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Oil Price Volatilityand International Trade in Nigeria

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Abstract

Trade is a crucial engine of economic growth particularly in a fast growing economy like Nigeria. Considering the importance of oil as an internationally traded commodity, its volatility could result to external trade imbalances especially in oil exporting economies like Nigeria. As such, this study examines the effect of oil price shocks on international trade via Oil Trade Balance (OTB), Non-Oil Trade Balance (NOTB) and Terms of Trade (TOT). Crude Oil Price Volatility (COPVOL) was measured and extracted using ARCH/GARCH model with data spanning from 1990-2019. The paper conducted the stationarity and cointegration test to examine the time series characteristics of the variables, and applied the Structural Vector Auto Regressive (SVAR) Model as well as Impulse Response Function (IRF) and Forecast Variance Decomposition (FVD) to examine the influence of oil price shocks on Oil Trade Balance (OTB), Non-Oil Trade Balance (NOTB) and Terms of Trade (TOT). The result showed that upward swings in oil price have a positive and significant impact on Terms of Trade and Oil Trade Balance, however, for Non-Oil Trade Balance, Oil price Shocks is negative and insignificant. The paper, therefore, recommended that Government should exploitthe downstream sector of the oil industry to capture additional values from hydrocarbons resources, linking new petrochemical facilities with refineries to capture operational synergies; and to strengthen entrepreneurship through access to finance to encourage innovation and technology towards transforming the economy. The paper further recommended improving quality and standard of exports to encourage demands towards improving Nigeria's terms of trade.

Key Words: Oil price shock, International Trade, Terms of trade,

1.0 INTRODUCTION

The provision of plausible explanation for the relationship between oil price volatility and macroeconomic variables has occupied the attention of researchers and policymakers over the last four decades; especially the central roleoil plays in the world economy and the observed link between oil price movement and business cycle. Many studies exist in Nigeria where proceeds from crude oil sales accounts for major proportion of government total earnings with attendant implications for the larger economy.

Oil has been a dominant factor in Nigeria's fiscal space since the 1970s. The various episodes of oil price boom since the late 1970s resulted in substantial revenue accretion, which gave the government the much-neededimpetus to embark on additional expenditure outlays to promote economic growth. Thus, the sizeable oil-windfall over the years has made the country oil dependent and extremely vulnerable to the volatility in international oil prices. A study by the World Bank (2013) found the Nigerian economy among the most volatile in the world between 1961 and 2000. The study attributed this finding mainly to oil price volatility.

Trade is a crucial engine of economic growth particularly in a fast growing economy such as Nigeria, while oil is one of the highly traded commodities in the world. Given the importance of oil as an internationally traded commodity, its volatility could result to external trade imbalances especially in oil exporting economies like Nigeria. As such, this study examines the effect of oil price shocks on international trade via trade openness and trade balance.

A large literature has investigated the macroeconomic impact of oil-price shocks, focusing in particular on the response of real economic growth and consumer price inflation in oil-exporting countries (Barsky and Kilian, 2004 and Hamilton, 2005). A much smaller literature including, for example, Bruno and Sachs (1982), Ostry and Reinhart (1992), and Gavin (1990, 1992) has studied the impact of oil price shocks on external accounts. This relative neglect of the external channels of the transmission of oil price shocks does not reflect a lack of interest in this question.

Other studies such as Tiwari and Olayeni (2013) and Lilian (2009) have focus on oil importing countries like India and Japan, however this study deviate by focusing on Nigeria, an oil exporting developing country. Though Babatunde (2018) study was on Nigeria, the study did not consider terms of trade (TOT). One channel through which oil price affects an economy is through the terms of trade. A rise in oil prices is likely to improve the terms of trade for oil exporters, but worsen the terms of trade for importers. This tends to raise the demand for non-oil goods and services in oil-exporting economies, but reduce demand in oil-importing economies.

Thus, price volatility becomes of great concerns to every country that deals in oil in commercial quantity. This is more so because it determines the direction of government revenue and hence macroeconomic variable (including external balance) anywhere. The assertion that volatility only affects oil-exporting nation may not be true. The fact is that both importing nations and exporting nations have their fair share of effects from continuous volatility. Specifically, exporting nations gain when international price of petrol becomes very high while the importing nations record losses. The reverse would be the case if the international price of petrol should fall deep low. This study becomes interesting, as Nigeria is both oil exporting and oil products importing country, the study fill the gap in literature byincluding terms of trade to examinethe effect of oil price volatility innNigeria.In terms of methodology this study is also an improvement on previous studies carried out on Nigeria as it uses quarterly data from 1990-2019 analysed with the system equation of three stage least square technique. Thus, the study intends to provides answers to the research question: whether there exist volatility in oil price and if yes, to what extent does it affect trade balance in Nigeria?

Furthermore, the study decomposes the aggregate trade balance into oil and non-oil trade balance. This is necessary for policy makers, especially in oil dependent economies, to understand the dynamics of oil price shocks on the macro economy.

2.0 Literature Review and Theoretical Framework

Over the past twenty years, dozens of scholars have explored the relationships between oil volatility and macroeconomic performance of different economies. Different methods of analysis have yielded different results. Review some of these studies relating to oil price shocks are made in this section starting with studies on the Nigerian economy.

Aliyu (2019) assesses empirically, the effects of oil price shocks on real macroeconomic activity in Nigeria. The variables used were, oil price volatility, GDP and exchange rate. The methodology used includes Granger causality tests and multivariate Vector Auto-Regression (VAR) analysis using both linear and non-linear specifications. The study finds evidence of both linear and non-linear impact of oil price shocks on real GDP. In particular, asymmetric oil price increases in the nonlinear models are found to have positive impact on real GDP growth of a larger magnitude than asymmetric oil price decreases.

Husain, (2018) assess the impact of oil price shocks on non-oil economic cycle in 10 oil rich countries, including Oman over the period 1990-2007. The results obtained using panel VAR on the behaviour of government expenditure during boom/bust on commodity price cycles of 32 oil rich countries over the period 1992-2009, show that in countries where the oil sector is dominant, oil price changes affect the economic cycles through the fiscal policy channel.

Oriakhi & Osaze (2013),in an attempt to also establish the impact of oil price volatility on the Nigerian macroeconomic variables, examined the effect of oil price volatility on the growth of the Nigerian economy using quarterly data from the period 1970 to 2010; the study employed the VAR methodology. The study found that oil price volatility had a direct impact real government expenditure, real exchange rate and real import, while the impact on real GDP, real money supply and inflation was through other economic variables particularly, real government expenditure. This implies that oil price volatility determines the level of government expenditure, which successfully determines economic growth in Nigeria.

A similar study by Olomola (2016) investigated the impact of oil price shocks on aggregate economic activity (output, inflation, the real exchange rate and money supply) in Nigeria using quarterly data from 1970 to 2013. The findings revealed that contrary to previous empirical findings, oil price shocks do not affect output and inflation in Nigeria significantly. However, oil price shocks do significantly influence the real exchange rate. The study argued that oil price shocks may give rise to wealth effect that appreciates the real exchange rate and may squeeze the tradable sector, giving rise to the "Dutch-Disease".

Umar &Kilishi (2010) examined the impact of crude oil price changes on four key macroeconomic variables in Nigeria (GDP, money supply, consumer price index and unemployment). They used annual data from 1970 to 1980 and employed the VAR methodology. They found that crude oil prices have significant influence on GDP, money supply and unemployment. However, its impact on consumer price index was insignificant. They are of the conclusion that oil price volatility affects the GDP, money supply and unemployment in Nigeria.

Apere and Ijomah (2013) investigated the relationship between oil price volatility and the Nigerian macroeconomic variables. The study used the exponential generalized autoregressive conditional heteskedasticity (EGARCH) and impulse response function and lag-augmented VAR (LA-VAR) models in its analysis. The study found a unidirectional relationship between interest rates, exchange rate and oil prices but no significant relationship between real GDP and oil prices. The paper concluded that fluctuations in oil prices do substantially affect the real exchange rates and interest rate in Nigeria. However, the study found that it is not the oil price itself but rather its manifestation in real exchange rates and interest that affects the fluctuations of aggregate economic activity (GDP).

Oyeyemi (2013) using annual data for the period 1979-2010 investigated the impact of oil price volatility on Nigeria's macroeconomic stability using robust least squares method. The study found that there is a positive relationship between oil price and the real exchange rate, which implied that an increase in oil price leads to an appreciation of the real exchange rate and increases the output level. Specifically, the estimates revealed that a unit change in crude oil price level would cause real GDP to change by 15.0 per cent. He also observed that accumulation of foreign exchange and increase in government capital and recurrent expenditure was because of periods of oil boom in Nigeria while its decrease had a destabilizing effect on the balance of payment position and government finances.

According to Ani et al. (2014), oil price volatility does not have significant impact on the Gross Domestic Product (GDP) and exchange rate in Nigeria, at least not in the short run; a positive but insignificant relationship exists between oil price and Nigerian GDP. The study is of the conclusion that countries amply endowed with resources, tend to grow slower than others are as is the case in Nigeria. This study uses annual data spanning 1980 to 2010, and applied the causality and ordinary lease squares analytical techniques. The result suggests that Nigeria has a special case of the

Dutch disease, where a country seemingly good fortune proves ultimately detrimental to its economy.

According to Alhassan and Abdulhakeem (2016) analyzed Oil Price- Macroeconomic Volatility in Nigeria, adopting a GARCH model and its variants (GARCH-M, EGARCH and TGARCH) on daily, monthly and quarterly series found that all the macroeconomic variables considered in the study (real gross domestic product, interest rate, exchange rate and oil price) were highly volatile. It was revealed that the asymmetric models (TGARCH and EGARCH) out-perform the symmetric models (GARCH (1 1) and GARCH – M), and oil price is a major source of macroeconomic volatility in Nigeria. What this means is that, the Nigerian economy is not just vulnerable to external shocks (exchange rate volatility and oil price volatility) but also the internal (interest rate volatility, real GDP volatility). Thus, the conclusion that asymmetric models should be given more credence in dealing with macroeconomic volatility in Nigeria and oil price volatility should be considered as relevant variable in the analysis of macroeconomic fluctuations in Nigeria.

Alley et al. (2014) examined the relationship between oil price shocks and Nigerian economic growth covering the period 1981 to 2012 using general methods of moment (GMM) model, the study established that oil price shocks negatively (though not significant) impact on economic growth but that oil price itself have a positive and significantly impact on it. The study recommended that the Nigerian economy should diversify her export revenue base in order to minimize the dependence on crude oil and petroleum products.

On studies conducted for other countries, Bartleet and Gounder (2010) examined oil price shocks and economic growth in Venezuela using the Vector Autoregressive (VAR) methodology based on quarterly data. Following the various theoretical implications that oil price shocks have on economic growth three oil price measures were considered,. The authors analyzed the short-run impact of oil price shocks in a multivariate framework, which traced the direct economic impact of oil price shocks on economic growth as well as indirect linkages. Furthermore, the models employed the linear oil price and two leading nonlinear oil price transformations to examine various short-run impacts. A Wald and Likelihood Ratio tests of Granger Causality was utilized and the results indicated that linear price change, the asymmetric price increase and the net oil price variables were significant for the system as a whole, whereas the asymmetric price variables was not. Following the causality analysis of oil price nexus, the generalized impulse responses and error variance decompositions, the study reaffirmed the direct link between the net oil price shock and growth as well as the indirect linkages.

Raguindin and Reyes (2014) examined the effects of oil price shocks on the Philippine economy over the period 1981 to 2012. Their impulse response functions for the symmetric transformation of oil prices showed that an oil price shock leads to a prolonged reduction in the real GDP of the Philippines. Conversely, in their asymmetric VAR model, oil price decreases play a greater role in each variable's fluctuations than oil price increases.

The empirical literature so far review affirmed that Oil price volatility hasa significant impact on the macroeconomic variables like GDP, Oil revenue and Exchange rate. However, since one of the ways oil price volatility affects an economy is through the terms of trade; this study expand on the existing studies by considering the impact of oil price volatility on Nigeria terms of trade.

2.1 Theoretical Framework

The theoretical framework for this study is the linear/asymmetric growth theory. The Linear/Asymmetric theory of growth which has as its proponents, Hamilton (1983), Gisser (1985), Goodwin (1985), Hooker (1986) and Laser (1987) postulated that volatility in GNP growth is driven by oil price volatility. They hinged their theory on the happenings in the oil market between 1948 and 1972 and its impact on the economies of oil-exporting and importing countries respectively.

According to the theory, oil price shocks affect Trade balance through the traditional channels of external adjustment labeled the "trade" (or macroeconomic) channel, and the "financial" (or valuation) channel of adjustment (Zied et al, 2016). The trade channel works through changes in the quantities and prices of goods exported and imported; while the financial channel works through changes in external portfolio positions and asset prices. Focusing first on the trade channel, an oil-price increase, *citeris paribus*, lowers real income in oil importing economies, as the terms of trade deteriorate. As real income falls in oil importing countries, firms and households will curtail their expenditures and investment plans. Oil importers' currencies will depreciate, while oil exporters' currencies will appreciate in response to their real income gains. Real output falls at least temporarily in the oil-importing economy. Over time, the initial oil trade deficit will decrease, and the non-oil trade balance increase in oil importing countries. Policy responses may further cushion or amplify these effects. For the oil exporting countries, a rise in oil price will increase foreign reserves and revenue, which will result in excessive importations if the increase in revenue is not reinvested in sovereign wealth funds, leading to BOP deficit (Woodford, 1996). The workings of the financial channel in response to an oil-price increase are more nuanced (El Anshasy & Bradley, 2012). The financial channel could either cushion or exacerbate the effect of oil price increases on oil-importing countries' external balances. A decrease in asset prices and dividends in oil-importing countries in response to an oil price increase will affect all asset owners, including residents of oil exporting countries. Conversely, asset prices in oil exporting countries will increase, again affecting all asset owners, including residents of oil importing countries. As a result, capital gains and income flows may blunt the impact of oil-price changes on the current account. Bond and equity prices and exchange rates typically respond much faster than the prices and quantities of goods and faster than portfolio positions (Zied et al, 2016). In practice, the response will depend on the precise configuration of countries' portfolios, and the extent to which these portfolios canrebalance effectively. With certain portfolio configurations, the financial consequences of the shock could even completely offset the need for short-term external adjustment.

3.0 Methodology

3.1 Model Specification

i. Measuring Oil Price Volatility

Volatility measures the rate and magnitude of price changes around a trend. In other words, it captures the deviation of the actual observed price from its normal or expected value (Pindyck, 2002). It is important to state here that one expects crude-oil price to exhibit volatility properties *a-priori*. This is because volatility is associated with rational expectations of variables that are susceptible to daily spikes dictated by market fundamentals.

The ARCH test is used to test for conditional heteroskedasticity (existence of volatility) as suggested by Engle (1982) and applied in Narayan and Narayan (2007). The study carried out the test in order to ascertain whether an ARCH/GARCH effect exists in oil price series.

The ARCH type model, for testing the existence of volatility follows the framework of a moving average (MA). More specifically, equation (3.2) regress the square of the contemporaneous residual on the squares of their lagged residuals.

Algebraically, we specified the ARCH-type model as follows:

$$\varepsilon t^2 = \lambda + \sum_{i=1}^{p} \delta 1 x^k a^{n-k} \quad (3.1)$$

and in a more explicit form, we have:

$$\varphi^2{}_t = \eta_0 + \eta_1\varphi^2{}_{t-1} + \eta_2\varphi^2{}_{t-2} + \eta_3\varphi^2{}_{t-3} + \ldots + \eta_n\varphi^2{}_{t-n} + \iota_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.2)$$

The study modeled the extent of volatility by formulating a GARCH (k, p) model. This becomes necessary only if the outcome of the ARCH-effect test on Crude-oil price (COP) shows that it is volatile.

The model for measuring the extent of volatility is a system model that combines both the mean equation and the variance equation. The ARCH/GARCH(q,p) model is given as;

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_i h_{t-j} + V_t \quad (3.3)$$

$$V_t \sim IIN(O, h_t) \quad (3.4)$$

Where; $\alpha_0$is the constant term, $\epsilon_{t-1}^2$is the ARCH process, h_{t-j} is the GARCH term. To ensure the conditional variance is positive, we imposed inequality restriction on the variance equation in (3.3):

$\alpha_0 > 0 \; and \; \alpha_i \geq 0, \beta_i \geq 0, \forall i$,j

To ensure that the process is stationary, it is also required that:

$$\sum_{i=1}^{q} \alpha_i < 1 \quad (3.5)$$

The right hand side of equation (3.3) contains two components, the expected volatility and a random component, V_t. We further divided the expected volatility of $h_t$in (3.3) into two components, the time varying component in the summed lagged terms and the mean variance, α_o, to which the time varying component reverts, that is, $h_t$is a stationary process. We obtained the parameters α_i, β_i in equation (3.3) through the maximization of the log likelihood function:

$$\boldsymbol{l}\text{ogL} = \sum_{t=1}^{T} l_t = -\frac{T}{2}\log[2\pi] - \frac{1}{2}\sum_{t=1}^{T} \log\sigma_t^2 - \frac{1}{2}\sum_{t=1}^{T} \frac{\mu_t^2}{\sigma_t^2} \quad (3.6)$$

Where T is the sample size, and

$$l_t = -\frac{1}{2}\log[2\pi] - \frac{1}{2}\log[\sigma_t^2] - \frac{1}{2}[V_t]/\sigma_t^2 \quad (3.7)$$

Where;

$$V_t = h_t - (\alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_i h_{t-j}) \quad 3.8)$$

We maximized equation 3.6 to obtain the ARCH/GARCH Parameters α_i, β_i

ii. Structural Equation Modeling

The study employed the Structural equation models to examine the influence of oil price shocks on international trade. The model used is adapted from Babatude (2018). The equations of the model are stated as:

$$NOTB = \alpha_1 + \alpha_2 COPVOL + u_1 \quad (3.9)$$

$$OTB = \beta_1 + \beta_2 COPVOL + u_2 \quad (3.10)$$

$$TOT = \gamma_1 + \gamma_2 COPVOL + u_3 \quad (3.11)$$

Where TOT is Terms of trade, OTB is Oil Trade Balance, NOTB is Non-Oil Trade Balance, and COPVOL is Crude Oil Price Volatility.

Equation 3.9; 3.10 and 3.11 will be estimated with the Three Stages Least Square (3SLS). According to Bowerman and O'connel (1979) the 3SLS is more robust to the 2SLS for system equation estimation.

3.3 Data

The study used secondary data, which were time series in nature computed quarterly. Using GARCH model on the Bonny Light oil Price, we derived the oil price shocks. The difference between oil exports and oil imports gave the oil trade balance (OB). Non-oil merchandise trade balance (NOB) is measured as the difference between non-oil exports and non-oil imports. The sample period runs from 1990 to 2019. The scope of our study was due to data availability. We sourced the data on Nigerian Bonny Light Spot Price (Dollars per barrel) from the United States Energy Information Administration (EIA, 2019); and Data on Terms of Trade, Oil Trade Balance and Non-Oil Trade Balance from The Nigerian Trade Statistics of the World Bank (2019).

4.0 Data Analysis

The data were analyzed with Econometric views (E-views, version 9.0) using various econometric techniques to determine the direction of interaction amongst the variables under consideration. We used graphics to analyze trend in the variables under consideration; and diagnostic tests conducted to ensure the data were valid enough for relevant inferences.

4.2 Data Analysis

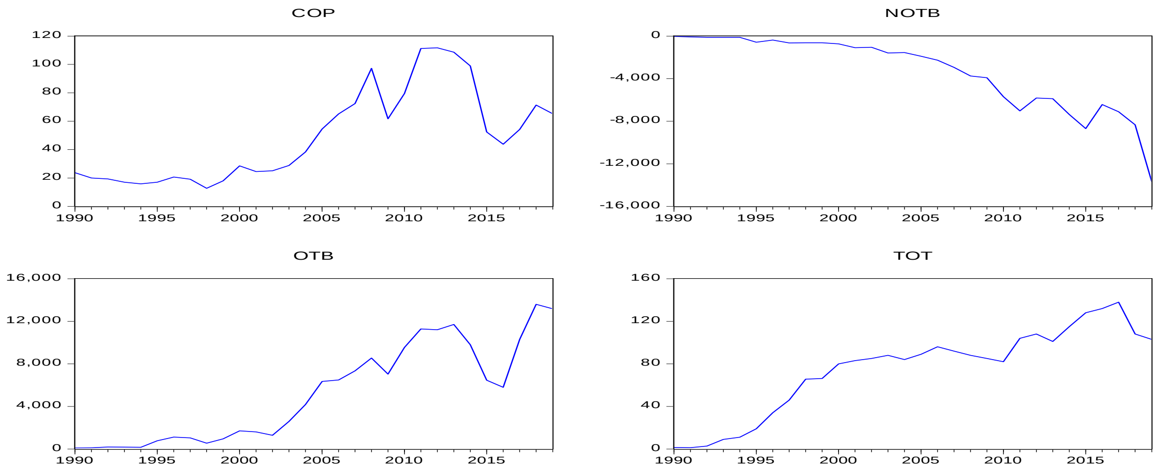
Table 1: Descriptive Statistics

Statistic	**COP**	**NOTB**	**OTB**	**TOT**
Mean	49.20800	-3340.641	5169.891	74.84000
Median	42.00815	-1702.861	5094.005	85.62007
Maximum	115.8579	-26.96248	13902.13	141.9712
Minimum	11.93886	-14946.82	70.67832	1.248725
Std. Dev.	32.31572	3454.347	4543.698	40.32413
Skewness	0.674402	-1.122150	0.386963	-0.594809
Kurtosis	2.154324	3.784807	1.703866	2.280652
Jarque-Bera	2.617220	4.216401	1.391462	3.663262
Probability	0.177201	0.104931	0.123355	0.087974
Sum	5904.960	-400876.9	620387.0	8980.800
Sum Sq. Dev.	124272.4	1.42E+09	2.46E+09	193498.2
Observations	120	120	120	120

Source: *Computed using E-Views 9 Software Package*

Table 1: shows the descriptive statistics of the variables in the study while figure 1 shows the trend analysis. The descriptive analysis gives the characteristics and properties of the time series in terms of mean, median, maximum and minimum values, coefficients of variation etcetera. The trend analysis shows the behavior of each variable over the time. Figure 1 shows the trend analysis of each variable considered in this study.

Figure 1: Trend of Variables used in the model



Source: *Computed using E-Views 9.0 Software Package*

4.2.1 Estimating GARCH (1, 1)

Following the trend analysis, the study modeled the extent of volatility using GARCH (1, 1) model. Table 2 summarizes the coefficient of variance equation, used in generating GARCH variance series, named Oil price volatility series.

Table 2: GARCH (1, 1)

	Mean equation		Variance equation			Diagnostics:			ARCH LM test on Models	
Variable	α_0	α_1	η_0	η_1	η_2	AIC	SIC	HQC	F-Statistics	nR^2
GARCH (1,1)	0.002***	0.176**	0.0004***	0.165*	0.793*	-2.003	-1.922	-1.971	0.022***	0.022***

Note: * = 1per cent level of significance; ** = 5per cent level of significance; ***= 10per cent level of significance

Source: *Computed using E-Views 9 Software Package*

As revealed from Table 2, the coefficients of variance – ARCH Effect (η_1) from the GARCH (1,1) model is seen to be significance at 5 per cent level of significance. Thus, we reject the null hypothesis (H_0) of no ARCH effect. Based on the above results, we used the generated GARCH variance series as the oil price volatility series in the study.

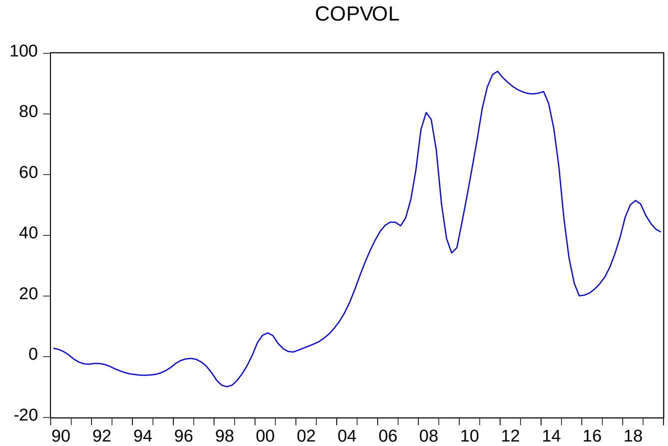


Figure 2: Crude Oil Price Volatility

Source: *Computed using E-Views 9.0 Software Package*

4.2.2 Unit Root Tests

The results of the unit root tests is shown in Table 3

Table 3: Unit root test using the SIC and Newey-West Bandwidth Criterion

Variables	ADF Test Statistic	Longest Lag	Order of Integration	PP Test Statistic	Longest Bandwidth	Order of Integration
COPVOL	-3.974267*	14	I(0)	-3.714131*	4	I(0)
NOTB	-11.11705*	14	I(1)	-10.95364*	5	I(1)
OTB	-20.03443*	14	I(1)	-19.98948*	1	I(1)
TOT	-13.83175*	14	I(1)	-13.88077*	4	I(1)

Source: *Computed using E-Views 9 Software Package*

As seen in table 3, Augmented Dickey Fuller (ADF) test for stationarity at various lag lengths using selected by the SIC criterion shows that LEXRT, LFDOR, and MLR, are not stationary at their levels but stationary at their first difference, while COPVOL is stationary at level. The Philip Perron (PP) test confirms the same results. In addition, the results suggest that the variables need transforming in order to be devoid of spuriousness.

4.2.3 Co-integration

With the observation that some of the variables have unit root problem, that is, not stationary at their levels, a co-integration test becomes a necessity. We applied the Johansen test for the co-integration test. Table 4is an extract from the co-integration result.

Table 4: Co-integration Test Result

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.46253	361.1595	95.75366	0
At most 1 *	0.356925	236.983	69.81889	0
At most 2 *	0.272348	148.6844	47.85613	0
At most 3 *	0.217986	85.0978	29.79707	0

Source: *Computed using E-Views 9.0 Software Package*

Table 4 shows co-integration result using Johansen Co-integration test. The result indicates 3 co-integrating equation indicating that all the variables are co-integrated at 1% level of significance. This result indicates that there exists a long-run equilibrium relationship among the variables under study.

4.2.4 Structural Equation Estimation

The structural equation specified in the previous section is estimated with the 3SLS technique. The result is presented below.

Table 5. 3SLS Result

System: Estimation
Estimation Method: Three-Stage Least Squares
Sample: 1990Q1 2019Q4
Included observations: 120
Total system (balanced) observations 360
Stacked instruments: (COPVOL,*)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1362.989	303.7439	-4.487298	0.0000
C(4)	-72.26672	7.190418	-10.05042	0.0000
C(2)	1727.739	242.3294	7.129715	0.0000
C(5)	125.7820	5.736576	21.92632	0.0000

C(3)	53.26100	3.729450	14.28119	0.0000
C(6)	-0.788533	0.088286	-8.931580	0.0000
Determinant residual covariance	5.90E+15			

Equation: TOT = C(1)+C(4)*COPVOL
Observations: 120

R-squared	0.457040	Mean dependent var	-3340.641
Adjusted R-squared	0.452439	S.D. dependent var	3454.347
S.E. of regression	2556.126	Sum squared resid	7.71E+08
Durbin-Watson stat	0.039322		

Equation: OTB = C(2)+C(5)*COPVOL
Observations: 120

R-squared	0.800254	Mean dependent var	5169.891
Adjusted R-squared	0.798561	S.D. dependent var	4543.699
S.E. of regression	2039.298	Sum squared resid	4.91E+08
Durbin-Watson stat	0.034838		

Equation: NOTB = C(3)+C(6)*COPVOL
Observations: 120

R-squared	0.399319	Mean dependent var	74.84000
Adjusted R-squared	0.394228	S.D. dependent var	40.32413
S.E. of regression	31.38481	Sum squared resid	116230.8
Durbin-Watson stat	0.025368		

Source: *Computed using E-Views 9.0 Software Package*

We extracted the following equations below from table 5:

TOT = -1362.989+125.7820COPVOL
t Stat (-4.487298) (21.92632)
Prob (0.0000) (0.0000)

OTB = -72.26672 + 53.26100COPVOL
t Stat (-10.05042) (14.28119)
Prob (0.0000) (0.0000)

NOTB = 1727.739 – 0.788533COPVOL
t Stat (7.129715) (8.931580)
Prob (0.0000) (0.0000)

Where:

TOT is Terms of trade, OTB is Oil Trade Balance, NOTB is Non-Oil Trade Balance, COPVOL is Crude Oil Price Volatility.

A unit change in COPVOL, will results in increase in TOT by approximately 125.7820 unit, while holding other variables constant. The positive sign on COPVOL means that if in oil price swings upward it will improve the overall terms of trade. The lower probability value when compared to the conventional level of significance shows that the impact is significant.

A unit change in COPVOL will lead to increase in OTB by 53.26100 units. The result signifies that the change is significant judging by the probability value, which is lower than the conventional 5 percent level of significance.

For Non-oil Trade Balance (NOTB) model, a unit change in COPVOL with other variables held constant would decrease NOTB by approximately 0.788533 units. The probability value is higher than the conventional level of significance, which means the COPVOL coefficient is insignificant for NOTB.

The results from the three equations relating to oil trade balance, non-oil trade balance and terms of trade all indicated the influence of oil price volatility. Thus, the result implies that crude oil price volatility has a significant impact on the Nigerian External Balance via Terms of Trade, Oil Trade Balance and Non-Oil Trade Balance.

5.0 Conclusion and Recommendations

From the findings, it is evident that volatility exists in Crude-oil price, and it has a linkage with Nigerian external balance. The reason is that Oil is a major source of energy in Nigeria accounting for about 80 per cent of the revenue and 90 per cent of the foreign earnings;no surprises as its impact on Terms of Trade and Oil trade balance is significant. The study provides answers to the research questions: is there an existence of volatility in Crude-oil price, if yes, does it significantly impact Terms of Trade and trade balance. This study,therefore, is in agreement with some studies as reviewed in the course of this study to conclude that persistence shock in Crude-oil price is a major determinant of changes in some key macroeconomic variables in Nigeria.

Recommendations

Based on the conclusion drawn and findings in the course of this project particularly the results of the 3SLS model, it is clear that the development of the Nigerian economy is highly dependent on Oil which is no doubt the major source of revenue.

We, therefore, suggest the following recommendations:

i. Government should exploitthe downstream sector of the oil industryto capture additional values from hydrocarbons resources, linking new petrochemical facilities with refineries to capture operational synergies. Expansion into petrochemicals offers the potential for more resilient margins.

ii. Strengthen entrepreneurship through access to finance to encourage innovation and technology to transform the economy from declining and unproductive activities. Here, we support the different intervention programmes of the Central Bank encouraging entrepreneurship, MSMES, and Agriculture.

iii. Improving quality and standard of Exports to encourage demands towards improving Nigeria's terms of trade.

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