NIU Journal of Social Sciences Copyright©2022
Nexus International University ISSN: *3007-1682*; 8(3): 103- 114

Oil Price Bubbles and Exchange Rate Movement in Nigeria

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Abstract. The study examined the impact of oil price bubble on naira exchange rate in Nigeria for the period of 1990-2020. Secondary data was collected from World development indicators and CBN statistical bulletin. Descriptive statistics, unit root test, co-integration test, granger causality test, variance decomposition and vector autoregressive model were conducted. Findings revealed that first and second period lag of oil price bubble have negative effect on exchange rate movement in Nigeria while first period lag was not significant, second period lag was significant at 5% level. The study recommended that there is need for policymakers to be cognizant of oil prices in determining appropriate exchange rate equilibrium. Thus, when oil price changes take place, relevant monetary policy measures should be employed to stabilize the unanticipated impacts on exchange rates that may distort the economy. In addition, diversifying away from oil to other non-oil activities that would generate foreign exchange should be a continuous policy pursuit. Also, the revenue generated from oil should be channelled into creation of necessary and adequate infrastructural facilities in order to encourage small industries in producing locally made goods. By this, the importation of goods will reduce and the trade balance becomes favourable.

Keywords: Oil Price, Exchange Rate, VAR Model, Nigerian Economy.

1. Introduction

Crude oil prices bubbles are as a result of the dynamism in the international markets. Whenever there is a drop in oil prices, the consequences are exchange rate depreciation, significant drop in the level of foreign exchange inflows, and reserve depletion that often causes budget deficit and plummeting economic growth. The advancement of every economy is dependent on the operations of related macroeconomic variables such as exchange rate, interest rate and inflation which work together to determine economic growth. According to Nwuju, Ifeoma, Lekara-Bayo and Etuk (2019) the exchange rate of a national currency relative to another currency has a direct bearing on the national economy because of bilateral trade relationship between both countries. When the exchange rate of the foreign currency rises with respect to the domestic currency, more number of units of domestic currency are required for one unit of the foreign currency. The implication is that the country has to pay more for its imports an activity that will disturb its balance of payments situation and reduce its foreign exchange reserves. This will also affect the entire economy negatively. All imports, foreign currency loan and interest payments are affected as the country has to pay more for them. Exchange rate affects the inflation rate too (Chelawat, 2019).

The Nigerian exchange rate policy has undergone a good number of changes. It developed from a fixed parity in 1960 when it was solely tied with the British Pound Sterling. By 1967, following the devaluation of the Pound Sterling, the United States (US) dollar was included in the parity exchange. In 1972, the parity exchange with the British Pound was suspended as a result of the emergence of a stronger US dollar (Chelawat, 2019). In 1973, Nigeria reverted to a fixed parity with the British Pound following the devaluation of the US dollar. In 1974, in order to minimize the effect of devaluation of a single individual currency, Nigerian currency was tied to both the pound and dollar. Like other low-income countries, Nigeria has adopted two main exchange rate regimes for the purpose of gaining balance both internally and externally. Aliyu and Usman (2009) explain that the reason behind this practice is to maintain a stable exchange rate, since a fluctuating real exchange rate arising from volatile oil prices are damaging to non-oil sector, capital formation and per capita income (Bagella, Becchetti & Hasan, 2006). According to literature, there are strong connections between exchange rates and oil prices especially in the long run Beckmann. It discloses that either exchange rate or oil price is a potentially useful predictor of the other variable in the short-run. However, the effects differ strongly from time to time (Czudaj, & Arora, 2020).

Almost throughout the 1970s, the persistent appreciation of the nominal exchange rate of the Naira coincided with some substantial increases in the price of oil in the international market. From early 1970s to late 1970s and during the oil boom era, the exchange rate of the naira was relatively stable. However, since September 1986 when the market-determined exchange rate system was introduced in Nigeria through the second-tier foreign exchange market, the naira exchange rate has exhibited the features of continuous depreciation and instability (Czudaj, & Arora, 2020). This instability and continued depreciation of the naira in the foreign exchange market has resulted to declines in the standard of living of the citizenry and increased cost of production which also lead to cost push inflation. It has also tended to undermine the international competitiveness of non-oil exports and made planning and projections difficult at both micro and macro levels of the economy. A good number of small and medium scale enterprises have been strangled out as a result of low dollar/naira exchange rate (Czudaj, & Arora, 2020).

Considering the importance of the effects of oil prices changes on exchange rate, many previous studies have attempted to examine the relationship between them. Notable among these studies are Hassan and Zaman (2012) and Tiwari and Olayeni (2013). While Hassan and Zaman (2012), Asaleye, Rotdelmwa, Inegbedion, Lawal and Ogundipe (2021) concluded that there are negative relationships between oil price changes and exchange rate for India, studies such as Olomola and Adejumo (2006) found a positive relationship between oil price and exchange rate for Nigeria. Hence, the results of past studies have not been uniform. Moreover, apart from the inconclusiveness of the literature on the causal effects of oil price on exchange rate, a lot of previous studies have employed causal analysis in the time domain which cannot analyze causality in the short-, medium-, and long-term but only at a point in time. According to Olayungbo (2019) oil is the mainstay of the Nigerian economy. For Oluwatomisin, Ogundipea, Ojeagaa and Ogundipea (2014), oil accounts for over 95 percent of its foreign earnings and about 83 percent of its budgetary allocation. For this reason, changes in oil prices have implications for the Nigerian economy and, in particular, exchange rate movements. The latter is mostly significant as Nigeria is exposed to the double dilemma of being an oil exporting and oil-importing country. Despite the abundance of oil in the country, Nigeria has become a net importer of refined oil as a result of the underutilization of her existing refineries. The situation in the country is that it exports crude oil and imports refined petroleum product at higher cost. This cost implication has had a significant impact on the trade balance and the macroeconomic performance of Nigeria (Olayungbo, 2019). As a result of the inconclusiveness of the literature on the causal effects of oil price changes on exchange rate movement, this paper is motivated to contribute to literature. Also, considering the inability of monetary authorities to achieve realistic exchange rate policy even after adopting the Structural Adjustment Program (SAP) and constant fluctuations in the value of the naira this paper seeks to find out the impact that the oil price changes has on exchange rate movement in Nigeria.

2. Review of literature

2.1 Conceptual clarifications and theoretical underpinnings

Exchange rate is the price of one country's currency in relation to that of another country; the required amount of units of a currency that can buy another amount of units of another currency. Exchange rate is usually referred to as the ratio at which a unit of currency of one country is expressed in terms of another currency (Jhingan, 2004). The rate is normally determined in the foreign exchange market. According to Beckmann, Czudaj and Arora (2020), the difference between real and nominal measures of exchange rate is crucial when investigating the relationship between oil prices and exchange rates. The nominal spot exchange rate at a specific point in time is expressed as domestic currency per US dollar. The implication is that an increase reflects a nominal appreciation of the US dollar. The real exchange rate equally includes price indices for both countries, and reflects the basket of domestic goods that can be purchased with one basket of US goods (Beckmann, Czudaj and Arora, 2020). An increase is a real appreciation of the US dollar as the real purchasing power of US goods goes up. It is possible to express both nominal and real exchange rates as a geometric or arithmetic trade weighted index between multiple countries, instead of just between two countries. According to Beckmann, Czudaj and Arora (2020), such effective exchange rates reflect the entire external competitiveness for an economy. The nominal oil price is usually measured in US dollars per barrel. The real oil price is computed by adjusting the nominal oil price for any alterations in the US price level which is usually based on the US consumer price index (CPI). Instead of analyzing current or spot price dynamics, another alternative is to focus on futures price dynamics, since these also reflect expectations. There are three major types of exchange rate systems, namely the float, the fixed rate, and the pegged float.

Oil prices are denominated in US dollars and available from the US Energy Information Administration (EIA). In the crude oil market, there are various types and qualities of oil used for different purposes. The price of oil highly depends on in its grade, factors such as specific gravity, its content as well as location. 160 different blends of oil have been identified universally. However, the three primary benchmarks are WTI, Brent and Dubai. Crude oil prices are quoted in different markets all over the universe. According to Trung and Vinh (2011), macroeconomic variables should be affected by oil shocks for two reasons First, oil increase leads to lower aggregate demand assuming that income is redistributed between net oil import and export countries. Oil price hikes can affect economic activity because that will make more household income to be spent on energy consumption. Firms will also reduce the amount of crude oil they purchase an exercise that will lead to underutilization of the factors of production like labor and capital. Second, the supply side effects are linked with the fact that crude oil is considered as the basic input in the production process. An increase in oil price will lead to a decrease in the supply of oil as a rise in cost of crude oil production will lead to a reduction in potential output. Oil price fluctuations have received significant considerations for their perceived role in macroeconomic variables dynamism. According to Sill (2009), the aftermath of huge increases in the oil price on macroeconomic variables have been of great concern among economist, policy makers and the general public since two major oil price shocks shook the global economy in the 1970s. Several papers have suggested that oil price might have a significant influence on exchange rate. According to Amano and Norden (1998) many researchers suggest that oil fluctuations has a significant consequence on economic activity and that the effect differs for both oil exporting countries and oil importing countries. It benefits the oil exporting countries when the international oil price is high but it poses a problem for oil importing countries. The reverse becomes the case when the crude oil price is low.

The fundamental channels derived from inter-temporal models tend to suggest that a fall in oil prices should be accompanied by a real depreciation of oil exporters. However, according to Bützer (2015), things may be somewhat different in practice. While economic theory suggests that oil exporters' currencies should depreciate in the wake of negative oil price shocks (and vice versa for positive shocks), in practical situations there may be counterbalancing forces. First, monetary authorities may not favour large movements in the nominal exchange rate, and may choose to counter exchange rate pressures through the accumulation or reduction of foreign exchange reserves. Second, the international risk-sharing channel may provide an automatic stabilizer through currency exposure. Assuming that oil exporters have accumulated a large pool of foreign exchange reserves and tend to be net long in foreign currency, a decline in the oil price accompanied by a depreciation produces a positive valuation effect. This becomes a net gain for them relative to domestic Gross Domestic Product and plays a stabilizing role. What this implies is that the exchange rate does not need to depreciate quite as much to be able to ensure external sustainability (Bützer, 2015).

2.2 Empirical Review

Jebbin and Osu (2012) examined the effect of oil price fluctuations, foreign exchange, real gross domestic product on exchange rate fluctuations. The study used co-integration, VAR and GARCH techniques to examine the long-run relationship among the variables. The study found out that real exchange rate fluctuation in Nigeria is significantly influenced by oil price fluctuations.

Hodo, Akpan and Offiong (2013) examined the asymmetric effect of oil price shocks on exchange rate volatility and domestic investment in Nigeria. The study employed annual time series data spanning 1970-2010 and VAR techniques to carry out the analysis. The study reveal that government expenditure has positive effect on oil price shock, but public investment, private investment and industrial production have negative effect oil price shock, which confirms the evidence of a "dutch disease" in Nigeria.

Ogundipe, Ojeaga, and Ogundipe (2014) examined the effects of oil price, external reserves and interest rate on exchange rate volatility in Nigeria. The study used annual time series data from 1970 to 2011. The Johansen Co-integration and VECM technique was employed for the analysis. It was revealed that a proportionate change in oil price leads to a more than proportionate change in exchange rate volatility in Nigeria; which implies that exchange rate is susceptible to changes in oil price.

Osuji (2015) examined the effect of oil price movements on exchange rate pair. The study used 420 observations from monthly time series data for the period of 2008 to 2014. The ordinary least squares estimation technique (OLS) and VAR technique were used for the analysis respectively. Findings point out that oil prices on a relative basis significantly affect exchange rate compared to imports also evidence of unidirectional causality relationship from oil prices to exchange rate and from oil prices to foreign reserves was found.

Rotimi, Ojo and Babatunde (2018) examined the long-run association of real exchange rates, real oil prices, interest rate, inflation and external debt in Nigeria. The study used monthly data for the periods 1980-2017. The study employed various co-integration tests and observed that co-integration exists among the selected variables. The granger causality test found that oil price positively and significantly impacts exchange rates in Nigeria, suggesting that a rise in global oil prices results in exchange rate appreciation.

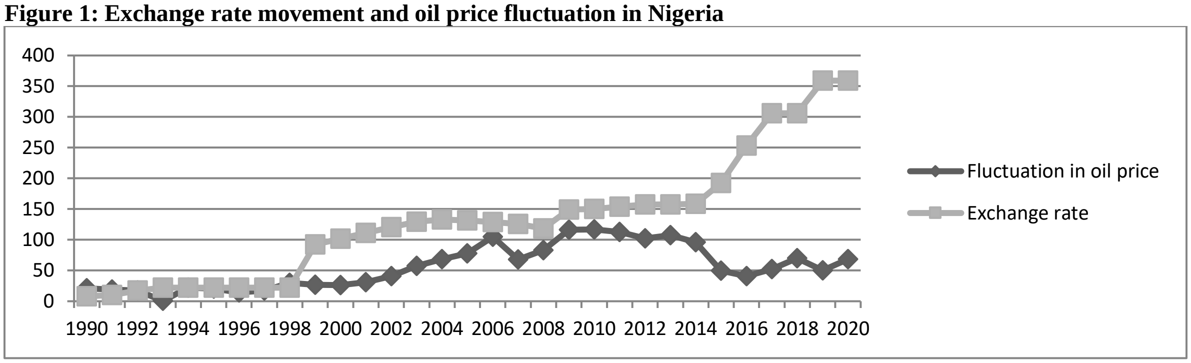
Jungo and Kim (2019) examined the effect oil price fluctuations on exchange rates in selected sub-Saharan African (SSA) countries. The study used the nonlinear autoregressive distributed lag. The results show that changes in oil prices have the asymmetric effects on the real exchange rates in the long-run; that is, the movements in the real exchange rates in selected SSA countries appear to respond mostly more to oil price increases than to decreases. In the short-run, however, the asymmetry of oil price changes was not observed.

Asaleye, Rotdelmwa, Inegbedion, Lawal, and Ogundipe (2021) examined the impact of oil price volatility on exchange rate in Nigeria using annual time series data from 1986 to 2015. The Autoregressive Distributed Lag (ARDL) Bounds testing procedure was adopted because the variables were integrated of order I(0) and I(1). The results show a negative and significant relationship between volatility of crude oil prices and exchange rates in Nigeria in the long-run. In the short-run, however, this relationship was negative and statistically non-significant within the period of study.

2.3 Stylized facts

The trend in Figure 1 below is very instructive about the relationship between exchange rate movement and oil price dynamics in Nigeria. Both variables are largely negatively related such that an increase in the international prices of oil indicates a fall in the value of exchange rate of naira to the international reference currency of dollar. This suggests exchange rate appreciation. On the other hand, a fall in the international prices of oil denotes exchange rate depreciation. The implication is that Nigeria, as an oil-dependent economy, has its domestic currency largely susceptible to the prices of oil in the international market. Between 1980 and 1992, there is a fall in the exchange rate; denoting exchange rate appreciation consequent upon increase in the international price of oil. However, there is exchange rate depreciation due to fall in the international price of oil between 1998 and 2008. In reverse, exchange rate has continues to depreciate due to occurrences of global economic crises and the crash in the oil market in the year 2016 and 2019. Hardly has the currency recover from the first shock that the second shock occurred.

Figure 1: Exchange rate movement and oil price fluctuation in Nigeria



CBN Statistical Bulletin and World Development Indicators (2020).

3. Research Methodology

This research employed the following methods for analysis: Descriptive Statistics, Unit Root test, Co-Integration test, granger causality test, variance decomposition and vector autoregressive model.

3.1 Data description

The study utilised secondary data sourced from, world development indicators and CBN statistical bulletin for the period 1990 to 2020. In this study, fluctuation in oil price per barrel, kerosene pump price fluctuation, diesel pump price fluctuation and petrol pump price fluctuation were used to proxy oil price bubble while exchange rate was used as the dependent variable.

3.2 Theoretical framework and model specification

Following the earlier studies, we base our model on the theoretical underpinning. This study is based on the macroeconomic theory of exchange rate of Balassa-Samuelson (1964). The estimated concise specification of the model is stated as;

LnAt = Ө + yLnJAt + Zt + u..(1)

Where:
A = The price of US dollars per one unit of domestic currency
JA = Labour productivity differentials
Z = other determinant of exchange rate movement
t = at current time
u = random term

Adjusted version of equation (5), with exchange rate volatility infused as a salient factor inputs, and Inflation rate, external reserve, exchange rate, as ancillary variables. Putting these variables into equation (5) gives the functional form of the model given as:

EXCH = (FOPPB, EXPORT, IMPORT, INT, INF)...(2)

In studying economic phenomena, The VAR technique is attractive because it facilitates the study of economic relationships in interdependence; hence all the variables become endogenous. VAR has also been proven to be powerful in analyzing time series data, analysis of both short-run and long-run dynamics. Thus, the above model can be re-written in its compact econometric form as;

$V_t = \alpha + \sum_{i-1}^{k} A_i V_{t-1} + U_t$ ....….(3)

Where:
V_t = (FOPPB, EXPORT, IMPORT, INT, INF)
α = Intercepts of autonomous variables
A_i = Matrix of coefficients of all the variables in the model
U_t = Vector of the stochastic error terms.
V_{i-1} = Vector of the lagged variables
EXCH = Exchange rate movement
FOPPB = Fluctuation in oil price per barrel
EXPORT = Exportation of goods and services
IMPORT = Importation of goods and services
INT = Interest rate
INF = Inflation rate

3.3 Techniques of Estimation

3.3.1 Tests for Stationarity

The estimation of variable-series that are non-stationary will thus lead to estimates that are spurious and thus render the coefficients unreliable for policy prescription and usage. This entails that the investigation will thus carry out the conventional unit root tests on each of the variables to be used in this analysis. The stationarity test will be carried out with the application of Augmented-Dickey Fuller Statistic. The test involves the estimation of the following regression equation. ^{a}xt = a + bt x dxt-1 + Σt (3)

Where x is the variable under consideration. Thus the ADF unit root test states that **Ho:** b = O and Hi: b<O, where the ADF statistic was compared with the observed Mackinnon critical values. A series that exhibits a stochastic trend will not be stationary and cannot be forecast far in the future. Stationary series will constantly return to a given value and no matter the starting point, in the long-run, it is expected to attain the value.

Given an auto-regressive AR (I) process as follows: Yt = m + PYt-1 + Σt, where m and P are parameters and Σt, is the white noise assumption. Y is a stationary series if -1<P<1. However, the above description is valid only if the series is an AR (1) process. (Dickey & Fuller, 1981). A non-stationary series could be made stationary by differencing once or twice.

3.3.2 Tests for Long-run Relationship

In this research, the Johansen (1991) co-integration method was adopted. A non-stationary series could be made stationary by differencing once or twice. This is called an integrated series. It could be integrated of order I which is often denoted as 1(1) or order 2 represented by 1(2). The stationary linear combination of the variables under consideration is called co-integration equation. Variables are co-integrated implies that they share a long –run relationship and will move closely together over time, meaning that the differences between such variables are stable over time and there is some degree of convergence in the long-run.

Testing for unit root is a formalization approach of differencing. The analysis and testing for unit roots naturally lead to the theory of co-integration (Iyoha & Ekanem, 2002). This is because, co-integration deals with methodology of modelling non-stationary time series variables and the idea rests on the fact that even though two time series variables may not themselves be stationary, a linear combination of two non-stationary time series are said to be co-integrated.

4. Empirical Results and Discussion

This section begins with the descriptive statistics and correlation matrix analysis of the various variables used in estimating our regression model. Also, the unit root test, co-integration test and granger causality test were conducted. The Vector autoregressive model was conducted. Furthermore, diagnostic tests such as Cholesky VAR normality residual tests, Serial correlation and Heteroskedasticity test were conducted to ascertain the credibility of our model.

4.1 Summary Statistics

Table 4.1: Descriptive statistics

	EXCH	FOPB	EXPORT	IMPORT	INF	INT
Mean	131.0045	55.80581	21.47224	15.41797	16.99212	3.199465
Median	128.6500	50.30000	21.23634	14.25264	10.22849	5.790567
Maximum	359.0000	116.8800	36.02327	22.81126	75.40165	18.18000
Minimum	8.040000	0.550000	8.829530	9.509990	0.686099	-31.45257
Std. Dev.	100.7227	35.43453	6.730126	3.841251	15.93033	10.45916
Skewness	0.780818	0.363925	-0.023340	0.478535	2.014630	-1.369056
Kurtosis	3.002588	1.844953	2.537028	2.141419	7.234712	5.303467
Jarque-Bera	3.150007	2.407537	0.279674	2.135310	44.13329	16.53749
Probability	0.207007	0.300061	0.869500	0.343814	0.000000	0.000256
Sum	4061.140	1729.980	665.6393	477.9570	526.7556	99.18341
Sum Sq. Dev.	304352.2	37668.19	1358.838	442.6563	7613.264	3281.820
Observations	31	31	31	31	31	31

Source: Author's computation (2022) using Eviews

The table above shows the descriptive statistics of the variables used in estimating our regression model. It is revealed that exchange rate (EXCH) has an average value of 131.0045 with a standard deviation of 100.722. Fluctuation in oil price per barrel (FOPB) was seen to have an average value of 55.80 with a standard deviation of 35.43. Exportation of goods and services (EXPORT) was seen to have an average value of 21.47 with a standard deviation of 6.730. Importation of goods and services (IMPORT) is seen to have an average value of 16.99 with a standard deviation of 3.841. Inflation rate (INF) was seen to have an average value of 21.47 with a standard deviation of 15.930. Interest rate (INT) is seen to have an average value of 3.199 and a standard deviation of 10.45916.

4.2 Correlation matrix

Pearson Correlation depicts the strength of linearity among variables under investigation. Thus the result of our Pearson correlation is given in table 4.2 below.

Table 4.2: Correlation matrix

	EXCH	FOPB	EXPORT	IMPORT	INF	INT
EXCH	1.000000	0.457235	-0.487805	0.070376	-0.445752	0.315975
FOPB	0.457235	1.000000	0.083145	0.066216	-0.444493	0.327945
EXPORT	-0.487805	0.083145	1.000000	0.294328	0.141823	-0.121911
IMPORT	0.070376	0.066216	0.294328	1.000000	-0.230158	0.244741
INF	-0.445752	-0.444493	0.141823	-0.230158	1.000000	-0.961753
INT	0.315975	0.327945	-0.121911	0.244741	-0.961753	1.000000

Source: Author's computation (2022) using Eviews

Table 4.2 above reveals the correlation between the variables used in the model. It is seen that fluctuation in oil price per barrel (FOPB), interest rate (INT) and importation of goods and services have a positive correlation with exchange rate movement in Nigeria. However, exportation of goods and services and inflation rate have negative correlation with exchange rate movement in Nigeria. However, exportation of goods and services and inflation rate have negative.

4.3 Stationarity Test Results

Most time series data are not usually stable in nature; hence they are most times not suitable for forecasting purposes. Thus, the need arises to check the stationary status of the data used. This test was carried out using augmented dickey-fuller ADF test and Phillip-perron test.

Table 4.3: unit root test result

Variables	ADF Levels	ADF First diff	ADF Second diff	PERRON Levels	PERRON First diff	PERRON Second diff
EXCH	1.214034 (0.9975)	-4.430414 (0.0015)	-8.473103 (0.0000)	1.214034 (0.9975)	-4.420873 (0.0016)	-15.32236 (0.0000)
FOPB	-1.387747 (0.5749)	-5.031788 (0.0003)	-6.970731 (0.0000)	-1.387747 (0.5749)	-5.019290 (0.0003)	-21.44456 (0.0000)
EXPORT	-2.669418 (0.0911)	-6.951226 (0.0000)	-6.833251 (0.0000)	-2.635570 (0.0972)	-10.85918 (0.0000)	-35.23892 (0.0000)
IMPORT	-4.003525 (0.0044)	-6.993164 (0.0000)	-5.573480 (0.0000)	-4.017243 (0.0042)	-14.36022 (0.0000)	-25.92543 (0.0000)
INF	-2.200571 (0.2106)	-3.895258 (0.0063)	-3.844758 (0.0076)	-2.753779 (0.0771)	-7.733571 (0.0000)	-21.83587 (0.0000)
INT	-2.136968 (0.2327)	-4.182253 (0.0031)	-3.719793 (0.0101)	-3.277469 (0.0251)	-13.48111 (0.0000)	-18.06652 (0.0001)

Source: Author's computation (2022) using Eviews

The table above shows the unit root result of the variables used in the model. It is revealed that using ADF test all the variables were not stationary at levels. However, all the variables became stationary after second difference. Also, using Philip-Perron test, all the variables were not stationary at levels but they all became stationary at second difference.

4.4 Long-Run Relationship Test

It is important we consider the relationship among macroeconomic variables in the long-run. If a long run relationship exists among the variables then policy formulation will be reliable based on the perceived relationship among them. Against this backdrop, the Johansen integration test was conducted to examine the presence of long-run relationships among the variables.

Table 4.4: Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalues)

Null hypothesis	Trace Statistics	Prob	Max-Eigen value	Prob
R=0	204.2535	0.0000***	83.32131	0.0000***
R=1	120.9322	0.0000***	60.42552	0.0000***
R=2	60.50664	0.0021***	28.71675	0.0357**
R=3	31.78989	0.0291**	22.47772	0.0322**
R=4	9.312174	0.3373	7.570004	0.4241
R=5	1.742170	0.1869	1.742170	0.1869

Source: Author's computation (2022) using Eviews; ** significant at 5%, *** significant at 1%

From table 4.4 above, it is observed that trace test statistic indicates four co-integrating equations among the variables while Max-Eigen value test indicates four co-integrating equations among the variables. Based on the evidence above, we can safely reject the null hypothesis (Ho) and rather accept the alternate hypothesis which says that there are co-integrating vectors. Thus, we can conclude that a long run relationship exist among the variables.

4.5 Granger-Causality Test

Since impact analysis does not suggest causal relationship, the Granger causality test is employed to determine the causal link between fluctuation in oil price per barrel, exportation of goods and services, importation of goods services, inflation rate, interest rate and exchange rate movement in Nigeria. The granger causality result is presented in table 4.5 below

Table 4.5: Granger causality test

Null Hypothesis	Observations	F-Statistic	Prob.
FOPB does not Granger Cause EXCH EXCH does not Granger Cause FOPB	30	0.90480 1.10937	0.3499 0.3016
EXPORT does not Granger Cause EXCH EXCH does not Granger Cause EXPORT	30	4.65331 2.87901	0.0401 0.1012
IMPORT does not Granger Cause EXCH EXCH does not Granger Cause IMPORT	30	0.01706 0.02817	0.8971 0.8680
INF does not Granger Cause EXCH EXCH does not Granger Cause INF	30	1.81315 2.62716	0.1893 0.1167
INT does not Granger Cause EXCH EXCH does not Granger Cause INT	30	1.93633 1.84522	0.1754 0.1856
INF does not Granger Cause FOPB FOPB does not Granger Cause INF	30	1.05293 3.04970	0.3139 0.0921
INT does not Granger Cause FOPB FOPB does not Granger Cause INT	30	0.78562 2.95119	0.3833 0.0973
INT does not Granger Cause EXPORT EXPORT does not Granger Cause INT	30	0.33004 3.57777	0.5704 0.0693
INT does not Granger Cause INF INF does not Granger Cause INT	30	0.91657 3.26141	0.3469 0.0821

Source: *Author's computation (2022) using Eviews*

The result revealed a unicausal relationship between exchange rate movement (EXCH) and importation of goods and services (IMPORT) at 5% level of significance. There is unicausal relationship between fluctuation oil price per barrel and interest rate (FOPB) at 10% level of significance. There is unicausal relationship between fluctuation oil price per barrel and inflation rate (FOPB) at 10% level of significance. A unidirectional relationship exists between exportation of goods and services (EXPORT) and interest rate (INT) at 10% level of significance. There is unicausal relationship between interest rate (INT) and inflation rate (INF) at 10% level of significance.

4.6 Regression result and interpretation

Table 4.6: **Vector autoregressive model (EXCH)**

Variable	Coefficient	Std. Error	t-Statistic	probability
Constant	10.75935	11.05902	0.972903	0.3435
D(FOPB(-1))	-0.007498	0.183452	-0.040873	0.9679
D(FOPB(-2))	-0.402792	0.182715	-2.204479	0.0435
D(EXPORT (-1))	2.543642	0.956435	2.659505	0.0178
D(EXPORT (-2))	1.297770	0.764756	1.696972	0.1103
D(IMPORT(-1))	-0.149052	0.932608	-0.159823	0.8752
D(IMPORT(-2))	-0.821349	0.905320	-0.907247	0.3786
D(INF(-1))	1.487295	0.848629	1.752584	0.1001
D(INF(-2))	1.986559	0.905839	2.193059	0.0445
D(INT(-1))	-0.139884	1.237988	-0.112993	0.9115
D(INT(-2))	2.373195	1.307769	1.814690	0.0896
R-square	0. 720	N/A	N/A	N/A
R-square Adjusted	0.496	N/A	N/A	N/A

Source: *Author's computation (2022) using Eviews*

The table above shows the result of the vector error correction model estimation. According to the result, first and second period lag of fluctuation in oil price per barrel (FOPB), have negative effect on exchange rate movement (EXCH) in Nigeria. While First period lag was not significant, second period lag was significant at 5% level. First and second period lag of exportation of goods and service (EXPORT), have positive effect on exchange rate movement (EXCH) in Nigeria. While First period lag was significant at 5% level, second period lag was not significant. First and second period lag of importation of goods and services (IMPORT), have negative effect on exchange rate movement (EXCH) in Nigeria. However, they are not significant at 5% level. First and second period lag of inflation rate (INF) have positive effect on exchange rate movement (EXCH) in Nigeria. While First period lag was not significant, second period lag was significant at 5% level. First and second period lag of interest rate (INT) have positive effect on exchange rate movement (EXCH) in Nigeria. While First period lag was not significant, second period lag was significant at 10% level. The R-square value of 0.72 shows that all the independent variables (FOPB, EXPORT, IMPORT, INF, INT) can jointly explain 72% variation in exchange rate movement (EXCH) in Nigeria.

4.7 The Cholesky VAR normality residual tests

One major prerequisite for good regression model is that the error terms of the observations are normally distributed. The study employed the Cholesky (Lutkepohl) test to ascertain this. The results are presented below table

Table 4.7: Cholesky VAR normality test

Component	**Test criterion**	**Joint chi-square**	**Probability**
6	Skewness	4.025784	0.6732
6	Kurtosis	4.786693	0.5714
6	Jarque-Bera	8.812478	0.7189

Source: *Author's computation (2022) using Eviews ** Chi-square test significant at 5%*

Results from table 4.7 show that the residuals are not normally distributed as the Skewness, Kurtosis and Jarque-Bera statistics did not passed the chi-square test at 5%. This support a-priori expectation as according to economic literature, non-normality is a typical characteristic of financial data series (Elias, 2021).

4.8 Serial correlation and Heteroskedasticity test

To further ascertain the credibility of the model, a variety of diagnostic tests were carried out. The model was tested for autocorrelation (Breusch-Godfrey serial correlation LM test), and VEC Residual Heteroskedasticity test.

Table 4.8: Serial correlation and Heteroskedasticity test

Test	Value	Probability
Chi-sq (Heteroskedasticity)	562.9141	0.2992
LM-Stat (serial correlation)	40.71514	0.2706

Source: *Author's computation (2022) using Eviews*

Considering the null hypothesis of "there is autocorrelation", the result in table 5 above indicates that the probability value of (0.2706) is not statistically significant which rejects the null hypothesis and accept the alternate hypothesis of "there is no auto correlation. Also, given the null hypothesis that "the variables are Heteroskedastic" the result in table 5 above reveals that the probability value of (0.2992) rejects the null hypothesis and accepts the alternate hypothesis of "the variables are Homoskedastic. Therefore, residuals are serially uncorrelated and homoskedastic which means the model is valid and can be used for policy recommendations.

4.9 Variance Decomposition Results

To further examine the short-run dynamic properties of the model, the forecast error variance decomposition (FEVD) was examined. Akinbobola (2012) believed that the statistical efficiency of the coefficients estimates from Vector autoregressive model (VAR) cannot be guaranteed, hence most scholars resort to the interpretation of dynamic simulations of Forecasting Error Variance Decomposition (FEVD). The FEVDs is presented in Table 4.9 below.

Table: 4.9: Forecasting Error Variance Decomposition

Period	EXCH	FOPB	EXPORT	IMPORT	INF	INT
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	71.09155	21.19527	0.519085	4.115764	2.645982	0.432342
3	44.87356	37.12589	0.710846	6.439474	10.00668	0.843550
4	46.93924	31.42293	0.478643	9.425282	11.18282	0.551091
5	46.49482	30.02005	0.328381	11.89166	10.74779	0.517304
6	47.55373	29.09378	0.265454	12.69144	9.906103	0.489487
7	47.48023	29.23935	0.263668	12.84703	9.648845	0.520869
8	47.24001	29.76466	0.233146	12.72215	9.518291	0.521749
9	47.16747	29.76888	0.199434	12.84294	9.516775	0.504504
10	47.08262	29.67683	0.181422	13.03884	9.516518	0.503772

Source: *Author's computation (2022) using Eviews*

In Table 4.9 the FEVD for the variable exchange rate movement (EXCH) for ten periods is presented. Analysis revealed that the variance of EXCH is principally driven by own shock. In the period 1, EXCH accounted for 100% of its own variance. However, its variance decreases consistently throughout the period until the 10th period to 47%. The variables that made significant impact on EXCH are FOPB, IMPORT and INF. By the tenth period, FOPB, IMPORT and INF contributed 29.67%, 13% and 9.5% to EXCH respectively. However, EXPORT and INT made insignificant contribution to the variance of EXCH, which stood at 0.18% and 0.50% by the tenth period.

5. Discussions and Policy Recommendations

This paper examined the effect of oil price bubble on exchange rate movement in Nigeria utilizing annual time series data for the period of 1990 through 2020. The study revealed that first and second period lag of fluctuation in oil price per barrel (FOPB), have negative effect on exchange rate movement in Nigeria. While First period lag was not significant, second period lag was significant at 5% level. The result supports the findings of Habib and Kalamova (2007) for Russia, Norway, and Saudi Arabia that no significant causal relationship exists between oil price and exchange rate for the oil rich countries. It is also in support of findings by Bayat et al. (2015) that oil price does not have significant causal effect on exchange rate in Hungary with frequency domain analysis. In addition, our results agree with Benhabib et al. (2014) as well as Hassan and Zaman (2012), Olayungbo (2019) and Henry(2019) which concluded that there are negative but not significant relationships between oil price and exchange rate for India.

The non-significance (second period lag) impact of oil price bubble on in Nigeria could be as a result of the frequent use of foreign exchange to stabilize the exchange rate level by the Central bank of Nigeria (CBN) periodically may be responsible for the weak causal effects of oil price changes on the exchange rate. Nigeria practices floating exchange rate system. An exchange rate policy intervention of this kind is capable of greatly eliminating the effects of oil price changes on the exchange rate. The result of variance decomposition indicated that fluctuation in oil price per barrel (FOPB), importation of goods and services (IMPORT) and inflation rate (INF) are the largest source of variation in exchange rate apart from self-shock. All the variables used for estimating our model were found to stationary at second difference. The LM serial correlation result shows that the model has no sign of serial correlation which means the assumption of the linearity of the model has not been violated because of the superiority of the autocorrelation test in accepting of alternative hypothesis. The vector Normality test was also considered to show if the model is normally distributed. From the estimation result the Skewness, Kurtosis and Jarque-Bera statistics values which are not significant at five percent shows that the variables are not normality distributed. Another test considered by this study is the vector heteroskedasticity test confirms each of the specified equations has a constant variance.

The findings have implications for the Nigerian government. Policymakers should be cognizant of oil prices in determining appropriate exchange rate equilibrium. Thus, when oil price changes take place, relevant monetary policy measures should be employed to stabilize the unanticipated impacts on exchange rates that may distort the economy. In addition, diversifying away from oil to other non-oil activities that would generate foreign exchange should be a continuous policy pursuit of the policy makers in the country. Also, the revenue generated from oil should be channelled into creation of necessary and adequate infrastructural facilities in order to encourage small industries in producing locally made goods. By this, the importation of goods will reduce and the trade balance becomes favourable. Finally, permanent adjustment in exchange rate of the naira should be the main issue of concern when oil prices are fluctuating.

6. Conclusion

This study examined the impact of oil price bubble on exchange rate movement in Nigeria. The study adopted the VAR model using annual time series data for the period 1990 to 2020 obtained from the CBN statistical database. Based on the results of empirical analysis, it was ascertained that there was sufficient evidence to indicate that oil price bubbles have both negative effect on exchange rate in Nigeria. Only first period lag was significant at 5% level. The trace statistics and the max Eigen value test also indicate a case of no co-integration. Thus, the study attests to the fact that the relationship between oil price bubble and exchange rate movement in Nigeria is insignificant in the long run while in the short run oil price fluctuation could influence exchange rate movement. In conclusion, it can be said that oil price bubble drives exchange rate movement in Nigeria only in the short run.

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