government expenditure (TEXP), money supply (M2), inflation rate (INFL) and real GDP (RGDP) are presented Figures 4.1. The responses are for five (5) quarters, which are quarters aftershock. Movement in the exchange rate was positive four (4) quarters after oil price decrease. This is not counterintuitive for a net oil-exporting and oil-dependent economy as a decline in oil revenue put pressure on foreign exchange reserves, thereby depreciating the value of the domestic currency. These findings confirm the findings by Babatunde (2015) that oil price shocks depreciate exchange rate in Nigeria. Data from CBN (2017) revealed that in first quarter 2016, an exchange rate that was officially N197/US$ increased to N283/US$ and N305/US$ in the second and third quarter of the same year respectively, the rate became constant at N305/US$ afterward. After 2016: Q4, the exchange rate becomes negative, suggestive of the domestic currency appreciation.

The response of total government revenue to oil price decrease was positive throughout the period, with the effects separated into two. The first period, 2016: Q1 to Q3 was period of steady increase in revenue as an aftermath of the oil price decline that commenced in 2014, the second period was from 2016: Q4 to 2017: Q1, which was a period of slow growth in total government revenue. Obviously, fall in oil prices reduces government revenue in the early period of 2016, explaining part of the economic crisis faced in the period. This result further buttresses the fact the dominance of oil revenue in total, which has remained above 70%.Increase in revenue was as a result of immediate policy response used to stem the tide of falling revenue, among which are: increased non-oil tax collection efficiencies and inclusion of some luxurious goods into the existing non-oil tax net. The response of government expenditure to oil price shocks mirrors the movement in government revenue, although at a lower magnitude. The positive effect is not far-fetched since debt financing was used to augment the spending gap created by oil price fluctuations, cushioning the effect of oil price decline. In 2016, the country's domestic debt outstanding increased to N11,058 billion from N8,837 billion in 2015, which indicates 25% increases. In like manner, external debt increased to N2, 111.5 billion in 2016 from N3, 478.9 billion in 2015. The subsequent slow down effect affirmed the fact that government expenses were not sustainable outside higher oil prices.

The dynamic response of money supply to oil price decrease was negative in the immediate lag, indicative of a decline in money supply. There was a gradual increase in money supply beginning from the second quarter. This finding is as expected, at the immediate period, since a decline in oil price will dampen oil revenue for an oil exporting country, hence total money in

[5]See appendix

circulation as a result of changes in government consumption expenditure. Inflation rate responded positively immediately aftershocks, with the responses declining speedily after 2016 quarter two (2). The existing fiscal oil policy, fuel consumption subsidy, was not able to curtail the inflationary pass-through effect, as the domestic price of gasoline (Premium Moto Sprit-PMS) was reviewed upward in late 2015/2016 to ameliorate the effect of falling oil receipt on the domestic foreign reserves. Hence, oil price decline was inflationary in the recession period, 2016: Q1 to 2016: Q3

Oil price shock was almost muted on real output (aggregate output) before second quarter 2016.Gradually, the effect became negative starting from late 2016: Q1 up to the mid-2017: Q1. The response became positive thereafter. Obviously, oil price decline culminated into the 2016 economic recession, as real output (RGDP) was in the negative territory periods aftershocks. This is not a surprise in an oil-dependent economy, where budgetary allocations are tied to movement in the international price of crude oil, dampening expectations in both private and public investment. It is important to note that our findings agree with Gronwald *et al* (2009) the results of which clearly indicate that net-oil exporting economies are considered vulnerable to oil price decline.

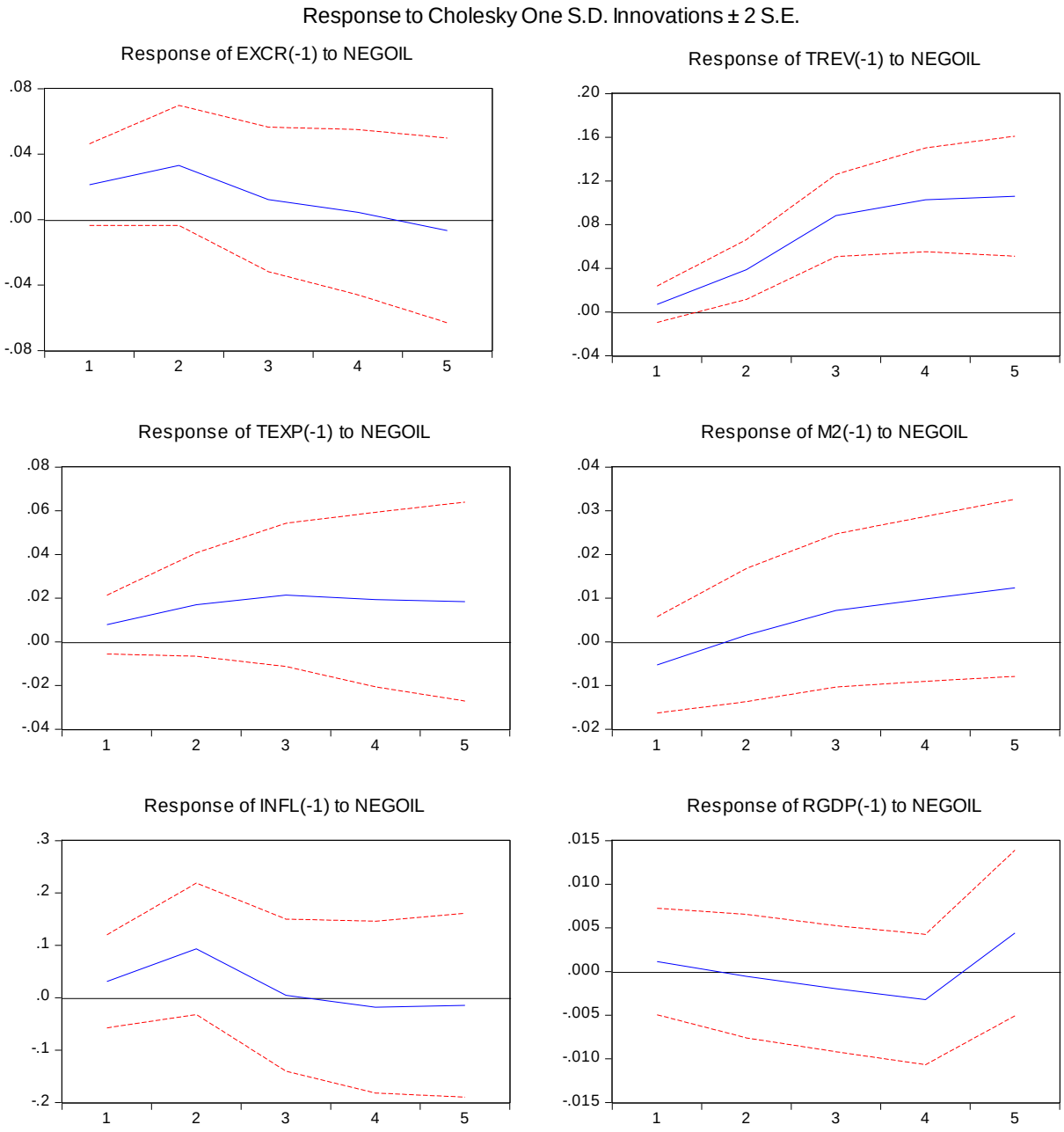

Figure4.1. *Responses of Macroeconomic Variables to Oil Shock*

The variance decomposition shows the amount of forecast error variance decomposition of a variable explained by its own shock and other shocks within the VAR system. In Table 4.2, pre-recession period, negative oil shocks accounted for less than 1 percent fluctuations on real GDP over the five quarter horizon. Equally, the other macroeconomic variables also had less than 1 percent impact on real GDP, except for the effect of the real GDP on itself. Although, the magnitude of shocks from other macroeconomic variables were not phenomenal, negative oil price and inflation shocks caused output fluctuations outside variability from own-self. Thus, fluctuations in Gross Domestic Product were primarily caused by the variability in real GDP, negative oil price, and inflation rate.

Table4.2. *Forecast Variance Decomposition Result*

Source of Variation to Real Gross Domestic Product (RGDP)							
Period	**Negative Oil Price**	**Exchange Rate**	**Government Revenue**	**Government Expenditure**	**Money Supply**	**Inflation Rate**	**Real Gross Domestic Product**
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	91.38991
2	0.064540	0.072382	0.037471	0.008063	0.025055	0.208575	84.02674
3	0.060078	0.081314	0.045403	0.012862	0.023960	0.157762	72.65439
4	0.354531	0.076518	0.050560	0.013202	0.042141	0.129789	66.73905
5	0.388249	0.076401	0.038713	0.012258	0.117997	0.170000	72.63180

Estimation Result-Full Sample Analysis

The full sample model (1980: Q1 to 2017: Q4) was analysed using four (4) as the appropriate lag length based on Akaike Information Criterion (AIC) and Hannan-Quine (HQ).

The SVAR stability Condition Check, analogous of the Roots of Characteristic Polynomial, and the Inverse Roots of AR Characteristic Polynomial tests revealed that the estimated model is stable (Appendix B and Appendix D).[6]

The dynamic effects of negative oil price shocks on the selected macroeconomic variables as depicted in Figure 4.2 shows that in the three quarters of 2018, the exchange rate was positive, depreciating, at a declining rate starting from the second quarter. This pattern was not too different from what obtained with the pre-recession analysis. The effects on total government revenue show an increasing positive trend all through the time horizon, although a seemingly linear trend ensued. This could be as a result of declining negative oil prices in the past few quarters. The effect of oil on expenditure was on the increase in the initial periods, with movement becoming constant from 2018:Q2. Since other financing options are used to douse the effects of oil on government spending, the effects of negative oil became negligible.

There was an immediate impact of negative oil shocks on money supply, but became positive from the late 2018:Q1. The full sample result conforms to sub-sample results, implying a decline in money supply due to oil price decrease. Thus, a resultant fall in oil revenue instantly reduces the overall money in circulation; however, there is a trend reversal when policy responses are quickly designed. The effect of negative oil price on inflation rate, from the full sample analysis is the same, suggestive of the fact that oil price shocks have inflationary effect on the Nigerian economy.

Negative oil price shocks has a positive, though insignificant, impact on the real output. This result is divergent to what we found in the pre-recession analysis. A major reason could be as a result of soaring oil prices. The gradually increase in output reflects government policy response in pulling the economic back to the path of growth recovery.[7]

[6]See appendix

[7]Pulling out of recession, the Nigerian economy in 2017 designed an Economic Recovery Growth Plan (ERGP), a strategic plan for 2017 to 2020. The overall crux of the blueprint is built on the tenets of restoring economic growth (Ministry of Budget and National Planning, 2017)

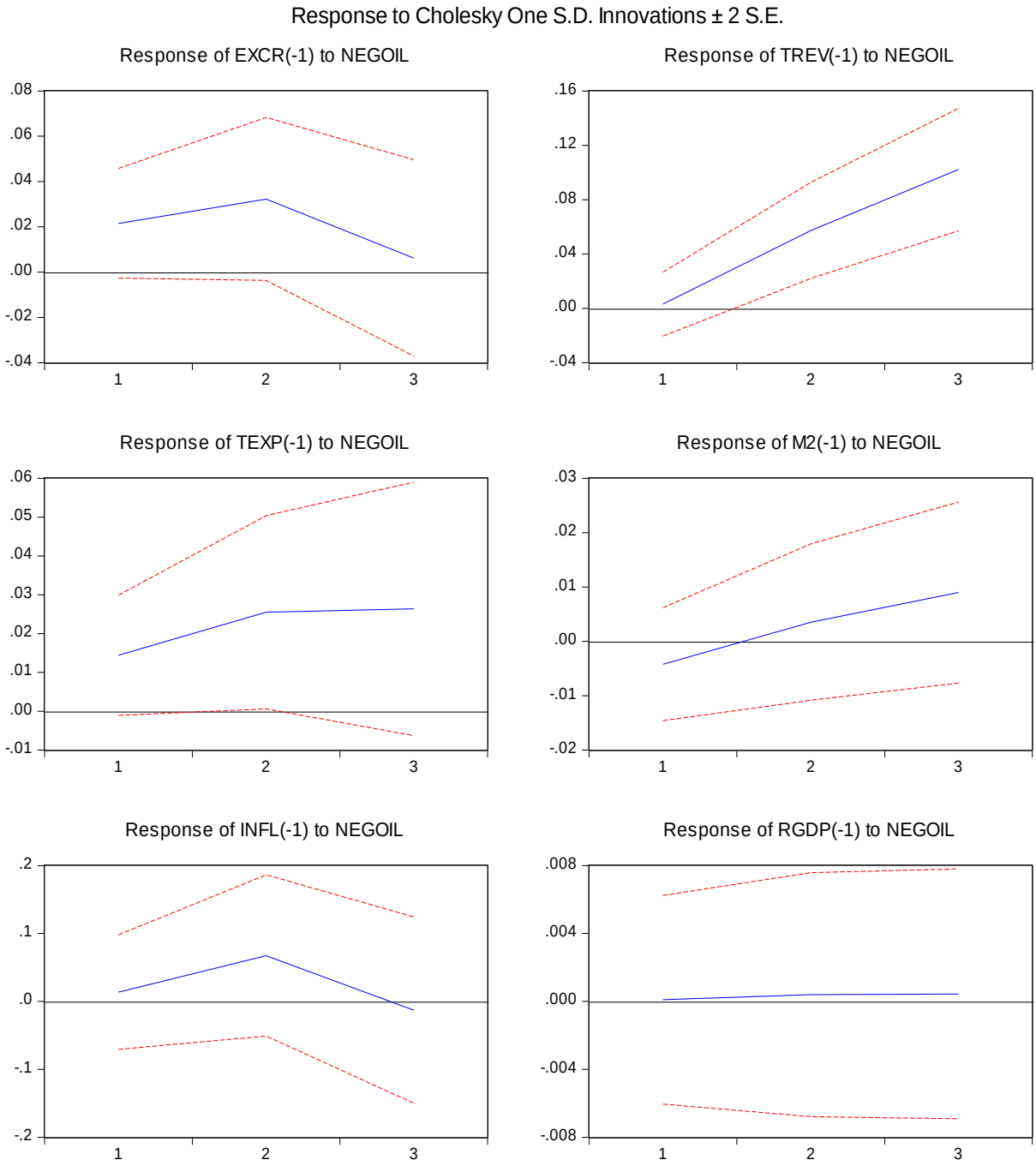

Figure4.2. *Responses of Macroeconomic Variables to Oil Shock*

Based on the full sample analysis (Table 4.3), shocks from inflation rate and real RGDP were apparent, with the shocks from real GDP to itself accounting for more than 60 percent. Other shocks aside the aforementioned variables were not significant to real GDP fluctuations. Thus, movement in the general price level have explains some variation on the Nigerian economy. This further reinforces the findings that increasing oil prices has no effect on real output, hence economic growth

Table4.3. *Forecast Variance Decomposition Result*

	Sources of Variation to Real Gross Domestic Product						
Period	**Negative Oil Price**	**Exchange Rate**	**Government Revenue**	**Government Expenditure**	**Money Supply**	**Inflation Rate**	**Real Gross Domestic Product**
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	90.13303
2	0.081311	0.074294	0.041852	0.072530	0.020193	0.160608	82.25956
3	0.071952	0.083648	0.025124	0.048066	0.026863	0.124777	72.08554

Having discussed the general findings from this study, it is important to note that negative oil price (decrease) significantly impact on real output, hence the 2016 economic recession. The full sample analysis shows negligible impact of negative oil price on the Nigerian economy, arising from the soaring oil prices in recent time. Notably, the effect of negative oil price was phenomenal on the exchange rate, government revenue, money supply and inflation rate, a situation that reflects the overly dependence of the economy on oil proceeds.

CONCLUSION

It cannot be refuted that negative oil price shocks had much effect on falling aggregate output, culminating into the 2016 economic recession. This brought about the investigation into the role of oil on the recently exited economic crisis in Nigeria. Like other empirical literature, this paper employed the SVAR model to empirically examine the effects of negative oil on the macroeconomy, with special interest on real GDP. The analysis was carried out in two stages, the first considers the role of oil shocks on 2016 economic recession, and the second level analysis used both pre and post-recession period data to ascertain the possibility of differences in the macroeconomy effects of negative oil shocks.

Extant literature revealed the muted effects of oil on the Nigerian macroeconomy owing to the disarticulated nature of the oil sector from other sectors of the economy. The findings in the study show that; the effect of negative oil shocks was prominent on the Nigerian economy, stimulating the 2016 economic recession, a major transmission channel was through the exchange rate, total government revenue, and money supply and inflation rate. The Forecast Variance Decomposition revealed that real GDP variation was due to shocks from negative oil prices, and the inflation rate. Shocks from the real GDP itself accounted for more than 60 percent variation. Findings from the analysis with pre-recession data were different from the estimation with full sample analysis, as soaring oil prices brought about a moderated effect of negative oil shocks on the Nigerian economy.

Diversifying the economy is a necessity to curtail successive effects of negative oil price shocks, and it is equally important for monetary policy to be free of undue executive intervention, so as to control general price level through effective money supply targeting, while also allowing market dynamics to stabilize the exchange rate. In addition, structural impediments to economic growth require pragmatic actions from the State actors to facilitate the efficient running of the economy. The overarching role of government is to facilitate an enabling environment for private-sector led growth.

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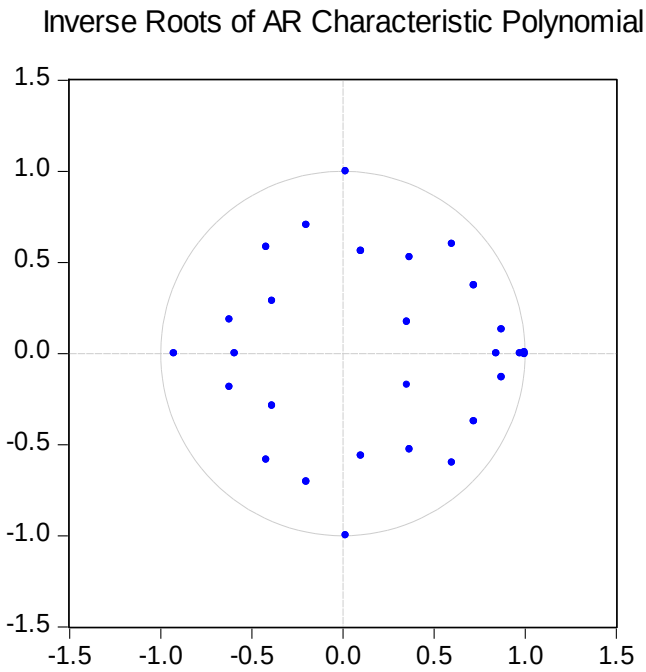
APPENDICES

Appendix A: Inverse Roots of AR Characteristic Polynomial Stability Test

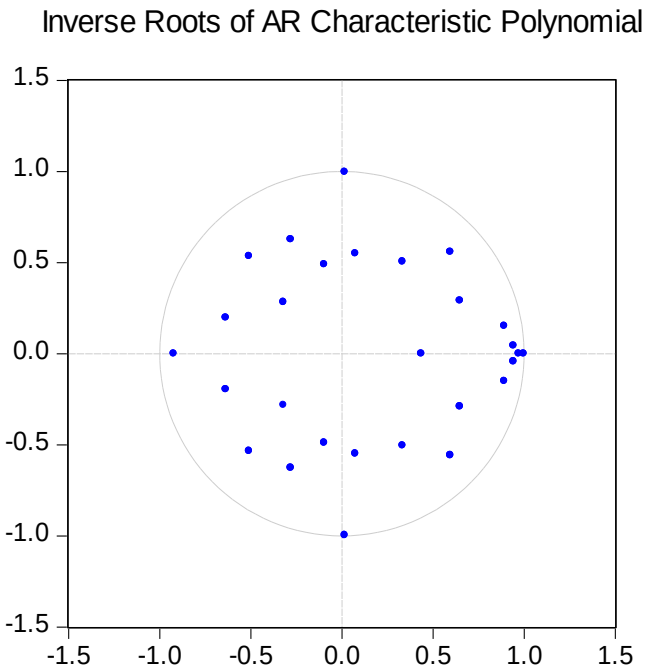


Appendix B: Inverse Roots of AR Characteristic Polynomial Stability Test

Roots of Characteristic Polynomial	
Endogenous variables: NEGOIL EXCR(-1) TREV(-1) TEXP(-1) M2(-1) INFL(-1) RGDP(-1)	
Exogenous variables: C	
Lag specification: 1 4	
Date: 11/19/18 Time: 10:30	
Root	Modulus
0.017415 + 0.998655i	0.998806
0.017415 - 0.998655i	0.998806
0.998200 - 0.005047i	0.998213
0.998200 + 0.005047i	0.998213
0.973253	0.973253
-0.926512	0.926512
0.871695 + 0.131200i	0.881513
0.871695 - 0.131200i	0.881513
0.599868 + 0.600574i	0.848841
0.599868 - 0.600574i	0.848841
0.842880	0.842880
0.719426 - 0.374029i	0.810846
0.719426 + 0.374029i	0.810846
-0.198856 - 0.704455i	0.731985
-0.198856 + 0.704455i	0.731985
-0.419504 - 0.584159i	0.719184
-0.419504 + 0.584159i	0.719184
-0.620017 - 0.184872i	0.646992
-0.620017 + 0.184872i	0.646992
0.368221 - 0.527021i	0.642913
0.368221 + 0.527021i	0.642913
-0.593567	0.593567
0.099954 + 0.561478i	0.570306
0.099954 - 0.561478i	0.570306
-0.386357 - 0.287946i	0.481855
-0.386357 + 0.287946i	0.481855

0.353373 + 0.172809i	0.393365
0.353373 - 0.172809i	0.393365
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Appendix C: Inverse Roots of AR Characteristic Polynomial Stability Test



Appendix D: Inverse Roots of AR Characteristic Polynomial Stability Test

Endogenous variables: NEGOIL EXCR(-1) TREV(-1) TEXP(-1) M2(-1) INFL(-1) RGDP(-1)	
Exogenous variables: C	
Lag specification: 1 4	
Date: 11/19/18 Time: 10:48	
Root	Modulus
0.997791	0.997791
0.016943 - 0.997023i	0.997167
0.016943 + 0.997023i	0.997167
0.971897	0.971897
0.941756 + 0.043354i	0.942753
0.941756 - 0.043354i	0.942753
-0.921673	0.921673
0.892292 - 0.151653i	0.905088
0.892292 + 0.151653i	0.905088
0.595830 - 0.557914i	0.816260
0.595830 + 0.557914i	0.816260
-0.508729 - 0.534683i	0.738032
-0.508729 + 0.534683i	0.738032
0.648218 - 0.290487i	0.710330
0.648218 + 0.290487i	0.710330
-0.280490 - 0.626873i	0.686763
-0.280490 + 0.626873i	0.686763
-0.637235 - 0.195977i	0.666690
-0.637235 + 0.195977i	0.666690
0.334494 - 0.504623i	0.605417
0.334494 + 0.504623i	0.605417
0.075430 - 0.548575i	0.553736
0.075430 + 0.548575i	0.553736
-0.096270 - 0.489224i	0.498606

-0.096270 + 0.489224i	0.498606
0.437045	0.437045
-0.319450 + 0.282325i	0.426328
-0.319450 - 0.282325i	0.426328
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

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