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DUTCH DISEASE: MYTH OR REALITY? AN ANALYSIS OF THE ARDL MODEL

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ABSTRACT

The theory of Dutch disease has existed in literatures since the 1960's. The concept has developed and has been attributed to the increase in pernicious distributive struggle of resources and rent seeked by various equally powerful groups, which resulted in a decline in investment levels and growth rates. This concept is applicable to the Nigerian economy as Nigeria is a mono-product economy depending solely on crude oil. This paper differs from others as a different model (ARDL model) is used to analyze the extent of Dutch disease prevalent in Nigeria. The methodology can be applied irrespective of whether the time series is I(0), I(1) or frictionally integrated; the problem of endogeneity is avoided while the short run and long run parameters are estimated simultaneously. Data used spans the years 1980-2016, as it captures both long run and short run relationships effectively. The stationarity test depicts stationary at I(1) taking into consideration two lags. In addition, the long run and short run relationships were established through the bound test since the computed F statistic is higher than the upper boundary. Analysis suggests that the relationship between effects of oil production on the balance of payments and exchange rate in Nigeria extends to the long run. The results showed that for every unit change resulting from the balance of payment, oil price increased by 90% and for every unit change resulting from the exchange rate, oil price fell by 59%. This study supports the fact that the balance of payment and exchange rates are veritable ingredients to raise economic growth if maintained for the benefit of all. Therefore, the option of economic diversification should be seriously considered by the Nigerian government.

Contribution/Originality: This study is to contribute by applying different model (ARDL model) in order to analyze the scope of Dutch disease in case of Nigeria.

1. INTRODUCTION

To consolidate the increasing literature on the booming economic sector and the Dutch Disease, the Nigerian economy is used as a model to investigate the theory of Dutch Disease. The term Dutch Disease refers to the adverse effects of the Dutch manufacturing of natural gas discovered in the 1960's, essentially through the subsequent appreciation of the Dutch real exchange rate (Corden, 1984). Dutch disease was coined from the experience of Netherlands in the 60's as a result of the exploitation of the newly discovered large deposits of natural gas in the North sea; non-tradable sectors therefore became less competitive and declined with a ripple effect in which the entire economy also declined (Olusi and Olagunju, 2005). Subsequently the rest of the tradable goods sector declined too. The aforesaid resource curse leads to two areas of research: Politics and economy of mineral rent generation and distribution, and general equilibrium effects of the minerals boom, including the spending effects of the mineral rents.

A new concept of the Dutch disease developed by Lane and Aaron (1996) and Bature (2013) attributed the Dutch disease to an increase in rent seeking and pernicious distributive struggle of resource rents by various and equally powerful groups, which resulted in a decline in investment levels and growth rate. The Nigerian economy as a mono-product economy depends solely on a single commodity, oil, and the federal government revenue profile shows that oil earnings account for over 80 percent of foreign exchange earnings. However, the resurgence of the oil industry over the past few years has been erratic, thus exposing the economy's vulnerability to changes in the price of oil in the international market (Eko *et al.*, 2013).

Production levels have reached totals not recorded since the late 1980s and has continued to increase. In 2010, total Nigerian production was almost 7.3 trillion barrels, with 2012 reaching above 8.3 trillion. It appears that Nigeria is a world leading producer of crude oil, with the United States of America as a major buyer (www.opec.org).

Nigeria depends on its crude oil revenue to finance its economic activities; this over dependence on crude oil has created vulnerability to the vagaries of the international market. Also mismanagement of resources by political regimes could have an impact on the Nigerian economy. Presently, the price of crude oil has fallen 50%. The fall in the price of oil has a significant effect in reducing transport and other business costs. Falling oil prices is good for oil importers such as Europe, china, India and Japan but it is bad news for oil exporters such as Venezuela, Kuwait, Iraq and Nigeria.

With the falling oil prices Nigeria would face a balance of payment deficit as revenue accrued by the government will not be enough to fund both her recurrent and capital expenditure. A fall in oil prices largely reflects weak global growth rather than economic recovery. The fall in the prices of crude oil will also have an impact on the Naira exchange rate as due to the balance of payment deficit experienced, Nigeria would have to resort to borrowing both internally and externally thus leading to a fall in the value of the Naira.

This research examines the presence of Dutch disease in Nigeria, taking the agricultural and manufacturing sectors as the lagging tradable sectors, unlike earlier studies that either took the manufacturing sector or the agricultural sector as the declining tradable sector. Also political regimes would be considered as Nigeria has experienced both military and democratic rules. The core model would be extended to account for economic dynamics of spending, saving and investment. This would therefore mean the decomposition of the lagging tradable sector.

The recent trend in the fall of oil prices has been associated with raising fiscal deficit financing of the economy, suggesting that oil prices play a major role in the economy of most countries. Deficit financing of the economy however leads to retarded economic growth in developing and developed countries, due to the inability of countries like Nigeria to check inflation during the deficit years. Thus, the research gives insight into problems that arise in mono-sectors, where the economy is mainly driven by oil as it impacts the economic growth of the world at large.

Also, this study would enable policy makers to key into other sectors of the economy so as to contribute to the revenue generation of the country, thus promoting economic growth without recourse to huge deficit financing of the economy. Deficit financing tends to lead to inflation especially when there is increase in tariffs or tightening import quotas is not matched by corresponding increase in other revenue generating sectors of the economy of Nigeria. The avoidance of a loss of import- competing industries then comes at the expense of the lagging export sector as well as the booming sector, which is the present case in Nigeria.

The objective of the study is to appraise the dynamic effects of oil production on the balance of payments and exchange rate in Nigeria. The Time series data of oil prices and gross domestic production of each sector (petroleum, agriculture, manufacturing, education and defense) in Nigeria will be used to study the performance of the economy, with data spanning 1980-2017.

2. LITERATURE REVIEW

Ezeala-Harrison (1993) in his diagnosis of a severe Dutch disease syndrome, using Nigeria as a case study, adopted the structural adjustment economic reforms of 1986, in an attempt to retrace steps towards economic stability. Despite determined efforts, success may be threatened by two fundamental economic errors that contribute to the problem of Dutch disease; the errors are committed when economic restructuring programs are being operated mainly as urban-based and secondary/industrial sector based, while the primary agricultural rural-based sector has little bearing. Also serious efforts have to be taken by the government to treat both symptoms and also to cure the Dutch disease; this would be achieved by stringent federal government fiscal restraint on immediate spending of export boom revenues. This would mean maintaining a federal government surplus budget and, at the same time; the prevention of commercial banks by the federal government from turning increased foreign exchange reserves into more credits for the private sector.

Nyatepe-Coo (1994) study was entitled "Dutch disease, government policy and import demand in Nigeria". Government policies and sectoral changes on importation demands in Nigeria were examined in the context of the oil shocks of the 1970s and 1980s. A two –equation model was estimated to determine the real exchange rate and import demand. The results showed that import demand increased significantly in the boom era, and induced a squeeze on the agricultural sector. Also by inducing and sustaining real exchange rate overvaluation, expansionary government policies contributed to higher demand for import even after the collapse in oil prices.

Findings by Davis (1995) showed little corroborating evidence of Dutch disease effects. 91 out of the 127 countries defined as developing countries by UNDP were used in the study; the selection process was based on the availability of complete social and economic data. The countries seen as developing were classified as either (i) newly mineral- based economies, (ii) ongoing mineral based economies or (iii) ex-mineral based economies. The paper examined the economic and development performance of the mineral based economies in the long run.

Olusi and Olagunju (2005) examined "The primary sectors of the economy and the Dutch disease in Nigeria". Variables of interest were sourced from International Financial statistics, and were analyzed through the use of the Vector autoregressive (VAR) modeling consisting of impulse response functions and variance decomposition analysis. Findings proved that Dutch disease was diagnosed as a delayed occurrence, therefore suggesting that the government should lay more emphasis on the agricultural sector.

Smith (2010) examined the impact of the oil price boom in the 1970s and the subsequent bust on non-oil economic activity in oil-dependent countries. During the booming periods, manufacturing value rose and exports were on the increase, relative to non-oil dependent countries, along with employment, investment and wages. To a lesser extent, measures reduced during the bust showed positive relationships with oil prices. In contrast to the Dutch Disease model, export manufacturing sectors grew faster than non-export sectors. The results suggested a push towards industrialization induced by the oil revenue windfall, since exports of agricultural products and non-hydrocarbon natural resources displayed strongly negative relationship to prices.

Ismail (2010) derived structural implications of the Dutch disease in oil-exporting countries due to permanent oil price shocks, using a Heckscher-Ohlin factor endowment model. These implications were tested through manufacturing sector data accessed from a wide group of countries including oil-exporters, from 1977 to 2004. The results derived on oil-exporting countries were fourfold. Firstly, an increase in oil price had a negative impact on output from the manufacturing sector. Secondly, data showed that oil windfall shocks had a stronger impact on manufacturing sectors in countries with more capital markets open to foreign investment. Thirdly, the relative factor price of labor to capital, and capital intensity in manufacturing sectors appreciated as windfalls increased. Lastly, manufacturing sectors with higher capital were less affected by windfall shocks than their peers, possibly due to a larger share of the effect being absorbed by more labour intensive tradable sectors.

Over the years several authors have attributed the decline in Nigerian agricultural production as a result of the discovery of crude oil.

Ammani (2011) set out to investigate if agriculture was really neglected as a result of the oil boom. The study took a historical perspective to trace the path of capital expenditure allocations to the agricultural sector in Nigeria. Secondary data on planned capital expenditure and the budget estimates of capital expenditure allocations to the Agriculture, Water Resources, Health, Education and Defence sectors in Nigeria during the oil boom period from 1977-1983 were sourced and used. Descriptive statistics and the one-way analysis of variance technique were used to achieve the objectives of the study. The Turkey's Multiple Comparison method was employed to determine which mean(s) differed in both cases. The empirical findings of the study indicated a substantial increase in the quantity of capital expenditure allocation to the agriculture sector during the oil boom period; and that more capital expenditure was allocated to the agriculture sector than was allocated to either the Health, Education or Defence sectors in Nigeria during the oil boom period. Conclusions drawn indicate a decline in agricultural production in Nigeria; however the decline is not attributable to the neglect of the agricultural sector resulting from the oil boom. The reason could be a manifestation of Dutch Disease, Natural Resource Curse, or Rent Seeking phenomenon.

Oyesanmi (2011) investigated the presence of the Dutch disease hypothesis in Nigeria in a situation of long run equilibrium. The focus was on the concept of long run equilibrium between crude oil export and agricultural output, covering the period between1970-2009. The study used the Johansen cointegration test, Vector Error Correction Model type of VAR, Impulse Response Function and Variance Decomposition in investigating this possible long run relationship. The results of the (Trace and maximum Eigen values) Johansen tests found cointegration of order (1) which means the variables move together in the long run and crude oil has the expected sign and is significant in explaining the expected relationship. The Vector Error Correction (VEC), when agriculture is normalized on other variables showed crude oil having the same expected negative sign and it is significant in explaining the relationship. Also, the Impulse Response Function showed innovation in crude oil is significant in explaining the negative changes in agriculture as expected. Lastly using Variance Decomposition in crude oil showed about 20% variations in agriculture when shocks were applied. The findings proved that the Dutch Disease hypothesis exists in Nigeria and cannot be ignored.

Otaha (2012) examined why the various promises held out by revenue inflow from oil export had not made any significant impact on the lives of Nigerians and the economy as a whole. The paper traced the problem to the inherent contradictions, anomalies, and problems associated with countries that depended on oil as their primary export commodity. The revenue it generated when prices were high tended to cause "Dutch-Diseases" as high oil revenue increased exchange rates, promoted adverse balance of payments when prices fell, and reduced the incentive to risk investment in non-oil sectors like agriculture and manufacturing. The paper concludes that it is imperative to establish strong political governance to address these anomalies.

Edun (2012) assessed the impact of expanding oil revenues on non-oil sectors of the Nigerian economy, taking the agricultural sector as the non-tradable sector. It produced some empirical findings indicating that the Nigerian agriculture in the past five decades or more has been declining and it demonstrated that the changes in the Nigerian economy in general were in part a direct consequence of the increase in oil revenue which pushed up the exchange rate and made agricultural products uncompetitive for export. The study included both fixed and post fixed exchange rate systems in Nigeria, grouped into three phases; data was analyzed through the use of vector autoregressive (VAR) modeling consisting of impulse response functions and variance decomposition analyses. The study showed that Dutch Disease existed and concludes that the contraction of the agricultural sector in Nigeria was a result of the sudden windfall from oil.

Bresser-Pereira (2013) examined the value of exchange rate and the Dutch disease, defined by the existence of two exchange rate equilibriums (the current and the industrial exchange rate equilibriums). The study claimed that there is a value and a market price for each good or service; we also have a value and market price for foreign currencies. The value is said to be the cost plus reasonable profit corresponding to the exchange rate that makes competitive the country's competent business enterprises; the nominal exchange rate floats around the value based on the demand and supply of foreign currencies. This basic distinction of exchange rate in terms of value and price allows us to understand that the two equilibriums are defined in value terms, and opens room for a clear distinction of the policies that affect the value from the ones that affect the market price of the exchange rate.

Botta (2014) described the medium-run macroeconomic effects and long-run development consequences of a financial Dutch disease that may take place in a developing country with abundant natural resources. Giving the post Keynesian view of the macroeconomics of the financial Dutch disease, the Dutch disease was first prevalent in the financial markets. Findings suggested the introduction of constraints on short-term capital flows, in the form of taxes on exchange rate-based capital gains, to tame exchange rate/capital flows boom-and-bust cycles. Also a monetary policy that targets competitive nominal and real exchange rates should be introduced in order to favour the process of production and export diversification. Such a policy would be more effective to counter-act the long-run negative effects of Dutch disease.

Onodugo *et al.* (2015) examined the Nigerian economy in their work, "Diversification of the economy: A panacea for Nigerian Economic Development". The work was based on descriptive statistics and the findings proved that for the economy to be diversified there has to be a serious shift in economic policies and political will and readiness to implement such changes and policies. Furthermore, the data showed that the neglect of agriculture had led to a constant depreciation in the GDP of the country. Eko *et al.* (2013) and Suberu *et al.* (2015) were of the opinion that agriculture and tourism could be a source of diversification for Nigeria towards attaining sustainable growth and development.

The study differs from other works because the aim is to know to what extent the booming sector (Oil production) has on the balance of payment and exchange rate. Also this study is based on econometric models and facts, not descriptive statistics. The VAR modeling technique is applied, consisting of variance decomposition analyses. The theory that supports this research is the core model, taking into consideration the decomposition of the lagging sector and international capital mobility model. These four models are summarized as the Dutch disease theory. The reason this model is chosen is to test its applicability to the Nigerian situation and how relevant it is to the Nigerian situation, while considering the political eras experienced in Nigeria from 1970-2017.

3. METHODOLOGY

For the purpose of this study the ARDL model is adopted. The model is employed based on the dynamism of economic variables. Among other advantages, it can be applied irrespective of whether the time series variables are I(0), I(1) or frictionally integrated (Pesaran *et al.*, 2001). Moreover, the problem of endogeneity is avoided and small sample properties of ARDL approach are more reliable compared to Johansen and Juselius's cointegration method. Moreover, short-run and long run parameters can be estimated simultaneously and the error correction model can integrate short-run adjustments and long-run equilibrium without missing the long-run information.

For cointegration to be established, the computed F-statistics must be greater than the upper bound critical values and the null of no cointegration rejected. For a lower computed F-statistics compared to the upper bound critical values, the result should fail to reject the null of no cointegration. However, if the existence of cointegration is established, the next stage is the estimation of short run and long run coefficients of the cointegrated equations.

The ARDL Bounds test approach to cointegration is based on the ordinary least square (OLS) estimation of a conditional unrestricted error correction model (UECM) developed by Pesaran *et al.* (2001). This approach is applied to ascertain the existence of a long run relationship and for the estimation of long and short run coefficients. From the ARDL approach, we can derive a dynamic error correction model (ECM) following a simple linear transformation, where the ECM integrates short run dynamics with long run equilibrium without losing long run information. In order to implement the bounds testing procedure, it is necessary to model Equation 1 and Equation 2 as a conditional ARDL as in Shin and Pesaran (2011) in the following form:

$$OPR_t = f(INF_t, INT_t, EXR_t, (X - M_t), MS_t, BOP_t \quad (1)$$

$$OPR_t = f(INF_t + INT_t + EXR_t + (X - M)_t + MS_t + BOP_t \quad (2)$$

Stating Equation 2 in a linear regression form, we obtain;

$$OPR_t = f(INF_t + INT_t + EXR_t + (X - M)_t + MS_t + BOP_t + \mu_t \quad (3)$$

OPR=f(INF,INT,EXR,(X-M),MS BOP)

OPR= oil production

INF= inflation

INT= interest rate

EXR= exchange rate

MS= money supply

X-M=net income (x=export, M=import)

BOP=balance of payment

Equation 3 therefore becomes

$$Y_t = \beta^+ X_t^+ + \beta^- X_t^- + \mu_t \quad (4)$$

Where β^+ and β^- are the associated long-run parameters and X_t is a $K \times 1$ vector of regressors decomposed as:

$$X_t = X_0 + X_t^+ + X_t^- \quad (5)$$

Where, X_t^+ and X_t^- are partial sum processes of positive and negative changes in X_t:

$$X_t^+ = \sum_{j=1}^{t} \Delta X_j^+ = \sum_{j=1}^{t} max(\Delta X_j, 0)\ and\ X_t^+ = \sum_{j=1}^{t} \Delta X_i^- = X_t^+ = \sum_{j=1}^{t} \min(\Delta X_j, 0 \quad (6)$$

By associating Equation 2 to the ARDL (p, q) case, we obtain the following asymmetric error correction model (AECM):

$$\Delta Y_t = PY_{t-1} + \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^- \sum_{j-1}^{p-1} \varphi_j \Delta Y_{t-j} + \sum_{j-0}^{q} (\pi_j^+ \Delta X_{t-j}^+ + \pi_j^- \Delta X_{t-1}^-) + e_t$$

'for j =1,……q (7)

Where: $\theta^+ = -PB^+\ and\ \theta^- = -PB^-$

$$\Delta lnOPR_t = cons + \sum_{i=1}^{n} b_i \Delta lnOPR_{t-1} + \sum_{i=1}^{n} c_i \Delta lnINF_{t-1} + \sum_{i=1}^{n} d_i \Delta lnINT_{t-1} + \delta_1 lnOPR_{t-1} + \delta_2 lnINF_{t-1} + \delta_3 lnINT_{t-1} + \mu \quad (8)$$

$$\Delta OPR_t = cons + lnOPR_{t-1} + \theta_1^+ lnINF_{t-1}^+ + \theta_1^+ lnINT_{t-1}^- \theta_2^+ lnEXR_{t-1}^+ + \theta_2^- ln(E-M)_{t-1}^- + \theta_1^+ \theta_1^+ lnMS_{t-1}^+ + lnBOP_{t-1}^+ \sum_{i=1}^{p-1} \varphi_1 \Delta lnOPR_{t-1} + \sum_{i=1}^{q} \varphi_1 \Delta lnINF_{t-1}^+ + \sum_{i=1}^{q} \varphi_1 \Delta lnEXR_{t-1}^- + \sum_{i=1}^{q} \varphi_1 \Delta ln(X-M)_{t-1}^+ + \sum_{i=1}^{q} \varphi_1 \Delta lnBOP_{t-1}^- + \mu \quad (9)$$

The model shows the short and long run relationships respectively

Empirical implementation of the nonlinear ARDL approach entails the following steps.

First, while the ARDL approach to cointegration is applicable irrespective of whether the variables are I(0) or I(1), it is absolutely necessary to conduct unit root tests such that no I(2)variable is involved. This is important as the presence of an I(2) variable renders the computed F-statistics for testing cointegration invalid. To this end, the study applies the widely used ADF and PP unit root tests for establishing the variable orders of integration. In the second step, the study estimates equation using the standard OLS estimation method. As in Katrakilidis and Trachanas (2012) the present study adopts the general-to-specific procedure in order to arrive at the final specification of the ARDL model by trimming insignificant lags. Third, based on the estimated ARDL, a test is carried out to detect the presence of cointegration among the variables using the bounds testing approach of Pesaran *et al.* (2001) and Shin and Pesaran (2011). This involves the Wald F test of the null hypothesis, β0 = β1 = β2 = β3 = 0. In the final step, with the presence of cointegration, examination of the effects of long-run and short-run asymmetric relations of oil production on the balance of payments and exchange rate of the Nigerian economy is made and inferences are drawn.

4. RESULT ANALYSIS

The investigation of the dynamic effects of oil production on the balance of payments and exchange rate in Nigeria commences with the unit root test followed by the descriptive statistics and correlational matrix to show the correlation between the variables. Although, the ARDL test allows for the combination of both I (1) and I (0) variables, I (2) variables are not allowed. The tables below are actually formulated to provide answers to the research question which are: What is the effect of oil prices in the oil industry in Nigeria which is the booming sector, What is the impact of fluctuating oil prices on the lagging sector in the Nigerian economy which are the manufacturing and agricultural sector, and What effect does fluctuating oil prices have on the non- tradable sectors such as defense and educational sector in Nigeria? To analyze the results obtained, we first take into consideration all the test results obtained to see if it is in confirmation with the basic assumptions. Table 4.1 shows the summary of the relevant stationarity test (Phillips- Perron), and serial correlation test respectively. The results of this study are as follows:

The tables below (Table 4.1 – Table 4.4) show the results of the augmented dickey-fuller test and Phillip-Perron unit root test for stationarity conducted on the variables; results were stationary at both the 5% and 10% critical values as shown in Table 4.1a, taking into consideration 2 lagged values. For all the variables, the ADF test statistic and PP adjusted T-stat are higher than the critical values. Therefore each variable is stationary.

The unit root test results revealed that all variables are stationary at I (1) and none of the variables exhibit I (2) behaviour. Therefore, the ARDL estimation technique is suitable to estimate the data to reveal both long run and short run relationships between the variables. The results of using the bounds test to see the cointegration results for the equation are shown in Table 4.1b. The Phillip- Perron unit root test was chosen above the augmented dickey fuller test (ADF) because it is superior. The estimates of the bound test to confirm co integration for equations as shown in table 4.1b supports the existence of a long run relationship for the equations since the computed F-statistic for the equations are higher than their critical upper bounds. This suggests that the relationship between effects of oil production on the balance of payments and exchange rate in Nigeria extends to the long run.

Table-4.1. summary of Stationarity Test (ADF AND PP).

Table-4.1a. Unit Root Test - Augmented Dickey-Fuller test (ADF).

Variable	WITHOUT TREND			WITH TREND		
	Level of Significance	**Critical Values**	**ADF t-Statistic**	**Level of Significance**	**Critical Values**	**ADF t-Statistic**
D(**LOPR**)	1% level	-3.632900	-7.435275	1% level	-4.243644	7.326153
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **INF**)	1% level	-3.711457	0.867909	1% level	-4.243644	-6.533370
	5% level	-2.981038		5% level	-3.544284	
	10% level	-2.629906		10% level	-3.204699	
D(L **INT**)	1% level	-3.639407	-2.015383	1% level	-4.243644	-12.18694
	5% level	-2.951125		5% level	-3.544284	
	10% level	-2.614300		10% level	-3.204699	
D(L **EXR**)	1% level	-3.632900	-5.458546	1% level	-4.243644	-5.361776
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **MS**)	1% level	-3.632900	-6.176653	1% level	-4.243644	-6.099608
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **X-M**)	1% level	-3.639407	-9.121497	1% level	-4.252879	-9.052809
	5% level	-2.951125		5% level	-3.548490	
	10% level	-2.614300		10% level	-3.207094	
D(L **BOP**)	1% level	-3.632900	-7.705970	1% level	-4.243644	-7.853980
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	

Table-4.1b. Unit Root Test- Phillips-Perron Test.

Variables	WITHOUT TREND			WITH TREND		
	Level of Significance	**Critical Values**	**PP TEST STATISTIC**	**CRITICAL VALUES**	**ADJ. T-STAT**	**PP TEST STATISTIC**
D(**LOPR**)	1% level	-3.632900	-7.523538	1% level	-4.243644	-7.415936
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **INF**)	1% level	-3.632900	-6.466199	1% level	-4.243644	-6.629449
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **INT**)	1% level	-3.632900	-9.606170	1% level	-4.243644	-11.37401
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **EXR**)		-3.632900	-5.470751	1% level	-4.243644	-5.376731
		-2.948404		5% level	-3.544284	
		-2.612874		10% level	-3.204699	
D(L **MS**)	1% level	-3.632900	-9.903692	1% level	-4.243644	-10.32673
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
D(L **X-M**)	1% level	-3.632900	-10.01343	1% level	-4.243644	-9.894680
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	
: D(L **BOP**)	1% level	-3.632900	-7.940887	1% level	-4.243644	-10.83501
	5% level	-2.948404		5% level	-3.544284	
	5% level	-2.948404		5% level	-3.544284	
	10% level	-2.612874		10% level	-3.204699	

Table-4.2. Bound test to cointegration for Equation 6.

	Null hypothesis: No cointegration	
Computed F-statistic	**4.2**	
Critical values	**Lower bound**	**Upper bound**
1% significance level	2.79	4.1
5% significance level	2.22	3.39
10% significance level	1.95	3.06

Table-4.3. ARDL Short Run Estimates and ECM equation.

	Equation	
Variable	**Coefficient**	**Variable**
D(LOPR)		
D(LOPR(-1))	0.404728	0.0395
D(LINF)		
D(LINF(-1))	-0.025125	0.0892
D(LINT)	-0.030839	0.0047
D(LINT)	0.017509	0.0602
D(LEXR(-1))		
D(EXR)	0.178376	0.0570
D(LSM(-1))	-0.105016	0.0951
D(LMS)	-1.042487	0.0536
D(LX-M(-1))	-18.275127	0.0016
D(LX-M)	0.402927	0.0032
D(LBOP(-1))	0.344087	0.0078
D(CBOP)		
ECT(-1)	-0.806116	0.0002
J-B Normality Test	0.2001	
LM Test	10.86	0.004
ARCH Test	0.5406	0.502
Heteroskedasticity Test	0.698730	0.7695

Table-4.4. Long run Coefficients for Equations.

	Equation	
Variable	**Coefficient**	**Prob.**
LOPR	0.077983	0.0051
LINF	-0.181203	0.0684
LEXR	0.090611	0.0408
LINT	0.699827	0.0000
LSM	18.627740	0.0000
LX-M	-0.188625	0.0154
LBOP	0.696821	0.0000
C	-324.0569	0.0000

The short run coefficients, error correction model (term) are shown in Table 4.2, while the long run coefficients are shown in the Table 4.3 for the separate equations.

Furthermore, the interaction equation is interpreted differently from the ECM equation because the indirect relationship between the effects of oil production on the balance of payments and exchange rate in Nigeria is based on Brambor *et al.* (2006).

Results of OLS showed that the variables were statistically significant (Table 4.4). For every 1% rise in inflation (LIFN), Oil prices (LOPR) decreases by about 18%, A change of 1% in interest rate (LINT) tends to increase LOPR by 91%, while a percentage change in exchange rate (LEXR) increases LOPR by 70%, a unit change in money supply (LMS), LOPR increases by 19%. A unit change LMS, LOPR decreases by 19%. While a unit changes in net income (LX-M), LOPR increases by 23%. Therefore, Oil price has a positive and significant relationship with net income.

From the equations above, it is clear that the effects of oil production on the balance of payments and exchange rate in Nigeria vary with the presence or absence of net income. These conditional effects can be easily calculated by inserting substantively relevant values for the variables of interest into equations. Two values were applied to explain the interaction effects of money supply and interest rate and inflation. These values are zero and one. Zero signifies the absence of a variable and one implies the presence of a variable. When the absence of inflation reduces oil price by 59%, the introduction money supply led to a reduction of oil price by 58%, which is more than before the existence of government through net income. Furthermore, the absence of inflation suggests that oil price is reduced by 0.141 %.

5. CONCLUSION AND RECOMMENDATIONS

This study attempts to investigate the dynamic effects of oil production on the balance of payments and exchange rate in Nigeria in a sample framework from 1980-2017. Also this research can be expanded further by making use of other methodologies that may serve as alternatives to the ARDL model and results can be compared to determine if the same findings can be obtained. Based on the findings of the study and the conclusions arrived, the following recommendations are made:

The results of this study reveal that oil price has a significant impact on the balance of payment and exchange rate. Net income also reduces oil price by creating economic growth. This is also in line with the exchange rate. Therefore the Nigerian Government should double effort in increasing its export than import in other to always maintain a balanced economy The study shows that there is short run relationship between effects of oil production on the balance of payments and exchange rate in Nigeria. There is also a long run relationship, whereby for every unit of change resulting from the balance of payment, oil price increases by 90% and for every unit change resulting from the exchange rate, oil price goes down by 59%. In line with that the importance of the Nigerian government maintaining a balance of payment would be a necessity in other to curb the ever increasing oil prices.

However, exchange rates, inflation and interest rates should be checked because they constitute a conduit pipe that increases the rate of oil price in the country. This might be due to high levels of corruption noticed in the country over the year where government funds meant for developmental projects were siphoned into private pockets. The rate of inflation confirms the existence of Philips curve in the case of Nigeria and this result is supported by Anyanwu (2014). Furthermore, the combination of inflation, exchange rate, interest rate, money supply, net income and balance of payment all have significant effect on oil price, which shows that all the variables are essential for a more rapid reduction or increase in oil price in Nigeria. The result supports this fact and makes it imperative for more to be done by the government to operate a mixed economic system to regulate economic activities effectively. Therefore, the government should promote diversification. This study supports the fact that the balance of payment and exchange rates are veritable ingredients to increase economic growth if maintained for the benefit of all.

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