EFFECT OF OIL PRICE, INFLATION RATE ON EXCHANGE RATE IN NGERIA: AN EMPIRICAL ANALYSIS.

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ABSTRACT

The study investigates the effect of oil price on inflation and exchange rate. The study spanned 1980-2019 in Nigeria. The paper first revealed the descriptive statistics of the dependent and independent variable. Among the pair of variables examined the exchange rate has the highest mean value of 115.0664 which implies that Nigeria exchange rate relative to dollar depreciated sharply during the study period. The study further conducted a stationary test by using Augmented Dickey Fuller test so as to avoid spurious regression result. It was observed that all the variables were stationary at level. this further propel the study to run abound co-integration test to ascertain, the existence of long run equilibrium relationship between oil price, exchange rate and inflation rate. The result observed that crude oil price is a determinant of exchange rate. The result of the bound co-integration test showed the existence of long run equilibrium relationship between oil price, inflation and exchange rate. The study therefore recommends that since the oil price is a strong determinant variation in inflation and exchange rate, the government should concentrate on diversifying our economy.

Key words: oil price, inflation rate, exchange rate, ARDL.

تأثير أسعار النفط ومعدل التضخم على سعر الصرف في نيجيريا: تحليل تجريبي

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خلاصة

تبحث الدراسة في تأثير أسعار النفط على التضخم وأسعار الصرف. امتدت الدراسة 1980-2019 في نيجيريا. كشفت الورقة أولاً عن الإحصائيات الوصفية للمتغير التابع والمستقل. من بين المتغيرات التي تم فحصها، كان لسعر الصرف أعلى قيمة متوسطة تبلغ 115.0664 مما يعني أن سعر صرف في نيجيريا مقارنة بالدولار انخفض بشكل حاد خلال فترة الدراسة. وأجرت الدراسة أيضًا اختبارًا ثابتًا باستخدام اختبار ديكي فولر المعزز لتجنب نتائج الانحدار الزائفة. وقد لوحظ أن جميع المتغيرات ظلت ثابتة عند المستوى. وهذا يدفع الدراسة إلى إجراء اختبار التكامل المشترك للتأكد من وجود علاقة توازنية طويلة المدى بين سعر النفط وسعر الصرف ومعدل التضخم. ولاحظت النتيجة أن سعر النفط الخام هو المحدد لسعر الصرف. وأظهرت نتائج اختبار التكامل المشترك المقيد وجود علاقة توازنية طويلة المدى بين سعر النفط والتضخم وسعر الصرف. ولذلك توصي الدراسة بأنه بما أن سعر النفط هو عامل محدد قوي للتغير في التضخم وأسعار الصرف، فيجب على الحكومة التركيز على تنويع اقتصادنا.

الكلمات المفتاحية: سعر النفط، معدل التضخم، سعر الصرف، ARDL.

1. Introduction

Over the past four decades, experts and decision-makers have focused on developing a tenable explanation for the relationship between the price of oil and the macroeconomic environment. The importance of oil to the global economy and the relationship that has been shown between changes in oil prices and the business cycle has attracted attention.

According to Micheal (2022), inflation is a measure of the rate of rising prices of goods and services in an economy. If inflation occur , it would leads to higher prices for necessities such as food, Inflation can occur in nearly any product or service, including need-based expenses such as housing, food, medical care, and utilities, as well as want expenses, such as cosmetics, automobiles, and jewellery etc. Once inflation becomes prevalent throughout an economy, the expectation of further inflation becomes an overriding concern in the consciousness of consumers and businesses alike.

Through both direct and indirect pathways, fluctuations in the price of oil have an impact on a nation's inflation rate. It has an impact on the consumer Price Index (CPI) directly through increases in the price of refined oil products and indirectly through changes in the price of goods and services that use oil or oil products as production inputs (Zivkov, Duraskovic& Manic, 2019). The direct effect would depend, among other things, on the proportion of household spending that goes toward refined oil goods. According to Alvarez et al. (2011), direct impacts typically have a stronger pass-through to inflation than indirect effects. While this is happening, the inflationary pressures brought on by rising oil prices through these channels (first round effects) may prompt behavioral responses from businesses and employees, leading to revisions in inflation expectations, increases in nominal wages, the transfer of a marginal increase in production costs to consumers, and additional changes in the price level through second round effects. Conflitti and Luciani (2017) support this by stating that an increase in oil prices may have an inflationary effect in four ways: an increase in production costs, an increase in inflation expectations, a demand for higher wages from workers to offset the increase in energy prices, and an unfavorable supply shock if real wages do not fall sufficiently, leading to an adjustment in employment. However, because increased oil prices tend to diminish net disposable income, which in turn affects consumption and investment, it could have a deflationary effect through a demand shock.

An exchange rate is the rate at which one currency will be exchanged for another currency and affect trade and the movement of money between countries. Exchange rates are impacted by both the domestic currency value and the foreign currency value (Micheal, 2022). According to the literature, there are strong connections between exchange rates and oil prices especially in the long run (Beckmann et al 2017). 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. When oil prices fall, the effects typically include exchange rate depreciation, a sharp decline in the volume of foreign exchange inflows, and reserve depletion, which frequently results in budget deficits and slower economic growth. Every economy's growth depends on the interactions of macroeconomic factors, which are interrelated and influence each other to determine economic growth. One of the many macroeconomic factors that influence a country's economic growth is the exchange rate. They are all tightly related because the amount of money in circulation has a direct impact on each one of them. According to Etuk (2019), because of the bilateral economic relationships between the two countries, the exchange rate of a national currency in reference to another currency directly affects the national economy. When the domestic currency's exchange rate increases relative to foreign currency, more domestic currency units are needed to buy one foreign currency unit. The country would presumably have to pay more for its imports, which will affect its balance of payments and decrease its foreign exchange reserves. Additionally, this will badly impact the entire economy. Because nation must pay more for all imports, foreign currency loans, and interest payments, all three are impacted. The rest of this study is structured as follows: section 2 covers empirical literature, section 3 is devoted to stylized facts on trend of oil price , inflation and exchange rate during the period of the study.

2. Empirical Review

According to the study carried out by Bawa, et al (2020), the impact of oil price shocks on Nigeria's inflation was investigated. On quarterly data covering 1999Q1 to 2018Q4, a autoregressive distributed lag(ARDL) method was used. The results indicated that rising oil prices caused headline, core, and food inflation indices in Nigeria to rise. The marginal cost of manufacturing did, however, decrease as a result of the drop in oil prices, which eventually moderated domestic inflation. Additionally, when the exchange rate is excluded from the models, negative oil price shocks resulted in higher inflation in Nigeria, indicating that the exchange rate had already absorbed the impact of oil price declines earlier.

This is because lower oil prices ultimately led to lower external reserves, a depreciation of the naira, and higher inflationary pressures.

Using annual data from 1979 to 2014, Ben, et al.(2016) looked at the implications of the oil price shock on macroeconomic performance in Nigeria. The unrestricted Sims Vector Auto Regression model serves as the theoretical foundation for this study (1980). The models are used to calculate the link between changes in the price of oil, the rate of inflation, the GDP, and the real exchange rate. The pace at which the variables were adjusted from the short run dynamics to the long run dynamics was investigated using unit root tests, the Johansen cointegration technique, the variance decomposition test, the Granger casualty test, and the vector auto regression mechanism. In Nigeria, real exchange rates, interest rates, and GDP have all been found to move more than proportionally in response to changes in oil prices. To prevent crude oil from becoming the economy's mainstay and to ensure that frequent swings in the price of crude oil do not significantly affect exchange rate volatility in Nigeria, the Nigerian government needs to diversify its economy away from the oil sector.

In their study, Akinleye, et al.(2020) used the vector autoregressive (VAR) estimation technique to explore the linear and nonlinear of oil price and oil revenue shocks in Nigeria. The study discovers that both positive and negative changes in the price of oil have an impact on real government spending only over the long term, rather than in the short term. Meanwhile, examining changes in the value of external reserves revealed stronger implications for spending over the long term, with positive rather than negative changes in the price of oil having a greater short- and long-term impact on real GDP and consequently leading to inflationary pressure and domestic currency depreciation. This suggests that both in the short and long terms, the nation displays a Dutch disease syndrome, which states that discovery of large oil reserve which ordinarily should be a blessing to any economy, turns to have a negative impact on the economy when oil revenue are not well manage. The results obtained, however, indicate that oil revenue shocks only have the potential to slow economic growth over the long term, while only slightly increasing general price levels in the short term after the initial shocks. There is also evidence that the domestic currency and interest rates are seriously threatened in the short and medium term as import volume rises along with external reserves. Findings on the asymmetric effects of oil revenue shocks showed that, in keeping with theory, positive oil revenue shocks in the near run encourage an expansionary fiscal stance in the Nigerian economy, leading to inflationary pressure and a

depreciation of the local currency. The combined implications of these discoveries suggest the need for proper coordination of fiscal and monetary policy for sustainable macroeconomic stability to be achieved.

In a similar study conducted by Al Rasasi, and Yilmaz, (2016) on the impact of higher oil price on rising consumer prices where as fall in oil price is associated with exchange rate appreciation. He further revealed that unemployment movement has a negative and significant effect on oil price. In another study conducted by Francisco (2016) on economic activity in Portugal. The study used Vector Autoregression model. The result showed that the rise in oil price translated into higher inflation rate.

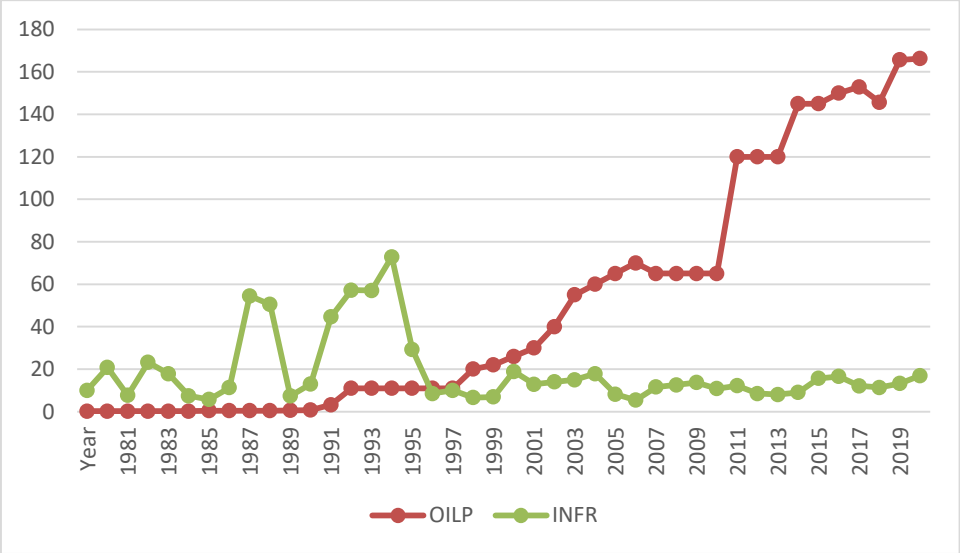
Nchor and Vaclav (2016) conducted a study on the impact of oil price shocks on the Ghanaian economy using Vector Error Correction Model (VECM). The study found out that oil price fluctuation reduces domestic currency value in Ghana. This study was supported by the work of Riadh and Arafet (2016) on the macroeconomic impact of oil price shocks on inflation and exchange rate in selected Middle East and North Africa (MENA) countries such as (Tunisia, Morocco, Algeria, Saudi Arabia, Iran and Bahrain) using a vector autoregression model. The study found out that Algeria and Bahrain oil price shock stimulates appreciation in domestic currency in the short run; the response to real exchange rate to oil price shocks is negative, leading to a reduction in domestic currency value in Tunisia and Morocco.

The work of Aktas et al (2010) on the impact of oil price, on macroeconomic variables in Turkey contradicted the findings of Riadh and Arafet (2016) which found insignificant relationship between oil price increases and macroeconomic variables.

Using monthly secondary data covering the period from January 1997 to August 2020,Agbo (2021) looked at how changes in the price of oil affected changes in the currency rate in Nigeria. The study used the Nonlinear Autoregressive Distributed Lag technique and found that only a fall in oil price's effect on the exchange rate is substantial, even if both increases and decreases in the price of oil will have an opposing effect on the exchange rate. Therefore, in Nigeria, a decline in oil prices has a higher and stronger influence on the exchange rate than an increase. Asymmetry between changes in oil prices and changes in exchange rates is also demonstrated by the results. The study therefore recommended that, policymakers should consider oil prices increase or decrease before choosing an acceptable exchange rate equilibrium to formulate appropriate policy.

3. Stylized facts

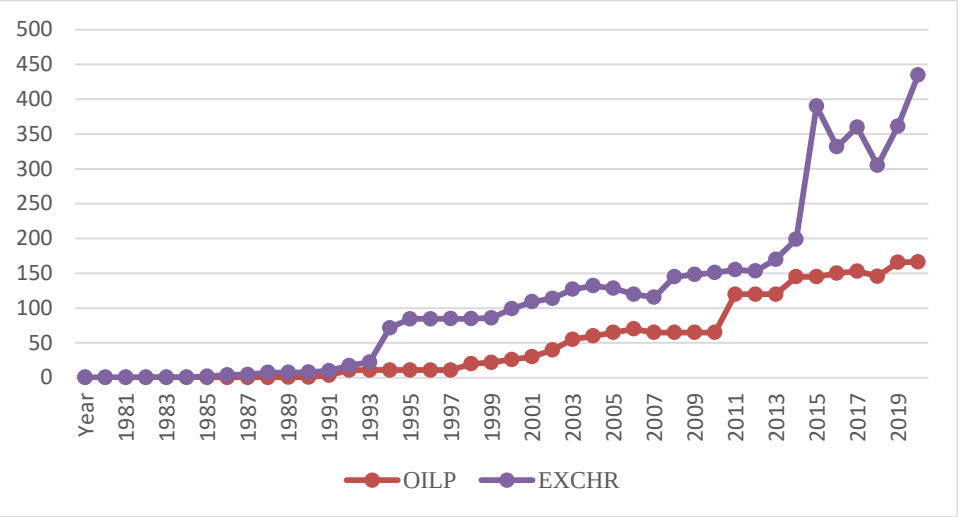
Fig 1: Trend of Oil Price and Inflation Rate in Nigeria between 1980 and 2020



Source: Author's computation, 2022

From Figure 1, the oil price has a steady trend from 1980 to 1991 before the upwards trend in 1992 while the inflation rate has an erratic movement due to fluctuation in inflation rate as a result of the shock. It has an impact on the Consumer Price Index (CPI) directly through increases in the price of refined oil products in 1992 and indirectly through changes in the price of goods and services that use oil or oil products as production inputs.

Fig 2: Trend of Oil Price and Exchange Rate



Source: Author's computation,2022

From Figure 2 , both the oil price and exchange rate move in the same upwards direction from 1980 to 1993 before a sharp upwards increase in exchange rate with a steady increase in the oil price. In 2008 there was a deep drop in both trends due to recession before the pickup then a sharp drop again in 2015. It discloses that either the 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.

4. Theoretical Review

The theoretical underpinning of the study is based on Dutch disease theory which was developed by Corden M and J.PeterNeary in 1982. The model encompasses a non-tradable sector which includes services and two tradable sectors: the booming sector and non booming sector. The booming sector is usually the extraction of natural resources such as oil, natural gas, gold, copper, diamonds etc while the non—booming sector is manufacturing or agriculture. Here, the rapid development in one sector results in a negative impact on the country's overall economy. This assertion corroborates Rybcznsk theorem which states that $dy_1^* > 0, dy_2^* < 0$ which implies dk dk

that if good 1 is capital intensive and good 2 is labour intensive, then if a factor endowment in a country rises (falls) and if prices of output remain the same, the output that uses the factor intensively will rise at the expense of the other good.

Therefore, since the price of petroleum product is a significant economic input, a rise in it affects the consumer price, which tracks the general pace of price rises throughout the economy. The constant

modifications to the local pricing of petroleum products have further increased the pressure on inflation in Nigeria. There is evidence to support the constant and spontaneous price adjustments for petroleum products between 1980 and the present. However, the majority of the adjustment typically results in an increase in the price of consumable items and transportation (Nwosu, 2019). Consumer prices will inevitably alter as oil prices fluctuate in a nation that imports refined petroleum products. This will have an impact on consumption, which will then change aggregate demand (Otoakhia, 2020). This ultimately results in a high cost of living (Nwosu, 2009).

However, shocks in oil prices are thought to have both supply and demand effects on the citizens and the economy (Tang et al.2010). Farazanegan and Markwardt (2009) assert that for the supply effect, the rise in the price of oil leads to a decrease in production inputs, which raises production costs and slows the output and productivity of consumable goods within the economy. Regarding the demand effect, general prices rise due to increasing oil prices, and demand declines due to a decrease in real money available for spending.

5. Methodology

The purpose of this study is to provide empirical analysis of the oil price and macroeconomic fluctuations in Nigeria. The study started by presenting the

descriptive statistics, following a test for the unit root to determine the stationarity of the series. The data used for the paper were collected from secondary source data. Annual time series data over the period of 1980 to 2020 for the price of petroleum products, consumer price index and exchange rate were obtained from the World Bank Development Indicator, The oil price was used as a proxy for the price of petroleum products, while the consumer price index was used as a proxy for the inflation rate.

To determine the effect of inflation and exchange rates on oil prices in Nigeria:

5. 1 Model Specification

INFR = f(OILP) .....(1)

EXCHR = f(OILP) .....(2)

where:

OILP = Oil Price

INFR = Inflation Rate

EXCHR= Exchange Rate

For that reason, to form our multiple regression model, we say:

INFR = β0+ β1OILP .....(3)

EXCHR = β0+ β1OIL .....(4)

Since we have some variables that could affect OILP but not captured in the model, however, due to parsimony, they were all included in the error term which leads to an econometric equation in (3) below:

INFR = β0 + β1OILP + ε ..... (5)

EXCHR = β0 + β1OILP + ε ..... (6)

Theoretically, the a priori expectation is as follows:

β_0> 0; autonomous consumption

β_1>0 in eqn (5); as the oil price increases, the inflation rate increases

β_1>0 in eqn (6); as the oil price increases, the exchange rate increases

ε = Error term

Note that the coefficient of the dependent variable will be explained as β_1 and β_2 while α 0 and μ represent the constant or intercept, and the stochastic error term, respectively.

METHOD OF DATA ANAYLISIS

The study used time series analysis which typically requires a large number of data points to ensure consistency and reliability. The data on oil price , exchange rate and inflation rate were sourced from world bank development indicator (WDI,2021)

5.2 EMPIRICAL RESULT AND DISCUSSION

Table 5.1: Descriptive Statistics

	OILP	EXCHR	INFR
Mean	51.23595	115.0664	18.73531
Median	24.00000	92.49000	12.71577
Maximum	166.2400	435.0000	72.83550
Minimum	0.200000	0.610000	5.388008
Std. Dev.	57.30843	119.4328	16.51313

Skewness	0.833845	1.175731	1.892215
Kurtosis	2.210259	3.586296	5.460058
Jarque-Bera	5.958536	10.27795	35.65415
Probability	0.050830	0.005864	0.000000
Sum	2151.910	4832.789	786.8831
Sum Sq. Dev.	134654.5	584832.1	11180.02
Observations	42	42	42

Source: Author's computation, (2022) via EView9Output

Table 5.1 above shows the descriptive statistics of the dependent and independent variables with the mean for OILP as 51.23595, EXCHR as 115.0664 and INFR as 18.73531. Additionally, the standard deviation revealed the OILP, EXCHR and INFR to be 57.30843, 119.4328 and 16.51313 respectively; and its Jacque-Bera coefficient was 5.958536, 10.27795 and 35.65415. The probabilities of OILP, EXCHR and INFR are all significant at the 5% level of significance. From the table the mean represent the average value in a data set. It can be deduced that exchange rate has the highest mean value of 115.0664 which indicates that Nigeria exchange rate relative to dollar has depreciated extremely. Going by the standard deviation values, the exchange rate has a high standard deviation which indicates that the data are more spread out. The statistical minimum , also known as the low outlier limit is the minimum values in a set of values, excluding outliers. The statistical maximum also known as the high outlier limit, is the maximum values in a set of values, excluding any outliers. From the table, the exchange rate has the highest maximum values which supports the results of the mean and standard deviation value.

5.2 Unit Root Test

To obtain a reliable model that captures the relationship between oil prices and macroeconomic fluctuations in Nigeria, a unit root test is employed to examine the time series properties of the variables in the study. To an extent, this aids in avoiding spurious regression. Therefore, the augmented Dickey-Fuller (ADF) test was used in order to avoid the problem of autocorrelation.

Table 5.2. AUGUMENTED DICKEY FULLER. TEST RESULT (UNIT ROOT TEST)

Variable	ADF Statistics	5% critical value	Probability	Order of Integration	Remarks
OILP	-6.937800	-2.936942	0.0000	I(0)	Stationary at level
INFR	-3.094009	-2.935001	0.0349	I(0)	Stationary at level
EXCHR	-7.264570	-2.936942	0.0000	I (0)	Stationary at level

Source: Author's Computation (2022) via EView9 Output

The study was only concerned with the negative values of our test statistic DFr if the calculated test statistics is less (more negative) than the critical value, the null hypothesis of $\gamma=0$ is rejected and no unit root is present. Where the process has no unit root, it is stationary and henceforth it exhibits diversion to the mean; so the lagged level will provide relevant information in predicting the change of the series and the null hypothesis of the unit root will be rejected. Example: DF statistics of -6.937800 which is more than the tabulated critical value of -2.936942, so all the 95% level of the null hypothesis of a unit root was rejected.

Table 5.3: BOUND CO-INTEGRATION TEST

Null Hypothesis: No long-run relationships exist

Dependent variable	SIC lag	Calculated F-Statistics	Probability	Outcome
INFR	2	1163.522	0.0000	Cointegration
EXCHR	2	1421.78	0.0000	Cointegration
Critical values	1%	5%		10%
K=2	I(0) I(1) 4.326 6.240	I(0) I(1) 3.212 4.4344		I(0) I(1) 2.651 3.739

Source: Author's Computation (2022) via EView9 Output

The result from the bound cointegration test shows that crude oil price as a function of exchange rate and lagged value of crude oil price. The lag length structure was selected based on akaike information criterion and the F-calculated of 1163.522 which, when compared with critical values generated from

Pesaran and Pesaran (1997) shows the existence of long run relationship among the variables. In the second equation, inflation rate is modelled as a function of crude oil price and lagged values of inflation rate itself, the F-calculated of 1421.78, which is also greater than the critical value generated from Pesaran and Pesaran (1997), shows the existence of long run relationship of the variables.

CONCLUSION The objective of this work is to establish the effect of oil prices on exchange rate and inflation rate in Nigeria. A time series properties of the variables were examined using ADF. The result revealed that the variable contained unit root at 5% level of significance, but their first difference was stationary. The study conducted a post-estimation test using bound cointegration and found the existence of long run relationship between crude oil price, exchange rate and inflation rate. The empirical result was in line with what economic theory will suggest. International trade theory specifies that when price of an export rises, if its demand is inelastic, this produces a demand for domestic currency, driving up its value. It is obvious that Nigerian foreign exchange rate will appreciate when oil price were driven up by an increase in global demand for oil. Conclusively, oil price is a strong determining factor of exchange rate and also has a direct link to inflationary or deflationary tendencies and influences the monetary policies in Nigeria in terms of the cost of borrowing.

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