



Exchange Rate Fluctuations, Oil Prices and Economic Performance: Empirical Evidence from Nigeria

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ABSTRACT

The dominance of oil in the Nigeria's external sector and as its major source of revenue is not in dispute. This therefore necessitates the need to probe the nexus and the magnitude of the effects of fluctuation in the exchange rate on oil price and on how it impacts the Nigeria's economic performance. Against this background, this study evaluated the effects of exchange rate fluctuations on crude oil price as well as on economic performance, simultaneously. The ordinary least square and the two stage least squares estimation techniques were employed. The study found that real exchange rate has a positive effect (1.2%) on the Nigeria's economic performance. We also found that a 1% increase in the price of oil would positively influence the economic performance of Nigeria by the magnitude of 4%. The R^2 shows that 82% deviation in the gross domestic product was captured by the explanatory variables whereas the J-statistics of the model is insignificant, thus, confirming the relevance and validity of the instruments used.

Keywords: Exchange Rate, Oil Prices and Economic Performance

JEL Classifications: E3, F41, F43

1. INTRODUCTION

Many developing countries, gifted in natural resources, like Nigeria heavily depend on international commodity prices which make their domestic economic activities tied to the vagaries of the commodities prices. Since it is generally recognized that commodity prices can be a source of macroeconomic instability in developing countries, the dependency of the Nigerian economy on oil resource glaringly insinuate the possibility of instability in the economy because of the fluctuation that may arise in the price of such commodities in the international market.

According to Obadan (2006), "oil is an international trade commodity that attracts foreign exchange and is a quick source of capital accumulation. Huge revenues are realized from the wide differential between unit production costs and economic rents, royalties, petroleum taxes, oil exports etc." With the neglect of the real sector of the Nigerian economy due to the discovery of oil, the performance of its economy has been on the downturn considering other institutional difficulties that impede the growth possibilities of the economy.

Further, the Nigerian government's annual budget has always been pegged to a specific amount of the international price of crude oil, thus, making both the government fiscal and monetary policy to be susceptible to fluctuation that may arise in crude oil price volatility which engenders the performance of the economy through the exchange rate¹. The age-long debate among economists regarding the effect of exchange rate fluctuations on oil prices and economic performance still remains unresolved. For instance, it has been argued in the recent time that volatility of the exchange rate induces uncertainty and risk in investment decision with destabilizing impact on the macroeconomic performance (Mahmood and Ali, 2011). In line with this argument, CBN (2011) document that the appreciation of the Nigerian Naira from N128 in the year 2007 to N120 in 2008 was accompanied by a decline in the growth rate from 7% in the year 2007 to 6% in the year 2008. This implies that holding

¹ Exchange rate is the price of one country's currency in relation to another country. It is the required amount of units of a currency that can buy another amount of units of another currency. It can further be classified into nominal and real exchange rates. Exchange rate is often expressed in terms of two currencies: domestic and foreign. It can also be expressed either in nominal or real terms.

other factors constant, the exchange rate had a significant effect on the Nigeria's economic growth rate in the year 2007-2008. From the year 2008 to 2009, the growth rate increased from 6% to 7% while the Naira depreciated from N120 to N148. Thus, this confirms that the exchange rate has a significant impact on the movement of the growth rate of the economy overtime. However, beyond the exchange rate, there are other factors that affect the performance of the economy. The scenario observed in 2011 wherein the Naira witnessed incessant depreciation that brought its value to N156 while the growth rate stood at 6.9% gives credence to this (CBN, 2011).

In Nigeria, the management of the exchange rate is monitored by the Central Bank of Nigeria. Following the adoption of structural adjustment policy in 1986, the country has moved from a peg regime to a flexible exchange rate regime. In practise, no exchange rate is clean or pure float, that is, a situation where it is left completely to be determined by market forces but rather the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange market in order to attain some strategic objectives (Mordi, 2006).

In lieu of the significance of exchange rate on domestic and foreign economic activities, business owners appear convinced that its fluctuations have real effects especially on oil prices and economic performance of a country. Mordi (2006) reports that operators in the private sector are concerned about volatility of exchange rate because of its effects on their investment which may result into capital gains or loses. Also, lots of empirical studies have been carried out on oil prices and the real exchange rate in the developed countries (Clarida and Gali, 1995; Chaudhuri and Daniel, 1998; Spatafora and Stavrev, 2003; Bjournland and Hungnes, 2008; Akram, 2004). However, only a few studies exist on the relationship between oil price and real exchange rate (Ozsoz and Akinkunmi, 2011; Suleiman and Naurah, 2011) in developing countries including Nigeria. Thus, since these studies examine the causality from oil prices to real exchange rate, this study therefore investigates the causality running from real exchange rate to oil prices in Nigeria.

The dominance of oil in the Nigeria's external sector and as its major source of revenue is not in dispute. This therefore necessitates the need to probe the nexus and the magnitude of the effects of fluctuation in the exchange rate on oil price and on how it impacts the Nigeria's economic performance. There is a plethora of separate studies on the effect of exchange rate fluctuations on economic performance (Iqbal et al., 2011; Dada and Oyeranti, 2012; Polodoo, 2011) and oil prices and exchange rate (Jamaladeen and Auwal, 2011; Shehu, 2011). This study is unique in the sense that it analyses the effects of exchange rate fluctuations on crude oil price as well as on economic performance, simultaneously.

The remainder of this paper is structured as follows. Section 2 presents the exchange rate, oil price and economic growth profile of Nigeria. Section 3 briefly describes the methodology and as well presents the empirical results. The last section concludes the study.

2. EXCHANGE RATE, OIL PRICE AND ECONOMIC GROWTH PROFILE OF NIGERIA

A survey of data relating to Nigeria's exchange rate, oil price and gross domestic product (GDP) growth rate indicates a rising trend with a few exceptional cases. Over a 4 year average, the GDP annual growth rate rose consistently from 1960 to 1970 and afterwards began to decline. In specific, from its average value of 5.8% in 1970 to 1974, it came down to 4.1% and later assumed a negative value of 2.8%. From 1980 to 1985, something dramatic would have happened to the Nigeria's annual growth rate. The average for the period rose to 5.4%. Nigeria had another bad growth experience from 1990 to 1994 when its growth rate deteriorated to an unexpected value of 2.5%. The decade 2000-2010 brought good economic fortunes for Nigeria. It provided another phase of consistent annual economic growth (Figure 1).

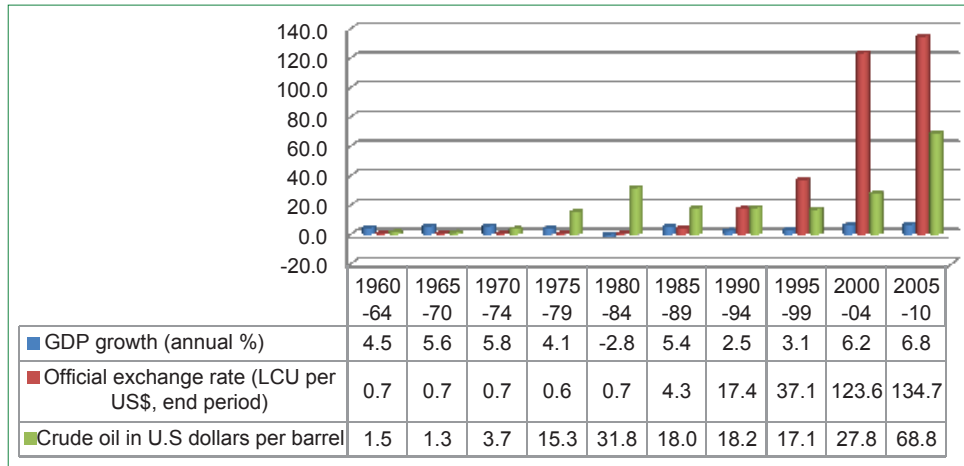
In addition, the data from the World Bank's WDI (2013) further provides the exchange rate profile of Nigeria. Figure 1 shows that from 1960 to 1970, the Nigeria's official exchange rate remained unchanged. Over the 4 year average considered in the Figure 1, the official exchange rate appreciated further, at least since after Nigeria's independence, by dropping to 0.6 Nigeria's Naira for 1 U.S dollar as against the earlier 0.7 Naira. It is striking to note that for the period of 1980-1984 when the annual growth rate of the GDP became negative, the official exchange rate depreciated to 7.0 Naira. 1985-1989 was another period when the official exchange rate appreciated again and afterwards depreciated consistently till 2010.

Crude oil price in U.S dollar per barrel had an obvious jump in the 70's. Something intriguing is further observed considering the fact that the jump from 3.7 dollars per barrel of crude oil (1970-1974) to 15.3 dollars (1975-1979) did not translate into GDP growth. In fact, the reverse was witnessed. Even as the as rise in oil price persisted in the next four period, the GDP growth rate plunged to negative. The period that spans 1985-1999 was not in favour of crude oil prices. Notice that within the same period, the Naira official exchange rate rose consistently (Figure 1).

3. METHODOLOGY AND PRESENTATION OF EMPIRICAL RESULTS

Leaning on the literature review as the premise for the inclusion of variables into the model of this study, the GDP serves as a proxy for economic performance (Azeez et al., 2012; Dada and Oyeranti, 2012). Also, the inclusion of oil price in equation 2a and 2b is to capture the impact of oil price on the GDP of Nigeria. To better capture the external sector performance, trade openness which shows the relationship of the country with other nations of the world is included in the model, terms of trade also is included in the model in this regard. The inflation rate further explains the effects of price on the performance of the economy at large whereas the inclusion of the exchange rate like in previous studies is to enable us evaluate its impact on the dependant variables.

Figure 1: Exchange rate, oil price and economic growth profile of Nigeria



Source: Analysis of data from World Bank’s WDI (2013) and OPEC (2013)

In equations 2a and 2b, the measure of oil price was included based on existing literatures (Suleiman and Naurah, 2011). The real exchange rates capture the relationship that exists between real exchange rate and the oil price while according to Barsky and Kilian (2004), world GDP indicates the demand for oil. The world crude oil production also is used as a proxy for the supply of oil in the world which includes both the OPEC and the non-OPEC countries. The equations are specified as follows;

$$OILP = \alpha_0 + \alpha_1 RER + \alpha_2 WGDP + \alpha_3 WCROP \quad (1a)$$

$$GDP = \beta_0 + \beta_1 OILP + \beta_2 RER + \beta_3 TROP + \beta_4 INF + \beta_5 TOT \quad (2a)$$

Incorporating the stochastic variable, the equations become:

$$OILP = \alpha_0 + \alpha_1 RER + \alpha_2 WGDP + \alpha_3 WCROP + u_1 \quad (1b)$$

$$GDP = \beta_0 + \beta_1 OILP + \beta_2 RER + \beta_3 TROP + \beta_4 INF + \beta_5 TOT + u_2 \quad (2b)$$

Where:

GDP = Gross domestic product of Nigeria

OILP = Oil price

RER = Real exchange rate

TROP = Trade openness

INF = Inflation

TOT = Terms of trade

WGDP = World gross domestic product

WCROP = World crude oil production

In equation 1, α_{0-3} are parameter estimates depicting the relationship that exist between oil price and its explanatory variables while in equation 2 β_{0-5} are the parameter estimates describing the relationship between the independent variables and dependent variable. u_1 and u_2 are the error terms.

The econometric model is of the simultaneous equation type given that oil price which entered as endogenous variable in equation 2 first entered as an exogenous variable in equation 1.

Considering the estimation of equation 1, real exchange rate, world GDP and world crude oil production are independent of the error term (u_1), that is, the $cov(RER, u_1) = 0$, $cov(WGDP, u_1) = 0$ and $cov(WCROP, u_1) = 0$. However, GDP is not independent of u_1 , thus, $cov(GDP, u_1) \neq 0$. This therefore indicates that while equation 1 can be estimated using the ordinary least square estimation technique; using the same for equation 2 will yield a biased result. Therefore, the instrumental variable regression technique (two stage least squares [TSLS]) was employed in estimating equation 2.

In order to examine the time series properties of the data, the study employed the augmented dickey-fuller (ADF) method since the Engle–Granger single equation cointegration test is based upon the ADF test. Therefore,

$$\Delta y_t = \beta_0 + \beta_1 t + \sum \alpha \Delta y_{t-1} + \epsilon_t \quad (3)$$

Where ϵ_t is the random disturbance term, and y_t represents the first difference of the series under consideration, α is the coefficient of y_{t-1} which allow for chosen lag length that will make the error term uncorrelated. The null hypothesis of unit root is tested against the alternative hypothesis of times series being stationary.

For the short run analysis of the model, the ECM is incorporated into the model so as to account for disequilibrium that may arise in the short run while the Engle–Granger single equation cointegration test was performed to examine the possibility of a long run relationship between the variables. Engle and Granger (1987) cointegration definition is given as follows; Y_t and X_t are said to be cointegrated of order (d, b) where $d \geq b \geq 0$, written as $Y_t, X_t \sim CI(d, b)$, if both series are integrated of order b and there exists a linear combination of them. Thus, this establishes the long run relationship between the variables. Incorporating the error correction mechanism into equations 1 and 2, we have;

$$OILP = \alpha_0 + \alpha_1 RER + \alpha_2 WGDP + \alpha_3 WCROP + \alpha_4 ECM_{t-1} \quad (1c)$$

$$GDP = \beta_0 + \beta_1 OILP + \beta_2 RER + \beta_3 TROP + \beta_4 INF + \beta_5 TOT + \beta_6 ECM_{t-1} \quad (2c)$$

For equation 1, the relationship between crude oil price and the WGDP, real exchange rate is expected to be positive. On the contrary, its relationship with WCROP is expected to be negative while in the second equation the independent variables are expected to exert a positive effect on the GDP.

From the above ADF test (Table 1), inflation rate and WCROP are stationary series at 10% each while all the remaining variables are non-stationary I(1).

From the Engle–Granger cointegration test (Table 2), using the tau-statistic and the z-statistic, there exists one cointegrating relationship stemming from the WGDP which is significant at 1% judging with the z-statistic.

3.1. The Error Correction Model

Model 1:

$$d(OILP) = -9.63 - 0.04d(RER) - 1.94d(WCROP) + 0.004d(WGDP) + 0.28d(RER[-1]) + 1.82d(WCROP[-1]) - 0.15ECM$$

$R^2 = 0.70$, $F\text{-stat} = 9.04$.

From the above error correction model, the relationship between the real exchange rate and oil price is found to be negative. That is, a percentage increase in the real exchange rate will induce a 0.04% decrease in the crude oil price and vice versa. The relationship between the world crude oil WCROP and the oil price is negative which satisfies a priori expectation. Thus, a 1% increase in crude oil supply will cause about a 1.94% decrease in its price. This affirms the conventional inverse relationship between crude oil supply and its price. In addition, the relationship between the world GDP and the crude oil price is positive which confirms that oil price is also been driven by the growing demand from the emerging economies and from all other demanders of crude oil. Thus, a percentage increase in the world GDP will trigger a 0.4 increase in the crude oil price.

The previous year’s real exchange rate parameter exhibits a direct relationship with the current crude oil price likewise the relationship between the previous crude oil production level and the current crude oil price. The error correction mechanism incorporated in the model shows that the speed of adjustment of the short run disequilibrium is 15% before converging to its long run equilibrium. The R^2 shows that 70% variation in the crude oil price is capture in the model while the F -statistics shows the joint significance of all the explanatory variables in explaining the crude oil price.

From Table 3, using the tau statistic and z-statistic decision criteria, there exist no cointegrating relationships among the variables. In view of this, equation 2 was estimated using the TSLS. From the obtained regression results, it was noticed that the relationship between oil price and the GDP is positive, thus, satisfying the a priori expectation given that Nigeria is both oil exporting and importing country. In specific, a 1% increase in the oil price would positively influence Nigeria’s economic performance by the magnitude of 4%.

Table 1: Unit root test

Variable	ADF statistics		Order of integration
	Level	First difference	
GDP	0.9995	0.0004	I (1)
INF	0.0933	0.0030	Stationary
OILP	0.6487	0.0009	I (1)
RER	0.5255	0.0538	I (1)
TOT	0.2964	0.0011	I (1)
TROP	0.8114	0.0301	I (1)
WCROP	0.0829	0.0066	Stationary
WGDP	0.9901	0.0144	I (1)

ADF: Augmented dickey-fuller

Table 2: Engle-Granger single equation co-integration test (Equation 1)

Automatic lags specification based on Schwarz criterion (maxlag=7)				
Variables	tau-statistic	P*	z-statistic	P*
OILP	-4.024138	0.1110	-12.08116	0.5892
RER	-2.757143	0.5683	-11.94880	0.5985
WCROP	-3.075034	0.4186	-13.32739	0.5020
WGDP	-1.834910	0.9103	-32.68741	0.0014

*MacKinnon (1996) P values

Table 3: Engle-Granger single equation co-integration test (Equation 2)

Automatic lags specification based on Schwarz criterion (maxlag=6)				
Variables	tau-statistic	I*	z-statistic	P*
GDP	-2.544732	0.8997	-10.97616	0.9093
OILP	-3.905712	0.3674	-18.68531	0.4794
RER	-1.903709	0.9827	-6.907756	0.9879
TROP	-3.090223	0.7226	-13.45014	0.8035
INF	-3.257010	0.6577	23.42238	1.0000
TOT	-2.893343	0.7979	-13.19527	0.8164

*MacKinnon (1996) P values

In the same vein, the real exchange rate had a positive influence (1.2%) on the performance of the Nigeria economy. Thus, an appreciation of the exchange rate will have a negative effect on the performance of the economy while its depreciation will have a positive influence on the economic performance. The relationship between trade openness and the performance of the Nigeria economy is positive thereby explaining that the Nigerian economy benefits from her integration into the world market. The relationship between inflation and economic performance is negative. Thus, an increase in the inflation rate would damp down (-0.4%) the performance of the economy while terms of trade influences the Nigeria’s economic performance positively (66%). The R^2 shows that 82% deviation in the GDP is being captured by the explanatory variables. The J -statistics of the model is insignificant which confirms that the instruments used are relevant and valid enough to instrument for the respective variables.

Model 2:

$$GDP = 15.20 + 0.04OILP + 0.012RER + 6.24TROP - 0.04INF + 0.66TOT$$

$R^2 = 0.82$, $P(J\text{-stat}) = 0.14$

4. CONCLUSION AND POLICY RECOMMENDATION

The analysis revealed that exchange rate and world crude oil production had negative effect on oil price while world demand had positive effect. These results confirmed the *a priori* expectation. It was also found that the speed of adjustment to short run disequilibrium and convergence to the long run relation existing among the variables in the model is 15%.

Inflation also had a negative impact on economic performance whereas trade openness had a positive impact on it. The exchange rate had positive impact on the economic performance, thus, spelling out its importance in spurring development in the economy. Since Nigeria is both an oil importing and exporting country, the oil price positively affected its economy likewise the terms of trade.

Therefore, the study concludes that real exchange rate has a negative effect on the oil price and a positive effect on the economic performance. To promote sound economic policy capable of fast tracking development, the study recommends that the government should diversify the economy through judicious investment in the real sector so as to guide the economy against external shocks such as the international oil price.

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