Economic Insights – Trends and Challenges	Vol.X(LXXIII) No. 1/2021	21 - 30

Environmental Impact of Economic Growth and Fuel Subsidy in Nigeria

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DOI: 10.51865/EITC.2021.01.03

Abstract

The study investigates the impact of economic growth and fuel subsidy on the environment of Nigeria from the year 1985-2018. We used Auto-regressive Distributed Lag (ARDL) to analyse the data employed in this study. From our findings, it was revealed that output per head had a positive and significant impact on carbon emission both in the long-run and short-run, while subsidy which explains government policy also had a negative and significant impact on carbon emission both in the short-run and long-run. The Error Correction Model (ECM) showed that 96% of shocks in the response variable are corrected in the long-run by the independent variables. It was concluded that increasing output in the economy increases the amount of carbon emission in the economy while removal of fuel subsidy reduces the amount of carbon emission in the economy. Therefore, effective policies should be implemented towards reducing carbon emission without hampering the growth of the economy.

Keywords: *carbon emission; economic growth; fuel subsidy; ARDL.*

JEL Classification: *E6; O4; C4.*

Introduction

Examining the relationship between economic growth and the environment has gained a significant attention among researchers in recent years. The argument is yet to reach an agreement among scholars as to diversify the source of energy supply in the economy from fossil fuel to a cleaner source. Environment and economic growth nexus are linked to energy consumption and economic growth nexus (Javid & Sharif; 2015, Romero & Jesus; 2016, and Alam *et al.*; 2012). Garber (2011) noted that implementation of industrialization and development policies in most cases lead to increase in environmental activities which cause climate change as more natural resources are consumed using less efficient technology and ignore environmental consequences. Energy generated from fossil fuel are explored from Africa, but mostly wasted in the flaring process, which contributes to the global warming (Organisation for Economic Co-operation and Development/ African Development Bank, 2003/2004).

Eradicating the issue of carbon emission adequately needs behavioural changes towards consumption of energy especially fossil fuel (Edeoja & Edeoja, 2015). Nigeria is ranked 13th producer of fossil fuel energy in the world, the largest exporter of crude oil in Africa (Wikipedia, 2017) and with the largest population of about 186million in Africa (World development Indicator, 2016). The country has committed itself in the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol on reducing emission of greenhouse gases accompanied with poverty reduction and economic growth promotion. However, the Nigerian policy framework to support and promote low-carbon development has been evolving, partly in response to international obligations and incentives, and partly due to internal drivers, such as the need to develop more options for power generation, increase energy accessibility and consumption for proper economic growth.

In all economies, households and companies have extensive demand for electricity. This demand is driven by such important factors as industrialization, extensive urbanization, population growth, rising standard of living and even the modernization of the agricultural sector (Masuduzzaman, 2012). The problem of adequate energy supply has attracted a larger percentage of national budget over the years, lead to different economic models and principles tested to increase the sector efficiency, conflict among stakeholders and lose of trust in the efficient supply of energy by the consumers. The percentage of the Nigerian population that have access to electricity in the economy as at 2014 was accounted to be 57%, while those that have access to clean fuels and technologies for cooking was estimated to be 2.32% of the population.

In adequate accessibility to energy supply has also contributed to social vices in the economy. Significant numbers of youth have shifted into informal transport sector from technical and engineering sector. Many, who have trained as electricians, welders, fashion designers and other electric based skills are now the operators of motorcycle taxis popularly called “okada” and tricycle taxis otherwise known as “Keke NAPEP” while local economic development strategies conceived around electricity components have remained paper concepts, industrial activities hampered, alternative source of generating energy considered (generator), which contributes largely to the carbon emission (Oshodi, 2014).

With proven reserves of up to 193.4trillion cubic feet of natural gas (OPEC, 2017), Nigeria is reputed to have the 9th largest gas reserves in the world. Yet, the country reported loss about US$710million through gas flaring as at 2016 (NNPC, 2016) and ranked 7th in the world for gas flaring. Natural gas has been flared in Nigeria since the start of oil production in 1956 and despite several express attempts to prohibit gas flaring (for instance, through the enactments of the Petroleum (Amendment) Decree 1973; Associated Gas Re-Injection Decree 1979; Associated Gas Re-Injection (Amendment) Decree (1985); the signing of the Associated Gas Framework Agreement 1992 and most recently, the Gas Flaring (Prohibition and Punishment Bill, 2009).

Growth theories proposed four hypotheses regards the strong link between an economy and energy. According to these theories, a reduction in energy consumption will lower automatically economic growth. The second hypothesis states the conservation effect; it states that that unidirectional causality runs only from economic growth to energy use. Thus, any attempt to diminish energy consumption may not have much influence on economic growth. The feedback hypothesis presumes the existence of bi-directional causality between energy consumption and economic growth. Under the fourth hypothesis (neutrality hypothesis), it's assumed that any change in energy consumption might not have any effect on economic growth, and vice versa (Belke, Dobnik, & Dreger, 2011). This study however settled its objective on investigating the impact of economic growth and fuel subsidy on carbon emission in Nigeria.

The rest of the study is arranged as follow, section two deals with the theoretical framework/empirical review, section three consists of the methodology and model specification, section four captures the analytical framework and interpretation of the results, while section five handles the conclusion and recommendations.

Theoretical Framework/Empirical Review

Theoretically, economists such as Malthus, Ricardo and Mill, Galbraith, Mishan, Carson, Boulding, and Commoner, argued that economic growth imposes a negative impact on the environment. They argued that increased growth produces pollution and wasteful consumption in an economy. Seldon and Sang (2004) opined that these economists predict the future development of an economy by using five interrelated variables which include population, food production, industrial production, non-renewable resources and pollution. The model predicted that in the future population level, food production and industrial production will first grow exponentially and collapse during the 21st century. Seldon and Sang (2004) further explained the submission of the theory that natural resources will get exhausted at a time whereby industrial activities of the world continues which will cause environmental hazards. Galetotti, *et al.* (2009) referred to the view of these economists as “The limit to Growth Model”. The theory implies that the objective of a growth model needs to be reviewed in order to curb its negative impact on human welfare, pollution of the environment, under-utilisation of natural resources, and its neglect on the socio-economic impact. Galetotti (2009) further explained the argument of the theory that pollution increases as economic growth activities (industrial activities) increases. Thus, carbon emissions have the potentials of causing hampering economic growth through reduction in productivity. Frankel and Rose (2002) also submitted their view on the point that trade activities and individual income contributes positively to carbon emission in an economy. Although their argument was situated in support of Kuznet curve which opines that as income increases, carbon emission increases, but decreases as income grows far enough. However, Holton (2012) noted the missing gap in the literature and modify the argument so far by considering fuel subsidy as a means increasing carbon emission.

On the empirical front, studies have quantified the effect of economic growth and fuel subsidy on carbon emission, while some focused on the effect of carbon emission itself on economic growth. Among the studies are, Hamilton and Turton (2002) who used decomposition analysis to examine factors that contributes to changes in emissions in the OECD countries. They agreed from their results that energy intensity, structural change and economic output contribute to changes in emissions. This argument relates more to the existing literature as it’s of the view that improve growth enhances carbon emission, but in the long run the growth in emissions is make up for by a decline in energy intensity which is coupled with an improved technology achievable through increase in the income stream. In West Africa Muftau, Iyoboyi and Ademola (2014) submitted that the Environmental Kuznet curve does not work in the West African context as they identified an N-shape relationship between income and carbon emission in the long-run. They recommended effective policies to capture emission problem in the West Africa countries region. Porter and Brown (2009) noted a negative nexus between carbon emission and economic growth as a result of low productivity and underutilization of manpower. Mesih and Mesih (2009) and Leo (2011) in contrary to the result of Porter and Brown (2009) argued in support of a positive nexus between carbon emission and economic growth which they traced to improved productive activities in an economy which promotes growth and development. In the economy of Taiwan, Torras and Boyce (2008) argued in support of “The Limited Growth Theory”. They submitted that improved growth implies more carbon emission in the economy, which is linked to increased industrial activities. Sanglimsuwan (2011) proposed that effective implementation of government policy has the potentials of positively initiating environmental quality.

Holton (2012) used panel regression model to examine the margin effect of fossil fuel subsidies in G20 countries. The data spans through the period 2002 to 2009. It was argued from the study results that subsidy is only significant when it is restricted to the international bench-mark price for the products. Reducing subsidies decreases environmental carbon emission and promotes income inequalities in the economies covered.

Aslanidis and Xepapadeas (2006) anticipated a 2-regime smooth transition regression (STR) model which is a more flexible parametric specification. The estimation of the model was carried out using non-linear least square (NLS). Aslanidis and Iranzo (2009) applied this methodology for 77 non-OECD countries over the period 1971-1997. Though the evidence of EKC could not be justified but the results reveal two regimes. First, a low-income region where CO2 emissions accelerate with growth; and second, a middle-to-high-income region associated with a deceleration in environmental degradation Alege and Ogundipe (2013). Alege and Ogundipe (2013) used fractional cointegration analysis to examine the environmental nexus with growth in the economy of Nigeria. Their study supports the view of Grossman and Kreuger (1995) that early stage of Nigeria’s development, trade activities and land density heightened carbon emission in Nigeria. Ejuvbekpokpo (2014) also concluded based on their empirical findings that carbon emission impacted negatively on economic growth in Nigeria.

Akinwale *et al.* (2013) using the least square method investigated the impact of phasing out fuel subsidy on fuel consumption in Nigeria. Findings from the study implied that the removal of fuel subsidy would lead to a decrease in fuel consumption which would cause fuel demand to be efficient and consequently reducing carbon emission.

However, based on the few literatures reviewed for the purpose of this study, we observed that the studies lack consensus in terms of conclusion because they have focused on different areas in terms of country and objective. Also, the scope of the study is also a factor that may have led to the missing conclusion among the studies. However, this study seeks to contribute to the existing literature by replicating the model Frankel and Rose (2002), modified by Holton (2012) in the context of Nigeria.

Data Source and Methodology

This study used secondary data sourced from World Development Indicators (WDI) (2019) and Central Bank of Nigeria Statistical Bulletin (2019). The variables for this study include, Carbon emission from liquefied fuel consumption, GDP Per Capita, Exchange rate, and Inflation rate are sourced from the WDI (2019), Polity sourced from Integrated Network for societal Conflict Research (INSCR) data base, Trade is calculated as the ratio of the total of export and import to GDP at Local currency unit, likewise Investment calculated as the ratio of investment to output, PMS price is used to measure energy policy in form of fuel subsidy and the data is sourced from Nigerian Data Portal (2019), and Land Density calculated as the ratio of Land-Area to population data sourced from WDI (2019).

The data were first subjected to pre-estimation tests which include correlation matrix, descriptive statistics, unit root test, and heteroskedasticity test. In order to estimate the parameters, we adopt the ARDL bounds proposed by Narayan (2005) to be suitable for small sample size of 30-80. GDP per capita, exchange rate, Carbon emission are estimated in the natural logarithm form. We included exchange rate and inflation in the model in order to account the monetary policy effect on the environment.

Frankel and Rose (2005) specified a separate model to capture the environmental impact of trade in the countries under study. The model was specified as:

$$EnviroDamage_i = \varphi_0 + \varphi_1 In(\frac{Y}{pop_1})_{90,i} + \varphi_2 In(\frac{Y}{pop_2})_{90,i}^{2} + u(\frac{[X+M]}{Y})_{90,i} + \pi(polity)_{90,i} + \pi(LandArea/Cap)_{90,i} + \epsilon_i \quad (1)$$

$EnvDam_i$ was captured as one of the three stated measurements of environmental damage for country i. φ_0 represents the sets of control variables in the model. $In(y/pop_1)_{90,i}$ is the natural logarithm of the GDP per capita for country i. $([X+M])_{90,i}$ explains the ration of export to import (in form of trade openness contribution) to the GDP in country i. $(Polity)_{90,i}$ captures the democratic or autocratic structure of the government. $(LandArea/pop)_{90,i}$ was used to explain per capita land area, and ε_i a residual capturing other causes of environmental damage.

Holton (2012) while examining the environmental impact of subsidy removal on human welfare adapted the environmental model of Frankel and Rose (2005). The study specified it model as;

$$EnviroDamage_i = \beta_0 + \beta_1 In\left(\frac{Y}{pop}\right) + \beta_2 In\left(\frac{Y}{pop}\right)^2 + \beta_3\left(\frac{[X+M]}{Y}\right) + \beta_4 In(subsidy) + \beta_5(polity) + \beta_6 In\left(\frac{LandArea}{Cap}\right) + \epsilon \quad (2)$$

Equation (4) implies the environmental impact of trade as a ratio of GDP, polity, population density, and residuals unaccounted for.

This study therefore adapts equation four by including exchange rate and inflation rate as the control variables in the model and drop Increased in GDP per capita and Investment as the study founds perfect collinearity between the variables included in the model. We specify our model as;

$$CO_{2_t} = \beta_0 + \beta_1 In\left(\frac{Y}{pop}\right)_t + \beta_2\left(\frac{[X+M]}{Y}\right)_t + \beta_3 In(subsidy)_t + \beta_4(polity)_t + \beta_5 In\left(\frac{LandArea}{Cap}\right)_t + \alpha_6 Z_t + \mu_t \quad (3)$$

In order to capture the long-run and the short-run effect, we specify our long-run model as;

$$\text{In}(CO_2)_t = c_0 + \sum_{i=1}^{p}\theta_1 In(C0_2)_{t-i} + \sum_{i=1}^{p}\theta_2 In\left(\frac{y}{pop}\right)_{t-i} + \sum_{i=0}^{q_1}\theta_3 In(subsidy)_{t-i} + \sum_{i=0}^{q}\theta_4\left(\frac{[X+M]}{Y}\right)_{t-i} + \sum_{i=0}^{q}\theta_{5\_}(polity)_{t-i} + \sum_{i=0}^{q}\theta_6(landarea/pop)_{t-i} + \sum_{i=0}^{q}\theta_{7\_}(Z)_{t-i} + \varepsilon_t \quad (4)$$

The dynamics of the short-run environmental effect of uncompensated fuel subsidy in Nigeria is specified as:

$$\text{In}(CO_2)_t = c_0 + \sum_{i=1}^{p} \Delta_1 In(C0_2)_{t-i} + \sum_{i=1}^{p} \Delta_2 In\left(\frac{y}{pop}\right)_{t-i} + + \sum_{i=0}^{q_1} \Delta_3 In(subsidy)_{t-i} + \sum_{i=0}^{q} \Delta_4 \left(\frac{[X+M]}{Y}\right)_{t-i} + \sum_{i=0}^{q} \Delta_{5\_}(polity)_{t-i} + \sum_{i=0}^{q} \Delta_6 (landarea/pop)_{t-i} + \sum_{i=0}^{q} \theta_{7\_}(Z)_{t-i} + \delta ecm_{i-1} + \varepsilon_t \quad (5)$$

Analytical Framework

Correlation matrix

The correlation matrix is used to test the existence of multicollinearity problem among the variables employed in the study.

For Environmental effect model, the correlation result revealed a weak correlation between income per head (GDP per capita), increase in income per head $(GDP\ per\ capita)^2$ and carbon emission (CO_2), which implies that doubling the output per head still have the same impact, therefore we drop the variable from the model. Ratio of investment to output (INV), subsidy (PMS) and polity also revealed a weak correlation with carbon (CO_2) emission as they revealed values less than 0.50. The Land density measured in ratio of land area to population had a weak downhill linear trend with carbon emission (CO_2) with value less than -0.50 (see results in Table 1).

Table 1. Correlation matrix test

Variables	*InCE*	*LAND_AREA*	*TRADE*	*POLITY*	*InPMS*	*INF*	*InGDP*	*EXR*
InCE	1	-0.18238	-0.215	0.38072	0.040933	-0.26008	0.173946	0.477392
LAND_AREA	-0.18238	1	-0.1839	-0.28082	-0.95924	0.368083	-0.99584	-0.59615
TRADE	-0.215	-0.1839	1	-0.06831	0.25314	0.005021	0.173285	-0.05357
POLITY	0.38072	-0.28082	-0.06831	1	0.172187	-0.06702	0.275292	0.255491
InPMS	0.040933	-0.95924	0.25314	0.172187	1	-0.29849	0.96262	0.545889
INF	-0.26008	0.368083	0.005021	-0.06702	-0.29849	1	-0.34725	-0.80115
InGDP	0.173946	-0.99584	0.173285	0.275292	0.96262	-0.34725	1	0.583204
EXR	0.477392	-0.59615	-0.05357	0.255491	0.545889	-0.80115	0.583204	1

Source: Authors' computation (2020).

Descriptive statistics

The descriptive statistics revealed that all the variables have a mean that falls within their maximum and minimum values. This implies the variables are well behaved within the period studied. The kurtosis result signal a leptokurtic distribution of all the variables except polity, exchange rate and inflation rate as they showed values less than 3, while polity exchange rate and inflation rate revealed a value greater than 3. Also, for the jarque-bera statistics, the result revealed that, CO_2, Y/P $(Y/P)^2$, PMS, INV and Land-Area are normally distributed as they have a probability value greater than 10%, while polity, exchange rate and inflation rate are not normally distributed as it reveals a probability value less than 10% (see result in Table 2).

Table 2. Descriptive statistics test

	$InCE$	$LAND\_AREA$	$TRADE$	$POLITY$	$InPMS$	INF	$InGDP$	EXR
Mean	10.36927	0.007703	0.543754	-3.46667	0.995419	20.38173	4.453336	1.53174
Maximum	10.59102	0.010893	0.818128	4	1.986772	72.8355	5.708256	2.029668
Minimum	10.06686	0.005161	0.237168	-88	-0.69897	5.382224	2.940949	-0.13077
Kurtosis	2.24458	1.890438	2.405456	23.13449	1.951777	3.728321	1.90991	3.09652
Jarque-Bera	2.091476	1.849118	1.153603	606.058	3.820308	11.54966	1.812927	6.162463
Probability	0.351432	0.396706	0.561692	0	0.148058	0.003105	0.40395	0.045903
Sum	311.0781	0.231103	16.31262	-104	29.86256	611.4518	133.6001	45.9522
Observations	30	30	30	30	30	30	30	30

Source: Author's Computation (2020)

Unit root test

The unit root method adopted includes the Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) test, to check for stationarity problem among the variables in the study. it was confirmed that the variables are stationary at levels and first difference [(That is, I(0) and I(1)]. This implies that there is problem of unit root among the variables which negate the traditional (Engle and Granger, 1981) view of estimating parameters. The study therefore aligns with Pesaran and Shin (1999) and Pesaran (2001) proposition on using ARDL bounds test to check the long-run cointegration when variables are found to be stationary at I(0) and I(1). See Table 3 below:

Table 3. Unit root results

	Levels			**1st difference**		
Variables	**None**	**Intercept**	**Intercept & Trend**	**None**	**Intercept**	**Intercept & Trend**
$InGDP$	5.290358	-1.21602	-1.83206	-2.8461**	-5.65166**	-5.96574**
$InPMS$	0.871227	-1.81305	-1.46102	-3.99067**	-4.61166**	-4.66943**
$Trade$	-0.56686	-2.77613	-2.50168	-7.84212**	-7.69953**	-8.64993**
EXR	-0.59397	-1.59455	-2.96148	-6.47364**	-6.35452**	-6.35649**
INF	-1.61927	-2.51111	-3.02481	-4.7955**	-4.70595**	-4.66404**
$InCE$	-0.15015	-3.50214	-3.67909	-7.30937**	-7.17736**	-7.11924**
$Polity$	-4.783**	-4.86469**	-5.23679**	-8.95717**	-8.7947**	-8.62592**
$Land\_Area$	-218.236**	-44.7823**	-17.5271**	-19.9549**	-6.5886**	-2.17225**
PP results Variables						
$InGDP$	5.290358	-2.39539	-1.60902	-2.82021**	-5.74062**	-8.00049**
$InPMS$	0.625685	-2.61965	-1.4054	-4.00626**	-4.5827**	-5.41628**
$Trade$	-0.40392	-2.77613	-2.2312	-7.83225**	-7.70393**	-24.085**
EXR	-0.56939	-1.7317	-2.96353	-6.42169**	-6.31112**	-6.30594**
INF	-1.43372	-2.50712	-2.73466	-6.24529**	-5.99576**	-6.11089**
$InCE$	-0.39908	-3.50214	-3.6403	-9.83998**	-9.46378**	-10.5506**
$Polity$	-4.7914**	-4.86349**	-5.23526**	-24.3043**	-27.2792**	-27.2872**
$Land\_Area$	-108.054**	-22.5765**	-11.1085**	-11.274**	-4.668**	-1.82237**

** implies the 5% significant level of the variables.

Source: Authors' computation (2020).

ARDL bounds test

From the ARDL bounds test, we found a co-integrating long-run among the variables as the F-statistic is greater than both the upper and lower bound at 5% level of significance (see Table 4).

Table 4. Bounds test result

Test Statistic	**Value**	**K**
F-statistic	5.301378	7
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.38	3.45
5%	2.69	3.83
2.5%	2.98	4.16
1%	3.31	4.63

Source: Authors' Computation (2020).

ARDL Estimation

From the result below in Table 5, Land density had a positive impact on carbon emission in the long-run and in the short-run, but insignificant in the long-run and significant in the short-run. Trade activities had a negative and insignificant impact in the long-run and short-run. Polity, a proxy for government practices in the economy, had a positive and insignificant impact on carbon emission both in the long-run and short-run. Inflation rate impact on had a positive impact, Subsidy (PMS) had a negative and significant impact on carbon emission both in the short-run and long-run. Also, GDP and Exchange rate (EXR) also had a positive and significant impact on carbon emission in the short-run and long-run. The Error correction model (ECM) is rightly signed, which implies that the independent variables are capable of correcting about 96% deviation of the environment from the expected equilibrium in the short-run back to equilibrium in the long-run if appropriate measures are taking on the variables. The results support the view of Akinwale *et al.* (2013) that the removal of fuel subsidy causes carbon emission to reduce through fall in fuel consumption as the result shows a negative nexus between fuel subsidy and carbon emission. Also, in consonance with the proposition of Galeotti (2009), our result support the view that as economic growth increases, carbon emission increases, since we found a positive nexus between economic growth and carbon emission. The monetary policy tools included in the model showed that the movement of price and value of the currencies in the economy favours carbon emission in the economy. This implies that prices and the currency value in Nigeria are moderated towards consuming more of carbon emission products.

Table 5. Long-run and short-run estimate

Selected Model: ARDL (1, 1, 0, 0, 1, 0, 0, 1)

$Variable$	$Coefficient$	$Std.Error$	$t-Statistic$	$Prob.$
$Land\_Area$	521.562851	580.700586	0.898161	0.3824
$Trade$	-0.28976	0.230953	-1.25463	0.2276
$Polity$	0.000788	0.001225	0.643617	0.5289
$InPMS$	-0.685635	0.157678	-4.34834	0.0005
INF	0.005414	0.002261	2.394091	0.0293
$InGDP$	0.780666	0.330325	2.363324	0.0311
Exr	0.463669	0.103472	4.481108	0.0004
C	8.232419	4.445251	1.851958	0.0826
$Trend$	-0.038712	0.076674	-0.50489	0.6205

Table 5 (cont.)

Short-run estimate $Variable$	$Coefficient$	$Std. Error$	$t - Statistic$	$Prob.$
$\Delta Land\_Area$	23381.69914	9440.629137	2.47671	0.0248
$\Delta Trade$	-0.277468	0.224608	-1.23534	0.2345
$\Delta Polity$	0.000755	0.001189	0.634936	0.5344
$\Delta InPMS$	-0.362062	0.153693	-2.35575	0.0316
ΔINF	0.005184	0.00181	2.864402	0.0112
$\Delta InGDP$	0.747549	0.303231	2.465282	0.0254
ΔExr	0.262762	0.0743	3.536513	0.0027
$\Delta Trend$	-0.037069	0.073916	-0.50151	0.6228
ECM_{t-1}	-0.957579	0.167274	-5.72461	0.0000

Source: Authors' computation (2020).

Heteroskedasticity test

This is also called the residual analysis. It is compulsory to check for the presence of heteroscedasticity in order to check if the model built can explain some variations in the response variable which eventually shows up in the residual. If there is a problem of heteroskedasticity, there is high possibility of the model been unstable and inefficient to predict the phenomenon. From the result in Table 6; the p-value of the test is greater than 5% significant level, which implies that the model specified is free of heteroskedasticity problem.

Table 6. Heteroskedasticity test: Breusch-Pagan-Godfrey

F-statistic	0.444234	Prob. F(12,16)	0.9199
Obs*R-squared	7.247428	Prob. Chi-Square(12)	0.8408
Scaled explained SS	1.938383	Prob. Chi-Square(12)	0.9995

Source: Authors' computation (2020).

Conclusion and Recommendations

The study investigates the impact of improved growth and energy policy on carbon emission in the economy of Nigeria. The Auto-regressive Distributed Lag was as the estimation method for the study for data span from 1985-2018. The study observed from its findings that as economic growth increases, carbon emission also increase which support the view of "The Limit growth theory" of Malthus, Frankel and Rose (2002) and Holton (2012). Also, it was observed that subsidy removal had a negative impact on carbon emission. Which implies that the more subsidies are removed, the more carbon emission reduces both in the long-run and short-run. The study therefore concludes that an adverse relationship exists between subsidy and carbon emission, while an inverse relationship exists between carbon emission and economic growth. The study therefore recommended from its findings that subsidy should further be removed but should be a gradual process to avoid its heavy effect in the short but achieve its goal in the long-run, while appropriate policies should be designed to save the output growth of the economy from the expense of reducing carbon emission.

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