OIL PRICE SHOCKS AND STOCK MARKET PERFORMANCE IN THE NIGERIAN ECONOMY: A NON-LINEAR ARDL ANALYSIS, 2008-2017

Abdulaziz Shehu[6] and Adamu Hassan[7]

ABSTRACT

This paper examines the asymmetric effect of oil price shocks on stock market performance in the Nigerian economy using monthly time series data over the period January 2008 to May 2017. The short-run and long-run asymmetries were analysed using nonlinear autoregressive distributed lags (NARDL) framework. The empirical results suggest the presence of cointegration as well as asymmetric relations. Specifically, positive changes in oil price tend to have no significant effect on the Nigerian stock performance. However, negative changes turned out to have negative and significant effect on stock performance in both the long and short runs. This implies the need for the regulatory agency to continue to strengthen its effort aimed at promoting the development of the capital market and making it better able to cope with external shocks such as adverse movements in crude oil prices. The current efforts of the SEC in spearheading the implementation of the capital market master plan are part of such measures. Fresh data when it is available is therefore required to enable newer research to gauge whether or not these efforts by the SEC are making the market more resilient to falls in crude oil prices on the world market.

Keywords: Asymmetry; Nigeria; Oil price; Shocks; Stock Market Performance

JEL Classification: E02, E44,Q43

*Corresponding author, Department of Economics, Federal University Birnin Kebbi, Nigeria, email: abazizu@gmail.com
[7]Department of Economics, Sokoto State University, Nigeria

1. INTRODUCTION

In recent years, the price of crude oil has been unstable. It rose from US$25 per barrel in 2002 to US$55 in 2005, achieving a peak of US$138 in mid-2008. From that level, it underwent a precipitous decline, falling to US$30 in January 2016 before beginning to rise somewhat sluggishly to stabilise around US$57 per barrel by the third quarter of 2017 (CBN, 2017). The fluctuations in oil price observed during the period have been attributed to demand and supply shocks in international crude oil market (Hamilton, 1983, Lorruso and Pierroni, 2015).

The likely effect of oil shocks on real economic activity has stimulated the interest of researchers in exploring its linkage with stock market performance. Numerous studies such as Ramos and Velga (2010), Buthaina Muhtaseb and Al-Assaf (2017) argued that the relationship is asymmetric, implying that the effect of oil price decrease on stock performance significantly differs from that of oil price increase. However, other scholars such as Dhaoui and Khraief (2014), Uwubanmwen and Omorokunwa (2015) and Abraham (2016) found that the relationship is linear or symmetric, which assumes that the effect of increase and decrease in oil prices are equal but with opposite signs.

The debate in the literature concerning the impact of oil price shocks on stock performance is inconclusive. While some authors (e.g. Ani et al., 2014) argued that oil price fluctuations do not influence stock returns, others (e.g. Hamma, Jarboui &Ghorbel, 2014; Olufisayo, 2014 and Abraham, 2016) maintained that oil price changes affect stock market performance. In contrast, Adebiyi et al. (2009); Basher &Sadorsky, (2006); Akinlo &Apanisile (2014) provided empirical evidence that oil price shocks affect stock markets of only oil exporting countries but not those of non-oil exporting economies.

In the case of Nigeria, oil price shocks are reckoned to be among the factors affecting stock market performance in view of the predominance of crude oil both as a source of government revenue and foreign exchange earnings. Record has shown that the country's all share index (ASI), which measures stock market performance has persistently declined from 65,652.38 in February 2008 to less than 30,000 in December, 2012. It however increased from 31,853.19 to 41,210.10 between January 2013 and September, 2014, after which it underwent a steady decline, plunging to less than 30,000 from October 2015 to the end of May, 2017 (CBN, 2017). It is clear from the above picture that stock market performance (as measured by the country's all share index) has tended to exhibit a similar pattern of movement with that of crude oil price, tending to fall when crude oil falls, and to recover when it recovers (Hamilton, 1983; Basher and Sadorsky, 2006; Zhu, Su, Guo and Ren, 2016).

Given the need to offer some policy suggestions on ways to reduce vulnerability of the stock market to external shocks, especially those emanating from oil price declines, several studies have assessed the relationship between stock market performance and oil prices (Adenuga, Abeng &Omanukwue, 2009; Mordi &Adebiyi, 2010; Asaolu &Ilo, 2012; Olufisayo, 2014; Uwubanmwen & Omorokunwa, 2015; Abraham, 2016; Okere &Ndubuisi, 2017). However, the existing studies have focused nearly exclusively on symmetric effect, tending to fail to capture the independent effect of positive and negative changes of

oil price on stock performance. The only exception is Mordi &Adebiyi, (2010) who revealed that oil price has an asymmetric relation with all share index of the Nigerian stock market over the period 1999 to 2008. Further, the existing literature has not captured critical periods of economic recession such as the one experienced between 2016 and 2017.

The objective of this paper is to examine the asymmetric effect of oil price shocks on stock market performance in Nigeria using data for the period 2008-2017. The paper adopted nonlinear autoregressive distributed lags (NARDL) model advanced by Shin, Yu &Greenwood (2011) for its empirical analysis, which is an asymmetric extension to the well-known ARDL model of Pesaran &Shin (1999) and Pesaran et al. (2001).This has enabled the paper to improve on the existing literature that is based on the standard time series techniques of cointegration, error-correction modelling, Granger causality and ARDL in their empirical analysis. While these techniques enable evaluation of the long-run and short-run relations, they have not been employed to adequately capture the potential asymmetries between crude oil prices and stock market performance in Nigeria.

To achieve the foregoing, the rest of the paper is structured into four sections. After reviewing the literature in section two, the paper discusses the methodology in section three. Section four presents results and discussion while section five offers some concluding remarks.

2. REVIEW OF RELATED LITERATURE

Numerous studies have examined the effects of oil price shocks on stock market performance in both developed and developing countries (see Adebiyi, et al., 2009; Ramos &Velga, 2010; Asaolu &Ilo, 2012; Akinlo &Apanisile, 2014; Hamma et al., 2014; Olufisayo, 2014; Dhaoui & Khraief, 2014; Uwubanmwen&Omorokunwa, 2015; Sufang, Huiming &Rong, 2015; Diaz & Gracia, 2016; Abraham, 2016; Buthaina et al., 2017; Okere &Ndubuisi, 2017). Ramos &Velga (2010) considered the effect of oil shocks on stock returns for a sample of 43 developed and developing countries using asymmetric cointegration technique. For the sub-sample of developed countries covered in their study, their results indicated that an increase in oil prices tends to depress international stock markets, while decreases do not necessarily increase the returns. In contrast, their results showed that for developing countries in the sample, stock market returns have tended to be insensitive to oil price variations.

Dhaoui &Khraief (2014) studied the effect of oil price shocks on stock market returns for eight developed countries for the period 1991-2013. Their findings indicate evidence of a strong negative relation in all countries under consideration except Singapore. On the volatility side, the changes in oil prices were found to be significant for six markets. A recent study by Diaz & Gracia (2016) on developed countries (the G-7countries) also confirms the negative reaction of stock markets to an increase in oil price volatility.

Sufang, Huiming & Rong (2015) examined the nonlinear dynamic relationship between oil price and stock markets for a sample of eight Asia Pacific economies. The results suggest evidence of asymmetric oil- stock market nexus in South Korea and Malaysia.

However, there are no asymmetric adjustments between oil price and stock markets in Japan, Australia, South Korea, India, Indonesia and Singapore.

Using a sample of developing countries, Akinlo & Apanisile (2014) examined the impact of oil price volatility on economic growth in sub-Saharan Africa using panel analysis. Their results showed that oil price volatility tended to exert a positive and significant effect on economic growth for oil-exporting countries but turned out to be insignificant for non-oil producing countries. Similarly, Hamma et al. (2014) found not only that there exists a relationship flowing from oil volatility to stock market performance in Tunisia but also that the conditional volatility of the stock market depends on its past variation and that of the shocks on the oil prices. In contrast, Buthaina, et al., (2017) found that Jordan's stock returns tend to react to oil price variations in an asymmetric manner. However, the study found that compared to their declines, oil price increases were found to have a larger impact on stock returns.

For Nigeria, Adebiyi et al. (2009) reported that real stock returns tend to respond immediately and negatively to oil price shocks in the country. Further, their Granger causality test showed evidence of causality running from oil price shocks to stock returns. Similarly, Olufisayo (2014) supported this finding of a uni-directional relationship between oil price shocks and stock returns. In the same vein, Asaolu &Ilo (2012) found that in the long run oil price decrease has a negative and significant effect on Nigerian stock market returns. Adebiyi, et al. (2009) have also reaffirmed these findings.

In contrast, Uwubanmwen&Omorokunwa (2015) found that oil price has positive and significant effect on Nigerian stock performance. Also, recent studies by Abraham (2016) and Okere & Ndubuisi (2017), using autoregressive distributed lag (ARDL) model contradicted the negative findings, reporting that oil prices were positively related to the performance of Nigerian stock market and economic activities.

On balance, it can be surmised that the evidence from existing body of literature seems to suggest a paucity of studies that examined the asymmetric effect of oil price changes on stock performance in Nigeria and other developing countries. In addition, no empirical study has so far been published to examine the relationship using fresh data covering the most recent economic recession that gripped Nigeria between 2016 and 2017.

3. METHODOLOGY

3.1 Source of Data

The study employed monthly time series data from January 2008 to May 2017 for its empirical analysis. The data were all sourced online from the website of Central Bank of Nigeria (www.cbn.gov.ng). This period was chosen in order to capture the independent effects of both positive and negative changes in oil price on the performance of the Nigerian stock market within the context of the global economic crises, post global economic crisis and the recession that the country began to experience from August 2016.

3.2 Model Specification

Following Shin et al. (2011) and Ibrahim (2015), the non-linear NARDL model for the analysis of the asymmetric effect of oil price on stock performance is specified as follows:

$$ASI_t = \beta_0 + \beta_1 OP_t^+ + \beta_2 OP_t^- + \beta_3 MPR_t + e_t \qquad (1)$$

where *ASI* denotes all share index, which is a proxy for Nigerian stock market performance. *op*⁺ is the partial sum of positive changes in oil price. *op*⁻ denotes partial sum of negative changes, *MPR* represents monetary policy rate while $\beta_0, \beta_1, \beta_2 \text{and} \beta_3$ are the long run parameters of the independent variables in the model.

To capture both the short run and long run asymmetric effect, equation 1 is framed in an ARDL setting along the line of Pesaran and Shin (1999) and Pesaran et al. (2001) as:

$$\Delta ASI_t = \beta_0 + \beta_1 ASI_{t-1} + \beta_2 OP_{t-1}^+ + \beta_3 OP_{t-1}^- + \beta_4 MPR_{t-1} + \sum_{i=1}^{p} \varphi_1 \Delta ASI_{t-i} + \sum_{i=1}^{q} \varphi_2 \Delta OP_{t-i}^+ + \sum_{i=1}^{r} \varphi_3 \Delta OP_{t-i}^+ + \sum_{i=1}^{s} \varphi_4 \Delta MPR_{t-i} + e_t \qquad (2)$$

Where all variables are as defined in equation one (1) and p, q , r and s are lag orders of the variables in the model. β2 and β3 denote the long run impacts of the positive and negative changes in oil price on stock market performance. Lastly $\sum_{i=1}^{q} \varphi_2$, $\sum_{i=1}^{r} \varphi_3$ measure the short-run impact of increase and decrease in oil price on stock market performance respectively. They demonstrate that this modified test has the best overall performance in terms of small-sample size and power.

To avoid spurious regression and ensure that no I(2) variables are involved in the estimation of the models, the paper applied the modified version of unit root tests developed by Elliott, Rothenberg and Stock (1996) and the Ng-Perron (1995) tests to establish the order of integration of the variables. The modified tests were used because they accept small-sample size and have greater power than the commonly used ADF and PP tests. The study also performed a test for the presence of cointegration among the variables using a bounds test approach of Pesaran et al. (2001) and Shin et al. (2011). After confirming the presence of integration, the paper went further to examine the long-run and short-run asymmetric effect of positive and negative changes in oil price on the all share index, which serves as a proxy of stock market performance.

4. RESULTS AND DISCUSSION

4.1 Trend of Oil Price and the Nigerian Stock Market Performance

The trend of oil price and all share index over the sample period January 2008 to May 2017 are presented in Figure 1a -1d. Figures 1a and 1c show the movement of oil price and all share index during the period while Figure 1b and 1d show the volatile nature of the series. The four figures indicate that both oil price and all share index have been

experiencing unimpressive growth during the period. However, oil price tends to exhibit more swings than the all share index. This suggests that oil prices are more volatile compared to the Nigerian stock market performance. It can also be observed that during the period, when oil prices fell steeply, the Nigerian stock market tended to plummet.

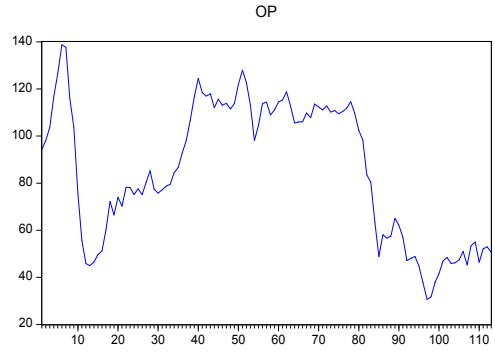


Figure 1a- Oil l price (British Brent) in US

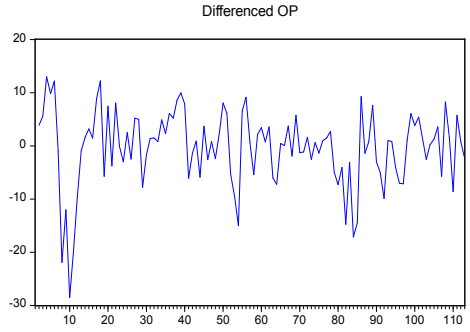


Figure 1b- Shock trend in Oil Price

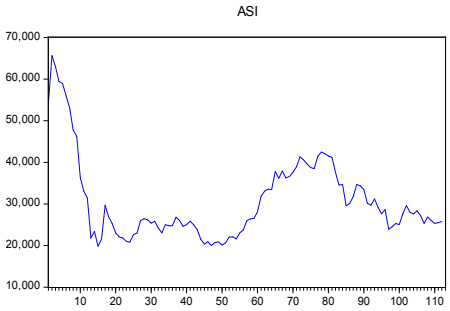


Figure 1c- All share Index

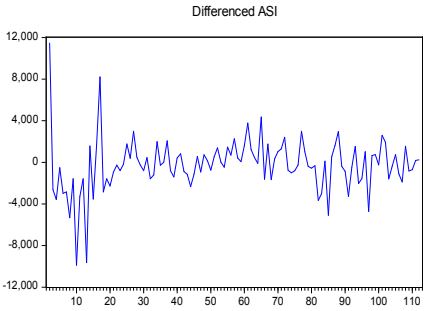


Figure 1d-Shock in All share Index

4.2 Unit Root Tests

The results of both DF-GLS method of Elliott, Rothenberg and Stock (1996) and the Ng-Perron (1995) unit root tests are presented in Table 1.

Table 1: Unit Root Test

Variables	Domestic Currency (Naira) Oil Price Model			
	DF-GLS method		Ng-Perron	
	Level	First Diff.	Level	First Diff.
LASI	-1.288607	-6.193667***	-0.94376	-6.98672***
NOP+	-1.414866	-7.199828***	-2.52973	-5.03814***
NOP-	-1.712312	-7.742378***	-1.39247	-4.91496***
MPR	-1.271556	-10.03680***	-1.22726	-5.23951***
			U.S. Dollar Oil Price Model	

LASI	-1.288607	-6.193667***	-0.94376	-6.98672***
OP+	-1.739410	-6.948818***	-1.69887	-4.83476***
OP-	-1.540632	-8.969598***	-1.275205	-5.72701***
MPR	-1.271556	-10.03680***	-1.22726	-5.23951***

Note: the constant and trend terms are included in the test equations and the SIC is used to select the optimal lag order in the ADF test equation.
***, ** and * indicate at 1%, 5% and 10% levels of significance respectively.

The results in Table 1 show that all the variables in the model, namely all-share index measuring stock market performance, monetary policy rate, positive and negative changes in oil price are not stationary in their levels. However, their first differences each turned out to be stationary, implying that the variables were I(1) since they became stationary only after the first differencing. Constant and trend terms were included in the estimation of the unit root tests, while SIC was automatically selected for the choice of optimal lags. Since the series were integrated of order one I (1) and none of them was found to be integrated of order 2, the paper proceeded to conduct the NARDL bounds test for cointegration.

The result of bound test given in Table 2 indicates that the value of F-Statistics of both the Naira and Dollar based models are greater than the critical upper and lower bounds at even the 1% level of significance. This implies that all the variables are cointegrated in the long run.

Table 2 : NARDL Bounds Test for Cointegration

Model Specification	**F-Statistics**	**99% Lower Boundary**	**99% Upper Boundary**	**Conclusion**
Domestic Currency (Naira) Oil Price Model	6.71	3.65	4.66	Cointegration
U.S. Dollar Oil Price Model	7.41	3.65	4.66	Cointegration

Notes: the critical values are obtained from Narayan (2005)
Source: Authors' Computation from Eviews 9 Output.

In the presence of cointegration as presented above, the paper goes further to assess the dynamics of stock market performance and its long run relation to monetary policy rate as well as positive and negative changes in oil price using NARDL model. The results of estimated long run NARDL presented in Table 3 show that negative changes in oil price have a positive and significant effect on stock market performance at 5% level of significance in both the naira and US dollar oil price models. However, positive change in oil price has no significant effect on stock market performance. The results were in tandem with those of Mordi and Adebiyi (2010) which revealed that oil price has an asymmetric relation with Nigerian stock performance.

The results in Table 3 also indicate that a decrease in oil price by 10% would reduce stock market performance by roughly 0.011% and 1.17% for domestic and U.S dollar currency

based models respectively. The results also indicate that the long run coefficient of monetary policy rate has a positive and significant effect on stock market performance. An increase in monetary policy rate by 10% will ceteris paribus lead to an increase in stock market performance. This is a surprising result because high policy rates imply high interest rates, which tend to shift investor attention to the money market. Further investigation is therefore required on this unexpected result.

Table 3: Long Run Coefficients of NARDL

Domestic Currency (Naira) Oil Price Model			**US Dollar ($) Oil Price Model**		
Dependent Variable: LASI					
Variable	Coefficient	P-value	Variable	Coefficient	P-value
NOP(+)	0.000028	0.8966	OP(+)	0.010288	0.7312
NOP(-)	-0.001095	0.0171	OP(-)	-0.117263	0.0334
MPR	0.074506	0.0372	MPR	0.075003	0.0571
C	9.725693	0.0000	C	9.705357	0.0000

Source: Authors' Computation from Eviews 9 Output.

The short run estimates presented in Table 4 demonstrate that except in one case, all the variables in domestic and dollar currency models have significant and contemporaneous effect on stock market performance. This implies that oil price has a minimal immediate impact on stock performance.

As expected, the error correction term for each of the models is less than one with a negative sign and is statistically significant at one percent. This indicates that in the case of any downswing in the stock market price, the system may correct itself in 12 months at the monthly speed of adjustment of about 8.38% and 7.53% for domestic and dollar currency models respectively.

The paper conducted various diagnostic tests for the adequacy of the dynamic specification. These include LM statistics for autocorrelation, CUSUM and CUSUMSQ for testing structural stability of the models. The result of LM test presented in the lower panel of Table 4 indicates that all the two models are stable and free from serial correlation.

Table 4: Short Run Coefficients of NARDL

Domestic Currency (Naira) Oil Price Model			**U.S. Dollar ($) Oil Price Model**		
Variable	Coefficient	P-value	Variable	Coefficient	P-value
Δ(NOP+)	0.000002	0.8549	Δ (OP+)	0.004350	0.0041
Δ (NOP-(-1))	-0.000048	0.0047	Δ (OP-(-1))	-0.003071	0.0421
Δ (MPR(-1))	0.024730	0.0678	Δ (MPR(-1))	0.024647	0.0682
ECM (-1)	-0.083832	0.0000	ECM (-1)	-0.075318	0.0000
R^2 = 0.93, F- stat. = 148.10 (0.0000), D.W = 2.12 LM test= 0.2266 (0.7976)			R^2 = 0.93, F-stat. = 151.65 (0.0000), D.W = 2.17, LM test = 0.4075(0.6664)		

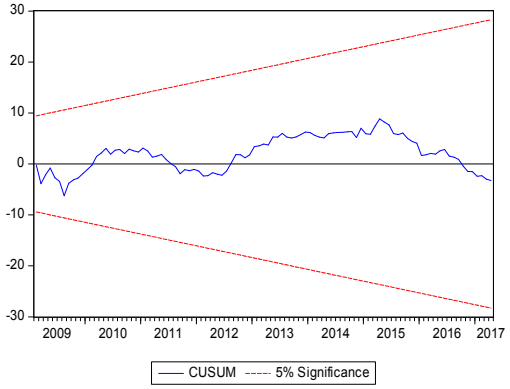
Note: LM is the diagnostic test for serial correlation.

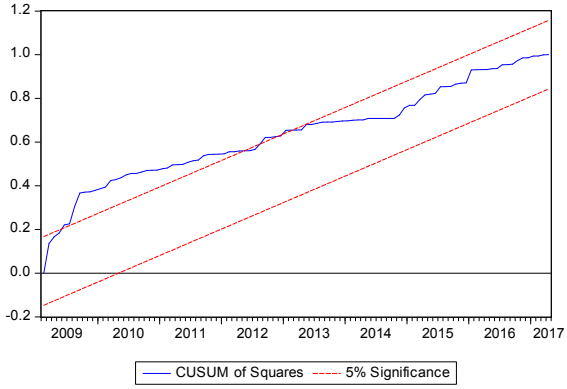
Source: Authors' Computation from Eviews 9 Output.

4.3 Stability Test

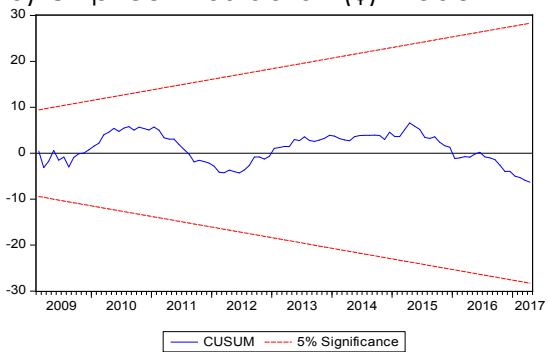
Figure 2 represents CUSUM and CUSUMSQ tests of the two models. The figure shows that all the models passed the CUSUM test. However, the CUSUMQ` graphs have shown that none of the models passed the test as the significant lines crossed the critical lines, suggesting instability in the models. Meanwhile, this is not surprising as the sample covered a period of insecurity in the north east and oil producing region as well as periods of episodes of economic recession.

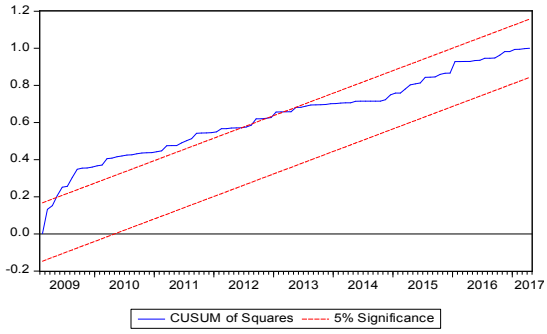
a) Oil price in domestic currency (Naira) Model





b) Oil price in US dollar ($) Model





5. SUMMARY AND CONCLUSION

With the aid of nonlinear ARDL model this paper examined the long run and short run asymmetric effect of oil price shocks on Nigerian stock market performance using data for the country's All Share index as a proxy for stock market performance over the period of 2008 through 2017. The findings revealed presence of asymmetries in both the long run and short run. More specifically, a decrease in oil price was found to have a positive and significant effect on stock performance while oil price increase turned out to have no such significant effect.

These results have some implications for the capital market regulators. Fortunately the SEC has been implementing a set of measures (such as e-dividend, dematerialisation, investor education amongst others) aimed at developing the capital market. In implementing the set of activities contained in the Capital Market Master Plan, the SEC seeks to achieve the dream of making Nigeria's capital market the most developed in Africa by 2025. The pursuit of such measures is expected to improve the liquidity and depth of the capital market both of which will make it more resilient and therefore better able to cope with adverse shocks such as oil price falls. In the face of these measures, the findings of this study suggest the need for further research, using data when it becomes available to estimate the extent to which the market has become more resilient to cope with those shocks as a result of the SEC's continuing efforts to spearhead the development of the capital market.

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