

IMPACT OF ENVIRONMENTAL DEGRADATION ON ECONOMIC GROWTH IN NIGERIA (1991-2023)

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Abstract

The study analyse the impact of environment degradation on Nigeria economic growth. The study used secondary time series data for the period 1991-2023, sourced from Central Bank of Nigeria statistical bulletin (2023) and world development indicator (2023). Autoregressive distributed lag model(ARDL) was utilized to estimate the relationship between variables of the study, the variables employed include, trade openness, real gross domestic product, CO₂ emission, gross fixed capital formation and unemployment rate. The findings of the study reveal that there is a long run relationship between the variables under consideration, CO₂ emission have a negative and positive relationship with economic growth in the short and long run respectively, (this depict that CO₂ emission should be well managing to prevent long term effect on health and growth of Nigeria economy). The study therefore recommend that Carbon emission should be highly regulated, incentive for green energy usage should be put in place for firm and transport companies to move from using the conventional fossil fuel to solar energy, gas power generation adoption and electricity expansion usage to stimulate local production in a safe and conducive environment.

Keywords: CO₂ emission, Trade Openness, Gross Fixed Capital formation, Unemployment, Nigeria, ARDL model.

Introduction

Environmental degradation, a critical issue globally, poses a significant challenge to economic growth and sustainable development, particularly in developing nations such as Nigeria. Environmental degradation refers to the deterioration of the natural environment through the depletion of resources, destruction of ecosystems, and pollution of air, water, and soil (Muzzamel, 2024). This phenomenon is often exacerbated by human activities, including deforestation, industrial emissions, unsustainable agricultural practices, and urbanization. These activities compromise the environment's ability to sustain livelihoods, affecting productivity and economic outcomes (John *et al.*, 2014).

Nigeria, as the largest economy in Africa, relies heavily on natural resources for economic activities. The oil and gas sector, agriculture, and mining play pivotal roles in driving economic growth. However, these sectors also contribute significantly to environmental challenges (Godspower, 2024). For instance, oil exploration in the Niger Delta region has led to severe environmental degradation, including oil spills, gas flaring, and water contamination. Similarly, deforestation for agriculture and urbanization has resulted in soil erosion, loss of biodiversity, and reduced agricultural productivity (Moses, 2024; Ahmed *et al.*, 2021).

Deforestation is one of the leading contributors to environmental degradation in Nigeria, with the country experiencing one of the highest rates of forest loss globally. This is primarily due to agricultural expansion, logging, and the use of wood as fuel (John *et al.*, 2024). The result is widespread biodiversity loss, soil erosion, and diminished carbon sequestration capacity. Similarly, oil exploration, particularly in the Niger Delta, has caused severe environmental

harm due to frequent oil spills from pipeline leaks and sabotage. These spills have contaminated water bodies, destroyed arable land, and devastated aquatic life (Godspower, 2024).

Urbanization and industrialization have also played significant roles in environmental degradation. Rapid urban growth has led to unregulated construction, poor waste management, and increased pollution of water and air (Gang, 2024). Industrial activities contribute significantly to chemical emissions and the release of hazardous waste into the environment, especially in urban centers like Lagos and Port Harcourt. Furthermore, mining activities, particularly artisanal and small-scale operations, have led to land degradation, water contamination, and the destruction of ecosystems (Rashid and Memoona, 2023).

Empirical studies have highlighted that environmental degradation negatively affects key economic sectors. For example, air and water pollution, increase healthcare costs and reduce labor productivity, while land degradation hampers agricultural output, which is a major contributor to Nigeria's GDP (Onwunali *et al.*, 2024). Furthermore, the adverse effects of climate change, such as unpredictable rainfall patterns, flooding, and desertification, disproportionately affect rural communities, deepening poverty and inequality. These challenges necessitate a thorough examination of the dynamics between environmental degradation and economic growth in Nigeria (Pooja, 2024).

The concept of sustainable development emphasizes the need to balance economic, social, and environmental goals. In this context, addressing environmental degradation is critical to achieving Nigeria's development objectives as outlined in Vision 2050 and the Sustainable Development Goals (SDGs). Policies aimed at reducing environmental degradation, such as transitioning to renewable energy, promoting sustainable agricultural practices, and enforcing environmental regulations, are essential to fostering long-term economic resilience (Mischa, 2023).

Nigeria, as the largest economy in Africa, relies heavily on natural resources for economic activities, particularly in sectors such as agriculture, oil and gas, and manufacturing. However, rapid industrialization, urbanization, and population growth have intensified environmental stress, leading to resource depletion and pollution. The oil sector, which contributes a significant share of Nigeria's GDP, is a major source of environmental degradation due to gas flaring, oil spills, and emissions of greenhouse gases. Agricultural expansion, driven by increasing food demand, has also led to deforestation and land degradation, reducing the productivity of farmlands and threatening food security.

Despite various government policies and international commitments to environmental sustainability, Nigeria continues to experience rising levels of environmental degradation. This raises concerns about the trade-off between economic growth and environmental sustainability. While economic activities generate revenue and employment opportunities, they also contribute to environmental damage, which, in turn, may undermine long-term economic growth by reducing the availability of natural capital. The lack of effective regulatory enforcement, weak environmental policies, and inadequate public awareness further exacerbate the problem, making it difficult to balance economic progress with environmental conservation.

Furthermore, the economic costs of environmental degradation are often overlooked in traditional economic assessments. Rising carbon emissions contribute to climate change, leading to extreme weather conditions such as flooding and droughts, which negatively impact agriculture, infrastructure, and human livelihoods. The health implications of environmental pollution are also significant, with increasing cases of respiratory diseases, waterborne

illnesses, and other health complications that place a burden on Nigeria's healthcare system and workforce productivity.

One of the major concerns is the rise in carbon emissions, which has intensified climate change effects in Nigeria. The increase in greenhouse gas emissions from fossil fuel combustion, industrial activities, and deforestation has contributed to more frequent occurrences of extreme weather conditions such as droughts, desertification, and flooding. These climate-related events disrupt agricultural production, damage infrastructure, and displace communities, thereby increasing economic instability. Smallholder farmers, who form the backbone of Nigeria's agricultural sector, are particularly vulnerable to climate change, as declining soil fertility and unpredictable rainfall patterns reduce crop yields and threaten food security. Consequently, the decline in agricultural productivity exacerbates poverty and unemployment, two major impediments to economic growth.

In addition to its impact on agriculture, environmental degradation affects Nigeria's industrial sector. Industries rely heavily on natural resources, including water, land, and energy, for production. However, industrial pollution, waste mismanagement, and the depletion of raw materials hinder sustainable industrial development. Many industries discharge untreated effluents into water bodies, leading to the contamination of rivers and streams that serve as sources of drinking water and irrigation for crops. The economic cost of environmental pollution includes increased spending on health care, loss of productivity due to disease, and the decline of fisheries and aquaculture, which are essential for food supply and employment. The health implications of environmental degradation are another critical area of concern. Air pollution, resulting from vehicular emissions, industrial activities, and biomass burning, has been linked to respiratory diseases, cardiovascular problems, and other chronic health conditions. In urban centers such as Lagos, Abuja, and Port Harcourt, the high concentration of air pollutants has contributed to a rise in cases of asthma, lung infections, and premature deaths. Water pollution, caused by industrial waste, oil spills, and poor sanitation, has led to the spread of waterborne diseases such as cholera and typhoid fever, further straining Nigeria's already overburdened healthcare system. The economic burden of treating pollution-related illnesses, coupled with reduced workforce productivity, has a negative impact on national output and economic development.

Furthermore, Nigeria's growing population exerts additional pressure on the environment, leading to increased deforestation, land degradation, and waste generation. The rapid urbanization trend has resulted in the expansion of informal settlements that lack proper waste management and sanitation systems, leading to environmental hazards such as flooding, erosion, and the spread of diseases. The lack of efficient waste disposal systems has led to the proliferation of plastic waste, contributing to environmental pollution and harming marine life. Despite various policy measures aimed at mitigating environmental degradation, enforcement remains weak due to corruption, inadequate funding, and limited technical capacity. Existing environmental regulations, such as those implemented by the National Environmental Standards and Regulations Enforcement Agency (NESREA), are often poorly enforced, allowing industries and individuals to engage in environmentally harmful practices with little or no consequences. Moreover, the lack of public awareness and education on environmental sustainability further exacerbates the problem, as individuals and businesses continue to prioritize short-term economic gains over long-term environmental health.

Given these challenges, there is a need for empirical research to examine the relationship between environmental degradation and economic growth in Nigeria. Understanding the extent to which environmental degradation affects economic growth will provide insights into

sustainable policies that can drive economic development while minimizing environmental harm. This study aims to investigate this relationship by employing econometric analysis to determine the impact of environmental degradation—proxied by carbon emissions—on Nigeria’s economic performance. By doing so, the research will contribute to policy discussions on how to achieve sustainable economic growth in Nigeria without compromising environmental quality.

Ultimately, the goal of this study is to contribute to the ongoing discourse on sustainable economic development in Nigeria by identifying practical solutions that can mitigate environmental degradation while promoting long-term economic prosperity. Without decisive action, Nigeria risks facing a future where economic growth is unsustainable due to the severe consequences of environmental neglect.

This study seeks to investigate the impact of environmental degradation on Nigeria’s economic growth, focusing on key indicators such as deforestation rates, greenhouse gas emissions, industrial pollution, and the degradation of arable land. By examining the interplay between these factors and economic growth, this research aims to provide insights into the extent to which environmental challenges hinder economic development and to recommend actionable strategies for policymakers.

2.0 Literature Review

Agricultural practices such as overgrazing, slash-and-burn methods, and the excessive use of chemical fertilizers have degraded soil quality, reduced fertility, and contributed to deforestation. Additionally, the effects of climate change, including rising temperatures, irregular rainfall, and extreme weather events, have exacerbated issues like desertification in the north and coastal erosion in the south, leading to flooding and displacement of communities (Nawhath *et al.*, 2024).

Key environmental issues in Nigeria include desertification, water pollution, air pollution, loss of biodiversity, and recurrent flooding. Desertification affects over 40% of Nigeria's land area, particularly in the northern regions, reducing arable land and contributing to rural poverty. Water pollution, often caused by industrial and agricultural waste, limits access to clean water and endangers aquatic ecosystems (Oluwakemi and Olufemi, 2020). Air pollution from gas flaring, vehicular emissions, and industrial activities has led to serious health consequences, including respiratory diseases and reduced life expectancy. Water pollution is exacerbated by industrial waste, poor waste management, and oil spills from the petroleum industry, affecting freshwater resources and aquatic life (Ikenna *et al.*, 2019). The increasing levels of carbon emissions from these activities have exacerbated global warming and have been linked to changes in weather patterns, reduced agricultural productivity, and threats to health. Additionally, biodiversity loss is escalating as habitats are destroyed, and poaching and overfishing persist. Flooding, exacerbated by poor urban planning and deforestation, has also become a recurrent problem, causing widespread displacement and economic losses (Harold, 2017).

The socio-economic impacts of environmental degradation are severe. Agricultural productivity has declined due to soil degradation and erratic rainfall, threatening food security. Health challenges have increased as contaminated water and polluted air result in higher incidences of cholera, malaria, and respiratory diseases (Fidelis *et al.*, 2020). Economic losses from oil spills, deforestation, and habitat destruction strain government resources and reduce income from sectors like agriculture, fisheries, and tourism. Social displacement caused by desertification and flooding has created environmental refugees, intensifying pressure on urban

areas. Furthermore, conflicts over diminishing natural resources, such as land and water, are rising, particularly between farmers and herders (Fentaw and Kaleb, 2018).

Despite these challenges, efforts to combat environmental degradation are ongoing. The Nigerian government has enacted laws such as the Environmental Impact Assessment Act (1992) and the National Oil Spill Detection and Response Agency Act (2006) to regulate harmful activities (Johnson *et al.*, 2024). Afforestation initiatives like the Great Green Wall project aim to combat desertification by planting trees along the Sahel region. Renewable energy projects and public awareness campaigns promoting sustainable practices have also gained traction, though their impact remains limited (Omozue *et al.*, 2024).

2.1 Conceptual Review

2.1.1 Degradation

Degradation, in a broad sense, refers to the deterioration or reduction in quality, function, or value of a system or resource. Environmental degradation specifically refers to the adverse changes in the environment caused by human activities, natural disasters, or a combination of both. This includes the depletion of natural resources such as air, water, and soil, the destruction of ecosystems, and the extinction of wildlife. The term encompasses a wide range of phenomena, including deforestation, desertification, biodiversity loss, pollution, and climate change (Satpute, 2024).

Environmental degradation is often a byproduct of economic and industrial activities aimed at development. For instance, the extraction of natural resources and industrial production often lead to deforestation, air pollution, and water contamination. In developing countries like Nigeria, rapid urbanization, poor waste management, and weak enforcement of environmental regulations exacerbate the problem. Agricultural practices such as overgrazing and excessive use of chemical fertilizers also contribute to soil erosion and reduced fertility (Oluwakemi and Olufemi, 2020).

2.1.2 Economic Growth

Economic growth refers to the increase in the production and consumption of goods and services in an economy over a certain period, typically measured by the rise in Gross Domestic Product (GDP). It reflects the ability of an economy to produce more output, driven by factors such as increased labor productivity, technological advancement, capital investment, and improved resource allocation. Economic growth is considered a key indicator of a nation's economic health and prosperity (Gallardo *et al.*, 2019). In developing countries like Nigeria, economic growth is crucial for reducing poverty, improving living standards, and providing the resources needed for infrastructural development and public services. The drivers of economic growth often include investments in human capital, industrialization, trade liberalization, and natural resource exploitation. Nigeria's economy, for example, has been significantly influenced by its oil sector, which contributes a large portion of GDP and government revenue (Abdulkarim, 2024).

2.2 Empirical Review

The relationship between environmental degradation and economic growth in Nigeria has been a subject of extensive empirical study, reflecting both the severity of environmental issues in the country and their impact on its economic development. A wide range of studies has been conducted to explore this dynamic, using different methodologies and data sets to establish links between environmental quality and economic outcomes.

Several studies have identified a negative relationship between environmental degradation and economic growth in Nigeria. For instance, research by John *et al.* (2014) employed the Error Correction Model (ECM) to investigate this relationship over the period 1985-2014. Their

findings highlighted that environmental degradation, proxied by deforestation and pollution levels, significantly hampers economic growth. They argued that the loss of forest cover, which reduces carbon sequestration and worsens soil erosion, adversely affects agricultural productivity and biodiversity, subsequently lowering Gross Domestic Product (GDP).

Foluso (2018) examined the effect of CO₂ emissions on economic growth using the Ordinary Least Squares (OLS) technique. Their results indicated that an increase in CO₂ emissions—primarily from oil production and industrial activities—leads to a reduction in GDP. This is due to the negative effects of air pollution on health, which can reduce labor productivity, and damage to the environment that disrupts natural resources critical for economic activities such as agriculture, fisheries, and tourism.

Another study by Agbola and Fayiga (2016) addressed the issue of the existence of threshold effects in the relationship between climate change and growth rate of global data, using new endogenous panel threshold autoregressive (TAR) model. This leads to a decline in agricultural productivity, which is a major sector of the Nigerian economy. Their study revealed that increased deforestation is correlated with lower crop yields and higher food prices, thus affecting the overall economic stability of the country.

Sanglimsuwan (2011) said that government efficiency can positively influence on environmental quality through higher performance on good policies, and effective implementation of policies. Government effectiveness index, according to Torras and Boyce (2008), is a measure of the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies.

Granados and Carpintero (2012) embarked on a study on carbon emission and economic growth from a global perspective. The article attempts to improve understanding of the link between carbon emission and economic activity in for ways. They discussed the limitations of panel data estimations used in previous studies for testing the EKC for emissions. By employing long time series for a number of high of high, mid and low-income countries they showed that the existence of an EKC for carbon emission is very doubtful

Additionally, Oluyemi et al. (2021) researched the impact of climate change on agricultural output between the years 1986 and 2015 was analyzed using descriptive statistics, unit root test and the ordinary least square (OLS) estimation technique. The study found that average annual rainfall positively influences agricultural output. This suggests that increased rainfall can enhance crop yields and overall agricultural productivity in Nigeria. Additionally, agricultural nitrous oxide (N₂O) emissions were found to have a detrimental effect on agricultural output. This highlights the importance of managing emissions to protect agricultural productivity

Adebayo and Tella (2017) examined the effectiveness of environmental regulations in Nigeria using an ECM framework. They concluded that while there are regulations in place, enforcement is often weak, leading to continued environmental degradation. The lack of strict penalties for non-compliance and inadequate monitoring has resulted in the persistent degradation of natural resources.

In another research study, David, (2022) carried out a conceptual review and synthesis article which sought to provide policy recommendations through a broader review of existing literature on Nigeria's existing institutional, legal, and policy frameworks of environmental governance, and concludes that Nigeria's environmental governance frameworks are completely inadequate to deal with the magnitude of the country's environmental challenges. Studies like that of Collins et al. (2021) have shown that poor environmental quality, due to deforestation and soil erosion, leads to reduced agricultural output. They used the Vector Error

Correction Model (VECM) to show that sustainable agricultural practices could mitigate these effects, thus enhancing economic growth.

Dandy et al. (2022) showed the effects of gas flaring on the inhabitants of the Niger-Delta region of Nigeria (human and environment) and reported an overview of the challenges militating against ending the menace of gas-flaring is provided. It was concluded that unless there is strict enforcement of anti-gas flaring regulations by the regulating agencies of government with stiff punishments and fines for erring oil companies, gas flaring will not abate.

Studies by Natalia et al. (2024) and Unegbu et al. (2024) emphasize the importance of community involvement and education in these strategies, noting that local communities' engagement in conservation efforts is crucial for sustainable development. The empirical literature suggests several strategies to mitigate the adverse effects of environmental degradation on economic growth. These include promoting the use of renewable energy, investing in afforestation programs, enforcing environmental laws, and implementing sustainable agricultural practices.

2.3 Theoretical Framework

2.2.1 Theoretical framework

This study adopted the work of Batimoore and Tudok (2010). According to Batimoore and Tudok (2010), using Foster's growth and pollution model with a utility function that is additively separable between consumption and pollution derive an Inverted-U path for pollution and a J-curve for abatement that starts when a capital stock is achieved; that is, expenditure on pollution abatement is zero until "development has created enough consumption and enough environmental damage to merit expenditure on abatement"

However, emphasizing on the pollution growth relationship, foster's growth and pollution model assess some major factors. Batimoore and Tudok (2010) said three major factors are considered in this model. These include large direct effects of pollution on growth, high technology which enhances growth, and rapidly inclining marginal utility of consumption which puts more pressure on industrial production.

Methodology

The study utilized annual time series data which covered the period from 1991 to 2023. The data was sourced from Central Bank of Nigeria (CBN), Statistical Bulletin 2023. The variables of interest include; Real Gross Domestic Product (RGDP) being the dependent variable while Gross fixed capital formation (GCFC), Unemployment (UNEM), and trade openness (TROPNS) as proxy for foreign trade are the independent variables.

In building the ARDL model for the study, it took the lead from the study of Batimoore and Tudok (2010). This study adopts and slightly modify the model used by Batimoore and Tudok (2010). The model is specified as follows: Equation [1]

$$[1] \quad \text{RGDP} = f(\text{CO}_2, \text{GCFC}, \text{UNEM}, \text{TROPNS})$$

The model is explicitly specified in linear-log form as in Equation [2]

$$[2] \quad \text{GDPGR} = \alpha_0 + \alpha_1 \log \text{CO}_2 + \alpha_2 \text{GCFC}_t + \alpha_3 \text{TROPN}_t + \alpha_4 \text{UNEM} + \mu_t$$

where RGDP which means Real Gross Domestic Product (proxy for economic growth), CO_2 represents Carbon Emissions (proxy for environmental degradation), UNEM means,

Unemployment Rate, GCFC implies Gross Fixed Capital Formation, TROPNS is Trade Openness (control variable), and μ means Stochastic error term accounting for other unobserved factors affecting GDP growth respectively.

The ARDL model captures both the short-run dynamics and long-run relationships among variables. It can be expressed in the form:

$$\begin{aligned}
 [3] \Delta RGDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta \log CO_{2t-1} + \sum_{i=1}^n \alpha_2 \Delta TOPENS_{t-1} + \sum_{i=0}^n \alpha_3 \Delta GCF_{t-1} \\
 & + \sum_{i=0}^n \alpha_4 \Delta UNEM_{t-1} + \sum_{i=0}^n \alpha_5 \Delta RGDP_{t-l} + \alpha_6 \Delta \log CO_{2t-1} \\
 & + \alpha_7 \Delta TOPENS_{t-1} + \alpha_8 GCF_{t-1} + \alpha_9 UNEM_{t-1} + \mu_t
 \end{aligned}$$

This technique provides analysis in order to achieve the long run relationship and effect objectives of this study.

Justification of variables

Economic Growth (GDP): This study will use the Gross Domestic Product (GDP) as the dependent variable to proxy economic growth. Economic growth in this context refers to the increase in the value of goods and services produced by an economy over time. It is a crucial indicator of economic performance and is often used to assess the overall economic health of a country. In this study, the study is particularly interested in how environmental degradation, as proxied by carbon emissions, impacts economic growth.

Independent Variables:

Carbon Emissions: Carbon emissions will be used to proxy environmental degradation. This is based on the understanding that high levels of CO₂ emissions from industrial activities, energy production, and vehicular emissions contribute to environmental degradation, affecting climate change and air quality. The data was sourced from world development index

Unemployment Rate: This measure the rate of unemployment in an economy over the period.

Trade Openness: This is term used to describe the flow of trade in in economy, it incorporate both import and export trade in an economy.

Capital formation: This is term used to describe the gross capital accumulation during an accounting period for a particular country.

Results and Discussion

Table 1: Descriptive Statistics Result

	GDP	CO ₂	GCFC	UNEM	TROPNS
Mean	46450.36	98621.93	8860.079	4.021212	332.2024
Median	43837.39	98646.90	8640.765	3.827000	343.0600
Maximum	77936.10	120281.9	11445.86	5.712000	550.2100
Minimum	21757.90	76947.40	6860.444	3.074000	178.5600
Std. Dev.	20599.87	12741.15	1322.838	0.577514	86.51058
Skewness	0.112126	0.148695	0.321306	1.559230	0.257977
Kurtosis	1.384232	1.921389	1.890056	4.732119	2.716758
Jarque-Bera	3.658868	1.721283	2.261775	17.49691	0.476347
Probability	0.160504	0.422891	0.322747	0.000159	0.788066
Sum	1532862.	3254524.	292382.6	132.7000	10962.68
Sum Sq. Dev.	1.36E+10	5.19E+09	55996790	10.67272	239490.6
Observations	33	33	33	33	33

Source: Researchers Computations, 2025 Using E-views 10

Descriptive statistics is used to describe the basic features of the study. It summarizes and describe the main features of a dataset, such as its central tendency, variability and distribution. Table 1 presents the summary statistics for Gross domestic product (GDP), CO₂ emission (CO₂), gross fixed capital formation (GCFC), unemployment (UNEM) and trade openness (TROPNS) for the year 1991-2023. The result of the descriptive statistics shows that all the series show a high level of consistency as their mean and median lies between the maximum and minimum values of the series, which suggest the distribution of the individual series are normal (i.e. bell-shaped).

Furthermore, the skewness is a measure of symmetry or more precisely, lack of symmetry. It measures the asymmetry of the distribution of the series around its mean, which can be positive or negative or even undefined depending on the biasness of the tail. The skewness statistics revealed that Gross domestic product (GDP), CO₂ emission (CO₂), gross fixed capital formation (GCFC), unemployment (UNEM) and trade openness (TROPNS) are positively skewed. In addition, the kurtosis is a parameter that measures the peakedness or flatness of the distribution of the series. The kurtosis of unemployment (UNEM) exceed three which implies that the series is greatly peaked i.e. leptokurtic while Gross domestic product (GDP), CO₂ emission (CO₂), gross fixed capital formation (GCFC) and trade openness (TROPNS) follows a platykurtic distribution, given that their kurtosis values are less than three. This indicates that the distribution of the series is less peaked relative to the normal distribution. Finally, we may accept the assumption that the underlying series is normally distributed if the probability value of the Jaque-Bera statistic is greater than the significance level (in this case, 0.05). Thus, on the basis of the rule, it can be said that the series are normally distributed.

Stationarity Test Result

The test tries to examine the property of the variables. It is used for the presence of unit root i.e. to check for the stationarity of the variables. This test is carried out using the Augmented Dickey Fuller (ADF) test. This is the first test that is to be carried out. $I(1)$ $I(0)$



Table 2: Stationarity Test Result

Variables	ADF statistics	test	Critical Value of 5%	Prob. Value	Order of Integration
GDP	-2.960411		-2.911615	0.0455	I (1)
CO ₂	-6.340819		-2.960411	0.0000	I (1)
GCFC	-6.621081		-2.945842	0.0000	I (1)
UNEM	-3.464117		-2.971853	0.0169	I (0)
TROPNS	-3.111127		-2.957110	0.0357	I (0)

Source: Researchers Computations, 2025 Using E-views 10

From the result above using Augmented Dickey Fuller unit root test, it can be seen that unemployment (UNEM) and trade openness (TROP) were stationary at levels, Gross domestic product (GDP), CO₂ emission (CO₂) and gross fixed capital formation (GCFC) were stationary at first difference. The stationarity was determined at 5% level of significance.

Given the result of the unit root tests which shows that all the variables are not stationary at level, but instead a combination of I (1) and I (0) series, therefore the most appropriate test of co-integration is the Autoregressive Distributed Lag (ARDL) Bound Test of co-integration. This is employed for the model in this study. The null hypothesis indicates that, there is no long-run relationship between the dependent and independent variables. The decision rule is to reject null hypothesis when F-statistics of the test is greater than the Critical Value of Upper Bound at a chose level of significance i.e (5% for this study). On the other hand, the null hypothesis is accepted when the F-statistics is less than that of the Critical Value of the Lower Bound. When the F-statistics falls between the upper and the lower bound, it then means that the test is considered inconclusive.

Table 3: ARDL Bound Test Result

F-Bound Test		Null Hypothesis: No levels relationship		
Test Statistics	Value	Signif.	I (0)	I (1)
F-statistic	12.59922	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Researchers Computations, 2025 Using E-views 10

However, the result of the test above indicates that the F-statistics of the variables is 12.59922 with 5% Critical Values of the Lower Bound 3.49 and the Upper 2.56 respectively. This shows that the F-statistics 12.59922 is greater than the Critical Values of both the lower and the Upper Bounds in the model. This implies the rejection hypothesis, while alternative hypothesis is accepted. Hence, the test shows that there is co-integration (long-run relationship) between the variables under consideration.

Estimated ARDL Model Test

Table 4: ARDL Test Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Short run relationship				
C	6031.060	3744.185	1.610780	0.1193
GDP(-1)	0.053630	0.024404	2.197602	0.0371
CO ₂	-0.024068	0.029152	-0.825587	0.4166
GCFC	0.075198	0.333757	0.225309	0.8235



UNEM	-1582.722	483.6286	-3.272598	0.0030
TROPNS	4.165739	3.752578	1.110101	0.2771
Long run relationship				
C	-112456.8	69637.84	-1.614880	0.1184
CO2	0.448774	0.503301	0.891661	0.3808
GCFC	-1.402171	6.587785	-0.212844	0.8331
UNEM	29511.86	15379.50	1.918909	0.0660
TROPNS	-77.67549	67.61736	-1.148751	0.2611
R-Squared	0.996564		Durbin watson	1.675205
Adjusted R ²	0.995903			
F-Statistics	1508.190			
Prob(F-Statistics)	0.0000000			

Source: Researchers Computations, 2025 Using E-views 10

The result of the short run and the long run models in Table 4 revealed that the independent variables: unemployment (UNEM), External Reserve (EXTR), gross fixed capital formation (GCFC) and trade openness (TROPNS) explained about 99% of the total variations in Gross domestic product (GDP) while the remaining 1% unexplained is captured by the error term. Considering the Prob (F-statistic) of 0.000000, the entire model is robust. The short run relationship reveal that a unit change in in co2 emission and unemployment led to -0.024068 and -1582.722 unit decrease in Gross domestic product (GDP) respectively, while a unit change in gross fixed capital formation, and trade openness (TROPNS) led to 0.075198 and 4.165739 unit increase in Gross domestic product (GDP) respectively. The Durbin Watson statistic is 1.675205; hence, based on the rule of thumb, the study concluded that there is autocorrelation or serial correlation in the model.

The study based on the long run relationship form of the ARDL model revealed that a unit change in gross fixed capital formation, and trade openness (TROPNS) led to -1.402171 and -77.67549 unit decrease in Gross domestic product (GDP) respectively, while a unit change in co2 emission and unemployment led to 0.448774 and 29511.86 unit increase in Gross domestic product (GDP) respectively.

The result of this study is consistent with the work of Musibau, Shittu and Ogunlana, (2021) and Kartal *et al.*, (2024) which shows that long run relationship exist between environmental degradation and economic growth in Nigeria.

Table 5: Post-Estimation Test Results

Diagnostic Tests Result	F-statistics	Probability
Ramsey RESET Test result	16.69708	0.0004
Serial Correlation LM Test Result	0.298231	0.7448
Heteroskedasticity Test Result: Breusch-Pagan-Godfrey	0.859313	0.5213
Normality Test Result	0.726417	0.695441

Source: Researchers Computations, 2025 Using E-views 10

From Table 4, since the probability value of the Ramsey RESET test, Serial correlation LM test, heteroscedasticity test and the Jarque Bera value are all greater than 0.05 respectively, we therefore accept their null hypothesis and reject the alternative hypothesis respectively and conclude that the functional form of the regression is appropriate, also there is no serial correlation in the model. no heteroskedasticity in the model and the model is normally

distributed. For the observed multi co linearity, this study adopts the solution offered by (Gujarati, 2009, p.342) to do nothing.

Conclusion

The study concluded that there is a long run relationship between CO₂ emission and economic growth in Nigeria, the overall model is statistically significant evidence from the f-statistics of 0.000000 using a secondary data from world development indicator and central bank of Nigeria spanning from 1991-2023. The CO₂ emission and unemployment shows that CO₂ exhibit a negative relationship in the short run and positive relationship in the long run. Gross fixed capital formation and trade openness shows a positive relationship in the short run and negative relationship in the long run. The negative effect of CO₂ and unemployment will lead to an increase in economic growth in the Nigerian economy in the short run, the continuous increase in trade flow and expansion of capital inflow will ultimately lead to an increase in the economic growth in the economy

5.4 Policy Implication of the findings and Recommendations

The results of the study have policy implication which when adopted would go a long way in affecting the Nigeria economy. Based on the findings of this study, the following is therefore recommended:

Export policy that will ease the flow of export and lead to surplus trade should be put in place to encourage local production for export and increase the growth of the economy.

Carbon emission should be highly regulated, incentive for green energy usage should be put in place for firm and transport companies to move from using the conventional fossil fuel to solar energy, gas power generation adoption and electricity expansion usage to stimulate local production in a safe and conducive environment.

Investment in capital importation should be prioritize to expand the production base of the economy.

Employment in critical and productive sector should be prioritize to increase the growth of the Nigerian economy

5.5 Contribution to Knowledge

Study of this nature is key as it contributed to existing body of knowledge. This study contributed to existing knowledge on the analysis of the relationship between CO₂ emission and economic growth in Nigeria, understanding the impact of carbon emission on the growth of the economy is very germane as the government is advocating for a shift from fossil fuel and moving to a more green energy usage, this study helps to enlighten the population on the need to adopt a more green energy to reduce the adverse effect of the emission on climate change.

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