

# Effects of Foreign Direct Investment on Environmental Quality in West Africa

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## Abstract

Foreign direct investment (FDI) has played a key role in the growth and development of developing economies. However, one prominent opposing question about foreign direct investment is whether it is a blessing or a curse to the natural environment of the host country. Despite the existing theoretical ambiguity on FDI-environmental quality nexus in West Africa, few studies conducted in the area have not considered all the sixteen West African countries. Again, these studies did not extend the argument to cover the pollution haven hypothesis (PHH) to determine whether emission in the sub-region is attributed to domestic industries or pollution-induced multinational companies. This is the knowledge gap that this research seeks to address. Specifically, this research examines the effect of foreign direct investment (FDI) on environmental quality in West Africa and also tests empirically the existence of the pollution haven hypothesis. Using carbon dioxide emission as a proxy for environmental quality, this study employs the random/fixed effects model on ten-year panel data for all the sixteen countries in West Africa. Parallel to the Sustainable Development Goal (SDG) 13, examination of these issues is of great importance as it will help save the environment from the concomitant effects of climate variations and also enlighten policymakers with concrete knowledge as to whether domestic industries or influx of multinational companies is the source of emissions level in West Africa.

**Key words:** Foreign Direct Investment, Environmental pollution, Pollution Haven Hypothesis, Climate Change, West Africa

## Introduction

The quest to preserve the quality of the environment has become a necessity in the 21st Century. This is due to numerous adverse effects of increased levels of carbon dioxide, the main constituent of greenhouse gases (GHGs) which causes global warming (Ciais et al. 2013; Danso-Mensah, 2015). Global warming causes temperature rise and results in negative effects of climatic conditions. Though natural occurrence poses a threat to the environment, the alarming rate of environmental challenges are anthropogenic-based (Kula, 1998).

According to Zugravu-Soilita (2017), the activities of multinational companies (MNCs) through foreign direct investment (FDI) predominantly contribute to the increased emissions level of greenhouse gases and

other pollutants that causes climate change. Specifically, countries endowed with natural resources and with lax environmental regulations often experience an increase in carbon dioxide emissions levels via FDI. This asserts the prediction that GHG emissions and other ozone-depleting gases emission could rise from 25% to 90% between the years 2000 and 2030, putting the host country into numerous health challenges from the concomitant effects of climate change (Sarkodie, 2018).

In these current environmental challenges, research by Fankhauser and Mcdermott (2014) has suggested that developing countries, especially in Africa are at a high risk of climate change effects as compared to the developed industrial countries. The factsheet presented after the United Nations Climate Change Conference in Nairobi, 2002

reported that Africa is already experiencing a temperature rise of approximately  $0.7^{\circ}\text{C}$  from 1990 to 2000 and this has led to a reduction in food production, floods, drought, and loss of biodiversity.

Despite the relatively low emissions rate in the West African sub-region to the global emissions level, West Africa has not been spared of climate challenges. However, existing literature on environmental quality such as Demena & Afesorghor (2020) has revealed that West Africa's  $\text{CO}_2$  emissions could be attributed to the influx of multinationals that invest in the sub-region.

It is also noted that for many decades West African countries have not saved enough, making private foreign capital the main source of capital for investment (Kamara, 2013). The average foreign direct investment inflow of US\$2,126.991million recorded between 1990 and 2000 consistently increased to US\$6,494million between 2000 and 2010, and further to US\$13,373million between 2010 and 2020 (UNCTAD, 2020). Foreign direct investment has numerous positive effects on the host country; providing direct capital financing, job creation, and positive externalities like managerial skills and technology transfer (Lee, 2013).

Multinational companies (MNCs) in West Africa mostly invest in the extractive and manufacturing subsectors. The activities of these MNCs benefit the host country in diverse ways but also emit various greenhouse and ozone-depleting gases like carbon dioxide, sulfur dioxide, chlorofluorocarbons (CFCs), etc, which are the source of global warming that result in climate change in West Africa (Brown, 2014). In line with this, Fauzel et al. (2016) reiterated that the human and industrial activities of multinationals have significantly given rise to  $\text{CO}_2$  emissions in the past century. Increased global warming causes a rise in temperature above the normal level which results in climate change effects. Though there is an inconclusive view on the environmental effect of FDI (Ning & Wang (2017; Ndeffo et al. 2018), it is empirically proven that FDI significantly affects carbon dioxide emissions

(Jayanthakumaran et al., 2012; Twerefou et al. 2017; Abokyi et al. 2019) and as such, the intensity of  $\text{CO}_2$  emission captured in the activities of extractive and manufacturing sectors FDI cannot be overlooked.

In analyzing the FDI-environmental quality relationship, Elliott & Shimamoto (2008) have revealed that to increase FDI inflows in developing countries, such countries have to leverage their stringent environmental regulations. This makes them havens of pollution from MNCs. This forms the basis of the pollution haven hypothesis (PHH) where multinationals who find it difficult to internalize environmental pollution in their parent country relocate part of their plant in developing economies with lax environmental regulations and standards to pollute.

While some schools of thought argue that the environment will only experience betterment when a country develops through opening up of the economy (Antweiler et al., 2001; Twerefou et al. 2015), others posit that the increase in production and other economic activities from multinationals generates a larger quantity of waste products that deteriorates the environment (Meadows et al., 1972; Dumrul & Kilicarslan, 2017; Assamoi et al. 2020). Though some recent works on FDI-environment nexus have used updated data and also extended the relationship to analyze the existence of PHH empirically, most of them are either at the global level (Cai et al. 2018; Yoon & Heshmati 2017) or the sub-regional level (Gharnit et al. 2020). This is very little on the topic in the case of West Africa. One study that focused on West Africa is Awodumi (2020). However, the study focused on eight out of the sixteen West African countries and did not test for the existence of PHH. This study adds to the literature by taking into consideration all the sixteen countries in West Africa as well as testing comprehensively for the pollution haven hypothesis (PHH) using carbon dioxide as a proxy for environmental quality.

The continuous attempt of West Africa to catch up with the developed world through industrialization is in part the reason for the sub

region’s increasing greenhouse gas emissions specifically carbon dioxide emissions (Ameyaw & Yao, 2018). This agendum taken as a lighter issue by West Africa has heinous effects on the environment, threatening its future sustainability. Policies, regulations, and actions to protect the environment should be treated with urgency as the economy thrives through financial development (FDI inflow).

**Materials and methods**

*Empirical Model Specification*

The literature surrounding the environmental impacts of FDI mostly adopts the structural equation that links environmental pollution to its determinants (Stern 2004). The study follows the standard CO<sub>2</sub>-FDI regression model in equation 1.

$$lnCO_{2it} = \alpha + \beta_1 lnFDI_{it} + \beta_2 lnGDPPC_{it} + \beta_3 ln\frac{K}{L}_{it} + \beta_4 lnHAVEN_{it} + \beta_5 lnDD_{it} + \mu_{it} \dots (1)$$

where CO<sub>2it</sub> is the proxy for the environmental quality variable, measured by CO<sub>2</sub> emission per capita (CO<sub>2</sub>) in metric tons. According to Sanglimsuwan(2011), CO<sub>2</sub> is a global indicator for measuring environmental quality because it is the major greenhouse gas (GHG) emitter contributing almost 72%. FDI<sub>it</sub> represents foreign direct investment as a percentage of GDP. This is because 70% of FDI inflow to the West African sub-region goes to the extractive and the industrial sub-sectors.

GDPPC<sub>it</sub> is the gross domestic product per capita. Following Twerefou et al. (2017) to

measure the level of income in West Africa, GDPPC is used as a proxy for the income level of residents in West Africa. The DD<sub>it</sub> represents the degree of democracy in West Africa. This represents the gross capital formation per labour ratio. The HAVEN<sub>it</sub> represents the interaction term between trade openness and per capita GDP. The interaction term captures the existence of PHH or otherwise. The μ<sub>it</sub> represents a stochastic error term assumed to be normally distributed with zero means. While α represents the individual fixed effect, β<sub>1</sub> to β<sub>5</sub> measures the estimated parameters.

*Data and Variables*

The study sourced a 10-year (2010-2019) panel dataset of all 16 West African countries from World Development Indicators (WDI) and the Integrated Network for Societal Conflict Research (INSCR). The dependent variable

adopted for the study is carbon dioxide emissions (metric tons per capita) as a proxy to measure environmental quality. Explanatory variables are the foreign direct investment (FDI net inflows as a percentage of GDP) and HAVEN (Interaction of trade openness and per capita GDP). The study control for gross domestic product per capita (GDPPC- GDP per capita) and capital-labour ratio ( $\frac{K}{L}$ ) which is the ratio of gross capital formation and total labour force so as governance proxy, degree of democracy (DD)( Ranges from -10 to 10 with higher values indicating increasing

**TABLE 1**  
Variable expected signs and data source

No.	Variable	Expected Sign	Source
1	CO <sub>2</sub>		WDI data
2	FDI	+/-	WDI data
3	GDPPC	+	WDI data
			Authors
		+/-	computation on
4	K/L		WDI data
5	DD	+/-	INSCR data
6	HAVEN	+/-	Authors computation from WDI data

democracy ) which affects the environmental quality (Buitenzorgy & Mol, 2011; Sulemana et al., 2016).

#### *Estimated Technique*

The model specified above is perceived to fail the five assumptions that hold for ordinary least squares (Linearity, exogeneity, homoscedasticity, non-autocorrelation, full rank, or non-multicollinearity and non-stochastic independent variable) analysis where individual effects do not matter. Following Wooldridge (2010), panel data is ideal for the measurement of relationships that cannot be explored by specific time series analysis or cross-section model analysis. The study employed a fixed and random effects model because it caters for individual time effect (Danbolt, 2004), corrects for heteroscedasticity problems (Gujarati & Sangeetha, 2007) and also corrects for models with huge standard errors and small test statistics.

### **Results and Discussion**

The study presents the random GLS results for discussion.

#### *Discussion of Results*

There is a positive relationship between FDI and per capita carbon dioxide emission levels. This can be interpreted as all other things being

equal, per capita CO<sub>2</sub> emissions increases as foreign direct investment increases. Thus, an increase in foreign direct investment decreases the quality of the environment and increases environmental deterioration. The results reveal that FDI is positive and significant at 5%. Specifically, an increase in West Africa's FDI inflow by 1% increases per capita carbon dioxide emission by 0.0462% representing a weak significant value. The positive coefficients might be as a result of numerous emissions from multinational companies in West Africa (Eluka, 2016; Ouoba, 2017). This stems from the quest of West Africa to improve its economy through trade openness that brings in foreign direct investment (Antweiller 2001). This result posits that activities of multinationals that increase the emissions level in developing countries with less stringent environmental standards are a function of foreign direct investment (Ferdausy & Rahman, 2009). Thus, West Africa accepts FDI to develop the sub-region while doing little to control the negative impact this might have on the natural environment. In line with this, Ouoba (2017) indicated that the government of Mali has not done so much to control the environmental challenges of FDI in the country, Anekwe (2018) and Osuagwu & Obumneke (2013) also noted that this case is not different in Nigeria. This weakens the ability of the sub-region to protect its environment.

Again, increased emission in West Africa as

**TABLE 2**  
Random Effects GLS Regression Model Results

Variables	Coefficient	Standard Error	z-Statistic	p-values
<b>lnCO<sub>2</sub></b>				
lnFDI	<b>0.0462**</b>	(0.0218)	[2.12]	<b>0.034</b>
lnGDPPC	0.0260	(0.0239)	[1.09]	0.276
lnK/L	0.0113	(0.0123)	[0.92]	0.356
lnHAVEN	<b>0.0031**</b>	(0.0015)	[2.05]	<b>0.041</b>
lnDD	<b>0.0728*</b>	(0.0441)	[1.65]	<b>0.099</b>
Constant	<b>-0.7047***</b>	(0.1156)	[-6.10]	<b>0.000</b>
Number of Obs = 160	<b>Wald Chi2(14) = 877.60</b>			
Number of groups = 16	<b>Prob &gt; chi2 = 0.0000</b>			
<b>Obs per group:</b>	sigma_u	= 0.40001986		
Minimum = 10	sigma_e	= 0.06516332		
Average = 10	rho	= 0.9741495		
Maximum = 10	Corr( u_i , X)	= 0( assumed)		

**Source:** Author's Estimation with data from World Bank's WDI and INSCR data

\*\*\*, \*\* & \* denote 1% and 5% and 10% level of significance respectively

a result of FDI-inflows may be caused by the failure of some environmental authorities and protection agencies in the sub-region to perform their duties effectively. It could also be attributed to the lax environmental regulations found in West African countries. This may suggest that governments in the sub-region are focused on FDI to improve growth but doing less in protecting the negative effect on the environment. The result is in line with the findings of Maku et al. (2018) which established that FDI-inflow increases carbon dioxide emission in Nigeria. Again, Abdouli and Hammami (2017) also examined the environmental performance of foreign direct investment in the Middle East and North African (MENA). Their study concluded that FDI-inflow harms the natural environment. On the other hand, the result is in contrast to the findings of Mabey & McNally (1999) who argued that updated technology in recent production is moving the economy from pollution haven to pollution halo and sustainable development. Also, Paziienza (2015) revealed that FDI is beneficial to the natural environment of the OECD countries. The result of this study opposes the finding of Demena & Afesorbor (2020) who found that FDI is beneficial to environmental quality in West Africa.

The positive coefficient of HAVEN 0.0031 implies that the pollution haven hypothesis exists in West Africa. This could be attributed to high emissions from industrial operations from multinational plants and machinery. From Table 2, the HAVEN variable is positive and significant at 5%. To be more specific, this means *ceteris paribus*, a percentage increase in multinational industries in West Africa increases carbon dioxide emission by 0.0031 percent. This confirms the PHH that multinational companies relocate from the developed world of stern environmental regulations to pollute in developing countries with lax environmental regulations (Baghebo & Apere, 2014; Grether et al., 2012). This finding corroborates that of Solarin et al. (2017), Yu (2019), To et al. (2019) and Gharnit et al. (2020) who also validated the PHH that

multinational companies from the developed countries with stringent environmental standards relocate part of their activities into developing countries with lax environmental regulations and this increases the emission level of the developing countries. In contrast to the result of the study is the finding of Mert and Caglar (2020) and Salehnia et al. (2020) who rejected the PHH.

### Conclusion

The attention in the literature is on the Environmental Kuznets Curve (EKC) hypothesis that it is the growth of an economy that degrade the natural environment, without addressing the negative effects of some multinationals in the sub-region (PHH). This particular study considers all the sixteen countries in West Africa to examine FDI-environmental quality nexus and also extend the debate to prove the PHH. The study concludes that FDI inflow to West Africa harms its natural environment. It also indicated that the pollution haven hypothesis exists in West Africa. The study, therefore, recommends that in as much as West Africa aims to boost growth through FDI inflow it is prudent that regional policymakers, government, and environmental protection agencies, non-governmental organizations (NGOs) among other stakeholders ensure that environmental quality rules and regulations are intensified and strictly adhered to so that the sub-region will not suffer increased environmental degradation. The study also recommends that the Economic Community of West Africa States, West Africa Science Service Centre on Climate Change and Adapted Land Use (WASCAL), Partnership for Environmental Governance in West Africa (PEGWA), and others should treat environmental issues with a high level of interest and sense of urgency and also supervise the activities of multinationals in the sub-region. There should be a complete ban on the importation and use of plants and machinery that are obsolete by multinational companies to reduce emissions. The study

also suggests that modern and pollution-free technology should be used by firms in West Africa during production while effecting ban on the activities of subsidiary firms engaged in illegal mining (*galamsey*). Again, the study recommend a scrutiny into the operations of multinationals engaged in recycling of scrap materials to maintain pollution threshold less harmful to the natural environment.

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