Journal of Challenges
2017 Vol. 3, No.1, pp.1-15
ISSN(e): 2410-6569
ISSN(p): 2412-3471
DOI: 10.18488/journal.85.2017.31.1.15

IMPLICATIONS OF CRUDE OIL PRICE VOLATILITY AND PARALLEL EXCHANGE RATE FLUCTUATION ON THE COST OF LIVING IN NIGERIA

Chimaobi V. Okolo[1]

[1]*Department of Economics Enugu State University of Science and Technology, Enugu, Nigeria*

Article History
Received: 27 September 2016
Revised: 22 March 2017
Accepted: 26 April 2017
Published: 14 June 2017

Keywords
Cost of living
Crude oil price
Fluctuation
Impulse Response
Parallel exchange rate
Two stage least square
Variance decomposition
Vector error correction
Volatility.

ABSTRACT

As the sixth largest exporter of crude oil, Nigeria heavily depends on oil earnings to fund economic activities. The country also rely heavily on imports of consumables, both oil and non oil consumables. Nigeria's vulnerability to crude oil price shock at the international oil market exposes the nation to certain unfavourable results. The study investigated the influence of crude oil price volatility on parallel exchange rate and their influence on the cost of living and doing business in Nigeria. Two stage least square, generalized autoregressive conditional heteroscedasticity, vector error correction, impulse response and variance decomposition was employed to measure the influence of crude oil price on parallel exchange rate and their influence on cost of living in Nigeria. Crude oil price volatility negatively and significantly influenced parallel exchange rate fluctuation and consumer price index in Nigeria. Parallel exchange rate positively and significantly influenced consumer price index in Nigeria. Declining crude oil prices implies decreasing income for the Nigerian economy and in turn per capita income. Rising cost of living with declining per capita income further impoverishes Nigerians. Therefore Nigeria should effectively take control of the production of crude oil, increase her refining capacity and increase production and export of other products with comparative advantages.

Contribution/ Originality: The study contributed to the existing literature on crude oil price, parallel exchange rate and cost of living in Nigeria. The paper's primary contribution is finding that volatility of crude oil price negatively influenced parallel exchange rate which in turn positively impacted on the cost of living in Nigeria.

1. INTRODUCTION

GIVEN its importance in the supply of the world's energy, crude oil has become a major indicator of economic activities in Nigeria and as an oil exporting nation she has relied heavily on oil price in making her annual budgets [1]. As an oil dependent economy, Nigeria is highly vulnerable to oil price shocks at the international oil market notwithstanding that she is the 6th largest oil producer in the world. The country's development plan could be disrupted due to fluctuations in the price of oil at the international market and worse still if the oil price drops as the case is at present. These fluctuations could cause ripple effect on both the macro and micro economy. Reference [2] asserts that increase in oil price firstly, will results in a reduction in economic activity as energy becomes more expensive, given that oil is both an important input to production and consumer goods (i.e. petrol and heating oil).

Secondly, they continued that increasing oil prices directly influence the level of inflation, particularly in energy dependent countries. This should not be so for an oil exporting economy, as rising oil price implies increased earnings and may not necessarily increase the cost of doing business or cost of household living.

However, Nigerian being a peculiar nation that exports crude oil and yet imports the refined products (PMS, DPK, AGO etc.) consumed locally may follow the trend of outcomes as asserted by Masih, et al. [2]. Although, rising crude oil may increase the nation's income, yet, importation of refined products becomes expensive affecting the cost of living and doing business in the country.

On the other hand, decreasing oil price could also have negative implications for a major importing economy such as Nigeria. An economy that imports almost all its consumables, including refined crude oil products will also have depreciating currency value, rising inflation level, cost of living and doing business and other negative macroeconomic implications. Therefore, giving the above analogy, for an oil exporting country such as Nigeria, though earning increases with rising oil price and declines as oil price declines, neither rising oil price nor declining oil price reduces the cost of living and the cost of doing business. That notwithstanding, over time, the impact on activity and inflation will also depend on policy responses and supply-side effects [2].

Abdelaziz *et. al.*, 2008 in Adebiyi, et al. [3] argued that falling oil prices impacts differently on exchange rates of oil-exporting and oil-importing countries. They explained that rising oil prices improves the balance of trade, leading to higher current account surplus and a growing net foreign asset position, as well as increase in private disposable income in oil exporting countries. This increases corporate profitability and raises domestic demand thereby causing exchange rate to appreciate. However, the reverse is the case in oil-importing countries: trade deficit are offset by weaker growth and, over time, real exchange rate depreciates.

The study examined the dynamics of oil price volatility (particularly decline in oil price) in causing parallel exchange rate fluctuations and its implication on the cost of living in Nigeria. The impact of oil price volatility on the parallel exchange rate was examined. The impact of exchange rate fluctuations on cost of living was considered. Furthermore, the pass through from oil price shock to cost of living through parallel exchange rate was equally examined within a 24 months (September, 2013 to August, 2015).

2. LITERATURE REVIEW

Reference [4] examined the dynamic relationship between oil price volatility and the real exchange rate in Nigeria and revealed that though most of the movements in real exchange rate were due to changes in the permanent components, dynamic short run impact of oil price volatility on exchange rate did not hold. He explained that the result may be due to the fact that transactions on crude oil are not primarily carried out using the naira and so the fluctuation in prices may not be easily transmitted to the naira exchange rate in the short run. On the contrary, Ogundipe, et al. [5] discovered that a proportionate change in oil price leads to a more than proportionate change in exchange rate volatility in Nigeria; implying that exchange rate is susceptible to changes in oil price. Motivated by Nigeria's position as oil exporting and oil importing country, their study examined the effects of oil price, external reserves and interest rate on exchange rate volatility in Nigeria using annual data covering the period 1970 to 2011.

Empirical results of the study of causal effect of international oil prices on USD-Naira exchange rate show that oil prices on a relative basis significantly affect exchange rate compared to imports [6]. The study further contributed that unidirectional Granger causality from oil prices to exchange rate and from oil prices to foreign reserves existed in Nigeria. Reference [7] clearly revealed that while government expenditure exhibited immediate positive response to oil price shock, public investment, private investment and industrial production exhibited negative response to oil price shock, further confirming the evidence of "Dutch disease" in Nigeria. The study further exposed that via the variance decomposition analysis that exchange rate, government expenditure and domestic investment were mainly affected by oil shock, particularly, in the short run. Reference [8] agrees with the

evidence of "Dutch disease" in Nigeria as their study suggest that in the short run, changes in the gross domestic product (GDP) is not influenced by oil price volatility, nor does it influence key macroeconomic variables. However, they argue that oil price has positive but insignificant relationship and with Gross domestic product and exchange rate in Nigeria.

Studying the exchange rate fluctuations and trade flows in Nigeria, exchange rate fluctuations were found to have a negative and significant effect on Nigeria's trade with the US [9]. The study further revealed that different policy changes in the economy were found to have great influence on the fluctuations of exchange rate, which directly or indirectly affect trade flows negatively. In line with theoretical expectation, Ngene [9] argued that US GDP exerts a significant positive effect on Nigeria's trade but curiously, domestic income exerts a significant negative effect on trade. The study also revealed that real exchange rate may lead to an increase in the volume of net exports. Supporting the direction of relationship, Alalade, et al. [10] exposed from their study that a one per cent increase in the naira exchange rate result to 0.4 per cent decrease in non-oil export revenue and that GDP (2.34 per cent) accounts for the highest individual variations in non-oil export revenue. The study also discovered that exchange rate, degree of economic openness, GDP inflation rate and price index collectively accounts for 97.7 per cent variations in non-oil export variations.

Agreeing with Ngene [9] and Alalade, et al. [10]; Jongbo [11] argued that real exchange rate play a significant role in determining the industrial output and that foreign exchange increase through contentious export drive from both oil and non-oil products contribute tremendously to increase industrial output. He further argued that the capacity utilization ratio is low, partly due to epileptic power supply, lack of adequate and appropriate technology.

In their study of the nexus of capital flight and exchange rate volatility in Nigeria, Uguru, et al. [12] discovered that the coefficient of capital flight was positively signed and statistically very highly significant at 1%, implying that exchange rate is positively influenced by the volume of capital flight in Nigeria.

3. METHODOLOGY

The study employed econometric analysis. The methods used were autoregressive conditional heteroscedasticity (GARCH), two stage least square (TSLS) and vector auto-regression (VAR). VAR was specified to help examine the influence of crude oil price volatility on the Parallel exchange rate and on the cost of living in Nigeria. The response to impulse function of crude oil price with respect to parallel exchange rate and cost of living in Nigeria were estimated. Variance decomposition was employed to explain how a random shock to crude oil price caused the fluctuations to the other innovations (parallel exchange rate and cost of living) that are not accounted for by their own prior innovations. In line with Masih, et al. [2] and Okolo and Ani [1] and given the peculiar nature of the Nigerian economy, the influence of crude oil price volatility and parallel exchange rate fluctuation on consumer price index was estimated taking into consideration the influence of crude oil production and crude oil export. GARCH was employed specifically to correct the presence of autocorrelation and measure whether the error variance of each observation is constant or not, while measuring the short-run influence of crude oil price on parallel exchange rate and the influence of both variables on the cost of living in Nigeria. The conditional fluctuations values are obtained from the estimated variance equation of GARCH model. The variables were sourced from the Central Bank of Nigeria (CBN) statistical bulletin, 2014, Central Bank of Nigeria (CBN) Statistical database, United Nation Statistical database and Country Meters.

The study hypothesizes thus;

i. Crude oil price volatility has not significantly influenced parallel exchange rate fluctuation in Nigeria.

ii. Crude oil price volatility and Parallel exchange rate fluctuation has not significantly influenced the cost of living in Nigeria.

The GARCH model is specified thus;

$$X_t = a0 + bY_{t} + \mu_t \quad \ldots. \ (1)$$

In the above mean equation, X_t = Individual time series data of the variables of interest while Y_t is a (k x 1) vector of explanatory variables and it includes also autoregressive terms of the dependent variables [9].

VAR model that satisfies the hypotheses can be expressed as:

$$Yt = A_o + \sum_{t=1}^{p} At-1\ U_t \quad \ldots.. \ (2)$$

Where,

$Yt = (Y_1 + \ldots Y_{kt})$ is a column vector of observation on the current values of all variables in the model, A, is K x K matrix of unknown coefficients, A_0 is a column vector of deterministic constant terms, U_t is a column vector of errors with properties of E (U_t) = O for all t, E $(U_S\ U_t)$ = Ω if s = t; O if s ≠ t.

Specifically, TSLS was employed to measure the effect of crude oil price on the parallel exchange rate, cost and standard of living in Nigeria (without lags). While a VAR system estimates coefficients on successive lags, TSLS estimates the coefficients without lags. Therefore, short-run effects, if any was also estimated using the TSLS.

TSLS model can be estimated as:

$$X = B_o + B_1 w + \mu \quad \ldots.. \ (3)$$

$$Y = B_o + B_1 x + \mu \quad \ldots.. \ (4)$$

Where w determines X, and x determines Y (condition for two stage least square).

Therefore,

X, Y = Dependent variables

w, x = Independent variables

μ = error term

B_0, B_1, = denotes unknown parameters to be estimated.

The study hypothesizes thus;

i. Crude oil price has not significantly influenced parallel exchange rate in Nigeria.

ii. Crude oil price and Parallel exchange rate has not significantly impacted cost of living in Nigeria.

In line with the hypotheses, the model for the TSLS can be specified thus;

PEXR = f (COPRICE, COPROD, COEXP)

Therefore;

$$PEXR = B_o + B_1 COPRICE + B_2 COPROD + B_3 COEXP + \mu \quad \ldots. (5)$$

Crude oil price and parallel exchange rate effect on the cost of living in Nigeria is estimated using the model:

CPI = f (COPRICE, PEXR)

Therefore;

$$CPI = B_o + B_1 COPRICE + B_2 PEXR + \mu \quad \ldots. (6)$$

Where,

PEXR = Parallel Exchange rate

CPI = Consumer Price Index

COPRICE = Crude oil price

COPROD = Crude oil production

COEXP = Crude oil export

μ = error term

B_0, B_1, B_2… = denotes unknown parameters to be estimated.

4. DISCUSSION

4.1. Unit Root Test

Table-1. Units Root Test on Variables

Variables	ADF STAT	1%	5%	10%	Order of Integration
Coprice	-5.08852	-3.8067	-3.0199	-2.6502	I[2]
Coprod	-4.80339	-3.7856	-3.0114	-2.6457	I[1]
Coexp	-4.80339	-3.7856	-3.0114	-2.6457	I[1]
PEXR	-3.72524	-3.8067	-3.0199	-2.6502	I[2]
CPI	-3.19978	-3.8067	-3.0199	-2.6502	I[2]

Source: author's computation using e-view software

The unit root test conducted at 5% level of significance showed that none of the variables were stationary at level form crude oil production and crude oil export was stationary at first difference while crude oil price, parallel exchange rate and consumer price index were stationary at second difference. This implies that there is unit root problem and therefore, vector error correction better suit the analysis. However, the variables were logged and further tested for stationarity prior to a cointegration test to reveal whether there exists a long run relationship among variables.

Variables	ADF STAT	5%	Order of Integration
LNCOPRICE	-3.728149	-3.632896	I[1]
LNCOPROD	-5.934974	-3.632896	I[1]
LNCOEXP	-5.949129	-3.632896	I[1]
LNPEXR	-4.283926	-3.632896	I[1]
LNCPI	-5.990581	-3.644963	I[2]

Source: author's computation using e-view software

Result of the unit root test conducted on the log of variables showed that there is still unit root in the variables at log level form. However, the order of integration changed. Only the log of consumer price index was stationary at second difference, while the logs of other variables were stationary at 1st difference.

B. Crude oil price volatility and parallel exchange rate fluctuation

i. Correlation Result of Crude Oil Price, Crude Oil Production, Crude Oil Export and Parallel Exchange Rate In Nigeria From September, 2013 to August, 2015

Table-2. Correlation Result of Crude Oil Price, Crude Oil Export and Parallel Exchange Rate in Nigeria

	LNCOEXP	LNCOPRICE	LNCOPROD	LNPEXR
LNCOEXP	1	0.389195793	0.999980478	-0.491642879
LNCOPRICE	0.389195793	1	0.389706721	-0.89751916
LNCOPROD	0.999980478	0.389706721	1	-0.491397882
LNPEXR	-0.491642879	-0.89751916	-0.491397882	1

Source: author's computation using e-view software

The relationship between crude oil price, crude oil production, crude oil export and parallel exchange rate follows the a priori expectation as shown in the correlation result. While crude oil price has strong and negative relationship with parallel exchange rate, crude oil export has weak and negative relationship with parallel exchange rate and crude oil production has less than average but positive relationship with parallel exchange rate in Nigeria.

ii. GARCH Result of Crude oil price, crude oil production, crude oil export and parallel exchange rate from September, 2013 to August, 2015.

Table-3. Result of Crude Oil Price, Crude Oil Production, Crude Oil Export and Parallel Exchange Rate in Nigeria

	Coefficient	**Std. Error**	**z-Statistic**	**Prob.**
C	-10.36508	0.836474	-12.39140	0.0000
LNCOPRICE	-0.283382	0.033312	-8.506813	0.0000
LNCOEXP	-39.11436	1.997105	-19.58553	0.0000
LNCOPROD	49.08612	2.501871	19.61976	0.0000
	Variance Equation			
C	-7.85E-05	0.000169	-0.463291	0.6432
ARCH(1)	0.011402	0.988492	0.011535	0.9908
GARCH(1)	1.264168	1.160394	1.089431	0.2760
R-squared	0.823158	Mean dependent var		5.217247
Adjusted R-squared	0.760743	S.D. dependent var		0.122757
S.E. of regression	0.060045	Akaike info criterion		-3.257573
Sum squared resid	0.061293	Schwarz criterion		-2.913974
Log likelihood	46.09087	F-statistic		13.18851
Durbin-Watson stat	1.470758	Prob(F-statistic)		0.000014

Source: author's computation using e-view software

Looking at the regression result of the GARCH, crude oil price, crude oil export and crude oil production had statistically significant impact on parallel exchange rate in Nigeria. Crude oil price and crude oil export had inverse effect on the parallel exchange rate. This is in accordance with the a priori expectation. However, crude oil production had positive (direct) relationship with parallel exchange rate. The size of production determines the volume of export (99.99%) as evidenced in the correlation result. Therefore, crude oil production and crude oil export should have direct relationship with each other in principle and inverse relationship with parallel exchange rate (-49.13% and -49.16% respectively) as shown in the correlation result. However, the impact of crude oil production on parallel exchange rate is positive. The direct relationship between crude oil production and parallel exchange rate fails the a priori expectation and may be reporting that less than the increase in production is being exported, causing a direct effect on the parallel exchange rate. This could also reduce Nigeria's strength to significantly control crude oil price at the international oil market.

The R^2 shows that 82.31% variation in the parallel exchange rate can be attributed to variations in the independent variables. Furthermore, the f* (13.18851 and prob. of 0.000014 < 0.05) implies that the general regression is significant.

GARCH (1) (1.089431 with probability of 0.2760 > 0.05) implies that previous month's volatility of the parallel exchange rate did not impact significantly on its current volatility in Nigeria.

Table-4. Johansen Cointegration Of Crude Oil Export, Crude Oil Price, Crude Oil production And Parallel Exchange Rate In Nigeria

	Likelihood	**5 Percent**	**1 Percent**	**Hypothesized**
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.940822	92.93193	47.21	54.46	None **
0.545869	30.73332	29.68	35.65	At most 1 *
0.403716	13.36720	15.41	20.04	At most 2
0.086582	1.992365	3.76	6.65	At most 3

*(**) denotes rejection of the hypothesis at 5% (1%) significance level

L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Source: author's computation using e-view software

The Johansen cointegration test conducted at 5% significance level reveal that there exists long run relationships among variables. It indicates the existence of 2 cointegrating equations. Having established relationship between variables used to test the implication of crude oil price volatility on parallel exchange rate fluctuation, it necessary to adopt the GARCH and Vector error correction (VEC) mechanism rather than the unrestricted Vector autoregression (VAR) in order to take care of the identified unit root problem and avoid spurious results.

iii. TSLS Result of Crude oil price, crude oil production, crude oil export and parallel exchange rate from September, 2013 to August, 2015.

Table-5. Result of crude Oil Price, Crude Oil Production, Crude Oil Export and Parallel Exchange Rate in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.21018	14.17539	-0.720275	0.4797
LNCOEXP	-39.27544	32.37084	-1.213297	0.2392
LNCOPRICE	-0.320299	0.036949	-8.668597	0.0000
LNCOPROD	49.22163	40.96280	1.201618	0.2435
R-squared	0.840902	Mean dependent var		5.217247
Adjusted R-squared	0.817037	S.D. dependent var		0.122757
S.E. of regression	0.052508	Sum squared resid		0.055143
F-statistic	35.23610	Durbin-Watson stat		1.799702
Prob(F-statistic)	0.000000			

Source: author's computation using e-view software

The result of the two stage least square regression analysis conducted at 5% level of significance showed that the crude oil price had statistically significant impact on parallel exchange rate (-8.668597). The logged coefficient of crude oil price has an inverse relationship with the logged coefficient of parallel exchange rate in Nigeria. This follows the a priori expectation that as crude oil price increase, the currency of an oil exporting nation such as Nigeria increases over the foreign currency (USD since Nigeria's crude oil is traded at the international market in USD), and therefore exchange rate decreases. The reverse is the case when Nigeria's crude oil price declines.

Although not statistically significant, the coefficient of crude oil export passed the a priori expectation with respect to parallel exchange rate. It follows that as export increases (whether oil or non oil export or both increases), the value of local currency increases and gains over the foreign currency. This will cause the parallel exchange rate to decrease and vice versa. So far this has been the case in Nigeria as shown in the result. On like crude oil price and crude oil export,, crude oil production has directly influenced parallel exchange rate in Nigeria. Although, its effect is not statistically significant, a one percent increase causes parallel exchange rate to increase by 49.22%. Also, a one percent increase in crude oil export and crude oil price caused parallel exchange rate to decrease by 39.27% and 0.32% respectively. This reveals that a one percent increase in crude oil production counters the contributions of crude oil price and crude oil export to parallel exchange rate by 9.63%, keeping the parallel exchange rate slightly higher and resistant to the significant effect of crude oil price.

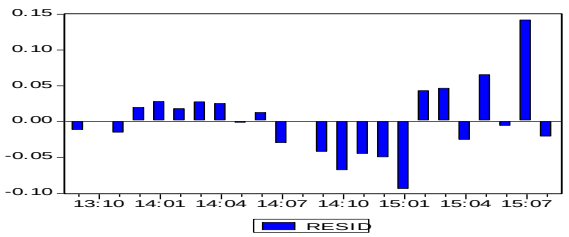

Fig-1. Response of parallel exchange rate to the interaction of crude oil price, crude oil production and crude oil export in Nigeria from September, 2013 to August, 2015 (Parallel Exchange rate fluctuation).

Source: author's computation using e-view software

The R^2 show that the independent variables contribute 84.09% to the variations in parallel exchange rate in Nigeria. Therefore, the regression plane is a good fit. Furthermore, the F-statistics of 35.23610 reveals that all the variables aggregately impacted significantly on the parallel exchange rate in Nigeria from September, 2013 to August, 2015.

The monthly contribution of crude oil price, crude oil export and crude oil production on the parallel exchange rate in Nigeria as evidenced in the residual graph was negative for 11 months. It was negative in the months of September and November, 2013, and July, September, October, November and December, 2014, and April, June, August, and January, 2015. For the months of October, 2013, May and August, 2014, from December, 2013 to April, 2014, February and March, 2015, the independent variables contributed positively to parallel exchange rate. The independent variables further contributed positively on parallel exchange rate in May and July, 2015. Therefore, there were more positive contributions to parallel exchange rate over the period than there were negative contributions to parallel exchange rate. This supports that the volatility of the parallel exchange rate can be attributed to the variations in the explanatory variables.

iv. Vector Error Correction Result of Crude oil price, crude oil production, crude oil export and parallel exchange rate from September, 2013 to August, 2015.

The vector error correction was done at 5% level of significance. While crude oil price had statistically significant impact on crude oil export and crude oil production in the third month, its effect on parallel exchange rate was positive but insignificant in the second month and negative and insignificant in the third month. The f* (9.206603) shows that the variables generally impact significantly on parallel exchange rate in Nigeria. Crude oil export continues to have inverse relationship with parallel exchange rate in Nigeria in the second and third month. Although insignificant, it is important to note that a percentage change in crude oil export and crude oil production in the third month caused parallel exchange rate to decline by 18.23% and increase by 22.86% respectively. This further shows that crude oil production continued to directly influence parallel exchange rate even after two (2) months.

Furthermore, the Adjusted R-square implies that 80.40% of the variations in parallel exchange rate could be attributed to the variations in crude oil price, crude oil export and crude oil production in Nigeria.

v. Response of parallel exchange rate to changes in Crude oil price, crude oil production and crude oil export in Nigeria from September, 2013 to August, 2015.

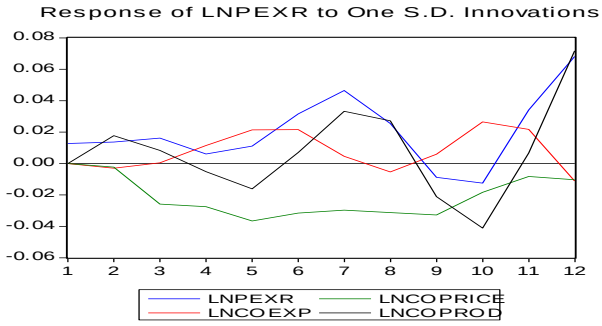

Fig-2. Impulse response graph of log of parallel exchange rate in Nigeria over 12 month period of shock
Source: author's computation using e-view software

Parallel exchange rate had an unstable and fluctuating response to various shocks. The response of parallel exchange rate to own shock caused was positive and significant for the first six periods. It responded negatively and significantly in the ninth and tenth period and then responded positively just before the 11^{th} period and dispersed afterward for the rest of the period. The response of parallel exchange rate to crude oil price shock remained negative and significant over the period. Parallel exchange rate responded positively and negatively in different

directions but significantly over the period to shock in crude oil export. PEXR responded to crude oil production in the same manner until the 11th period. This proves that parallel exchange rate responded significantly to the joint volatility of crude oil price, crude oil production and crude oil export in Nigeria.

vi. Variance Decomposition of log of parallel exchange rate in Nigeria over 12 periods of shock

Table-6. Variance Decomposition of Log of Parallel Exchange Rate in Nigeria

Period	S.E.	LNPEXR	LNCOEXP	LNCOPRICE	LNCOPROD
1	0.012722	100.0000	0.000000	0.000000	0.000000
2	0.026034	51.49561	1.305752	0.787453	46.41119
3	0.040961	36.35942	0.538076	40.19597	22.90654
4	0.051292	24.58153	5.392800	54.39770	15.62797
5	0.069367	16.00466	12.52295	57.49077	13.98162
6	0.085582	24.15873	14.59515	51.38811	9.858009
7	0.107180	34.17233	9.491526	40.42397	15.91217
8	0.117823	32.94800	8.059456	40.47973	18.51282
9	0.124546	29.98103	7.438008	43.14528	19.43569
10	0.135637	26.12214	10.10146	38.20133	25.57507
11	0.141932	29.61952	11.57639	35.22558	23.57851
12	0.173666	35.16982	8.142904	23.88444	32.80284

Source: author's computation using e-view software.

Considering the forecast variance decomposition of parallel exchange rate for 12 periods, it is evident from the result that shock to parallel exchange rate (own shock) accounts for 51.49% of the variation in parallel exchange rate in the second period. In the same period, shock to crude oil production accounts for 46.41% of the variation in parallel exchange rate. Interestingly, shocks to crude oil price account for 54.39% and 57.49% of the variation in parallel exchange rate in the 4th and 5th periods respectively. Furthermore, shocks to crude oil price accounts for 51.39% of the variation in parallel exchange rate in period six. In period 12, crude oil price volatility caused 23.88% of the variation in parallel exchange rate. However, fluctuations in parallel exchange rate (own shock) and crude oil production causes 35.17% and 32.80% of the variation in parallel exchange rate in Nigeria in period 12, while crude oil export accounts for 8.14% of the variation in parallel exchange rate in the same period.

C. Crude oil price Volatility, Parallel Exchange rate and Cost of Living in Nigeria

i. Correlation result of the relationship between crude oil price, parallel exchange rate and consumer price index in Nigeria from September, 2013 to August, 2015

Table-7. Correlation Result of Crude Oil Price, Parallel Exchange Rate and Consumer Price Index in Nigeria

	LNCPI	LNCOPRICE	LNPEXR
LNCPI	1	-0.890800016868	0.887562683997
LNCOPRICE	-0.890800016868	1	-0.89751916239
LNPEXR	0.887562683997	-0.89751916239	1

Source: author's computation using e-view software

The result of the correlation test proves that crude oil price, parallel exchange rate and consumer price index followed the a priori expectation in Nigeria. Their relationship is strong too (over 88%). Crude oil price has inverse and strong relationship with consumer price index in Nigeria and parallel exchange rate has a positive and strong relationship with consumer price index in Nigeria.

ii. GARCH Result of crude oil price, parallel exchange rate and Consumer Price Index in Nigeria from September, 2013 to August, 2015.

Table-8. Result of Crude Oil Price, Parallel Exchange Rate And Consumer Price Index In Nigeria

	Coefficient	Std. Error	z-Statistic	Prob.
C	4.399225	0.278407	15.80140	0.0000
LNCOPRICE	-0.066480	0.020142	-3.300532	0.0010
LNPEXR	0.189612	0.039736	4.771846	0.0000
	Variance Equation			
C	4.47E-05	4.86E-05	0.920375	0.3574
ARCH(1)	0.831234	0.557747	1.490341	0.1361
GARCH(1)	-0.199944	0.478052	-0.418248	0.6758
R-squared	0.775765	Mean dependent var		5.082631
Adjusted R-squared	0.713477	S.D. dependent var		0.049476
S.E. of regression	0.026483	Akaike info criterion		-4.844242
Sum squared resid	0.012625	Schwarz criterion		-4.549728
Log likelihood	64.13090	F-statistic		12.45455
Durbin-Watson stat	0.169000	Prob(F-statistic)		0.000025

Source: author's computation using e-view software

Looking at the regression result of the GARCH, crude oil price and parallel exchange rate had statistically significant impact on consumer price index in Nigeria. Crude oil price had inverse effect on the consumer price index, while parallel exchange rate had positive effect on consumer price index in Nigeria. This is in line with the a priori expectation. The size of production determines the volume of export (99.99%) as evidenced in the correlation result.

The R^2 shows that 77.57% variation in the parallel exchange rate can be attributed to variations in the independent variables. Furthermore, the f* (12.45455 and prob. of 0.000025 < 0.05) implies that the general regression is significant. The GARCH (-0.418248 with probability of 0.6758 > 0.05) implies that the previous month's volatility of the consumer price index did not significantly impact on the current volatility of the consumer price index in Nigeria.

iii. Johansen Cointegration of crude oil price, parallel exchange rate and price index in Nigeria from September, 2013 to August, 2015.

Table-9. Cointegration of Crude Oil Price, Parallel Exchange Rate and Consumer Price Index in Nigeria

Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue Ratio	Critical Value	Critical Value	No. of CE(s)
0.783100 45.65880	29.68	35.65	None **
0.358554 12.03579	15.41	20.04	At most 1
0.097919 2.267117	3.76	6.65	At most 2

*(**) denotes rejection of the hypothesis at 5% (1%) significance level

L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Source: author's computation using e-view software

The Johansen cointegration test conducted at 5% significance level reveal that there exists long run relationships among variables. It indicates the existence of a cointegrating equation. Having established relationship between variables used to test the implication of crude oil price volatility and parallel exchange rate fluctuation on the cost of living in Nigeria, Vector error correction (VEC) mechanism was adopted to correct the unit root problem and avoid spurious results.

iv. Two Stage Least Square Result of crude oil price, parallel exchange rate and consumer price index in Nigeria from September, 2013 to August, 2015.

Table-10. Result of Crude Oil Price, Parallel Exchange Rate and Consumer Price Index in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.459017	0.551014	8.092378	0.0000
LNCOPRICE	-0.074199	0.030940	-2.398182	0.0258
LNPEXR	0.182499	0.081408	2.241786	0.0359
R-squared	0.833396	Mean dependent var		5.082631
Adjusted R-squared	0.817528	S.D. dependent var		0.049476
S.E. of regression	0.021134	Sum squared resid		0.009380
F-statistic	52.52352	Durbin-Watson stat		0.241206
Prob(F-statistic)	0.000000			

Source: author's computation using e-view software

The result of the two stage least square regression analysis conducted at 5% level of significance showed that the crude oil price and parallel exchange rate had statistically significant impact on consumer price index (0.0258 < 0.05 and 0.0359 < 0.05 respectively). The logged coefficient of crude oil price has an inverse relationship with the logged coefficient of consumer price index in Nigeria. This follows the a priori expectation that as crude oil price increase, exchange rate decreases alongside cost of living (consumer price index) for such a country as Nigeria that depends heavily on oil (refined products) and non-oil imports. The reverse is the case when Nigeria's crude oil price declines. However, parallel exchange rate has a direct relationship with consumer price index in Nigeria, being an import dependent economy.

The R^2 shows that the independent variables contribute 83.34% to the variations in consumer price index in Nigeria. Therefore, the regression plane is a good fit. Furthermore, the F-statistics of 52.52352 reveals that all the variables aggregately impacted significantly on the consumer price index in Nigeria from September, 2013 to August, 2015.

v. Graphic representation of the monthly impact of crude oil price, crude oil production and crude oil export on parallel exchange rate in Nigeria from September, 2013 to August, 2015.

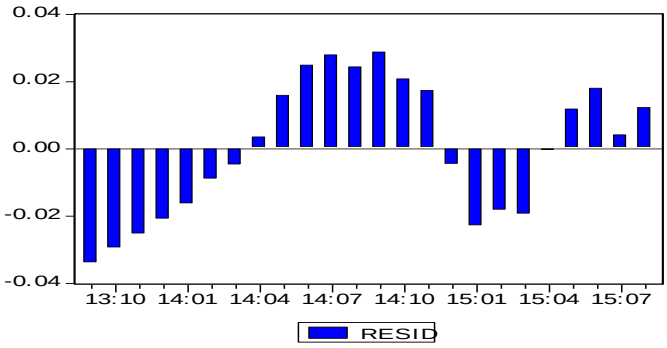

Fig-3. Response on consumer price index to crude oil price, crude oil production and crude oil export in Nigeria from September, 2013 to August, 2015 (Volatility of Consumer Price Index in Nigeria).
Source: author's computation using e-view software

The monthly contribution of crude oil price and parallel exchange rate on consumer price index in Nigeria as evidenced in the residual graph was negative for 11 months. It was negative in the months of September, 2013 through to January, 2014, and from December, 2014 to march, 2015. For the months of April, 2014 to November, 2014, and from April, 2015 to August, 2015, the independent variables had positive impact on consumer price index. Therefore, there were equal distributions of positive contributions to consumer price index over the period as well as negative contributions.

vi. Vector Error Correction Result of Crude oil price, parallel exchange rate and consumer price index from September, 2013 to August, 2015.

The vector error correction conducted at 5% level of significance reveals that only crude oil price had statistically significant and positive effect (3.10905) on consumer price index in the second month. For an import dependent nation, rising oil price increases the cost of living and doing business and therefore, increases the consumer price index too. Rising crude oil price implies increased earnings for an oil exporting nation, like Nigeria. The increased earnings allows for expanding the economy via expansionary policy objective by increasing aggregate demand, employment, investment and output. This in turn can lead to both demand-pull and cost-push inflation (increase in cost of living) and vice versa. On the other hand, rising crude oil price causes a decline in exchange rate, which reduces the cost of living and cost of doing business and vice versa for an import dependent economy. The peculiar case of Nigeria exporting crude oil and importing refined crude oil products and non oil products brings her in between the proverbial 'devil and deep blue sea". Rising and declining crude oil price has undesirable effects on the cost of living in Nigeria. However, A simple explanation for the inverse relationship between crude oil price and consumer price index in the "GARCH" and "TSLS" result, and a direct relationship between both variables in the "VEC" result (not accounting for monetary and fiscal policy objectives) is that the crude oil export influence consumer price index more than the nation's import in the first instance, causing the consumer price index to respond negatively to crude oil price. Nonetheless, in the second and third month, the nation's import influences more the consumer price index, causing a consumer price index to increase in response to the rise in crude oil price. Oil (refined products) and non oil imports, and crude oil exports are pass-through for crude oil price. Parallel exchange rate, which also could be a pass through for crude oil price impacts positively and significantly on consumer price index in the first stance but negatively and insignificantly after the first and second months.

The f* (2.699044) shows generally slight significance of the variables' impact on consumer price index in Nigeria after the first and second month. Furthermore, the Adjusted R-square implies that only 37.29% of the variations in consumer price index could be attributed to the variations in crude oil price and parallel exchange rate in Nigeria, given two month lags.

vii. Response of consumer price index to changes in Crude oil price and parallel exchange rate in Nigeria from September, 2013 to August, 2015.

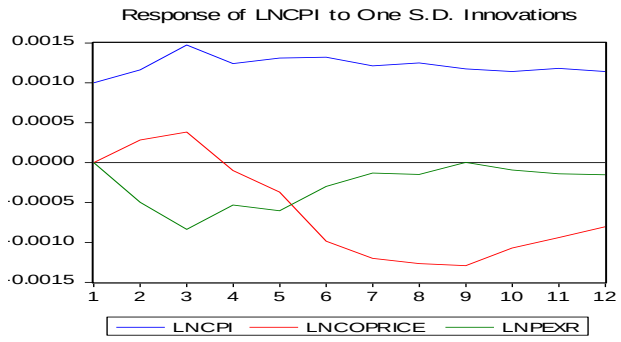

Fig-4. Impulse response graph of log of consumer price index in Nigeria over 12 months period of shock
Source: author's computation using e-view software

The impulse response of consumer price index expose that consumer price index responded negatively and significantly to shock to parallel exchange rate from period one to period 12. It responded positively and significantly from to crude oil price shock from period one to period four and then negatively and yet significantly from period four to twelve. However, consumer price index responded positively and significantly to its own shock all through the period.

viii. Variance Decomposition of consumer price index in Nigeria over 12 period of shock

Table-11. Variance Decomposition of Log of Consumer Price Index in Nigeria

Period	S.E.	LNCPI	LNCOPRICE	LNPEXR
1	0.001000	100.0000	0.000000	0.000000
2	0.001637	87.75518	3.026016	9.218805
3	0.002388	79.40645	3.998363	16.59518
4	0.002745	80.54197	3.156310	16.30172
5	0.003123	79.82996	3.844516	16.32552
6	0.003544	75.90830	10.70927	13.38243
7	0.003936	71.06252	17.97517	10.96231
8	0.004321	67.30485	23.48297	9.212178
9	0.004661	64.20977	27.87061	7.919617
10	0.004917	63.07734	29.77148	7.151176
11	0.005145	62.87720	30.51853	6.604269
12	0.005333	63.10223	30.67162	6.226149

Source: author's computation using e-view software

Considering the forecast variance decomposition of consumer price index for 12 periods, it is evident from the result that shock to consumer price index (own shock) accounts for 87.75% of the variation in consumer price index in the period 2 and further account for over 60% of the variations all through the period. Therefore, shock to crude oil price result to decline to exchange rate (rising value of the Naira) and in turn an increase in consumer price index (cost of living).

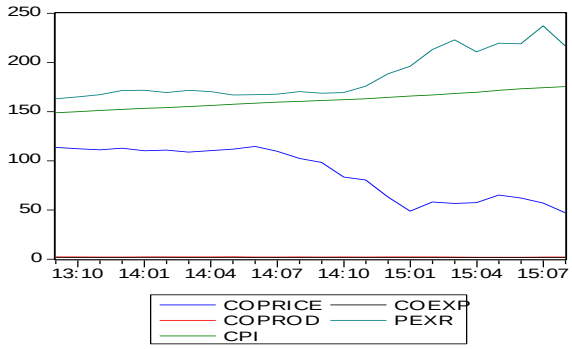

Fig-5. Graphic Trend of crude oil price, crude oil production, crude oil export, parallel exchange rate and consumer price index in Nigeria from September, 2013 to August, 2015.
Source: author's computation using e-view software

The graphic trend shows that Nigeria's crude oil price declined from September, 2013 to August, 2015, while consumer price index and parallel exchange rate increased over the same period. This further supports the inverse relationship between crude oil price and parallel exchange rate as well as consumer price index. Notably, parallel exchange rate remained slightly above consumer price index in Nigeria. Furthermore, while consumer price index increased steadily over the period, parallel exchange rate had a fluctuating increase from September, 2013 to August, 2015. The trend further supports that the decline in Nigeria's crude oil price caused parallel exchange rate to increase more than the increase in consumer price index in Nigeria. The impulse response graph showed that the consumer price index very poorly and insignificantly to the deviations in crude oil price and parallel exchange rate.

D. Granger Causality

The Granger causality shows that crude oil price cause parallel exchange rate and consumer price index. The result further shows that parallel exchange rate granger cause consumer price index in Nigeria. Interestingly, while parallel exchange rate and consumer price index cause crude oil production and crude oil export by more that 80% each, crude oil production and export cause parallel exchange rate and consumer price index by less than 45% each.

Crude oil price has bi-directional causality with consumer price index and parallel exchange rate in Nigeria as evidenced from the result.

E. Test of Hypotheses:

i. Hypothesis 1

The first Hypothesis states that crude oil price volatility has not significantly influenced parallel exchange rate fluctuation in Nigeria. Given the statistical significance of the t-test and f-test results of the GARCH, TSLS and the f-test result of the vector error correction, we reject the null hypothesis and conclude that crude oil price volatility does significantly influence parallel exchange rate fluctuation in Nigeria.

ii. Hypothesis 2

The second hypothesis states that crude oil price volatility and parallel exchange rate fluctuation has not significantly influenced the cost of living in Nigeria. Given the statistical significance of the t-test and f-test results of the GARCH, TSLS and f-test result of the vector error correction, we reject the null hypothesis and conclude that crude oil price volatility and parallel exchange rate fluctuation does significantly influence the cost of living in Nigeria.

5. CONCLUSION

As the sixth exporter of crude oil in the world market, Nigeria heavily relies on earning from sale of crude oil to fund the nation's economic activities. The price of Nigeria's crude oil is basically determined by its demand and supply in the international oil market as the crude oil has little or no domestic value. Shocks to crude oil price greatly affect national income, exchange rate and the cost of living in Nigeria. Also heavily dependent on imports (oil and non oil imports), the nation's earnings which is supposed to cushion the cost of living and doing business as an oil exporting nation is countered by heavy dependence on import for almost all consumables, including foods. This has both direct and inverse effect on the cost of living in Nigeria. Evidenced from the result of the GARCH, TSLS and VEC analysis, crude oil volatility significantly influenced parallel exchange rate fluctuation and in turn the cost of living and doing business in Nigeria.

It is recommended within the limits of the study that Nigeria reduce her heavy dependence on imported goods. Nigeria should also increase earnings from export of other products, thereby reducing the nation's dependence on crude oil export and crude oil price. Since declining oil prices means reduced national earnings and in turn declining per capita income (given Nigeria's growing population), rising cost of living could have adverse effects on Nigerians. Government should pay attention to declining earnings as population increase (shrinking per capita income), while consumer price index rises. This implies that the average Nigerians will be poorer than they were before the decline in crude oil price.

Nigeria, being the 6th largest oil producing nation should increase her strength in determining oil price by better control of crude oil production, effectively increasing her refining capacity and increase production and export of other products with comparative advantage and gradually increase export of crude oil as price increase.

Funding: This study received no specific financial support.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

REFERENCES

[1] C. V. Okolo and A. J. Ani, "Oil price movement effect on the Nigerian stock market," *Canadian International Journal of Science and Technology*, vol. 2, pp. 21-30, 2015.

[2] R. Masih, S. Peters, and L. De Mello, "Oil price volatility and stock price fluctuations in an emerging market: Evidence from South Korea," *Energy Economics*, vol. 33, pp. 975-986, 2011. *View at Google Scholar | View at Publisher*

[3] M. A. Adebiyi, A. O. Adenuga, M. O. Abeng, and P. N. Omanukwue, "Oil price shocks, exchange rate and stock market behaviour: Empirical evidence from Nigeria," presented at the African Econometric Society Conference Proceedings, Sheraton Hotels and Towers, Abuja, 2009.

[4] J. E. Onoja, "The impact of oil price volatility on the real exchange rate in Nigeria: An error correction model," *African Financial Review*, vol. 9, pp. 15-22, 2015. *View at Google Scholar | View at Publisher*

[5] M. O. Ogundipe, P. Ojeaga, and A. A. Ogundipe, "Oil price and exchange rate volatility in Nigeria," *IOSR Journal of Economics and Finance*, vol. 5, pp. 01-09, 2015. *View at Google Scholar | View at Publisher*

[6] E. Osuji, "International oil prices and exchange rate in Nigeria: A causality analysis," *International Journal of Academic Research in Economics and Management Sciences*, vol. 4, pp. 11-22, 2015. *View at Publisher*

[7] H. B. Riman, E. S. Akpan, and A. I. Offiong, "Assymetric effect of oil price shocks on exchange rate volatility and domestic investment in Nigeria," *British Journal of Economics, Management and Trade*, vol. 3, pp. 513-532, 2013. *View at Google Scholar | View at Publisher*

[8] W. Ani, D. Ugwunta, O. Inyiama, and B. Eneje, "Oil price volatility and economic development: Stylized evidence in Nigeria," *Journal of Economics and International Finance*, vol. 6, pp. 125-133, 2014. *View at Google Scholar | View at Publisher*

[9] A. N. Ngene, "Exchange rate fluctuations and trade flows in Nigeria: A time series econometric model," M.Sc. Project Research, University of Nigeria Virtual Library, 2010.

[10] S. Y. Alalade, O. A. Adekunle, and O. A. Joseph, "Foreign exchange rate regimes and non-oil export performance in Nigeria (1986 – 2010)," *International Journal of Business and Behavioral Sciences*, vol. 4, pp. 01-22, 2014.

[11] O. C. Jongbo, "The impact of real exchange rate fluctuation on industrial output in Nigeria," *Journal of Policy and Development Studies*, vol. 9, pp. 268-278, 2014. *View at Google Scholar | View at Publisher*

[12] L. C. Uguru, B. M. Ozor, and C. C. Nkwagu, "Capital flight and exchange rate volatility in Nigeria: The nexus," *Research Journal of Finance and Accounting*, vol. 5, pp. 27-36, 2014.