Exchange Rate Policy and Falling Crude oil Prices: Effect on the Nigerian Stock Market

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This paper examines the effect of crude oil price movement on the Nigerian stock market and the role of exchange rate as a plausible countercyclical policy tool. Daily data on All Share Index of the Nigerian stock market, crude oil prices and exchange rate, were collected for two periods: 2008-2009 and 2012-2015. Results from the Autoregressive Distributed Lag (ADL) model show that oil prices are positively related with the performance of the Nigerian stock market thus would drag the market down in times of turmoil. Howbeit, devaluation of the naira is found to be effective in cushioning the effect of crude oil price decline on the stock market. Results from the granger causality test, however, suggest that this policy measure may not be potent as expected.

Key Words: Crude Oil Prices, Stock Market, Exchange Rate

JEL Classification*:* Q32; G12; E52

1.0 Introduction

Oil price fluctuation affects the economy through a number of channels (Eryiğit 2012). The financial market channel in particular, has gained the attention of authors (e.g. Le & Chang 2011). While the debate around this issue is often to examine the effect of crude oil price fluctuation on the volatility of financial markets, the direct effect on stock market performance and how adjustments in exchange rate policy (e.g Basher *et al*, 2010; Imarhiagbe, 2010; Kumar, 2014), as recently observed in 2014 in Nigeria, calls for further investigation. The objective of this paper therefore, is to examine the effect of crude oil price on the Nigerian stock market. The effect of exchange rate policy on the performance of the Nigerian stock market is also examined. This link is critical as swings in crude oil price have direct implication for exchange rate. Hence, it would inform policy makers on the potency of exchange rate policy in curtailing stock market swings in a climate of falling oil prices.

The debate in the literature concerning the impact of oil price volatility on the stock market is in two dimensions: (1) on whether or not, oil prices affect stock market performance (e.g. Sari & Soytas, 2006; Al-Fayoumi, 2009); and

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(2) on whether or not oil prices affects stock markets of oil exporting countries or that of non-oil exporting countries (Adebiyi *et al*, 2009). This paper focuses on the first aspect of the debate. Though some studies have also examined these issues, this paper differs from them in that other studies (e.g. Sari & Soytas, 2006; Aliyu, 2009; Adebiyi *et al* 2009; Babatunde *et al* 2013) employ Vector Autoregressive (VAR) models to facilitate their estimations. While this technique is good in estimating the response of a dependent variable on the lagged values of an independent variable, the model leaves out the possibility of the current values of the dependent variable to influence the performance of the dependent variable.

More so, this paper offers empirical evidence on the debate concerning to devalue or not to devalue the naira given the challenge of the drop in crude oil price that started mid-2014 into 2016. Furthermore, by comparing trends of exchange rate, crude oil price and stock market performance during the 2008 financial crisis period with those of 2012-2015, the paper offers further insight on possible lessons to learn for the direction of exchange rate policy in different episodes of crude oil price and stock market performance dynamics.

The stock market is used as a barometer (see Peterside, 2012) to measure the effect of the falling crude oil price on the economy and the direction exchange rate policy should take because its market capitalization runs into trillions and is by far larger than any size of the Nigerian budget since 2001. The proposed deficit in the 2016 Appropriation Bill of ₦2.22 trillion for instance, is just 22.54% of the market capitalization of the Nigerian stock exchange of ₦9.85 trillion as at December 31st 2015. The proposed aggregate expenditure of ₦6.08 trillion in 2016 Appropriation Bill is 61.73% of the market capitalization as at December 31st, 2015. These reasons explain the choice of the stock market as a proxy for the Nigerian economy in this regard.

2.0 Literature Review

Basher and Sadorsky (2006) argued that the impact of falling oil prices on stock market differs depending on whether the country is an oil-exporter or importer. In an oil-exporting country, a rise in world oil prices improves the trade balance, leading to a higher current account surplus and an improved net foreign asset position. In addition, it tends to increase private disposable income in the countries. This increases corporate profitability, raises domestic demand and stock prices thereby causing exchange rate to appreciate. In oil-importing countries, the reverse is the case, generally. Trade deficits may be offset by weaker growth and, over time, real exchange rate depreciates, while stock prices decline (see Basher and Sadorsky, 2006). Three models of oil price have been identified in the literature as: the linear measure of oil price (Afshar *et al*, 2008); asymmetric oil price (Mork, 1989; Lee *et al*, 1995); and net oil price increase (Hamilton, 1996).

The linear or symmetric measure of oil price, which is adopted for this paper, assumes that effects of oil price movements (increases or decreases) are equal in opposite directions, such that a rise in oil price is expected to have a negative impact on the level of economic activities of oil importing countries, while oil price declines have a positive impact. Asymmetric oil price shocks refer to an oil price measure that differentiates between the positive and negative oil price volatility. This measure of oil price assumes that when oil price is merely increasing to attain its maximum level in the previous period, it would have no impact. However, when the current price of oil is increased to a level above its maximum value in the previous periods, it is expected to have an impact.

Bollerslev (1986) developed the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model with some variations. Basically the model is useful for detecting volatility clustering in a trend or not, with the aim of forecasting the future values of the series with minimal errors. Like the Vector Autoregression (VAR) model, GARCH is not sufficient in establishing the dynamic process it takes for an independent variable to impact on the dependent. The Autoregressive Distributed Lag (ADL) model overcomes this challenge as it examines the relation of a dependent variable y_t against its lagged values as well as current and lagged values of one or more explanatory variables (Greene, 1997). The lags in the ADL model measure the dynamic responses of the dependent variable to any given change in the independent variable(s). Mustapha *et al* (2013), following modification in Narayan & Narayan (2005), used the ADL model to examine the impact of inflation bias on output growth in Nigeria hence, revealing the lag impact of inflation bias on the growth process.

Employing multivariate VAR analysis, Adebiyi *et al* (2009) estimated the effects of oil price shocks and exchange rate on the real stock returns in Nigeria using quarterly data from 1985-2008. Among others, they found that real stock returns responds immediately and negatively to oil price shocks in Nigeria. Further results from Granger causality test also showed causation from oil price shocks to stock returns, implying that variation in stock market performance is partly influenced by volatility in oil price. They concluded that, because economies are interwoven by way of increasing globalization of markets worldwide, establishing the linkages between oil price, exchange rate and stock markets is important for a number of reasons. Paramount among the reasons is that such knowledge could aid the government in the prevention of an economic crisis triggered by exchange rate and crude oil price dynamics.

3.0 Research Methodology

Following Afshar *et al* (2008), linear measure of oil price, is adopted as the framework for representing oil price movement. Autoregressive Distributed Lag (ADL) model following Mustapha *et al*, (2013), is then used to estimate the effect of crude oil price on the Nigerian stock market while controlling for exchange rate adjustments. Granger causality is also used to determine the direction of causation between the crude oil price, stock market performance as well as exchange rate. The Granger causality model is specified below:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_l y_{t-l} + \beta_1 x_{t-1} + ... + \beta_l x_{t-l} + \varepsilon_t \tag{1}$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + ... + \alpha_l x_{t-l} + \beta_1 y_{t-1} + ... + \beta_l y_{t-l} + \upsilon_t \tag{2}$$

where y_t is Nigerian stock market all share index and x_t is crude oil price. Furthermore,

$$y^*{}_t = \alpha_0 + \alpha_1 y^*{}_{t-1} + ... + \alpha_l y^*{}_{t-l} + \beta_1 x_{t-1} + ... + \beta_l x_{t-l} + \varepsilon^*{}_t \tag{3}$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + ... + \alpha_l x_{t-l} + \beta_1 y^*{}_{t-1} + ... + \beta_l y^*{}_{t-l} + \upsilon^*{}_t \tag{4}$$

The All Share Index and crude-oil price series were tested for stationary using the Augmented Dickey Fuller (ADF) and Phillip Perron (PP) unit root tests. The idea is to ascertain the stability of the series during the study period and to deduce how exchange rate adjustments over the study have affected the performance of the Nigerian stock market. Asemota and Bala (2011) demonstrated the use of these measures to determine the time series properties of inflation and interest rate in their study on Nigeria. Taking a cue from them, the time series properties of exchange, oil price and stock market all share index, were also examined based on the ADF and PP unit root tests. These models are presented below:

The ADF equation is specified below:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_p \Delta y_{t-p} + \upsilon_t \tag{5}$$

$$\Delta x_t = \alpha x_{t-1} + y_t'\delta + \beta_1 \Delta x_{t-1} + \beta_2 \Delta x_{t-2} + \ldots + \beta_p \Delta x_{t-p} + \upsilon_t \tag{6}$$

$$\Delta y_t^* = \alpha y_{t-1}^* + z_t'\delta + \beta_1 \Delta y_{t-1}^* + \beta_2 \Delta y_{t-2}^* + \ldots + \beta_p \Delta y_{t-p}^* + \upsilon_t \tag{7}$$

where y_t is the all share index of the Nigerian stock exchange, x_t is crude oil price and y^*_t exchange rate. An alternative nonparametric method for unit root testing is the Phillip Perron (PP). Given equation:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \varepsilon_t \tag{8}$$

Unit root test by the PP test estimates equation (8) and modifies the t-ratio of the coefficient (see Phillips and Perron, 1988). Thus, the asymptotic distribution of the PP modified t-ratio is the same as the ADF statistics.

To estimate the effect of crude oil price and exchange rate on the Nigerian stock exchange, the ADL Model (modified from Mustapha *et al.*, 2013) is specified below

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 \lambda_{t-1} + \alpha_j \sum_{j=0}^{p} \lambda_{t-j} + \alpha_i \sum_{i=1}^{p} y_{t-i} + \beta_1 \chi_{t-1} + \beta_j \sum_{i=0}^{p} \chi_{t-j} + \varepsilon_t \tag{9}$$

where y is the Nigerian stock index, λ captures the effect of crude oil price and χ the effect of exchange rate.

The data used in this study were collected from the Central Bank of Nigeria, the Nigerian Stock Exchange and Bloomberg on daily basis from June 18th 2012 to June 30th 2015 on a five day weekly (Monday to Friday) basis. The choice of Mondays to Fridays is to harmonize the oil price data with the Nigerian stock market data (which are available on a-five day weekly basis). Global crude oil prices are often reported using the Brent or WTI (the West Texas Intermediate). Thus, to examine the response of the Nigerian stock market to crude oil price movement, daily oil price data for the Brent was collected from Bloomberg. The all share index data was collected from the Nigerian stock exchange, while exchange rate data (Nigerian naira to the United States dollar), was from the Central Bank of Nigeria. In all cases, the data collected covered two periods: January 2008 to July 2009 (for the 2008 global financial crisis); and June 2012 to June 2015 (to capture price movement before and after the 2014 fall in global crude oil price). Empirical estimation of equations was done using Eviews software. The next section discusses results.

4.0 Results and Discussion

Table 1 presents the result from the granger causality tests. The result for the 2008 financial crisis period showed evidence of a short run relationship between stock market performance and crude oil price fluctuation. Effect of the global financial crisis during that period, however, showed no evidence of using exchange rate policy to cushion the effect of crude oil price fluctuation on the stock market. The reason is simple: global crude oil price did not record significant decline during the 2008 global financial crisis, compared to the experience in 2014. This might not be unconnected with the high and stable price of crude oil (averaging $83 pb) which Nigeria benefitted from during the crisis period of 2008-2009.

Table 1: Granger Causality Results

Interacting Variables	2008 Financial Crisis		2014 Decline in Crude oil Price
	Lag Length	Direction of Causality	Direction of Causality
Stock Market & Crude oil Price	1	→ **	No Causality
	2	No Causality	No Causality
	3	No Causality	No Causality
	4	↔ **	No Causality
	5	↔ ***	← *
	6	↔ ***	No Causality
Exchange Rate & Crude oil Price	1	No Causality	No Causality
	2	No Causality	→ *
	3	No Causality	No Causality
	4	No Causality	No Causality
	5	No Causality	No Causality
	6	No Causality	No Causality

*Source: Authors; *** Significant at 1%, ** Significant at 5%, *Significant at 10% critical value*
Note: ↔ means bi-directional causality, ← means unidirectional from right to left, → unidirectional causality from left to right

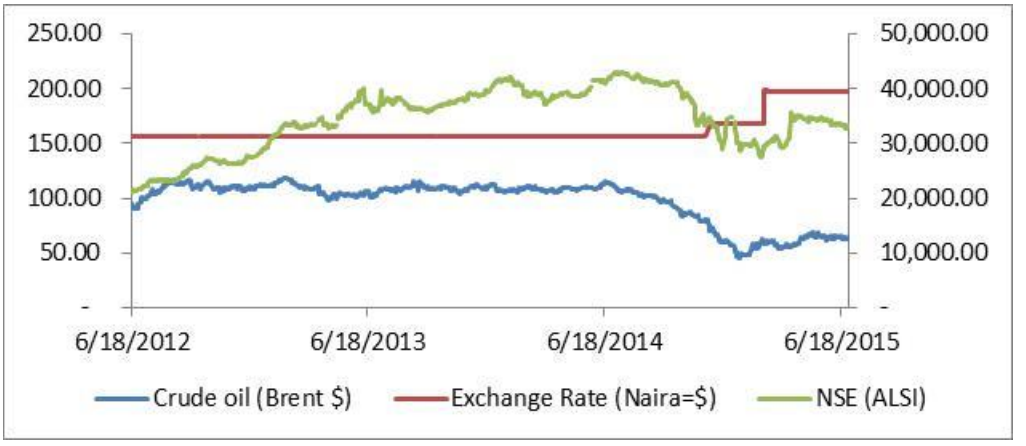
On the other hand, granger causality results for the 2014 Decline in Crude oil Price period (see Table 1), showed that crude oil price granger causes stock market performance. Also, that exchange rate policy could be used to cushion the effect of crude oil price decline on the stock market. Allowing the naira to retain its appropriate market value relative to the US dollar, is one way to keep foreign currency supply flowing steady to Nigeria. In the absence of a strong manufacturing sector and weak industrial base, naira devaluation allows for this. ***The granger causality result is statistically significant at 10% critical value hence, requires further exploration on the issue of naira devaluation and its effect on calming the effect of falling crude oil price on the Nigerian stock exchange in particular, and the Nigerian economy in general.*** Further insight on the effect of crude oil price on the performance of the Nigerian stock market and the possible effect of exchange rate policy could be gleaned from the time series property of the these variables during the 2008 global financial crisis and he 2014 crude oil price decline period.

Table 2: Stationarity Result

	2014 Decline in Crude Oil Price (Brent)		2008 Global Financial Crisis	
Variables	**ADF Test**	**Philip Perron**	**ADF Test**	**Philip Perron**
Stock Market	*I*(I)	*I*(I)	*I*(I)	*I*(I)
Crude oil	*I*(I)	*I*(I)	*I*(I)	*I*(I)
Exchange Rate	*I*(0)	*I*(0)	*I*(I)	*I*(I)

Source: Author

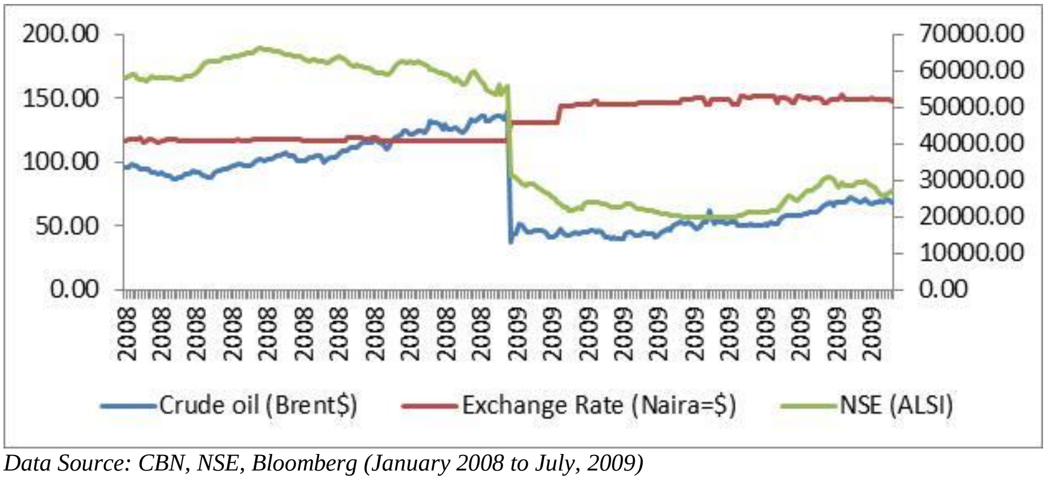
Result from the Augmented Dickey Fuller and Philip Perron unit root test shows that all the variables were non-stationary in both periods except for exchange rate in the 2014 period. The flexible exchange rate policy that operated during the 2008 global financial crisis period helped in checking the effect of the global financial crisis on the value of the nation’s currency. Since the decline in crude oil price started in 2014, however, no commitment to such path has been demonstrated by the Central Bank. Rather, the apex bank has pegged the rate at 197/$1. Figure 1 and Figure presents the trend of crude oil price, stock market performance and exchange rate during the 2014 crude oil price decline period and the 2008 global financial crisis.



Data Source: CBN, NSE, Bloomberg (June 2012 to June 2015)

Figure 1: Trend of Crude oil Price, Stock Market Performance& Exchange Rate

In Figure 1, exchange rate remained stable in periods when the stock market performance maintained a positive trend. From mid-2014 however, when the crude oil price and stock market performance fell, the naira was allowed to find its value hence, mitigating situations of widened gap between the official and parallel market rate. Thus, as the price of crude oil continued to fall, the government could devalue again to sustain inflow of dollar to the economy while finding long term solutions by making clear its policy direction on diversification of the economy. The trend of crude oil price, stock market performance and exchange rate (relative to the dollar) shows what was done in 2008 (see Figure 2).



Data Source: CBN, NSE, Bloomberg (January 2008 to July, 2009)

Figure 2: Trend of Crude oil, Stock Market and Exchange Rate

During the 2008 global financial crisis, the trend of exchange rate can be seen in Figure 2 to record some level of up and down movement. This reflects effort by the Central Bank at the time to stabilize the value of the naira despite the effect of the global financial crisis on the economy through the stock market stock market for instance. Situating these results in an Autoregressive distributed lag model showed that, while crude oil price is positively correlated with the performance of the Nigerian stock market, exchange rate adjustment could be used to cushion co-movement effect between crude oil price and stock market performance (see Table 3).

Table 3: Estimated ADL Model (2014 Oil Price Drop)

Variables	**Coefficients**
NSE (-1)	0.1710***
	0
Oil (-1)	6681.22***
	-0.009
Exchange Rate (-5)	-36941.7*
	-0.0894
Constant	8.5221
	-0.5428
Durbin Watson	2.046
F-statistics	9.799
	0
Adjusted R-square	0.0447

Figures in parenthesis are p-values

Evidence from autoregressive distributed lag model showed that, since oil prices are positively related with Nigeria's equity market, negative price shocks would drag the stock market down in times of turmoil (Table 3). This result is significant at 1% critical value. Stabilizing the exchange rate, however, could assist in cushioning the effect of dwindling oil prices on stock prices. Structural stability test also showed evidence of multiple structural breaks in the model (see Figure 3). This result was, however, significant at 10% critical value.

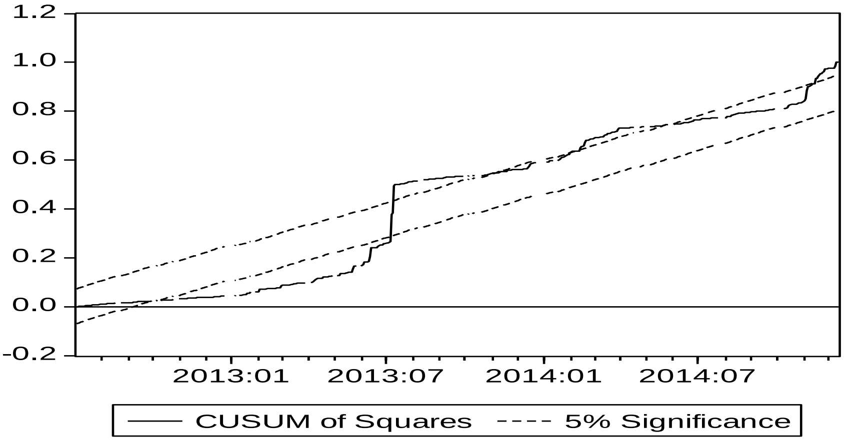


Figure 3: Structural Break Trend (CUSUM of Squares)

From the estimated distributed lag model, while the effect of crude oil price on the stock market would be felt within a day, the lag length for exchange rate policies in cushioning oil price effect on the stock market could take up to five days. This implies that while exchange rate policy adjustments could help boost stock prices, it might not be fast enough to calm stock market rumblings attributed to oil price fluctuation. Test of residual stability using the CUSUM of squares test, revealed evidence of multiple breaks in the Nigerian stock exchange caused by oil price volatility. This implies that, it would require more than exchange rate policies to stabilize distortions in the nation's financial market caused by oil price volatility.

5.0 Summary and Conclusion

This paper examines the effect of crude oil price movement on the Nigerian stock market during the 2008 global financial crisis and the 2014 decline in crude oil price. During the 2008 global financial crisis, no causality was found between exchange rate and crude oil price movement in Nigeria. Rather, causality was found from stock market to crude oil prices in the first lag and granger causing each other at higher lags. In periods of persistent decline in crude oil prices, however, where causality is from crude oil price to stock market performance, devaluation of the naira was effective in calming wide swings in the country's capital market. The analysis of daily data on stock market All Share Index, exchange rate (to the US dollar) and crude oil price (the Brent) collected from the Nigerian stock exchange, the Central Bank of

Nigeria and Bloomberg, showed that oil prices positively relates with the Nigerian stock market performance thus, would drag the market down in times of turmoil. Devaluation of the naira, however, was found to have been effective in cushioning the effect of crude oil price decline on the performance of the Nigerian stock market.

The conclusion from this paper is that the Central Bank of Nigeria (CBN) cannot continue to keep the official exchange of the naira to the dollar low as though it is very strong when really it is not. This would lead to wide gap between the official rate and the parallel market rate. Result from the granger causality result which is statistically significant at 10% critical value, signals weak causal influence hence, requiring further exploration on the issue of naira devaluation as a policy option in calming the effect of falling crude oil price on the Nigerian stock exchange in particular, and the Nigerian economy in general.

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