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Crude Oil Price Volatility and its Impact on Nigerian Stock Market Performance (1985-2014)

Olamide T. Ojikutu[1], Rita U. Onolemhemhen[2]*, Sunday O. Isehunwa[3]

[1]University of Ibadan, Nigeria, [2]University of Lagos, Nigeria, [3]University of Ibadan, Nigeria. *Email: ritaonos@gmail.com

ABSTRACT

The impact of falling oil prices on stock market and exchange rates (EXRs) differs from country to country, either oil-exporting or oil-importing country. Empirically, previous studies have measured the impact of crude oil price (COP) volatility on stock market performance. However, limited studies exist for Nigeria and other oil exporting countries. Thus, this study seeks to fill the gap in existing literature by establishing the nexus between oil price, EXR and stock market performance in Nigeria. Using the ordinary least square estimation technique, the basic variables adopted in this study are all share index (ASI) which serves as a proxy for market performance, COP and EXR. Annual time series data covering the period of 1985-2014 was used to estimate the model using regression analysis. Based on the Trace statistics result, there exists one co-integrating relationship among ASI, COP, and EXR. The $R^2 = 0.505$; showing that 50.5% of the variation in stock market performance can be explained by COPs and EXR. The F-statistic value of 2.17 ($P < 0.05$) shows that ASI, COPs and EXR are jointly significant and the Durbin–Watson value of 2.22 implies that the model does not suffer from autocorrelation. Also, based on the P-values, COPs was found to be insignificant, which means that fluctuations in oil prices do not directly affect the performance of the stock market. In conclusion, COPs and EXR does impact ASI. It is therefore recommended that the Nigerian government should take steps to ensure that Oil companies in Nigeria are listed on the stock market, to have more direct impact on the economy. The novelty of this study is the ability to tell the relationship between COPs and the Nigerian stock exchange. This study will guide government in formulating policies relating to the petroleum industry considering the impact their decisions will have on the economy if the oil companies are listed in the stock market.

Keywords: Oil Price, Exchange Rates, Volatility, Stock Market
JEL Classifications: E3, F31, Q4

1. INTRODUCTION

One area that has received considerable attention, especially, in relation to oil price volatility is the stock market. Stocks are long-term investments whose profitability is based on a company's performance. If the company's profit goes up, investors share in those profits. If the company's profits fall, so does the stock price. The price of a share at any given stage is dictated by demand and supply within the market. This effectively means that shares are priced by the collective will and attitudes of the market, which comprises of all traders and investment houses that actively trade in those securities.

The stock market is an aspect of the financial system which mobilizes and channels long term funds for economic growth. The Nigerian stock exchange acts as the clearinghouse for each transaction, i.e., they collect and deliver the shares, and guarantee payment to the seller of a security. The market serves a broad range of clientele including different levels of government, corporate bodies, and individuals within and abroad. For quite some time now, the capital market has become one of the means through which foreign funds are being injected into most economies. It is, therefore, valid to state that the growth of the capital market has become one of the indicators for measuring overall economic growth of a nation.

The stock market can be split into two main sections: The primary market and the secondary market. The difference between the primary and secondary capital market is that in the primary market, investors buy securities directly from the company issuing them, while in the secondary market, investors trade securities among themselves.

A simple measure of a stock market's size is the total value of all the shares in the market at each point in time or the average of this value over a period. Stock market size can also be measured by the number of listed companies in the stock exchange and the volume of stocks traded in each period. The level of savings mobilization and risk diversification depends strongly on the market size.

The impact of falling oil prices on stock market and exchange rates (EXRs) differs from country to country depending on whether the country is an oil-exporter or oil-importer. Abdelaziz et al. (2008). It is generally argued that for net exporting countries, an increase in price directly increases real national income through higher export earnings. Whereas in net importing countries, higher petroleum prices could lead to inflation, increased input costs, reduced demand, and lower investment. The increasing volatility of crude oil prices (COPs) is a development that poses a great challenge to policy makers across countries (Olomola and Adejumo, 2006). It is therefore important to empirically measure the impact of COP volatility on market performance in Nigeria.

In energy parlance, the term volatility is the pace at which prices rise or fall sharply within a period of time, (Ogiri et al., 2013). Volatility in COPs implies: (i) Huge losses or gains to oil producing and exporting nations, particularly the oil dependent economies and, hence, they are confronted with economic instability; and (ii) huge losses or gains to independent investors in the oil market and thus, they are confronted with greater uncertainty (Salisu and Fasanya, 2012).

Further, the price of crude oil can act as a channel through which the real EXR affects the stock market. Thus, in recent times, the global financial markets have been engulfed in systemic crisis giving rise to loss in asset value/share price particularly of mortgage-related securities, stock market declines, and speculative bubbles among others. This study therefore seeks to estimate the impact of COP volatility on stock market performance in Nigeria by investigating the relationship between oil price shocks and stock market performance in Nigeria.

The nature of COPs changed fundamentally after the 1973 oil embargo by the Organization of Arab Petroleum Exporting Countries. Prior to 1973, the US petroleum prices displayed low volatility across broad time periods and approximated a step function due to the distinct regulatory structure of the petroleum industry from 1948 to 1972 (Hamilton, 1983). Post-1973, COPs began to exhibit nonlinearity and unprecedented levels of volatility, a characteristic that increased sharply during the major supply disruptions over the past four decades, and which continues to typify the oil market today.

With particular focus on Nigeria as an exporter and importer of petroleum, the economy is characterized as an open economy with international transactions constituting an important proportion of her aggregate economic activities. Over the years, the degree of openness of the economy has grown considerably with crude oil exports taking the lead. With such dependency on crude oil revenue, fluctuations in its price make the economy prone to high instabilities. Also, the emergence of shale oil production by the United States and favourable policies for renewables, has led to constant depreciations in COPs.

Empirically, many studies have been able to measure the impact of COP volatility on stock market performance. However, limited studies exist for oil exporting countries. Thus, this study sets out to fill the gaps of already existing literature by establishing the linkages between oil price, EXR and stock market performance in Nigeria.

2. BACKGROUND OF THE STUDY

The pursuit of economic growth and development to improve the living standard of their people has been the main driver behind the development of policies by many nations of the world. Although, there are various sources of economic growth, but energy remains an integral part particularly for developing countries like Nigeria.

The origin of the Nigerian capital market dates back to colonial times when the British Government ruling Nigeria at that time sought funds for running the local administration. Most of these funds were derived from agriculture and solid mineral mining.

2.1. Brief History of the Nigerian Stock Exchange

The origin of the Nigerian Capital Market dates back to colonial times when the British Government ruling Nigeria at that time sought funds for running the local administration. Most of these funds were derived from agriculture and solid mineral mining. Discovering that these sources were inadequate to meet its growing financial obligations, the colonial administration found it necessary to establish a financial system.

In 1957, the government and other securities (local trustees powers) acts were enacted. This law specified the types of securities in which trust funds may be invested. It also clearly defines the powers and responsibilities of trustees. In September 1960, The Nigerian Stock Exchange was established as the Lagos stock exchange. The exchange maintains an All-Share Index which was formulated in January 1984. Currently, only common stocks (ordinary shares) are included in the computation of the index. Following the deregulation of the capital market in 1993, the Federal Government in 1995 internationalised the capital market, with the abrogation of laws that constrained foreign participation in the Nigerian capital market. Consequent upon the abrogation of the exchange control act 1962 and the Nigerian Enterprise Promotion Decree 1989, foreigners can now participate in the Nigerian capital market both as operators and investors. Also, there are no limits any more to the percentage of foreign holding in any company registered in the country.

The percentage share of Nigeria in Africa's total oil production as well as the share of Africa in total world oil production is shown Figure 1.

The trend in the Figure 1 shows that Nigeria had the highest percentage share of about 34.8% in the total oil production for Africa within the period of 1971-1976. This magnitude reduced to 32.2% within the fiscal period of 1977-1982. The trend fluctuated further to about 27% within 1983-1988.

2.2. Trends in the Nigerian Oil Sector in Relation with Economic Performance

There exist a strong correlation between the Petroleum industry and the economy. This is based on the fact that the Petroleum industry is a major source of revenue generation for the government as well as a contributor to gross domestic product (GDP). The government derives value from crude oil exploration in the form of taxes, royalties, bonuses and a share of production. The Petroleum sector's contribution to GDP increased from about 18% within the period of 1971-1975 to about 23% in 1976-1980. Also, in the period preceding the pre-deregulation era (1981-1985), its average contribution to total GDP was put at 35%. Since then, the oil sectors contribution to GDP has been declining (Table 1).

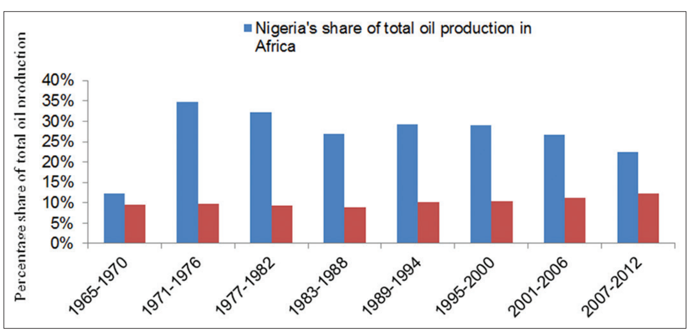
Table 1 show that there exist high levels of volatility related to changes in COP for the sampled period. It can also be deduced that in spite of the wealth generated from Nigeria's minerals resources, economic growth has not appreciated compared with other member countries of Organization of Petroleum Exporting Countries.

3. LITERATURE REVIEW

Several research papers have used different methodologies to determine the impact of COP fluctuations on market performance. Most of these methods are based on the development of econometric models capturing the essential economic variables.

Mukherjee and Naka (1995) made use of vector error correction approach to model the relationship between Japanese stock return and macroeconomic variables. Cointegration relation was detected among stock prices and the six macroeconomic variables, namely EXR, inflation rate, money supply, money supply, real economic activity, long-term government bond rate and call money rate.

Figure 1: Nigeria's share of total oil production in Africa and Africa's share in the World



Source: Statistical Review of World Energy, 2012

Examining the Algerian economy from 1970 to 2003, Koranchelian (2005) adopted a vector equilibrium correction model approach and concluded that movements in the real EXR were time varying and were accounted for by fluctuations in productivity and real oil prices with deviations from real EXR adjusting itself within 9 months. In specific terms, he found that a 1% rise in oil price led to an appreciation of the real EXR by 0.2% which can affect stock returns.

In a work conducted by Bjørnland (2008) for Norway, in which stock returns were incorporated in a structural VAR model, it was observed that a 10% rise in oil prices, increased stock returns by 2.5% with robust results for linear and non-linear measures of oil prices. The author concluded that the Norwegian economy responds to higher oil prices by increasing aggregate wealth and demand, while emphasizing the role of monetary policy shocks, in particular, as driving forces behind stock price variability in the short run.

Aleisa and Dibooğlu (2002) decomposed the shocks (real and nominal) affecting real EXR fluctuations in oil resource based in Saudi Arabia by employing the VAR technique. Their findings showed that real shocks had a stronger influence in explaining real EXR movements in Saudi Arabia, while nominal shocks were more important at explaining price level movement. Huang et al. (1996) examined the link between daily oil future returns and daily US returns using an unrestricted vector autoregressive (VAR) approach. The study showed that oil returns do lead some individual oil company stock returns, but oil future returns do not have much impact on general market indices.

Also based on the VAR approach, Pappetrou (2001) examined the interaction amongst oil prices, real stock prices, interest rates, real economic activity and employment in Greece. The results showed that oil price changes affect real economic activity and employment. Moreover, oil prices explained a significant movement in stock price. Cheung and Ng (1998) employed the Johanson co-integration technique and established the existence of long run co-movement between five national stock market indexes and real oil price, real consumption, real money and real output. They found that oil prices were negatively correlated with stock prices.

Table 1: Trends of selected economic indicators in Nigeria (1971-2010)

Years	GDP per capita growth (annual %)	% of oil in total GDP	% of oil revenue in total revenue	% of non-oil revenue in total revenue	Growth rate of oil rev	Growth rate of govt rev	Growth rate of govt exp
1971-75	3.2	17.8	63.5	36.5	114.0	62.9	51.5
1976-80	0.9	22.9	75.8	24.2	29.6	24.2	26.0
1981-85	−5.3	34.5	69.6	30.4	−0.1	1.2	−0.8
1986-90	2.6	34.3	71.4	28.6	58.8	54.2	36.2
1991-95	−0.1	33.9	80.4	19.6	42.7	45.1	38.9
1996-00	0.6	32.9	75.9	24.1	49.8	42.0	29.0
2001-05	3.7	26.7	79.9	23.5	30.3	27.4	21.9
2006-10	4.2	18.2	77.9	21.9	11.9	10.7	18.6

Source: World Development Indicator, 2010 And CBN Statistical Bulletin, 2013. CBN: Central Bank Of Nigeria, GDP: Gross domestic product

Hammoudeh and Aleisa (2004) also used the Johansen co-integration technique to examine the relationship between oil prices and stock markets in gulf cooperation council (GCC) countries, and conclude that the Saudi market is the only market in the group that can be predicted by future oil prices. Yet in another study, Bashar (2005) employed a VAR analysis to study the effect of oil price change on GCC stock markets. The result showed that only Saudi and Muscat markets have predictive power of oil price increase.

Using a multi-factor approach, Syed and Sadorsky (2006), studied the impact of oil price changes on emerging stock market. They argued that oil price volatility impacts stock price returns. Narayan and Narayan (2012) used the generalized autoregressive conditional heteroskedasticity (GARCH) method to model daily data of COPs and concluded that shocks influence constantly and asymmetrically the volatility over the long-term period. Asymmetric effect indicates that positive shocks affect oil price differently than negative shocks.

Similar to the method adopted by Narayan, Arouri and Nguyen (2010) measured the effect of oil prices on European sector returns. Based on their findings, they concluded that oil prices tend to exercise a significant influence on various European sectors; however, the magnitude and the direction of the effect differ from one sector to another.

By conducting a Granger causality test within the context of a VAR model, Ciner (2001) concluded that a statistically significant relationship existed between real stock returns and oil price futures, but that the connection was non-linear. Abdalla (2013) employed a bivaraite VAR-GARCH model recently developed by Ling and McAleer (2003) to examine the impact of oil price fluctuations on stock market returns (MRs) in Saudi Arabia over the period of 7 years. The model was estimated using maximum likelihood method under the assumption of multivariate normal distributed error terms. The log likelihood function was maximized using Marquardt's numerical iterative algorithm to search for optimal parameters.

Taiwo et al. (2012) on their part applied co-integration, unit root test and error correction model (ECM) to examine the relationship between COP, stock price and macroeconomic growth and established that growth rate of GDP is significantly affected by growth rate in oil prices, growth rate of stock prices and EXR.

4. METHODOLOGY

4.1. Theoretical Framework

The literature review presented above examined the various theoretical concepts as part of developing a clear understanding of the oil price volatility stock market performance. The theoretical framework of this study is based on the technical school of thought which claims that stock price behaviour can be predicted by the use of financial or economic data. By employing economic methods, tools and techniques, technical analysts engage themselves in studying changes in market prices, the volume of trading and investors' attitude by using past market data.

This study therefore extends the findings of Sadorsky (1999), Papapetrou (2001), Maghyereh (2004), Bjømland (2008), Park and Ratti (2008), Henriques and Sadorsky (2008), Lescaroux and Mignon (2008), and Cong et al. (2008) by adopting the empirical model used by Asaolu and Ilo (2012). Asaolu and Ilo (2012) made use of four variables which were the annual stock MR, Dollar price of oil, EXR and GDP. This present study adopts 3 variables which are the all share index (ASI), EXR and COP; where COP serves as the main variable and EXR as the control variable.

4.2. Data Source

Annual time series data covering the period of 1985-2014 was used to estimate the model. The basic variables used in this study are ASI which serves as a proxy for market performance, COP and EXR. The data were gathered from the annual Central Bank of Nigeria statistical Bulletin and BP statistical review of world energy June 2015. Appendix A contains the data collection.

4.3. Data Analysis Technique

The major method of analysis employed in this project is the regression analysis. However, since time series variables are used it is essential to examine their properties in order not to end up with a spurious regression, which is modeling the relationship among non-stationary series. Therefore, all variables are examined through their time plots, unit root tests and co-integration analysis. Each of these methods is discussed below.

4.3.1. Unit root tests

Unit Root tests are usually performed on variables to determine if they are stationary (i.e., zero mean and constant variance) or otherwise, to determine their order of integration (i.e. number of times they are to be differenced to achieve stationarity). The time series characteristics of the variables using the augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) tests were examined. Basically, the idea is to ascertain the order of integration of the variables as to whether they are stationary I (0) or non-stationary; and, therefore, the number of times each variable has to be differenced to arrive at stationarity. The standard DF test is carried out by estimating the following;

$$y_t = \rho y_{t-1} + x_t^{'}\delta + \varepsilon_t \tag{1}$$

After subtracting y_{t-1} from both sides of the equation:

$$\Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \varepsilon_t \tag{2}$$

Where $\alpha = \rho - 1$ (3)

The null and alternative hypotheses may be written as:

H_0: $\alpha = 0$ (4)

H_1: $\alpha < 0$ (5)

The simple Dickey–Fuller unit root test described above is valid only if the series is an AR (1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t is violated. The ADF test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR (P) process and adding P lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ...\beta_p \Delta y_{t-p} v_t \quad (6)$$

The usual practice is to include a number of lags sufficient to remove serial correlation in the residuals and for this; the Akaike Information Criterion is employed. Therefore, the ADF test given in equation (3) above is first used and then the P-P test described below.

P-P propose a non-parametric alternative method of controlling for serial correlation when testing for a unit root. The P-P method estimates the non-augmented DF test equation (2), and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The P-P test is based on the statistic:

$$t_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0}\right)^{\frac{1}{2}} - \frac{T(f_0 - \gamma_0)\left(se\left(\hat{\alpha}\right)\right)}{2f_0^{\frac{1}{2}}s} \quad (7)$$

Where $(\hat{\alpha})$ is the estimate, and t_α the t-ratio of α, se $(\hat{\alpha})$ is the coefficient standard error, and s is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance in equation (2) (calculated as (T-K) s2 where k is the number of regressors). The remaining term, f_0, is an estimator of the residual spectrum at f_0. Therefore, both equation (3) and (4) are used to test for the stationarity of the variables.

4.3.2. Co-integration analysis

Co-integration is the idea that the linear combinations of non-stationary series can be stationary, implying a long-run relationship, thus they can be modeled. In testing for Co-integration, the Johansen Efficient Maximum Likelihood test was used to examine the existence of a long-term relationship among the variables.

Consider a VAR or order P.

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + \beta x_t + \varepsilon_t \quad (8)$$

Where y_t is a k-vector of non-stationary I (1) variables, x_t is a *d*-vector of deterministic variables, and ε_t is a vector of innovations. We can rewrite this VAR as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta y_{t-1} + \beta x_t 9 + \varepsilon_t \quad (9)$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i - I, \quad \Gamma = -\sum_{j=i+1}^{p} A_i \quad (10)$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank, r < k, then there exist k × r matrices α and β each with rank r such that $\Pi = \alpha\beta$ 1 and β 1yt is I (0), r is the number of co-integrating relations (the rank) and each column of β is the co-integrating vector. As explained below, the elements of α are known as the adjustment parameters in the ECM. Johansen's method is to estimate the matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

4.3.3. ECM

This is the final specification that includes a short run dynamic process, consistent with data and converging to the long run equilibrium. The ECM attempts to integrate economic theory useful in characterizing long run equilibrium with observed disequilibrium by building a model that explicitly incorporates behaviour that would restore equilibrium. ECM has the co-integrated relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. The ECM is the one-period lagged value of the residual from a static model.

In this project therefore, having established the co-integration relationships among variables, an over-parameterized ECM was estimated which initially consisted of 3 lag length of each variable. The over-parameterized ECM estimated is given in the equation below;

$$\Delta ASI_t = b_0 + \sum_{t=1}^{n} b_{1t}\Delta ASI_{t-1} + \sum_{t=1}^{n} b_{2t}\Delta COP_{t-1} + \sum_{t=1}^{n} b_{3t}\Delta EXR_{t-1} + \lambda U_{t-1} + \varepsilon_{t-1} \quad (11)$$

Where Δ stands for the first difference operator, U_{t-1} is the lagged value of the long-run random disturbance term and the parameter is the error correction coefficient.

4.4. Model Specification

The econometric model of the study uses ASI as the dependent variable, while the independent variables are COP s and EXR.

$$ASI_t = b_0 + b_1 COP_t + b_2 EXR_{t-1} + \varepsilon_t \quad (12)$$

Where:
b_0: Is the intercept,
b_1: Is the coefficient of COPs,
b_2: Is the coefficient of EXR,
ε_t: Represents the error term.

In this study, the E-views version 7.0 was adopted. The ordinary least square estimation technique was used in the single equation models.

Following the general to specific modeling methodology, the over-parameterized model was continually simplified and re-parameterized by removing variables with low explanation until a parsimonious and encompassing representation of the data generation process was obtained with the choice of optimum lag length guided by the Akaike and Schwarz Information Criteria.

5. RESULT AND DISCUSSION

5.1. Descriptive Analysis of Variables

Table 2 shows the descriptive statistics of the variables used in the analysis. According to the Table, the mean value of ASI in the period was 64.495 with the standard deviation of 57.917 and its value ranges from 0.890 to 150.30. Also, the value of COP ranges from 4.850 to 10.970 with an average of 8.243 and standard deviation of 1.897 respectively. More-so, the logarithm value of EXR has the minimum value of 2.54 with a maximum value of 4.62 with the mean of 3.310 and standard deviation of 0.601 respectively.

Normality is a condition in which the variables to be used in the model must follow. To ensure normality the series are logged prior to estimation. Thereafter, Jarque-Bera statistics is used to test the normality of the variable under the following hypotheses;

H_0: The series is normally distributed,
H_1: The series is not normally distributed.

It is observed from Table 6, with reference to the Jarque-Bera estimates and probability value that the variables (ASI, COPs and EXR) examined in this study are normally distributed due to its P = 0.1647, 0.324 and 0.163 for ASI, COP and EXR respectively which are P > 0.05.

Table 2: Descriptive statistics and normality test table

Descriptive statistics	LASI	LCOP	LEXR
Mean	64.49538	8.243462	3.310769
Median	22.03500	8.705000	3.110000
Maximum	150.3000	10.97000	4.620000
Minimum	0.890000	4.850000	2.540000
SD	57.91672	1.897097	0.600586
Skewness	0.228499	−0.455957	0.873872
Kurtosis	1.233266	1.882439	2.459951
Jarque-Bera	3.607712	2.253908	3.625116
Probability	0.164663	0.324019	0.163236
Observations	26	26	26

Source: E-views output (2015). SD: Standard deviation

5.2. Interpretation of Results

This section presents the results of the unit root (stationarity) tests, co-integration tests and ECMs.

5.2.1. Stationarity test

The time series behaviour of each of the series is presented in Tables 3 and 4 using the ADF and P-P tests at both level and first difference of the series. The outputs are presented in the Appendix B, but these have been extracted into the tables 3 and 4below. The ADF test results presented in Table 3 shows that ASI, COPs and EXR are non-stationary at level which are integrated at order one. Similarly, the P-P test depicts that ASI, COPs, and EXR are homogenous of order one. Therefore, they are made stationary by first difference prior to subsequent estimations to forestall spurious regressions.

5.2.2. Co-integration test

The results of the co-integration tests are extracted into Table 5. The output is contained in Appendix C. The Table shows the converge of ASI, COPs and EXR in the long run thereby depicting the existence of a long run relationship amongst them. The long run relationship exists at 5% level of significance according to the Trace test statistics and the Eigen value. There exists one co-integrating relationship based on the Trace statistics result and one co-integrating vectors amongst ASI, COP, and EXR based on the eigen value.

5.3. ECM

The ECM involves three steps. The first is to estimate a long-run model; the second is to include the error term from the long model in a dynamic over-parameterized model and the third is to work on this model until one obtains the parsimonious model

Table 3: ADF test

Variables	Level		First difference		Order of cointegration	Interpretation
	Intercept	Trend	Intercept	Trend		
LASI	−1.9441	−1.2145	−3.9162	−4.1456	I (1)	Non-stationary
	(0.3085)	(0.8885)	(0.0058)	(0.0149)		
LCOP	−0.3567	−3.0486	−4.5294	−4.6780	I (1)	Non-stationary
	(0.9041)	(0.1371)	(0.0013)	(0.0046)		
EXR	−0.4047	−2.1110	−5.1378	−5.0393	I (1)	Non-stationary
	(0.8957)	(0.5185)	(0.0003)	(0.0019)		

Source: Authors' Computation (2015). ADF: Augmented Dickey–Fuller

Table 4: P-P test

Variables	Level		First difference		Order of cointegration	Interpretation
	Intercept	Trend	Intercept	Trend		
LASI	−1.9279	−1.3408	−3.9477	−4.3240	I (1)	Non-stationary
	(0.3155)	(0.8568)	(0.0054)	(0.0200)		
LCOP	−0.2665	−3.0506	−7.0726	−7.1687	I (1)	Non-stationary
	(0.9184)	(0.1366)	(0.0000)	(0.0000)		
EXR	−0.4047	−2.1786	−5.1376	−5.0391	I (1)	Non-stationary
	(0.8957)	(0.4832)	(0.0003)	(0.0019)		

Source: Authors' computation (2015). P-P: Phillip-Perron

Table 5: Co-integration testing

Number of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	P**	Number of CE(s)	Eigenvalue	Max eigen	0.05 critical value	P**
None*	0.749939	51.51210	29.79707	0.0000	None*	0.749939	36.03734	21.13162	0.0002
At most 1	0.363435	15.47476	15.49471	0.0504	At most 1	0.363435	11.74338	14.26460	0.1207
At most 2	0.133692	3.731387	3.841466	0.0534	At most 2	0.133692	3.731387	3.841466	0.0534

Source: Authors' computation (2015). Trace and max-eigenvalue test indicates 1cointegrating equation at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon–Haug-Michelis (1999) P-values

Table 6: ECM result

Variables	Coefficient	SE	t-statistic	P
D(LNCOP)	−0.242161	0.292386	−0.82822	0.419
D(LNASI(−1))	0.420718	0.190413	2.209504	0.0411
D(LNASI(−2))	−0.25317	0.244435	−1.03574	0.3148
D(LNCOP (−2))	−0.40096	0.279659	−1.43375	0.1698
D(LNASI (−3))	0.51326	0.207805	2.469908	0.0244
D(LNCOP(−3))	−0.212977	0.20124	−1.05833	0.3047
D(EXR(−3))	0.005761	0.004676	1.232073	0.2347
ECM(−1)	−0.205627	0.08051	−2.55404	0.0205
Intercept	0.129743	0.08736	1.485152	0.1558
R^2	0.5053			
F-statistics	2.1705			
Durbin–Watson	2.2222			

Source: Authors' computation (2015). ECM: Error correction model

which is then interpreted. The results of the long run models and over-parameterized models are contained in the Appendix. What are normally interpreted are the parsimonious results which are given below.

Therefore, based on the result from Tables 5, an over-parameterized model was estimated. ASI, COPs and EXR were set at 3 lag. The parsimonious interaction involves dropping insignificant variables. Therefore, the size of the model was reduced by imposing zero coefficients on those lags where 't' statistic is low.

The parsimonious result is shown in Table 6. According to the result, $R^2 = 0.505$ shows that COPs and EXR can explain about 50.5% of stock market performance. F-statistic of 2.17 ($P < 0.05$) shows that they are jointly significant and the Durbin–Watson value of 2.22 implies that the model does not suffer from autocorrelation.

In terms of the significance of the individual variables, it is observed that immediate past of ASI [D(LNASI(-1))] and the value before the immediate [D(LNASI(-2))] were significant. Also, the ECM has the correct sign of negative meaning that about 20.6% of the errors are corrected yearly and was found to be significant.

6. CONCUSION AND RECOMMENDATION

This study examines the impact of COP volatility on stock market performance in Nigeria. The analyses were based on the yearly data of ASI, COPs and EXR. The data was subjected to time series econometric analyses which include the test for Stationarity and Cointegration. The test for Cointegration was used to depict the existence of a long run relationship amongst the variables. Based on the result of the Trace test statistics and the Eigen value, there exists a long-run relationship amongst ASI, COPs and EXR at 5% level of significance.

A test for normality was also conducted with the use of Jarque-Bera statistics. With reference to the Jarque-Bera estimates and probability value, the study found that all the variables examined were normally distributed since their $P < 0.05$.

A unit root test was conducted using the ADF and P-P tests both at level and first difference of the series. The ADF result depicts non-stationarity of variables at level. Similarly, the P-P test result shows that all the variables are homogenous of order one. The value of the R^2 at 0.505 shows that the variables were able to explain about 50.5% of changes in ASI. F-statistic of 2.17 ($P < 0.05$) depicts that the variables are jointly significant and the Durbin–Watson value of 2.22 implies that the model does not suffer from autocorrelation problem.

The ECM was also used to adjust for serial correlation. In terms of the significance of the individual variables, it is observed that immediate past of ASI [D(LNASI(-1))] and the value before the immediate [D(LNASI(-2))] were significant. Also, the negative sign of the ECM means that about 20.6% of the errors were corrected yearly and were found to be significant.

Based on the findings of this study, this study therefore recommends that the Nigerian stock market regulatory agencies should take steps that will allow and encourage Oil and Gas companies to be listed on the market, so that they can have more direct impact on the economy.

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APPENDICES

Appendix A: Data presentation

Years	All share index	Exchange rate	Crude oil price $/bbl
1985	127.3	0.893774	27.75
1986	163.8	1.754523	14.46
1987	190.9	4.016037	18.39
1988	233.6	4.536967	15.00
1989	325.3	7.364735	18.30
1990	513.8	8.038285	23.85
1991	783.0	9.909492	20.11
1992	1107.6	17.29843	19.61
1993	1543.8	22.0654	17.41
1994	2205.0	21.996	16.25
1995	5092.2	21.89526	17.26
1996	6992.1	21.88443	21.16
1997	6440.5	21.88605	19.33
1998	5672.7	21.886	12.62
1999	5266.4	92.3381	18.00
2000	8111.0	101.6973	28.42
2001	10,963.1	111.2313	24.23
2002	12,137.7	120.5782	25.04
2003	20,128.9	129.2224	28.66
2004	23,844.5	132.888	38.13
2005	24,085.8	131.2743	55.69
Years	All share index	Exchange rate	Crude oil price $/bbl
2006	33,189.3	128.6517	67.07
2007	57,990.2	125.8081	74.48
2008	31,450.8	118.546	101.43
2009	20,827.2	148.9017	63.35
2010	24,770.5	150.298	81.05
2011	20,730.6	154.7403	113.65
2012	28,078.8	156.8097	114.21
2013	41,329.2	160.461	111.95
2014	50,644.8	163.7168	101.35

Source: CBN: Central Bank of Nigeria, Bulletin (2013)

Appendix B: Augmented Dickey–Fuller test

All share index by intercept

Null hypothesis: LNASI has a unit root			
Exogenous: Constant			
Lag length: 0 (automatic - based on SIC, maxlag=7)			
		t-statistic	P*
Augmented Dickey–Fuller test statistic		−1.944138	0.3085
Test critical values	1% level	−3.679322	
	5% level	−2.967767	
	10% level	−2.622989	

*MacKinnon (1996) one-sided P-values

Null Hypothesis: LNASI has a unit root

Exogenous: Constant, Linear Trend			
Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
		t-statistic	P*
Augmented Dickey–Fuller test statistic		−1.214538	0.8885
Test critical values	1% level	−4.309824	
	5% level	−3.574244	
	10% level	−3.221728	

*MacKinnon (1996) one-sided P-values

Null hypothesis: D(LNASI) has a unit root

Exogenous: Constant			
Lag length: 0 (automatic - based on SIC, maxlag=7)			
		t-statistic	P*
Augmented Dickey–Fuller test statistic		−3.916246	0.0058
Test critical values	1% level	−3.689194	
	5% level	−2.971853	
	10% level	−2.625121	

*MacKinnon (1996) one-sided P-values

Null hypothesis: D(LNASI) has a unit root

Exogenous: Constant, linear trend			
Lag length: 0 (Automatic - based on SIC, maxlag=7)			
		t-statistic	P*
Augmented Dickey–Fuller test statistic		−4.145566	0.0149
Test critical values	1% level	−4.323979	
	5% level	−3.580623	
	10% level	−3.225334	

*MacKinnon (1996) one-sided P-values

Appendix C: Error correction model

Dependent variable: D(LNASI)

Method: Least squares				
Sample (adjusted): 1989 2014				
Included observations: 26 after adjustments				
Variable	**Coefficient**	**Standard error**	**t-statistic**	**P**
D(LNCOP)	−0.242161	0.292386	−0.828223	0.4190
D(LNASI(−1))	0.420718	0.190413	2.209504	0.0411
D(LNASI(−2))	−0.253170	0.244435	−1.035736	0.3148
D(LNCOP(−2))	−0.400960	0.279659	−1.433749	0.1698
D(LNASI(−3))	0.513260	0.207805	2.469908	0.0244
D(LNCOP(−3))	−0.212977	0.201240	−1.058327	0.3047
D(EXR(−3))	0.005761	0.004676	1.232073	0.2347
ECM(−1)	−0.205627	0.080510	−2.554041	0.0205
C	0.129743	0.087360	1.485152	0.1558
R^2	0.505292	Mean dependent variable		0.206884
Adjusted R^2	0.272488	S.D. dependent variable		0.312773
Standard error of regression	0.266778	Akaike info criterion		0.462621
Sum squared resid	1.209894	Schwarz criterion		0.898116
Log likelihood	2.985927	Hannan–Quinn criterion		0.588028
F-statistic	2.170464	Durbin–Watson statistics		2.222215
Prob (F-statistic)	0.085374			