FINANCIAL INCLUSION AND ENVIRONMENTAL POLLUTION IN NIGERIA

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Abstract

The study examined the link among financial inclusion, energy utilization, economic growth, urbanization and environmental deterioration in Nigeria from 1980-2022 by employing Autoregressive distributed lag(ARDL) Bound testing technique. It is clear that given out credit facilities (financial inclusion)to citizens by both public and private financial institutions may accelerates the level of environmental pollution in Nigeria. Hence, the estimated result in the short-run reveals that financial inclusion and economic performance reduce Carbon dioxide (CO_2) emissions. Nonetheless, energy utilization is positively linked with CO_2emissions. The long-run analysis also indicates that financial inclusion and growth domestic product (GDP) are negative and significant in influencing CO_2 emissions. Therefore, policymakers in Nigeria should emphasize on more efficient policies inclined to financial development such as financing the low emissions technologies in Nigeria for better environment in the country.

Keywords: CO_2 emissions, financial inclusion, energy use, environmental sustainability, GDP, ARDL. **JEL Code:** Q53

1.0 Introduction

The increased level of environmental degradation in the recent time has become a global concern to achieve sustainable environment and development(Begum et al., 2015). Technological advancement and innovations couple with economic and population growth are some of factors to environmental pollution(Danlami et al., 2018).This situation has raised the level of environmental threats through the augmented global heat and the deterioration of climate, which affect human heath, environment and the general economic activites (Danlami et al., 2018).Moreover, several nations have emphasized on the new measures to reduce CO_2 emission in order to avoid future consequences of the increased level of global temperature, which has been predicted to be more than double before 2030(Tiwari, 2011). Thishas led the international communities to advocate for mitigating the CO_2 emissions in nations of the world. The level at whichCO_2 emissions is growing in developing nation, such as Nigeria has been considered as a threat to environmental setting in West Africa(Hassan & Kouhy, 2013). It is

streesed that nation is the major producer of CO_2 in African states. Example, in 2020 Nigeria accounted to 0.6 %of these emissions in the global nations(World Bank, 2017). According to OPEC, Nigeria is the world 5th gas flaring nation, accounting about 8 %in 2020 globally. Similarly, Nigeria was ranked 38th among nations in the world regardingthe CO_2 emissions discharged.

Presently, in Nigeria financial inclusion is among the trending factor increasing environmental pollution. Government policies and private sectors initiatives were toward given out credits to citizens for welfare development in the country. Statistics shows that for the past decade over $24 billion is were disbursed to many Nigerians and it has been on increasing trend (CBN, 2022). In this development, it is essential to note how financial inclusion influenceCO_2 emissions in the country. Environmental Kuzent theory explain that factors such as financial development and credit influence economic growth and consiquently increase environmental pollution in near future unless environmental control measures are put in place. Similarly, Dinda (2004) stressed that any factor that can promote economic growth like financial inclusion may acclerates the capacity of environmental pollution.

Hence, the question here is that how does the financial inclusion, energy use, economic progress, andurbanization are responsible for the increase in CO_2emissions in Nigeria? Thus, study examines the impact of financial inclusion, energy use, economic progress and urbanization on CO_2 emission in Nigeria. It is observed that the impact financial inclusion in Nigeria, especially in the rural areas where their contributions are not counted on the effect of environmental pollution and also very few studies consider financial inclusion in nation. Therefore, the study will contribute to the existing knowledge by addition financial inclusion aspect of rural credit allocation to the environmental studies literature. Hence, the study is significant to both policymakers and stakeholders in making appropriate policies concerning environmental sustainability and development in Nigeria and to improve the capacity of financial inclusion to target low emissions technologies for sustainable environment.

2. Review of literature

The association among financial inclusion and environmental pollution has been analyzed in the economic literature. For instance Yahaya et al. (2020) examine the influence of financial inclusion on environmental degradation in SSA country using FMOLS technique. The analysis of the study reveals that financial inclusion increase the level of environmental degradation. Ibrahim and Vo (2021) analyze the influence of financial sector performance on environmental degradation in 27 industrialized countries from 1991 to 2014. The estimated result of the study

reveals that financial sector development increases the level of environmental degradation. Similarly, Assi et al. (2021) used P-ARDL technique to analyze the influence of financial inclusion on CO_2 emission discharge in ASEAN nations. The study outcome reveals that financial inclusion positively affect the capacity of CO_2 emissions discharge. In another development, Wu et al. (2021) studied the impact of financial services on CO_2 emissions in China from 1999 to 2017. The findings of the study indicate that financial services provided by financial institutions positively affect CO_2 emissions in China. Islam, (2022) investigates the effect of financial inclusion on environmental pollution in 5 South ASIAN nations using GLS and PMG techniques from 1980 to 2018. The result illustrates that financial inclusion positively affect environmental pollution. However, Yurt Yurtkuran and Güneysu (2023) examine the impact of financial services on environmental pollution in Turkey by using A-ARDL approach. The study outcome shows that financial inclusion and hydropower energy use decreases the level of environmental pollution in the country. Hence, it is suggest that hydropower generation should be more emphasized as well as financial services aligned to pollution reduction in (Konuk et al., 2024) examine the impact of financial inclusion on CO_2 emissions in G7 nations from 1971 to 2019. The outcome indicates that financial inclusion increases the level of CO_2 emissions in these countries. Moreover, Said (2024) employed fully modified ordinary least squares techniques to examine the influence of financial inclusion on environmental pollution in 23 SSA nations from the period of 2004 to 2019. The estimated result of the study reveal that financial inclusion accelerates the level of environmental pollution in Africa nations.

Various studies have invstigates thelinkage among financial inclusion, energy utilization, economic progress, urbanization and emission in developed nations. However, very few studies consider financial inclusion in less developed countries like Nigeria. The study includes financial inclusion among the factors that attract the concentration of CO_2 in Nigeria. The inclusion of financial inclusion was on the basis that it attracts the purchases of none low Carbone emission technology such cars and home appliances. Therefore, investigating the effect of financial inclusion on CO_2 may give out recommendations for better policies.

3. Methodology

3.1 Data

Annual series data was utilized in the study from 1980 –2022. The source of data is world development indicators (WDI, 2022) and the variables are; carbon dioxide emissions (kt),domestic credit to private sector % of GDP (financial inclusion), energy consumption (kg of oil), economic progress (GDP current USD) and urbanization (Urban population %). All data were converted to natural log for compatibility of the unit of measurements.

3.2 Specification of the study model

Dogan and Turkekul(2015)corrected model was employed for the model analysis as stated below:

CO_2 = f (CO_2, EC, FD, GDP, UBR)

Where: CO_2, EC, FD, GDP, UBR represents CO_2, energy utilization, financial inclusion, and urbanization. This study employed Autoregressive Distributed Lag (ARDL) to estimate the study model. This technique is applied due its ability to capture variable that are found in a mixed stationary level, as the variable of the study were found in this nature. Hence it is justified to use for the study estimation. The models used in this study are expressed as:

$$\Delta LCO_2 = \beta_0 + \sum_{j=0}^{n} \beta_1 LEC_{t-j} + \sum_{j=0}^{n} \beta_2 LFD_{t-j} + \sum_{j=0}^{n} \beta_3 LGDP_{t-j} + \sum_{j=0}^{n} \beta_4 LUBR_{t-j} + \alpha_1 LEC_t + \alpha_2 LFD_t + \alpha_3 LGDP_t + \alpha_4 LUBR_t + \varepsilon_t$$

$$\Delta LCO_2 = \beta_0 + \sum_{j=0}^{n} \beta_1 LEC_{t-j} + \sum_{j=0}^{n} \beta_2 LFD_{t-j} + \sum_{j=0}^{n} \beta_3 LGDP_{t-j} + \sum_{j=0}^{n} \beta_4 LUBR_{t-j} + \nu_0 ECT_{t-1} + \varepsilon_t$$

$$LCO_2 = \alpha_0 + \alpha_1 LEC_t + \alpha_2 LFD_t + \alpha_3 LGDP_t + \alpha_4 LUBR_t + \varepsilon_t$$

Where ε represent the error term, t designates the time trend and Δdenotes the first difference operator.

4. Result and Discussion

This segment discusses the findings of the study. The results of the unit root in Table 1, shows that two variables tested are stationary at levels I(0) and three variables are stationary at the first difference I(1). Thus, based on the above condition, ARDL method is suitable for the study estimation.

Table 1; Unit Root test result

-	ADF	ADF
Variables	**Level**	**1st Difference**
LCO2	**-4.793161* (0.0005)**	**-**
LEC	**-6.193425 * (0.0001)**	**-**
LFD	**-2.462427(0.1341)**	**-4.931001* (0.0004)**
LGDP	**-1.414574 (0.8365)**	**-7.012676* (0.0000)**
LUBR	**-1.437033 (0.5541)**	**-5.995694* (0.0000)**

Source: Authors' 2022; Notes: * denotes statistically significant at 1% level.

The outcome bound test indicates that long-runrelationship exists among the variable as F-statistic 7.9 is bigger than the critical values of I (0) 3.74 and I(1) 5.06 at 1 % level of significance

Table 2 illustrates the outcome of short and long run estimation. The estimates reveal that lag-*EC*, *Log FD,* and *GDP* are significant in influencing the CO_2 in Nigeria. Example, a 1% rise in energy utilization leads to 2.4% increase in CO_2 emissions, while a1% rise in financial inclusion leads to 1.5% decrease in CO_2.Moreover, a 1% increase in economic growth leads to 1.8% decrease in CO_2. The result also indicates that UBR is not in influencing CO_2 emissions. The speed of adjustment approaching long-run condition is 72.38 %, and significant at 1%.

Furthermore, the long run result indicated that financial inclusion and economic performance have significant negative influence on environmental. The outcome shows that a 1% increase in financial development and GDP leads to reduction on environmental pollution by 0.06 and 0.35 % respectively. Nonetheless,a1% increase in the energy utilization in Nigeria leads to about 3.4% increase in CO_2. It shows that more energy utilization is linked with the 3.4% rise inCO_2emissions. However, urbanization is not influencing environmental pollution in the country.

Based on the above findings it is observed that financial inclusion found significant and negative in influencing environmental pollution in Nigeria. It is illustrated that environmental pollution is reduced by 0.06 % annually in the country as a result of the implementation of financial inclusion from the financial authorities of Nigeria. Hence, financial inclusion is a significant factor to use for enhancing environmental quality in Nigeria. This outcome is justified by the work of (Yurtkuran & Güneysu, 2023).

Table 2: Short Run and Long Run estimate

Short run estimates	**Coefficients**	**SD Errors**	**t-Statistics**	**Prob**
ΔEC	**2.440855***	**0.752363**	**3.244250**	**0.0048**
ΔLFD	**-1.484847***	**0.408317**	**-3.636506**	**0.0020**
ΔLGDP	**-1.830118**	**0.427574**	**-4.280234**	**0.0005**
ΔLUBN	**-0.259677**	**1.317385**	**-0.197116**	**0.8461**
ECT(-1)	**-0.723840**	**0.161743**	**-4.475251**	**0.0003**
Long run estimates				
LEC	**3.372094****	**1.285498**	**2.623182**	**0.0178**
LFD	**-0.066781**	**0.844719**	**0.079057**	**0.0379**
LGDP	***-0.353295***	***0.368904***	***-0.957690***	***0.0516***
LUBR	***2.244602***	***1.446998***	***1.551213***	***0.1393***
C	***-31.076964***	***15.773345***	***-1.970220***	***0.0653***

*Source: Authors' 2022; Notes: * and ** denote statistically significant at 1 and 5 % levels*

Table 3 illustrates the model validation tests, and model has shown no Heteroskedasticity, serial correlation and the errors are normally distributed.

Table 3; Model validation tests

Test Type	F-statistics	Probability	Result
Breusch-Pagan Test.	1.235454	0.3367	No Heteroskedasticity
Breusch-Godfrey Test	0.570058	0.5773	No Serial Correlation
Jarque-Bera	1.354824	0.5079	Normally Distributed

5. Conclusion

This study examined the relationships between financial inclusion, energy use, economic progress, urbanization and CO_2 emissions by employing ARDL technique. The short-run estimate shows energy utilization rise the level of CO_2, while financial inclusion and economic progress reduce CO_2. Long-run estimate also reveals that an increase in energy utilization is associated with higher CO_2. Nonetheless, financial inclusion and economic progress reduce environmental degradation in Nigeria.

From the findigs of the study clearly it indicates that finamcial inclusion significantly reduced environmetal pollution. Therefore, policymakers should emphasize on low emissions technologies such as solar power generation and thermal technologies in Nigeria to reduce the concentration of CO_2 emissions. This is because consumption of energy has become paramount for the concentration of carbon dioxide emissions in Nigeria. Moreover, financial inclusion should be taken with greater emphasis especially in rural areas as it become a factor of decoupling CO_2 emissions. In this regard, financial inclusion should be re-introduced and expanded in both rural and urban areas by making financial inclusion as an instrument of growth and development from government at various level and financial institutions.

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