



TESTING ASYMMETRIC EFFECT OF OIL PRICE ON EXCHANGE RATE IN NIGERIA: NEW EVIDENCE FROM NONLINEAR ARDL APPROACH

¹Namadina Hamza and ²Sunday Elijah

¹Department of Economics, Federal University Gusau, Zamfara State, Nigeria

hamzanamadi60@gmail.com

²Department of Economics, Federal University Gusau, Zamfara State, Nigeria

elijahsundayecons@gmail.com

ABSTRACT

This study examined the existence of asymmetry relationship between oil price and exchange rate in Nigeria during the period 2008:1-2017:12. The study applied unit root test to ensure that none of the variables is integrated of order I (2) and nonlinear autoregressive distributed lags (NARDL) model, respectively. The results revealed that all the variables are stationary at their first difference and that there exist cointegrating relationship between oil price increase, oil price reduction and exchange rate in the study period. Similarly, the findings from the study indicate that oil price reduction has a significant negative impact on the exchange rate. However, the increase in oil price has a negative but not significant effect on exchange rate in the long run, thereby confirming the existence of asymmetric relationship between oil price increase and decrease on the exchange rate. The estimated model on the basis of diagnostic tests is found to be adequate and stable from the CUSUM stability test. The paper therefore recommends that the monetary authorities should adopt other policy measures to guard against the negative effect of oil price decrease on the values of Nigeria's currency (Naira)

Key words: Asymmetry, Exchange Rate, Nonlinear ARDL, Oil Price

INTRODUCTION

Oil is an important source of energy for the global economy. With the increasing energy demand, countries are becoming more and more dependent on oil, and the oil price fluctuations following this dependency may affect countries' economies (Delavari, Alikhani & Esmaeil, 2013). In this regard, the oil price fluctuations have a diverse effect on oil exporting and importing countries. Specifically, it will affect manufacturing costs and inflation rate of oil importing countries and vice versa. Similarly, rising oil prices leads to not only transfer of income from oil importing to oil exporting countries but also affects exchange rate (Amano & Norden, 1998; Turhan, Hacıhasanoğlu & Soytaş, 2012).

As for oil exporting countries, decreasing oil prices will decrease export revenue (the opposite applies for increasing prices), decreasing oil prices pressure on balance of payments, affect economic growth negatively. While public expenditures decrease with the decline in income, interest rates will raise in financial markets which will have liquidity problems (Rickne, 2009).

Nigeria has been an oil producing country which source more than 85 percent of its revenue from sale of crude oil. The shock in the price of oil may likely exert some influence on macroeconomic activity particularly exchange rate. For instance, an appreciation of real exchange rate creates a problem in the country's balance of payments because it results to overvaluation which makes imports cheaper and exports dearer thereby reducing the competitiveness of a country and Nigeria been import dependent country may have its competitiveness reduce in the international market. Considering the importance of oil on exchange rate financial economists were prompted to undertake a number of researches to examine the relationship between oil price and exchange rates such as (Ahmad(2004); Osuji, 2015; Amano, 1998; Beckman & Czudaj, 2016; and Basher, Haug &



Sardosky, 2016; Akhil, Rishad & Kumar, 2017; Khalid, Arezou & Amjad, 2018) amongst others and the results have been mixed with some having negative relationships between oil price and exchange rate (Ahmad, 2004; Amano, 1998) and others find a positive relationship such as, Beckman & Czudaj (2013) and Osuji (2015). However, there are studies that could not establish any significant relationship between oil price and exchange rate Olomola, (2006) and Bai & Rath (2015). Therefore, Nigeria being an oil exporting and importing country, there is the need to re-examine the effect of oil price on its exchange rate. While other numerous studies such as Ogundipe, Ojeaga & Ogundipe (2014), Olomola, (2006) and Osuji (2015) examine the effect of oil price on exchange rates on a linear modelling framework in Nigeria. However, the studies failed to examine the asymmetric relationship between oil price and exchange rate dynamics as they assume the same effect of oil price increase and oil price decrease have same effect on exchange rate. This study therefore, fills in the gap by decomposing oil price into positive and negative to see if they exact same effect on exchange rate or not.

The study is structured into five sections, following the introduction is the review of empirical literature, section three of the paper dwells on the methodology, section four is the presentation of results and discussion while section five concludes and make recommendations based on the findings of the study.

LITERATURE REVIEW

Amano (1998) applies Johansen Juselius (1990) cointegration approach and Phillips and Hansen (1992) fully modified ordinary least square methods of cointegration on monthly datasets of Germany, Japan and United states for the period from January 1973 to June, 1993 to investigate the effect of oil price on exchange rates of some developed countries and finds a negative relationship between oil prices and Japanese Yen and German Mark, where as there is a positive significant relationship between oil price and United states Dollar. Quariee, Mignon & Penot (2007) also use Johansen (1988) as well as Johansen and Juselius (1990) cointegration approach on united states, China, Japan monthly data from January 1974 to November, 2004 and finds that oil price rise is associated with the appreciation of foreign exchange rate, that there is significant positive relationship between oil prices and exchange rate. Similarly, Beckman & Czudaj (2013) using United States monthly data from the period of January 1974 to November, 2011 by applying Markov switching and vector error correction model to examine the effect of oil price on exchange rate in the event of regime shift finds a significant positive relationship between oil prices and the Dollar, in other words, increase in oil price is associated with the appreciation of the United States Dollar. Similarly Ogundipe, Ojeaga & Ogundipe (2014) examining the effect of oil price shocks on Nigeria's exchange rate using annual data for the period from 1970 to 2011 and using Johansen cointegration approach and vector error correction model find a significant positive log run relationship between oil price and exchange rate in the study period. Osuji (2015) examines the impact of international oil prices on exchange rates in Nigeria using monthly data over the period from January 2008 to December, 2014 and applying multiple regression analysis of estimation. The study finds a significant positive relationship between oil price and the exchange rate.

But on the contrary, Ahmad (2004) undertakes a study in Norway to examine the nonlinear effect of oil price on Norwegian Krone to US Dollar exchange rate using daily data for the period 01/01/1986 to 12/8/1998 and applies nonlinear econometric model framework of Ozkan and Sutherland (1998) equilibrium correction model and find a significant negative relationship between oil prices and exchange rate in the study period. Olomola (2006) investigated the impact of oil price shocks on aggregate economic activity in Nigeria using quarterly data from 1970 to 2003. He found that contrary to previous empirical findings, oil price shocks do not affect output and inflation in



Nigeria significantly. However oil price shocks were found to significantly influence the exchange rate.

Similarly, Ghosh (2011) applying Generalised Auto Regressive Conditional Heteroskedasticity (GARCH) and Exponential Generalised Auto Regressive Conditional Heteroskedasticity (EGARCH) models on India's daily dataset for the period 2:7:2007 to 26:11:2008 find that increase in oil price returns leads to a depreciation of India's Rupee, that is there exist a negative significant relationship between oil prices and exchange rate of the Rupee. Beckman & Czudaj (2016) also used static and dynamic copula approach on five oil exporting countries namely; Brazil, Canada, Mexico and Norway using daily data for the 01:09:2003 to 01:09:2013 finds that oil prices is associated with depreciation of currency of the countries used for the study, in other words, there exist a negative significant relationship between oil prices and exchange rates. Similarly, Narayan, (2013) in a study of 14 Asian countries using monthly data for the period from 1990 to 2009 and applying generalized least squares based time series predictive regression model, that is Westerland and Narayan (2012) approach find that oil price is a significant predictor of exchange rates in Bangladesh, Honk Kong, Cambodia and Vietnam. Applying structural vector autoregressive analysis Basher, Haug & Sardosky (2016) analyse monthly data that ranges from 01:1988 to 2008:12 for the emerging markets countries documents a negative relationship between oil price and exchange rate that is positive oil price shocks leads to a drop in the foreign exchange rate. Benhamad (2012) applies wavelet analysis approach to a United States monthly data for the period between 1970:02 to 2010:02 finds a strong bidirectional causality real oil prices and real dollar exchange rates in the period of the study. Zhang (2012) applies linear causality on US daily data for the period January, 2, 2003 to June 3, 2011 divided into two samples post financial crises and pre financial crises period and finds unidirectional causality between oil price and exchange rates.

Similarly, Bai & Rath (2015) applies Hiemestra and Jones (1994) non linear granger causality on India and China monthly datasets for the period between January 1994 and April 2013 and finds out that oil price does not linear granger cause exchange rate in both the two countries, but find a significant non linear causality between oil price and exchange rate in India. Akhil, Rishad & Kumar (2017) examined the causality between oil prices and exchange rate in India using daily data from 16th February 2016 to 1st February 2018 using Toda and Yamamoto approach, the study finds that there exist unidirectional causality from oil price to exchange rate and not vice versa. Khalid, Arezou & Amjad (2018) investigates the relationship between oil price and exchange rate in ASEAN-5 countries using the nonlinear autoregressive distributed lag approach and Toda and Yomamoto non granger causality approach, the study finds a long run asymmetry between oil price and exchange rate for Indonesia and Malaysia. The study also finds a unidirectional causality between oil prices and exchange rate.

METHODOLOGY

This section of the paper presents the methodology used in the paper. It is classified into two subsections, which are data and variable measurements and model specification.

Data

The data used in this paper is monthly data from the period of 2008:1 to 2017:12 obtained from statistical Bulletins of the Central Bank of Nigeria (Various) editions. The use of time series data for the study is informed by the fact that to test asymmetric relationship among various variables of interest using the nonlinear autoregressive distributed lag bounds test approach requires the use of time series. Moreover, the period is chosen to assess both the effect of oil price increase and decrease on exchange rate in Nigeria.

Variables Measurement

The variables used in this paper are measured as follows:

Exchange Rate: It is the price of country currency in relation to other country currency. It is measured as the exchange rate of Naira to the United State's Dollar. It is measured in nominal terms following the works of Ogundipe *et al*, 2014.

Oil Price: Oil price is measured as the price of crude oil in the United States Dollar. It is the price at which oil is sold at the international oil market. In this paper both the price in the United States Dollar as used in the works of Ghosh (2011); Osuji (2015) and Khalid, Arezou & Amjad (2018).

Model Specification and Methodology

The model for the study is specified in its functional form as follows:

$$EXR = f(OP) \text{-----} (1)$$

Where:

EXR= exchange rate

OP = oil price

And specifying the model in econometric form is as follows:

$$EXR = \beta_0 + \beta_1 OP + \varepsilon_t \text{-----} (2)$$

Where the variables are as defined in equation 1, β_0 is the constant and β_1 is the slope coefficients with respect to oil price effect on exchange rate. ε_t is the error term that is assumed to be identically and independently distributed with zero mean and constant variance.

Many macroeconomic relationships such as the one depicted in equation (2) is assumed to follow linear relationship, where as macroeconomic relationships may tend to exhibit nonlinear relationships because the speed at which macroeconomic variables trend in the downward direction is different from the speed at which it moves in the upward direction, therefore suggesting asymmetric relationship. Non consideration of asymmetry in macroeconomic relationships may hide some vital information for inference and hence policy decisions (Shin, Yu & Greenwood, 2014). Hence, decomposing the regressors into positive and negative component around an assumed zero threshold level plays a vital role in establishing macroeconomic relationships.

The non linear autoregressive distributed lags (NARDL) model is a model advance by Shin et al 2014 is an extension of the linear ARDL model as advanced by Pesaran, Shin, & Smith (2001) by adding the positive and negative component of the independent variable of interest to the linear ARDL model. Following the works of Pesaran *et al*. (2001), the model for the estimation in linear ARDL framework is specified as:

$$\Delta EXR_t = \alpha_0 + \alpha_1 EXR_{t-1} + \alpha_2 OP_{t-1} + \sum_{i=0}^p \Delta \alpha_3 EXR_{t-i} + \sum_{i=0}^q \Delta \alpha_4 OP_{t-i}^+ + \sum_{i=0}^r \Delta \alpha_5 OP_{t-i}^- + \varepsilon_t \text{-----} (3)$$

Where all the variables are as defined above, to account for asymmetry, oil price is decomposed into its positive and negative partial sum following the works of Shin et al 2014 and Badeeb and Lean (2016) as OP^+ and OP^- .

$$OP^+ = \sum_{j=1}^t \Delta OP_j^+ = \sum_{j=1}^t \max(\Delta OP_j, 0)$$

$$OP^- = \sum_{j=1}^t \Delta OP_j^- = \sum_{j=1}^t \min(\Delta OP_j, 0)$$

The asymmetric error correction model following the works of Shin et al 2014 and Ibrahim, 2015 is specified as:

$$\Delta EXR_t = \alpha_0 + \alpha_1 EXR_{t-1} + \alpha_2^+ OP_{t-1}^+ + \alpha_2^- OP_{t-1}^- + \sum_{i=0}^p \Delta \alpha_3 EXR_{t-i} + \sum_{i=0}^q \Delta \alpha_4 OP_{t-i}^+ + \sum_{i=0}^r \Delta \alpha_5 OP_{t-i}^- + \varepsilon_t \quad (3)$$

The variables are as defined above ,p,q, and r are the lag orders and automatic lag selection and $\theta_1 = -(\alpha_2^+ / \alpha_1)$ and $\theta_2 = -(\alpha_2^- / \alpha_1)$ are the long run coefficient of the positive and negative changes in oil prices $\sum_{i=0}^q \Delta \alpha_4 OP_{t-i}^+$ and $\sum_{i=0}^r \Delta \alpha_5 OP_{t-i}^-$ captures the short run effect of oil price increase and oil price decrease on exchange rate respectively.

EMPIRICAL RESULTS

This section of the paper presents the results of the unit roots tests and test for the presence of cointegration among the variables.

UNIT ROOTS TEST

The test for the presence of unit roots in macroeconomic time series datasets is vital to avoid the problem of spurious results and hence in appropriate policy decisions. Moreover, the nonlinear ARDL like the linear ARDL does not accommodate I (2) variables, therefore there is the need to carry out stationarity test of the variables. Hence the traditional augmented Dickey- Fuller (ADF) and Phillips and Peron (1988) unit roots test were conducted and the variables were all found to be stationary at their first difference considering constant with trend, and all the variables contains unit root at their level value and there exist no I(2) among the variables.

The results are presented in Table 1 below.

Table 1: Results of Unit Root Tests

	Level		First Difference	
	Augmented Dickey-Fuller	Phillips Peron	Augmented Dickey-Fuller	Phillips Peron
NEER	-1.2076	-1.2075	-2.4875**	-8.8546**
OIL	-1.4857	-2.0705	-5.2790***	-6.7651**
Oil_P	-2.6605	-2.7382	-8.8333**	-8.1645**
Oil_N	-3.6688	-2.5496	-4.8794***	-6.5456**

Notes: * and ** denotes significance at 5% and 1% significance level respectively. The figure in parenthesis denotes the optimal lag**

COINTEGRATION TEST

The next stage in the estimation of the non linear ARDL model is to test for the presence of cointegration and it uses an F test for the joint significance of the lagged level values of the independent variables. It tests the null hypothesis of no cointegration ($H_0: \alpha_1 = \alpha_2^+ = \alpha_2^- = 0$) against the alternative ($H_1: \alpha_1 \neq \alpha_2^+ \neq \alpha_2^- \neq 0$). The test uses two sets of critical values as used in Pesaran et al (2001). If the computed F statistic is greater than the upper bound critical value, the null hypothesis is rejected. But, if on the other hand the F computed value is less than the lower bound critical value, it establishes no cointegration. In other words, we fail to reject the null hypothesis of no cointegration. The empirical result of the test for cointegration is presented in Table 3 below.

Table 3: Results of Bounds Test and Test for Asymmetry

F statistic	95% Lower Bound	95% Upper Bound	Conclusion
6.61905	2.45	3.61	Cointegration
37.6559(0.000)			Asymmetry Exist

Source: Extracted from Pesaran *et.al.* (2001) Table and computed using EVIEWS 9

The results from Table 3 above indicates that the computed F statistic value of 6.61905 exceeds the 5 percent upper bound critical value of 3.61 and therefore, reject the null hypothesis of no cointegration. Having established the existence of cointegration relationship among the variables, the next step is the use of nonlinear ARDL is to test for the existence of asymmetry between oil price and exchange rate. It uses Wald test to test the hypothesis that the effect of oil price increase or decrease on the exchange rate is equal. In other words it test the hypothesis that $\theta_1 = \theta_2 = 0$ against the alternative hypothesis that $\theta_1 \neq \theta_2 \neq 0$. The result from the test of asymmetry indicates an F statistic value of 37.6559 with the probability value of 0.000 and therefore, the probability value indicates significance to reject the null hypothesis and therefore concludes that the effects of oil price increase and decrease on exchange rate are not symmetrical.

The Long run estimate of the long run relationship with the presence of cointegration is presented in Table 4 below.

Table 4: Long Run Coefficients of NARDL

Dependent Variable: Nominal Exchange Rate			
Variable	Coefficient	t- statistic	P- Value
Oil ⁺	-0.0410	-0.6545	0.5140
Oil ⁻	-0.2224	-4.1748	0.0001
C	72.11	19.721	0.0000

Source: Computed by the author Using Data from using E views econometrics 9.0.

From the results in Table 4 it shows that there is a negative relationship between oil price increase and nominal exchange rate in Nigeria in the study period using the price of oil in United States Dollar. The result indicates that decrease in oil price has a negative impact on exchange rate where a 10% decrease in oil price decreased exchange rate by 2.224%. However, when oil price increased

by 10 % the exchange rate decreased only by about 0.4 % and it is not significantly affected by the oil price increase. The exchange rate was not affected at the same level when the oil price decreased as compared to the oil price increase.

TABLE 5: SHORT RUN RESULTS OF NARDL

Dependent Variable: Nominal Exchange Rate			
Variable	Coefficient	t-statistic	P value
Dneer(-1)	0.6811	2.4313	0.0166
Doil_p(-1)	0.15425	1.0117	0.3138
Doil_n(-1)	-0.08304	-0.8310	0.4077
ECT(-1)	-0.5519	-1.8574	0.0659
R² = 0.069, D.W = 2.08327, F statistic= 2.08327(0.0876), J-B = 0.6578(0.7091)			

The short run results presented in Table 5 indicates that all the variables under estimation do not have significant short run effect on exchange rate with the exception of lagged value of the nominal effective exchange rate which is the dependent variable. Additionally, the error correction term is negative and statistically significant at 10 percent level of significance, which shows that in the event of crash in the nominal exchange rate the system adjusts itself to long run equilibrium at the speed of 55 percent.

To ensure that the model is free from any problem a test for the presence of serial correlation indicates that the model is free from serial correlation given the probability value of Breusch-Godfrey LM test of 0.79 which is greater than 0.05 and also the Durbin Watson statistic of 2.083 reaffirms that the model is free from serial correlation. Similarly, the Jacque- Bera test for the normality of the residuals indicates that the residuals are also normally distributed since the probability value of the Jacque - Bera test is more than 0.05.

Stability Tests

Stability test is conducted using the plots of cumulative sum of recursive residuals and cumulative sum of square residuals as plotted in figure 1 and 2 below, The plot of CUSUM test shows that the model is stable given that the lines fall within the 5 percent critical bound lines, that is the blue lines. However, the plot of the CUSUMQ indicates that model is not stable in the study period as the red line is sometimes outside the 5 percent critical upper and lower bounds line. However, this may not be unconnected with the period when there was global economic crisis coupled with the political instability and economic crisis the country faced such as oil theft and so could affect the forecast value of future exchange rate.

Figure 1 CUSUM graph

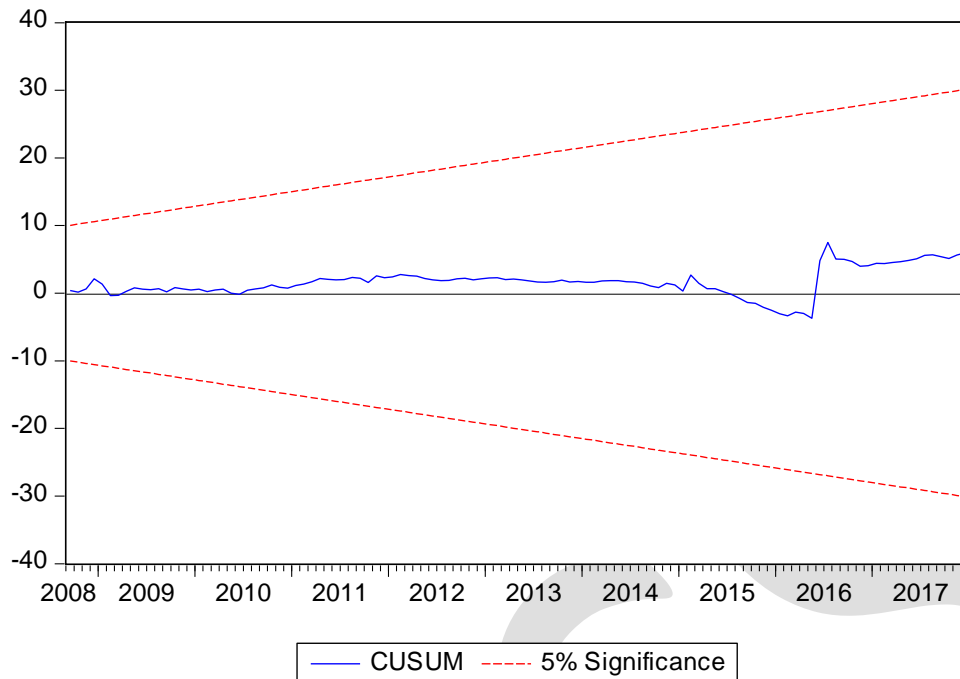
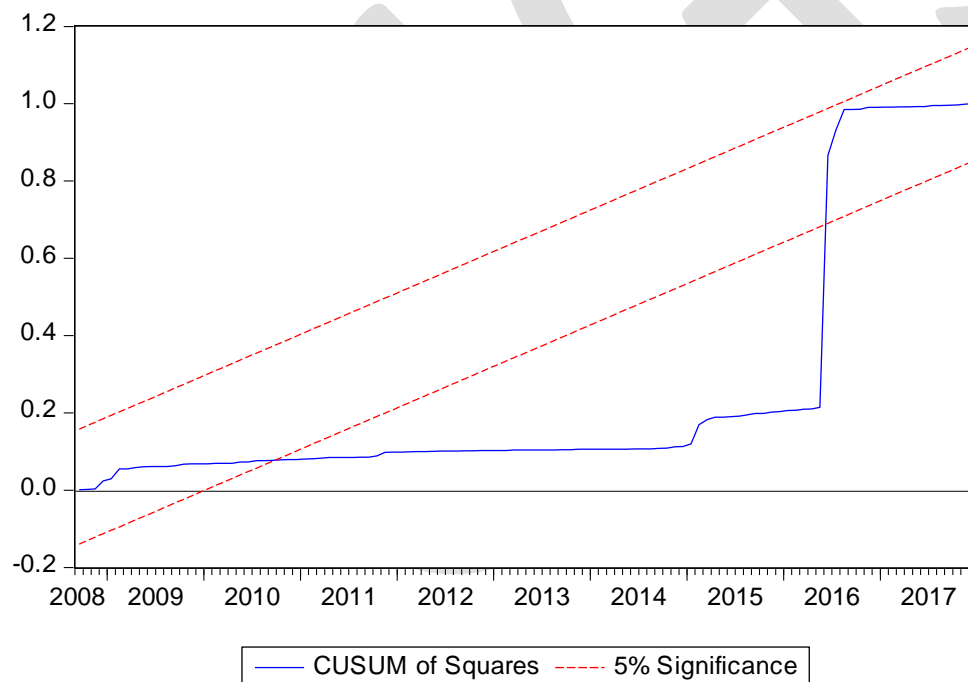


Figure 2 CUSUMQ graph



DISCUSSION

This study examines the effect of oil price increase and decrease on nominal exchange rate in Nigeria using monthly time series data for the period from January 2008 to December, 2017 by applying recently developed non linear autoregressive distributed lag model approach.



On the relationship between positive effects (oil price increase) on nominal exchange rate the study finds that oil price has neither significant long run nor short run relationship with nominal exchange rate in the study periods. The finding from the study concurs the finding of Bai & Rath (2015). However the findings from the study contradicts the finding of Osuji(2015); Beckman (2013); Basher, Haug and Sardosky who finds a significant positive relationship between oil price and exchange rate. The finding from the study also differs from the previous finding of other works such as Amano (1998); Ahmad (2004); Ghosh (2011) and Beckman, Berger & Czudaj (2016) among other studies who finds a significant negative relationship between oil price and exchange in their various studies. Furthermore, since this study decompose oil price increase into positive and negative to test if their exists asymmetric effect of oil price on exchange rate, the study finds that oil price decrease has a significant negative effect on exchange rate in Nigeria which is in conformity with other findings such as Beckman, Berger & Czudaj (2016) but which negates the findings of Osuji (2015) and Beckman & Czudaj (2013) among other studies that finds a positive relationship between oil price and exchange rate although they consider symmetric relationship in their model estimations.

CONCLUSIONS AND POLICY IMPLICATIONS

In this study we examine the effect of oil price on exchange rate in Nigeria using the nonlinear autoregressive distributed lag bounds test approach to capture both the long run as well as the short run asymmetric effect of oil price on exchange rate. Based on the analysis we found evidence of asymmetries in the long run and short run. Specifically, in the long run oil price reduction has a significant negative effect on nominal exchange rate that is oil price reduction tends to reduce exchange rate, while, oil price increase does not have significant effect on exchange rate. On the other hand, the short run result indicates that neither oil price increase nor reduction has a significant effect on exchange rate in the study period.

The results have important implications for both policy and research. From the policy perspective it is evident that oil price reduction is what normally affects the exchange rate of the country, therefore, the monetary authorities should as a matter of policy devise some measures that the increase in foreign exchange earnings from the sale of crude oil be used to set off the negative effect of oil price reduction on the exchange rate. Another policy perspective of the finding of this work is the need for the economy to be diversified from its monoculture economy so as to have other sources of foreign exchange to cope with effect of shocks in oil prices on macro economy in general and exchange rate in particular.

The implication for future research from this study is that accounting for asymmetric effect of independent variables on the dependent variable. This study explores the asymmetric effect of oil price on exchange rates in Nigeria. Other researches could also be conducted to explore the asymmetric effects of other determinants of exchange rate in Nigeria.

REFERENCES

- Ahmad, Q. F. (2004). Oil price and exchange rate: norwegian evidence. *Econometrics Journal*, 7(1), 476-504.
- Akhil, S., Rishad, A., & Kumar, V. (2017).Crude oil prices and exchange rates in india: evidence from toda and yomamoto approach. *Journal of Business and Economics Research*, 23(2), 234-243.



- Amano, R. A., & Van Norden, S. (1998a). Oil prices and rises and fall of the us real exchange rate. *Journal of International Money and Finance*, 17(2), 299-316.
- Amano, R.A., & Van Norden, S. (1998b). Exchange rate and oil prices. *Review of International Economics*, 6(4), 683-694.
- Bai, D. P., & Rath, B.N. (2015). Non linear causality between oil price and exchange rate: a comparative study of China and India. *Energy Economics*, 51(1), 149-156.
- Basher, S.A., Haug, A.A., & Sadorsky, P. (2016). The impact of oil shocks on exchange rates. A Markov -switching approach. *Energy Economics*, 5(4), 11-23.
- Beckman, J., & Czudaj, R. (2013a). Oil prices and effective dollar exchange rates. *International Review of Economics and Finance*, 27(1), 621-636.
- Beckman, J., & Czudaj, R. (2013b). Is there a homogenous causality pattern between oil prices and currencies of oil importers and exporters? *Energy Economics*, 40(1), 665-678.
- Beckman, J., Berger, T., & Czudaj, R. (2016). Oil price and FX-rates dependency, *Quantitative Finance*, 16 (3), 477-488.
- Benassy-Quere, A., Mignot, Y.A., & Penot, A. (2007). China and the relationship between oil price and the dollar. *Energy Policy*, 35(11), 5795-5805.
- Benhmad, F. (2012). Modelling non linear granger causality between oil price and U.S. dollar: A wavelet based approach. *Economic Modelling*, 29(4), 1505-1514.
- Bernanke, B., Gertler, M., & Watson, M., (1997). Systematic monetary policy and the effect of oil price shocks. *Brookings Papers on Economic Activity*, 1, 91-142.
- Delavari, M., Alikhani, G. N., & Esmaeil, N., (2013) Does long memory matter in forecasting oil price volatility? *International Journal of Engineering, Business and Enterprise Applications*, 7(1), 27-34.
- Ghosh, S. (2011). Examining crude oil prices-exchange rate nexus for India during the period of extreme oil price volatility. *Applied Energy*, 88(5), 1886-1889.
- Johansen, S. (1988). Statistical Analysis of cointegration vectors. *Journal of Dynamics and Control*, 12(2-3), 231-54.
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration- With applications to the demand for Money. *Oxford Bulletin of Economics and statistics*, 52(2), 169-210.
- Khalid, M. K., Arezou, H., & Amjad, M. K. (2018). Revisiting the effects of oil prices on exchange rate: asymmetric evidence from ASEAN-5 countries. *Economic change and Restructuring*, 51(1), 1-22
- Ogundipe, O. M., Ojeaga, P., & Ogundipe, A.A. (2014). Oil price and exchange rate volatility in Nigeria. *Journal of Economics and Finance*, 5(4), 1-10.
- Olomola, A. (2006). Oil Price Shock and aggregate economic activity in Nigeria, *African Economic and Business Review*, 4(2), 120-125.



- Osuji, E. (2015). International oil price and exchange rate in Nigeria: A causality analysis. *International Journal of Academic Research in Economics and Management Sciences*, 4(3), 11-23.
- Phillips, P. C. B., & Hansen, B. (1990). Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies*, 57(1), 99-125.
- Phillips, P.C. B., & Perron, P. (1988). Testing for unit roots in a time series regression.
- Rickne, J. (2009). Oil prices and real exchange rate movements in oil-exporting countries: The role of institutions. *Research Institute of Industrial Economics*. Working Paper, 810.
- Turhan, I. Hacıhasanoğlu, E., & Soytaş, U., (2012), Oil Prices and Emerging Market Exchange Rates. *Central Bank of the Republic of Turkey*, Working Paper, No: 12/01.
- Zhang, Y. J. (2013). The links between oil price and the exchange value of US dollar. *International Journal of Energy Economics and Policy*, 3(4), 341-351.