

Effect Of Crude Oil Price And Exchange Rate Volatility On Capital Formation In Nigeria (1981-2015)

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Abstract: The study examined the effect of crude oil price and exchange rate on capital formation in Nigeria from 1981 to 2015. The study used two explanatory variables (crude oil prices and exchange rate) and one explained variable (capital formation). Test carried out include unit root test, co-integration test, and ordinary least square. The study revealed that: There is negative and insignificant relationship between exchange rate and capital formation in Nigeria, there is positive and significant relationship between capital formation and crude oil prices in Nigeria. Based on the findings, the study recommends that, government should implement policies that will aid Nigeria to produce, export goods and demand less of foreign currencies so as to enable the nation's currency to appreciate. Also government should ensure that any form of crude oil transaction that will make crude oil prices to decline should be avoided, so as to enable crude oil prices to rise at all time.

Keywords: Crude oil prices, Exchange rate and Capital formation.

I. INTRODUCTION

For any economy to strive optimally, it is essential that it expands the capacity for production and services. Capital accumulation provides the money needed to expand economic activities and thus contributes to the overall economic growth. Capital formation is that part of gross domestic product which includes income, net exports and services and stands as an indicator of the level of investment in the economy (Lucky and Uzah, 2016). This indicates that, society does not utilize the whole of its current production activities to the needs and immediate desires of consumption but channels some portion of it to the creation of capital good (Jhingan, 2005). Nwikina (2000) stated that capital formation is the conscious process of accumulating and increasing the stock of capital assets of a nation. In a narrower sense, Anamgba and Azubuike (2012) opined that capital formation is how a nation increases its real capital such as factory building, machinery, tractors, human resources etc. The term capital formation has been defined differently by various scholars, but virtually means the same thing. Therefore, this study will not go into definitional analysis. This study defined capital formation as the nation's accumulated capital for the purpose of future production.

Over the years, due to the felt importance of capital asset to the Nigerian economy, the nation have embarked on several structural, institutional and policy reforms to achieve economic growth and development but these reforms have not specify the portion to be directed as capital stock particularly when crude oil prices are favorable.

Studying the relationship between crude oil price, exchange rate and capital formation is crucial, but it has received little attention from researchers in the Nigerian economic environment over the years, and there is a technical literature on various aspects of the subject; whether the crude oil price and exchange rate can be seen as a determinant of capital formation is however, not as clear. To the best of our knowledge this study is the first to examine the relationship between crude oil price, exchange rate and capital formation in Nigeria. Based on these, this study is embarked upon to fill the gap in literature.

II. LITERATURE REVIEW

Economic theories have shown great evidence that capital formation contributes greatly in the growth and development

of an economy. Inadequate capital is therefore a block to economic growth and development. Nigeria is still a developing country, oil accounts for more than 90 percent of its export, 25 percent of its gross domestic product and 80 percent of government total revenues (Mordi and Adebisi, 2010).

Crude oil price changes in the international market could have an impact on capital accumulation due to the link between crude oil and all economic activities. Theoretically, crude oil price increase leads to a transfer of income from importing countries to exporting countries through a shift in the terms of trade, Majidi (2006). In economic reasoning, the higher the crude oil price increase and the longer higher prices are sustained, the higher the macroeconomic impact.

This is to show that in an oil exporting countries, higher crude oil prices lead to increase in capital, increase in employment, favorable exchange rate, and increase in tax revenue, budget surplus, low interest rate and moderate inflation rate. Crude oil price increase then could have positive effect on crude oil exporting countries, that is income and wealth increases in oil exporting countries, because importing countries pays more and if the exporting countries utilize income in home country then this will lead to more investment opportunities and employments.

Keynesian views which support the view that so long as an economy has not reached the level of full employment, any increase in money supply or the price would exhaust itself in raising the level of employment and output and not the general price level in the economy, Nigeria being a country that has not attained full employment will not experience high inflation as a result of crude oil price increase, rather it increases the capital stock and currency appreciates in this regard.

The term crude oil price changes refer to the rise or fall (change), volatility, instability or fluctuation in the crude oil prices in the international oil market. "Price volatility" refers to the extent at which prices fluctuate over a period of time. When market prices tend to change a lot over a relatively short time, the market is said to have high volatility. When relatively stable prices prevail, the market is said to have low volatility. When crude oil prices are high, it is believed that, crude oil exporting countries such as Nigeria will earn more income. In Nigeria, it is not clear whether high prices leads to more savings. If Nigeria does save more in periods of high crude oil prices and these savings are channeled to productive activities, the nation's export in other products outside crude oil could rise, and this could lead to favorable exchange rate.

Over the years the prices of crude oil fluctuate in the international market. Evidence from the OPEC basket list, the crude oil price oscillated between \$33 and \$140 in 2008, \$38 and \$77 in 2009, \$66 and \$90 in 2010, \$89 and \$120 in 2011, \$88 and \$124 in 2012, \$96 and \$114 in 2013, \$52 and \$110 in 2014 and \$34 and \$63 in 2015 and \$26 and \$51.29 in 2016, \$45.13 and \$64 in 2017 and between \$60 and \$68.46 from January to February 2018.

It is observed that, the nation's economy has been largely unstable, consequence of the heavy dependence on crude oil revenue and the changes of the crude oil prices. As a result, oil dependence has exposed Nigeria to oil price changes which could result to systematic shocks.

The system here include exchange rate. Exchange rates could be said to be the price of one currency in terms of another. Exchange rate could be seen as the rate of transformation of one currency to another or the rate at which one currency is exchange for another. Nzota, (2014) expressed exchange rate as the price of one unit of foreign currency in terms of the domestic currency.

The monetary model assumes that changes in the money supply affect exchange rates in one way or the other. The model explains fluctuations in exchange rates in terms of changes in the demand for and supply of money between two currencies. Conceptually, any rise in real incomes given a fixed nominal money supply leads to a fall in prices, thus induces exchange rates to appreciate. On the other hand, any increase in money demand leads to increase in prices which eventually lead to exchange rate depreciation (Nzota, 2014).

It is expected that when crude oil prices are high, Nigeria will earn more income, which will minimize the demand for foreign currency. This will lead to more investments and output that will lead to more exports. From the balance of payment theory, a favorable balance will induce exchange rate to rise. A favorable balance implies a decrease in demand of foreign currencies.

Studies have investigated the impact of crude oil price and exchange rate volatility on capital formation but ended with conflicting results and conclusions.

Uremadu (2006) investigated the possible determinants of capital formation in Nigeria from 1980 to 2004. The study employed Ordinary Least Squared method. The results revealed positive influence of cumulative foreign private investment, index of energy consumption and total banking system credit to the domestic economy, and a negative influence of gross national savings, domestic inflation rate, maximum lending rate, foreign exchange rate and debt service ratio on capital formation.

Ogbonna and Ebimobowei (2012) investigated the impact of petroleum revenue and the Nigeria economy, employing ordinary least square model from 1970 to 2009, with oil revenue, inflation rate, gross domestic product and per capita income. The study showed that petroleum revenue affects per capita income and gross domestic product positively, while inflation was affected negatively.

Mohmmadreza, Ali and Zahra (2013) assessed the effect of oil price shocks on economic growth in 26 oil exporting countries by employing GLS model, the relationship between capital formation, gross domestic product, employment rate and oil prices revealed that positive shocks affected all the variables positively and negative shocks affected all the variables negatively. Udude, Odo, Ituma and Elom-Obed (2017) investigated the impact of oil export on gross fixed capital formation in Nigeria from 1980 to 2015. Using the ordinary least square method, the result revealed the relationship to be negative and insignificant. Similarly, Lucky and Uzah (2016) investigating the determinants of capital formation in Nigeria from 1981 to 2014. The variables in the study include gross capital formation, gross domestic product, broad money supply, credit to private sector, gross national savings, commercial bank lending rate, exchange rate, inflation rate, external debt, public expenditure, government revenue, terms of trade and operating surplus. The results from

the ordinary least square showed that exchange rate have negative and insignificant relationship with gross fixed capital formation.

Nahousse (2017) examined the causality between economic growth and changes of the real exchange rate in Cote d' Ivoire between 1980 and 2012. The study employed ARDL and Yamamoto causality test to investigate the long run relationship and causal relationship. The results revealed the existence of a long run relationship, also revealed the existence of a bidirectional relationship among the variables. Stephen and Obah (2017) examined the impact of national savings on economic growth in Nigeria from 1990 to 2015. National savings was used as independent variable and gross domestic product was used as a dependent variable. Utilizing ordinary least square method, a positive and significant relationship was found among the variables.

From the forgoing, there is no consensus regarding how significant and the relative impact whether negative or positive, thus becomes imperative for a study such as this to verify the claims of the previous scholars.

III. METHODOLOGY

A. RESEARCH DESIGN

The study adopted an ex-post facto research design which is a form of descriptive research in which investigator starts with the observation of the dependent variable then studies the independent variable in retrospect for possible relationship and effects on the dependent variable.

B. DATA COLLECTION METHOD

This study collected data from secondary sources. Secondary data were collected from the central bank of Nigeria and as well as journal publications with the scope of 1980 to 2015.

C. MODEL SPECIFICATION

In order to achieve the objectives of this work, a linear regression model was formulated and the Granger causality tests were conducted on the formulated model. The model is stated as follows:

$$CF = f(COP, EXR,) \quad (1)$$

This equation can be transformed into a linear function thus:

$$CF = \text{D}_0 + \text{D}_1\text{FDI} + \text{D}_2\text{CF} + \text{AE} \quad (2)$$

where;

FDI = Foreign Direct Investment

UER= Unemployment rate

CF= Capital Formation

D_0 = the constant

D_1 - D_2 = the coefficients of the explanatory variables

AE = Error term

D. ESTIMATION METHODS

Different econometric analysis tools have been employed in this study to analyze the effect of crude oil price and exchange rate on capital formation in Nigeria.

a. DESCRIPTIVE STATISTIC

The study employed descriptive statistics for the calculation of mean, median, mode, frequencies, variances and standard deviations.

b. LINEAR REGRESSION

The linear regression is an econometric technique which correlates the changes in the variables to other variables. Regression analysis is used to show the accuracy and appropriateness of model and how much independent variable influence on the dependent variable in our study.

c. CORRELATION ANALYSIS

This shows the direction of the relation. The signs – or + will show whether the relationship is in positive direction or in the negative direction.

d. UNIT ROOT TEST

This test is a pre test that shows the stationarity or otherwise of the variables specified and a yardstick for chosen further investigation approaches (Odo, Anoke, Nwachukwu and Agbi, 2016). The essence is to determine the nonstationary property of each variable. We must test each of the series in the levels. All variables will be tested in levels using the Augmented Dickey-Fuller (ADF).

e. CO-INTEGRATION

The co-integration test is conducted to look at the long run linear relationship using the Johansen co-integrating model, and find out if there is a possibility of an existence of a co-integrating relationship among the variables.

f. ERROR CORRECTION MECHANISM

The reason for error correction mechanism is to measure the speed of adjustment of the dependent variables to the changes in the independent variables on the short run and to their equilibrium levels. This study expects a negative coefficient as a sign, suggesting an automatic adjustment mechanism and that the capital formation responds to deviations from equilibrium in a balancing manner.

IV. DATA PRESENTATION AND ANALYSIS

A. DATA PRESENTATION

It shows the variables used for this study on yearly basis from 1980 to 2015. CF represents Capital Formation, COP

represents crude oil price and EXR represent exchange rate. Data is in the appendix.

B. DESCRIPTIVE STATISTICS

Table 4.1 below shows the descriptive statistics of the data presented in table 4.1.

Descriptive Statistics

	CF	COP	EXR
Mean	1.74E+10	40.31743	72.74914
Median	4.14E+09	27.60000	22.05000
Maximum	8.57E+10	109.4500	192.4400
Minimum	2.02E+09	12.28000	0.610000
Std. Dev.	2.51E+10	30.63322	67.41015
Skewness	1.657735	1.182559	0.209963
Kurtosis	4.126839	3.004568	1.319923
Jarque-Bera	17.88225	8.157627	4.373535
Probability	0.000131	0.016928	0.112279
Sum	6.10E+11	1411.110	2546.220
Sum Sq. Dev.	2.14E+22	31905.39	154500.4

Observations 35 35 35

Table 4.1: Descriptive Statistics

The descriptive statistics on table 4.1 shows that capital formation (cf) has a mean value of 1.74E+10, while the maximum and minimum values are 8.57E+10 and 2.02E+09 respectively. Crude oil price (cop) has a mean value of 40.31743, while the maximum and minimum values are 109.45 and 12.28 respectively. Exchange rate (exr) has a mean value of 72.74914, while the maximum and minimum values are 192.44 and 0.61 respectively.

The Jarque-Bera statistic indicated that only exchange rate is normally distributed with the p-value 0.112279, while capital formation (cf =0.000131), and crude oil price (cop = 0.016928).

C. CORRELATION MATRIX

	CF	COP	EXR
CF	1	0.831785336781931	0.6601635327239081
COP	0.831785336781931	1	0.7317821085464384
EXR	0.6601635327239081	0.7317821085464384	1

The correlation matrix on table 4.2 shows the correlation among the variables. CF is shown to have a strong positive correlation of 0.83 with COP, and strong positive correlation of 0.66 with EXR. COP has a positive strong correlation of 0.83 with CF, and a strong positive correlation of 0.73 with EXR. EXR has a strong positive correlation of 0.66 with CF and 0.73 with COP.

D. AUGUMENTED DICKY-FULLER UNIT ROOT TEST

Variable	ADF value	Critical Values			Conclusion
		1%	5%	10%	
CF	-5.468402	-4.262735	-3.552973	-3.209642	Stationary @ 1 st dif.
COP	-4.059727	-4.262735	-3.552973	-3.209642	Stationary @ 1 st dif.
EXR	-4.993715	-4.262735	-3.552973	-3.209642	Stationary @ 1 st dif.

Source: Extracted from Unit Root Test Result (Appendix)

Table 4.3: Unit root test result

The Augmented Dickey-Fuller Unit Root test result as summarized above shows that all the variables are stationary at first difference.

E. JOHANSEN CO-INTEGRATION

Date: 02/28/18 Time: 01:57
Sample (adjusted): 1983 2015
Included observations: 33 after adjustments
Trend assumption: Linear deterministic trend
Series: CF COP EXR
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized	Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.613610	41.85502	29.79707	0.0013
At most 1	0.271350	10.47509	15.49471	0.2460
At most 2	0.000865	0.028554	3.841466	0.8658

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.613610	31.37994	21.13162	0.0013
At most 1	0.271350	10.44653	14.26460	0.1842
At most 2	0.000865	0.028554	3.841466	0.8658

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b*S11*b=I):

CF	COP	EXR
7.46E-11	-0.076962	0.001626
-6.76E-11	0.007041	0.008352
5.08E-11	-0.061623	0.026990

Table 4.4: Summary of co-integration test

Both trace test and Maximum Eigenvalue test indicated one co-integrating equation existing between the dependent and independent variables. This reveals that there is a long-run equilibrium relationship between the dependent and independent variables.

F. REGRESSION ANALYSIS

Dependent Variable: CF
Method: Least Squares
Date: 02/28/18 Time: 03:06
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.12E+10	3.41E+09	-3.284323	0.0027
COP	7.10E+08	1.02E+08	6.928117	0.0000
EXR	-2.374525	5.012213	-0.473360	0.6395
ECM(1)	-0.575742	1.26E+08	-0.632729	0.0319

R-squared	0.779326	Mean dependent var	1.57E+10
Adjusted R-squared	0.756498	S.D. dependent var	2.40E+10
S.E. of regression	1.18E+10	Akaike info criterion	49.33979
Sum squared resid	4.06E+21	Schwarz criterion	49.52119
Log likelihood	-810.1066	Hannan-Quinn criter.	49.40083
F-statistic	34.13852	Durbin-Watson stat	0.780595
Prob(F-statistic)	0.000000		

Table 4.5: Regression analysis

The result above shows that, COP has a coefficient of 7.10 meaning that one percentage change in crude oil price leads to 7.10 percent change in capital formation in the positive direction in Nigeria. This indicates that there is a high response of capital formation to changes in crude oil prices in the positive direction, and this is statistically significant at 5% level.

EXR has a coefficient of -2.37 meaning that one percent change in exchange rate leads to 2.37 percent change in capital formation in the negative direction in Nigeria. This indicates that there is a high response of capital formation to the changes of exchange rate, but this is not statistically significant at 5 percent level.

The results further show that r-squared is 0.78 while adjusted r-squared is 0.76 indicating that 76 percent of changes in capital formation is attributable to the combined effect of the crude oil prices and exchange rate in Nigeria.

Overall, the results show that F-statistic is 34.14 with a probability of 0.000000 indicating that the combined impact of the independent variables on the dependent variable is statistically significant.

Furthermore, the Error Correction Co-efficient is appropriately signed with a value of -0.58 with a probability of 0.03, which is significant at 5% level of significance. The coefficient indicates that the model has a 58 percent speed of adjustment from equilibrium position on the long run.

G. GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests

Date: 02/28/18 Time: 02:13

Sample: 1981 2015

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
COP does not Granger Cause CF	33	19.1335	0.0256
CF does not Granger Cause COP		4.18978	6.E-06
EXR does not Granger Cause CF	33	2.77184	0.0397
CF does not Granger Cause EXR		0.26298	0.7706
EXR does not Granger Cause COP	33	1.85579	0.1750
COP does not Granger Cause EXR		0.17995	0.8363

H. DISCUSSION OF RESULTS

The relationship between capital formation and crude oil prices is found to be positive, while the relationship between capital formation and exchange rate is found to be negative.

Generally, our model suggests a significant relationship between crude oil prices, exchange rate and capital formation using the f-statistics. The coefficient of determination (R^2) 76% Meaning 76% change in capital formation is influenced

by the predictor variables while the remaining 24% is explained by other variables not captured in the model. The result also indicated a unidirectional causation running from crude oil prices to capital formation in Nigeria. Also, there is a unidirectional relationship running from exchange rate to capital formation but indicated non causation between crude oil prices and exchange rate.

The findings of this study concur with that of Mohammadreza, Ali and Zahra (2013) that positive oil price shocks affected capital formation positively and negative crude oil price shocks affected capital formation negatively. It is also line with the findings of Lucky and Uzah (2016) and Uremadu (2006) that exchange rate fluctuation had a negative and insignificant relationship with capital formation.

V. SUMMARY OF FINDINGS

The research work investigated the effect of crude oil prices, exchange rate on capital formation in Nigeria from 1981 to 2015. The following were the findings:

- ✓ Crude oil price has a positive relationship with capital formation.
- ✓ Exchange rate is found to be negatively related with capital formation.

VI. CONCLUSION

The study examined the relationship between crude oil prices, exchange rate and capital formation in Nigeria from 1981 to 2015. The variables used in the study include crude oil prices (COP) and exchange rate (EXR) as independent variables, while capital formation (CF) was used as dependent variable. The relationship between exchange rate and capital formation is found to be negative but insignificant. It means if exchange is increasing, then capital formation will be decreasing and vice versa. This empirical finding followed fairly close to what economic theory will have suggested. The monetary model assumes that changes in the money supply affect exchange rates in one way or the other. The model explains fluctuations in exchange rates in terms of changes in the demand for and supply of money between two currencies. Conceptually, any rise in real incomes given a fixed nominal money supply leads to a fall in prices, thus induces exchange rates to appreciate. On the other hand, any increase in money demand leads to increase in prices which eventually lead to exchange rate depreciation. The result suggests that for a significant improvement on capital formation, the focus of policy and strategy should be on measures to reduce the rising exchange rate.

The relationship between capital formation and crude oil price is found to be positive and significant. It means higher crude oil price leads to increase in capital formation. The result suggests that for a significant increase in capital formation, the focus of policy and strategy should be on measures to increase crude oil prices.

VII. RECOMMENDATIONS

Based on the findings of the study, we therefore recommend the following;

- ✓ Government should implement policies that will aid Nigeria to produce, export and demand less of foreign currencies so as to enable the nation's currency to appreciate. With this, there will be improvement on the nation's capital formation.
- ✓ Government should ensure that any form of crude oil transaction that will make crude oil prices to decline should be avoided, so as to enable crude oil prices to rise at all time. Rising crude oil prices means more income, more investment, more output, less demand for foreign currencies and more capital assets.

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