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Exploring the Nexus between Crude Oil Price and Stock Prices in Sub-Saharan Africa: A Case Study of Nigeria

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ABSTRACT

Objective: The objective of this article is to investigate the connection between unrefined oil price and stock prices in Sub-Saharan Africa with particular accentuation on the Nigerian economy.

Research Design & Methods: Based on the time series data used, we applied co-integration test and a restricted Vector Autoregressive Approach to verify the existence of each short and long-term relationship among the variables of interest.

Findings: The results revealed that there is very little correlation between crude oil price and stock indices, thereby implying that such an impact cannot be completely expected in the short run. Moreover, the study showed causality relation running from crude oil price and real rate of exchange to stock indices.

Implications & Recommendations: Since the study disclosed that petroleum price and rate of exchange values have far more impact on stock market indices in the long run than in the short run in Nigeria with rate of exchange contributing more to the general changes in available market indices throughout the study period, thereby suggesting that stock exchange indices are insensitive to crude oil price variations in the short run and thus resulting in loss of confidence by the investors. Consequently, the study recommends that the sitting government ought to utilise the revenue generated on the sales of petroleum to diversify the economy.

Contribution & Value Added: In this study, we tried to point out the responses of crude price shocks to stock prices, particularly throughout the previous and current administration in Nigeria. The study was able to discover that changes in unrefined oil do not impact the stock indices.

Article type: research paper

Keywords: crude oil price; VECM; stock market; causality; Sub-Saharan; Nigeria

JEL codes: G10, B41, O55, Q43

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INTRODUCTION

Undoubtedly, many studies have been carried out to examine the nexus between shock in macroeconomic fundamentals and crude oil price changes across the globe. This is owing to the fact that crude oil tends to be the largest commodity market in the world and that changes in its price could be projected to exert an inverse effect on economies of the world with implication on international stability and changes in the behaviour of investors and stock prices, to mention a few. Particularly in Nigeria crude oil has over the years been regarded as the key determinant of economic growth, this is because it has been the top-most product that has preoccupied the country's export in the past forty years as revealed by (National Bureau of Statistics, 2006).

As a matter of fact, these studies have one way or the other proven that shocks accrued to oil price has the potential to impact inflation, interest rate, unemployment, gross domestic product (GDP), exchange rate, to mention a few, depending on whether the country in question imports or exports the commodity as put by (Evangelia, 2001; Sadorsky, 2001). Some other studies focused on the impact of a particular individual macroeconomic factor and oil price changes. For instance, a study by Vipin and Matthew (2012) has revealed that oil price upset responds speedily to short and long term U.S. and international real interest rate.

Similar but more recently, a study by Beckmann, Czudaj and Arora (2017) established a direct link between exchange rates and oil prices in the long run and that they are strong predictors of each other in the short run although with strong time varying effect. This assertion was also backed by the study by Osuji (2015). It is equally worthwhile to note that in an oil importing country there is the tendency that shocks in oil price can results in inflation, thereby pressurising the policy makers to raise interest rates, which in turn makes the stock market be less attention-grabbing with implication for its returns.

Markedly, an increase in oil price has the demerit of decreasing the money flows of corporations in addition to the chance of a high rate that depresses the value of stocks traded. This successively shows oil boom as a more major risk issue to the securities market of any economy than the innumerable edges which will be derived from it in the long or short run, particularly in the emerging and developing economies as opined by Fatima and Bashir (2014).

Particularly in oil importing countries like the UK, the USA, Japan, and Germany, to mention a few, lots of research has been carried out on stock returns – crude oil prices nexus. Consequent upon the above, and the fact that not too many studies (Akinlo, 2014; Afeez & Kazeem, 2017) have been done on the interaction between changes in oil price and stock market price, there is therefore a need to undertake this study also in the oil exporting economies, with particular emphasis to developing countries: a case study of Nigeria especially because it is described as one of the largest oil exporting countries in Africa. In essence, the objective of this study is to investigate whether changes in crude oil price are capable of influencing the stock market indices in an African country using Nigeria as a case study. To achieve the aforementioned aim, the study intends to employ a restricted Vector autoregressive approach.

LITERATURE REVIEW

Despite the different studies that explored the oil price-macroeconomic variables in emerging and developed economies, only few have been done on the relationship between stock market and oil prices in underdeveloped countries like Nigeria, while most of investigations are in developed ones. Therefore, in order to contribute to the body of literature, this current study seeks to explore the relationship between crude oil price and stock prices in Nigeria. Notably, the foremost study in this regard is the one carried out by Chen, Roll and Ross (1986) who explored the effect of macroeconomic variables on stock returns. Their study pinpointed that macroeconomic factors, including interest rate, bond yields spread and inflation rate, stimulate stock prices strongly.

Disappointingly, despite their salient result, they were unable to pinpoint the effect of oil price on stock return. In consonance to the aforementioned, the study by Hamilton (1983) found that oil prices shock exerts some remarkable impact on the US economy. In addition, the study identified that there is an inverse relationship between oil price shock on financial markets and the economy to a great extent, especially during periods of recession.

Similarly, the study by Sadorsky (1999) explored the volatility of oil prices and its effect on stock returns utilising a VAR model in monthly series between the period of 1947 to 1996 in the U.S. Evidently, the results showed that oil price shock exerted a significant and negative effect on the U.S. stock market, which is consistent with the study by Hamilton (1983). In the same vein, Sadorsky went further to investigate the asymmetric relationship of oil price within the study period. The result particularly found that a rise in oil prices has a greater effect on the financial market and economy than the otherwise. Furthermore, Sadorsky (2001) extended his study to inquire the impact of oil price changes on the Canadian stock market. His result found that the Canadian stock market tends to be more sensitive to oil price and interest rate risk when compared to other macroeconomic factors by utilising a multifaceted arbitrage pricing theory approach.

Surprisingly, a more recent study by Killian and Park (2009) investigated the effect of oil price change on stock market both from the demand and supply side. Their results categorically point that oil price shocks, whether evaluated from the demand or supply side or jointly, affect the stock market in the long run. In contrast, the study by Huang and Masulis (1996) examined the link between daily oil future returns and daily U.S returns employing the VAR approach. The results revealed that oil price returns do foster some individual oil company's return but do not impact the general stock market much.

There are various studies from other developed economies aside from the U.S. and Canada which investigated the relationship between oil price shock and stock market returns/prices. For instance, the study by Mehmet, Renee, Josine and Rangan (2014) proved that oil price shocks are significant avenues that trigger economic fluctuations in Spain. The above was further refuted by the study by Kaul and Seyhun (1990) where it was noted that oil price volatility has a negative significant relation with real stock returns in the NYSE. Similarly, the study by Jones and Gautam (1996) utilised the valuation model on the U.S, Canada, Japan and England stock markets. The results indicated that fluctuations in oil prices impacts stock market performance in those countries. In the same vein, Ciner (2001) concludes that there is a non-linear relationship between stock return and oil prices. In Norway, the study by Bjornland (2008) showed that there is a positive relationship between

oil price shock and stock return; with implication that wealth and economic growth couple with a robust linear and non-linear measure of oil prices. The study also pinpointed the role of monetary policy shocks in the short run with respect to variation in stock prices.

This was followed by a study carried out in Greece by Pappetrou (2001), which considered the interaction amongst the price of oil, economic growth, real stock prices and employment using a VAR model. The results of the study showed that shock in oil price affects real economic activity and employment in Greece. More importantly, oil prices were found to exert a significant movement in stock price in Greece as well. The studies by O'Neil, Penm and Terrell (2008) and Park and Ratti (2008) revealed clearly that oil price shocks exert a significant influence on stock returns of markets in developed economies. Moreover, the study by Lescaroux and Mignon (2008) showed that there exists a strong unidirectional causality which runs from oil prices to share prices. To corroborate the above, the UK study by Irene and Sadorsky (2008) pinpointed a negative association between oil prices and the stock market. In addition, a long run association was also established between oil prices and stock market performance. This standpoint was equally supported by the study carried out by Panagiotis and Katrakilidis (2014). Furthermore, Faffa and Brailsford (1999) investigated the impact of oil price on the Australian stock market with results indicating that oil price exerts a positive impact on oil companies.

On the relationship between crude oil price and stock price in the emerging and developing economies, a bulk of studies have been done, although the results evoke mixed feelings. For example, Basher and Sadrosky (2006) explored this relationship on 21 emerging stock markets, including Pakistan and India, using CAPM multifactor model. Evidently, the results proved that oil prices impact stock markets of the emerging economies. Aside from the above mentioned, the asymmetric effects were also proven. In line with the aforementioned, Lin, Fang, and Cheng (2011) pinpointed the assertion that oil price shock impact on China's market is with mixed outcome. Bhar and Nikolova (2010), which is an earlier study, also discovered that global oil price returns have effect on Russian equity returns and volatility. A little different from the findings of the above is the study by Ciner (2001) which opined that there was a non-linear statistical significant relationship between stock returns and oil price futures. More recently, a study by Khalid and Mohammad (2017) investigated the relationship between oil prices and Kuwait stock exchange (KSE) prices at the sector level using a NARDL model. The evidence from the findings showed that asymmetric long run effect exists between oil prices and some Kuwait sectoral stock prices. Nonetheless, Jouini and Harrathi (2014) examined Chinese and Russian stock markets with respect to the oil price effect. The study found out that oil price volatility strongly influences the risk profile of trading strategy in both countries.

In Africa, studies like that by Koranchelian (2005) in Algeria adopted a vector error correction model (VECM). The study concluded that the movements in the real exchange rate were time varying and in turn impacted stock returns. A recent study by Grakolet and Pierre (2016) explored oil prices and African stock market co-movement using a time frequency analysis. Shockingly, the results revealed that the co-movement between financial markets and stock markets and oil price is very low with the exception of some emerging stock markets, such as Egypt and South Africa, which recorded a large scale impact on their stock markets. Furthermore, they opined that African stock markets at a small scale are possibilities of diversification benefit for oil market active investors.

There are studies in Sub Saharan Africa, for example, Gyasi (2016) examined the link between Ghana stock exchange market and crude oil prices. The results revealed a bi-directional causality between the Ghana equity market and crude oil prices with respect to both returns and volatility. Thereby, making results stand to be beneficial to both investors and policy makers. In the same vein, Aliyu (2012) investigated the aforementioned relationship by employing GARCH model on time series data of Nigeria and Ghana. The results showed that in Nigeria bad news negatively affects stock return as compared to good news, while in Ghana it is the opposite case.

In Nigeria, some empirical studies have investigated this relationship, too. For instance, Nsisong and Ebong (2016) modelled the dynamic relationship that exists between crude oil prices, stock market indicators and economic growth using vector autoregressive (VAR) and co-integration technique. The results revealed that there is a viable long run and sustainable relationship among the series. The above study was followed by the studies by Adaramola (2012) and Ogiri, Amadi, Uddin and Dubon (2013), which investigated the long-run and short-run dynamic effects of oil price volatility on the Nigerian stock market behaviour from 1985 to 2009 using quarterly data within the period in question. Interestingly, the results revealed that the stock market has a significant positive impact on oil price. Furthermore, the result of the Granger causality test indicated a strong evidence that causality runs from oil price shock to stock returns, meaning that variations in the Nigerian stock market performance are explained by oil price movements. Similarly, the study by Babatunde *et al.* (2013) investigated the interactive relationship between oil price shocks and the behaviour of the Nigerian stock market. Their results suggested that the Nigerian stock market returns have a positive but insignificant impact on oil price shocks but they revert to negative effects after a period of time depending on the type of the oil price shocks.

The above literature revealed that the bond between oil prices and stock market performances has been carried out in several developed and few developing economies although the outcome had a mixed outcome. It is based on the aforementioned that this current study seeks to focus on these relationships in Sub-Saharan Africa with Nigeria as a case study. The essence is to explore the impact of fluctuations in oil price on stock prices in Nigeria.

MATERIAL AND METHODS

This article employs annual data on crude oil prices, stock market all share index and interest rate. In particular, the oil price adopted is the US dollar per barrel price and financial development which is proxied by the ALL share index. Exchange rate is used to proxy monetary policy. The study aims to adopt Vector Autoregressive (VAR) technique. In a simplistic manner, the study hopes to employ the below model as expressed in equation (1).

$$\mathrm{ASPI}_t = \propto_0 + \propto_1 \mathrm{COIP}_t + \propto_2 \mathrm{EXR}_t + \mu_t \quad (1)$$

where:

ASPI_t - is the ALL share Index;
COIP_t - is the crude oil price;
EXR_t - is the naira /U.S dollar exchange rate.

The data were obtained from the Central Bank of Nigeria, the statistical bulletin and the US Energy Information Administration (2017). As a pre-requisite for time series analysis, the study tested for stationarity by using both Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root method. After the above mentioned test, if the variables under consideration are found to be integrated in the same order, then there may be the evidence of co-integration. This in turn will make the co-integration test to be useful in the analysis. In this wise, the co-integration test is carried out via the Johansen co-integration approach as suggested by Johansen and Juselius (1990). For instance, if co-integration tends to exist between the series under consideration, then there is a need for an additional error correction term i.e. to the Error correction model (ECM). To do this, the Johansen co-integration procedure in a vector autoregressive (VAR) environment is employed, that is, the unrestricted VAR. Here, the null hypothesis i.e. H_0 is that there is a different number of co-integration relationships as against the H_1, that all series in the VAR are stationary. More particularly, the VECM model to be utilised in this research is adopted from Akinlo (2014) with modification, and it is specified as below.

$$\Delta\mathrm{ASPI_t} = \ell_1 + \sum_{i=1}^{k-1} \delta 1i\ \Delta\mathrm{ASPI_{t-i}} + \sum_{i=1}^{k-1} \theta 1i\ \Delta\mathrm{COIP_{t-i}} + \sum_{i=1}^{k-1} \psi 1i\ \Delta\mathrm{EXR_{t-i}} + \\ + \mu 1\ \mathrm{ECT_{t-i}} + \varepsilon_t \quad (2)$$

$$\Delta\mathrm{ASPI_t} = \ell_2 + \sum_{i=1}^{k-1} \delta 2i\ \Delta\mathrm{ASPI_{t-i}} + \sum_{i=1}^{k-1} \theta 2i\ \Delta\mathrm{COIP_{t-i}} + \sum_{i=1}^{k-1} \psi 2i\ \Delta\mathrm{EXR_{t-i}} + \\ + \mu 2\ \mathrm{ECT_{t-i}} + \varepsilon_t \quad (3)$$

$$\Delta\mathrm{ASPI_t} = \ell_3 + \sum_{i=1}^{k-1} \delta 3i\ \Delta\mathrm{ASPI_{t-i}} + \sum_{i=1}^{k-1} \theta 3i\ \Delta\mathrm{COIP_{t-i}} + \sum_{i=1}^{k-1} \psi 3i\ \Delta\mathrm{EXR_{t-i}} + \\ + \mu 3\ \mathrm{ECT_{t-i}} + \varepsilon_t \quad (4)$$

From equation (2), (3) and (4) above, the ECT_{t-1} term describes the long run causality. In the same vein, the joint f-test of the considered coefficients of the first differenced explanatory variables signifies the short run causality. To ascertain causality, the Wald joint significant test would be used. In order to ascertain further the interrelationship among the variables of interest, variance decomposition (VDF) and impulse response function (IRF) are utilised.

RESULTS AND DISCUSSION

This section involves the presentation of data and interpretation of the results analysed regarding this research work. The descriptive statistics (Table 1) show that the average of ASPI is 12812.05 with S.D of 1620.769; similarly, the mean of COIP is 37.179 with S.D of 28.0 and expected value of the exchange rate is 74.372 with S.D of 87.664. ASPI, COIP and RER were considered to be positively skewed. Again, the kurtosis statistic of the data showed that all the variables used are leptokurtic. And finally, the J-B statistic shows that the residuals follow a normal distribution.

As a follow up of the outcome of the descriptive statistics of the variables, the researcher deemed it necessary to check for the time series properties of the variables utilised. To check for these properties, the Augmented Dickey-Fuller (ADF) and the Phillip Perron test were used and the result presented in Table 2 below. The result of the unit root test showed that all the variables were not stationary at a level but later became stationary after first differencing.

Table 1. Result of Descriptive Statistics

Statistics	ASPI	COIP	RER
Mean	12812.05	37.18	74.37
Median	5266.40	28.00	21.89
Maximum	57990.20	109.00	363.00
Minimum	32.90	10.60	0.55
Std. Dev.	16207.69	28.32	87.66
Skewness	1.22	1.46	1.26
Kurtosis	3.67	3.976	4.466
Jarque-Bera	11.527	16.959	15.26
Probability	0.313	0.24	0.15
Sum	550918.00	1598.70	3197.99
Sum Sq. Dev.	1.10E+10	33690.31	322766.60
Observations	43	43	43

Source: own study adopted from E-views 7.

Table 2. Result of Unit Root Test

Variable	AT LEVEL				AT FIRST DIFFERENCED			
	ADF-t stat	PP-t stat	CV at 5%	Decision	ADF-t stat	PP-t stat	CV at 5%	Decision
ASPI	-0.366	0.422	-2.933	NS	-6.145	-5.825	-2.935	*S*
COIP	-1.977	-1.901	-2.933	NS	-7.471	-7.560	-2.935	*S*
EXR	3.12	2.637	-2.933	NS	-3.519	-3.519	-2.935	*S*

Source: own calculations adopted from E-views 7.

Prior to the co-integration test, we find it necessary to construct an initial VAR model to determine the lag order/length of the co-integration test. This is because it is important and also a prerequisite to conduct the co-integration test. The outcome of the estimation of the lag structure of a system of VAR in levels indicates that the optimal lag length based on the Schwartz information criteria (AIC) is 1 as shown in Table 3.

Table 3. Lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-848.75	NA	2.22e+14	41.55	41.674	41.594
1	-753.77	171.41	3.36e+12	37.355	37.856*	37.5375*
2	-743.19	17.552*	3.14e+12*	37.277*	38.155	37.597

Source: own calculation adopted from E-views 7.

We defined the lag order as the 1st order using AIC. As a matter of fact, one of the advantages of VAR specification is that it allows for the computations of Impulse Response Function (IRF), that is, functions of the response of any dependent variables to one standard deviation shock in any other endogenous variable in the system as emphasized by Rad (2014).

The result of the co-integration test is shown in Table 4 below. From the table it can be observed that the null hypothesis of no co-integration, for r=0, r≤1 and r≤2 was rejected by both the trace and the maximum Eigen-value statistic. The reason for this is because their critical values were found to be lesser than their corresponding statistical values. This

in turn depicts that there is a long-run linear relationship among the variables of interest with 3 co-integrating equations at 5% level of significance.

Table 4. Co-integration test

Trace Test				Maximum Eigen Value Test			
Null	**Alternative**	**Statistics**	**95% Critical Values**	**Null**	**Alternative**	**Statistics**	**95% Critical Values**
r = 0	r ≥ 1	50.52	29.797	r = 0	r = 1	29.265	21.132
r ≤ 1	r ≥ 2	21.257	15.495	r ≤ 1	r = 2	15.177	14.265
r ≤ 2	r ≥ 3	6.08	3.84	r ≤ 2	r = 3	6.08	3.841

Source: own calculation adopted from E-views 7.

As a matter of fact, the implication of vector error correction mechanism (VECM) as presented in this research is that it offers the opportunity to ascertain two things. The first one is the long run causality and the nature of the error correction term. The other one is to ascertain whether there is short run causality or not. Furthermore, the VECM result will also entail the Granger causality outcome. This result will be presented in Table 5.

Table 5. Result of Granger causality test and Error correction term

Chi Square statistics				ECT_{t-1}
Variables	**$\Delta(ASPI)_t$**	**$(COIP)_t$**	**$(RER)_t$**	**t- statistics**
ΔASPI	–	0.092 (0.76)***	0.569 (0.45)***	-0.312** (-3.66)
ΔCOIP	16.59 (0.00)**	–	0.009 (0.92)***	-0.145 (0.00)**
ΔRER	3.120 (0.08)***	2.097 (0.15)***	–	-0.104 (0.53)

NB: ** and *** represent 1% & 5% respectively
Source: own calculations adopted from Eviews 7.

From the Granger causality result it was discovered that long run causality existed between COIP and RER to ASPI, as presented in the table above, which emanated from a one period lagged error correction term. The implication of the above is that there is long run causality among the variables of interest. This is explained by the fact that the error correction term showcased a negative sign which is statistically significant at 1% level given ASPI as the response variables. Evidence shown from the Granger causality test is that a unidirectional causal relationship runs from COIP to ASPI. This corroborates the study of Lescaroux and Mignon (2008). It was also discovered that there is no causality running from RER to COIP and from RER to ASPI, respectively. Furthermore, the study went ahead to ascertain if the crude oil price can cause ALL share index or not in the short run. To do this, we state the null hypothesis that H_0: c(3) = 0 by employing the Wald significance test. Evidently, the results of the Wald significance test as seen from the probability value of the chi-square p (0.2155>0.05) is equal to zero and should hence be accepted. Meaning that there is no short run causality running from COIP to ASPI. Similarly, the study went further to check for the second variable i.e. RER. The results revealed that there is no short run causality running from RER to ASPI respectively. In the overall, the researchers went ahead to ascertain if RER and COIP joint cause ASPI in the short run.

The null hypothesis H_0: c (3) = c(4) = 0. The results of the chi-square probability (p = 0.4604>0.05) revealed that the null hypothesis of no causality can be accepted. The implication is that there is no short run causality between RER and ASPI.

To validate the appropriateness of the above evaluated model, we set out to do some diagnostic tests. We started by examining the probability of the chi-square (p = 0.9829>0.05) which tends to be greater than 5%. The implication is that we accept the null hypothesis of no serial correlation, meaning that there is no serial correlation in the model. Also, we went further to check for heteroskedasticity in the model. The chi-square results (p = 0.2561>0.05) revealed that the null hypothesis of no heteroskedasticity is accepted. In addition, we also checked to know whether the series is normally distributed or not. Surprisingly, the results of the Jarque-Bera test revealed that the null hypothesis of the series normally distributed is accepted based on the fact that the probability value (0.4558) is greater than 5%. The results suggest that there are no lagged forecast variances in the conditional variance equation. In essence, it stipulates that the errors are conditionally and normally distributed, thereby making it useful for inference as buttressed by Nwachukwu and Odigie (2009). In the same vein, evidence from the CUSUM test (Table 6, Figures 1-2) that uncovered the VECM model is stable, thereby implying that the model was reasonably specified based on its statistical significance and fitness.

Table 6. Results of the CUSUM test

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.312	0.085	-3.663	0.0008
C(2)	0.317	0.138	2.303	0.027
C(3)	-0.145	0.117	-1.239	0.224
C(4)	-0.105	0.166	-0.633	0.530
C(5)	0.145	0.0482	2.999	0.005
Statistics				
R-squared	0.391	Mean dependent var		0.177
Adjusted R-squared	0.324	S.D. dependent var		0.28
S.E. of regression	0.23	Akaike info criterion		0.012
Sum squared resid	1.903	Schwarz criterion		0.22
Log likelihood	4.76	Hannan-Quinn criter.		0.088
F-statistic	5.791	Durbin-Watson stat		1.978
Prob(F-statistic)	0.001	–		

Note: Dependent Variable: D(LASPI); Method: Least Squares; Date: 03/15/18 Time: 07:42; Sample (adjusted): 1977 2017; Included observations: 41 after adjustments; D(LASPI) = C(1)*(LASPI(-1) + 0.00587339841049*LCOIP(-1)-1.15064609978*LRER(-1) - 4.35761708759) + C(2)*D(LASPI(-1)) + C(3)*D(LCOIP(-1)) + C(4)*D(LRER(-1)) + C(5)

F-statistic	1.323	Prob. F(6,34)	0.274
Obs*R-squared	7.762	Prob. Chi-Square(6)	0.256
Scaled explained SS	8.465	Prob. Chi-Square(6)	0.206

Note: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.000393	Prob. F(1,35)	0.984
Obs*R-squared	0.000460	Prob. Chi-Square(1)	0.983

Note: Breusch-Godfrey Serial Correlation LM Test

Source: own calculations adopted from Eviews 7.

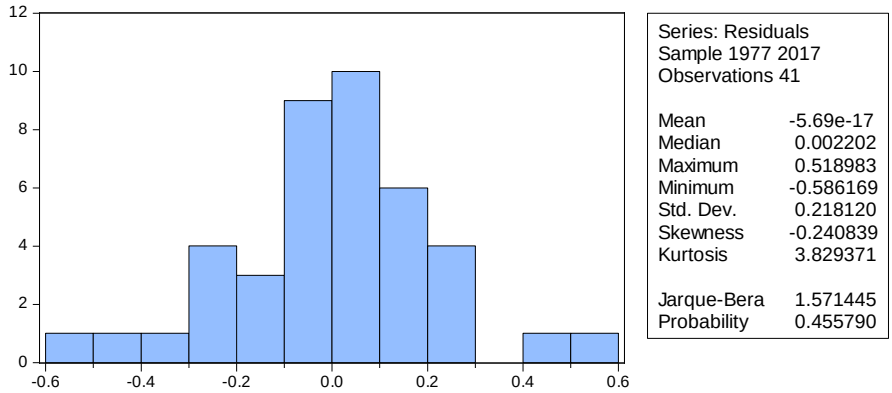

Figure 1. Jarque-Bera Normality Test
Source: own study based on statistical calculations from Eviews 7.

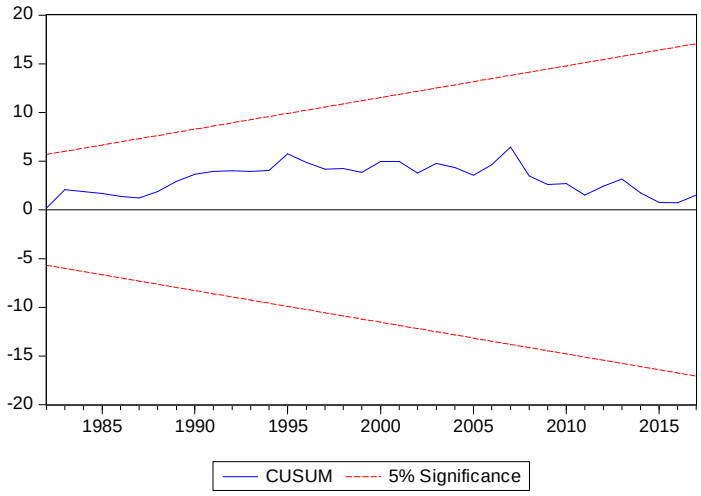

Figure 2. CUSUM Test for Stability
Source: own study based on statistical calculations from Eviews 7.

In order to give further consideration to the short-run dynamic properties of the stock market index with respect to the variables in the system, we employ the variance decomposition function. As a matter of fact, VDF indicates the amount of information each variable contributes to the other variables in a vector auto regression (VAR) models. The results are reported in Table 7.

Findings from VDF results presented in Table 6 showed that the dynamic behaviour of the stock market index reports 100% variation of the fluctuation in the first year when innovation by a standard deviation (SD) of 0.23 is the variable itself. In the short run, that is period 3, shock to ALL share index accounts for 71.68% variation of the fluctuation in ALL share index (own shock), whereas an impulse to crude oil price plus exchange rate caused 14.32% and 13.99% fluctuation in the stock market development, respectively, but as a whole, total fluctuation

becomes 100 percent, while in the long run, that is period 10, the shock to ALL share index contributes to 28.04% of stock market index (own innovation), however; shock to crude oil price and exchange rate can cause 28.50% and 43.46% to the variance of the stock market development, respectively. From the analysis, we find that in the short run, the ALL share index contributed more to own shock, but in the long run such contribution declined significantly. But in the case of both crude oil price and exchange rate, the analysis is reversed with more contributions from the exchange rate. Noticeably, from the result it can be seen that the contribution of the exchange rate is more consequential to stock market development. This may be attributed to the fact that the Central Bank of Nigeria has recently initiated a formal intervention to control the exchange rate and the forex market which in turn encourages more foreign investors to participate in the Nigerian Stock Exchange (NSE) market.

Table 7. Results of the Variance Decomposition function (VDF)

Period	S.E.	ASPI	COIP	RER
1	0.229	100.00	0.00	0.00
2	0.345	90.087	6.548	3.366
3	0.435	71.676	14.325	13.999
4	0.525	54.24	20.26	25.499
5	0.607	43.048	23.698	33.254
6	0.678	36.688	25.616	37.696
7	0.737	33.07	26.756	40.174
8	0.79	30.85	27.50	41.65
9	0.839	29.29	28.053	42.657
10	0.886	28.043	28.497	43.459

Source: own calculations adopted from Eviews 7.

Here, IRF refers to a shock that is accrued to the VAR system. Impulse response typically identifies the responsiveness of the dependent variable to a one positive shock in the exogenous variable in the VAR when the shock is put to the error term.

Particularly, in this study the IRF is utilised to ascertain the effect of a one standard deviation generalised innovation in crude oil price and exchange rate on the market index of Nigeria. The result of the impulse response is shown in Figure 3. Here, we started with the response of ALL share index to ALL share index (own innovation). That is, to ascertain how one positive standard deviation (SD) shock of ASPI reacts to its own shock. In the graph we discover that initially ASPI reacts positively, it turns negative between period 3 to 7 and afterwards positive, and then drops to zero at period 10. Similarly, it was discovered that one positive SD shock of COIP generated positive responses to the ASPI both in the long and short run. Meanwhile, one positive SD shock of RER caused a positive response on the ALL share index of Nigeria from period 1 to 10, accordingly.

On the other hand, one positive SD shock of COIP initially generated positive and later negative reactions to the value of ASPI between periods 1 to 10 in the future. On the contrary, it was discovered that the response of one positive SD shock of COIP to own innovation was found to be positive. The same applied to the response of RER to COIP, as well. The implication is perhaps that crude oil price and exchange rate react both positively and negatively to stock market development in Nigeria and this outcome buttressed the findings of Babatunde *et al.* (2013) and Ojikutu, Onolemhemhen and Isehunwa (2014), respectively.

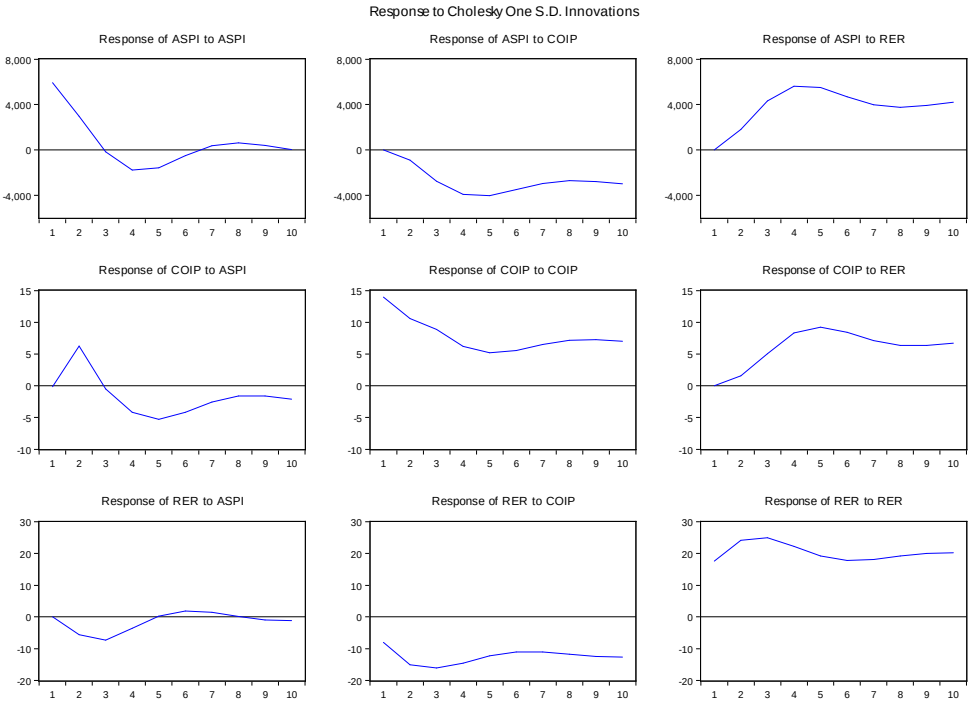

Figure 3. Impulse Response Function (IRF) of the link between crude oil price and stock market indices
Source: own study.

CONCLUSIONS

The stock market is often described as a stimulus to macroeconomic fundamentals, and having its inherent effect on the welfare of any economy, Most policy makers, investors and economists are apprehensive with these nexus, especially the relationship between changes in crude oil price and stock market performance, with particular reference to oil exporting countries like Nigeria where some nonchalant attitude towards the above has its economy into the immediate pasted recession. It is in line with the above that this current study investigated the link between crude oil price and stock market performance using a restricted VAR approach. The results revealed that all variables utilised were stationary after first differencing, and evidence of a long run linear relationship was also found based on the unit root and co-integration test, respectively.

The VECM model showed that there is long run causality from crude oil price and exchange rate to ALL share indexes (stock indices). This is because the error correction term (-0. 312) was negative and statistically significant at 5% level. The coefficient of the ECT_{t-1} indicated that the errors in the model can be corrected for about 31.2% yearly. Furthermore, unidirectional causal relationship was noted to run from the crude oil price to ALL share indexes. However, no causality was established between RER to COIP and RER to ASPI, respectively. Evidence from the variance decomposition function VDF showed that crude

oil price and exchange rate contributed minimally to stock market development in the short run, while the contribution of same variables was prominent in the long run. However, exchange rate was found to contribute more to stock market development in Nigeria than the crude oil price. The outcome of the VDF was equally validated by the IRF result in Figure 3. Based on the above findings, the study recommends that the government should diversify the national economy with the revenue generated on crude oil in order to avert the likely economic conditions that could emanate from the shocks of decline in the price of crude oil in future. especially on the financial sector and the like. The government should also deepen its intervention in the exchange rate in order to encourage more foreign investors into the market. Despite the above salient result obtained from this study, there is availability of data limitation which made the study to be country specific, thereby minimising the generalisability of the result to other Sub-Saharan African countries.

Despite the above salient result, the study still has data limitations which have portrayed it to be more of country specific analysis, thereby minimising the generalisability of its result to alternative Sub-Saharan African countries. This was because data of different Sub-Saharan African countries were not readily out there as at the time this research was undertaken. Therefore, the authors suggest that additional cross-country studies should be undertaken on the link between changes in crude oil value and stock exchange indices in Africa to a great extent for future research in order to ensure a sturdy outcome and for the purpose of comparison, among others.

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