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# Volatility Spillover and Co-Movement between Oil Price Shocks and the Nigerian Equity Market Returns

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***Author's contribution***

*The sole author designed, analyzed and interpreted and prepared the manuscript.*

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## ABSTRACT

This study investigates empirically the volatility spillover and co-movement between oil price shocks and equity return behavior in Nigeria. Data for the study were obtained from secondary sources particularly from Central Bank of Nigeria (CBN) and Nigeria Stock Exchange Publications. Data covered the period 2000 to 2015 and were analyzed using Exponential Generalized Autoregressive conditional Heteroscedasticity (EGARCH) model for the volatility spillover and Autoregressive Distributive Lag (ARDL) model for long and short dynamics. The results are three folds: First, the results revealed that oil price volatility has a significant negative impact on stock returns in Nigeria. Second, the results also revealed that there were leverage and symmetric effects and volatility persistence in the Nigeria Stock Market. Third, the study confirms co-movement between oil price shock and equity returns in Nigeria. The study therefore recommends that the government should carefully monitor developments in the world crude oil market with a view to diversifying the economy away from crude oil dependence to minimize the consequences of oil shocks on the stock market and the economy at large.

*Keywords: Volatility; oil price; oil price shock; stock return; EGARCH.*

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## 1. INTRODUCTION

An oil price shock is any significant and sudden increase or decrease in oil prices. Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market [1,2]. According to Hamilton's [1] original paper, oil shocks are the log change in oil prices under the implicit assumption that the effect of oil shocks on stock returns was symmetric. These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil-rich Middle East and activities of militant groups in the Niger Delta region of Nigeria. Akpan [3] asserts that this shock in oil price could be a rise (positive) or a fall (negative). Two issues are usually deduced from oil price shocks: one is the magnitude of the price increase which can be quantified in absolute terms or as percentage changes, and two the timing of the shock, that is, the speed and persistence of the price increase [3].

In practice it is unlikely for demand to grow rapidly enough to cause a price shock unless it is motivated by fears of supply shortages. Historically, the supply side has been primarily responsible for observed oil price shocks, at least as an initial trigger. There are at least two important dimensions of a price shock. The first is the magnitude of the price increase, which may be measured in absolute terms or in percentage changes. Furthermore, one can distinguish between nominal and relative (or real) price changes. The second aspect is one of timing: The speedand durability of price increases. Three cases may be identified: (1) A rapid (e.g. occurring within a few quarters) and sustained price increase (a "break"): (2) a rapid and temporary price hike (a "spike"); and (3} a slower but sustained rise (a "trend"). The speed of a shock is important as it affects the ability of economies to adjust, which is typically very restricted in the short run. Durability has obvious implications for the permanence and overall extent of the consequences.

Most of the major fluctuations in oil prices are caused by exogenous political events but subsequent movements are mostly the result of demand shocks. Barsky and Kilian [4], Kilian [5], provides a thorough discussion of the different categories of shocks, noting that the source of the shock is critical in determining its effect on macroeconomic aggregates. Others have focused on stock returns and macroeconomic aggregates. While others have focused on the responses in output to oil price movements. Hence, oil-price shocks are often viewed as one of the primary exogenous causes of stock return fluctuation [6].

Crude oil is arguably one of the single most important driving forces of the global economy, and changes in the price of oil have significant effects on stock returns and welfare around the world [7]. The performance of an economy is usually assessed in terms of the achievement of economic objectives. These objectives can be long term, such as sustainable growth and development, or short term, such as the stabilization of the economy in response to sudden and unpredictable events, called economic shocks.

Oil price shock is believed to have implications for stock market performance. The effect will differ from economy to economy depending on whether the economy is an oil-exporter or oil-importer. In oil-exporting economies, a rise in oil prices improves the trade balance and disposable income. This will raise domestic demand and stock price. The reverse becomes the case in an oil importing economy [8].

In the last couple of years, the global oil and financial markets have been engulfed in systemic crisis giving research experts and policymakers serious concern. Since 2007, the world has witnessed pronounced collapse in financial institutions, stock market declines, oil prices and exchange rate volatility. Besides, the empirical researches on oil price-stock return nexus have in the past, been the concern of many economists particularly in the developing countries. The results have been mixed and empirical consensus indecisive. As a follow up, this study is aimed at examining the relationship between Oil price shocks and stock return in Nigeria (2000-2015), determine the impact of oil price shocks and macroeconomic aggregates on stock returns, identify if there are leverage effects, asymmetric effects and volatility persistence in the Nigeria stock market. The rest of the paper is as follows; section two is the literature review, section three is the methodology. Section is the data presentation and analysis and last section summary and conclusion.

## 2. THEORETICAL FRAMEWORK

The theories of oil price shock and effects on stock returns and macroeconomic indicators can be explained through channels of oil price shock transmission. Theoretically, a transmission channel mechanism has been devised to explain the media through which oil prices affect stock prices and real economic activities. Some theories have argued that since the mid-1970s, oil price movements have been a major source of business cycle fluctuations, but rather failed to reach consensus on the validity of a peculiar transmission channel that helps to explain the processes by which fluctuations in oil prices influence the stock price and macro economy.

Theoretical literature has identified the transmission mechanisms through which oil prices affect stock returns and real economic activity to include both supply and demand channels. The supply side effects relate to the fact that crude oil is a basic input to production and commerce, and hence an increase in oil price leads to a rise in production and distribution costs that induces firms to lower output. Changes in oil price also entail demand side-effects on consumption and investment. Consumption is affected indirectly through its positive relation with disposable income while investment is adversely affected indirectly because such increase in price also affects firms' input prices and thereby increasing their costs.

According to Hunt, Isard and Laxton [9], an increase in oil prices can influence the economy through many channels. The first mechanism reflects the transfer of income from oil-importing to oil-exporting countries, which leads to a decrease in global demand in the oil-importing nations. The decrease in demand in the oil-importing countries outweighs the increase in the oil-exporting countries because of an assumed low propensity to consume in the later. Secondly, given the level of capital stock and assuming that wages are relatively inflexible in the short run, an increase in input costs of production will result in non-oil output being affected. Also, since crude oil is a basic input in production, an increase in oil prices leads to an increase in production costs. The third channel is when workers and producers resist a decrease in their real wages and profit margins. This results in upward pressure on labor costs and prices. The fourth channel is through the definition of core inflation. An increase in energy prices raises the consumer price index, leading to calls for action from the central bank. A tight monetary policy has dire consequences on stock returns.

According to Odularu [10] the magnitude of the direct effect of a given price increase depends on the share of the cost of oil in national income, the degree of dependence on imported oil and the ability of end-users to reduce their consumption and switch away from oil. It also depends on the extent to which gas prices rise in response to an oil-price increase, the gas-intensity of the economy and the impact of higher .prices on other forms of energy that compete with or, in the case of electricity, are generated from oil and gas. Naturally, the bigger the oil-price increase and the longer higher prices are sustained, the bigger the macroeconomic impact.

In most of oil exporting countries, like Nigeria, government which is considerably large in comparison with small private sector, directly receives the oil revenue. Spending this revenue, government's behavior becomes the most important characteristic of the economy. In other words, the funds needed for government's expenditure come from oil revenue. So, fiscal and monetary policies depend upon oil price [11]. Since any rise or fall in the oil price is not permanent oil revenue variation injects instability to the economy. In this situation, so/called - resource curse occurs. When oil pricerises, the government has more money to spend. In other words, according to Kilian [5], when the country's terms of trade are favorable, oil-dependent government’s spending can be easily financed through oil revenue. Though, this revenue can be used to finance developmental projects to increase the welfare, but inefficient public spending and fiscal expansion lead to wastes. This destructive strategy, over time, makes the economy more vulnerable to oil price volatility particularly in the presence of capital market imperfections [12].

Oil price changes also influence foreign exchange markets and generate stock exchange panics, higher interest rate, produce inflation and eventually lead to monetary and financial instability. According to Jimenez-Rodriguez and Sanchez [13]. Some of these indirect effects may involve economic policy reactions. For instance, authors like Bohi [14] and Bernanke, Gertler and Watson [15], argue that economic downturns observed after oil price shocks are caused by a combination of direct impacts of the shocks themselves and the monetary responses to them. Mckillop [16] adds that such could lead to higher interest rates, inflation and even a plunge into recession.

## 3. EMPIRICAL LITERATURE

Literature on Oil- price stock return nexus is replete in Nigeria. The available empirical literatures in Nigeria have been grouped and reviewed under the following sub-headings based on the objectives of the study. Oyeyemi [17] studied the effect of oil price shocks on stock returns in Nigeria within a VAR framework. He found no substantial role for oil price shocks in explaining movements in stock returns. Only the long run money supply and the real exchange rate are significantly affected following a shock to oil prices. Based on all these findings, very limited studies have been done to assess the direct effects of oil price fluctuations on the stock returns.

Basley and Kilian [4], using VAR., studied the impact of crude oil price changes on stock returns and other macroeconomic variables. The results show that oil prices have significant negative impact on stock prices, money supply and unemployment. This implies that macroeconomic variables in Nigeria are significantly explained by exogenous and the highly volatile variable. Hence, the economy is vulnerable to external shocks. Consequently, the macroeconomic performance will be volatile and macroeconomic management will become difficult. Diversification of the economy is necessary in order to minimize the consequences of external shocks.

Omojolaibi [18] examines the effects of crude oil price changes on stock returns in oil-dependent economy-Nigeria. A small open economy Structural Vector Autoregressive (SVAR) technique was employed to study the macroeconomic dynamics of domestic price level, stock returns, money supply and oil price in Nigeria. The sample covers the data from 1985:ql to 2010:q4. The Impulse Response Functions (IRFs) and the Forecast Error Variance Decompositions (FEVDs) results suggest that domestic policies, instead of oil-boom should be blamed for inflation. Also, oil price variations are driven mostly by oil shocks. However, domestic shocks are responsible for a reasonable portion of oil price variations, which impacts negatively on stock prices.

Using linear and non-linear specifications, Aliyu [19] assessed empirically the effects of Oil price shocks on the stock returns in Nigeria using the Granger causality tests and multivariate VAR analysis. The paper finds evidence of both linear and non- linear impact of oil price shocks on stock returns. In particular, asymmetric oil price increase in the non-linear models are found to have positive impact on *stock returns* of a larger magnitude than asymmetric oil price decrease *adversely affects stock returns.* Furthermore, the authors utilized the Wald and the Granger multivariate and bi-variate causality tests. Results from the latter indicated that linear price change and all the other oil price transformations are significant for the system as a whole. The Wald test indicates that oil price coefficients in linear and asymmetric specifications are statistically significant.

Frankel [20] used the VAR model with quarterly data from 1970 to 2003 to examine the effect of oil price shock on stock returns in Nigeria. Their findings showed that while oil prices significantly influenced exchange -rates, it did not have significant effect on stock returns and output in Nigeria. The conclusion drawn from the study was that an increase in the price of oil results in wealth effects which appreciates the exchange rate and increases the demand for Common stocks: Ayadi [21] examined the effects of oil production shocks on stock returns in Nigeria. The impact responses showed that a positive oil production shock was followed by rise in output, reduction in inflation and a rise in stock returns. With the same methodology and set of variables (except that oil price replaces its level of production), Ayadi [21] finds negligible responses of stock returns, inflation and the real exchange rate following an oil price shock.

Akinleye and Ekpo [22] examined the macroeconomic implications of symmetric and asymmetric oil price and oil revenue shocks in Nigeria, using the Vector Autoregressive (VAR) .estimation technique. The paper stated that both positive and negative oil price shocks influence stock returns only in the long run rather than in the short run. While examining positive and negative shocks to external reserves, it revealed stronger implications for stock returns in the long run, with positive rather than negative oil price shocks having stronger short and long run effects on stock prices and therefore triggering inflationary pressure and domestic currency depreciation as- importation rises. However, results obtained showed that oil revenue shocks are capable of affecting stock returns only in the long run while raising general price levels marginally in the short run after the initial shocks, with evidence of serious threat to interest rate and the domestic currency in the short and medium term, as the volume of imports increases significantly along with the external reserves. Findings on the asymmetric effects of oil price shocks revealed that positive shocks to oil price stimulate stock prices in the Nigerian economy in the short run in line with theory, thereby creating inflationary pressure and domestic currency depreciation.

Chuku et al. [23] studied the linear and asymmetric impacts of oil price shocks on the Nigerian stock markets for the period 1970QI-2008Q4, using VAR model and Granger causality test approach; and found that oil price shocks are not a major determinant of stock returns in Nigeria in the linear model; while Granger causality results indicate that world oil prices do not influence stock returns and that non linear specification results show that the impact of world oil price shocks on stock returns are asymmetric.

Fasanya and Onakoy [24] examined the impact of oil price movements on stock prices in Nigeria during the period 1970 to 2011 making use of annual time series data. The empirical analysis rests on dynamic VAR analytical framework. To capture the possible channels reflecting the fluctuations in the oil prices, the mode] includes money supply, real exchange rate, government spending and inflation. The findings indicated that lagged effects of the VAR model are not able to capture any significant impact of changes in oil prices, and oil price shocks are therefore not found to affect stock prices, exchange rate or inflation in the short run but show a positive significant relationship to stock prices in the long run. Following the VAR model results, the generalized impulse responses reaffirm the direct link between the net oil price shock and stock returns, as well as the indirect linkages.

Ushie, Adeniyi and Akongwale [25] offer an elaborate econometric analysis which tests the sensitivity of stock returns to oil price shocks, using the Impulse Response functions (IRFs) and Variance Decomposition (VDC) techniques within a Vector Autoregressive (VAR) framework. The sensitivity analysis showed that fluctuations in oil prices have resulted in inflation, high stock returns and real exchange rate appreciation in Nigeria. Importantly, the institutional variable was found to be significant.

Ojapinwa and Ejumedia [26] examine the industrial impact of oil price shocks in Nigeria from 1970-2009, the econometric approaches adopted in the paper is the VAR impulse response. This study came out with empirical evidence that will help in understanding the impact of oil price shocks on stock returns in Nigeria while also considering other variables like Exchange rate, inflation, unemployment and money supply. The study came to the conclusion that oil price, inflation and exchange rate have the potentials of causing significant changes in stock returns in Nigeria.

## 4. METHODOLOGY AND DATA

### 4.1 Unit Root Test Analysis and Data

Empirical work based on time series data assumes that the underlying time series is stationary. Broadly speaking, a data series is said to be stationary if its mean and variance are constant (non-changing) over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed [27]. This will help to determine whether the variables are likely to be co-integrated. In this study we used the Augmented Dickey Fuller (ADF) test for stationary of the variables.

Also data for this study are extracted from Central Bank of Annual Bulletin, several issues and *Nigeria Stock Exchange Publications*. To establish the volatility spillover, monthly data on the equity returns was employed. The other macroeconomic variables used in the study annual data.

### 4.2 Computation of Equity Return

Following Hamadu and Ibiwoye [28], equity return is approximated by

$$In\ (SR)_t = In\ \left[\frac{AI}{AI_{t-1}}\right] \quad (1)$$

Where AI = All Share Index

Hence in equation (1) above, In (SR) was obtained as shown in equation (2) while In (OP) was obtained thus

$$OP = \frac{OP_1 - OP_{t-1}}{OP_{t-1}} \quad (2)$$

## 4.3 Volatility

This paper uses two steps estimation procedure for volatility modelling.

**a.** Testing for ARCH effects: Is the series in question volatile?
**b.** Estimation with ARCH-type Models and post estimation: This is considered only if the series (oil price and equity return) are volatile.

### 4.3.1 Testing for ARCH (1) effects

The test, following the procedure of ARCH LM test proposed by Engle [29], begins with estimation of AR model as specified in equation (1) below;

$$R_t = \alpha + \delta_1 R_{t-1} + \varepsilon_t;\ \varepsilon_t \sim IID(0, \sigma^2) \qquad (3)$$

Where $R$ is the rate of return of the series.

Estimated residual is obtained from equation (1), then the squared of estimated residual is regressed on its lag as follows:

$$\hat{\varepsilon}^2{}_t = \gamma_0 + \gamma_1 \hat{\varepsilon}^2{}_{t-1} + \nu_t \qquad (4)$$

$$H_O: \gamma_1, while\ H_1: H_1: \gamma_1 \neq 0$$

The test statistics for the null hypothesis are F-test and nR2 tests.

The null hypothesis of no ARCH effects is rejected if the probability values (p-values) of these tests are less than any of the conventional levels of statistical significance (10%, 5%, and 1%). The rejection of Ho implies presence of ARCH effect in the series. Thus, if ARCH effects are present, the estimated parameters should be significantly different from zero (the series are volatile). However, if ARCH effects are not present, then, the estimated parameters should be statistically insignificant (the series are not volatile).

### 4.3.2 Estimation with ARCH-type Models (EGARCH)

To capture the volatility spillover, the study adopted the ex-post facto design as it relied on secondary sources of data. The analytical tools consist of the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) Model. The methodological framework employed for testing volatility was based on the assertions of Adjasi et al. [30] and Koulakiotis et al. [31]. According to them, EGARCH is preferred to GARCH in modeling volatility in the financial market because GARCH is weaker than EGARCH in studying financial markets.

Generally, the standard EGARCH specification is expressed as follows:

$\log \sigma_i^2 =$

𝑎0+𝑖=1𝑝𝑎𝑖𝑒𝑡−𝑖𝑎𝑡−𝑖+𝑗=1𝑞𝛽𝑗𝑙𝑜𝑔𝑎𝑡−𝑗2+𝑖=1𝑝𝛾 𝑘𝑒𝑡−𝑖𝑎𝑡−𝑖 (5)

Where $\log \sigma_i^2$ = logarithm of conditional variance of stock market returns

$\alpha_0, \alpha_i, \beta_j, \& \gamma_k$ are intercept, coefficient, coefficient and asymmetric effect respectively

According to Brooks [32], the EGARCH is preferred for two reasons;

(1) By using $\log(\sigma_i^2)$, even if the parameters are negative, the equation will be positive.
(2) asymmetries are allowed under EGARCH formulation if $\gamma_k < 0$, this implies that leverage effect exists; and where $\gamma_k = 0$, it indicates that an asymmetric effect exists in the model.

To determine the impact of oil price shocks and other macroeconomic aggregates on stock returns we use

$$SR = f(oilp, infl, m2, tbr, extr) + U_t \qquad (6)$$

Explicitly, the above equation is stated in its standard form as:

$$In(er) = a_0 + a_1 In(oilp) + a_2 In(infl) + a_3 In(m2) + a_4 In(tbr) + a_5 In(extr) + U_t \qquad (7)$$

Where:

ER = Equity return obtained as shown in equation (4)
oilp = Crude oil price volatility or variations in crude oil price at time (t)
m2 = Money supply
tbr = Treasury Bill rate
infl = Inflation rate
extr = Exchange rate
$a_0$ = Intercept, $a_1$ to $a_5$ = the coefficients of the variables to be estimated,
$U_t$ = Error term
$a_1$, $a_3 > 0$, $a_5$, $a_2$ and $a_4 < 0$

### 4.4 ARDL Approach to Cointegration

The concept on which co-integration is based is that, if two or more variables are linked to form an equilibrium or long run relationship between them, even though the series themselves in the short run deviate from equilibrium, they will move together in the long run. This implies that if two time series variables *pt* and *qt* are both non-stationary at levels but stationary when differenced, i.e. they are of order 1(1), then there could be a linear combination of the two time series variables *pt* and *qt* which is stationary. Co-integration tests therefore involve testing for the existence or otherwise of long-term equilibrium between the series in the model. ARDL approach was put forward by Pesaran and Shin [33] and it enjoys several advantages over the traditional co integration technique documented by (Johansen and Juseline [34]. Firstly, it requires small sample size. Two set of critical values are provided, low and upper value bounds for all classification of explanatory variables into pure I(1), purely I(0) or mutually co integrated. Indeed, these critical values are generated for various sample sizes. However, Narayan [35] argues that existing critical values of large sample sizes cannot be employed for small sample sizes. Secondly, Johensen's procedure require that the variables should be integrated of the same order, whereas ARDL approach does not require variable to be of the same order. The ARDL model is written as follow;

$$\Delta lnER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta lnER_{t-1} + \sum_{i=0}^{n} \beta_{2i}\Delta lnoilp_{1_{t-1}} + \sum_{i=0}^{n} \beta_{3i}\Delta lnm2_{2_{t-1}} + \sum_{i=0}^{n} \beta_{4i}\Delta lntbr_{3_{t-1}} + \sum_{i=0}^{n} \beta_{5i}\Delta lninfl_{4_{t-1}} + \sum_{i=0}^{n} \beta_{6i} extr_{4_{t-1}} + \beta_7 lnER_{t-1}$$

$$+\beta_8 lnoilp_{t-1} + \beta_8 lnm2_{t-1} + \beta_9 lntbr_{t-1} + \beta_{10} lninfl_{t-1} + \beta_{11} lnextr_{t-1} + \varepsilon_t \quad (8)$$

Where Δ is the difference operator while $\varepsilon_t$ is white noise or error term.The bounds test is mainly based on the joint F-statistic whose asymptotic distribution is non-standard under the null hypothesis of no cointegration. The first step in the ARDL bounds approach is to estimate the equations (8) by ordinary least squares (OLS). The estimation of this equation tests for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The null hypothesis of no co-integration and the alternative hypothesis which are presented below as thus:

| null hypothesis of no co-integration | alternative hypothesis | Equation |
|---|---|---|
| $H_0: \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = 0$ | $H_1: \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq \beta_{10} \neq \beta_{11} \neq 0$ | 8 |

*Source: author's design*
*Note: all the variables defined previously*

Two sets of critical values for a given significance level can be determined (Narayan [35]). The first level is calculated on the assumption that all variables included in the ARDL model are integrated of order zero, while the second one is calculated on the assumption that the variables are integrated of order one. The null hypothesis of no cointegration is rejected when the value of the test statistic exceeds the upper critical bounds value, while it is not rejected if the F-statistic is lower than the lower bounds value. Otherwise, the cointegration test is inconclusive.

### 4.5 Error Correction Mechanism (ECM)

Having determined whether or not co-integration exists, we applied the ECM to ascertain the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. If co-integration is accepted, it suggests that the model is best specified in the first difference of its variables with one lag of the residual [ECM(-1)] as additional regressor. The (ECM) incorporates the variables at both side levels and first difference s and thus captures the short-run disequilibrium situations as well as the long-run adjustments between variables [36].

In the spirit of Odhiambo [37], we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. The equation, where the null hypothesis of no co integration is rejected, is estimated with an error-correction term [38]. The vector error correction model is specified as follows:

$$\Delta lnER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta lnER_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta lnoilp_{1_{t-1}} + \sum_{i=0}^{n} \beta_{3i} \Delta lnm2_{2_{t-1}} + \sum_{i=0}^{n} \beta_{4i} \Delta lntbr_{3_{t-1}} + \sum_{i=0}^{n} \beta_{5i} \Delta lninfl_{4_{t-1}} + \sum_{i=0}^{n} \beta_{6i} extr_{4_{t-1}} + \beta_7 lnER_{t-1} + \lambda_2 ECM_{t-1} + \mu_{2t} \quad (9)$$

$ECM_{t-1}$ is the error correction term obtained from the cointegration model. The error coefficients ($\lambda_2$) indicates the rate at which the cointegration model corrects its previous period's disequilibrium or speed of adjustment to restore the long run equilibrium relationship. A negative and significant $ECM_{t-1}$ coefficient implies that any short run movement between the dependant and explanatory variables will converge back to the long run relationship.

## 5. RESULTS AND DISCUSSION

### 5.1 Preliminary Results

#### 5.1.1 Unit root test result

Table 1 clearly shows that the daily equity return as obtained using equation (7) is stationary at first difference, that is, it is 1(1). Same is also true of the rest of the economic variables in equation (6).Both Akaike and Schwarz information criteria for optimal lag selection suggest a lag length of one.

**Table 1. Shows the preliminary analysis statistics**

| Variable | Order of integration |
|---|---|
| ER | 1(1) |
| Oilp | 1(1) |
| Infl | 1(1) |
| M2 | 1(1) |
| Tbr | 1(1) |
| extr | 1(1) |

The results of the impact of oil price shock on stock return using EGARCH (1,1) are presented in Table 2. The above results indicate that there is statistically significant negative relationship between stock return and oil price shock in the Nigerian emerging stock market. This can be seen in the mean equation part of Table 2. On

**Table 2. Result of the test of the effect of oil price (OILP) on stock return (ER) with EGARCH**

Dependent Variable: (ER)
Method: ML - ARCH '(Marquardt) - Normal distribution
Date: 2/20/2017 Time : 10:11
Sample: 1 191
Included observations: 191
Convergence achieved after 48 iterations
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2)+C(3)*ABS(RES1D(-1)/@SQRT(GARCH(-1)))+C(4)*RESID(
1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

| Variable | Coefficient | Std. Error | z-statistic | Prob. |
|---|---|---|---|---|
| OP | -0.473691 | 0.066569 | -7.115808 | 0.0000 |
| Variance Equation | | | | |
| C(2) | -11.70602 | 2.002737 | -5.845010 | 0.0000 |
| C(3) | 0.025510 | 0.123347 | 0.206813 | 0.8362 |
| C(4) | 0.201010 | 0.091015 | 2.208538 | 0.0272 |
| C(5) | -0.636007 | 0.280565 | -2.266882 | 0.0234 |
| R-squared | 0.068581 | Mean dependent var | | 0.003650 |
| Adjusted R-squared | 0.068581 | S.D. dependent var | | 0.030325 |
| S.E. of regression | 0.029266 | Akaike info criterion | | -4.228891 |
| Sum squared resid | 0.162740 | Schwarz criterion | | -4.143753 |
| Log likelihood | 408.8591 | Hannan-Quinn criter. | | -4.194406 |
| Durbin-Watson stat. | 1.608053 | | | |

**Table 3. Establishment of existence of co-integration**

Dependent Variable: **D(SR)**
Method: Least Squares
Date: 2/20/2017 Time: 10:50
Sample (adjusted): 3 191
Included observations: 189 after adjustments

| Variable | Coefficient | Std. Error | t-statistic | Prob. |
|---|---|---|---|---|
| C | 0.728584 | 0.101878 | 7.151545 | 0.0000 |
| D(ER(-1)) | -0.115476 | 0.077808 | -1.484108 | 0.1396 |
| D(OILP(-1)) | 0. 1 32525 | 0.317840 | -0.416956 | 0.6772 |
| D(INFL(-1)) | -0.000187 | 0.000186 | 1.005802 | 0.3159 |
| D(M2(-1)) | -0.000873 | 0.000698 | -1.251708 | 0.2123 |
| D(TBR(-1)) | -0.161281 | 0.094423 | -1.708074 | 0.0894 |
| D(EXTR(-1)) | -0.279862 | 0.301047 | -0.929629 | 0.3538 |
| ER(-1) | -0.722774 | 0.100520 | -7.190339 | 0.0000 |
| OILP(-1) | 0.038698 | 0.334854 | 0.115567 | 0.9081 |
| INFL(-1) | -0.000374 | 0.000263 | -1.422933 | 0.1565 |
| M2(-1) | 0.000769 | 0.000983 | 0.781739 | 0.4354 |
| TBR(-1) | -0.003112 | 0.130721 | -0.023808 | 0.9810 |
| ER(-1) | 0.204588 | 0.426250 | 0.479973 | 0.6318 |
| R-squared | 0.448415 | Mean dependent var | | 0.000187 |
| Adjusted R-squared | 0.410807 | S.D. dependent var | | 0.090108 |
| S.E. of regression | 0.069166 | Akaike info criterion | | -2.438323 |
| Sum squared resid | 0.841963 | Schwarz criterion | | -2.215346 |
| Log likelihood | 243.4215 | Hannan-Quinn criter. | | -2.347989 |
| F-statistic | 11.92336 | Durbin-Watson stat. | | 2.005971 |
| Prob. (F-statistic) | 0.000000 | | | |

**Table 4. Wald's test**

Wald Test:
Equation: Untitled

| Test statistic | Value | Df | Probability |
|---|---|---|---|
| F-statistic | 10.70908 | (6,176) | 0.0000 |
| Chi-square | 64.25447 | 6 | 0.0000 |

*Null Hypothesis: C(8)=C(9)=C(10)=C(11)=C(12)=C(I3)=0*
*Null Hypothesis Summary:*

**Table 5. Normalized restriction**

| Normalized restriction (=0) | Value | Std. err. |
|---|---|---|
| C(8) | -0,722774 | 0.100520 |
| C(9) | 0,038698 | 0.334854 |
| C(10) | -0,000374 | 0.000263 |
| C(11) | 0.000769 | 0.000983 |
| C(12) | -0,003112 | 0.130721 |
| C(13) | 0.204588 | 0.426250 ' |

the variance equation side, it is observed that while the intercept coefficient (C(2)) is statistically significant at 5% level, the arch effect (C(3)) is not. C (4) and C(5) indicate that there is statistically significant GARCH and Leverage effect respectively.

In the conditional variance equation, the estimated $\beta$ coefficient (i.e. C4) is considerably greater than $\alpha_1$ coefficient (i.e. C3) in the specification which implies that the market has a memory longer than one period and that volatility is more sensitive to its lagged values than it is to new surprises in the market values. The

**Table 6. Short-run equilibrium (or Error correction) test result**

Dependent Variable: D(ER)
Method: Least Squares
Date:2/20/2017 Time 10:40
Sample (adjusted): 3 191
Included observations: 189 after adjustments

| Variable | Coefficient | Std. Error | t-statistic | Prob. |
|---|---|---|---|---|
| C | -0.000167 | 0.005140 | -0.032490 | 0.9741 |
| D(ER(-1)) | -0.110072 | 0.079201 | -1.389785 | 0.1663 |
| D(OILP(-1)) | 0.273051 | 0.279409 | 0.977242 | 0.3298 |
| D(INFL(-1)) | -0.000108 | 0.000135 | -0.797007 | 0.4265 |
| D($M_2$(-1)) | -0.000393 | 0.000492 | -0.797890 | 0.4260 |
| D(TBR(-1)) | -0.119766 | 0.068932 | -1.737443 | 0.0840 |
| D(ER(-1)) | -0.275467 | 0.217409 | -1.267045 | 0.2068 |
| ECT(-1) | -0.717779 | 0.102289 | -7.017179 | 0.0000 |
| R-squared | 0.408073 | Mean dependent var | | 0.000187 |
| Adjusted R-squared | 0.385181 | S.D. dependent var | | 0.090108 |
| S.E. of regression | 0.070654 | Akaike info criterion | | -2.420647 |
| Sum squared resid | 0.903542 | Schwarz criterion | | -2.283430 |
| Log likelihood | 236.7511 | Hannan-Quinn criter. | | -2.365057 |
| F-statistic | 17.82589 | Durbin-Watson stat. | | 2.011545 |
| Prob. (F-statistic) | 0.000000 | | | |

implication of this is that volatility is persistent. Furthermore, the sum of the estimated ARCH and GARCH effects (i.e.,$\alpha_1 + \beta$) is high for the specification but still less than one which signifies that the GARCH process is mean reverting. The asymmetry parameter ( $\gamma$ ) turned out to be negative and statistically significant. The implication of this is that there is leverage effect in the Nigerian Stock Exchange.

With respect to the impact of oil price shock and other macroeconomic variables on stock return, the estimated results are presented in Table 3.

In Tables 3 and 4, we present the result of the Wald's test. The high F-value which is greater than the critical value for k = 5 @ 5% (for unrestricted intercept '&no- trend) both for -the lower bound (2.62) and upper bound (3.79) clearly confirms the .existence of long-run relationship among the variables.

The result in Table 6 indicates the existence of short-run equilibrium relationship between stock return and the macroeconomic variables, judging from the statistically significant ECT(-l) at *5%* level. Again, the coefficient of the error correction term is -0.717779 meaning that any disequilibrium on the short-run corrects at a speed of 71.78% on the long-run.Lagged valued of equity return, oil prices, money supply and inflation indicate negative and statistically insignificant on the equity return. This is an indication that the selected macroeconomic variables are not effective in driving equity returns in Nigeria. Surprisingly, treasury bill has the coefficient of -0.119766 which is negative and statistically significant. It implies that1% decrease in the treasury bill cause equity returns to reduce by 0.119766% and vice versa.

## 6. SUMMARY, CONCLUSION AND RECOMMENDATIONS

### 6.1 Summary

The findings resulting from the study are as follow:

1) During the period covered in the study, oil price volatility negatively impacted on stock return.
2) There exists both long-run and short-run equilibrium relationship between stock return and oscillations in oil price in the Nigeria's emerging market.
3) Any disequilibrium on short-run corrects at speed of 71.78% on the long-run

### 6.2 Conclusion

The study examined the impact of oil price shock on stock market return using asymmetric Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. The Autoregressive Distributed Lag

(ARDL) Model was used to explore the impact of key macro-economic variables on stock market return in Nigeria. Data obtained from Central Bank of Nigeria statistical bulletin, the Nigeria Stock Exchange Factbook and annual reports over the period 2000 to 2015 were used. From the various tests and analysis conducted in the study, the following conclusions are reached. Firstly, oil price shock significantly impacted on stock return during the period. Secondly, the macro-economic variables included in the model were significant in explaining the variation in stock return in Nigeria. Thirdly, EGARCH(1,1) model adequately capture the asymmetric effect in stock return in Nigeria economy.

## 6.3 Recommendations

Based on the findings of this study, the following recommendations are necessary:

The Federal Government of Nigeria should carefully monitor developments in the world oil market and seek out ways for economic diversification to minimize the effects of shocks or volatility in crude oil prices on the economy in general and on stock returns in particular.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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