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RESEARCH ARTICLE

THE ROLE OF ENERGY CONSUMPTION IN CARBON DIOXIDE (CO_2) EMISSION AND ECONOMIC GROWTH RELATIONSHIP IN NIGERIA

Deekor[1], LeeLee N.[1] and Aziaka Duabari S[2]

1. Department of Economics, Ignatius Ajuru University of Education, Port Harcourt, Nigeria.
2. Department of Mechanical Engineering, Ken-SaroWiwa Polytechnic, Bori, Rivers State Nigeria.

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Abstract

This paper uses the Autoregressive Distributed Lag(ARDL) method which allows for the combination of variables with mixed order of integration in a single regression model to the hypothesis that energy consumption matters in the carbon dioxide effect of economic growth. Using Nigerian dataset, our findings suggest that there is probable of a cointegrating relationship among the variables of interest. However, the estimation results refute the Environmental Kuznets Curve (EKC) in the context of the Nigerian economy. Essentially, we find the relationship between carbon dioxide (CO_2) emissions and Gross Domestic Product (GDP) per capita to be monotonically increasing. We also find the response of CO_2 emission to energy consumption to vary for different energy-mix.

Introduction:-

Energy consumption in the process of production is considered as a precondition for the attainment of economic growth and sustainable development. It is indispensable for economic activity because all production and consumption activities are directly related to energy consumption. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly.However, the simultaneous rise in the production activities that generate economic growth cannot be in isolation of energy consumption,thus, motivating our hypothesis that the consumption of energy matters in the carbon dioxide(CO_2) and economic growth relationship. By using the transitive property in mathematics, we can infer that economic growth thrives on energy consumption which in turn drives carbon dioxide emissions (Bosupeng, 2016). Thus, energy consumption plays the dual role of providing the foundation for economic activity and human well-being as well as acting as the driving force for environmental degradation. Thus, the energy consumption –growth driven hypothesis has the potential to cause high carbon dioxide emitters, particularly for energy intensity economy such as Nigeria.

Partially due to their continuousexpanding towards industrialization and urbanization stage of development, energy consumption and environmental degradation have continued to gain prominence in developing and energy-dependent economies such as Nigeria. Given that it is a growing economy, Nigeria has huge energy demands and energy requirements. As an oil-dependent economy, it is well established that all hydrocarbon extraction activities generate CO_2 emissions. One particular by-product of crude oil production is associated with gas, the flaring of which generates large amounts of greenhouse gases (Total.com, 2018). On the net calorific value, Nigeria's economy is fueled by unclean and traditional energy, comprising 80.9 per cent of the total consumption. Cleaner and modern energy like gas and electricity comprised only a paltry amount of 11.1 per cent (Rapu et al., 2015). The sustainability of the energy systems in Nigeria is likely to be vulnerable if the anticipated energy crisis – in

Corresponding Author:- Deekor
Address:- Department of Economics,Ignatius Ajuru University of Education,Port Harcourt, Nigeria.

particular, the electricity crisis and CO_2emissions issues – are not addressed appropriately.This is because the country is still highly dependent on fossil fuels such as oil and gas in its productive activities which also represents other main causes of carbon (CO_2) emissions.

As part of the global initiative to reduce the emission of CO_2 around the world, Nigeria has also adopted several environmental policies and strategies to reduceher share of the global emission of CO_2. However, understanding the cost and economic implications associated with such initiatives cannot be in isolation of evidence-based facts on the extent to which rise in the production activities that generate economic growth is also expected to increase CO_2 emissions. Economic growth, energy consumption and carbon emissions are interrelated and, therefore, their relationship must be examined using an integrated framework to avoid misspecificationUsing the case of Nigerian economy, the focal point of this paper is to understand the extent to which productive activities relying on energy consumption matter for the country's share of carbon dioxide emissions. In addition to this introductory section, the rest of this paper is structured as follows: Section 2 reviews the empirical findings of the previous studies. Section 3 is the methodology, while section 4 discusses the data and offers some preliminary analyses. Section 5 presents the empirical results and discusses the findings while section 6 concludes the paper.

Literature review:

The earlier literature analyzed the relationship between economic growth and environmental degradation according to the EKC analytic scheme and proposed an inverted U-shaped relationship between economic growth and environmental degradation (Grossman and Krueger, 1991; Stern et al., 1996; Ekins, 1997; Gani, 2012). Subsequently, scholars started to review empirical EKC studies (Dinda, 2004; Stern, 2004). In their pioneering work, Grossman and Krueger (1991) proposed an inverted U-shaped relationship between economic growth and environmental degradation. In recent time, however, empirical investigation on economic growth and environmental degradation has been extended to include the extent to which consumption of energy in the production activities accelerate the emission of CO_2. Notwithstanding, the intensity of research on the relationship between energy consumption, economic growth, and environmental pollution, the empirical evidence remains controversial and ambiguous to date(see, for example, Stern, 2004; Galeotti 2006; Ozturk et al., 2010;Belke et al., 2011; Halkos and Tzeremes 2011; Yang et al., 2012; Ahmad et al., 2012; Pirlogea and Cicea, 2012; Yali 2014;Esen, 2017; Taylor et al., 2018).

We also acknowledge the growth of the strand of empiricalliteraturethat captures energy consumption as a potential determinantofCO_2.Lean and Smith (2009) for example, examined the causal relationship between carbon dioxide emissions and energy consumption through a panel vector error correction model for five ASEAN countries over the period 1980–2006. The long-run estimates indicate that there is a statistically significant positive association between energy consumption and emissions. In Iran, a one-way causal relationship from energy consumption (petroleum products and natural gas consumption) to CO_2 emission was found in the case of (Lotfalipour et al., 2010). In South Africa, Menyahand Rufael (2010) found a positive effect of CO_2 emissions on energy consumption. Similarly, Niu et al. (2011) show a positive relationship between energy consumption and $_{CO2}$ emissions in eight Asian economies. Some studieshavealso considered otherforms of energyindicators. The studies by Tiwariet al. (2013); Shahbaz etal.(2013a), include coal consumption,thestudyby Lotfalipour etal.(2010), includes fossil fuel consumption,thestudyby Iwataetal.(2010), analyses the roleofnuclearenergyinFrance.Cowanetal.(2014), Farhani and Shahbaz (2014), Al-Mulali andOzturk(2015), Bento and Moutinho (2016), among others have also considered electricity power consumption as a proxy for energy consumption.

For Adewuyi and Awodumi (2017), it was argued that studiesexamining the relationship between energy consumption and economic growth without considering carbon emissions do not contribute much to the literature.Summarizing the inconsistency that has characterized findings of the existing studies on CO_2 emissions-growth relationships, He (2009),argues that there is no one-fit-for-all growth-pollution relationship even when using the same estimation method. For example, Tamazian and Rao (2010), Taguchi (2012) and Gholami and Shafiee (2013) used GMM and they found inverted U, linear and N-shapes, respectively, although they used different samples of countries as case studies.

The Model:

The EKC hypothesis postulates an inverted U-shaped relationship between CO_2 emissions and per capita income: emissions per person increase up to a certain threshold level as per capita income goes up, after which they start to decrease (Dinda 2004; Müller-Fürstenberger and Wagner 2007; Kaika and Zervas, 2013). Following Storm and Mir

(2016), this study estimates a general reduced-form model in which CO_2 emissions per capita is a polynomial cubic function (of degree three) of per capita income:

$$CO_{2t} = \beta_0 + \beta_1 Y_t + \beta_2 Y_t^2 + \beta_3 Y_t^3 + \beta_4 EC_t + \varepsilon_t \quad (1)$$

Where CO_{2t} denotes per capita emissions of carbon dioxide while Y_t denotes per capita income in real terms (measured at levels, quadratic and cubic form). The rapid growth of a country's economy may be caused by over-development and inappropriate use of natural resources which will result in pollution and destruction of the environment and environmental crisis. The development and utilization of natural resources will increase the emissions of industrial pollutants, environmental degradation and resource depletion. Another main driver of carbon dioxide emissions is energy consumption given that the bulk of developing countries depend largely on fossil fuel consumption.

Table 1:- Apriori expectation.

	Values of coefficients β_i	Relationship between income per capita (Y) and CO_2 emissions per capita
1	$\beta_1 = \beta_2 = \beta_3 = 0$	No relationship
2	$\beta_1 > 0\, and\, \beta_2 = \beta_3 = 0$	A monotonically increasing or linear relationship
3	$\beta_1 < 0\, and\, \beta_2 = \beta_3 = 0$	A monotonically decreasing relationship
4	$\beta_1 > 0, \beta_2 < 0, \beta_3 = 0$	An inverted-U-shaped relationship (KC)
5	$\beta_1 < 0, \beta_2 > 0, \beta_3 = 0$	A U-shaped relationship
6	$\beta_1 > \beta_2 < \beta_3 > 0$	An N-shaped relationship
7	$\beta_1 = \beta_2 = \beta_3 = 0$	An inverted-N-shaped relationship
8	$\beta_4 > 0$	The higher the choice of fossil fuels in energy consumption, the higher the carbon emission.
9	$\beta_5 < 0$	The higher the carbon dioxide emission, the lower the life expectancy.
10	$\beta_6 > 0$	Higher FDI inflows will require higher energy consumption which generates higher CO_2 emission
11	$\beta_7 > 0$ or $\beta_7 < 0$	There is ambiguity in the effect of financial development and CO_2 emission.

It can be seen that the EKC is only one of various possible numerical outcomes for equation (2), namely outcome 4 in Table 1, which occurs when we find that $\beta_1>0$, $\beta_2<0$ and $\beta_3 = 0$.

Estimation technique:

To examine the long-run relationship among the variables, we employ the use of the ARDL Bounds co-integration testing approach developed by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001). The technique is largely preferred by economists and econometricians due to its flexibility to simultaneously accommodate variables with mixed order of integration in the same regression. Again, the Bounds test co-integration approach provides robust long-run estimates even in the presence of some endogenous variables in the model (Narayan, 2005). Finally, unlike the conventional techniques such as the Johannson co-integration approach, the bounds test is capable of giving robust results even when the sample size is small. Hence, these advantages make the adoption of the ARDL approach suitable in investigating the long-run impact of CO_2 emission, energy consumption and economic growth in Nigeria. Using the bounds test approach, the following unrestricted error correction model will be estimated through the OLS method.

$$\begin{aligned}\Delta \ln CO_{2t} = {} & \alpha + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln CO_{2t-i} + \sum_{i=0}^{q} \lambda_{2i} \Delta \ln Y_{t-i} + \sum_{i=0}^{r} \lambda_{3i} \Delta \ln Y_{t-i}^2 + \sum_{i=0}^{r} \lambda_{4i} \Delta \ln Y_{t-i}^3 + \sum_{i=0}^{v} \lambda_{5i} \Delta \ln EC_{t-i} + \\ & \varphi_1 \ln CO_{2t-1} + \varphi_2 \ln Y_{t-1} + \varphi_3 \ln Y_{t-1}^2 + \varphi_4 \ln Y_{t-1}^3 + \varphi_5 \ln EC_{t-1} + \varepsilon_t \quad (2)\end{aligned}$$

where the parameters, λ_{mi} for m= 1, 2 . . . 5, represent the short-run dynamics in the model while the long-run relationships are given by φ_i. To determine the long-run relationship between the regressand and regressors, the ARDL bounds test approach requires estimating equation (2) and restricting the parameters of the lag level (long run) variables to zero. Hence we test the null hypothesis (no co-integration) $H_0 : \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0$ against the alternative hypothesis of co-integration. The hypothesis is tested using the F-test. The computed F-statistic is then compared with the Pesaran et al. (2001) asymptotic critical value bounds to ascertain the existence of a long-run relationship (co-integration). The null hypothesis of no co-integration is accepted if the computed F-statistic is less than the lower bounds and vice versa. The decision, however, remains inconclusive, if F-statistics lies between lower and upper critical bounds. Thus, in the event of a level relationship among the variables, the resulting long-run model can be estimated as:

$$\ln CO_{2t} = \phi_0 + \phi_1 \ln Y_{t-1} + \phi_2 \ln Y^2_{t-1} + \phi_3 \ln Y^3_{t-1} + \phi_4 \ln EC_{t-1} + v_t \qquad (3)$$

The concluding step of the bounds test is to estimate the short-run elasticities which are obtained via the error correction framework represented by equation (4):

$$\Delta \ln CO_{2t} = \delta_1 + \xi_{ect} ECT_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta \ln CO_{2t-i} + \sum_{i=0}^{q} \lambda_{2i} \Delta \ln Y_{t-i} + \sum_{i=0}^{r} \lambda_{3i} \Delta \ln EC_{t-i} + \eta_t \qquad (4)$$

where ECT_{t-1} is the error correction term while ξ_{ect} is the coefficient which captures the speed of adjustment of the model to its long-run equilibrium. In other words, ξ_{ect} captures the rate of correction at time t of deviation from the long-run equilibrium at time t−1.

Data and Preliminary Analysis:

Based on the empirical specification, annual time series data will be collected for Nigeria between 1970 and 2016. Gross domestic product per capita at a constant price of 2005 expressed in US dollar serves as a proxy for real income per capita (Y_t). Energy consumption (EC) is measured as fossil fuel energy consumption (ENC) as a percentage of the total. Nevertheless, the robustness of the energy consumption indicator will also be tested with energy use (ENU) measured as kg of oil equivalent per capita and electricity power consumption (EPC) as kWh per capita. The CO_2 emission is measured as CO_2 emissions (metric tons per capita). All the data are sourced from the World Bank World Development Indicator.

Reported in Table 2 are the statistical properties of the series including summary statistics and unit root testing results. Starting with the summary statistics in the (a) part of table 2, the mean statistic shows that average GDP per capita in Nigeria is 1.72$ million per capita and 0.64 metric tons per capita for the CO_2 emission series (GHC). All the series are negatively skewed but GDP per capita (GDPPC), while the kurtosis statistic is mostly platykurtic for all the series but ENC. Also, the null hypothesis of non-normality of the distribution of the series appears to be rejected for all the series but ENC. Concerning the unit root test, we consider both the conventional Augmented Dickey-Fuller (ADF) unit root test and modified version namely, Dickey-Fuller- Generalized Least-Squares (DF-GLS). The evidence mixed order of cointegration as reported in the (b) part of the table for both the ADF and DF-GLSfurther support our choice of estimation technique which allows for the combination of series with mixed order of cointegration.

Table 2(a):- Summary Statistics.

Statistics	**GDPPC**	**GHC**	**ENC**	**ENU**	**EPC**
Mean	1721.29	0.6359	17.7238	693.7958	89.9362
Std. Dev.	431.31	0.1894	4.4124	55.5471	35.6967
Skewness	0.4421	-0.0338	-1.5748	-0.4254	0.1134
Kurtosis	1.9397	1.9974	4.6064	2.6318	2.2287
J-Berra	3.7332 (0.1547)	1.9777 (0.3720)	24.4801 (0.0000)	1.6829 (0.4311)	1.2659 (0.5310)

Table 2(b): Unit Root Test

Variable	**ADF**			**ADF-GLS**		
	Level	**First Difference**	**I(d)**	**Level**	**First Difference**	**I(d)**
GDPPC	-0.6504^b	-6.0590^b***	I(1)	-0.7600^b	-5.1178^b***	I(1)
GHC	-2.2066^a	-6.8597a***	I(1)	-1.7192^b*	-	I(0)
ENC	-2.4770^b	-5.7695^b***	I(1)	-1.3730^b	-5.8937^b***	I(1)
ENU	-2.4633^b	-5.2402^b***	I(1)	-1.6024^b	-5.6428^b***	I(1)
EPC	-3.3328^b*	-	I(0)	-2.3833^b	-9.2510^b***	I(1)

Note: The exogenous lags are selected based on Schwarz info criteria while ****, **, * imply that the series is stationary at 1%, 5% and 10% respectively. The null hypothesis is that an observable time series is not stationary (i.e. has unit root).

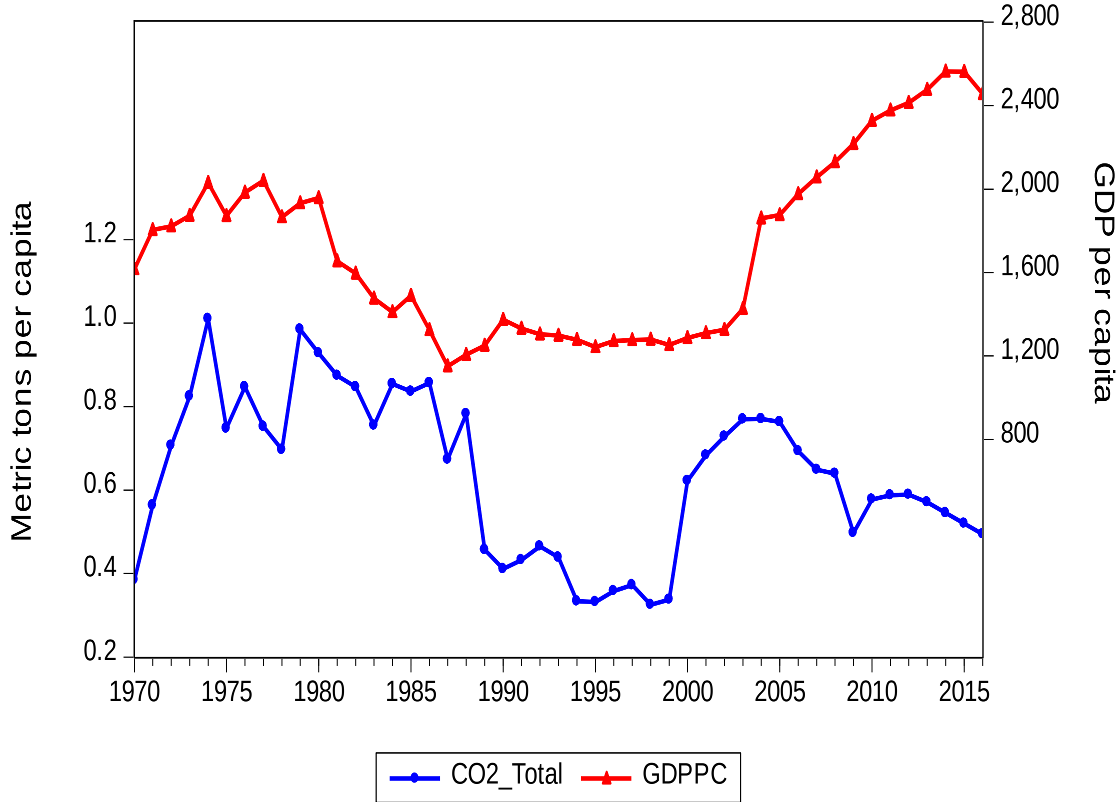

Figure 1:- Trends in CO_2 emission (GHC) and Economic Growth.

Figure 1 depicts possible co-movement between GHC and economic growth measured as CO_2 emission and GDP per capita, respectively. Quite an interesting in the figure is the potential of positive and negative co-movements between the economic growth and CO_2 emission. A cursory look at the figure, for example, shows that both the CO_2 emission and economic growth appear to be moving in the same direction in the period between 1970 and 1987. The movement is, however, in the opposite direction for the period between 1986 and 2016. This though gives little or no statistical credence, yet it provides us with pre-information on the potential of the EKC hypothesis in the CO_2 and economic growth relationship in Nigeria.

Empirical Results:-

Presented in Table 3 are empirical estimates from log-linear, log-quadratic, and log-cubic version of CO_2 emission – economic growth functions. Starting with the Bound cointegration testing results, the decision on whether to reject the null hypothesis of no long-run relationship appears to be statistically indistinct in both squared and cubic with the F-statistic hovering between the upper and lower bounds of the critical values. The hypothesis of no cointegration is, however, significantly rejected when the GDP per capita is linearly expressed. Also, the fact that only the coefficient on GDP per capita appears to be statistically significant both in the linear and squared models thus suggesting that the variance in production related to CO_2 emission is mainly linear in the case of the Nigerian economy. To put it differently, the estimated coefficient on the income variable (i.e. GDP per capita) has a positive sign, implying a linear relationship (monotonically increasing) among income and emissions. This by implication suggests that the EKC hypothesis does not hold for Nigeria over the period under consideration.

To examine the extent to which energy consumption matters in the CO_2 –economic growth relationship, we further extend the preferred carbon emission function which in this case is the linear function to include the energy consumption variables that is under consideration. Contrary to our earlier finding, the Bound cointegration testing resultsseem to be suggesting that the null hypothesis of no long-run relationship holds for Model_1 and Model_2 where the energy consumption is measured as ENC and ENU but rejected in Model_3 when energy consumption is measured as EPC. This by implication suggests that the probability of a long relationship between CO_2 emission and economic growth in a model that controls for energy consumption might be sensitive to the measure of energy consumption that is under consideration. Consequently, we find little or no significant evidence that the CO_2 emission is due to economic activity in the extended model, except when energy consumption in the model is measured as kg of oil equivalent per capita. This is quite expectant of the crude oil-producing economy. However, the negative sign on the coefficient on electricity power consumption (EPC) is an indication that renewable energy if initiated vial electricity consumption has the potential for reducing CO_2 emission in Nigeria.

Table 3:- ARDL estimates of carbon dioxide –GDP per capita nexus.

	Linear Model			**Quadratic Model**			**Cubic Model**		
Short-Run	**Coefficient**	**SE**	**T-stat.**	**Coefficient**	**SE**	**T-stat.**	**Coefficient**	**SE**	**T-stat.**
Constant	-1.5709*	0.8625	-1.8212	-8.3035	4.7678	-1.7415	-22.4593	20.7078	-1.0845
Trend	-0.0052**	0.0021	-2.4267	-0.0030	0.0026	-1.1497	-0.0030	0.0026	-1.1475
$\Delta\log(co_{2t-1})$	-0.2937***	0.0897	-3.2730	-0.3258***	0.0914	-3.5640	-0.3257***	0.0919	-3.5409
$\Delta\log(y_t)$	0.2095*	0.1164	1.7997	1.1748*	0.6823	1.7217	3.3133	3.1197	1.0620
$\Delta\log(y_t^2)$				-1.58E-07	1.10E-07	-1.4351	-1.16E-06	1.43E-06	-0.8112
$\Delta\log(y_t^3)$							2.37E-10	3.38E-10	0.7027
ECM_t	-0.2937***	0.0818	-3.9728	-3.5882***	0.0820	-3.9728	-0.3257***	0.0801	-4.0661
Long-Run									
$\log(y_t)$	0.7132**	0.3632	1.9632	3.6060*	2.0248	1.7808	10.1729	9.8149	1.0364
$\log(y_t^2)$				-4.86E-07	3.33E-07	-1.4604	-3.57E-06	4.49E-06	-0.7937
$\log(y_t^3)$							7.28E-10	1.06E-09	0.6890
Bound cointegration testing result									
Level of Significance	**Linear Model F-stat**	**I(0)**	**I(1)**	**Quadratic Model F-stat**	**I(0)**	**I(1)**	**Cubic Model F-stat**	**I(0)**	**I(1)**
10%		2.63	3.35		2.37	3.20		2.20	3.09
5%	3.0043	3.10	3.87	2.8760	2.79	3.67	2.4494	2.56	3.49
1%		4.13	5.00		3.65	4.66		3.29	4.37

Post-estimation result

			Linearity test	**Autocorrelation test**		
Model	**Adj-R2**	**F-stat.**	**Ramsey RESET**	**Q-Stat.**	**Q^2-Stat.**	**ARCH-LM test**
Linear	0.7203	39.6423***	0.7561 (0.3896)	1.4237 (0.491)	1.4237 (0.491)	0.0171 (0.9830)
Quadratic	0.7272	30.9968***	Not applicable	0.6340 (0.728)	0.6340 (0.728)	0.0665 (0.9357)
Cubic	0.7238	24.5900***		0.2992 (0.861)	0.2992 (0.861)	0.1338 (0.8751)

Note: The values in parenthesis represent the probability values for the various post estimation tests performance, while ***, ** and * denote 1%, 5% and 10% level of significance.

Table 4:- ARDL Estimates for the role of energy consumption in CO_2 -GDP per capita Nexus.

	Model_1			**Model_2**			**Model_3**		
Short-Run	**Coefficient**	**SE**	**T-stat.**	**Coefficient**	**SE**	**T-stat.**	**Coefficient**	**SE**	**T-stat.**

Constant	-1.4974	1.3128	-1.1406	-5.5226	6.5401	-0.8444	0.5832	1.2180	0.4788
Trend	-0.0050	0.0034	-1.4857	-0.0087	0.0061	-1.4336	0.0064	0.0053	1.2114
$\Delta\log(co_{2t-1})$	-0.2895**	0.1073	-2.6978	-0.3254***	0.1043	-3.1203	-0.1755*	0.0984	-1.7822
$\Delta\log(y_t)$	0.2011	0.1623	1.2390	0.2420*	0.1288	1.8783	0.1017	0.1192	0.8531
$\Delta\log(enc_t)$	-0.0007	0.0102	-0.0750						
$\Delta\log(oil_t)$				0.5771	0.9466	0.6096			
$\Delta\log(elec_t)$							-0.3547**	0.1486	-2.3869
ECM_t	-0.2895***	0.0806	-3.5894	-0.3254***	0.0889	-3.6606	-0.1755***	0.0383	-4.5736
Long-Run									
$\log(y_t)$	0.6948	0.4477	1.5518	0.7438**	0.3347	2.2217	0.5797	0.5786	1.0018
$\log(enc_t)$	-0.0026	0.0360	-0.0739						
$\log(oil_t)$				0.5771	0.9466	0.6096			
$\log(elec_t)$							-2.0208	1.7228	-1.1729
Bound cointegration testing result									
Level of Significance	**Model_1**			**Model_2**			**Model_3**		
	F-stat	**I(0)**	**I(1)**	**F-stat**	**I(0)**	**I(1)**	**F-stat**	**I(0)**	**I(1)**
10%	2.34	2.37	3.20	2.44	2.37	3.20	3.81	2.37	3.20
5%		2.79	3.67		2.79	3.67		2.79	3.67
1%		3.65	4.66		3.65	4.66		3.65	4.66

Post estimation result			
	Model_1	**Model_2**	**Model_3**
Adj-R^2	0.7135	0.7161	0.7485
F-stat.	29.0292***	29.3798***	34.4815***
Ramsey RESET Test	0.7582 (0.3891)	0.5621 (0.4578)	3.0288 (0.0895)
Q-stat.	1.3079 (0.520)	2.4812 (0.289)	0.3543 (0.838)
Q^2-stat.	1.3079 (0.520)	2.4812 (0.289)	0.3543 (0.838)
ARCH-LM	0.0116 (0.9884)	0.0957 (0.9089)	0.0879 (0.9060)

NOMENCLATURE
ARDL - Autoregressive Distributed Lag,
EKC-- Environmental Kuznets Curve
ENC-- Energy consumption
ENU --Energy use
EPC --Electricity power consumption.
GLS- Generalized Least- Squares.
GMM- Gaussian Mixture Model

Note: The energy consumption in model_1 is represented by fossil fuel energy consumption measured as a percentage ofthe total, log of kg of oil equivalent per capita in model_2, and log of electricity power consumption in kWh per capita in model_3. Value in parenthesis represents the probability values for the various post estimation tests performance, while ***, ** and * denote 1%, 5% and 10% level of significance.

Concluding Remark:-

This paper uses Nigerian dataset to examine carbon dioxide emission effects of economic growth while accounting for the role of energy consumption. To capture both the short and long-run dynamics of the relationship simultaneously, we explore the ARDL method which also allows for the combination of the variable with mixed order of integration in the same regression. Our findings though suggest that there is probable of a cointegrating relationship among the variables of interest, the estimation results yet suggest the EKC hypothesis does not hold in the case of the Nigerian economy. Essentially, we find the relationship between CO_2 emissions and GDP per capita to be monotonically increasing. We also find the response of CO_2 emission to energy consumption to vary for different energy-mix. For instance, while energy consumption measured as kg of oil equivalent per capita is capable of causing increasing GHC, our finding of a negative sign on the coefficient on electricity power consumption (EPC) seems to be suggesting that renewable energy if initiated vial electricity consumption has the potential for reducing CO_2 emission in Nigeria.

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