Yahaya, Nura Sani; Adamu, Sanusi; Mustapha, Aminu Muhammad

Article

Energy production and C02 emission in Nigeria

Academic Journal of Economic Studies
Vol. 6, No. 1, March 2020, pp. 110–114
ISSN 2393-4913, ISSN On-line 2457-5836

Energy production and $C0_2$ emission in Nigeria

Nura Sani Yahaya[1], Sanusi Adamu[2], Aminu Muhammad Mustapha[3]

[1,2]Kano State College of Education and Preliminary studies, [1]E-mail: nurasaniyahaya@gmail.com, [2]E-mail: sunusiadamu311@gmail.com
[3]Federal University Dutse, Jigawa State, [3]E-mail: 143aminu@gmail.com

Abstract

This study examine the effects of energy production, financial development and economic growth on $C0_2$ in Nigeria by applying ARDL technique from 1980 – 2011. The outcome of the cointegration test confirms the long run association among the variables. The short run analysis indicates energy production has positive effect on $C0_2$ in Nigeria. However, financial progress and economic growth condense $C0_2$. For the long-run estimate the outcome indicates that energy production, financial progress and output growth accelerates the level of $C0_2$. Hence, the study suggests that policymakers should emphasized on use of low emissions technologies especially in the process of oil exploration and re consider the use of other energy alternatives such as wind, thermal and solar in order to reduce the damaging effects of energy production and to achieve sustainable economic development.

Keywords

Energy production, financial development, economic growth, ARDL, Nigeria

JEL Codes: Q52, Q54

Received: 14 January 2020 **Revised: 29 January 2020** **Accepted: 08 February 2020**

1. Introduction

The increasing trend of the world $C0_2$ emission in the recent time is becoming worrisome (Sehrawat and Mohapatra, 2015). High explosion of $C0_2$ is believe to be linked with the deterioration of climate condition and the global temperature (GCP, 2018). Excessive heat, raising sea level, drought and low yield of agricultural production are among the effect of climate change (Danlami, Applanaidu & Islam, 2018). It is documented that the total global $C0_2$ reached about 36.17 billion kilotonne in 2017 and it would increase continuously if mitigation measure are not taken (GCP, 2018). Researchers, environmentalist and stakeholders have argued that several factors such as energy production, population growth, urbanization and economic development are the main cause of high explosion of $C0_2$. Hence, all nations most take necessary measure to reduce the level of $C0_2$ in the process of pursuing high level of economic development.

Today, African nations are contributing large share to the global $C0_2$ (GCP, 2018). In Nigeria the level of $C0_2$ discharge is growing to the significant extent. For example, 13,190.20 kilotonne was recorded in 2000 and 33,131.40 kilotonne estimated in 2014. Similarly, Nigeria was placed the 38th nation with the high $C0_2$ in the world. Furthermore, the nation occupied the position of the largest oil producer in Africa and ranked the 4th in the world gas exploration and exportation in 2015 (EIA, 2016). According to IMF, the nation's revenue from oil and gas constitute about 58 percent of the total government revenue that was equivalent to $87 billion in 2014. Currently, the nation's daily oil production is estimated at 2.3 million barrel (NNPC, 2019). Moreover, Nigeria is classified as the major country in terms of biomass and waste fuel energy production with the total production of 116,926 kilotonne of oil equivalent in 2017. Figure 1, illustrates the distribution of the total primary energy production.

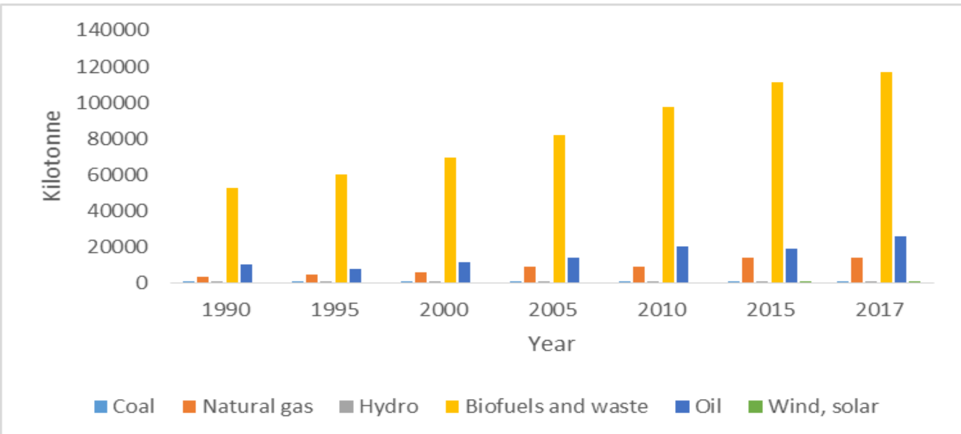

Figure 1. Distribution of the total primary energy production

Source: EIA, 2018

Thus, the increasing level of energy production in Nigeria may be connected with high explosion of $C0_2$ that could deteriorate environmental quality, standard of living, welfare and economic development. Therefore, understanding the effect of energy production on $C0_2$ in Nigeria is essential for policymakers toward promoting environmental quality, poverty reduction, welfare growth and economic performance.

2. Literature review

Several studies in the economic literature have examined association among energy production, consumption, output growth, financial development and $C0_2$. Taking the instance of the study of BOlük and Mert (2014) that emphasized on energy consumption increase $C0_2$ discharges in European Union economies. Heidari *et al.* (2015) examine the influence of use of energy on $C0_2$ for 5 Asian economies from 1980 to 2008. The outcome of study reveals that energy uses increase the level of $C0_2$. Similarly, Al-mulali and Ozturk (2015) documents that high consumption of energy resources increases $C0_2$ in MENA nations. Jebli et al. (2017) stressed that energy consumption increase the amount of $C0_2$ in 25 OECD nations. Nguyen and Kakinaka (2019) used 107 nations to study the influence of renewable energy on $C0_2$ from 1990 to 2013. The outcome indicates that renewable energy use reduces $C0_2$ in these countries. Furthermore, Hanif, Raza, Gago-de-santos and Abbas (2019) used 15 Asian nations to study the influence of fossil fuel on $C0_2$ from 1990 to 2013. The study's outcome reveals fossil fuel accelerates the level of $C0_2$. In another development, Danlami, Aliyu, and Danmaraya (2019) studied the effect energy production, GDP, capital and FDI on $C0_2$ in low income and MENA nations from 1980 – 2011. The finding reveals that energy production accelerates $C0_2$. However, study by Nguyen and Kakinaka (2019) analyze the influence of renewable energy on $C0_2$ for 107 economies from 1990 to 2013. The outcome shows that renewable energy decreases the level of $C0_2$.

Meanwhile, Saboori *et al.* (2014) analyze the performance of output growth on $C0_2$ for 27 OECD nations using FMOLS approach from 1960 to 2008. The outcome reveals that GDP promotes the level of $C0_2$ discharged. Similarly, Shahbaz *et al.* (2014) in their study emphasized that GDP increase $C0_2$ in UAE. Abdouli and Hammami (2017) examine the role of output growth performance on $C0_2$ for MENA countries using GMM method from 1990 to 2010. The finding reveals output performance accelerates $C0_2$. Nevertheless, Acheampong, (2018) maintain that GDP decrease $C0_2$ in 116 emerging economies. Moreover, study by Salahuddin et al. (2015) uterlize FMOLS approache to analyze the effect of financial development on $C0_2$ for GCC nations from 1980 to 2012. The outcome indicates that financial progress reduces $C0_2$. Al-mulali *et al.* (2015) argued that financial progress declines $C0_2$ in 129 emerging nations. Nonetheless, Javid and Sharif (2016) studied the effect of financial progress, output growth, energy resources and trade on $C0_2$ in Pakistan. The study's outcome reveals that financial progress, output growth, and energy increase $C0_2$. Similarly, Cetin and Ecevit (2017) stressed that financial progress accelerates level of $C0_2$ in Turkey. Ganda (2019) investigates the influence of financial progress on $C0_2$ for OECD countries from 2001 to 2012, by utilizing GMM technique. Outcome reveals financial progress increase $C0_2$.

Therefore, from the reviewed literature, many studies have been conducted in developed and industrialized nations with regards to the association among energy consumption and $C0_2$. However, investigating, the role of energy production on $C0_2$ has been neglected by the earlier studies. The only few known studies in the literature includes (Danlami *et al*., 2019). Hence, the present study examines the effect of energy production on $C0_2$ in Nigeria as the nation become largest in Africa in terms of oil exploration and exportation.

3.3. Methodology of research

3.1. Data

The data was retrieved from world development indicator (WDI) on annual bases for $C0_2$ (kt), energy production (kg of oil equivalent), financial development (credit % GDP) and GDP per capita (current USD) from 1980–2011. All the data for the variables were transform to logarism. Table 1 illustrates the descriptive features of the variables used in the analysis. The outcome indicates that energy production has the greatest mean and least standard deviation with in the variables for the study.

Table 1. Descriptive features for the variables

Variables	Min	Max	Mean	SD
LCO_2	10.46	13.0	11.1	0.46
LENP	11.62	12.4	12.0	0.25
LFD	2.16	3.64	2.65	0.33
LGDP	5.03	7.83	6.15	0.76

3.2. Test of the stationarity

Augmented dicky fuller (ADF) and Philips Peron (PP) test for stationarity are used to verify the integration order and stationarity of the variables utilized in the study. The first equation represents the ADF test as shown below:

$$\Delta Z_t = \beta + \theta_{yt-1} + \beta T + \sum_{j-1}^{k} \vartheta_j \, \Delta Z_{t-j-1} + \varepsilon_t \quad (1)$$

In the first equation Z shows the series for the period t, β represents the coefficient, while, k indicates the lags and ε_t denotes the error term. Hence, the variable to be stationary the ADF and PP value most be higher than the critical value. Moreover, equation 2, specify the PP test and it is stated as:

$$\delta^2 = T^{-1}\sum_1^T \bar{e}_r^2 + 2T^{-1}\sum_{t-1}^l w(t,l) \sum_{r=t+1}^l \bar{e}_t \bar{e}_{t-1} \quad (2)$$

In equation 2, w(r, l) = 1[t/ (1+l)] and l illustrates the lags.

3.2.1. Model of the study

A transformed model by Dogan and Turkekul (2015) is utilized for this study and is expressed in the following equation.

CO_2 = f (ENP, FD, GDP) (3)

Where $C0_2$, ENP, FD and GDP illustrates carbon dioxide emissions, energy production, financial development, and economic growth. Hence, the study applies Autoregressive Distributed Lag (ARDL) for estimation of the model. The technique offer efficiant and unbasiad estimations as compared with other traditional approches (Pesaran et al*.,* 2001). The model is shown below:

$$\Delta LCO_{2t} = \beta_0 + \sum_{j=1}^{n} \beta_1 \Delta LCO_{2t-j} + \sum_{j=0}^{n} \beta_2 \Delta LENP_{t-j} + \sum_{j=0}^{n} \beta_3 \Delta LFD_{t-j} + \sum_{j=0}^{n} \beta_4 \Delta LGDP_{t-j} + \alpha_1 LCO_{2t-1} + \alpha_2 LEC_{t-1} + \alpha_3 LFD_{t-1} + \alpha_4 LGDP_{t-1} + \varepsilon_t \quad (4)$$

From equation 4, ε indicates the error term, while, t, represents the trend of the time and Δ illustrates the first difference operator. Accordingly, the selection of the lag was based on the Akaike information criteria (AIC). Therefore, to confirm the existence of long run association among the variable, F-statistics value most be higher than the value of upper critical bound. Moreover, the error correction term value of the model is expected to be negative and significant.

4. Results

The outcome of the stationarity tests are reported in table 2. The result reveals that $C0_2$ and energy production are stationary at level I (0) while other at first difference I (1) for both the ADF and PP tests. Thus, based on the outcome of the stationarity test ARDL method is suitable for the analysis.

Table 2. Outcome of the stationarity tests

Variable	ADF LEVEL		PP LEVEL		ADF First Diff		PP First Diff	
LCO_2	-4.793161*	(0.0005)	-4.793161*	(0.0005)	-	-	-	-
LENP	-5.953425*	(0.0000)	-5.804955*	(0.0002)	-	-	-	-
LFD	-2.462427	(0.1341)	-2.345486	(0.1649)	-4.931001*	(0.0004)	-7.691048*	(0.0000)
LGDP	-1.414574	(0.8365)	-1.543909	(0.7917)	-7.012676*	(0.0000)	16.67529*	(0.0000)

Notes: * signifies statistical significance of the variable at 1 percent level.

The bound test outcome is indicated in Table 3. The result shows that F-statistics value is greater than UBC bound value at 1 % level of significance and it confirm the presence of long-run association among the variables of the model.

Table 3. Outcome of the bound test

F-statistics	1% I(0)	I(1)	5% I(0)	I(1)
7.01	4.29	5.61	3.23	4.35

The short and long run estimated result are presented in table 4. The outcome reveals that in the short run estimate, energy production accelerates the level of $C0_2$. It shows that a 1 percent rise in energy production leads to 1.8 percent increase in $C0_2$. However, financial progress and output growth reduce $C0_2$ in Nigeria. The result further indicates 83 percent adjustment of the variables toward long run condition. The long run estimate shows that energy production has positive influence on $C0_2$ in Nigeria. It indicates that a 1 percent increase in energy production cause 2.1 percent rise in $C0_2$. The positive association between energy production and $C0_2$ is justified by the fact that the nation explores and exports large amount of oil in the African continent. Hence, energy production is directly linked to high level of $C0_2$ discharge in the country. This conclusion is consistent with the outcome obtained by (Danlami *et al.*, 2019). Moreover, the estimate reveals that a 1 percent upsurge in financial resources leads $C0_2$ to rise by 0.2 percent. Similarly, a 1 percent increase in economic progress cause 0.04 percent increase in $C0_2$ in Nigeria. This means that increase in domestic credit to public and economic progress is associated with the rise in $C0_2$.

Table 4. The estimate of the short and long run analysis

Variables	Coefficient	SE	t-Statistic	Prob
Short run analysis				
ΔLENP	1.819887*	0.576899	3.154605	0.0061
ΔLFD	-1.039519**	0.356470	-2.916152	0.0101
ΔLGDP	-2.053346*	0.459043	-4.473101	0.0004

Variables	Coefficient	SE	t-Statistic	Prob
ECT(-1)	-0.838353**	0.329229	-2.546414	0.0216
Long run analysis				
LENP	2.170788**	1.227359	1.768665	0.0360
LFD	0.246182**	0.550805	0.446949	0.0609
LGDP	0.041693**	0.322890	0.129123	0.0449
C	-15.89033	14.30507	-1.110819	0.2831

Notes: * and ** denotes statistical significant of the at 1 and 5 percent level

The post estimation check is presented in Table 5. The outcome indicates that there is absence of problems Heteroskedasticity as well as serial correlation issue. Moreover, the errors are normally distributed.

Table 5. Post estimation

Test	F-statistic	Prob.	Result
Breusch-Pagan Test.	0.464570	0.8995	No Heteroskedasticity
Breusch-Godfrey Test	0.694900	0.5155	No Serial Correlation
Jarque-Bera	0.458153	0.7952	Normally Distributed

5. Conclusions

The current study examine the effects of energy production, financial development and economic growth on $C0_2$ in Nigeria by applying ARDL technique from 1980–2011. The outcome of the cointegration test confirms the long run association among the variables. The short run analysis of the reveals that energy production has positive effect on $C0_2$ in Nigeria, while financial progress and economic growth condense $C0_2$. For the long-run estimate the outcome indicates that energy production, financial progress and output growth are related to the higher level of $C0_2$. The result implication shows that energy production is connected with increasing level of $C0_2$ in Nigeria. Hence, policymakers should emphasized on use of low emissions technologies especially in the process of oil exploration and re consider the use of other energy alternatives such as wind, thermal and solar in order to reduce the damaging effects of energy production in the country for sustainable economic development. The study is limited on the period of the analysis as it covers 1980-2011 due to unavailability of data on energy production. Therefore, future studies should consider extending the period of their study's analysis.

References

Abdouli, M., & Hammami, S. (2017). The impact of FDI inflows and invironmental quality on economic growth: An empirical study for the MENA countries. *Journal of the Knowledge Economy*, *8*(1), 254–278. https://doi.org/10.1007/s13132-015-0323-y

Al-mulali, U., & Ozturk, I. (2015). The effect of energy consumption , urbanization , trade openness , industrial output , and the political stability on the environmental degradation in the MENA (Middle East and North African) Region. *Energy*, *84*, 382–389. https://doi.org/10.1016/j.energy.2015.03.004

Al-mulali, U., Tang, C. F., & Ozturk, I. (2015). Does financial development reduce environmental degradation? Evidence from a panel study of 129 countries. *Environmental Science and Pollution Research*, *22*(19), 14891–14900. https://doi.org/10.1007/s11356-015-4726-x

BOlük, G., & Mert, M. (2014). Fossil & renewable energy consumption, GHGs (greenhouse gases) and economic growth: Evidence from a panel of EU (European Union) countries. *Energy*, *74*, 439–446. https://doi.org/10.1016/j.energy.2014.07.008

Cetin, M., & Ecevit, E. (2017). The impact of financial development on carbon emissions under the structural breaks : Empirical evidence from Turkish economy. *International Journal of Economics Perspective*, *11*(1), 64–78.

Danlami, A. H., Aliyu, S., & Danmaraya, I. A. (2019). Energy production, carbon emissions and economic growth in lower-middle income countries. *International Journal of Social Economics*, *46*(1), 97–115. https://doi.org/10.1108/IJSE-07-2017-0274

Danlami, A. H., Applanaidu, S.-D., & Islam, R. (2018). Movement towards a low Carbon Emitted Environment: A test of some factors in Malaysia. *Environment, Development and Sustainability*, *20*(3), 1085–1102. https://doi.org/10.1007/s10668-017-9927-7

Dogan, E., & Turkekul, B. (2015). CO2 emissions, real output , energy consumption , trade , urbanization and financial development : Testing the EKC hypothesis for the USA. *Environmental Science and Pollution Research*, *23*(2), 1203–1213. https://doi.org/10.1007/s11356-015-5323-8

Global Carbon Project. (2018). *Supplemental data of Global Carbon budget*.

Heidari, H., Katirciog, S. T., & Saeidpour, L. (2015). Electrical power and energy systems economic growth , CO 2 emisesions , and energy consumption in the five ASEAN countries. *International Journal of Electrical Power and Energy Systems*, *64*, 785–791. https://doi.org/10.1016/j.ijepes.2014.07.081

Javid, M., & Sharif, F. (2016). Environmental Kuznets curve and financial development in Pakistan. *Renewable and Sustainable Energy Reviews*, *54*, 406–414. https://doi.org/10.1016/j.rser.2015.10.019

Jebli, M. Ben, Youssef, S. Ben, & Ozturk, I. (2017). Testing environmental Kuznets curve hypothesis : The role of renewable and non-renewable energy consumption and trade in OECD countries. *Ecological Indicators*, *60*, 824–831. https://doi.org/10.1016/j.ecolind.2015.08.031

Nguyen, K. H., & Kakinaka, M. (2019). Renewable energy consumption, carbon emissions, and development stages: Some evidence from panel cointegration analysis. *Renewable Energy*, *132*, 1049–1057. https://doi.org/10.1016/j.renene.2018.08.069

Nigerian National Petroleum Corporation. (2019). *Monthly petroleum information*. Abuja.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616

Saboori, B., Sapri, M., & bin Baba, M. (2014). Economic growth , energy consumption and CO2 emissions in OECD (organization for economic co-operation and development) ' s transport sector : A fully modified bi-directional relationship approach. *Energy*, *66*, 150–161. https://doi.org/10.1016/j.energy.2013.12.048

Salahuddin, M., Gow, J., & Ozturk, I. (2015). Is the long-run relationship between economic growth, electricity consumption, carbon dioxide emissions and financial development in gulf cooperation council countries robust? *Renewable and Sustainable Energy Reviews*, *51*, 317–326. https://doi.org/10.1016/j.rser.2015.06.005

Sehrawat, M., Giri, A. K., & Mohapatra, G. (2015). The impact of financial development , economic growth and energy consumption on environmental degradation: Evidence from India. *Management of Environmental Quality*, *26*(5), 666–682. https://doi.org/10.1108/MEQ-05-2014-0063

Shahbaz, M., Sbia, R., Hamdi, H., & Ozturk, I. (2014). Economic growth, electricity consumption, urbanization and environmental degradation relationship in United Arab Emirates. *Ecological Indicators*, *45*, 622–631. https://doi.org/10.1016/j.ecolind.2014.05.022