Crude Oil Price Fluctuations and Sectorial Returns in Nigeria

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Abstract
The study investigated the impact of crude oil price fluctuations on selected economic sectors in Nigeria from 1986 to 2021. The data for the study, sourced from the Central Bank of Nigeria statistical Bulletin of various volumes, was analysed using Autoregressive Distributed Lag (ARDL) approach. The study focused on the Agricultural, Information and Communication and Manufacturing sectors of the Nigeria economy. The results of the analysis showed that a long–run relationship existed between crude oil price fluctuations and the sampled sectors' returns. Specifically, the study found that crude oil price fluctuations had a negative and significant effect on agricultural and telecommunication sector in the long-run, while its effect on the manufacturing sector was positive and statistically significant at 5% level. Hence, it was recommended among other things that Nigeria should diversify her export revenue base as a means of minimizing reliance on crude oil and petroleum products.

1. Introduction

Crude oil, as a major source of energy, plays a strategic role in many economies of the world, especially the emerging market economies; and its by-products play a unique role as input in the production process in many sectors of the economy. Over the years, crude oil price has been characterized by fluctuations and wide deviations. Crude oil price fluctuation is the swings or oscillations in crude oil prices over a period of time or the deviations from a bench mark or equilibrium price rate. This is not a new phenomenon; it has been a dominant feature in the oil market during the last two decades (Baumeister and Peerman, 2009). For example, the OPEC average monthly basket price of crude oil peaked at $107.89 per barrel in June, 2014 but dwindled very sharply to $59 per barrel by end of December, 2014. It further decelerated to $54.4 by end of March, 2015, resulting in Nigeria experiencing a sudden and significant drop in revenue realized from oil sales. (See Figure 1 for the trend in Organization of the Petroleum Exporting Countries (OPEC) annual oil price from 1960 to 2022).

The fluctuations in the price of crude oil have serious implications on the nation's economy owing to the fact that it is a major source of revenue to the country. It destabilizes the economy and affects the various sectorial returns of the nation; and also, adversely affects economic growth and development through links with other macroeconomic variables such as real exchange rate, inflation and terms of trade.

In order to meet up with the technological, and other demands of various sectors of the economy such as agricultural, manufacturing and telecommunications, Nigeria has relied heavily on the exportation of crude oil to generate the needed revenue. Such heavy reliance on crude oil as a major source of revenue makes the various sectors of the economy prone to unexpected swings arising from fluctuations in crude oil price. According to Okonjo-Iweala (2015), Nigeria government resolved to cut revenue projection as a measure designed to maintain economic stability in the face of dwindling oil prices. Hence the impact of oil price fluctuations, particularly that of shocks on economic growth and performance of an oil exporting country like Nigeria is the Dutch Disease Syndrome whereby sharp surge in oil price causes inflation in a developing economy that is yet to be diversified (Mieiro and Ramos, 2010). Despite windfall arising from oil revenue, Nigeria has an increasing proportion of impoverished population and has experienced continued stagnation of the economy (Okonjo-Iweala and Osafo-Kwaako, 2007).

According to Adenekan, Hilili and Okereke (2020), the effect of oil price volatility on the economy is still unsettled in the literature. By the same token, the impact of oil price volatility on firms' production cost and output of different sectors of the economy is also unclear. Thus, the link among these variables continues to be of interest to researchers, market actors and policy makers.

Consequently, there has been concern and intense debate on the media regarding the impact of volatility in crude oil price on firms' production cost and output of different sectors of the economy. Thus, the focus of this study is to empirically establish the impact of crude oil price fluctuations on sectorial returns in Nigeria and to make appropriate recommendations that will eventually place the country on the part of recovery. The broad objective of this study, therefore, is to empirically evaluate the impact of crude oil price fluctuations on sectorial returns in Nigeria and to make appropriate recommendations.

This paper is divided into five sections. Section one is the introduction, section two deals with a review of related literature while sections three and four focused on the research methodology, analysis and interpretation of empirical results. Section five has the conclusion and recommendations.

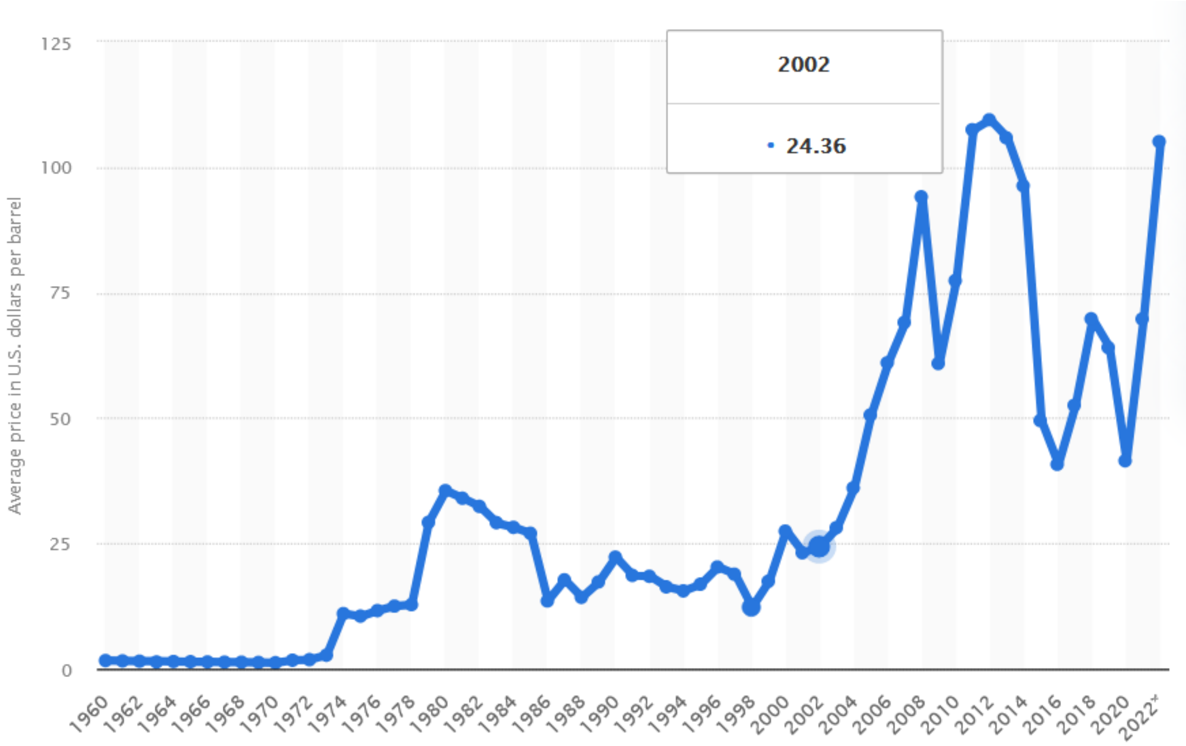


Figure 1: Organization of the Petroleum Exporting Countries (OPEC) annual oil price 1960-2022

2. Review of Related Literature

Several studies have examined the relationship between oil price fluctuation and economic growth. While some of these studies investigated the relationship on individual countries among Africa's oil-producing countries, others did a cross-country analysis. For example, Ighosewe, Akan and Agbogun (2021) investigated the effect of Crude Oil fluctuation on the Nigeria economy employing a resource-dependence approach for the period, 1984-2018. Using data from Central Bank of Nigeria (CBN) Statistical Bulletin, World Bank Report, and Oil Producing Exporting Countries Annual Report, and analysing same employing Auto-Regressive Distributed Lag (ARDL) model, they observed that in the short run, fluctuation in Oil Price per Barrel (FOBP) improved the Nigerian economy significantly.

Adenekan, Hilili and Okereke (2020) examined the nexus among oil price, exchange rate and stock market performance, using the VAR based technique. The Johansen cointegration test revealed the absence of long-run relationship among the variables. The Granger causality tests showed a unidirectional relationship running from crude oil price to shares and bidirectional relationship between crude oil price and exchange rate. Shocks to crude oil market had a positive impact on shares in the first two periods, but very minimal beyond these periods. They stated that the findings implied that there are inherent structural or institutional rigidity in the transmission mechanism of oil price.

Manasseh, Abada, Ogbuabo, Okoro, Egele, and Ozuzu (2019) viewed oil price fluctuation or volatility as the persistent upward or downward swing in the prices of oil over a long time followed by periods in which the price of oil in the international market is relatively calm. Such swings are usually caused by either demand or supply side of the international oil market resulting from political upheavals in the oil-rich middle-east, and the growing oil demand in Asian countries.

Anyalechi, Ezeaku, Onwumere, and Okereke **(2019)** examined the responsiveness of the stock market returns to fluctuation in oil price in Nigeria using monthly dataset from January 1994 to December 2016. Employing the autoregressive distributed lag estimation (ARDL) technique to analyze the long-run as well as the short-run dynamics, the findings revealed that changes in oil price have had positive but insignificant impact on stock market returns both in the long-run and the short-run.

Zied, Frédéric, Slim (2016) examined the degree of interdependence between oil prices and economic activities of four (4) major (OPEC states from 2000 to 2010. Countries considered include United Arab Emirates, Saudi Arabia, Kuwait, and Venezuela. Using the Engle and Granger co-integration test, the study established that oil price shock exhibited a long-run stable relationship with the economic activities of the countries under investigation.

Alley, Asekomeh, Mobolaji and Adeniran (2014) conducted a study on the effect oil price on the Nigerian economy. The study covered the period 1981 to 2012 using mainly secondary data. The study adopted ex-post facto research design. The finding revealed that oil price has positive and significant effect on the economic growth of the nation. It was recommended that government should use oil revenue to develop major sectors such as education, manufacturing, agriculture and health.

Ani, Ugwunta, Inyiama and Eneje (2014) conducted a study to ascertain the causal relationship between oil price and key macroeconomic variables in Nigeria. Using time series data from 1980 to 2010, and adopting Granger causality and ordinary least squares regression as the analytical techniques, the study revealed that there is a positive but insignificant relationship between oil price and economic growth in Nigeria.

Nwosa and Akinyemi (2013) investigated the relationship between gasoline price and sectorial output in Nigeria for the period 1980 to 2010. The study utilized the co-integration and Error-Corrections Model (ECM). The co-integration approach provided information about the long run relationship between the variables while the Error-correction model showed the short-run relationship between the variables. The long run regression estimate showed that gasoline price is a significant determinant of output growth in the agricultural, manufacturing, wholesale and retail, transportation and communication sectors of the Nigerian economy. In addition, the error-correction model estimate revealed that only output of the agriculture and the manufacturing sectors of the Nigerian economy are affected by gasoline price increase in the short run. The study recommended that paramount care should be taken on future changes in gasoline price given the harmful effect on the various sectors of the Nigerian economy and the need for the government to stabilize power supply to reduce the over reliance of the sectors on gasoline as a prime source of power.

Nwosa (2012) examined the effect of domestic fuel price on macroeconomic variables in Nigeria. The study covered from 1986 to 2011. The study utilized the co-integration and Error-Corrections Model (ECM). The study revealed that there is a short run relationship between domestic fuel price and inflation rate. It was recommended that serious caution should be taking by the government on domestic fuel price increase especially in an attempt to remove fuel subsidy and deregulate the downstream sector of the oil industry.

Arinze (2011) conducted a study on the impact of oil price on the Nigerian economy. The study covered from 1990 to 2007. The study adopted simple ordinary least square regression method. The finding revealed that increases in petroleum prices led to increase in inflation rate. Thus, the study recommended that more resources should be tapped to diversify the economy.

Wakeford (2006) assessed the impact of oil price shocks on the South African macro economy. The findings revealed that while commodity exports especially gold provided an initial buffer, the economy was not immune to sustained price shocks. The paper considered the outlook for future oil shocks and their possible impact, given South Africa's strengths and vulnerabilities; and hence concludes that while there are several short run supply risks, the major threat is the inevitable peaking of oil production which may occur within 5 to 10 years.

Hooker (2002) assessed the contribution of oil price changes on U.S. inflation in a Phillips curve framework, taking into account the asymmetries, non-linearities, structural breaks that had been put forth in the economic literature pertaining to the relationship between oil prices and key macroeconomic variables. The Phillips curve analyses the trade-off between inflation and output thus highlighting that some amount of inflation is necessary for growth and thus poverty reduction. The study revealed that there is a structural break, where changes in the price of oil contributed significant effects on core inflation before 1980 but weakened since that period.

It is apparent from the literature reviewed that there has been neglect among the previous studies on the impact of crude oil price fluctuations on sectorial returns in Nigeria. This study therefore fills this gap in literature by examining the impact of crude oil price fluctuations on sectorial returns in Nigeria with the conviction that the findings and recommendations if implemented by the various stakeholders in the country will place Nigeria on the part of recovery, financial freedom and sustained economic growth.

3. Data and Methodology

3.1 Research Design and Sources of Data

The study is designed to examine the impact of crude oil price fluctuations on sectorial returns in Nigeria from 1986 to 2021. An *ex post facto* research design was used for the thirty-six years study period. This space of time was chosen to capture various points of fluctuations (instabilities) in crude oil prices in terms of Naira / U.S dollar exchange. More importantly, the period incorporated details of the various crude oil regimes in Nigeria. Data for this study were sourced from the Central Bank of Nigeria's Statistical Bulletin (various volumes) and National Bureau of Statistics.

3.2 Model Specification

For the purpose of this study, we specified sectoral return series as a function of exchange rate and crude-oil price fluctuation; that is, Real exchange rate (RER) and Crude oil price fluctuations (CPF) were the explanatory variables while Agricultural sector returns (AGSR),

Manufacturing sector returns (MASR), and Information and Communications sector returns (ICSR) constituted the explained variables for each of the models.
Implicitly, the models used for the study were expressed implicitly as follows:

AGSR = *f* (CPF, RER) 1.
MASR= *f* (CPF, RER) 2.
ICSR = *f* (CPF, RER) 3.
The explicit forms of the equations above are stated in their semilog-linearized forms as:

$$\ln AGSR_t = \beta_0 + \beta_1 CPF_t + \beta_2 RER_t + \mu_t \quad 4.$$

$$\ln MASR_t = \beta_0 + \beta_1 CPF_t + \beta_2 RER_t + \mu_t \quad 5.$$

$$\ln ICSR_t = \beta_0 + \beta_1 CPF_t + \beta_2 RER_t + \mu_t \quad 6.$$

Where;
AGSR = Agricultural sector returns (or contribution to GDP)
MASR = Manufacturing sector returns (i.e, contribution to GDP)
ICSR = Information & communications sector returns (or contribution to GDP)
CPF = Crude oil price fluctuation
RER = Real exchange rate
ln = natural logarithm
t = time period
β_1 and β_2, = parameter estimates of the independent variables
μ = stochastic variable measuring unexplained variations.
The variables were log-linearized to standardize them.

3.3 Method of Data Analysis

Since the major objective of this study is to explore the impact of crude oil price fluctuations on sectoral returns, further to the ARDL approach employed, the GARCH analytical technique was used to model volatility of crude oil price in Nigeria.

Volatility test

In literature, various measures of crude oil price volatility have been employed to examine the variability of pair-wise cross-country exchange rate based on the observation that exchange rate time series are typically heteroscedastic, leptokurtic and exhibit volatility clustering i.e varying variance over a specified period of time (Peree and Steinherr, 1989; Cote, 1994; McKenzie and Brooks, 1997). Like other empirical studies, the Autoregressive Conditional Heteroscedasticity (ARCH) model introduced by Engle (1982) and the Generalized ARCH (GARCH) model by Bollerslev (1986) were used to capture the extent of crude oil price fluctuations in Nigeria. The choice of these models are based on their empirical use in the various areas of econometric modeling, especially in financial time series analysis (Akpokoje, 2009; Olowe, 2009) and their approaches in modeling financial time series with an autoregressive structure in that Heteroscedasticity observed over different periods may be autocorrelated. In developing an ARCH model, we consider two distinct specifications- one for the conditional mean and the other for conditional variance. Generalizing this, the standard GARCH (p,q) specification is expressed as:

$y_t = \alpha + \sum_{i=1}^{k} n_i \, x_{t-1} \varepsilon_t$ …………………………………………………………… eq. 9

$\delta = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - \bar{X})^2}$ ………………..……………………………………………… eq. 10

4. Empirical Results

Table 4.1 Presentation of Data for the Analysis

YEAR	LOGAGSR*	LOGMASR*	LOGICSR*	COPF	REXR
1986	1.552668	1.619361	1.274438	75.613	3.3166
1987	1.701482	1.662376	1.305721	51.473	4.1916
1988	1.867821	1.821783	1.337204	4.558	5.353
1989	1.945764	1.881634	1.3668	107.841	7.65
1990	2.027879	1.944288	1.433574	109.129	9.0001
1991	2.090752	2.06081	1.521186	-35.051	9.7545
1992	2.265101	2.203997	1.586627	295.753	19.6609
1993	2.470293	2.363653	1.680436	-16.956	22.6309
1994	2.648623	2.568385	1.728696	-74.024	21.886
1995	2.897704	2.792288	1.813161	22.324	21.886
1996	3.029591	2.892363	1.891036	105.491	21.886
1997	3.083309	2.928563	1.960791	-73.318	21.886
1998	3.127442	2.923517	2.04181	-222.581	21.886
1999	3.154415	2.950017	2.137693	1789.263	92.5284
2000	3.178519	2.993031	2.213623	1945.492	109.55
2001	3.304366	3.059443	2.406878	-661.437	112.486
2002	3.628544	3.133069	2.50558	330.818	126.4
2003	3.661427	3.213532	2.60122	1031.795	135.406
2004	3.69331	3.294148	2.738561	1436.051	132.86
2005	3.780485	3.366668	2.896752	1631.642	130.4
2006	3.875831	3.429603	3.289665	875.617	128.27
2007	3.932067	3.464379	3.438509	-147.542	117.97
2008	4.004336	3.513727	3.455811	4646.549	132.56
2009	4.065409	3.532332	3.474141	-4468.18	149.58
2010	4.115574	3.553718	3.774886	2828.065	150.66
2011	4.1473	3.655853	3.804791	2896.04	158.826
2012	4.199112	3.74732	3.861339	-520.57	157.33
2013	4.225737	3.859338	3.922175	539.93	160
2014	4.255721	3.938791	3.981754	-677.02	183
2015	4.293074	3.952975	4.032662	854.43	199.1
2016	4.332913	3.949548	4.059923	-2313.5	304.7
2017	4.379352	4.001928	4.068837	4156.34	306
2018	4.437295	4.095362	4.11327	5755.08	307
2019	4.503847	4.224819	4.187599	-2090.67	307

2020	4.571028	4.290915	4.225533	-4674.76	371
2021	4.614117	4.41037	4.24981	13643.46	416.21

Source: Compiled from CBN statistical bulletin and National Bureau of Statistics.
***** The log-Linearized form of the raw data

Table 4.2: Summary of the Result of Unit Root Test

LOGMASR	I(1)
LOGAGSR	I(0)
REXR	I(1)
COPF	I(0)
LOGICSR	I(1)

Source: EViews computations

4.3 Analysis of Result and Interpretation

4.3.1 Volatility Test

In order to carry out the GARCH volatility test, it was needful to plot the graph of the series to establish the evidence of volatility or otherwise. The graph is presented as shown in figure 4.1.

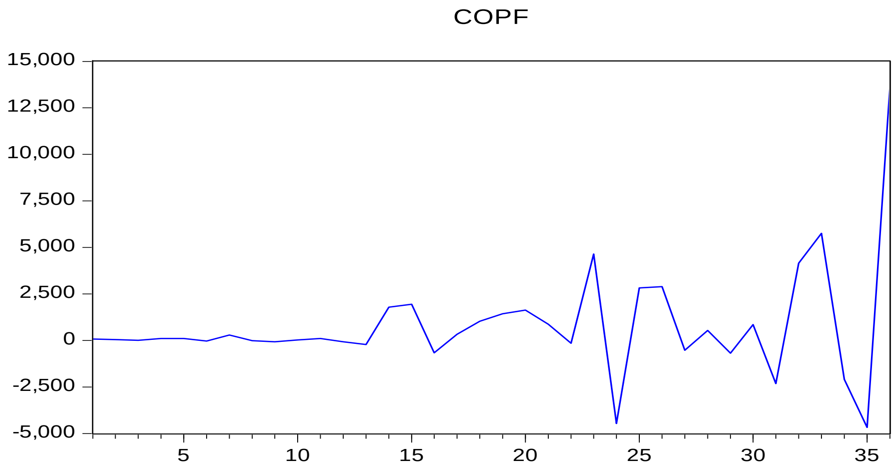


Figure 4.1: A Plot of the Graph of the Series
Source: EViews computations

Clearly, we can see evidence of volatility in the stationary series. Next, we tested for ARCH effect which is a necessary condition for using the GARCH (1, 1) model. The result is presented in figure 4.2.

Heteroskedasticity Test: ARCH

F-statistic	9.879366	Prob. F(1,32)	0.0036
Obs*R-squared	8.020619	Prob. Chi-Square(1)	0.0046

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/11/23 Time: 07:25
Sample (adjusted): 3 36
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3775281.	3232499.	1.167914	0.2515
RESID^2(-1)	0.802422	0.255293	3.143146	0.0036

R-squared	0.235901	Mean dependent var	7788178.
Adjusted R-squared	0.212022	S.D. dependent var	19507139
S.E. of regression	17316116	Akaike info criterion	36.22920
Sum squared resid	9.60E+15	Schwarz criterion	36.31898
Log likelihood	-613.8963	Hannan-Quinn criter.	36.25982
F-statistic	9.879366	Durbin-Watson stat	2.109855
Prob(F-statistic)	0.003592		

Figure 4.2: Test for ARCH effect

From the result in figure 4.2, the null hypothesis of homoscedasticity is rejected which suggests that crude oil price volatility (COPF) could be modelled using any of the ARCH family models since there is a strong evidence of arch effect in the series. Hence, we proceeded to model the series using GARCH (1, 1). The result is presented below in figure 4.3.

Dependent Variable: COPF
Method: ML ARCH - Normal distribution (Marquardt / EViews legacy)
Date: 12/11/23 Time: 07:37
Sample (adjusted): 2 36
Included observations: 35 after adjustments
Convergence achieved after 88 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
COPF(-1)	0.204611	0.030122	6.792724	0.0000
C	29.66976	29.59759	1.002438	0.3161

Variance Equation

C	4936126.	1932103.	2.554795	0.0106
RESID(-1)^2	1.782303	0.487186	3.658361	0.0003
GARCH(-1)	-0.993029	0.003523	-281.8933	0.0000

R-squared	-0.188701	Mean dependent var	830.9009
Adjusted R-squared	-0.224722	S.D. dependent var	3057.979
S.E. of regression	3384.178	Akaike info criterion	17.52341
Sum squared resid	3.78E+08	Schwarz criterion	17.74560
Log likelihood	-301.6597	Hannan-Quinn criter.	17.60011
Durbin-Watson stat	1.943310		

Figure 4.3: GARCH (1,1) Model Result.

The result of the GARCH (1, 1) model as presented in figure 4.3 suggests that past COPF significantly influences the current COPF as can be seen from the coefficient of COPF(-1) {i.e., 0.204611) which is statistically significant at 5% level. Again, the sum of the coefficients of RESID(-1)^2 and GARCH (-1) which amounted to 0.78927, and which approximates 1, suggests that the volatility is persistent. Volatility is said to be persistent if today's return has a large effect on the unconditional variance of many periods in the future.

4.3.2 Agricultural Sector Returns (Model One)

Dependent Variable: LOGAGSR
Method: ARDL
Date: 12/15/23 Time: 06:17
Sample (adjusted): 1990 2021
Included observations: 32 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): COPF REXR
Fixed regressors: C
Number of models evalulated: 100
Selected Model: ARDL(1, 1, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGAGSR(-1)	0.955746	0.029872	31.99508	0.0000
COPF	-2.98E-06	4.17E-06	-0.716110	0.4811
COPF(-1)	-1.37E-05	6.30E-06	-2.172245	0.0404
REXR	-0.000117	0.000461	-0.254989	0.8010
REXR(-1)	-0.000326	0.000692	-0.470679	0.6423
REXR(-2)	0.001150	0.000687	1.674850	0.1075
REXR(-3)	0.000971	0.000696	1.396063	0.1760
REXR(-4)	-0.001741	0.000592	-2.942329	0.0073
C	0.239554	0.080336	2.981897	0.0067

R-squared	0.995901	Mean dependent var	3.624827
Adjusted R-squared	0.994475	S.D. dependent var	0.760683
S.E. of regression	0.056540	Akaike info criterion	-2.675477
Sum squared resid	0.073526	Schwarz criterion	-2.263239
Log likelihood	51.80763	Hannan-Quinn criter.	-2.538832
F-statistic	698.5266	Durbin-Watson stat	1.399074
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Figure 4.4: Estimated ARDL Model
Source: EViews computations.

From figure 4.4 above, the one period lag of logAGSR was positively signed, and statistically significant at 5% level. This implies that, on the short run, the previous year's returns from the agricultural sector resulted to further returns in the agricultural sector in the current year. With respect to crude oil price fluctuations (COPF), it was observed that the variable negatively and significantly impacted on agricultural sector return at the first lagged period while the impact of REXR on LogAGSR was found to be negative and statistically significant only at the fourth lag.

With respect to model suitability and stability, the adjusted R^2, probability of the F-statistic and Akaike Info criterion suggest that the model is quite suitable, while the cusum test as shown in figure 4.5 shows that the model is very stable.

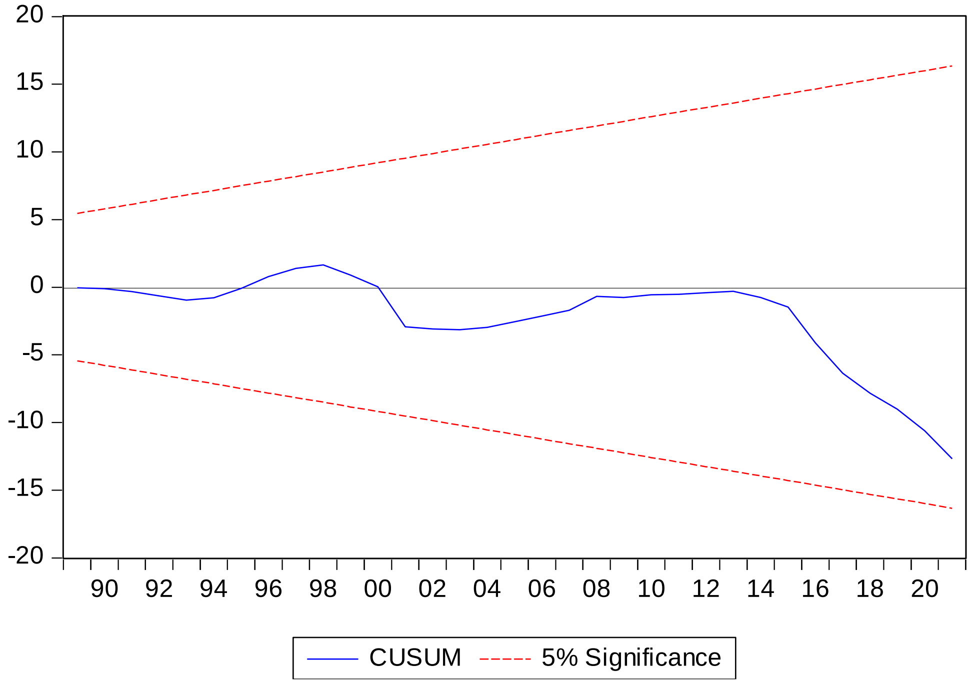


Figure 4.5: The Result of the Cusum Test
Source: EViews computations.

The ARDL Error Correction Regression and Bounds Test

The ARDL Error Correction Regression as presented in figure 4.6 shows the existence of long run equilibrium relationship between the variables of the model as demonstrated by the negatively signed and statistically significant cointEq(-1) factor at 5% level, and suggests too that any disequilibrium on the short-run corrects at the speed of 4.4% on the long run. The result in lower part of Table 4.6 - Bounds Test, shows that the calculated F-statistic exceeds the critical upper bound at 5% levels and so confirming the existence of a long-run relationship between crude oil price and agricultural sector returns in Nigeria.

ARDL Error Correction Regression
Dependent Variable: D(LOGAGSR)
Selected Model: ARDL(1, 1, 4)
Case 2: Restricted Constant and No Trend
Date: 12/15/23 Time: 07:03
Sample: 1986 2021
Included observations: 32

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(COPF)	-2.98E-06	2.53E-06	-1.180303	0.2499
D(REXR)	-0.000117	0.000369	-0.318754	0.7528
D(REXR(-1))	-0.000381	0.000434	-0.876879	0.3896
D(REXR(-2))	0.000769	0.000410	1.877860	0.0731
D(REXR(-3))	0.001741	0.000426	4.084905	0.0005
CointEq(-1)*	-0.044254	0.005427	-8.153730	0.0000

R-squared	0.531731	Mean dependent var	0.083386
Adjusted R-squared	0.441679	S.D. dependent var	0.071169
S.E. of regression	0.053178	Akaike info criterion	-2.862977
Sum squared resid	0.073526	Schwarz criterion	-2.588151
Log likelihood	51.80763	Hannan-Quinn criter.	-2.771880
Durbin-Watson stat	1.399074		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	14.70304	10%	2.63	3.35

k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Figure 4.6: ARDL Error Correction

The variables (COPF and REXR) were though not statistically significant at 5% level on the long run as could be seen from the result of the long-run form regression presented in figure 4.7.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LOGAGSR)
Selected Model: ARDL(1, 1, 4)
Case 2: Restricted Constant and No Trend
Date: 12/15/23 Time: 06:33
Sample: 1986 2021
Included observations: 32

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.239554	0.080336	2.981897	0.0067
LOGAGSR(-1)*	-0.044254	0.029872	-1.481464	0.1521
COPF(-1)	-1.67E-05	8.79E-06	-1.895380	0.0707
REXR(-1)	-6.26E-05	0.000283	-0.221101	0.8270
D(COPF)	-2.98E-06	4.17E-06	-0.716110	0.4811
D(REXR)	-0.000117	0.000461	-0.254989	0.8010
D(REXR(-1))	-0.000381	0.000534	-0.713276	0.4829
D(REXR(-2))	0.000769	0.000547	1.405710	0.1732
D(REXR(-3))	0.001741	0.000592	2.942329	0.0073

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COPF	-0.000377	0.000343	-1.098580	0.2833
REXR	-0.001415	0.007249	-0.195259	0.8469
C	5.413191	1.916102	2.825106	0.0096

Figure 4.7: The Result of the Long-Run Form Regression

Diagnostic Tests

The results of the diagnostic tests for the ARDL model are shown below:

Serial correlation and normality tests

The tests for serial correlation was carried out using correlogram squared Residual and Breusch-Godfrey Serial Correlation LM test as shown in Tables 4.1 and 4.2 below:

Table 4.1: Correlograms and Q-statistics

Date: 12/15/23 Time: 07:16
Sample: 1986 2021
Included observations: 32

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.033	-0.033	0.0383	0.845
. | . |	. | . |	2	0.069	0.068	0.2099	0.900
. | . |	. | . |	3	0.039	0.044	0.2668	0.966
. |*** |	. |*** |	4	0.363	0.363	5.3744	0.251
. | . |	. | . |	5	0.012	0.043	5.3806	0.371
. *| . |	. *| . |	6	-0.079	-0.138	5.6403	0.465
. |*** |	. |*** |	7	0.381	0.393	11.960	0.102
. | . |	. *| . |	8	0.033	-0.088	12.008	0.151
. | . |	. *| . |	9	-0.027	-0.125	12.044	0.211
. *| . |	. | . |	10	-0.073	0.028	12.308	0.265
. |* . |	.**| . |	11	0.118	-0.212	13.025	0.292
. | . |	. | . |	12	-0.030	-0.044	13.074	0.364
. *| . |	. | . |	13	-0.093	0.053	13.575	0.404
. | . |	. *| . |	14	0.010	-0.188	13.581	0.481
. *| . |	. *| . |	15	-0.085	-0.074	14.041	0.522
. *| . |	. | . |	16	-0.080	0.011	14.472	0.564

*Probabilities may not be valid for this equation specification.
Source: EViews computations

The correlogram displays the autocorrelation and partial autocorrelation functions of the residuals, together with the Ljung-Box *Q*-statistics for high-order serial correlation. If there is no serial correlation in the residuals, the autocorrelations and partial autocorrelations at all lags should be nearly zero, and all *Q*-statistics should be insignificant with large *p*-values. From the results, the Q-statistics is not significant, hence it was concluded that there no serial correlation in the residuals. This result is also confirmed by the Breusch-Godfrey Serial Correlation LM test as shown in Table 4.7 below.

Table 4.2: Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.444101	Prob. F(2,21)	0.2584
Obs*R-squared	3.868959	Prob. Chi-Square(2)	0.1445

The test accepts the hypothesis of no serial correlation up to order two. The *Q*-statistic and the LM test both indicate that the residuals are not serially correlated and the equation is well specified and can be used for hypothesis tests and forecasting.

The normality test of the residuals was done using the Jarque-Bera statistics. Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The results are as shown in figure 4.8 below:

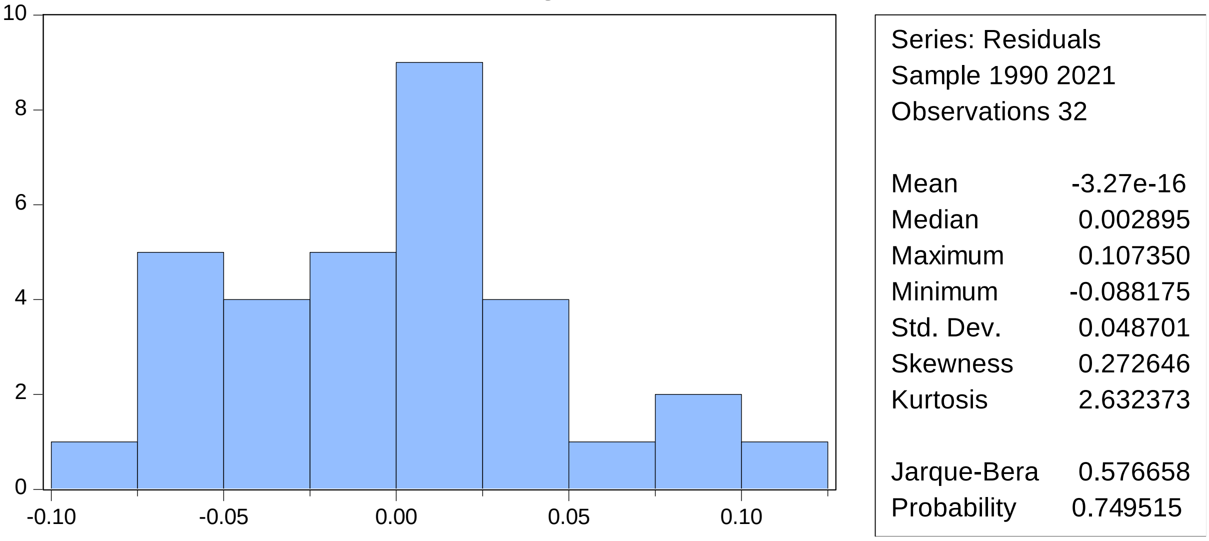


Figure 4.8: Normality test

The probability of the Jarque-Bera test indicates that the model passed the normality test and that the residuals of the model are normally distributed. Hence, the null hypothesis that the residuals are not normally distributed was accepted.

4.3.3 Information and Communication Sector Returns (Model Two)

Dependent Variable: LOGICSR
Method: ARDL
Date: 12/15/23 Time: 07:32
Sample (adjusted): 1988 2021
Included observations: 34 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): COPF REXR
Fixed regressors: C
Number of models evalulated: 100

Selected Model: ARDL(1, 2, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGICSR(-1)	1.009595	0.028857	34.98579	0.0000
COPF	1.03E-05	6.16E-06	1.674521	0.1052
COPF(-1)	6.11E-06	7.67E-06	0.796339	0.4325
COPF(-2)	2.41E-05	8.84E-06	2.723940	0.0110
REXR	-0.000331	0.000272	-1.218730	0.2331
C	0.078470	0.051694	1.517977	0.1402

R-squared	0.995565	Mean dependent var	2.876539
Adjusted R-squared	0.994773	S.D. dependent var	1.034282
S.E. of regression	0.074780	Akaike info criterion	-2.189746
Sum squared resid	0.156578	Schwarz criterion	-1.920388
Log likelihood	43.22568	Hannan-Quinn criter.	-2.097887
F-statistic	1256.954	Durbin-Watson stat	1.586130
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

Figure 4.9: Estimated ARDL Model
Source: EViews computations
From the table above, the two period lag of ICSR is significant and positive. This implies that two years returns from the Information and communication sector resulted to further returns in the sector in the current year, while REXR did not make any statistically significant impact on ICSR on the short run.

ARDL Bounds test
The bound test enables us to test for long run dynamic relationship among the variables in ARDL modelling approach. The result of the ARDL bound test was presented in figure 4.10 below:

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	12.74531	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Source: EViews computations

Figure 10: ARDL Bounds Test for the ICSR

Figure 4.10 reveals that the F-statistic is 12.74531 which exceed the upper bounds at both 5% and 1% critical values. This implies that there is evidence of co-integration or long run dynamic relationship among the variables used for the study.

The error correction term (ECM), though statistically significant at 5% level as expected, was however positively signed contrary to expectation, which suggests explosive long-run relationship.

The long-run coefficient of crude oil fluctuation (CPF) exerted a negative but non-significant effect on returns from the Information and communication sector in Nigeria. On the other hand, the effect of real exchange rate was positive and insignificant. This is not surprising.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COPF	-0.004222	0.013103	-0.322196	0.7497
REXR	0.034510	0.080285	0.429848	0.6706
C	-8.178491	29.61368	-0.276173	0.7844

Figure.4.11: Long run form for the Information and communication sector in Nigeria.

Diagnostic Test for Model Two

The results of the diagnostic tests for the ARDL model are shown below:

Serial correlation and normality tests

The tests for serial correlation was carried out using correlogram squared Residual and Breusch-Godfrey Serial Correlation LM test as shown in Tables 4.3 and 4.4 below:

Tables 4.3: Result of the Correlogram Squared Residual Test

Date: 12/15/23 Time: 08:06
Sample: 1986 2021
Included observations: 34

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.059	-0.059	0.1311	0.717
. |*. |	. |*. |	2	0.159	0.156	1.1006	0.577
. | . |	. | . |	3	-0.063	-0.047	1.2586	0.739
. |*. |	. |*. |	4	0.115	0.088	1.8014	0.772

. | . |	. | . |	5	0.003	0.029	1.8018	0.876
. | . |	. | . |	6	-0.010	-0.043	1.8059	0.937
. | . |	. | . |	7	-0.018	-0.015	1.8207	0.969
.*| . |	.*| . |	8	-0.117	-0.125	2.4692	0.963
.*| . |	.*| . |	9	-0.086	-0.103	2.8287	0.971
.*| . |	.*| . |	10	-0.097	-0.073	3.3077	0.973
.*| . |	.*| . |	11	-0.074	-0.071	3.5973	0.980
.*| . |	. | . |	12	-0.084	-0.057	3.9896	0.984
.*| . |	. | . |	13	-0.081	-0.060	4.3676	0.987
.*| . |	.*| . |	14	-0.084	-0.073	4.7971	0.988
.*| . |	.*| . |	15	-0.109	-0.108	5.5642	0.986
. | . |	. | . |	16	-0.039	-0.055	5.6700	0.991

*Probabilities may not be valid for this equation specification.

Source: EViews computations

Table 4.4: Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.439727	Prob. F(2,26)	0.2553
Obs*R-squared	3.390002	Prob. Chi-Square(2)	0.1836

Source: Eviews computations

Table 4.3 displays the autocorrelation and partial autocorrelation functions of the residuals, together with the Ljung-Box *Q*-statistics for high-order serial correlation. If there is no serial correlation in the residuals, the autocorrelations and partial autocorrelations at all lags should be nearly zero, and all *Q*-statistics should be insignificant with large *p*-values. From the results, the Q-statistics is not significant, hence it was concluded that there no serial correlation in the residuals. This result is also confirmed by the Breusch-Godfrey Serial Correlation LM test as shown in Table 4.4 above. The test accepts the hypothesis of no serial correlation up to order two. The *Q*-statistic and the LM test both indicate that the residuals are not serially correlated and the equation is well specified and can be used for hypothesis tests and forecasting.

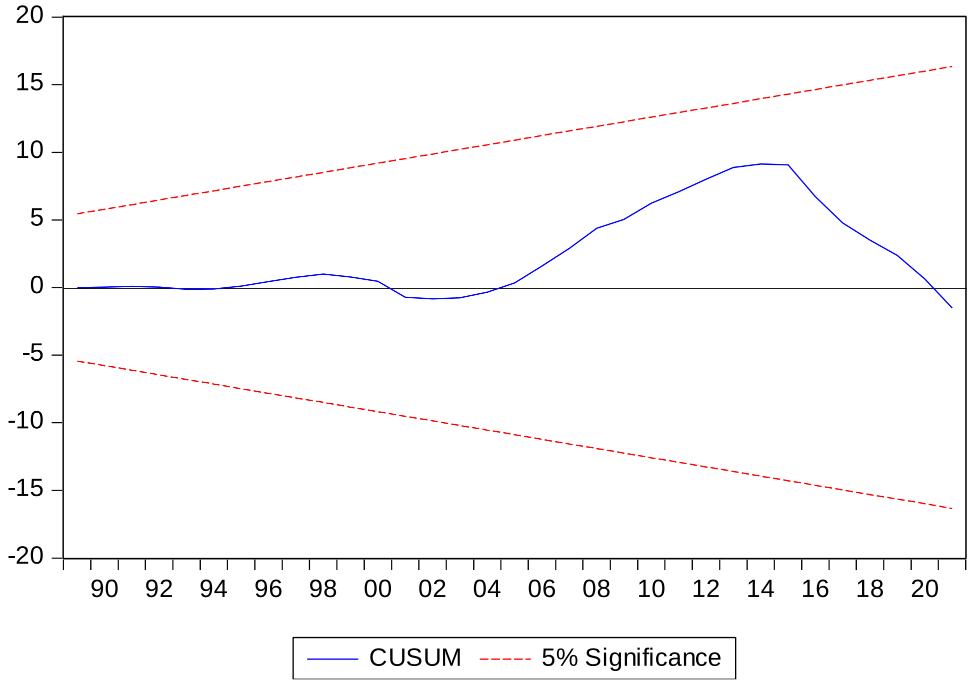


Figure 4.12: Cusum Test for ICSR

The results of the cusum test, the F-statistics, adjusted R^2 and Akaike information criterion all suggest that the model was quite stable.

4.3.3 Manufacturing Sector's Returns (Model Three)

In figure 4.12 below is the result of the ARDL short-run equilibrium relationship between the manufacturing sector return, and crude oil price fluctuations and real exchange rate in Nigeria within the reference period.

Dependent Variable: LOGMASR
Method: ARDL
Date: 12/15/23 Time: 08:32
Sample (adjusted): 1989 2021
Included observations: 33 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): COPF REXR
Fixed regressors: C
Number of models evalulated: 100
Selected Model: ARDL(3, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*

LOGMASR(-1)	1.760123	0.172575	10.19917	0.0000
LOGMASR(-2)	-1.000662	0.290548	-3.444053	0.0019
LOGMASR(-3)	0.210204	0.160270	1.311564	0.2007
COPF	4.91E-06	2.38E-06	2.062729	0.0489
REXR	0.000144	0.000144	0.996936	0.3276
C	0.104963	0.057152	1.836550	0.0773

R-squared	0.997394	Mean dependent var	3.278497
Adjusted R-squared	0.996912	S.D. dependent var	0.691478
S.E. of regression	0.038425	Akaike info criterion	-3.517236
Sum squared resid	0.039866	Schwarz criterion	-3.245144
Log likelihood	64.03440	Hannan-Quinn criter.	-3.425686
F-statistic	2067.138	Durbin-Watson stat	1.488017
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Figure 4:13: ARDL SHORT RUN REGRESSION FOR THE MANUFACTURING SECTOR
Source: EViews computations

From the table above, the one and two period lags of MASR were statistically significant and positive at the first lag but negative at the second lag. This implies that previous year's returns at lag one from the manufacturing sector resulted to further returns in the manufacturing sector in the current year but subsequently in the second lag, it impacted negatively on the current year's returns. Surprisingly, crude oil price fluctuation was found to have a rather significant positive impact on the manufacturing sector of the Nigerian economy. This result appears quite surprising, but it is however in tandem with the findings of Riaz, Sial, and Nasreen (2016) who noted that manufacturing production is non-linearly related with oil price uncertainty, as initially manufacturing production in Pakistan increases with increase in oil price uncertainty but after a threshold level manufacturing production starts declining with increase in oil price uncertainty.

ARDL Bounds Test
The bound test approach to co-integration enables us to test for long run dynamic relationship among the variables in ARDL modelling approach. The result of the ARDL bound test was presented in figure 4.14 below:

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LOGMASR)
Selected Model: ARDL(3, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 12/15/23 Time: 08:44
Sample: 1986 2021
Included observations: 33

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.104963	0.057152	1.836550	0.0773
LOGMASR(-1)*	-0.030335	0.022113	-1.371798	0.1814
COPF**	4.91E-06	2.38E-06	2.062729	0.0489
REXR**	0.000144	0.000144	0.996936	0.3276
D(LOGMASR(-1))	0.790458	0.166415	4.749929	0.0001
D(LOGMASR(-2))	-0.210204	0.160270	-1.311564	0.2007

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COPF	0.000162	0.000154	1.049812	0.3031
REXR	0.004731	0.002350	2.012991	0.0542
C	3.460183	0.960818	3.601288	0.0013

EC = LOGMASR - (0.0002*COPF + 0.0047*REXR + 3.4602)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.723697	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Figure 4.14: ARDL Bounds test for co-integration
Source: EViews computations

Figure 4.14 reveals that the F-statistic is 3.723697 which exceed the lower and upper bounds at 10% critical value but only exceeded the lower bound at 5%level. This implies that there is evidence of co-integration or long run dynamic relationship among the variables used for the study at 10% level but inconclusive at the 5% level.

ARDL Error Correction Regression
Dependent Variable: D(LOGMASR)
Selected Model: ARDL(3, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 12/15/23 Time: 08:52
Sample: 1986 2021
Included observations: 33

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGMASR(-1))	0.790458	0.138060	5.725461	0.0000
D(LOGMASR(-2))	-0.210204	0.141498	-1.485561	0.1490
CointEq(-1)*	-0.030335	0.007457	-4.068140	0.0004

R-squared	0.562830	Mean dependent var	0.078442
Adjusted R-squared	0.533685	S.D. dependent var	0.053382
S.E. of regression	0.036453	Akaike info criterion	-3.699055
Sum squared resid	0.039866	Schwarz criterion	-3.563009
Log likelihood	64.03440	Hannan-Quinn criter.	-3.653279
Durbin-Watson stat	1.488017		

Figure 4.15: ARDL Error Correction Regression
Source: EViews computations

The ARDL Error Correction Regression suggests, or rather, confirms the existence of long-run equilibrium relationship between the variables of concern at 5% level, and further indicates that any disequilibrium in the short run corrects on the long run at a speed of 3%. The co-integration factor is negatively signed as expected and further strengthens the belief in the existences of long run equilibrium relation between manufacturing sector returns, and crude oil price fluctuations and real exchange rate.

Diagnostic Test for Model Three
The diagnostic tests for model stability are as follows:

Table 4.5: Result of the Correlogram Squared Residual Test for MASR
Date: 12/15/23 Time: 09:00
Sample: 1986 2021
Included observations: 33

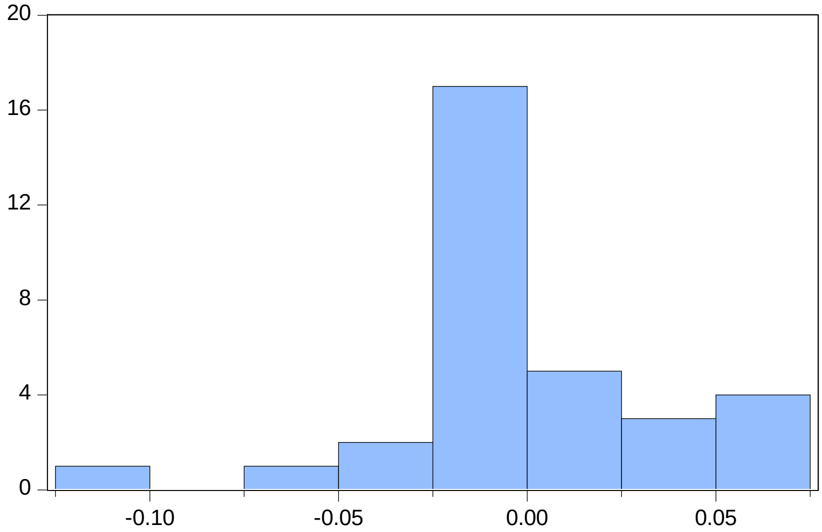
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |. |	. |. |	1	0.061	0.061	0.1352	0.713

. |*. |	. |*. |	2	0.087	0.084	0.4178	0.811
. *| . |	. *| . |	3	-0.070	-0.080	0.6041	0.896
. | . |	. | . |	4	0.003	0.004	0.6044	0.963
. |*. |	. |** |	5	0.209	0.225	2.4027	0.791
. |*. |	. |*. |	6	0.176	0.153	3.7253	0.714
. |*. |	. | . |	7	0.111	0.060	4.2772	0.747
. | . |	. | . |	8	-0.049	-0.057	4.3862	0.821
. | . |	. | . |	9	-0.028	-0.014	4.4234	0.881
. *| . |	. *| . |	10	-0.104	-0.133	4.9654	0.893
. | . |	. *| . |	11	-0.059	-0.140	5.1474	0.924
. *| . |	. *| . |	12	-0.081	-0.142	5.5049	0.939
. *| . |	. *| . |	13	-0.077	-0.098	5.8444	0.952
. *| . |	. *| . |	14	-0.102	-0.098	6.4728	0.953
. | . |	. | . |	15	-0.042	0.020	6.5848	0.968
. | . |	. | . |	16	-0.044	0.052	6.7150	0.978

*Probabilities may not be valid for this equation specification.
Source: EViews computations

Tables 4.5 and 4.6 clearly suggest the absence of autocorrelation in the series. From the results, none of the *Q*-statistics is not significant, hence it was concluded that there no serial correlation in the residuals. Furthermore, the P-values of the F-statistic and Obs*R-squared are not significant. Hence, it was concluded that there is no autocorrelation existed in the series.

The normality test of the residuals was done using the Jarque-Bera statistics. Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The results are as shown in figure 4.15 below:



Series: Residuals	
Sample 1989 2021	
Observations 33	
Mean	8.71e-16
Median	-0.001752
Maximum	0.072590
Minimum	-0.108441
Std. Dev.	0.035296
Skewness	-0.357994
Kurtosis	4.628729
Jarque-Bera	4.352420
Probability	0.113471

Figure: 4.16: Normality Test for MASR

4.4 Discussion of Findings

The findings clearly reveal that the impact of fluctuations in crude oil prices cut across key sectors of the Nigerian economy. Most importantly, it was found that a long-run relationship exist between crude oil price fluctuations and returns of agricultural, information and communication and manufacturing sectors in Nigeria. This was plausibly attributed to the overdependence on oil revenue as the mainstay of the economy. For instance, crude oil price fluctuations significantly reduced the returns of agricultural sector due to the fact that this important sector (agricultural sector) depends to a large extent on revenue from oil. This also was the case in communication sector as the effect of crude oil fluctuations dwindled the returns in the information and communication sector. However, the effect of oil price fluctuation on the manufacturing sector was rather positive and statistically significant at 5% on the short-run., though not as significant when compared with the other sector. Generally, the findings imply that fluctuations in oil price could be detrimental to returns from key economic sectors. This is in line with Arinze (2011); Al Rasi and Yilmaz (2016) that oil price volatility impacts negatively on economic output.

5.1 Summary of Findings

The study empirically analysed the effect of crude oil price fluctuations on selected economic sectors in Nigeria. Using ARDL technique for the analysis, the study found that crude oil price fluctuation has a long-run relationship with agricultural, information and communication, and manufacturing sectors in Nigeria. The impact of crude oil price volatility on agricultural sector returns was negative and significant in the short-run and long-run, while crude oil price fluctuation has a positive and significant impact on telecommunication sector returns in the short-run, while in the long-run it became negative. For the manufacturing sector, crude oil price fluctuation has a positive and significant impact on returns of the manufacturing sector in the short-run and long-run.

5.2 Conclusion

Economic failure among resource rich countries has been attributed to abundance of natural resources, and is often tagged in the literature as the Dutch disease or resource curse implying natural resource is more of a curse than a blessing. The time series estimation result suggest evidence of resource curse for the entire sampled economic sectors as oil price fluctuations influenced the returns of agricultural, telecommunication and manufacturing sectors meaningfully. This shows that the nation is yet to succeed at breaking the chain of low productivity despite her abundant endowment of oil resource. Consequently, it was concluded that oil price fluctuation exerts a decreasing effect on sectorial returns except the manufacting sector.

5.3 Recommendations

Based on the findings, the following recommendations were made:

1) Nigeria should diversify her export revenue base as a means of minimizing reliance on crude oil and petroleum product. This will further shield the economy from the effect of oil price fluctuations on key sectors of the economy, and thus prevent the negative effect of the shocks from attaining a statistical significance level as it was seen in agricultural sector.

2) Furthermore, to reduce the country's vulnerability to oil price volatility, policy makers must adopt risk management instruments such as physical reserves and hedging against oil prices. This will help control the significant effects observed in agricultural and telecommunication sectors.

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