Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.12, No.14, 2021

Oil Price Shocks and Stock Market Performance: A Non-Linear Approach (1986-2019)

Fadipe, Ebenezer Olufemi
Graduate Student, Department of Economics Ekiti State University, Ado-Ekiti, Ekiti State Nigeria

Ogunleye, Edward Oladipo PhD
Department of Economics Ekiti State University, Ado-Ekiti, Ekiti State Nigeria

Abstract
This study investigated the asymmetric effect of oil price shocks on stock market performance in Nigeria. Secondary data covering the period between 1986 and 2019 were employed for this study. Quarterly data of brent crude price, all share index, real exchange rate and inflation rate were sourced from Central Bank of Nigeria Statistical Bulletin (2019), OPEC Statistical Bulletin (various publications) and Nigerian Stock Exchange Fact Book (2019). Data collected were analysed using Non-Linear Autoregressive Distributed Lag (NARDL). The NARDL results showed that in the long run, positive oil price shocks, ($t= 5.39$; $p<0.05$) had significant positive effect on stock market performance. Negative oil price shocks ($t= 5.81$; $p<0.05$) had significant positive impact on stock market performance. In the short run, current period negative oil price shock ($t= 2.01$; $p<0.05$) exert significant positive effect on stock performance while previous period positive oil price shocks ($t= 1.94$; $p<0.05$) pose significant positive effect on stock market performance in Nigeria. The study concluded that oil price shocks is a deterrent to stock market performance in Nigeria and the impact of oil price shocks on growth rate in Nigeria is both positive and negative.
Keywords: Oil Shocks, GDP, Asymmetry, Stock Market, Stock Performance, NARDL
DOI: 10.7176/JESD/12-14-09
Publication date: July 31st 2021

Introduction

Crude oil since its discovery in the 1800's as an energy source has been extremely vital to the economy of the world. Oil is essential to a level that a sudden disappearance of oil in the world, will disrupt all major economic activities of distribution systems of more than local basis, which would lead to global economy collapse (Hathaway, 2009).

Nigeria first discovered crude oil in 1956, but commercial exploration of oil began in 1958. Since the 1960s, oil has placed itself at the fore front of Nigerian economy, influencing government policies, revenue and spending. Oil sector account for above 95 percent of export earnings and approximately 85 percent of the country's revenue. These facts have made Nigeria susceptible to fluctuations in oil prices by being dependent on proceeds from oil. Nigeria as a small open economy with no actual influence on the global oil price, which fluctuations in the global oil price greatly affects her economy (Uma and Ikpe, 2015).

The Nigerian economy has been wholly dependent on oil proceeds and has formed the basis upon which revenue sharing, budgetary allocation and capital allocations are strategized. The price of oil is exogenously determined and makes the country helpless in controlling its impact on the economy which somewhat stagnate the local currency. It has been recorded that energy revenue of Nigeria has an 80% flow to the government and 16% is expended on operational cost while only 4% is what the investor sees. The country has been able to boost revue and record a high current account surplus at a time of oil price peak, which brought about the creation of excess crude account (Atukeren, 2013).

Crude oil has been a main source of foreign exchange earnings and has maintained dominance as a source of revenue generation for the country (CBN, 2016). Evidently, economic activity and the crude oil market have felt the attendant multiplier effect of oil price shocks (Yuan, Liu and Huang, 2014). The persistent instability in global oil prices over the last four decades has subjected many oil producing economies of the world to different degrees of uncertainties.

These uncertainties have led to difficulties in establishing policies capable of sustaining economic growth and development of affected economies, as well as the production process which is largely hit because oil serves as its major input, higher oil prices inhibit foreign exchange activity and cause stock exchange fears, increased rate of interest, sprawl inflation and ultimately result in financial and monetary volatility. The harmful effect of these fluctuations has raised major concern to the policy makers specially, in oil-exporting nations of the world (Ono, 2015).

The collapse of oil price bring about volatility in the price of oil which comes with a handful of essential problems of reduced government spending, poor fiscal planning and financial difficulty. The economy is plunged into debt when the price of oil falls below the benchmark and causes the budget to go into deficit and country is forced to take loan to cushion reserve (Otaha, 2016). On the other hand, there is a problem of "Dutch-Diseases" when there is a high oil price and high revenue. This relationship explains that irrespective of the natural resources exploration increase, there is a reduction in manufacturing sector. (Auty, 2004).

A huge unexpected shift in the economic condition of the world which has attendant effect on a nation economy is what describes external shocks. An increase or decrease in international interest rate, a weak export demand growth and a change in foreign terms of trade could be described as a form of shocks. Every economy of the world is concerned with the shocks in the price of oil in the international market, as a sudden increase in price will make global output to fall (Degiannakis, Filis and Arora, 2018).

The effect of oil price shocks is felt directly on stock prices and its attendant effect is made evident on stock market. Stock prices is arguably expected to reflect both previous and current activities on the oil market as it is identified to efficient information about the stock market. Through their impact on expected income, stock market prices and oil price shock have been theoretically related (Brahmasrene, Huang and Sissoko, 2014).

Oil accounts for the largest fraction of energy consumption worldwide. As such, fluctuations in oil price remains a major external economic factor affecting countries of the world. Oil continues to act a prominent hero in economies of the world. Apart from being an essential input in the production process, it also serves as source of income to oil importing nations. Fluctuations in its pricing has been harmful, causing panic, uncertainties and ineffective policy implementations in the world economy. This has caught the attention of scholars (such as Hamilton, 1983; Lee, Ni and Ratti, 1995; Lee and Ni, 2002) over the years. Particularly, the right policy recommendation amid the uncertainties caused by oil price shock has been their major concern.

However, it is safe to say 80% of countries producing oil in Africa are both importer and exporter of oil owing to the fact that they export crude oil and import refined petroleum products. Hence, any authoritative and conclusive comments made on oil price shocks impact on them will been seen to be bias (Iyoha and Oriakhi, 2013). Researching the oil price changes consequences on economic output is specifically essential in Nigeria's case. This is so as changes in oil price impact her economy as exporter of crude oil and importer of refined petroleum products. In simple terms, it implies that any change in oil price (either increase or decrease) will simultaneously benefit and hurt economy of the country.

Nigeria's economy has witnessed stark structural difficulties triggered by over reliance on oil proceeds making the economy to be mono product. There has been renewed interest in investigating the relationship between output growth and oil price since the sudden fall of world price of oil (Obioma and Eke, 2015).

However, previous studies have revealed that the linkage between oil price shocks and stock market performance is not completely linear and that positive oil price shocks (i.e. price decrease) tends to have smaller impact on growth when compared to negative (Cologni and Manera, 2005; Atems and Lame, 2015; Olagbaju and Akinbobola, 2016). The transmission mechanism of oil price shocks to Nigeria stock market returns are ambiguous and the broad effect of oil price shocks on stock returns depends on which of the negative (domestic and imported inflation) or positive (effects of oil prices increase on Nigerian economy) effects offset the other.

In the light of the above problems, the study considers the following research questions as pertinent in addressing the various issues raised in this work: is there any asymmetric shocks between stock market and oil price in Nigeria? Specifically, the objective of this study is to investigate the asymmetric effect of oil price shocks on stock market performance.

This study covers a period of 1986 to 2019. The choice of reference period is informed by large variation in foreign exchange rate and periods of major recent oil shocks of rising and falling oil price.

Theoretical Review

The Discount Rate Theory

The theory stated that the expected discount rate consists of the expected inflation rate and the expected real interest rate both which may depend on expected oil prices. This means that higher oil prices will pose a negative impact on balance of trade and falling pressure on foreign exchange of the country and a skyward pressure on level of domestic inflation whose relationship to stock returns is negative and positive to discount rate for an oil importing nation. If a high oil price situation is considered relative to general price level, real rate of interest may increase, forcing an increase in return rate on corporate investment and in turn result in a stock price fall.

Huang, Masulis and Stoll (1996) posit that macroeconomic variables such as oil price pose an important impact on stock returns. In the production process, oil is an input factor and a high oil price will increase production cost and dampen total stock process. Stock prices will be affected by expected oil prices through discount rate which involves expected interest rate and expected inflation rate. Since expected interest and inflation rates are affected by oil price, there will be a plunging pressure on the foreign exchange of the country for a net importer of oil and rising pressure on the expected inflation rate of the country for a net exporter of oil. There will be a negative impact on stock return through greater expected inflation rate which increases discount rate.

Keynesian Theory of Aggregate Demand and Supply

In the case of floating nominal exchange rate and rising global oil prices, there is a quick strengthening of oil producing country's nominal exchange rate, resulting in a high domestic goods prices compared with aggregate demand and imported goods and a real exchange rate increase.

In the case of a fixed nominal exchange rate, relative prices will not change in the short term (assuming their rigidity) and, accordingly, we will see significant growth in demand for domestic goods which, assuming a flat supply curve, will lead to domestic goods output growth. Growth of output is prevalence in the level of unutilized production factors. This will bring about a rise in domestic goods demand and effect an economic agent income increase and a resultant effect for output income increase (Tse, 2011).

Empirical Review

Reboredo (2013) modelled how oil values and rates of exchange rates interrelate for broad set of currencies including those of net oil-exporting and importing economies, inflation-targeting countries and developed and emerging economies using two measures of dependence: correlations and copulas where he documented two main findings which is line with Reboredo and Rivera-Castro (2013) who used "the wavelet multiresolution analysis". First of all, the oil value-exchange rate dependence is weak in general although it rose substantially after the effect of the international financial crisis, and it was revealed that, there exists no ultimate dependence in market among oil values and rates of exchange.

Furthermore, Yasunori and Homori (2013) investigated the effects of oil value disturbances on exchange rate and real economic activities of the paramount industrial economies and so employed a two-step structural VAR as on the basis of Kilian's (2009) model. Establishing their findings on annual data between December 1974 and December 2010, the results shows that oil supply shocks causes an appreciation in the real effective of exchange rate and no significant effect on inflation in the oil abundant countries like USA, Canada, UK, France, Italy and Norway shows a decline in real effective exchange rate and inflation to crude price disturbances. These disturbances causes a temporary decrease in real effective exchange rate.

According to Brahmasrene *et al.* (2014) under the study of crude oil values and exchange rates, it was revealed that there was a causal relationship between rates of exchange and crude oil values during the short term while the crude values have a causal relationship with the rate of exchange in the long term. The work of Chou and Tseng (2011) utilized the ARDL model to examine the influence of oil values and rates of exchange instabilities on retails gasoline values in Taiwan. The study revealed that the response of gasoline values to the rate of exchange disturbances were sluggish and possessed the traits of non-reversible alternations during times of earlier rate of exchange depreciation.

Xiufang and Wang (2010) is study on the link between activities in the economy, stock and oil values, it was revealed that there is a long run link and co-integration between these variables in Russia. However, unlike Russia, there was no such relationship or co-integration between the variables in Japan and China. Also, Hasan and Mahbobi (2013) on the effect of oil revealed that the aftermath of oil value on the stock market in Canada had been increasing rapidly.

In addition, the study of Deluna (2014) where the technique of VECM was employed to investigate the link between oil value, rate of inflation and exchange, it was discovered that there was an additive long run link between the variables studied in Philippine. It was noted that a 1% rise in global crude prices had a 0.31% raise in the rate of inflation while a 1% rise in the rate of exchange had a 0.42% raise in the rate of inflation. Furthermore, it was noted that a rise in the previous values of global crude prices incur an increment in the rate of exchange even though the rate of exchange was not influenced by the previous rate of inflation values. It was also shown that the variables singly and jointly have a causal relationship with the rate of inflation. According to Kim and Courage (2014), it was discovered that there was positive relation among crude price and nominal rate of exchange in South Africa as an oil import trading economy. Using the GARCH test, to examine the exact influence of crude prices on the nominal rate of exchange, it was found that a rise in crude prices results in a 0.12% decrease in the rate of exchange which further implied the relevance of crude prices in determining the ability of the currency and its volatility in oil import trading economies such as South Africa.

Bal and Rath (2015) examined the link between crude prices and the rate of exchange on India and China using the non-linear and linear causality tests. This study revealed that rates of exchange do not granger-cause crude prices linearly in any of the 2 economies. Also even though there is causal relationship between crude prices and the rate of exchange for both economies, it is only in the long run. According to Adeniyi, Omisakin, Yaqub and Oyinlola (2012) in a study, using the GARCH and EGARCH models, it was revealed that a rise in the value of crude will cause the naira currency to appreciate as against the dollar currency. It was also further revealed that a 1% rise in crude value revenue will result in a higher percentage increase in naira as against the dollar currency.

In addition, Ogundipe and Ogundipe (2013), show that crude value had a meaningful influence on the economy. This study employed the GARCH and EGARCH and discovered that a change in crude price will result in a higher change in the rate of exchange volatility implying that the rate of exchange in Nigeria is subject to variation. In a study by Riman (2013) on the uniform effect of crude price disturbances on the rate of exchange and local investment, using the URVAR technique in reduced form, it was discovered that a long run link existed between the variables under study in which the DD was established. When the analysis of variance of decomposition was computed, it was discovered that the changes in the rate of exchange and local investment were majorly due to disturbances in crude values in the short-run. Also, in the country's currency depreciation and industrial negative growth, the effect of crude price disturbances were evident.

Apere and Ijeoma (2013) on the link among oil value volatility and economic variable volatility, employing the EGARCH model and Lag Augmented VAR approach, it was found that oil value volatility has no evident effect on government expenditure, production and rate of inflation in Nigeria. However, it was noted that instabilities in oil values influence the real rate of exchange and the rate of interest. The study revealed that it is the manifestation of oil values in the real rate of exchange and interest that influences the instabilities of total activities in the economy. The study therefore noted that oil value disturbances is a relevant determining factor of the real rate of exchange and that it is the rate of exchange and interest in the long run and not the oil cost disturbances that influences production growth in Nigeria.

Uma and Ikpe (2015) used the multivariate VAR and the VECM it was discovered that crude prices explain for the high ratio of predicted error variances of real rates of exchange. More particularly, the effect of the movement of oil value on the real rate of exchange is direct and positive which in turn results in a negative prompt flow to the determining level of non-oil export and import. For an economy under deregulation, positive disturbances on oil cost overtime culminate into an increment in the depth of external reserve and a rise in the country's ability for manufactured imports and output resources needed for the non-oil sector improvement.

According to the study by Obioma and Eke (2015) on the examination of the reaction of rate of exchange to oil price disturbances using the VAR model to employ a Vector Autoregressive (VAR) model, it was noted that there is a negative link between the crude value and rate of exchange. It was also established that a disturbance in the rate of exchange will lead to a reduction in the rate of inflation. Therefore, disturbances in real crude values have a reduction effect on the rate of exchange.

Methodology

Theoretical Framework

The theory of the Arbitrage Pricing as propagated by Ross (1976) was adopted by this study. This theory contends that a connection among the revenues of a portfolio and the revenues of a sole property may be charted by a direct mix of several exogenous economic variables. Alternatively, the foreseeable revenue of the indicators in a market (theoretical), such that the alternating ability in every resource is symbolized by a particular resource beta-coefficient. These macroeconomic variables are called risk factors. The APT is based on three basic elements; first is the assumption that a statistical model, the factorial model describes the returns of financial assets, the second assumption is the motion of arbitrage portfolio and finally the derivation of the relationship evaluation.

The theoretical framework of the Arbitrage Pricing Theory provided theoretical underpinning on the link among stock market, rate of exchange and the crude value. The popular Arbitrage Pricing Theory (APT) was found to be handy because the theory is built around stock market revenue alongside its determinants are well known in theory. According to the APT, stock market revenues have a functional link with the expected and unexpected revenue of the market. In other words, this study utilizes APT as a basis to establish a linear link among activities in the stock market and growth in response to crude value disturbances. The APT structure of revenue and risk is a recently termed concept relative to its alternative (Capital Asset Pricing Model-CAPM) by Treynor and Sharpe. APT and CAPM are of the notion that there is a positive link between expected revenue and risk.

Model Specification

The model in equation 1 is designed to determine the link among oil value disturbances, performance in stock market and growth in the Nigeria economy. Basing this study on Chen, Roll and Ross (1986) and Loungani (1986), the econometric model is stated as follows:

$$R_t = \alpha_0 + \beta_1 oilp_t + \beta_2 grt_t + \sum_{t=1}^{m} \beta_t X_t + \varepsilon_t \tag{1}$$

Where R is stock market performance, grt is the growth rate of GDP, oilp stands for oil value shocks and X is the control variable. Following the Loungani (1986) study, the variables; rate of inflation and rate of exchange will be introduced as control variables which explains the influence of oil value disturbances on stock market and the general economic performance. Hence, the inclusion of these into the equation (1) will give:

$$R_t = \alpha_0 + \beta_1 oilp_t + \beta_2 grt_t + \beta_3 rer_t + \beta_4 \inf_t + \varepsilon_t \tag{2}$$

Where R denotes the performance of stock market which is measured by the All Share indicator, grt is growth rate of GDP in the economy, oilp represents the oil value disturbances, rer is real rate of exchange, inf is rate of inflation and ε is the random error term.

Asymmetric Effect of Oil value shocks on Stock Market Performance

To examine the impact oil value disturbances have on the performance of stock market in Nigeria; the first objective of this study, the Nonlinear Autoregressive Distributed Lag cointegration approach (NARDL) is employed. In literature, the oil price – stock market performance link is normally analyzed through means of standard time series method of cointegration, error correction modelling (ECM) and Granger causality. While the techniques enable the determination of the long run and short run relations it is presumed that there is a symmetric link between stock market and oil price. However, they are not adequate to efficiently capture the potential asymmetries in the stock market changes rising from oil value disturbances. Recently, Shin, Yu and Greenwood (2011) advanced the NARDL as a similar extension to the well-known ARDL model of Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001), to capture both long run and short run similarities in variables of interest.

This study adopts this approach to achieve this objective due to four reasons. First, it allows modelling the cointegration relation that could exist between stock market and oil value disturbances. Second, it permits to test both linear and nonlinear cointegration. Third, it differentiates between the short run and the long run resultant effects from the independent to dependent variables. Even if all the three previous facts could also be tested within the nonlinear threshold Vector Error Correction Model (VECM), this model may suffer from the convergence problem due to the proliferation of the number of parameters, which is not the case with the NARDL model. Fourth, unlike other error correction models where the order of integration of the considered time series should be the same, the NARDL model relaxes this restriction and allows combining data series having different integration orders.

To achieve this objective, the model re-specifies equation (2) as follows:

$$R_t = \beta_0 + \beta_1 oilp_t + \beta_2 rer_t + \beta_3 \inf_t + \varepsilon_t \tag{3}$$

Given the linear specification of equation (3), it will not be possible to capture asymmetric impact of oil value shocks. Concretely, equation (3) can be written in a linear ECM specification without asymmetry in short run and long run dynamics as follows:

$$\begin{aligned} \Delta R_t &= \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 oilp_{t-1} + \alpha_3 rer_{t-1} + \alpha_4 \inf_{t-1} \\ &+ \sum_{i=1}^{p} \rho_i \Delta R_{t-i} + \sum_{i=0}^{q} \varphi_i \Delta oilp_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta rer_{t-i} + \sum_{i=0}^{s} \lambda_i \Delta \inf_{t-i} + \varepsilon_t \end{aligned} \tag{4}$$

Accounting for asymmetries in the relationship between oil value shocks and stock market performance, our model can be restated as follows:

$$R_t = \theta_0 + \theta_1 oilp_t^+ + \theta_2 oilp_t^- + \theta_3 rer_t + \theta_4 \inf_t + \varepsilon_t \tag{5}$$

Where θ_i is a vector of long run coefficients. The asymmetric impact of oil price is accounted for by including the positive shocks in $oilp_t^+$ and negative shocks in $oilp_t^-$. where the $oilp_t^+$ and $oilp_t^-$ are partial sums of positive and negative shocks in oil price respectively.

$$oilp_t^+ = \sum_{i=1}^{t} \Delta oilp_t^+ = \sum_{i=1}^{t} \max(oilp_t, 0) \tag{6}$$

and

$$oilp_t^- = \sum_{i=1}^{t} \Delta oilp_t^- = \sum_{i=1}^{t} \min(oilp_t, 0) \tag{7}$$

From equation (5) the magnitude of long run relationship between positive shocks in oil price and stock market performance is shown by θ_1 whereas the long run relation between negative shocks in oil price and stock market performance is captured by θ_2. Both coefficients are expected to have positive sign, but they are not anticipated to have similar magnitude, i.e. $\theta_1 > \theta_2$ since positive changes in oil price will have higher effect on stock market performance compared to negative changes in oil price (Hu *et al.,* 2017).

Equation (4) can be written in an unrestricted ECM form as proposed by Pesaran *et al.* (2001) and Shin et al. (2011) as:

$$\Delta R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 oilp^+_{t-1} + \alpha_3 oilp^-_{t-1} + \alpha_4 rer_{t-1} + \alpha_5 \inf_{t-1}$$
$$+\sum_{i=1}^{q}\rho_{1i}\Delta R_{t-1} + \sum_{i=0}^{r}\varphi_{2i}\Delta oilp^+_{t-1} + \sum_{i=0}^{s}\varphi_{3i}\Delta oilp^-_{t-1} + \sum_{i=0}^{t}\lambda_{4i}\Delta rer_{t-1} + \sum_{i=0}^{v}\gamma_{5i}\Delta\inf_{t-1} + \mu_t \qquad (8)$$

Where all variables are as explained above, q, r, s, t and v represent the lag order. From equation (8), the long run impact of positive and negative oil price changes on stock market is equivalent to $\theta_1 = -\alpha_2/\alpha_1, \theta_2 = -\alpha_3/\alpha_1$. The short run impact of positive oil price changes on stock market is shown by - $\sum_{i=0}^{r}\varphi_{2i}$, while the short run effect of negative changes in oil price on stock market is measured by $\sum_{i=0}^{s}\varphi_{3i}$. One of the advantages of NARDL as already stated above is that, it enables us to capture asymmetries in oil value shocks – stock market performance relation not only in the long run but in the short run as well.

Thus, we have the general form of the NARDL model as follows:

$$\Delta R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2^+ oilp^+_{t-1} + \alpha_3^- oilp^-_{t-1} + \alpha_4 rer_{t-1} + \alpha_5 \inf_{t-1}$$
$$+\sum_{i=1}^{q}\rho_i\Delta R_{t-1} + \sum_{i=0}^{r}(\varphi_i^+\Delta oilp^+_{t-1} + \varphi_i^-\Delta oilp^-_{t-1}) + \sum_{i=0}^{t}\lambda_i\Delta rer_{t-1} + \sum_{i=0}^{v}\gamma_i\Delta\inf_{t-1} + \varepsilon_t \qquad (9)$$

Analysis, Estimation and Results

In an attempt to test for the stationarity of the variables, this study employed both the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test (Phillips and Perron, 1988) with constant and linear trend. The results of the ADF and PP tests are shown in Table 1. The decision rule adopted here is that if the absolute value of ADF test or that of the PP test is lesser than the 5% critical value, then the tested variable is non-stationary. On the other hand, if the absolute value of ADF test or that of PP test is greater than the 5% critical value, then the tested variable is stationary. Hence, the purpose of unit root test is to know if the variable are I(0) or I(1).

From Table 1, both the ADF and the PP tests results indicate that stock market performance (R), inflation rate (INF) and oil price shocks (OILPRICE) are not stationary at levels, but these variables become stationary at their first difference, that is I(1). However, the ADF and PP test results indicate real effective exchange rate (REER) and GDP growth rate (GRT) are stationary at levels, that is I(0).

Table 1:

	ADF			PP		
Variables	**Level**	**1st Diff.**	**Status**	**Level**	**1st Diff.**	**Status**
Intercept and Trend						
R	-1.5123	-11.986	I(1)	-2.58278	-27.1748	I(1)
	0.8206	0.0000		0.2889	0.0001	
INF	-3.18164	-7.18753	I(1)	-3.41689	-11.0132	I(1)
	0.0927	0.0000		0.0535	0.0000	
REER	-4.57661		I(0)	-4.57661		I(0)
	0.0017			0.0017		
OILPRICE	-2.10113	-9.2506	I(1)	-2.33468	-7.81906	I(1)
	0.54	0.0000		0.4121	0.0000	
GRT	-3.65231		I(0)	-11.8312		I(0)
	0.0294			0.0000		
Test critical values						
1% level	-4.04282	-4.035		-4.03436	-4.035	
5% level	-3.45081	-3.44707		-3.44677	-3.44707	
10% level	-3.15077	-3.14858		-3.1484	-3.14858	

Source: Author's Computation, 2020.

Lag Length Selection Criteria

In order to estimate the specified models, it is appropriate to determine the optimal lag length to be used. The selection of an appropriate lag length is as significant as determining the variables to be included in any system of equations. As models with fairly large number of lags have the tendency of generating residuals that tend towards the white noise process, which might not be parsimonious, but fails to generate appropriate residuals that are random enough to approach a white noise process. That is, the more lags included in a model, the more loss of initial values.

This necessitates the need for determining the appropriate optimal lag length prior to the test of cointegration in order to avoid these problems of misspecification and loss of the degrees of freedom. The test result is shown in table 2. The result shows that the various lag selection criteria produced similar results. This study chooses the lag length of one as suggested by Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ).

Table 2: Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1580.744		1824276	25.7682	25.85965	25.80535
1	-1439.922	270.1966	239721.4*	23.73856*	24.19583*	23.92430*
2	-1425.707	26.34961	246995.9	23.76759	24.59067	24.10192
3	-1420.667	9.014646	295806.2	23.9458	25.13469	24.42872
4	-1415.897	8.220432	356476.6	24.12841	25.68311	24.75993
5	-1414.003	3.141131	451250.2	24.35778	26.27829	25.13789
6	-1411.192	4.480334	564489.3	24.57222	26.85855	25.50092
7	-1407.946	4.961115	703809.2	24.77961	27.43175	25.8569
8	-1380.503	40.15978*	594743.3	24.59355	27.6115	25.81943

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Asymmetric Effect of Oil Price Shocks on Stock Market Performance

The Autoregressive Distributed Lag (ARDL) is appropriate for variables that have different order of integration i.e. I(1) and I (0).

We then perform the cointegration test for the nonlinear specifications. The results of the bounds tests as presented in Table 3 shows the value of F-statistic and critical bounds. Specifically, the F-statistic is compared with the critical bound at 5% level of significance with restricted intercept and no trend for the nonlinear specifications. The result shows that the lower bound is 2.79 and the upper bound is 3.67 while the F-statistic is 65.80. This implies that there is presence of cointegration in the nonlinear specification model since the F-statistic result is greater than the upper critical bound at 5% significance level, indicating that we reject the null hypothesis of no long run relationship among variables (Pesaran, *et al*., 2001). Hence, we accept that long run relation exist among variables of interest.

We proceed to estimating the nonlinear model, which enables us to assess stock market performance and their response to positive and negative shocks in oil price. After estimating the short run and long run model, we perform some diagnostic tests to assess the adequacy of the dynamic model. The R-square value is 0.72, which shows high power of independent variables in explaining the changes in the dependent variable.

Table 3: ARDL Bound Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	65.80747	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.50%	3.15	4.08
		1%	3.65	4.66

Source: Author's Computation, 2020.

Nonlinear ARDL Presentation

In the short run, Table 4 reveals that positive oil price shocks have a negative but insignificant relationship with stock market with a coefficient of -0.000072 in the current period. This means that a unit increase in positive oil price fluctuations in the current period will result in a decrease of 0.0072 units in stock market performance. This implies that variations in oil price will lead to uncertainty and risk in stock market returns. Al-hajj *et al.,* (2018) shared similar view in their study in Malaysia. However, a positive oil price shocks has a positive and significant (at 10% level of significance) impact on stock market with a coefficient of 0.0086 in the previous period. This implies that a unit increase in positive oil price shock in the previous period will lead to an increase of 0.86 units in stock performance. This in line with the findings of Killian and Park (2009) and Effiong (2014). Also, a negative oil price shocks in the current period is found to have a positive and significant effect on stock market performance with a coefficient value of 0.0088 in the current period at 5% significance level. This means that at current period, negative oil price has positive short run effect on stock market performance in Nigeria and that a unit increase in the current year value of negative oil price shock will bring about an increase in stock performance by 0.88 units. The short run result of real exchange rate and inflation rate are negative and insignificant.

Long run estimates show that positive oil price shocks have positive and significant (at 1% level of significance) impact on stock market. The findings posit that positive shocks in oil price increases the performance of stock with a coefficient value of 0.0058. This implies that a unit increase in positive oil price shocks will lead to an increase of about 0.58 units in stock market performance. This means oil price increase has a significant positive long run effect on Nigeria stock market performance. This align with the result of Katrakilidis and Trachanas (2012) similarly, negative oil price shocks are shown to have a significant (at 1% level of significance) positive relationship with stock market performance. This posit that a unit increase in negative oil price shock will lead to 0.59 unit increase in stock performance. It further means that oil price decrease has a significant positive long run effect on stock market performance in Nigeria. Similar to the short run, the long run result of real exchange rate and inflation rate are negative and insignificant.

The Error Correction Term (ECT) indicates the speed of adjustment from short run equilibrium to long run equilibrium state (Nguyen and Pfau, 2010). The greater the coefficient of the parameter, the higher the speed of adjustment of the model from the short run to the long run. The interpretation of the ECM is that the coefficient of the ECT has to be negative and its probability value has to be significant (which means that it must be less than 0.05 at 5% significance level).

Based on the result in Table 4, the coefficient of the speed of adjustment towards equilibrium is -147.4%, meaning that it is adjusting at a pace of -147% quarterly towards equilibrium. In the result, it is evident that the ECT is statistically significant at 5% level, as its probability value which is 0.0000 is below 0.05. This shows that there is dynamic adjustment from short run to long run and that 147% of the errors in the short run are corrected in the long run.

Table 4: NARDL Short Run and Long Run

Dependent Variable: R				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Short Run Estimate				
R(-1)*	-1.47395	0.080761	-18.2509	0
DOILPRICE_POS(-1)	0.00859	0.004439	1.935279	0.0553
DOILPRICE_NEG**	0.008839	0.004395	2.011068	0.0465
REER**	-0.00028	0.000716	-0.39269	0.6952
DINF**	-0.00032	0.004453	-0.07065	0.9438
D(DOILPRICE_POS)	-7.17E-05	0.006375	-0.01124	0.991
CointEq(-1)*	-1.47395	0.079049	-18.6462	0.0000
Long Run Estimate				
DOILPRICE_POS	0.005828	0.001081	5.393224	0
DOILPRICE_NEG	0.005997	0.001033	5.80559	0
REER	-0.00019	0.000254	-0.75065	0.4543
DINF	-0.00021	0.000688	-0.31025	0.7569
C	0.101877	0.02389	4.264474	0
R-squared	0.724692	Mean dependent var		0.041365
Adjusted R-squared	0.724692	Durbin-Watson stat		2.208104
Log likelihood	-61.0136			
F-statistic	8.319261			
Prob(F-statistic)	0.000006			
*Note: p-values and any subsequent tests do not account for model selection.				

Source: Author's Computation, 2020.

NARDL Dynamic Multiplier

The dynamic multiplier allow us to trace out the evolution of stock market performance at a given level following a shock to oil price at another level providing a picture of the path to the new equilibrium. Figure 1 presents the dynamic multiplier for stock market performance to oil price increase and decrease. The estimate of the long run coefficient of oil price increase is 0.0058 while that of oil price decrease is 0.0059. Therefore, a 1 percent increase (decrease) in the oil price leads to a 0.58% (0.59%) increase (decrease) in stock market performance. Meaning that in the long run, positive shocks to oil price are transmitted to the stock market with grater intensity than the negative ones. We observe that stock market performance respond at almost the same rate to positive and negative shocks to oil price.

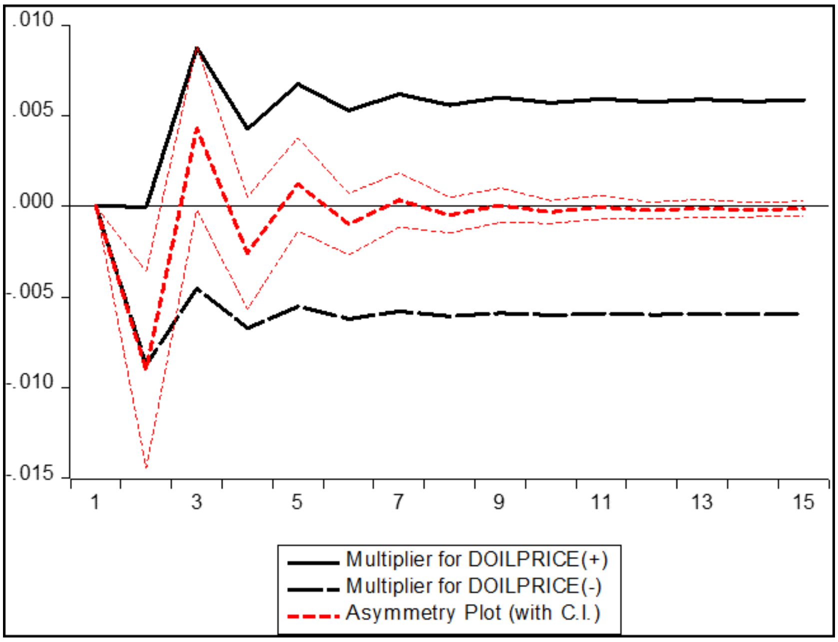

Figure 1: Multiplier Graph

NARDL Diagnostic Tests

According to the Breusch-Pagan test pf serial correlation, the null hypothesis of no serial correlation is tested against the alternative hypothesis of serial correlation (Greene, 2008). In order to verify the status of serial correlation in the model, the F-statistic and its corresponding probability value is noted. The result is presented in Table 5. The F-statistics is 3.83 and the P-value is 0.24. Since the probability value is less than 5%, we reject the null hypothesis, meaning that there is evidence of serial correlation.

To test for the presence of heteroscedasticity in the model, the study chose the Breusch-Pagan-Godfrey Test. In this test, the F-statistic is checked with its corresponding probability value. The null hypothesis here is that the model is homoscedastic, while the alternate hypothesis is that the model is heteroscedastic. We reject the null hypothesis if the P-value is less than 5%. From Table 5, the F-statistic is 0.19 and the P-value is 0.93. Since the probability value is greater than 5% level, we accept the null hypothesis of homoscedasticity. Hence the model are homoscedastic and this means that the model is desirable.

Finally, the stability of the model is tested by conducting Cumulative Sum of Recursive Residuals (CUSUM) test propounded by Brown, Durbin and Evans (1975). The CUSUM test is based on the cumulative sum of the recursive residuals which plots the cumulative sum together within the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. From Figure 2, CUSUM test reveal the stability of the model coefficients since the estimated model lies within the 5% significant line. This implies that the model is stable.

Table 5: ARDL Diagnostic Tests Results

Test Statistic	F-Statistic	P-Value
Serial Correlation	3.831085	0.0243
Heteroscedaticity	0.1974	0.9393
Normality	16503.37	0.0000

Source: Author's Computation, 2020.

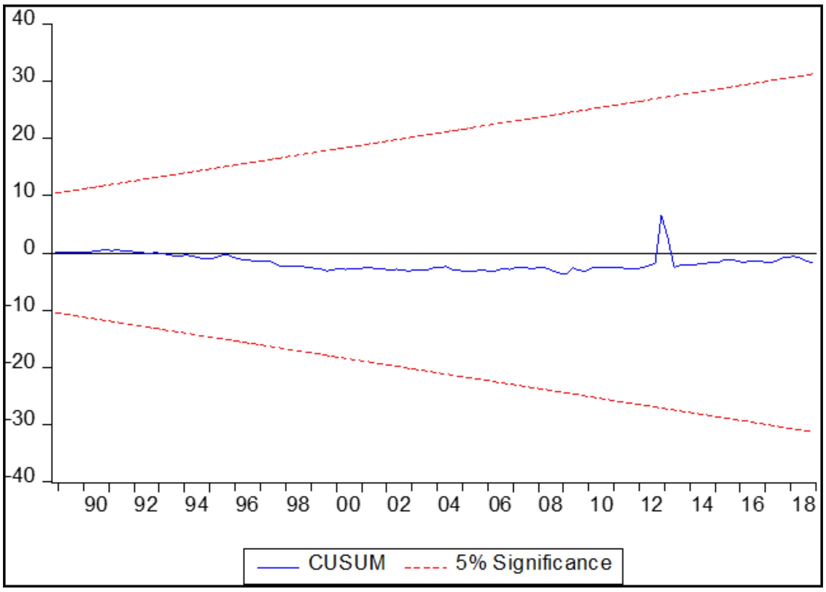

Figure 2: CUSUM

Conclusion

This study examined oil price shocks, stock market performance, its objective is to investigate the asymmetric effect of oil price shocks on stock market performance, and the study adopts the Nonlinear Autoregressive Distributed Lag (NARDL) model. This model uses the decomposition oil price shocks into positive and negative partial sums. Taking stock performance as the dependent variable, the study showed that positive oil price shock has a significant positive effect on stock market performance in the short run while the negative oil price shock has a positive and significant effect on stock performance in Nigeria. However, long run result shows that positive oil price shocks has a significant positive effect on stock market performance and negative oil price shocks also has a positive and significant effect on stock market performance in Nigeria.

Based on the findings from the analysis, the following conclusions are made; the result confirms the existence of both long run and short run asymmetric behavior in stock market performance. Precisely, in the long run and short run, positive oil price shocks tend to increase stock market performance in Nigeria. Similarly, negative oil price shocks bring about increase in the performance of the stock market in both long run and short run. The study also finds out that stock market affects both real exchange rate and inflation rate negatively. The result showed that oil price shock increase' and decrease will improves the performance in the stock market.

Recommendations

The essence of economic analysis is to enhance the decision making process of policy makers and to ensure that appropriate policies suitable to the dynamics of the particular economy in question can be implemented. Hence, based on the findings from the empirical analysis, the following recommendations are made: firstly, given the fact that positive oil price shocks has positive effect on stock market performance, government through the Monetary Policy Committee (MPC) should therefore make monetary policy decisions that will ensure this positive impact is maintained to sustain the stock market in periods of shocks. Also, the fact that oil price shocks leads to fluctuations in the stock market is worrisome but expected as far as Nigeria is concerned. The implication of this phenomena in Nigeria is a change in interest rate and inflation rate. Hence, policy makers should put in place measures that will ensure stable macro-economic environment. To do this means that we should have a stable interest rate, exchange rate and inflation rate, devoid of excessive response to shocks from oil price fluctuations.

References

Adeniyi, O., Omisakin, O., Yaqub, J. and Oyinlola, A. (2012). Oil price-exchange rate nexus in Nigeria: further evidence from an oil exporting economy. *International Journal of Humanities and Social Sciences*, 2(8), pp. 113-121.

Apere, O. T. and Ijeoma, A. M. (2013). Macroeconomic impact of oil price levels and volatility in Nigeria. *International Journal of Academic Research Economics Management Science*, 2(4):15-25.

Atems, B. D. and Lame, E. (2015). Do exchange rates respond asymmetrically to shocks in the crude oil market?'' Elservier *Journal of Energy Economics.*

Atukeren, E, (2013). Oil prices and the Swiss economy. *Swiss Institute for Business Cycle Research (KOF).*

Atukeren, E, (2013). Oil prices and the Swiss economy. *Swiss Institute for Business Cycle Research (KOF)*.

Auty, R. M. (2004). Resource abundance and economic development, *Oxford University Press, UK*.

Bal, D. P. and Rath, B. N. (2015). Nonlinear causality between crude oil price and exchange rate: A comparative study of China and India. *Energy Economics*, 51, 149-156.

Brahmasrene, T., Huang, J-C. and Sissoko, Y. (2014). Crude oil prices and exchange rates: Causality, variance decomposition and impulse response. *Energy Economics*, Vol. 44, pp. 407–412. doi:10.1016/j.eneco.2014.05.011

CBN (2016). Economic report second quarter 2016. Central Bank of Nigeria

Chen, N., Roll, R. and Ross, S. A. (1986). Economic forces and the stock market. *Journal of business* 59 (3): 383–403.

Chou, K. W. and Tseng, Y. H. (2011). Oil price pass-through into CPI inflation in Asian emerging countries: the discussion of dramatic oil value shocks and high oil price periods. *Journal of Economics Finance and Management Sciences*, 2 (1), pp. 1-13

Degiannakis, S., Filis, G. and Arora, V. (2018) Oil prices and stock markets: a review of the theory and empirical evidence. *BAFES –Bournemouth Accounting, Finance & Economic Series* NO 22

Hamilton, J. D. (1983). Oil and the macroeconomy since World War II. *Journal of Political Economy* 91:228-248

Hathaway, T. (2009). Oil's importance to the World's economy. *Online article posted in suite101.com*

Hasan, S. and Mahbobi, M. (2013). The increasing influence of oil prices on the Canadian stock market. *The International Journal of Business and Finance Research*, 7(3), 27 -39.

Hu, C., Liu, X., Pan, B., Chen, B. and Xia, X. (2017). Asymmetric Impact of Oil Price Shock on Stock Market in China: A Combination Analysis Based on SVAR Model and NARDL Model. *Emerging Markets Finance and Trade*. ISSN: 1540-496X

Huang, R. D., Masulis, R. W. and Stoll, H. R. (1996). Energy shocks and financial markets. *Journal of Futures Markets* 16, 1-27.

Iyoha, D.O. and Oriakhi, D.E. (2013). Oil price volatility and its consequences on the growth of the Nigeria Economy. Asian Economics and Financial Review, vol. 3, issue 5, 683-702.

Kilian, L. (2009). Economic research and statistics division oil price volatility: origins and effects. *World Trade Organization Staff Working Paper*

Kim, I. M. and Loungani, P. (1992). The role of energy in real Business Cycle models. *Journal of Monetary Economics* 29: 173-189.

Lee, K. and Ni, S. (2002). On the dynamic effects of oil value shocks: a study using industry level data. *Journal of Monetary Economics*, 49 823–852

Lee, K. S. and Ni, S. (2002). On the dynamic effects of oil value shocks: a study using industry level data. *Journal of Monetary Economics* 49: 823-852

Lee, K., Ni, S. and Ratti, R.A. (1995). Oil shocks' and the Macroeconomy: The Role of Price Variability, *The Energy Journal*, 16(4): 39-56.

Long, J. B. and Plosser, C. I. (1987). Sectoral vs. aggregate shocks in the Business Cycle. *American Economic Review, Papers and Proceedings* 77 (1987), pp. 333-336.

Loungani, P. (1986). Oil value shocks and the dispersion hypothesis. *Review of Economics and Statistics*, 68, 536–539.

Manera, M. and Cologni, A. (2005) Oil prices, inflation and interest rates in a structural cointegrated VAR model for the G-7 Countries. *, Fondazione Eni Enrico Mattei (FEEM),* No. 101.

Obioma, B. K. and Eke, C. N. (2015). An empirical analysis of crude oil price, consumer price level and exchange rate interaction in Nigeria: A Vector Autoregressive (VAR) Approach. *American Journal of Economics* 5(3).

Ogundipe, A. A. and Ogundipe, O. M. (2013). Oil price and exchange rate volatility in Nigeria. *MPRA Working Paper*

Olagbaju, I. O. and Akinbobola, T. O. (2016). A non-linear analysis of the oil price exchange rate nexus in Nigeria. *Journal of Economics and Behavioral Studies,* AMH International, vol. 8(4), pp 79-91.

OPEC (2017). Monthly oil market report. Organization of Petroleum Exporting Countries

Oriakhi, D. E. and Iyoha D. O. (2013). Oil price volatility and its consequences on the growth of the Nigerian economy: an examination (1970-2010). *Asian Economic and Financial Review,* Asian Economic and Social Society, vol. 3(5), pp 683-702.

Otaha, J. I. (2016). Dutch Disease and Nigeria oil economy. *African Res. Rev*. 6, 82–90.

Park, J. and Ratti, R. A. (2017). Oil value shocks and stock markets in the U.S. and 13 European countries. *Energy Economics*, 30(5):2587-2608

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, Vol. 6, pp. 289-326.

Pesaran, M. H. and Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration analysis. In S. Strom, (ed.) Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Cambridge University Press, Cambridge.

Phillips, P. C. B. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika* 75, 335-346.

Reboredo, J. C. (2011). How do crude oil prices co-move: a Copula approach? *Energy Economics* 33: 948-955.

Reboredo, J. C. and Rivera-Castro, M. A. (2013). A wavelet decomposition approach to crude oil price and exchange rate dependence. *Economic Modelling* 32(1):42–57

Riman, H. B., Akpan, E. S. and Offiong, A. I. (2013). Assymetric effect of oil value shocks on exchange rate volatility and domestic investment in Nigeria. *British Journal of Economics, Management and Trade* 3(4): 513-532.

Ross, S. A. (1976). The Arbitrage Theory of Capital Asst Pricing. *Journal of Economic Theory* Vol. 13 pp. 341-360

Shin, Y., Yu, B. and Greenwood, N. M. (2011). Modelling Asymmetric Cointegration and Dynamic Multiplier in a Nonlinear ARDL Framework, Mimeo.

Skott, P. (1996). Keynesian theory and the Aggregate-Supply/Aggregate-Demand Framework: A defense. Available at SSRN: https://ssrn.com/abstract=75888

Tse, H. (2011). Using oil value shocks to teach the AS-AD Model in a blended learning strategy. *Australasian Journal of Economics Education,* Vol. 8, Number 2, pp.63-87

Uma, E. and Ikpe, M. (2015). Interaction between oil value shocks and nigeria's non-oil macroeconomy. *International Journal of Economics, Commerce and Management United Kingdom,* Vol. III, Issue 1, pp. 1-13.

Xiufang, W. (2010). The relationship between economic activities, stock price and oil price: Evidence from Russia, China and Japan. *International research journal of finance and economics*, pp. 103 – 111

Yuan, Y., Zhaung, X., Liu, Z. and Huang, W. (2014). Analysis of the temporal properties of price shock sequences in crude oil markets. Physical A, 394: 235-24[2]