



# CLIMATE CHANGE, GEOPOLITICS AND FINANCIAL RESILIENCE OF SELECTED WEST AFRICAN COUNTRIES (1980-2023)

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**Abstract:** The study examined the impact of climate change and geopolitics on financial resilience of some selected West African countries from 1980 to 2023. The study did an examination of disruptions to ecosystems, global warming occasioned by industrial pollution and how geography, territorial disputes and military conflicts shape the economies of West African states. The purposive sampling method was used for selection of four countries with highest population growth rate in 2024. These selected countries are Nigeria, Ghana, Cote d'Ivoire and Niger republic. The Ex-post facto research designed was used on the secondary data sourced from world development indicator and published articles of other researchers. The study used carbon emission by industrialization, military expenses and economic growth rate to represent climate change, geopolitics and financial resilience respectively, while inflation rate served as a moderating variable. Pre and post estimation tests were carried out to ensure that estimated parameters are valid and reliable. Auto regressive

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distributed lag (ARDL) model was employed for parameter estimation. The specific objectives of the study are: (i) To examine the impact of industrial pollution on economic growth of West African countries, (ii) To assess the impact of territorial dispute and military conflicts on economic growth of West African countries. The study revealed that climate change and geopolitics had a negative and non-significant impact on the economic growth rate of West African countries (1980-2023). The study recommends that targeted policy intervention need to be explored through climate adaptation strategies and geopolitical risk mitigation to counteract the negative impact of economic growth in West African countries.

**Keywords:** Climate Change, Geopolitics, Financial Resilience, Ecosystems, ARDL model

## INTRODUCTION

### 1.1. Background to the Study

West Africa, a region that has historically been vulnerable to environmental and economic shocks, is increasingly facing the dual challenges of climate change and political instability. These pressures are compounded by the region's financial vulnerabilities. The impacts of climate change, coupled with geopolitical factors, significantly affect the financial resilience and long-term stability of countries in the region. Understanding these challenges and their inter-linkages requires an exploration of how environmental changes intersect with political and economic dimensions, particularly in countries such as Senegal, Nigeria, Ghana, Mali, and Burkina Faso. West Africa is one of the region's most vulnerable to climate change, experiencing diverse impacts such as erratic rainfall, rising temperatures, droughts, and sea level rise. These effects are especially pronounced in countries like Senegal, Ghana, and Nigeria, which are directly impacted by these environmental shifts. According to the Intergovernmental Panel on Climate Change (IPCC), West Africa is warming faster than the global average (IPCC, 2021). For instance, the Sahelian region, which includes countries like Mali, Niger, and Burkina Faso, has experienced rising temperatures, with some areas seeing a 1.5°C increase in temperature over the past 50 years (Sivakumar, 2019). This intensifies desertification and affects agriculture, a sector that millions of West Africans depend on.

Rainfall variability is a significant concern, with the region experiencing periods of intense drought followed by heavy, unpredictable rainfall. In Burkina

Faso and Niger, droughts have become more frequent, leading to a decline in crop production (Sivakumar, 2019). Conversely, coastal regions like Ghana and Côte d'Ivoire are experiencing increased flooding due to unpredictable rainfall and sea level rise, affecting agricultural productivity and infrastructure (USAID, 2020). Coastal countries such as Senegal and Ghana are facing rising sea levels, leading to the erosion of valuable land and threatening the livelihoods of millions of people who rely on fishing and coastal tourism (Nicholls & Cazenave, 2010). For instance, in Senegal, the capital city of Dakar has seen significant coastal erosion, leading to the displacement of communities and loss of valuable infrastructure (Toure, 2017). The Sahel region is particularly vulnerable to desertification. In Niger, for example, the expansion of the Sahara Desert is displacing pastoral communities and farmers, reducing the land available for agriculture (Moussa & Maman, 2020). The shift from arable land to desert, exacerbated by climate change, is a serious challenge to food security in these areas.

## 1.2. Statement of the Problem

The geopolitical context in West Africa is shaped by a mix of colonial legacies, political instability, resource competition, and climate change. These geopolitical challenges are intensified by the environmental stresses that many countries in the region face.

Climate change has intensified competition for natural resources, such as land and water. For instance, in the Sahel, particularly in Mali, Niger, and Burkina Faso, conflicts between farmers and herders over access to increasingly scarce water and grazing land have become more pronounced (Funk *et al.*, 2019). These resource-based conflicts have led to violent clashes and destabilized communities, further complicating governance efforts.

Climate-induced migration is another key geopolitical issue. In countries like Burkina Faso, Mali, and Chad, environmental degradation and violent conflict are forcing people to migrate, both internally and across borders. As a result, neighboring countries such as Mauritania and Niger are seeing an increase in climate refugees (UNHCR, 2021). This displacement exacerbates existing tensions in host countries and adds pressure to their already fragile economies.

The region's political instability is further exacerbated by climate change. Countries like Mali and Burkina Faso have faced coup d'états and insurgencies, where climate-related factors such as resource scarcity and food insecurity have

played a role in destabilizing these governments (Uppsala Conflict Data Program, 2021). The fragility of these states makes it harder for governments to address the multidimensional challenges posed by climate change. Nigeria has faced challenges due to insurgencies, corruption, and governance inefficiencies, which have weakened investor confidence and currency stability (Adebayo, 2021).

The West African region has made efforts to tackle climate change and its geopolitical consequences through organizations such as the Economic Community of West African States (ECOWAS). However, the success of regional cooperation has often been limited by political fragmentation and a lack of financial resources (ECOWAS, 2018).

The financial resilience of West African countries is critical to their ability to respond to climate change impacts. Several countries in the region have economies that are heavily reliant on agriculture, which is highly vulnerable to climatic changes, and their financial systems often lack the capacity to cope with large-scale climate shocks.

West African countries are highly dependent on agriculture, which accounts for a significant portion of GDP and employment. However, due to increasing frequency of extreme weather events, such as droughts and floods, agricultural productivity has been erratic. For example, Nigeria's agricultural sector, which employs over 70% of the population, faces reduced yields due to both flooding in the south and desertification in the north (IFPRI, 2019).

Many countries in the region are also heavily indebted. According to the World Bank, Ghana's public debt as a percentage of GDP surpassed 70% in recent years, and this is compounded by the need to fund climate adaptation strategies (World Bank, 2021). Climate-induced shocks often worsen fiscal deficits, as governments struggle to finance recovery and resilience-building initiatives. Insurance mechanisms in West Africa are limited, and few countries have comprehensive climate risk financing tools in place. Ghana has been a leader in experimenting with climate insurance products, but such schemes remain underdeveloped in the broader region (Kuyini *et al.*, 2020).

### **1.3. Objective of the Study**

The study examined the impact of climate change and geopolitics on financial resilience of some selected West African countries from 1980 to 2023. The specific objectives of the study are:

### Specific Objectives

- (i) Assess the effect of carbon emission on the gross domestic product of some selected West African countries from 1980 to 2023
- (ii) Examine the effect of military expenses on gross domestic product of some selected West African countries from 1980 to 2023.

### Research Hypothesis

- (i) Carbon emission have no significant effect on the gross domestic product of some selected West African countries
- (ii) Military expenses have no significant effect on the gross domestic product of some selected West African countries

## 2. REVIEW OF RELATED LITTERATURE

### 2.1. Conceptual Review

**2.1.1 Climate Change:** Climate change refers to long-term shifts in global or regional climate patterns, primarily driven by human activities such as burning fossil fuels, deforestation, and industrial pollution. This leads to global warming, rising sea levels, extreme weather events, and disruptions to ecosystems and economies. Key issues include: Carbon emissions and greenhouse gases, Rising temperatures and melting ice caps Natural disasters (hurricanes, wildfires, droughts), Impact on agriculture, water resources, and human health, and Climate policies and agreements (e.g., Paris Agreement)

**2.1.2 Geopolitics:** The term “geopolitics” is a multidimensional concept that has traditionally been used to describe the practice of states to control and compete for territory, although in recent decades, power struggles for other reasons (such as trade or politics) and of a diverse set of agents—including corporations, rebel groups, and political parties—have also been considered as part of geopolitics. See Caldara and Iacoviello (2022) and references therein. 2An escalation of geopolitical tensions could lead to countries imposing policy measures that restrict the cross-border flow of goods and services, capital, labor, and technologies with rival countries, resulting in increased fragmentation across countries. Such fragmentation may entail strategic advantages for individual countries but is likely to impose significant economic costs in the aggregate (Aiyar *et al* 2023).

Some countries could emerge as beneficiaries of rising global geopolitical tensions by attracting new capital. However, as noted earlier, the macro-financial implications of such capital are likely to depend on countries' absorptive capacity and policy frameworks as well as the stability of such flows (Ghosh, Ostry, and Qureshi 2017).

**2.1.3. Financial Resilience:** Financial resilience refers to the ability of a country's financial system to withstand shocks and maintain stability (World Bank, 2021). In West Africa, geopolitical factors such as regional conflicts, trade policies, and international relations play a crucial role. Political stability is a major determinant of financial resilience. Countries with stable governance structures, such as Ghana, tend to attract more foreign direct investment (FDI) and maintain stable financial systems (Asongu & Odhiambo, 2022).

**2.1.4. Inflation Rate:** This pertains to the percentage alteration observed in a price index during a specific timeframe (Wikipedia, 2017). In accordance with this delineation, inflation rate is described as the percentage escalation in prices of a particular dataset compared to the preceding year. (Oleka, Eyisi, and Onyeze, 2014). Onwumere and Suleman (2010) delineated three primary classifications of price indices commonly utilized for evaluating inflationary trends within an economy, namely the consumer price index (CPI), the wholesale price index (WPI), and the implicit price index (GDP deflator). The impact of inflation rate on macroeconomic performance can be adverse as it disrupts exchange mechanisms in a decentralized market economy (Quamrul, Boris, and Peter, 2016). Supporting this claim, Heimann and Leijonhufud (2015) suggest that inflation rate could hinder the market mechanisms that coordinate economic activities. Quamrul *et al.* (2016) reveal that the trajectory of the inflation rate substantially impacts economic performance, illustrating that subdued inflation rates can alleviate instability in the economy.

## 2.2. Theoretical Framework

The study is anchored on vulnerability and resilience theory by C.S Holling (1973). He introduced the concept of ecological resilience through the classification of systems that absorbed disturbances and the ones that can-not but ready to shift into new state. It explains how countries, institutions and economies respond to external shocks occasioned by climate change. This helps

the West African countries to manage their financial system against external shocks especially climate related risks.

Geopolitical tensions could affect financial stability through several other channels. Non-traditional risks such as cyber-security risks may increase as a result of geopolitical tensions, threatening macro-financial stability. Geopolitical tensions and financial fragmentation may also split commodity markets along geopolitical lines and make it more difficult to address climate change, which requires international cooperation to set country-level greenhouse gas reduction commitments as well as deeper global financial integration to support the needed investments to mitigate and adapt to climate change (Rajan 2022; Aiyar and others 2023).

### ***2.2.1. Resilience in the Context of Climate Change and Geopolitics***

Resilience refers to the capacity of individuals, communities, or systems to adapt to and recover from environmental, social, or economic shocks. In the context of climate change, resilience involves the ability to withstand or recover from climate impacts through adaptive strategies, such as improved infrastructure, disaster preparedness, and climate-smart agriculture. In West Africa, financial resilience is a critical aspect of coping with the impacts of climate change. Many countries in the region, such as Ghana and Nigeria, rely heavily on agriculture, which is particularly vulnerable to climate change. The inability to diversify economies beyond agriculture or adapt agricultural practices to the changing climate further exacerbates vulnerabilities (IFPRI, 2019).

Building resilience in West Africa requires a multifaceted approach that addresses both climate and geopolitical challenges. This includes strengthening institutional frameworks, enhancing regional cooperation, and securing financing for adaptation measures. However, financial resilience in the region remains weak due to high levels of debt and limited access to climate finance. For instance, Ghana's public debt, which has exceeded 70% of GDP, constrains the government's ability to invest in climate adaptation and resilience measures (World Bank, 2021). Furthermore, the lack of access to insurance mechanisms and climate risk financing in many West African countries means that the financial systems are ill-equipped to handle the large-scale economic shocks caused by climate-related events (Kuyini *et al.*, 2020).

International cooperation and support are essential to enhance resilience in West Africa. Climate financing mechanisms, such as the Green Climate Fund, have been introduced to provide financial resources to developing countries for adaptation and mitigation projects. However, these funds are often insufficient and slow to be disbursed, limiting the ability of countries to take timely action (Fenton & Dable, 2020). Thus, while resilience-building efforts are underway, they face significant obstacles related to governance, funding, and regional cooperation.

### **2.3. Empirical Review**

Griffin's 2023 work examined how climate-change-related extreme weather events affected business performance, firm value, what companies told their shareholders, and the fees companies paid to their auditors. He established that companies disclose little about the impact of wildfires despite this being a growing environmental threat and a material concern for many companies. Furthermore, he found that auditors charge higher fees when extreme weather impacts their clients and that stock markets are increasingly recognizing heat spells as a material risk factor, which is a threat to their market value. He has also studied whether investors distinguish between shareholder proposals on climate change that increase versus decrease firm value, finding indicate that investors are willing to accept lower returns for proposals designed to reduce carbon emissions or meet other sustainability objectives Taken together, this work has implications for disclosure regulators in deciding what should be reported to stakeholders on how firms contribute to climate change and how climate change affects firms.

In the investigation by Wang *et al.* (2023), an examination was conducted on the carbon dioxide emissions related to net energy in China. Through empirical evidence, it was substantiated that the advancement of green energy positively impacts industrial productivity within the country. Similarly, the study by Zhang *et al.* (2023) affirmed the favorable influence of green energy reservoirs on the expansion of agricultural land in China. The enhancement of agricultural land via policy interventions could be further reinforced by the incorporation of renewable energy sources. A review of recent studies indicates that numerous inquiries have been carried out on green finance in China; however, it is noted that these analyses lack practical guidance for policymakers.

Hou *et al.* (2022) have demonstrated that the influence of green financing on climate challenges in China significantly varies across different provinces.

The empirical study carried out by Abdulahi and Laou, 2020 on the impact of military expenses on gross domestic product of West African countries using a sample size of 15 West African countries, from 1980 to 2015. Their panel data were estimated using fixed effect model. Their findings suggested a non-significant impact of military expenses on GDP in most of the countries within the sample. This suggested that despite the substantial budget allocations to military spending, these expenditures do not have a measurable or meaningful impact on economic performance of the region.

**The Research Gap:** Several studies in this context concentrated on climate change and financial resilience or geopolitics and financial resilience but the study included geopolitics on climate change and financial resilience as an indispensable factor, playing some significant roles in every open economy where international trade, boundary adjustments, conflict resolutions caused by international politics are unavoidable among countries with common interest.

### 3. METHODOLOGY

#### 3.1. Research Design

The study used ex-post facto research design based on the historical data sourced from world development indicator and other published online materials. These are secondary data which can not be manipulated or compromised to achieve selfish desire.

#### 3.2. Model Specification and Modification

### 4. DATA PRESENTATION (USING TABLES)

#### 4.1. Unit Root Test

##### Statement of Hypothesis

$H_0$ : Series has a unit root

$H_1$ : Series has no unit root

Decision: Reject the null hypothesis if the probability value of Levin, Liu and Chu is less than 5% level of significance, otherwise accept the null.

**Table 4.1: Unit Root Table**

<i>Variables</i>	<i>ADF stat</i>	<i>5% critical V</i>	<i>P-value</i>	<i>Order of Dif</i>
CO2_IND	-2.044150	-1.942655	0.0396	1(0)
GDPGR	-8.956208	-2.877919	0.0000	1(0)
LNMLEXP	-12.38831	-3.440894	0.0000	1(1)
INFL	-4.700130	-2.878015	0.0001	1(0)

Source: Researchers computation

Table 4.1 displayed the stationary levels of all the estimated variables which either at levels or at difference order one where observed to be stationary .The augmented dickey fuller statistic is more negative than the critical values at 5% level of significance if we look at the corresponding probability values of each variables .

## 4.2. Co-integration Test and Error Correction Model

**Table 4.2: Bounds Co-integration and ECM Table**

	<i>F-stat</i>	<i>i(0) bound</i>	<i>i(1) bound</i>	<i>@ 5%</i>
<b>Co-int. test</b>	14.36	2.79	3.67	Co-integrated
	CointEq (-1)*	Coefficient	t- Stat	@ 5%
ECM		-0.64	-8.5864	0.0000

Source: Researchers computation

Table 4.2 showed the bounds co-integration and the speed at which the deviations in the short run are adjusted for. The outcome of f-statistic, the i(0) bounds value and the i(1) bounds value,14.36 ,2.79 and 3.67 respectively. We noticed that the value of the F-statistic (14.36) is greater that i(1) bounds therefore long run relationship exist among the variable. This implied that any deviation in the short run can be corrected in the long run at a significant peed of 64% .

## 4.3. Parameter Estimation

**Table 4.3: ARDL model Table**

<i>Variables</i>	<i>Coefficients</i>	<i>t-stat</i>	<i>p-values</i>	<i>Prob(F)</i>	<i>DW stat</i>	<i>R<sup>2</sup></i>
Co2_ Indus(-1)	-0.258822	-0.58259	0.5611	0.001768	1.99	0.54
LnMilexp(-1)	-0.028844	-0.07756	0.9383			
Infl (-1)	0.050656	1.725918	0.0865			

Source: Researchers computation

The coefficients of the explanatory variables in Table 4.3 are negatively signed (-0.258822 and -0.028844), while the control variable (inflation rate) had a positive coefficient value of 0.050656. The corresponding probability values of t-statistics are not less than 5% .The overall regression is statistically significant using the probability value of f-statistic. There is no evidence of serial auto correlation as the Durbin Watson statistics is 1.99.

#### 4.4. Ramsey Reset Test

Statement of hypothesis in null and alternate form

$H_0$ : the model is correctly specified and no relevant variables or non-linearities have been omitted.

$H_1$ : the model is mis-specified either due to omitted variables or an incorrect functional form.

Decision: Reject the null hypothesis if the probability value of t or f statistic is statistically significant (less than 5% level of significance), otherwise accept the null.

**Table 4.4: Post Estimation Table (Ramsey reset test)**

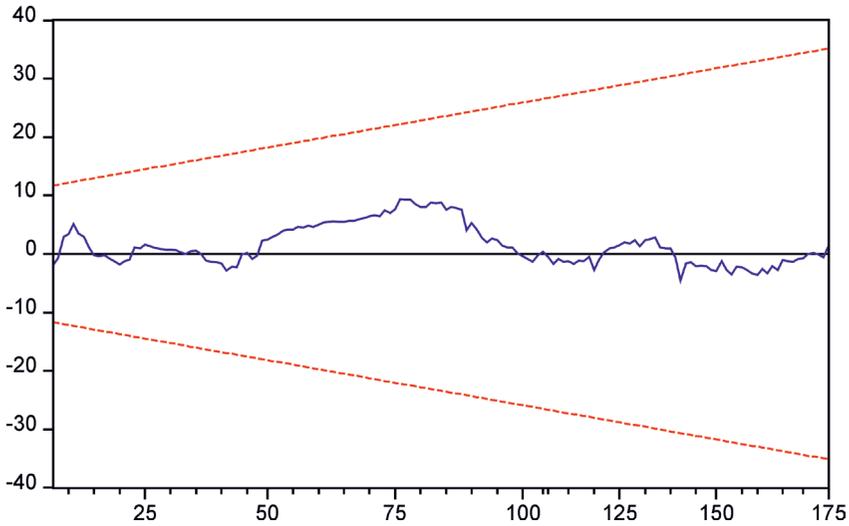
<i>ARDL model</i>	<i>t-stat (value)</i>	<i>f-stat(value)</i>	<i>df</i>	<i>p-value (t)</i>	<i>p-value (t)</i>
Gdpgr=f(co2_ indus,lnmiexp,infl	0.423718	0.179538		0.6724	0.6724

Source: Researchers computation

The post estimation test using Ramsey reset test is to ensure that parameters used for the regression is appropriate or not wrongly specified. Table 4.4 disclosed that the probability value of t-statistic and f-statistic are greater than 5% level of significance: therefore the null hypothesis is accepted stating that the model is correctly specified and no relevant variables or non-linearity have been omitted

#### 4.5. Parameter Stability Test (CUSUM test)

Figure 1 displayed the graphical movement of all the parameters jointly tested using cusum test. The blue line which represents CUSUM failed to cross the two red lines (5% significance) which means that estimated parameters are stable over the long period as there is no evidence of deviation over the period under study. This implied that from the point of origin or the base year of our study, to the end, we noticed that move in-between the 5% red lines is stable.



**Figure 1: Parameter stability graph**

#### **4.6. Discussion of the Findings**

Carbon emission as one of the industrial pollutions that constitute to environmental challenges were observed to have a non -significant impact on gross domestic product of some selected countries in West Africa. The result is in line with the reports on Economic Development in Africa ,exploring the factors that contributed to slow industrialization by the United Nations Conference on Trade and Development (UNCTAD)

Military expenses had a non -significant impact on the gross domestic product of some selected West African countries as evidenced by the study. similar to the study conducted by Abdulahi and Laou ,2020 on the impact of military expenses on gross domestic product of West African countries using a sample size of 15 West African countries, from 1980 to 2015.Their panel data were estimated using fixed effect model .Their findings suggested a non -significant impact of military expenses on GDP in most of the countries within the sample. We used different model (ARDL), different period of the study though had a sample size as a sub set of their sample and similar result.

### **5. SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

- (i) Carbon emission had a non -significant impact on the GDP of the selected West African countries.

- (ii) Military expenses had a non-significant impact on GDP of the selected African countries

## 5.1. Conclusion

Both carbon emissions and military expenses had a non-significant impact on the GDP of the selected West African countries. This could highlight the need to consider other variables, such as governance, infrastructure, or external trade relationships, when analyzing economic growth in these regions. Future research may explore other factors that contribute more substantially to GDP growth in these nations.

## 5.2. Recommendation

Based on the outcome, it is recommended that policymakers focus on other critical factors, such as infrastructure development and governance, to stimulate economic growth in West African countries.

Additionally, reallocating military spending to sectors like education and healthcare could potentially foster more significant and sustainable economic development.

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