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The Impact of Environmental Regulations on Foreign Direct Investment: Evidence from an Emerging Economy

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Abstract

The study investigated the impact of environmental regulations on foreign direct investment: Evidence from an emerging economy. Data from 2005 to 2023 was employed in the study. The Granger causality and ordinary least square (OLS) technique, was used to estimate the data. The finding showed that environmental regulation granger cause foreign direct investment, but foreign direct investment does not environmental regulation. There is a bi-directional causal relationship between carbon emission and FDI. It is observed that GDP granger cause FDI but FDI does not granger cause GDP. Also, environmental regulation impact FDI negatively and statistically insignificant. A negative insignificant relationship between carbon emissions and FDI is observed. A negative and significant relationship exist between GDP and FDI. Based on the findings from the study, the following recommendations are made; policymakers should focus on improving the regulatory environment in ways that encourage sustainable development, policymakers should consider improving factors like infrastructure, human capital, and business environment to offset the negative relationship between GDP and FDI in order to attract more foreign investments.

1. Introduction

The urgent and growing concerns about the environment and climate change necessitates the interconnection between environmental policy and the attraction of foreign direct investment is imperative. The United Nations Environment Programme (UNEP), assert that environmental regulations are policies and legal instruments established by governments to protect the environment, human health and natural resources; these regulations aim to prevent or minimise pollution, waste and other harmful effects on the environment caused by human activities. Environmental regulations hold a crucial position in ensuring the sustainable growth of a country's economy, as well as in creating a favorable business environment. Consequently, national governments are encouraging investment in significant ventures of polluting industries, with the objective of curtailing carbon emissions (Melega, 2022) [9]. If the location of multinational enterprise (MNE) activity can change due to environmental regulations, bringing environmental policies under the purview of existing institutional structures, such as the national constitution, may be necessary to achieve the goal of pollution abatement (Huang, 2020) [7].

The United Nations has called for action against climate change in Goal 13-one of its 17 Sustainable Development Goals (SDGs). Also, the Paris Agreement, a legally binding international treaty on climate change, has been agreed upon among 196 parties to limit the global average temperature to well below 1.5 °C (UNFCCC, 2024) [13]. The Organisation for Economic Cooperation and Development (OECD) countries have been at the forefront of these actions in response to environmental degradation. With the urgent need to turn environmental ambitions into concrete outcomes, the OECD countries have been using their climate-related experience to increase their contribution towards global climate goals. They are committed to the SDGs and the Paris Agreement, including the transition to net zero greenhouse gas (GHG) emissions and a climate-resilient future (Van *et al*, 2024) [14]. Many countries, however, are also facing the paradox of choosing between fostering economic growth and ensuring environmental standards. For instance, some evidence shows that pursuing economic growth comes at the expense of the environment (Ahmad, *et al* (2021); Bakhsh *et al*, (2017); Bakhsh *et al*, (2022); Ponce *et al*, (2023)) [1, 4, 3, 11]. Among factors contributing to economic growth, trade openness and diversification have been considered to

provide heterogeneous effects or non-linear effects on environmental degradation (Wang, *et al* (2024); Wang, *et al* (2024); Wang and Zhang, (2021))[17, 18, 15].

The objective of this paper is therefore to investigate the impact of environmental regulation on foreign direct investment in Nigeria. The rest of this paper is organized as follows; Section 2 reviews previous literature on the impact of environmental regulations on foreign direct investment. Section 3 contains the methodology for the paper and section 4 introduces the results and discussion of the findings. Section 5 presents the conclusion and recommendations reached from the study.
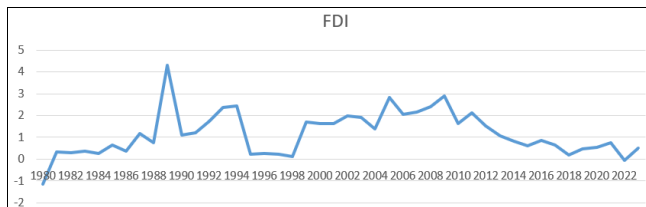
Source: World Bank's WDI, 2024

Fig 1: FDI

2. Literature Review
Empirical Review
Van *et al* (2024)[14] in their study revisited the feedback effect from foreign direct investments (FDI) on environmental regulations under the presence of the host country's political structure. They employed the two-step system generalized method of moments with data from 21 OECD countries from 1990 to 2019. Their findings confirmed that FDI flows influence environmental regulations, but such an effect is conditional on the host country's political constraints. Specifically, FDI increases (decreases) the stringency of environmental regulations if domestic political constraints are sufficiently high (low). Kong *et al* (2024)[8] in their study environmental regulation, outward foreign direct investment, and China's green total factor productivity found that OFDI has a single threshold effect on GTFP, and the negative effect increases with the reinforcing of environmental control. The main impact comes from home country's changes in green technology (GTC) rather than changes in green efficiency. Additionally, environmental regulation has a positive moderating effect on OFDI, the moderating effect of environmental regulation in western regions is more pronounced in promoting the home country's GTC. It is imperative to take into account regional variations and devise distinct policies for eastern, central, and western regions. Wang *et al* (2024) in their study focused on China's low-carbon cities development and analysed city-level panel data from 2003 to 2019 using a multi-period difference-in-differences approach to investigate its impact on foreign direct investment. Their findings suggested that the implementation of the low-carbon cities policy resulted in both a reduction in the number of foreign-invested enterprises and a less effective utilization of foreign direct investment. Furthermore, western China was more profoundly affected. Chen *et al*. (2024)[5] systematically elaborated on the relationship between environmental regulation, foreign direct investment (FDI), and green total factor productivity (GTFP) and then combines panel data from Chinese cities to empirically test these relationships using various methods, such as the mediation effect model, two-stage least squares, and

difference-in-differences method. They found that environmental regulation significantly boosts FDI and GTFP. FDI helps to improve GTFP, and environmental regulation can impact GTFP indirectly through FDI. The way that FDI and environmental regulations affect GTFP demonstrates regional variation. Large cities with high economic growth gain more from environmental regulation. FDI has a stronger promotion effect on GTFP in medium and small-sized cities than in large-sized cities, and it does not significantly impact GTFP in cities with high levels of economic development or in the eastern region. Wang *et al* (2020) investigated the interaction effect between corruption and foreign direct investment (FDI) on environmental pollution by applying the spatial econometric model to the panel data of China's 29 provinces from 1994 to 2015 and analyzes the differences between China's eastern, central and western regions. The results showed that FDI inflow deteriorates the environmental quality, validating the pollution haven hypothesis (PHH), by weakening the environmental standards, corruption enables the inflow of low-quality FDI, weakens the spillover effect of FDI and indirectly causes further environmental pollution, the interaction effect between corruption and FDI on environmental pollution is less significant in the eastern region than in the central and western regions. Huang (2020)[7] studied the spatial distribution of inbound FDI in manufacturing sectors by accounting for strategically determined environmental policies across Chinese cities over the period 2003-2014. They specifically investigated how the stringency of environmental regulation affects the FDI inflow of a city and its neighbors. They found strong evidence that the pollution haven hypothesis applies to the People's Republic of China based on both spatial lag of X and two-stage least-squares estimates. In particular, the laxity of a city's own environmental regulation is positively associated with its inbound FDI. They further investigated the investment deflection effect and found that the laxity of neighboring environmental regulation is negatively related to the FDI inflows to a city. Yoon and Heshmati (2017)[19] investigated the impact of environmental regulations on foreign direct investment (FDI). They used Korean outward FDI data covering the manufacturing sector for 2009-2015. The main results of the estimation of a FDI model showed that the stricter the regulations in host countries in Asia the lower the FDI both intensively and extensively to those countries. This supports the prevalence of the effects of pollution havens. Eskeland and Harrison (2003) examined the FDI pattern using 4digit industry level data from four developing countries after controlling country-specific factors (openness, market concentration, market size, wage, etc.). In order to see if the costs from environmental regulations led firms to move theirs plants abroad, they used pollution abatement costs. Even if foreign investors were skewed towards polluting sectors, the evidence was too weak.

Theoretical Review
Pollution Haven Theory: This theory argues that companies tend to shift their production and investment to countries with more relaxed environmental regulations in order to reduce costs and avoid the restrictions imposed by stringent regulations (Nasir, Huynh & Tram, 2019)[10]. This theory stresses the need to address the problem through an international framework, thereby ensuring that tax havens

do not undermine global environmental protection efforts. The pollution haven hypothesis (PHH) has been debated for decades between internationalization and environmental pollution. It is argued that trade and capital movement liberalization contribute to the transfer of polluting industries from countries with relatively strict environmental regulations to countries with less stringent regulations (Hille, 2018) [6]. For this reason, stringent regulation of environmental standards leads to new equipment requirements, landfill rules, restrictions on specific inputs and outputs, and additional production costs due to the need to find alternative methods for waste disposal. This is because investment is shifted to countries with relatively less stringent regulations (Rezza, 2015) [12]. PHH focuses on the cost-effectiveness of environmental regulations considered by enterprises. The difference in production costs is a sufficient stimulus for enterprises to relocate to production facilities. Assuming that increased production costs are sufficient reasons for firms to move, firms are usually associated with replacing certain production lines, using different equipment, or finding new methods.

3. Methodology
Model Specification
The expost facto research design is employed for the study. The ordinary least square (OLS) technique was used to estimate the linear relationship between dependent variable (foreign direct investment) and independent variables; environmental regulations, carbon emissions and economic growth. Environmental regulations is proxy by (CPIA policy and institutions for environmental sustainability rating (1=low to 6=high)). Policy and institutions for environmental sustainability assess the extent to which environmental policies foster the protection and sustainable use of natural resources and the management of pollution. The functional form of the model is as follows;

$$FDI = f(ER, GDP, EM)$$

The econometric form is given as;

$$FDI = \beta_0 + \beta_1 ER + \beta_2 GDP + \beta_3 EM + \varepsilon$$

Where; FDI is foreign direct investment, environmental regulations, carbon emissions and gross domestic product. β_0 is the intercept or regression constant; β_1-β_3 are the parameters of the independent variables to be estimated or Regression Coefficient. ε is the error term. Data for the study will be sourced from the CBN statistical bulletin, the data will be from 2005 to 2023.

4. Result and Discussion

Table 1: Descriptive Statistics

	FDI	ER	EM	GDP
Mean	1.268839	3.315789	106.0695	4.36E+11
Median	0.853396	3.500000	109.7451	4.80E+11
Maximum	2.900249	3.500000	123.3055	5.52E+11
Minimum	-0.039522	3.000000	78.03370	2.74E+11
Std. Dev.	0.908525	0.247797	14.67707	8.77E+10
Skewness	0.454346	-0.545545	-0.462615	-0.571353
Kurtosis	1.908612	1.297619	1.916893	1.967491
Jarque-Bera	1.596673	3.236790	1.606426	1.877714
Probability	0.450077	0.198217	0.447887	0.391075

Observations	19	19	19	19

Source: Author's computation with EVIEWS

The descriptive statistics of the variables used in the study is presented in Table 1. From the result, the mean value for foreign direct investment (FDI) is 1.27 percent of GDP, environmental regulation (ER) have an average value of 3.3 for the study period. Carbon emission (EM) stood at 106 Mt CO_2e, while gross domestic product (GDP) is N4.36billion. All the variables except foreign direct investment have negative skewness which implies that most of their observations are lower than their mean. All the variables of the study have a platykurtic kurtosis implying that they all have lower values. Based on the Jarque-Bera probability values of the variable, we can infer that all the variables are normally distributed since their probability values are clearly greater than the 0.05% level of significance.

Table 2: OLS estimates

Dependent Variable: FDI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ER	-0.158789	0.483733	-0.328257	0.7473
EM	-0.020219	0.012163	-1.662286	0.1172
GDP	-6.24E-12	2.09E-12	-2.980086	0.0093
C	6.663913	1.265869	5.264301	0.0001
R-squared	0.874694	Mean dependent var		1.268839
Adjusted R-squared	0.849633	S.D. dependent var		0.908525
F-statistic	34.90235	Durbin-Watson stat		2.443933
Prob(F-statistic)	0.000001			

Source: Author's computation with EVIEWS

The output of the OLS estimates showed that environmental regulation have a negative and statistically insignificant impact on foreign direct investment. A one-unit increase in environmental regulation is associated with a decrease of 0.1588 units in FDI, holding other variables constant. Carbon Emission (EM) displayed a negative and statistically insignificant effect on foreign direct investment this implies that a one-unit increase in carbon emissions is associated with a decrease of 0.0202 units in FDI, holding other factors constant. Gross domestic product (GDP) also has a negative but statistically significant effect on FDI with a very small coefficient, indicating that as GDP increases by one unit, FDI slightly decreases. The intercept term signifies that if all other variables were zero, the baseline level of FDI would be 6.6639 units. The p-value (0.0001) is highly significant, indicating that the constant term is statistically different from zero. The Adjusted R-squared of 0.849633 implies that the model explains about 84.96% of the variance in FDI, showing that the model is robust. F-statistic with p-value of 0.000001 shows that overall the model is statistically significant, meaning at least one predictor variable significantly explains variations in FDI. Durbin-Watson statistic of 2.4 indicates no significant autocorrelation in the residuals, which is desirable for regression analysis.

Table 3: Pairwise Granger Causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
ER does not Granger Cause FDI	18	10.9393	0.0048
FDI does not Granger Cause ER		0.03891	0.8463
EM does not Granger Cause FDI	18	5.59427	0.0319
FDI does not Granger Cause EM		7.77375	0.0138
GDP does not Granger Cause FDI	18	12.1728	0.0033
FDI does not Granger Cause GDP		1.01267	0.3302

Source: Author's computation with EVIEWS

From the Pairwise Granger Causality test presented in Table 3, we observed that environmental regulation granger cause foreign direct investment, but foreign direct investment does not environmental regulation. There is a bi-directional causal relationship between carbon emission and FDI. It is observed that GDP granger cause FDI but FDI does not granger cause GDP.
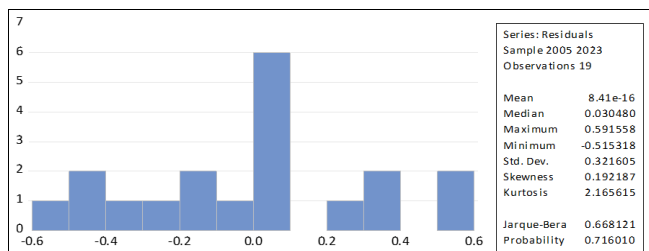
Diagnostic test

Fig 2: Normality test

To conduct the normality test, the Jarque-Bera statistic is used. In Fig 2, we observed that the null hypothesis for this test is that the residuals follow a normal distribution. The observed Jarque-bera statistic is 0.668121 with a p-value of 0.716010. Since the p-value is greater than the 5% level of significance, we cannot reject the null hypothesis, so this implies that the residuals are normally distributed.

Table 4: Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	1.293720	Prob. F(1,14)	0.2745
Obs*R-squared	1.607240	Prob. Chi-Square(1)	0.2049

Source: Author's computation with EVIEWS

From the Table 4 it is evident that the model formulated and estimated for the study is robust and devoid of serial correlation based on the probability values of 0.2745 which is clearly greater than the 5% level. The null hypothesis of the presence of serial correlation is therefore rejected.

Table 5: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity			
F-statistic	1.323277	Prob. F(3,15)	0.3038
Obs*R-squared	3.976145	Prob. Chi-Square(3)	0.2641
Scaled explained SS	1.444317	Prob. Chi-Square(3)	0.6952

Source: Author's computation with EVIEWS

From the Table 5 it is evident that the model formulated and estimated for the study is robust and devoid of heteroscedasticity based on the probability values of 0.3038 which is clearly greater than the 5% level. The null hypothesis of the presence of serial correlation is therefore rejected.

5. Conclusion and Recommendations

The research findings suggest that environmental regulation (ER), carbon emissions (EM), and GDP have different impacts on Foreign Direct Investment (FDI). Environmental regulation impact FDI negatively and statistically insignificant. This suggests that changes in environmental regulations, do not have a meaningful impact on FDI. A negative insignificant relationship between carbon emissions and FDI is observed. Therefore, carbon emissions do not

appear to have a direct influence on FDI in this model. A negative and significant relationship exist between GDP and FDI. This indicates that higher GDP might slightly discourage FDI. Based on the findings from the study, the following recommendations are made; since environmental regulation and carbon emissions do not significantly affect FDI in this study, policymakers may focus on improving the regulatory environment in ways that encourage sustainable development while still attracting foreign investments. This could involve clearer guidelines, incentives for clean energy investments, or fostering green technologies, which may have a more positive impact in the long run. Due to the the lack of significance, it would be useful for future research to explore other variables or thresholds where carbon emissions may have a stronger relationship with FDI, particularly in sectors sensitive to environmental impacts. The negative impact of GDP on FDI indicates that other macroeconomic factors might be influencing FDI more strongly than GDP. Policymakers may consider improving factors like infrastructure, human capital, and business environment to offset this negative relationship and attract more foreign investments.

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