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CO_2 Emissions and Environmental Implications in Nigeria

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ABSTRACT

Since the discovery of oil in 1956, the Nigerian economy has been dependent on fossil fuel as a means of energy generation, hence causing excessive emission of carbon dioxide in the environment. Given this background, this study investigates the effect of fossil fuel consumption on environmental quality in Nigeria. The study used secondary data from 1970 to 2017 obtained from World Development Index (WDI) and employs the Johansen co-integration analysis. The result reveals that about 80% of carbon emissions in Nigeria are directly consequence of fossil fuel combustion. Also, within the period observed, pollution was found to be a rising function of income and pollution rises as communities becomes more densely populated. The study recommends an urgent design of sustainable energy framework and national sensitization on the multidimensional adverse consequences of the use of dirty fuels.

Keywords: CO_2 Emissions, Fossil Fuel, Environment, Climate Change
JEL Classifications: Q53, L71, P28, Q54

1. INTRODUCTION

For a significant development take-off, economies need a stable and continuous supply of energy. This is predominantly fossil fuels and other alternative ones for developing economies. Energy is considered an important component of broader development, it is imperative to every feasible development agenda, as it is essential for eradicating poverty, improving human welfare and raising living standards (UNDP, 2010; Lotfalipour et al., 2010). However, the type of energy supply and use in most developing economies, especially SSA, are considered harmful, unsustainable and hampers economic development. Production and consumption activities in these economies are predominantly related to the energy use, principally fossil fuels – representing over 60% of global greenhouse gas emissions. This energy type, though, unsustainable but intrinsically linked with the economy and the environment in SSA economies. Fossil fuel is a source of energy that consists of oil, coal and natural gas. Its consumption in Nigeria constitute about 19.04 percent of total energy consumed in 2014, implying that Nigeria is not free from the problems attributed to the use of Fossil Fuel (Ogundipe et al., 2018).

Nigeria may not be able to eradicate fossil fuel consumption but must minimize its dependence due to environmental pollution arising from the use of fossil fuels. It is a known fact that carbon dioxide (gas released when fossil fuels are burnt) is a primary element responsible for global warming. The excess release of the gaseous elements increases temperature of earth which has resulted in melting of polar ice caps, flooding of low lying areas and rise in sea levels. If such conditions continue, there is a high probability of poor access and availability of food and high mortality rate (Ogundipe et al., 2020). Already, greenhouse gas emissions have contributed to the increasing rate of climate weather changes in oil producing nations of the world. Hence, the rising consumption of fossil fuel (which is a major source of energy use) constitutes a risk in the near future (Anomohanran, 2017; Adekomaya et al., 2016).

Also, there are intending threats to the climate, as a continuous rise in greenhouse gas emissions can be associated with lower water supplies and hotter temperatures increase the risk of drought, causing plants and crops to wither and die. This destroys important food sources for humans and animals, but also creates dangerous conditions for wildfires (Alimi et al., 2016). Air pollution caused by fossil fuel combustion not only acts directly on environment but contamination of water and soil leads to their degradation (Chmielewski, 2004). Fossil fuel combustion by-products are the world's most significant threat to children's health and future, and are major contributors to global inequality and environmental injustice. Environmental pollution arising from fossil fuel combustion, though, a global issue but its environment and burden of disease attributable to carbon emissions are heavier in low and middle income countries, particularly in Africa.

The emergence of sustainable development goals (SDGs) emphasized the importance of sound social and safe environment as critical for wellbeing. The agenda suggests ensuring good wellbeing and healthy lives for all (SDG 3) required making cites inclusive, safe, resilient and sustainable (SDG 11) which is hinged on universal access to energy (SDG 7) and combating climate change (SDG 13). This evidence suggests that energy is central to achieving other SDGs, but not just provision of energy but a clean, safe and efficient energy (Ogundipe et al., 2018). This is where the situation appears hapless for developing economies, especially SSA region; as the present energy use could jeopardize the efforts toward achieving SDGs. Evidences from existing studies posit that the major constituent of air pollution is derived from fossil fuel combustion, (others include industrial processes, waste incineration, agricultural practices and natural process such as wildfires and dust storms). And it's responsible for 4.2 million premature deaths in 2016; of these, almost 300,000 were children under the age of 5 years.

Energy is a very important for human survival and development. The use and exploitation of energy has a very huge impact on the development of the world's economy and the society. The energy source got from fossil fuel; coal, oil and natural gases are very essential for transportation, heating and mostly for electricity production and many others too. However, the processing and extraction of the fossil fuel and also the use of the fossil fuel have major impacts on the environment (Rhy, 2011). The oil spillage of over 4.9 million barrels of crude oil into the Gulf of Mexico and several oil spills in Nigeria mostly in the Niger Delta have brought awareness about the potential crisis and disasters that can occur due to the exploitation of fossil fuel to cause contamination of the natural environment.

The year 2015 was the hottest year ever in the history of the earth's climatologically chronology. This increased temperature can be attributed to global warming resulting from the selfish activities of man especially carbon emitters. As nations scramble to attain global supremacy, nature tends to suffer inadvertently. Thus, for the environment to be sustainable government has to effectively play its regulatory roles, stakeholders ought to rise to the challenge to address these problems. Investors should adhere to international best practices in energy exploitation while engineering and scientific bodies should ensure that they adopt technologies in the confine of their professional ethics.

From previous empirical analysis, it had been observed that the consumption of fossil fuel has both positive and negative impacts on the environment. But the over-dependence on the use of fossil fuel is more of a curse than a blessing because of the adverse effect it has on the environment. Though fossil fuel combustion releases not only carbon emissions into the atmosphere, other gaseous elements such as carbon monoxide and suphur dioxide are released but this study intends to disassociate carbon emissions by obtaining the magnitude and proportion of carbon emissions directly related to human activity in Nigeria. Hence, the study analyses the effect of fossil consumption on the level of CO2 carbon emissions in Nigeria.

2. REVIEW OF RELATED LITERATURE

Empirical studies on the environmental implication from the consumption of fossil fuel are numerous in developed countries and a few in developing countries. Theoretically, energy consumption is augured to stimulate growth and extant empirical findings have pointed energy as an essential requirement for growth. However, the use of unsustainable energy can lead to unsustainable development and unsafe environment. The under-development of the sector in developing economies and the insufficient access to quality energy sources have resulted

Table 1: Definitions, sources and measurement of variables

Variable	Definition	Source	Measurement
Carbon dioxide CO_2	This is measured by the total emission of carbon dioxide	World Development Indicators (WDI), of World Bank Publication, 2018	Metric tonnes per capita
Fossil fuel consumption	This is measured by the total energy consumed divided by the population	WDI	In percentage
Gross domestic product per capita	This measure the total value of final goods and services produced in a country divided by total population	WDI	Constant $US 2000
Square of GDP per capita	This is measured by the squared total value of final goods and services produced in a country divided by total population	WDI	Constant $US 2000
Population density	This is a measurement of population per unit area or unit volume	WDI	In percentage
Education (secondary school enrolment)	This is the total enrolmentin secondary education, expressed as a percentage of the population of official secondary education age	WDI	In percentage

Source: Authors' compilation

in over-dependence on non-renewable fossil fuel with adverse consequence on people and environment. It is expected that countries that energy consumption should propel growth, however, the reserve is the case. The more fossil fuel is consumed, the more the negative impact on the environment, such as gas flaring, oil spillage, soil erosion and most commonly, emission of CO_2. Therefore, the only guideline is that the rate at which fossil fuel is being consumed should be reduced or substituted for another energy generating source.

Following rapid industrialization, the resulting air pollution and the increased use of energy have significantly contributed to serious health and environment problems (Garbaccio et al., 2018). The 1997 World Bank Report illustrate the challenges for developing countries, for instance, the report estimated that air pollution caused 178,000 premature deaths in urban China in 1995, with total health damages at nearly 5% of GDP. Also, in many developing economies, particulate and sulphur dioxide emissions from burning fossil fuel constitute the bulk of local polluting elements. Also gaseous elements from combustion of fossil fuel such as carbon dioxide and greenhouse gas were major contributor to global climate change (Ogundipe et al., 2018). In supporting this evidence, a study of the environmental costs of fuel use in Bangkok, Manila and Shanghai show an overall serious damage to the communities, though the consequences divers significantly by cities and by the type of fuel used (Garbaccio et al., 2018).

Similar evidences were illustrated by Pieprzyk et al. (2009) have shown that worsening effects on environment and human health due to exposure to emission substances like Nitrogen dioxide and Sulphur dioxide. Exposure to human may cause chronic respiratory ailments, as already witnessed among children in the Niger Delta region. The chemicals can also exacerbate asthma, cause leukemia, blood disorders and chronic bronchitis.

In the words of Martins et al. (2019), the use of fossil fuels is responsible for environmental problems such as global warning and air pollution, which cause health problems and affect the quality of life of populations. Their study analysed fossil fuel consumption, fossil fuel depletion and their relationship with energy dependence and share of renewable energy in gross final energy consumption for 29 European countries. It concluded that many European countries still depend heavily on fossil fuels, though these countries do not possess abundant reserves of fossil fuels. The impact on the environment differs from what is obtained in developing Africa due to the adoption of advanced technologies which limits the emissions from fossil fuel combustion in the European countries.

According to Khan et al. (2016), there exists a strong relationship between energy consumption, air pollution, water resources, and natural resource rent in Pakistan. Also, similar evidence emerged from the study of Zheng et al. (2015) which sampled 26 Chinese provinces and four centrally controlled municipalities from 2002 to 2011 using panel data regression analysis and found empirical evidence in support of positive impact of provincial energy saving regulations and two environmental standards on the improvement of local air quality.

Rafindadi et al. (2014) examined the relationship between air pollution, fossil fuel energy consumption, water resources, and natural resource rents in some Asia-Pacific countries from 1975 to 2012. With the use of the fixed effect and panel two-stage regression and data from World Bank World Development Indicators (WDI), the results showed that there is a significant relationship between air pollution, energy consumption, and water productivity in the individual countries of Asia-Pacific, while fossil fuel energy consumption has a dominant impact on the changes to carbon dioxide emission in the region. The impact of fossil fuel energy consumption on carbon dioxide emission in the region was significant in 6 out of the 10 countries considered, that is, Brunie, China, Japan, Malaysia, Philippines and Singapore. Furthermore, the impact of GDP per energy use on carbon dioxide emission in the region was significant in also 6 out of the 10 countries studied, that is, South Korea, Indonesia, Japan, Malaysia, Philippines, and Singapore. The results validate the strong relationship amongst air pollution, natural resource rents and water productivity in the region.

Likewise, Boxal et al. (2004) examined the effect of raw petroleum and gaseous petrol offices on country private properties esteem with two factors describing danger and enhancement impacts. They demonstrated that petroleum gas wells and flaring degrades the cost of the property. The report likewise demonstrated a negative relationship between property estimations and the quantity of sharp gas wells. These discoveries mirror the wellbeing dangers related with the negative impact of hydrogen sulfide[1] on property estimations. Also, study by WHO recorded the negative impacts of hydrogen sulfide as visual ailment, respiratory pressure, neurological turmoil, cardiovascular and metabolic ailment and including however not constrained to loss of hunger. Similarly, He et al. (2007), Raimi et al. (2007) and Fredriksson and Sevesson (2003) in their paper that examined the impact of defilement on petroleum gas flaring, demonstrated that higher defilement level in an economy restrains the viability of ecological directions. Odiong (2010) utilized pattern fitting including essential and optional information to evaluate the negative impact of gaseous petrol flaring on the earth and advantages of its decrease. Their finding emphatically relates petroleum gas flaring to ecological corruption and demonstrated that flaring flammable gas was in charge of the fast loss of soil richness and diminished maintainable agrarian practice on account of soil fermentation by hydrogen sulfide.

Rhy (2011) documents the damaging consequences of emissions on environment, he specifically illustrated that early emissions are more damaging; because emissions are cumulative, early emissions are around for long, to this regard, early measures are of more benefits than later measures. Knutti (2013) examined the relationship between global emissions and global temperature rise. The study suggests that limiting climate change will require substantial and sustained reduction of greenhouse gas emissions; halting global-mean temperature rise at any level requires near zero carbon emissions at some point in the future. Nejat et al. (2014) analysed the energy consumption, CO_2 emissions and residential policies in top ten CO_2 emitting countries. Their study found that

1 Hydrogen sulfide is a constituent of gaseous petrol.

global residential energy consumption grew by 14% from 200 to 2011, with the developing countries accounting for a greater share of the increase. The study concluded that these countries' residential energy consumption and GHG emissions have direct, significant effects on the world's environment. A further assessment by Gurjar et al. (2004) assessed the potential large scale transport of the Delhi emissions based on 10-day forward trajectory calculations; they found that a strong growth of emissions results in substantial increase in photochemical O_3 formation in the regional environment. Also, Akimoto (2003) examined the impact of global air pollution on climate and the environment. The study found a strong effect of emission on climate and concluded that global emissions are capable of changing climate through their direct and indirect effect on radiative forcing.

In line with the foregoing, the 2018 Stockholm Environment Institute (SEI) Report concluded that a positive range of knock-on effects on human health and local environment emerges from emanating policies that address fossil fuel supply and consumption. This implies that efforts by the developing economies in managing decline in fossil fuel supply can yield multiple benefits. Also, limiting the expansion of coal, oil and gas production will reduce emissions and deliver other social and environmental improvements.

3. DATA AND METHODOLOGY

3.1. Data and Sources

The data used in the empirical analysis of the study were obtained from the World Bank 2018 Development Indicators (WDI). The variables' names, definitions and measurements are presented in Table 1.

3.2. Trend Pattern of Fossil Fuel Consumption and CO_2 Emissions

The trend analysis shows that movement in the carbon emissions can be systematically linked to changes in the share of fossil fuel in total energy consumed. The consumption of fossil fuel has consistently been on the increase since 1971, it increased by about 73% from 1971 to 1976, being a jump from 6% to about 13% of total energy consumed (Figure 1). Also, in the same period, CO_2 emissions rises from 0.56 to 0.9 metrics tonnes per capita, representing 50% increase. The trend continues until 1990 when the level of emissions fall to around 0.46 metric tonnes per capita and later dwindles to a record low of 0.33 metric tonnes per capita in 1995. This reduction was propelled by a slight reduction in the fossil fuel consumption, though; the rate of change witnessed in the former was larger than that of the latter. The trend reverses in the year 2000 as rising fossil fuel consumption resulted in raising the level of carbon emissions. CO_2 emissions increases from its record low in 1995 (0.33 metric tonnes) to 0.77 metric tonnes per capita representing about 133% change following a corresponding increase in fossil fuel consumption in Nigeria. The trend indicates that CO_2 emissions respond directly to changes in fossil fuel consumption in Nigeria.

3.3. Model Specification

The theoretical framework adopted in the study was based on the Environmental Kuznets Curve (EKC) hypothesis which expresses environmental quality as a function of income. The hypothesis suggests that an inverted-U relationship between environmental degradation and GDP per capita. The EKC states that economic development initially leads to deterioration in the environment, but after a certain level of economic growth, a society begins to improve its relationship with the environment and levels of environmental degradation reduces.

Following the specification by Ogundipe et al. (2014) and Egbetokun and Ogundipe (2016); the EKC model is represented thus:

$$CO_2 = f(FSS, GDPK, [GDPK]^2, PDEN, EDU)$$

The above model expressed as a linear econometric model is illustrates thus:

$$CO_{2t} = \alpha_0 + \alpha_1 FSS_t + \alpha_2 GDPK_t + \alpha_3 PDEN_t + \alpha_4 EDU_t + \varepsilon_t$$

Where CO_2= Carbon dioxide emission, FSS =fossil fuel Consumption, GDPK=Gross Domestic Product per capita, PDEN=Population Density, DINV=Domestic investment, EDU=Education (secondary school enrolment), ε=Error term.

The parameters of the above model feature a constant, α_0 and coefficients of independent variables ranging from $\alpha_{1-}\alpha_5$ measuring the impact of marginal increases in the respective explanatory variables.

3.4. Estimation Technique

3.4.1. Cointegration analysis

The co-integration analysis was adopted to establish long run equilibrium relationship among the variables. The Johansen time series can only be applied to series that are integrated of same order. Prior to applying the Johansen approach, it is necessary to ascertain the time series property of the series, in order to ensure there is no presence of unit root. In determining the stationarity and order of integration, two types of unit root test were used: namely, the Augmented Dickey-Fuller (ADF) test and the Philips-Perron test.

3.4.2. Vector error correction mechanism

This presents a means of reconciling the long run with the short run to enable further analysis. The theory of error correction model ascends out of the need to integrate short run dynamics with long run equilibrium. At this stage all the conventional statistical test of significance are considered to be appropriate including the diagnostic tests for the assessment of the adequacy of the model. The co-integration is a necessary condition for the vector error correction model to hold. This approach incorporates the error correction mechanism responsible for correcting the short run disequilibra as the model converges to the long run path. To ensure long run convergence of the model, the ecm must satisfy three main criteria which include: its absolute value must lie between zero and 1, the coefficient must be negative and its must be statistically significant.

4. ECONOMETRIC ANALYSIS AND RESULTS

This section presents the result from the empirical estimation and appropriate explanation towards validating the argument of the study.

4.1. Summary Statistics

The evidence from Table 2 shows that emissions per capita has risen considerably from a minimum of 0.33, reaching a high of 1.01 and has average value of 0.64. In the same vein, fossil fuel consumption has seen a steady rise in Nigeria from a minimum value of 4.43 to an all-time high of 56.2. This shows that fossil fuel consumption is closely related to CO_2 emissions. The spread of the population density shows that communities are becoming densely populated. This is evident in the spread between the minimum and the mean values of 61.5 and 121.2 respectively. This might be responsible for the rising level of fossil consumption and rising carbon emissions in Nigeria. All the variables appear to be normally distributed except fossil fuel consumption whose probability value of the Jarque-Bera statistics rejected the null hypothesis of normality. The evidence was supported by the skewness and the kurtosis statistics.

The skewness of a normal distribution is zero. Positive skewness implies that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. From the table above, it is observed that only CO_2 emission and fossil fuel consumption has a negative skewness and as such it has a long left tail whereas fossil fuel consumption, GDP per capita, population density and education all have positive skewness therefore they have long right tails.

Kurtosis measures the peakness and flatness of the distribution of the series. If the kurtosis is above three, the distribution is peaked or leptokurtic relative to the normal and if the kurtosis is less than three, the distribution is flat or platykurtic relative to the norm. From Table 2 above fossil fuel consumption exceeds three therefore they are peaked or leptokurtic while CO_2 emission, GDP per capita, population density and education are below three therefore they are flat or platykurtic. Jarque-berra is a test statistic to test for normal distribution of the series. It measures the difference of the skewness and kurtosis of the series with those with normal distribution. From the table above, the Jarque-berra for CO_2 emission, education, fossil fuel consumption, GDP per capita and population density are 1.789553, 0.721927, 24.39346, 3.798514 and 3.313703 respectively.

Table 2: Summary statistics

Var./Stat.	CO_2	EDU	FSS	GDPK	PDEN
Mean	0.635654	25.36892	17.72991	1797.402	121.221
Median	0.644362	24.71377	18.87677	1765.519	114.2536
Maximum	1.010017	56.17987	22.84479	2563.092	209.5878
Minimum	0.325376	4.43323	5.96777	1323.501	61.46601
Standard deviation	0.18691	13.30228	4.295403	397.4677	43.42267
Skewness	−0.02267	0.130094	−1.5604	0.38466	0.421257
Kurtosis	2.055166	2.43668	4.567611	1.856583	2.02685
Jarque-Bera	1.789533	0.721927	24.39346	3.798514	3.313703
Probability	0.408703	0.697004	0.000005	0.14968	0.190739
Observation	48	45	48	48	48

Source: Authors' compilation

Table 3: Test for stationarity

Variables	ADF		Phillip-Perron	
	Level	1st diff.	Level	1st diff.
CO_2	−2.3412	−7.7216	−2.5150	−7.7216
FSS	−3.0587	−5.5092	−3.30054	−5.5092
GDPK	−0.6095	−5.3193	−0.8192	−5.4855
PDEN	2.3255	3.1578	28.4608	1.4629
EDU	−1.1440	−5.5390	−1.1572	−6.2649
Critical values				
	Level	First diff.		
1%	−3.5777	−3.5812		
5%	−2.9257	−2.9266		
10%	−2.6007	−2.6014		

Source: Author's compilation from Eviews 9

4.2. Unit Root Test

The analysis begins by examining the time series properties of the variables. This is accompanied using the unit roots test for checking stationary status. Prior to the use of variables in regression analysis, there is need to clarify that such possess a mean and variance whose distributions are independent of time. This study uses the ADF and Philip Perron (PP) tests to establish this. Evidence from Table 3 shows that all the variables are not stationary at level both for the ADF and PP tests indicating that the series are not mean reverting at their level forms, $I(0)$. Following this evidence, it implies that the classical approach of ordinary least squares procedure (OLS) will provide spurious results if adopted. In ascertaining the stationary for such variables, a differencing (first-order) mechanism is incorporated and the ADF and PP statistics reject the null hypothesis of the existence of unit root, hence, implying that all variables in the model become stationary at first-order of integration $I(1)$. The differencing is conducted by including the drift component, an appropriate optimal lag (of zero) and the Schwarz information criterion (SIC) is used for the ADF test while the PP test also included the drift component but uses the Newey-West bandwith and a spectral estimation method based on Bartlet-Kernel approach.

The variables were tested for unit root with a log transformation of the variables in other to get an improved fit of the variable. The variables were tested for unit root using the ADF unit root test and The Phillips Perron (PP) unit root test. The null hypothesis (H_0) of the test is that there is no stationarity and the alternate hypothesis (H_1) is that there is stationarity. If the absolute value of the ADF test is higher than the 5% critical value of the ADF; the null hypothesis is rejected, then it can be concluded that there is stationarity otherwise there is no stationarity. Further, where variables are stationary without difference, they are stationary at level and integrated at order zero $I(0)$. However, when they are stationary after first difference we say they are integrated at order one $I(1)$. From the table above it is observed that all variables are stationary at first difference $I(1)$.

From the previous section, LCO2, LFSS, LGDPK, LPDEN and LEDU were all observed to be integrated of order $I(1)$ a, hence the use of the Johansen co-integration test. This is because the

Table 4: Johansen cointegration rank test

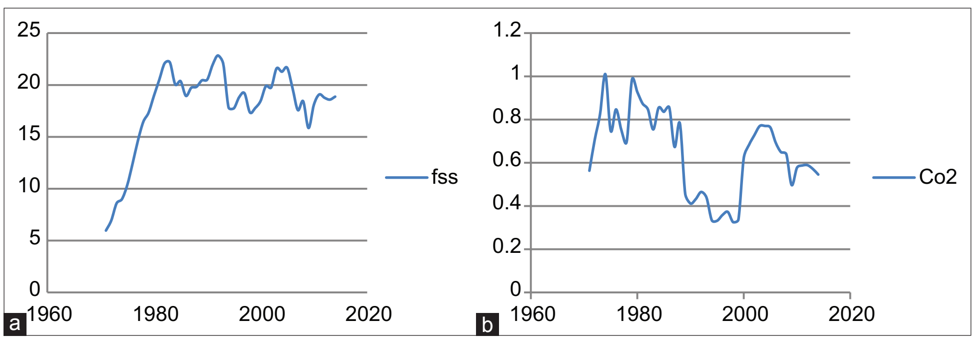
Cointegration	Trace test			Maximum eigenvalue		
rank	Statistics	Critical value	P-value	Statistics	Critical value	P-value
None	176.0348	107.3466	0.0000	93.19829	43.41977	0.0000
At most 1	82.83651	79.34145	0.0266	32.37260	37.16359	0.1607
At most 2	50.46391	55.24578	0.1235	24.44446	30.81507	0.2457
At most 3	26.01945	35.01090	0.3262	17.28949	24.25202	0.3164
At most 4	8.729959	18.39771	0.6077	6.470262	17.14769	0.7695
At most 5	2.259696	3.841466	0.1328	2.259696	3.841466	0.1328

Normalized cointegrating coefficients:
Lco2=0.7877LFSS+0.96LGDPK+0.533LGDPK2+0.20LPDEN+2.4427LEDU
t-stat (2.96) (5.65) (5.65) (18.34) (1.26)

Error correction coefficients						
Variable	Δ(LCO2)	Δ(LFSS)	Δ(LGDPK)	Δ(LGDPK2)	Δ(LPDEN)	Δ(LEDU)
ECM_1	−0.0576	−0.0315	−0.0582	−0.8676	−0.0008	0.0477
t-statistics	−0.9764	−1.1335	−3.5948	−3.5677	−13.9572	1.7212

Source: Authors' computation. CO_2: Carbon dioxide emission, FSS: Fossil fuel consumption, GDPK: GDP per capita, GDPK2: Squared of GDP per capita, PDEN: Population density, EDU: Education

Figure 1: (a and b) Trend of fossil fuel consumption and CO_2 emissions



Source: Authors' compilation

Johansen Cointegration is applicable when the variables involved are integrated at the same orders.

4.3. Cointegration Test Results

Having obtained first-order integration $I(1)$ for the series at the 5% significance level, the study proceeds to estimate the Johansen cointegration test. Based on SIC, the optimal model as determined by the Trace and Max-Eigen statistics are at three (3) and one (1) cointegrating vectors respectively, with no drift and trend. Likewise, a one-order lag specification for differencing endogenous variables is included and tested at the 5. The result indicates that the Mackinnon-Haug-Michelis P-value cannot reject the null hypothesis of one co-integrating relationship. Hence, the foregoing shows the feasibility of long-run relationship among the variables in the model.

The middle panel of Table 4 shows the normalized co-integration (long-run) coefficients. The results show that all the explanatory variables are significant at the1% and 5% levels.

The result shows that direct significant relationship between fossil fuel consumption and carbon emissions, that is, CO_2 emissions responds positively to fossil fuel consumption in Nigeria. It indicates that a 1% increase in fossil fuel consumption raises carbon emission by about 78%. This implies that fossil fuel combustion is a major driver of carbon emissions and an impediment to the quality of life and environment in Nigeria. The widening population and inadequate access to clean energy sources has increase dependence on the non-renewable dirty sources mostly for the household need of cooking and heating, businesses and industrial needs, hence, increasing exposure of life and environment to dangerous gaseous emissions.

The readily available evidence shows that a positive relationship exists between carbon emissions and GDP per capita and the squared of GDP per capita. This shows that carbon emissions (pollution) is a rising function of income but the threshold at which pollution starts falling with rising income not yet attained for the Nigerian economy. In other words, this implies that the income level that would guarantee the realisation of EKC is yet to be reached, hence, no feasible turning point. The realization of EKC hypothesis entails that at the initial stage of development, pollution rises with increasing income but reaching a threshold (determined by the squared of GDP per capita), pollution starts declining with increasing income; implying that income has grown significantly to avoid a cleaner environment.

More so, population density raises carbon emissions in Nigeria, as a 1% change in population density raises CO_2 emissions by 20%. This implies that a densely populated area impacts on the environmental quality; since fossil and wood fuel are predominant energy use, rising population will raise energy demand and use, hence increasing environmental pollution and atmospheric particulates arising from human activities.

Also, education raises the carbon emission. This evidence contradicts an ideal scenario, as more education tends to promote awareness for cleaner and safer environment. The more educated an individual, the likely he is to be more aware of the consequences of environmental degradation. However, income can serve a major impediment to the effect of education on environment. In an economy where average income is quite low or has not grown enough to afford cleaner environment and adopt cleaner and efficient energy technologies; education might play a negligible impact on environmental condition.

In summary, the study found that a long run relationship exists between fossil fuel consumption and environmental implication in Nigeria, it highlights that fossil fuel burning for national power generation from the thermal plants, commercial plants and household activities constitute the bulk of environmental pollution in Nigeria. The knowledge of this relationship is crucial to design an effective policy towards the reduction in the use of fossil fuel and also to make aware the consequences of the overdependence of fossil fuel consumption on human life and the ecosystem. The adverse effect of fossil fuel combustion on the environmental quality has been documented by some extant studies including: Alimi et al. (2016), and Nwafor (2006) and Rafindadi et al. (2014) who found a positive and significant relationship between fossil fuel consumption and environmental implication in Nigeria. This is due to the over dependence of fossil fuel as a major means of transportation, cooking and energy generation lead to a deterioration of the environment because the high emission of co2 in the air. Also, this re-examination confirms the non-existence of EKC for the Nigerian economy because a feasible turning point could not be reached.

4.4. Vector Error Correction Model Results

In an attempt to assess how stable the long-run relationship among the variables, the study adopts the vector error correction model. Here, the error correction mechanism (ECM) is estimated in order to know how well the short-run dynamics in the model are adjusted on the long-run equilibrium path. The estimated ECM satisfied all the theoretical conditions for validity. The coefficient is negative implying convergence in the long-run, the absolute value of the magnitude lies between zero and one and it is statistically significant at the 5% significance level. This evidence suggests that 57% of the short-run errors will be corrected in the long-run equilibrium path. Hence, the model possesses a moderate error correction as about 57% certainty that shocks that occurred in the immediate period are adjusted as the model converges in the long-run.

5. CONCLUSION AND RECOMMENDATION

This study examined the effect of fossil fuel consumption on environmental implication in Nigeria over the period of 1970-2017. A theoretical strand based on the EKC was adopted and the model analyzed using the Johansen co-integration technique. The study found a strong direct link between fossil fuel consumption and the level of atmospheric carbon content. Specifically, fossil fuel combustion accounts for about 80% of carbon pollution in Nigeria. Also, income and population density were found to stimulate pollution, this implies that income has not grown enough to afford technologies and measures required to mitigate degradation of the environment. On the other hand, education could not meaningfully influence carbon emissions; the evidence might not be unconnected to the weak and sluggish elasticity average income in Nigeria; as the awareness and desire for safer environment could have been hampered lack of purchasing power.

This study recommends that policy makers should design and implement on sustainable energy framework aimed at reducing the consumption of dirty non-renewable energy sources such as fossil fuel, hereby, reducing the emission of gaseous element injurious to the environment. The Nigerian government needs to invest in clean technologies in generating energy and embark on massive awareness on effective mitigation approaches. Also the Nigerian government should look into renewable energy as these are naturally replenish-able on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat which are better and cleaner options for energy generation and also to support the effort of the global community on climate change. Transitioning from fossil fuel to renewable energy in Nigeria will also help achieve improved power generation, which is a major means to the development of the country's economy. Also the government should support programs sensitizing the populace on the multidimensional consequences of the use of dirty energy such as fossil fuel.

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