Foreign investment and CO_2 discharge in Nigeria

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***Abstract*: This study examines the influence of foreign investment, economic performance, financial progress and energy use in Nigeria, by employing ARDL technique form 1980 to 2019. The cointegration test confirmed the long run linkage among the model's variables. The short run estimate indicates that foreign investment, economic performance, financial progress and energy positively influence the level of CO_2 discharge in Nigeria. The estimate form long-run analysis also reveals that foreign investment, GDP, financial progress and energy resources accelerate the capacity of CO_2 explosion. Hence, the study suggests that government and policymakers should design policies on foreign investment with aim to decouple the level of CO_2 discharge. This could be through the use of efficient energy and low emission technology.**

***Keywords*: CO2 discharge, foreign investment, GDP, ARDL, Nigeria**

I. INTRODUCTION

The growth of CO_2 discharge today became an issue of great concern in the world (Shahzad et al., 2017). Several commitments of the global institutions like Kyoto Protocol conference for climate change and United Nations sustainable development initiatives have pronounced more need on CO_2 mitigation (IPCC, 2018; IPCC, 2014). It is argued that about 36 billion kilo tonnes of CO2 is been discharged in a decade and it is estimated to rise by the year 2035 (Global Carbon Project, 2018). Increase in the global heat have changed the environmental settings which resulted to the low agricultural production, income, poverty and the reduced sea level water (NS Yahaya, 2020). This condition is directly link with low human, social and economic progress especially in developing nations (Danlami et al 2018). Based on the statistics from the world data, developing economies nowadays contributed to over 67 percent of the world's emission explosion with more than 80 percent vulnerability rate (WDI, 2019). Moreover, several factors such as foreign investment, trade, financial resources, energy use and population growth are among the determinants of CO_2 explosion (Sehrawat et al., 2015).

Nigeria found among the nations in Africa with high amount of CO_2 discharge (WDI, 2019). It is revealed that from 2010 to 2020, over 2 million kilo tonnes of CO_2 were discharge, the amount that is capable of upsetting the climate nature of the entire region (WDI, 2019). Emission discharge from the industrial use, nonrenewable energy resources have increased by 36 percent with a decade which may intensify the growth of CO_2 explosion in the country and seriously affect human development (IPCC, 2018). The level of foreign investment in Nigeria is receiving a considerable growth as the nation promotes bilateral relation with foreign nation and the existence of natural resources, energy and market. The growth of foreign investment have reached almost $ 600 billion and increased the level of GDP growth by 8 percent as well as the employment rate by 3 percent. Therefore, this situation might be the reason of the increased CO_2 discharge in the nation. Thus, this study examine the influence of foreign investment on CO_2 discharge in Nigeria.

II. LITERATURE REVIEW

The link among CO_2 discharges, FDI, economic performance financial progress and energy use have been discuss in the literature for instance, Ren et al. (2014) assess the influence of FDI, output development and business on CO_2 releases in China utilizing GMM estimation technique from 2000 – 2010. The study reveals that FDI accelerates the amount of CO_2 discharges. Similarly Zakarya et al. (2015) argued that FDI contributes positively in promoting CO_2 emissions in BRICS countries. Seker, Ertugrul and Cetin, (2015) established that effect of emission on FDI is positive. Gökmenoğlu and Taspinar (2016) examine influence of FDI, output growth and energy use on CO_2 emanations in Turkey from 1974 – 2010. The outcome reveals that FDI, energy promotes the level of CO_2 emissions. Study by Bakhsh et al. (2017) use 3SLS technique to discover the impact of FDI on CO_2 in Pakistan from 1980 – 2014. The outcome shows constructive influence of FDI on CO_2 discharges. Relatively similar method was used to assess the presence of pollution heaven hypothesis (PHH) in Ghana and China, the results established the affirmative correlation amid FDI and carbon dioxide emission (Solarin, Al-Mulali, Musah, & Ozturk, 2017). Shao (2018) utilize dynamic panel analysis to evaluate the role of FDI on CO_2 releases in 188 nations from 1990 – 2013. Their finding reveals adverse consequence of FDI on CO_2 releases. Salahuddin et al, (2018) in Kuwait by engaging ARDL bounds examination method and adding few vital aspects like monetary evolution, fiscal progress, electricity consumption, and carbon emanations, the outcomes of the paper established the association of FDI and emission both on short term and long term.

Furthermore, Heidari et al. (2015) argued that output is constructively associated with CO_2 discharges in 5 ASEAN nations. Abdouli and Hammami (2017) studied the effect of output evolution and ecological dilapidation in MENA nations by using GMM technique from 1990 to 2010. The study reveals a positive association among the variables. This result is similar with that obtained by Alvarado and Toledo (2017). Moreover, Riti et al. (2017) utilize ARDL technique to assess the influence of monetary growth on CO_2 productions. The paper finds that output growth enhances CO_2 releases in China in the time period 1979 to 2015. In addition, Javid and Sharif

(2016) examine the influence of fiscal progress, output development, and energy use on CO_2 releases in Pakistan. The finding shows that fiscal progress, output growth, and energy promote CO_2 discharges. Cetin and Ecevit (2017) documents that fiscal progress increases CO_2 emanations in Turkey. Likewise, Ozatac et al. (2017), Meng et al. (2018) reveal a similar results that fiscal progress is constructively associated with CO_2 releases in Turkey and Saudi Arabia. Ganda (2019) examines the effect of economic development on ecological dilapidation in OECD nations in the interval 2001 to 2012, utilizing static and GMM approaches. The result reveals significant positive relationship amongst economic progress and ecological dilapidation. Moreover, Zoundi (2017) studied the influence of natural energy use on CO_2 discharges for 25 selected African nations. The outcome reveals that use of energy has substantial negative effect on CO_2 discharges. Jebli et al. (2017) determine that consumption of energy minimizes CO_2 productions in OECD nations. Based on the reviewed literature several studies have examine the effect of FDI on CO_2, however, very few are done in the context of foreign investment and environmental pollution in Nigeria. Hence the study examine the influence of foreign investment on CO_2 discharge in Nigeria.

III. METHOD AND DATA

3.1 Data

Based annual data on CO_2, foreign investment (FDI net inflow), economic performance (GDP, current USD), financial progress (credit % of GDP) and energy use (kg of oil equivalent) are utilized for the model analysis. The data was sourced from WDI. Table 1 shows the statistical nature of the model variables. It indicates that GDP has the highest mean value of 3.422 and CO_2 obtained the least mean value of 0.142. However, FP has max value of 8.753 and CO_2 with lowest max value of 0.316.

Table 1 statistics nature for variables

Variables	Mean	SD	Min	Max
LCO_2	0.142	0.210	0.183	0.316
LFI	2.313	1.341	7.126	4.317
LGDP	3.424	4.716	1.634	3.761
LFP	2.162	2.656	5.654	8.753
LEU	1.152	2.417	3.613	1.752

3.2 Analytical model

This study utilize a refined model by Salahuddin et al, (2018) for the analysis and it is illustrate in equation 1.

$$LCO_2 = \propto_0 + \propto_1 LFI_t + \propto_2 LGDP_t + \propto_3 LFP_t + \propto_4 LEU_t + \varepsilon_t \quad (1)$$

In equation 1 LCO_2, LFI, LGDP, LFP and LEU indicate Carbon discharge, foreign investment, economic performance, financial progress and energy use. The study employed ARDL method for the model estimation. The technique of estimate was use due the advantages possessed over other techniques at the same it has the power of considering mix level of stationarity of variables (Pesaran et al, 2001). Therefore, the model shown as:

$$\Delta LCO2 = \beta_0 + \sum_{j=1}^{n} \beta_1 LCO2_{t-j} + \sum_{j=0}^{n} \beta_2 FI_{t-j} + \sum_{j=0}^{n} \beta_3 GDP_{t-j} + \sum_{j=0}^{n} \beta_4 FP_{t-j} + \sum_{j=0}^{n} \beta_5 EU_{t-j} + \sum_{j=0}^{n} \beta_6 + \alpha_1 LCO2 + \alpha_2 FI_t + \alpha_3 GDP_t + \alpha_4 FP_t + \alpha_5 EU_t + \varepsilon_t \quad (2)$$

In equation 2, t illustrates the time, Δ indicate the change term and ε is the disturbance term.

IV. RESULT

This part shows the outcome of the stationarity and the model estimation. The result from Table 2 indicates that the variables obtained mix stationarity nature in both ADF and PP tests. Hence, this condition justify the use of ARDL technique for the model estimation.

Table 2. Outcome of the Stationarity tests

Variable	ADF LEVEL		PP LEVEL		ADF First Diff		PP First Diff	
LCO2	-2.18748**	(0.0011)	-1.85426*	(0.0006)	-	-	-	-
LFI	-1.07514	(0.0614)	-3.98721	(0.9871)	-	-	-3.68623*	(0.0000)
LGDP	-3.86752	(0.4351)	-1.07652	(0.7652)	-2.31026*	(.00002)	-4.18520*	(0.0000)
LFP	-4.17452	(0.7683)	-0.97541	(0.4520)	-4.38711*	(0.0000)	-2.63297*	(0.0119)
LEU	-1.69721	(0.5172)	-1.76420	(0.6233)	-2.02426*	(0.0000)	-4.58015*	(0.0000)

Notes: * Illustrates significance at one percent level.

Table 3 reveals the existence of long run linkage among the model variables since F-statistics value is higher than the critical value.

Table 3. Cointegration test outcome

F-statistics	1% I(0)	I(1)	5% I(0)	I(1)
4.92	3.41	4.68	2.26	3.79

Table 4 shows the estimates of the model. The result from the short run analysis reveals that foreign investment increases the capacity of CO_2 discharge in Nigeria. This means that a percent rise in foreign investment leads 1.2 percent increase in CO_2 discharge. Similarly, economic performance, financial progress and energy use accelerate CO_2 explosion. It implies that economic performance, financial progress and energy rise the level of CO_2 explosion by 1.0, 0.3 and 0.4 percent in the nation. Moreover, the ECT value is negative and significant, implying that the variables converge toward long run. Furthermore, the long run estimated outcome shows that foreign investment positively increase CO_2 explosion in the country. This means that a percent increase in foreign investment result to 3.3 percent rise in CO_2 discharge. The implication of this outcome is that as a result of increase in foreign investment in Nigeria CO_2 discharge increases by 3.3 percent annually which indicates a threat in environmental sustainability. Therefore, policymakers should design policies on foreign investment with aim to decouple the level of CO_2 discharge. This could be through the use of efficient energy and low emission technology. This outcome is consistent with the result obtained by Ren et al. (2014). In addition, the result reveals that economic performance, financial progress and energy use increase CO_2 discharge. It indicate that a percent increase in economic performance, financial progress and energy use leads to 2.0, 0.2 and 0.1 percent rise in CO_2 discharge. The outcome illustrates that economic performance, financial progress and energy are responsible factors for the increase in CO_2 explosion in Nigeria.

Table 4. Model estimated outcome

ARDL estimation	Coefficients	SD Errors	t-Statistics	Prob
Short run estimates ΔLFI	1.207521*	0.072534	-3.428751	0.0021
ΔLGDP	1.008379**	0.009751	1.580194	0.0319
ΔLFP	0.318462*	0.009753	3.675931	0.0182
ΔLEU	0.41199**	0.087501	2.810927	0.0723
ECT(-1)	-0.78431*	0.349572	-4.972270	0.0024
Long run estimates				
LFI	3.309515*	0.006420	-4.311925	0.0092
LGDP	2.050322***	0.000159	2.020674	0.0218
LFP	0.208966**	0.007186	-1.887341	0.0426
LEU	0.176326***	2.745619	-0.011824	0.0772
C	5.10422***	2.552164	2.010026	0.0621

Notes: ***. ** and * illustrates significant at 1, 5, and 10 percent

Table 5 illustrate the outcome of the validation test. The outcome shows that the model is free form econometric problems of heteroscedasticity, serial correlation, and the normality of error term.

Table 5. Validation tests

Test Type	F-statistics	Probability	Result
Breusch-Pagan Test.	0.611343	0.1950	No Heteroskedasticity
Breusch-Godfrey Test	0.299672	0.8722	No Serial Correlation
Jarque-Bera	0.367912	0.4728	Normally Distributed

V. CONCLUSION

This study examines the influence of foreign investment, economic performance, financial progress and energy use in Nigeria, by employing ARDL technique form 1980 to 2019. The cointegration test confirmed long run linkage among the model's variables. The short run estimate estimates indicate that foreign investment, economic performance, financial progress and energy positively influence the level of CO_2 discharge in Nigeria. The estimate form long-run analysis also reveals that foreign investment, GDP, financial progress and energy resources accelerate the capacity of CO_2 explosion. Hence, the study suggest that government and policymakers should design policies on foreign investment with aim to decouple the level of CO_2 discharge. This could be through provision and emphasis on the use of efficient and low emission technology and energy for production. However, the study is limited by the fact that other influential factors such as population growth, energy price and urbanization were not incorporated in the estimated model. Therefore, future studies should use these variable for policy suggestions.

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