

# Oil Price Shocks and Stock Market Behaviour: The Nigerian Experience

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**ABSTRACT** Stock market plays an important role in the economic development of a country. A number of studies have been investigated on the causal relationship between oil price and stock returns. But in the context of Nigeria, not many studies can be traced in literature. This study therefore, examines the long-run and short-run dynamic effects of oil price on stock returns in Nigeria over 1985:1–2009:4 using the Johansen cointegration tests. A bi-variate model was specified and empirical results show a significant positive stock return to oil price shock in the short-run and a significant negative stock return to oil price shock in the long-run. The Granger causality test shows strong evidence that the causation runs from oil price shock to stock returns; implying that variations in the Nigerian stock prices are explained by oil price volatility.

## 1. INTRODUCTION

One major objective of this paper is to determine whether crude oil price exerts shocks on stock returns in the Nigerian Stock Exchange (NSE). The stock market plays a major role in financial intermediation in both developed and developing countries by channeling idle funds from surplus to deficit units in the economy. As the economy of a nation develops, more resources are needed to meet the rapid expansion. The stock market serves as a channel through which savings are mobilized and efficiently allocated to achieve economic growth (Alile 1984). Large and long term capital resources are pooled through issuing of shares and stocks by industries in dire need of finance for expansion purposes. Thus, the overall development of the economy is a function of how well the stock market performs. Empirical evidences from developed economies as well as the emerging markets have proved that development of the stock market is sacrosanct to economic growth (Asaolu and Ogunmuyiwa 2010).

The macroeconomic view is one of the five schools of thought having bearing on the stock price behaviour. Other approaches are: the fundamentalist approach, the technical approach, the efficient market approach and the random walk approach. The macroeconomic approach is a method of using factor analysis technique to determine the factors affecting asset returns. The arbitrage pricing theory (Ross 1976) has been the primary motives for earlier studies. Among macroeconomic factors included in the

models is the crude oil price especially for oil producing countries. The approach is based on the economic logic which suggests that everything does depend on everything else. The impact of oil prices on stock market differs from country to country depending on whether the country is an oil-exporter or oil-importer. In oil-exporting countries, a rise in world oil prices improves the trade balance, leading to a higher current account surplus and an improving net foreign asset position. At the same time, increase in oil prices tends to increase private disposable income in oil-exporting countries. This increases corporate profitability, raises domestic demand and stock prices thereby causing exchange rate to appreciate (Abdelaziz et al. 2008).

### 1.1 Literature Review

The recent trend in the crude oil market has attracted research interest in the oil prices-stock prices long-run relationships. Several studies have explored the oil price-stock price causal link and among them as reported in Adebisi et al. (2010) are: Hamilton (1983), Burbridge and Harrison (1984), Gisser and Goodwin (1986), Mork (1989), Loungani (1986), Hooker (1996), Hamilton (2000), and Francois and Valerie (2008). Research by Jones and Kaul (1996), Huang et al. (1996), Sadorsky (1999), Papapetrou (2001), Ciner (2001), Yang and Bessler (2004), El-Sharif et al (2005), Anoru and Mustafa (2007), McSweeney and Worthington (2007), and Miller and Ratti (2009). Their investigations on the effects of oil prices on stock

prices in both oil producing and oil importing countries have produced mixed results.

The six members of the Gulf Cooperation Council (GCC), Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates represent very promising emerging markets. The GCC economies are also oil-dependent, and on a daily or a weekly basis their oil prices take their cues from the futures prices for West Texas Intermediate (WTI), a primary crude oil stream traded on the New York Mercantile Exchange (NYMEX). Empirical evidence proved that there is a linkage between oil price volatility and the GCC stock market returns. Thus oil price movement is an important barometer for investors to make necessary investment decisions and for policy makers to adopt appropriate policies in managing stock markets (Adebiyi et al. 2010).

In their own study, Hammoudeh and Aleisa (2004) use Johansen co-integration to examine the relation between oil prices and stock markets in GCC countries, and conclude that the Saudi market is the only market in the group that can be predicted by oil future prices. Yet in another study, Bashar (2005) employs VAR analysis to study the effect of oil price change on GCC stock markets, and shows that only Saudi and Muscat markets have predictive power of oil price increase. Jones and Kaul (1996) studied the response of international stock markets to changes in the oil prices using quarterly data. The study focused on stock returns from the US, Canada, the UK, and Japan, utilized simple regression models, and reported that the stock returns for all countries (except the UK) were negatively impacted by oil prices. Sadorsky (1999) used monthly data to probe the relationship between oil prices and stock returns for the US from January 1947 to April 1996. The author applied variance decomposition. The findings suggested that oil prices and stock returns have a negative relationship in the short term, meaning higher oil prices lead to lower stock returns. Anoruo and Mustafa (2007) examined the relationship between oil and stock returns for the US using daily data, Johansen Bivariate Cointegration, and error-correction approach. The findings indicated long-run relationship between oil and stock returns in the US. The estimated Vector-error-correction Model (VECM) provided evidence of causality from stock market returns to oil market and not

vice versa. Although the Johansen and Juselius estimation technique did not yield evidence of cointegration, the Gregory-Hansen cointegration tests provided evidence of both oil and stock markets being cointegrated. The authors stated that this result implied that both markets are integrated and not segmented. Consequently, the authors believed that diversifying in both markets will not create benefits for the investors holding the portfolio because of the integration of the markets, and that risk minimization through portfolio diversification are unattainable by holding assets in oil and stock markets. Narayan and Narayan (2010) assessed the relationship between oil prices and Vietnam's stock prices with daily series from 2000 to 2008. Using the Johansen test, the findings provided evidence of oil prices, stock prices, and exchange rates for Vietnam sharing a long-run relationship.

## 1.2 Objectives

The broad objective of this paper is to investigate whether oil price shocks significantly affect stock price behaviour in Nigeria. As a corollary, the study also examines whether there are causal links between oil prices and stock prices.

## 2. METHODOLOGY

### 2.1 Data Sample

This paper investigates the dynamic relationship between stock prices and price of crude oil in Nigerian economy. The choice of the variables is familiar with the works of Abdelaziz et al. (2008) and Jones and Kaul (1996). All Share Index (ALS) was used as proxy for stock prices while the United States Costs of OPEC countries crude oil (dollar per barrel) was used as oil price. The time period employed is therefore from 1985:1 to 2009:4; implying the use of quarterly data, representing a total of 100 observations. Data were sourced from the Central Bank of Nigeria Statistical Bulletin and National Bureau of Statistics.

### 2.2 Model Specification

The two variables of stock price ( $ALS_t$ ) and oil price ( $OIL_t$ ) at time  $t$  were determined and

expressed in the natural log values of the data to express them in common denominator. The researcher then pursued the following econometric procedure. First, the researcher confirmed non-stationarity and the order of integration for both  $LALS_t$  and  $LOIL_t$  by employing the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests which use a null hypothesis of stationarity. The tests were performed for 0 to 100 lags that is, 25 years. For all the unit root tests, if non-stationarity is not rejected, the variable is differenced once and the unit root tests are performed again. This is repeated until stationarity is achieved. The number of differences taken before the series become stationary is then the order of integration, that is  $I(d)$ . If the two time series are found to be integrated of the same order, the researcher then proceeded to test for the existence of cointegration vectors among them by performing the Johansen Cointegration test as specified below:

$$\Delta v_t = \phi v_{t-1} + \sum_{j=1}^k \lambda_j \Delta v_{t-j} + \mu_t \quad (1)$$

If we find the existence of one cointegrating relation between the two variables of  $LALS$  and  $LOIL$ , we can then proceed to derive the error correction mechanism (ECM) of forms:

$$\Delta LALS_t = \mu_1 + \sum_{j=1}^{k-1} \Gamma_{11(j)} \Delta LALS_{t-j} + \sum_{j=1}^{k-1} \Gamma_{12(j)} LOIL_{t-j} + \Pi_{11} LALS_{t-k} + \Pi_{12} LOIL_{t-k} \quad (2)$$

$$\Delta LOIL_t = \mu_2 + \sum_{j=1}^{k-1} \Gamma_{21(j)} \Delta LALS_{t-j} + \sum_{j=1}^{k-1} \Gamma_{22(j)} \Delta LOIL_{t-j} + \Pi_{21} LALS_{t-k} + \Pi_{22} LOIL_{t-k} \quad (3)$$

Where the matrix  $\Gamma$  represents the short run dynamics of the relationship between  $LALS$  and  $LOIL$  and matrix  $\Pi$  captures the long run information in the data.

### 2.3 The Granger Causality Test

Thus, the model uses Granger causality test to ascertain the direction of causality between all share index (ALS) and oil prices in Nigeria between 1985 and 2009 which covers the structural adjustment, post adjustment and reform periods. The test procedure as described by Granger (1969) is illustrated as:

$$LALS_t = \sum_{j=1}^k A_j LOIL_{t-j} + \sum_{j=1}^k B_j LALS_{t-j} + U_{1t} \quad (4)$$

$$LOIL_t = \sum_{j=1}^k C_j LOIL_{t-j} + \sum_{j=1}^k D_j LALS_{t-j} + U_{2t} \quad (5)$$

Equations 5 and 6 were expressed and tested in their null forms. That is, whether causation runs from share price to oil price or vice versa.

## 3 RESULTS AND DISCUSSION

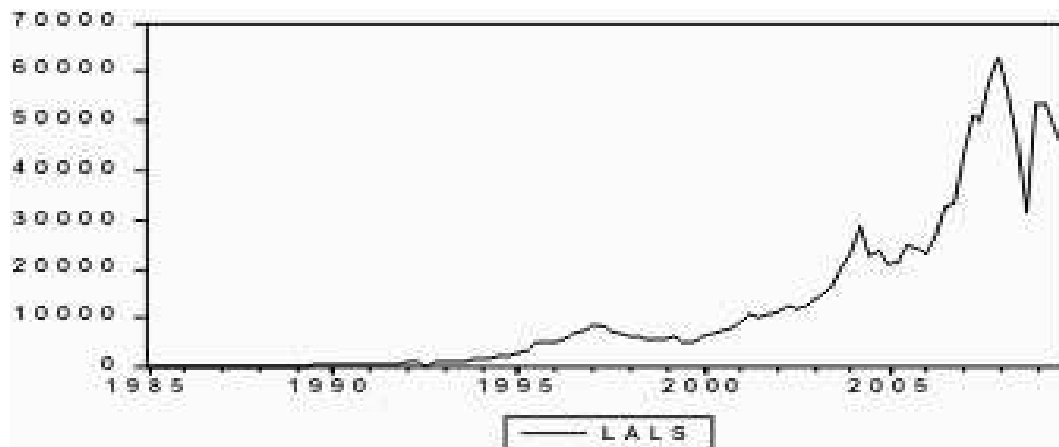
Figures 1 and 2 show the time series plots of the all share index (ALS) and oil price (OIL). A

**Table 1: Unit root test**

|     |                     | Variables in levels |           | Variables in 1 <sup>st</sup> diff |            |
|-----|---------------------|---------------------|-----------|-----------------------------------|------------|
|     |                     | ALS                 | OIL       | ALS                               | OIL        |
| ADF | H0:Unit Root ADF(c) | -0.334411           | -0.995653 | -9.870442*                        | -9.800617* |
| PP  | H0:Unit Root PP (c) | 0.013968            | -1.231354 | -10.15956*                        | -9.686777* |

Notes: All variables in logarithms; Period: 1985 – 2009; Significance levels: \* = 5%

Source: Author's Computation



**Fig. 1. Graph of share price index showing trend in Nigeria**

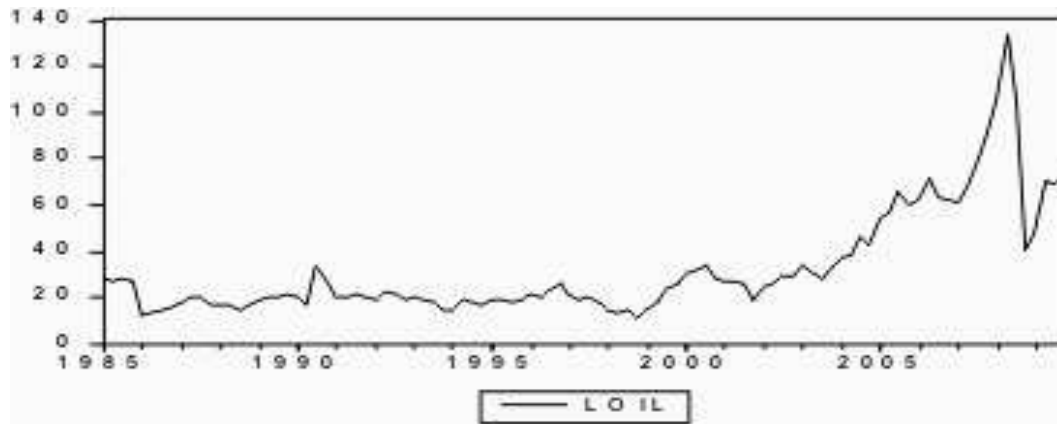


Fig. 2. Graph of trend in oil price per barrel in US dollars

Table 2: Johansen Cointegration Test

| Hypothesized No. of CE(s) | Eigen value | Trace statistic | 5 Percent critical value | 1 Percent critical value |
|---------------------------|-------------|-----------------|--------------------------|--------------------------|
| None *                    | 0.185494    | 19.96136        | 15.41                    | 20.04                    |
| At most 1                 | 0.000614    | 0.059565        | 3.76                     | 6.65                     |

\*(\*) denotes rejection of the hypothesis at the 5%(1%) level  
Trace test indicates 1 cointegrating equation(s) at the 5% level  
Trace test indicates no cointegration at the 1% level  
Source: Author's Computation

Table 3: Maximum Eigen Test

| Hypothesized No. of CE(s) | Eigen-value | Max-Eigen statistic | 5 Percent critical value | 1 Percent critical value |
|---------------------------|-------------|---------------------|--------------------------|--------------------------|
| None **                   | 0.185494    | 19.90179            | 14.07                    | 18.63                    |
| At most 1                 | 0.000614    | 0.059565            | 3.76                     | 6.65                     |

\*(\*) denotes rejection of the hypothesis at the 5%(1%) level  
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels  
Source: Author's Computation

visual inspection of the graphs suggests a lack of existence of time trending properties in both series. Hence, the need to perform the unit roots tests.

In general, the unit root tests for non-stationarity (that is, ADF and PP) as shown in the Table 1 fail to reject the null hypothesis of non-stationarity at both 1% and 5% levels for both ALS and OIL in level terms. However, the null hypothesis is not rejected at 1% and 5% significance levels for both variables in first-differenced terms. The unit root tests therefore show strong evidence that Nigerian all share index (ALS) and crude oil price (OIL) are non-stationary and are integrated of order one that is,  $I(1)$ .

Having confirmed the stationarity of the variables (LALS, LOIL) at the  $I(1)$ , we determine the existence of a long-run equilibrium relationship between the variables in the model. We determine this by using the trace statistics test and the maximum eigen test of the Johansen Cointegration test. From the Table 2, it could be deduced that the trace statistics is greater than the 5 percent critical value at the Non-hypothesized (None\*) which established a long-run

cointegration relationship in the model. Furthermore, the Maximum eigen test also confirms the existence of a long-run cointegration relationship in the model. The table below shows the result of the Maximum eigen test.

Results in the Table 3 further confirm the existence of a long-run equilibrium relationship in the model. Furthermore, it shows an existence of one cointegration equation which pointed out that the long-run relationship between ALS and OIL is negative (see results in the Table 4).  $t^* = -13.562$  which implies that oil price exerts a significant shock on stock prices in Nigeria.

From this, we determine the short-run relationship of the parameters using the Error Correction Model (ECM). The Error correction model shows that the individual coefficients of the explanatory variable (OIL) are in conformity with theory. This is shown in the Table 5.

The Table 5 shows that OIL including its lagged variable are positively related to ALS in deviation from the long-run perspective. The  $R^2$  shows that Oil price accounted for over half of

**Table 5: Error Correction Mechanism (ECM)**

| <i>Variable</i>    | <i>Coefficient</i> | <i>Std. error</i>     | <i>t-Statistic</i> | <i>Prob.</i> |
|--------------------|--------------------|-----------------------|--------------------|--------------|
| D(LALS(-1),2)      | -0.540362          | 0.083069              | -6.505016          | 0.0000       |
| D(LOIL,2)          | 303.6501           | 41.21291              | 7.367838           | 0.0000       |
| D(LOIL(-1),2)      | 10.30910           | 38.02131              | 0.271140           | 0.7869       |
| ECM(-1)            | -0.261719          | 0.068361              | -3.828473          | 0.0002       |
| R-squared          | 0.522450           | Mean dependent var    | -36.10928          |              |
| Adjusted R-squared | 0.507045           | S.D. dependent var    | 5236.561           |              |
| S.E. of regression | 3676.630           | Akaike info criterion | 19.29774           |              |
| Sum squared resid  | 1.26E+09           | Schwarz criterion     | 19.40392           |              |
| Log likelihood     | -931.9405          | Durbin-Watson stat    | 2.481183           |              |

Source: Author's Computation

**Table 4: Normalized cointegrating coefficient**

*Normalized cointegrating coefficients (std. err. in parentheses)*

| <i>LALS</i> | <i>LOIL</i>            |
|-------------|------------------------|
| 1.000000    | -779.8478<br>(57.5003) |

Source: Author's Computation

Stock price explanation with a value of about 52%. Further, the Durbin-Watson statistics shows that there exist no autocorrelation in the model.

Lastly, the Granger causality test shows a unidirectional relationship running from oil price to stock returns, that is, there is a strong evidence that the causation runs from oil price shock to stock returns; implying that variations in the Nigerian stock market is explained by oil price volatility.

#### 4. CONCLUSION

This paper applies the Johansen cointegration technique and error correction mechanism to investigate whether oil price exerts a shock on return on assets in Nigeria stock market. The main results of the paper show that oil price as a factor exerts significant shock on stock prices both in the short run and in the long-run. In the short-run, oil price has a positive significant impact on stock prices in Nigeria. This is consistent with theory as an oil producing country. However, the results also show that the relationship is significantly negative in the long-run. This is also consistent with theory especially for oil importing countries. This assertion gives empirical support for the work of Jones and Kaul (1996) on US, Canada and Japan. Although, Nigeria is an oil exporting country, the import bill on refined products of oil is substantially greater than what is exported in the recent times.

The signs exhibited both in the short run and in the long run are consistent with those obtained in oil exporting countries and oil importing countries respectively.

#### 5. RECOMMENDATIONS

The statistical significance of oil price both in the short-run and the long-run suggests that movement in stock prices in Nigeria is highly sensitive crude oil prices. Hence, investors are guided in their investment decision making. Again, policy makers must also be mindful of the trend in oil prices as regards the formulation of policies having impact on the stock market. The negative long run relationship is a sign for oil importing country. Therefore, another major recommendation based on this finding is that government has to revamp the various refineries in the country so that import bills on petroleum products will be kept at minimum so as to reap the full benefits of oil production in Nigeria.

#### 6. SUGGESTION FOR FURTHER RESEARCH

The study has not been able to address the effect of oil price on stock prices via industrial groupings in Nigeria. There is need to examine the industrial classification of firms most affected by oil price shocks. This is a subject for future work.

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