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THE LONG RUN IMPACT OF OIL REVENUE FLUCTUATIONS ON ECONOMIC GROWTH IN NIGERIA

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Abstract: The recent fluctuations in oil revenue prompted the researcher to analyze the impact of oil revenue fluctuations on economic growth in Nigeria between 1980 and 2022 using annual time series data. The research used the vector error correction model complimented by other econometrics tests such as the unit root test, Johansen cointegration test and the Pairwise granger causality tests. The long run VECM result shows a negative relationship between oil revenue fluctuations and economic growth in Nigeria. Non oil revenue shows a positive relationship with economic growth which indicates non oil revenue as a dominant source of growth in the Nigerian economy. The Pairwise Granger Causality test shows a bi-directional causation running from oil revenue and non oil revenue to GDP and from GDP to these independent variables in Nigeria. Recommendations made include: the government should ensure that revenue from the oil sector is well invested in the key economic sectors to cushion the effect on the economy in any event in the collapse of oil price and revenue and non oil revenue should be harnessed with great virgour to complement oil revenue fluctuations and its attendant consequences on economic growth in Nigeria.

Keywords: Oil Revenue; Fluctuation; Economic Growth and the VECM

1. INTRODUCTION

Empirical research from previous studies such as Dennis (2000) and Omo and Bashir, 2015 shows that while increases in oil price have a negative impact on oil importing economies, they have a positive impact on oil exporting economies although the impact of the oil price increase in the oil exporting country is

mitigated by a reduction in demand as a result of price increase. This is so because the increase in oil price would increase revenue for exporting country, the importing economies would naturally reduce the quantity demanded of crude oil which follows the law of demand which says that an increase in price would lead to a decrease in quantity demanded and vice-versa. Thus the reduction in quantity demanded would reduce the total revenue earned from oil exports.

The media through which these shocks are felt in the economy can be classified under demand and supply headlines. The supply side effects considers oil as a production input, thus an oil price increase would lead to an increase in the cost of production, which would result in reduction of output, hence reducing aggregate supply. This lowers economic activity and growth. The demand side effects however focus on the effect of oil price shock on consumption and investment. An increase in oil price leads to reduction in real disposable income since consumption and investment are positively related to income, a reduction in income would lead to a reduction in consumption and investment in the economy and hence aggregate demand.

In the case of oil exporting country like Nigeria, an increase in oil price per barrel combined with supply quota fixed by the Organization of Petroleum Exporting Countries (OPEC), results in a boom in the oil revenue making available more funds for consumption and investment in the exporting country. This enhances economic performance which could result in growth and even consistent economic development. However, the continued underdevelopment of Nigeria despite the accumulated increase in oil revenue over the years is shocking. Even in relating the Nigerian economy on the demand – supply effects of oil shock, Nigeria should be operating as an oil exporting country with less shock. What then is the major problem of the Nigerian economy in the 21st century as far as oil revenue fluctuation is concerned? This may be traceable to the mono-cultural nature of the economy and inability of the economy to manage revenue fluctuations.

The Nigerian economy is highly dependent on revenue from crude oil exports as such; the economy is highly susceptible to changes in oil prices. This study thus seeks to examine the impact of oil revenue fluctuation on economic growth in Nigeria. It is more relevant to estimate on empirical ground the consequences of oil revenue fluctuation on the Nigerian economy considering that the country is a relatively small open economy and has no real influence on the world oil prices, whereas, it is greatly influenced by the effect of oil revenue fluctuations as an exporter and as an importer of refined petroleum products (CBN, 2022). It thus implies that oil revenue fluctuation of whatever nature can be of both benefit and hurt the economy at the same time. The scope

of the work in terms of geographical coverage is Nigeria while the study time period is limited within 1980 to 2022. This time period is considered long enough to capture both pre SAP and post SAP effect of oil revenue fluctuations on economic growth in Nigeria.

2. OIL AND OIL REVENUE IN NIGERIA

Oil refers to crude oil and natural gas or simply put oil gas. Dennis (2000) defines oil as the mixture of various shapes and sizes, of hydrogen and carbon atoms found in the small connected pure space of some underground rock formations. These oil reservoirs are generally thousands of feet below the surface; crude oil is believed to be the remains of plants and animals, mostly small marine life, that lived many millions of years ago. Oil is discovered and produced through wells drilled down to the reservoirs. Experts such as Dennis (2000) agreed that from oil we can get numerous useful products such as transportation fuel, gasoline, diesel fuel, jet fuel etc. This definition has formed the basis for the understanding of oil and gas as a working definition for this work.

Oil revenue on the other hand refers to the monetary benefits that accrue to Nigeria for the sale of oil and oil related products. Nigeria is endowed with over 30 different minerals which include gold, limestone, iron ore, columbite, and coal. Being resource rich, Nigeria is endowed with about 37.2 billion barrels of proven oil reserves, 187 trillion cubic feet of proven natural gas and produces about 2.3 million barrels of oil per day (Omo and Bashir, 2015). This makes Nigeria the largest oil producer in Africa and the tenth largest in the world. Despite the statistics, the country import about 85% of its refined petroleum products due to the low capacity utilization and frequent breakdowns of its refineries (Oriakhi and Iyoha, 2013).

Over the years, Nigeria relied on revenue from oil to finance its budget. Following weaker prices and declining output which resulted from regional unrest, the consolidated overall budget surpluses of 2008 was substantially reversed to deficit amounting to 10.4% of the GDP in 2009 and to about 6.8% of GDP in 2010 (Omo and Bashir, 2015). Thus, in 2009, about #20 billion was utilized to finance the budget. The Nigerian economy slowed from 7.4% growth in 2011 to 6.6% in 2012 (Oriakhi and Iyoha, 2013). During this period the oil sector continued to drive the economy, with an average growth of about 8% compared to -0.35% for the non oil sector. This implies that the oil and gas sectors continue to dominate economic activities in Nigeria before economic recession that engulfed the country in the late 2015.

Furthermore, the share of capital expenditure on social community services in total rose from 10% in 2011 to 11.1% in 2012 and 11.8% in 2022 while economic services declined from 42.1% to 36.7% in 2012 and 20% in 2022 respectively (CBN,

2022). In consequence, the ratio of capital expenditure to total expenditure reduced from 24.3% in 2012 to an estimated 23.9% in 2022 (CBN, 2022). It is however worthy of note that despite the observed persistent decline in oil revenues and total revenue since the last two or more decades, non oil revenues were relatively rising over the same period, thereby compensating marginally for the shortfall in oil revenues. In this regard, the government has resulted to expenditure adjustments in order to accommodate the revenue shortfall. Nevertheless, capital expenditures suffer huge downward adjustments because recurrent expenditures, which are mainly salaries and overhead, could hardly be adjusted automatically. Meanwhile, the downward adjustments in capital expenditure may necessarily slowdown total economic activities and growth.

3. CHANNELS OF OIL REVENUE FLUCTUATIONS ON THE ECONOMY

There are four channels of oil revenue fluctuations on the economy. These channels are: real balance channel; income transfer channel; endogenous monetary policy response and sectoral shifts hypothesis. These theories all reflect how oil revenue fluctuations affect the macro economy. The real balance channel put forward that oil revenue increase lead to higher inflation and with a given money supply, it results to amount of real balances being lowered in the economy that is, the real value of money is devalued. The lower real balances then produce recessions through the familiar monetary channel-increased interest rate leading to depressed investment spending, reduced aggregate demand and a resultant fall in output (see CBN, 2022 and Chijioke, 2011).

Income transfer channel explains that oil revenue increases lead to a transfer of income from net oil importing economies to net oil exporting countries. This result in a reduction in consumption expenditure in the importing countries since the purchasing power of consumers has been eroded by the oil price hike. This income transfer from the importing economy to the exporting economy reduces aggregate demand. On the other hand, earlier scholars like Darby (1982) and Hamilton, (1988) opined that endogenous monetary policy responses are very important. Hence, real output declines which usually characterize oil price increases are vied as a result of counter inflationary responses of monetary policy. Responses of regulatory monetary authority such as buying back government bonds and raising interest rates; reduce money supply thus lowering aggregate output. The argument is that the oil revenue increases do not entirely account for the observed recessions but it is the reaction of the monetary policy that reinforces output declines (Adeniyi, 2010).

The sectoral shifts hypothesis posits that changes in oil revenues perform better in explaining observed variations in output growth. Within this framework, revenue shocks lead to a temporary surge in aggregate unemployment pending

improvement in conditions in their sector rather than outright movement into positively affected sectors within the economy (Hamilton, 1988 and Adeniyi, 2010). Thus an increase in unemployment reduces the income available to the economy as a whole, therefore, reducing private investment and aggregate investment. Other channels through which oil revenue fluctuations affect the economy include: Dutch-Disease channel, Hotelling rule and Irreversibility and Uncertainty channel. Dutch disease can be defined as an adverse effect of natural resource boom on other sectors of the economy such as industrial, manufacturing and agricultural sector.

Positive oil revenue shocks lead to an appreciation of real exchange rates of the exporting country, thereby squeezing the non-tradable sector (Akpan, 2009). This means that positive shocks for an exporting economy like Nigeria, results in appreciation of real exchange rates, thus drawing resources from other sectors to the mining sector. Hotelling rule states that the most socially and economically profitable extraction path of a non-renewable resource is one along which the price of the resource, determined by the marginal net revenue from the sale of the resource, increases at the rate of interest. It describes the time path of natural resources extraction which maximizes the value of resource stock. The rule was derived from the work of Harold Hotelling in his work "The Economics of Exhaustible Resources" published in 1931).

4. THEORETICAL FRAMEWORK: THE KEYNESIAN AGGREGATE EXPENDITURE MODEL

John Meynard Keynes developed the aggregate expenditure model in response to the Great Depression of the 1930s. Keynes believed that the cause of the depression was low aggregate spending in the economy. In order to fully understand the effect of investment expenditures on the economy, a two-sector simplified model will be examined in this section. The two-sector model comprises households and firms. There is no government sector, therefore income earned by the households is equal to their disposal income (income after tax), which is either consumed or saved. The fraction of household's income that is saved s invested by the firms, that is, savings equal investment in a two-sector economy. This is algebraically represented as:

$$Y = C+S \tag{2.1}$$

If $S = I$; Then

$$Y = C+I \tag{2.2}$$

According to Keynes, the consumption function is relatively stable, thus changes in income earnings of the households affect their savings and in turn, investment. An increase in income will result in households spending only a

fraction of the increase (marginal propensity to consume, MPC) and save the rest and vice- versa. This would in turn result in higher or lower investment respectively, as a result of the increase and decrease in savings. Determinants of investment spending include: profit expectation, interest rates, uncertainty about future costs and revenue. Thus, investment is the most volatile component of aggregate expenditure. This therefore means that in order to change expenditure level, it is more effective to effect these changes through investment rather than through consumption.

Equilibrium is reached when aggregate expenditure equals aggregate output. It is important to note however that equilibrium output does necessarily mean full employment in the economy. Keynes said that during periods of recessions, it is possible for equilibrium output to fall below the full employment level, and if this persists, would lead to depression in the economy. The amount by which equilibrium output exceeds full employment is known as inflationary gap. To correct a recessionary or inflationary gap, Keynes believed that aggregate spending must increase or decrease so that full employment is attained. Oil revenue fluctuations increases uncertainty in the economy thus, affecting the volume of investment hence growth rate of the economy. Through the multiplier effect, the change in investment leads to a magnified effect on the economy. Thus, oil revenue fluctuations have severe effect on growth by raising uncertainty about the entire macroeconomic aggregates within origin from investment.

5. RECENT EMPIRICAL WORKS

Balke (2010) employed Bayesian estimation with dynamic stochastic general equilibrium model of world economic activity, to identify the various sources of oil shocks and economic fluctuation and assess their effects on the US economy. He found out that oil price shocks have negative effect on economic growth. He recommended for the operation of oil reserve margin that will be introduced during severe fluctuations.

Ojapinwa and Ejemudia (2010) examined the industrial impact of oil price shocks in Nigeria from 1970 to 2009 using VAR impulse response. The study concluded that oil price, inflation and exchange rate have the potential of causing significant changes in industrial output in Nigeria while it also revealed that money supply did not significantly determine industrial output. Policy implications from the study include that attention should be given to proper management of exchange rate and inflation rate in the country.

Adeniyi (2010) carried out a pioneer attempt at introducing the threshold effects to the linkage between oil price shocks and output growth in Nigeria. The study adopted the regime dependent multivariate threshold model, together with the characteristic impulse response functions and forecast error variance

decomposition using quarterly data from 1985 to 2008. The results of the study show that oil price shocks do not account for a significant portion of observed movements in macroeconomic aggregates. This implies that the need to spend revenue productively is imperative if favourable effect on real output growth is envisioned.

Aliyu (2011) employed a granger causality approach tests and multivariate VAR analysis to assess the effects of oil price shocks on real macroeconomic activity. He found evidence of both linear and non linear effects of oil price shocks on economic growth. Asymmetric oil price increases in the non-linear models are found to have a positive impact on real GDP growth rate of a larger magnitude than asymmetric oil decreases affect real GDP.

Iwayemi and Fowowe (2011) examined the impact of oil price shocks on macroeconomic activity variables employing VAR model. The results found showed oil prices had significant impact on three key macroeconomic variables of GDP, money supply and unemployment thus indicating that the economy is highly vulnerable to oil price shocks. They jointly proposed diversification of the economy in order to mitigate the effects of oil shocks. Thus, on empirical ground, conflict exists of methodology and real effect of oil revenue shock. This study intends to contribute to the intellectual debate adopting the Vector Error Correction model.

6. METHODOLOGY

The study used only secondary data that was generated from CBN 2014 bulletin. The primary model showing the technical relationship with oil revenue fluctuations and economic growth in Nigeria is specified thus: GDP = F (OREV)

(1)

Equation (1) is a non stochastic model which implies that all the changes in GDP are caused by oil revenue (OREV). But GDP can grow as a result of several other factors. We can therefore expand the equation to cover other variables affecting GDP growth rate in Nigeria as explicitly stated below:

$$GDP = b_0 + b_1OREV + b_2CPI + b_3EXR + b_4NOREV + b_5INVT + U \quad (2)$$

Where b_o= Intercept; b_1-b_5= Coefficients to be estimated; GDP = growth rate of GDP; CPI = Consumer Price Index as a proxy for inflation rate; EXR = exchange rate; NOREV = Non oil revenue; INVT = Investment growth rate and U = Stochastic random error term. On *a priori* expectation, it was expected that all the independent variables except EXR and CPI would positively affect the GDP.

7. DISCUSSION OF RESULTS AND ANALYSIS

Table 1: Descriptive Statistics for the Variables in the Model

Variable	*GDP*	*OREV*	*CPI*	*EXR*	*NOREV*	*INVT*
Mean	3.656507	1897117.	20.23679	63.17216	611061.3	22.12857
Median	4.204831	324547.6	12.70000	21.88000	174339.9	22.70000
Maximum	33.73578	8878970.	72.90000	175.0000	2950560.	31.90000
Minimum	-13.12790	7253.000	4.700000	0.760000	2880.200	12.30000
Std. Dev.	7.667852	2656156.	17.65959	64.13501	835402.1	4.817833
Skewness	1.187070	1.273367	1.460521	0.383772	1.394706	-0.241789
Kurtosis	8.615317	3.308731	4.102662	1.360415	3.826505	2.727487
Jarque-Bera	54.20381	9.597537	14.21634	4.779488	12.34324	0.449328
Probability	0.000000	0.008240	0.000818	0.091653	0.002088	0.798784
Sum	127.9777	66399109	708.2878	2211.025	21387147	774.5000
Sum Sq. Dev.	1999.062	2.40E+14	10603.28	139852.2	2.37E+13	789.1914
Observations	42	42	42	42	42	42

Computed by the Author using Eviews 8.0, 2023

Table 1 above shows the mean to median ratio to be very low. That is very close to a unit proximity while the range; the difference between the maximum and minimum values in the distribution was shown to be positive for all the variables in the model. On skewness, all the variables except INVT were positively skewed indicating that the data set was dominated by positive values. INVT was negatively skewed. Kurtosis shows that only two of the series, OREV and NOREV satisfied its expected value of 3. The Jarque-Bera test statistic which seeks to harmonize the differences between skewness and kurtosis shows that most of the series were normally distributed. This decision is taken based on the significance nature of most of the probability values.

To test for unit root, the group unit root test which is made up of common unit root process as reported by Levin, Lin and Chu; and the individual unit root process as reported by Im, Pesaran and Shin W-stat; ADF Fisher Chi-square and PP Fisher Chi-square was used. The detailed result is presented in the Table 2 below:

The result of Table 2 shows only ADF-Fisher Chi-Square and PP- Fisher Chi-Square to be stationary at level with statistically significant probability values at 5% confidence level. There is also a disagreement between common unit root process and individual unit root process. This requires the unit root test at 1st difference. This is presented in Table 4.3 below:

Table 2: Unit Root Test at Levels

Group unit root test: Summary
Series: GDP, OREV, CPI, EXR, NOREV, INVT

Method	*Statistic*	*Prob.***	*Cross-sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.35150	0.3626	6	203
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.36635	0.0859	6	203
ADF - Fisher Chi-square	34.8475	0.0005	6	203
PP - Fisher Chi-square	32.4929	0.0012	6	204

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.
Computed by the Author using Eviews 8.0, 2023

Table 3 Unit Root Test at 1st Difference

Group unit root test: Summary
Series: GDP, OREV, CPI, EXR, NOREV, INVT

Method	*Statistic*	*Prob.***	*Cross-sections*	*Obs*
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-15.3269	0.0000	6	194
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-14.7966	0.0000	6	194
ADF - Fisher Chi-square	157.058	0.0000	6	194
PP - Fisher Chi-square	170.309	0.0000	6	198

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.
Computed by the Author using Eviews 8.0, 2023

The result of Table 3 above shows all the series to be stationary at 1st difference with no disagreement between the common unit root process and individual unit root process. The probability values are all statistically significant at 1% confidence level. Our choice for Johasen cointegration is justified since the series have shown the same order of integration.

Table 4 Johansen Cointegration

Series: GDP OREV CPI EXR NOREV INVT

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.745443	122.3541	95.75366	0.0002
At most 1*	0.627509	77.20249	69.81889	0.0114
At most 2*	0.547479	44.61355	47.85613	0.0977
At most 3	0.308739	18.44715	29.79707	0.5332
At most 4	0.171408	6.262284	15.49471	0.6645
At most 5	0.001737	0.057362	3.841466	0.8107

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.745443	45.15159	40.07757	0.0123
At most 1*	0.627509	32.58894	33.87687	0.0706
At most 2*	0.547479	26.16640	27.58434	0.0750
At most 3	0.308739	12.18487	21.13162	0.5295
At most 4	0.171408	6.204923	14.26460	0.5870
At most 5	0.001737	0.057362	3.841466	0.8107

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Computed by the Author using Eviews 8.0, 2023

The Johasen cointegration test shows that, both the trace test the maximum eigen values have unanimously agree to produce three conitegrating equations at 10% confidence level. In this event of no disagreement between trace and maximum eigen values, we thus reject the null hypothesis and accept the alternative hypothesis of many conitegrating equations.

Table 5: Long Run Vector Error Correction Estimates

Vector Error Correction Estimates
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	*CointEq1*
GDP(-1)	1.000000
OREV(-1)	-1.26E-05
	(2.7E-06)
	[-4.62549]
CPI(-1)	- 0.199359
	(0.21754)
	[-0.91640]
EXR(-1)	-0.305897
	(0.07786)
	[-3.92905]
NOREV(-1)	4.55E-05
	(8.4E-06)
	[5.43339]
INVT(-1)	7.554506
	(0.70613)
	[10.6984]
C	-164.5798

Computed by the Author using Eviews 8.0, 2023

The long run VECM dynamics displayed in Table 4.5 above shows the OREV, CPI and EXR to have a negative long run relationship with economic growth in Nigeria. In fact, a one percent fluctuation in OREV results into more than 12.6% decrease in the growth of output in Nigeria. A one percent increase in the CPI and EXR results into 1.9% and 3.0% reduction in GDP in Nigeria. There is however, a positive long run relationship between NOREV and INVT and economic growth in Nigeria. NOREV remains the best alternative source of growth in the Nigerian economy with INVT funds also playing a positive role on economic growth in Nigeria.

Table 6: Causality Test

Pairwise Granger Causality Tests
Lags: 1

Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*
OREV does not Granger Cause GDP	42	1.43324	0.0203
GDP does not Granger Cause OREV		2.32625	0.0373
CPI does not Granger Cause GDP	42	0.03292	0.8572
GDP does not Granger Cause CPI		0.00502	0.9440
EXR does not Granger Cause GDP	42	7.27632	0.0112
GDP does not Granger Cause EXR		0.00301	0.9566
NOREV does not Granger Cause GDP	42	1.52386	0.0263
GDP does not Granger Cause NOREV		0.72819	0.0400
INVT does not Granger Cause GDP	42	1.06296	0.3105
GDP does not Granger Cause INVT		0.17841	0.6757

Computed by the Author using Eviews 8.0, 2017

Table 5 above shows a bi-directional causality running between oil revenue and GDP and between non oil revenue and GDP in Nigeria. The result is statistically significant at 5% level of significance. There was uni-directional causality between EXR and GDP in Nigeria. There was however, no causation between CPI and INVT and GDP in Nigeria within the time period.

POLICY RECOMMENDATIONS

(i) Government must ensure that revenue from the oil sector is well invested in the key economic sectors to cushion the effect on the economy in any event in the collapse of oil price and revenue.

(ii) Non oil revenue must be harnessed with great virgour to complement oil revenue fluctuations and its attendant consequences on economic growth in Nigeria.

(iii) Economic diversification will certainly reduce the current pressure on oil and the revenue accruing from it for a more stabilized Nigerian economy.

(iv) Corruption in the oil sector must be stopped to pave way for greater revenue accruals for the Nigerian economy.

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