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Economic performance and environmental pollution in Nigeria

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Abstract
In line with the need to mitigate the capacity of CO_2 explosion, several elements have been analyze in relation to CO_2 discharge. For this purpose, the study examines the influence of economic performance, energy utilization, financial sector improvement and FDI on CO_2 discharge in Nigeria by the application of ARDL approach from 1980 to 2017. The out come from the cointegration test confirm the long run linkage on the variables of the model. In the short run estimation, economic performance and financial development have positive effect on CO_2 discharge in Nigeria, while FDI condense the explosion of CO_2. The long run estimates indicate that economic performance, financial progress and FDI reduce CO_2 discharge. However, energy use has no impact on CO_2 explosion in nation. Hence, it is suggest that policymakers should continue with the current measure on the mitigation of CO_2. In addition, other refine measures in terms of financial reform and anti-corruption should be considered for the sustainable economic performance. Government should also emphasize on the use of low emission technology for industrial and domestic purposes.

Keywords: Economic performance, financial progress, FDI, ARDL, Nigeria

1. Introduction
The growing discharge of CO_2 in the nations of the world affects environmental quality, human development and economic performance (Sehrawat *et al*., 2015) [20]. The level at which CO_2 explosion influence the destruction of human environs has drawn the attention of international communities to initiate all measures for mitigating the discharge of CO_2 in all nations (Meratizaman *et al*., 2015; Nejat *et al*., 2015) [11, 12]. It is estimated that the worlds CO_2 release reached almost 32 billion tones in a decade (IEA 2016) [9]. Developed nations such USA, Germany and Europe have produced enormous amount of CO_2 emission to the volume discharged in the globe. Nowadays, developing economies contributed to 63 percent of the total world CO_2 discharged (Hansen & Sato, 2016; IPCC, 2014) [7, 10]. This indicates that emerging countries, comprises of China, India, Asia and Africa explore more emission than developed nations. Hence, it has been emphasized that the growth of CO_2 in these nations was attributed to high use of energy, strive for increased economic performance, development of financial sector, population growth and urbanization (Yahaya, Mohd-jali, & Raji, 2020) [24].
In Nigeria the level of CO_2 discharge has increased by 79,170.53 kilo tones (kt) from 2000 to 2016 (WDI, 2017) [23]. It implies that the release of CO_2 is upsurge and the level of environmental condition, human development is on the threat of deteriorating. This may worsen the level of health condition by increasing the diseases outbreak, low agricultural production, drought, floods, farmers-headers crisis and the alteration of the ecosystem that affect human development, welfare and economic performance (Hassan & Kouhy, 2013) [8]. Furthermore, it is documented that value of industrial performance in country have been rising for many years. For example, Gross Domestic Product (GDP growth) have risen from $ 46.39 billion in 2000 to $ 568.49 billion in 2016 (WDI, 2017) [23]. This means that economic performance has upsurge as the level of production and investment raised. This may be the cause of the increased environmental pollution in nation. Therefore, the study examines the influence of economic performance on CO_2 discharge in Nigeria.

2. Review of literature
Several studies have discussed the link among economic performance, energy use, financial progress and FDI. For example, Saboori *et al*. (2014) [17] studied the link among value of economic performance performance and CO_2 for 27 OECD economies from 1960 to 2008. They reveal that industrial performance accelerate the level of CO_2 discharge. Mutascu, *et al*. (2014) [21] documents that economic performance, energy utilization promotes the capacity of CO_2 explosion in Romania.

Similarly, Asici (2015) [4] reports that industrial value increase CO_2 discharge in developing economies. Riti *et al*. (2017) [16] apply ARDL method to estimate the effect of industrial growth on CO_2 discharge for China. The estimates shows that GDP upsurge the release CO_2. Similarly, Wang *et al*. (2018) [22] use 170 nations to explore the influence of industrial performance CO_2 in 170. The outcome reveals industrial growth accelerates the explosion of CO_2. Bekun *et al*. (2019) [5] stressed that GDP positively increase CO_2 discharge in EU nations. However, study by Acheampong, (2018) [2] argued that industrial growth decelerates the level of CO_2 discharge in 116 industrialized and emerging economies.

Moreover, Al-mulali and Ozturk (2015) [3] investigate the link among energy utilization and CO_2 discharge in MENA nations. The study finds energy use accelerates the explosion of CO_2. Sarkodie and Strezov (2019) [19] emphasized that energy use promote the capacity of CO_2 explosion in developing economies. Nguyen and Kakinaka (2019) [13] estimate the influence of utilization of energy on CO_2 in 107 economies. The outcome indicates that energy utilization decelerates CO_2 discharge. Furthermore, study by Abid (2016) [1] employ GMM technique to estimate the effect of financial progress on CO_2 in 25 African from 1996 to 2010. It reveals that financial progress reduce the release of CO_2. Saidi and Mbarek (2017) [18] argued that financial sector performance decelerates CO_2 explosion in 19 emerging countries. Ganda (2019) [6] investigates the influence of financial development on CO_2 for OECD countries. The study finds that financial progress upsurge CO_2 discharge.

In other dimension, Paramati *et al*. (2017) [14] examine the performance of FDI inflow, on CO_2 for G-20 nations from 1991 to 2012. The study reveals that FDI reduce CO_2 discharge in developed nations. Based on the literature reviewed it is observed that association among economic growth performance and CO_2 explosion has been established in economic literature. Nevertheless, the influence of the industrial value on CO_2 discharge in Nigeria has not been investigated. Hence, this study adds to the current literature by examine the effect of industrial performance on CO_2 discharge in Nigeria.

3. Methodology and data

3.1 Data

In this study, yearly data for CO_2 (kt), economic performance (percapita GDP current USD), energy utilization (kg of oil equivalent), financial progress (credit percentage of GDP) and FDI (inflow percentage of GDP) are used from 1980 to 2017. The data was retrieved from WDI and all the variables are transform to log for compatibility of interpretation. Table 1 indicates the nature of data description. It reveals that variable FDI has the large value in terms of mean with 9.19 and 0.48 standard deviation. However, financial progress obtained the least mean value of 1.14 and industrial value has the lowest standard deviation of 0.07.

Table 1: Data description

Variables	Min	Max	Mean	SD
LCO2	4.54	5.02	4.82	0.16
LEP	1.30	1.59	1.47	0.07
LEC	1.20	1.35	1.28	0.03
LFD	0.48	1.39	1.14	0.20
LFDI	8.27	9.94	9.19	0.48

3.2 Stationarity test

Econometrically, testing the level of the data stationarity is the first priority before any meaningful estimation. This is done to actualize the stationarity status of the variables and integradation order that help to choose the rightful technique of estimation of a model. For this purpose two forms of test were performed that include ADF and PP stationarity test. The ADF test is applied for both small and large sample.

3.3 The study's model

For the purpose of estimating the model of the study in relation among CO_2 discharge and industrial performance. The study utilize Saboori *et al*. (2014) [17] modified model and it is shown in equation (1)

$$LCO_2 = f\,(LEP, LEC, LFD, LFDI) \quad (1)$$

In equation 3 LCO_2, LIND, LEC, and LFDI illustrate the CO_2 discharge, economic performance, energy use, financial progress and foreign direct investment. The study applies ARDL model for the analysis. Equation (2) shows the representation of the study's model.

$$\Delta LCO2_t = \lambda_0 + \sum_{j=0}^{n} \lambda_1 \Delta LCO2_{t-j} + \sum_{j=1}^{n} \lambda_2 \Delta LEP_{t-J} + \sum_{j=0}^{n} \lambda_3 \Delta LEC_{t-j} + \sum_{j=0}^{n} \lambda_4 \Delta LFD_{t-j} + \sum_{j=0}^{n} \lambda_5 \Delta LFDI_{t-j} + \varphi_1 LCO2_{t-1} + \varphi_2 LEP_{t-1} + \varphi_3 LEC_{t-1} + \varphi_4 LFD_{t-1} + \varphi_5 LFDI_{t-1} + \varepsilon_t \quad (2)$$

From the above equation, Δ represents the first difference indicator, while t illustrates the time and the symbol of ε shows the residual error. In the estimation, the element of F-statistics must be higher than critical value to confirm the long run linkage among the variables in the model (Pesaran *et al*. 2001) [15]. Moreover, the error correction value has to be significant and negative to indicate that the variable in the model are adjust to long run.

4. Result

In this part the outcome of the stationarity tests and the model estimation are discussed. From the result of the stationarity test of both the ADF and PP tests show that the variables are found in mixed stationarity. This means that some variables are stationary in the level while others are in the first difference as indicated in the table 2.

Table 2: Outcome of stationarity test

Variable	ADF LEVEL		PP LEVEL		ADF First Diff		PP First Diff	
LCO2	-1.818	(0.674)	-1.849	(0.659)	-5.566***	(0.003)	-5.566***	(0.003)
LEP	-3.294***	(0.083)	-3.856***	(0.024)	-	-	-	-
LEC	-3.145	(0.116)	-3.262***	(0.088)	-5.698***	(0.002)	-	-
LFD	-6.051***	(0.002)	-4.339***	(0.007)	-	-	-	-
LFDI	-2.594	(0.285)	-2.516	(0.318)	-5.351***	(0.006)	-4.339***	(0.007)

Notes: *** shows 1 percent significance level.

The outcome of the cointegration test is illustrated in table 3. It confirms that the variable in the model are cointegrated as the element of F-statistic (4.467) is higher than the critical value (4.01) at both percentages.

Table 3: Test of cointegration

F-statistics	1% I(0)	I(1)	5% I(0)	I(1)
4.467	3.74	5.06	2.86	4.01

Table 4 indicate the outcome of the estimation. It shows that in the short run economic performance and financial sector progress increase the explosion of CO_2 in Nigeria. Nonetheless, FDI decelerates the capacity of CO_2 discharge and energy use in the country has no influence on the release of CO_2. Moreover, the long run outcome reveals that economic performance decelerates the explosion of CO_2. This means that a percent rise in industrial value leads 1.3 percent reduction in CO_2 discharge. The situation justify the impact of the necessary measures that has been taken by policymakers on the mitigation of CO_2 discharge in Nigeria by emphasizing the use of low industrial technologies and energy in order to attain viable and sustainable development. Hence, it important for government and policymakers to continue on the current initiatives and refine other measures like financial reform and anti-corruption to ensure strict adherence and compliance on the policies with control measures for the achievement of viable economic progress. Furthermore, government should continue on to strive for other less or low emissions technologies for the country's industries and domestic use for the purpose of mitigating the level of CO_2 discharge. This outcome is similar with the result published by past studies (Acheampong 2018) [2]. In addition, the outcome illustrates that financial progress and FDI also decrease CO_2 explosion in the nation. That is a 1 percent increase in financial sector development and FDI cause 0.44 and 0.25 decrease in CO2 explosion. However, energy utilization in Nigeria does not affect the capacity of CO_2 explosion.

Table 4: Estimated outcome of the model

Variables	Coefiets	S E	t-Stat	Prob
Short run estimates ΔLEP	0.926*	0.590	-0.663	0.093
ΔLEC	-0.391	0.508	1.820	0.519
ΔLFD	0.337**	0.099	-2.578	0.024
ΔLFDI	-0.256**	0.142	2.367	0.035
ECT(-1)	-0.737**	0.270	-2.730	0.018
Long run estimates				
LEP	-1.313*	0.613	-2.139	0.053
LEC	0.262	0.606	0.432	0.673
LFD	-0.442**	0.188	-2.347	0.036
LFDI	-0.259***	0.065	-3.962	0.001
C	6.997***	0.785	8.908	0.000

Notes: ***, ** and ** indicates 1, 5 and 10 percent significant levels

The model diagnostic checks are illustrated in the table 5. The result confirms that no problems of serial correlation and heteroscedasticity as well as the residuals error are normally distributed.

Table 5: Diagnostic of the model

Test	F-statistics	Probability	Result
Breusch-Pagan Test.	3.283	0.108	No Heteroskedasticity
Breusch-Godfrey Test	5.252	0.195	No Serial Correlation
Jarque-Bera	0.252	0.881	Normally Distributed

5. Conclusion

In line with the need to mitigate the capacity of CO_2 explosion, several elements have been put in place to analyze their link with the CO_2 discharge. In this regard, the current study examines the influence of economic performance performance, energy utilization, financial sector improvement and FDI on CO_2 discharge in Nigeria by using ARDL model from 1980 to 2017. Result from the cointegration test confirm the long run linkage on the variables of the model. In the short run estimation, economic performance and financial development have positive effect on CO_2 discharge in Nigeria, while FDI condense the explosion of CO_2. The long run estimates indicate that economic performance, financial progress and FDI reduce CO_2 discharge. However, energy use has no impact on CO_2 explosion in nation. Hence, it is suggest that policymakers should continue with the current measure on the mitigation of CO_2. In addition, other refine measures in terms of financial reform and anti-corruption should be considered for the sustainable economic performance. Government should also emphasize on the use of low emission technology for industrial and domestic purposes. Moreover, the study was unable to consider other relevant factors like disaggregate forms of energy, human and development factors that may influence the CO_2 discharge apart from industrial performance due to lack of available data. Therefore, future research should use such factors for more effective policy recommendation.

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