FDI and Environmental Sustainability Nexus: Testing the Pollution Haven Hypothesis in the Presence of Regulatory Quality

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Abstract: *In this study, we examine the relationship between foreign direct investment (FDI) and environmental pollution within the context of the pollution haven hypothesis (PHH) in Ghana. We also investigate the role of regulatory quality in the FDI-pollution linkage. The study employs quarterly data spanning the period 2000Q1-2017Q4 and applies the fully modified least squares (FMOLS) technique. The empirical results show that FDI inflows significantly and positively drive environmental pollution. This result holds in the presence of regulatory quality. Accordingly, we confirm the validity of the pollution haven hypothesis in Ghana. The study also finds that industrialization increases pollution given its significant positive relationship with ecological footprint. We discuss relevant policy implications.*

Keywords: FDI, Pollution haven hypothesis, Ecological footprint, FMOLS, Ghana

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1. Introduction

Undoubtedly, one of the most pressing issues facing the globe in recent years is climate change commonly caused by anthropogenic green gas emissions (Yakubu et al., 2022a). Environmental pollution research has received considerable attention in recent literature as a result of increased global initiatives to mitigate climate change. In the drive to achieve environmental sustainability, several programs have been launched by international organizations and national governments. The Kyoto Protocol, the United Nations Framework Convention on Climate Change, and the Paris Agreement are all noteworthy initiatives to promote environmental sustainability.

To achieve sustainable development, there have been intensifying efforts to unearth the key drivers of environmental deterioration to put that at the forefront of memory. The impact of international trade flows, particularly foreign direct investment (FDI) on the environment has recently garnered a great deal of attention. FDI has been cited as one of the key drivers of economic growth by serving as a significant source of employment and paving the path for sophisticated technologies to be transmitted to host economies (Sapkota & Bastola, 2017; Yakubu, 2020). Firms can get access to protected markets through FDI by directly operating in those markets, thanks to trade protectionism. Considering the contributions of FDI to economic growth, countries have put mechanisms in place to motivate FDI flows (Demena & Afesorgbor, 2020).

Notwithstanding the importance of FDI in stimulating growth, concerns are growing regarding its possible negative environmental impacts. Due to the fact that FDI may occur concurrently with increased environmental pollution, the economic benefits accruing from FDI may be depleted (Cole et al., 2011). Given the possible environmental consequences of FDI, most economies are becoming more stringent in the sort of FDI even as they embark on actions and porgrammes towards achieving sustainable development. Owing to the lax environmental regulation in emerging economies, firms with high pollution levels in developed countries are increasingly establishing manufacturing units in developing countries to circumvent the strict regulatory mechanism in developed countries. This concept is described as the pollution haven hypothesis (PHH). The PHH lends weight to the premise that the decrease in emissions in many affluent nations is attributable in part to the rezoning of pollution-related activities to developing countries (Demena & Afesorgbor, 2020). As a result, while global FDI flows have been plunging, FDI flows to developing countries have held steady (UNCTAD, 2018).

It is worth noting that the environmental impact of foreign direct investment is still being debated. Whereas some studies find that FDI inflows have an adverse effect on the environment (Gorus & Aslan, 2019; Ur Rahman et al., 2019; Assamoi et al., 2020; Bediako, 2020; Bulus & Koc, 2021; Çamkaya et al., 2022; Tayyar, 2022), others note that FDI contributes to environmental sustainability, especially when those investments are green initiatives and involve the transfer of ecologically friendly technologies (Jugurnath & Emrith, 2018; Salehnia et al., 2020; Demena & Afesorgbor, 2020; Pradhan et al., 2022). The purpose of this research, therefore, is to contribute to the raging debate on the FDI-environment nexus in the context of Ghana. We do this by testing the validity of the pollution haven hypothesis (PHH) in Ghana.

It is glaring that the extant studies have largely focused on the direct impact of FDI on the environment, with little consideration of how other factors might moderate this effect. In this study, we employ a novel approach by factoring in regulatory quality as a moderating factor to examine the link between FDI and environmental quality. With this, we add a fresh dimension to the existing literature. Also, we use ecological footprint to measure environmental degradation. This metric is considered to be a more comprehensive indicator of environmental degradation.

The rest of the study is organized as follows: Section 2 reviews the literature and Section 3 outlines the research methodology. In Section 4, we present the empirical findings and conclude in Section 5.

2. Literature Review

Theoretically, the debate over the environmental effects of FDI has resulted in the development of two contradictory hypotheses. The first concept which is the pollution haven hypothesis asserts that high-pollution emitting industries will consider moving to areas with less stringent environmental regulations. The other hypothesis, referred to as the pollution halo hypothesis, on the other hand, assumes that clean technologies are transferred to host countries via FDI inflows which enhances environmental sustainability.

Not surprisingly the nexus between FDI and environmental degradation has gained considerable interest in the environmental economics literature, with most studies seeking to test the validity of the pollution haven hypothesis. For instance, using the autoregressive

distributed lag (ARDL) technique, Sun et al. (2017) tested for the presence of the pollution haven hypothesis for China over the period 1980–2012. The authors found that FDI inflows exacerbate the emissions of carbon dioxide, confirming the validity of the PHH in China. Behera and Dash (2017) examined the effect of foreign direct investment on carbon dioxide (CO_2) emissions of 17 countries in the South and Southeast Asian (SSEA) region over the years 1980–2012. The study established that the growth in FDI is associated with increasing levels of CO_2 emissions. Applying the fixed and random effects techniques, Sapkota and Bastola (2017) revealed that FDI increases environmental pollution, validating the PHH in Latin America. Using the ordinary least squares (OLS) technique with data covering from 1991-2014, Murthy and Gambhir (2018) evidenced that in the context of domestic and global policy change, the PHH is valid for India. In a panel of 54 African countries, Gharnit et al. (2019) used the dynamic ordinary least square (DOLS) and fully modified least squares (FMOLS) techniques to investigate the impact of FDI on CO_2 emissions in Africa. The results confirmed the presence of PHH in the sampled countries. Terzi and Pata (2020) applied the Toda-Yamamoto augmented granger causality method to establish the link between FDI inflows and CO_2 emissions in Turkey over the period 1974-2011. The findings of the study revealed that the PHH is valid in Turkey given the positive relationship between the two variables. Similarly, Tayyar (2022) confirmed the validity of the PHH for the energy sector in Turkey via the vector error correction model and the Toda-Yamamoto test. Bulus and Koc (2021) found that an increase in FDI leads to a surge in environmental pollution, therefore validating the PHH in Korea. Bunyaminu and Yakubu (2022) discovered that FDI inflows reduce renewable energy demand while increasing carbon dioxide emissions in Africa, lending support to the PHH.

On the other hand, some studies refute the pollution haven hypothesis by showing that FDI reduces environmental pollution (see Kathuria, 2016; Zhang & Zhou, 2016; Zaman & Abd-el Moemen, 2017; Shahbaz et al., 2019; Nathaniel et al.,2020; Khan & Ahmad, 2021; Pradhan et al., 2022).

Other empirical works (for example Huynh & Hoang, 2019; Halliru et al., 2020; Yilanci et al., 2020; Kisswani & Zaitouni, 2021) revealed contradictory results. In other words, given the varying effects of FDI on environmental pollution, they either accept or reject the PHH.
In this study, we seek to advance the inconclusive empirical debate surrounding the validity of the pollution haven hypothesis in the context of an emerging economy. We demonstrate how effective regulation can moderate the relationship between FDI and environmental pollution, rather than focusing on the direct impact of FDI on pollution.

3. Methodology

Data and Variables

This study empirically examines the validity of the pollution haven hypothesis in Ghana. To achieve our objective, we employ quarterly data covering the period 2000Q1-2017Q. In measuring the variables, we use ecological footprint as an indicator of environmental pollution. Ecological footprint (ECF) is “a composite of six dimensions comprising carbon, build-up land, grazing land, fishing grounds, forest land, and cropland" in gha per person terms. The main independent variable is foreign direct investment (FDI) measured by the net inflows of FDI in terms of the percentage of GDP. We employ regulatory quality (REGQ) as a moderating factor. Regulatory quality “captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.” Industrialization (IND) is used as a control variable.

Manufacturing value added (as a percentage of GDP) is used to measure industrialization (Akçay, 2019). The Global Footprint website, Worldwide Governance Indicators, and World Development Indicators served as the data sources.

Model and Estimation Technique

We estimate two different models given the objective of the study. First, the impact of FDI on environmental pollution is estimated alongside regulatory quality and industrialization. In the second model, we examine the interactive effect of FDI and regulatory quality. The basic models are specified as follows:

$$ECF_t = \alpha_0 + \beta_1 FDI_t + \beta_2 REGQ_t + \beta_3 IND_t + \varepsilon_t \quad (1)$$

$$ECF_t = \alpha_0 + \beta_1 FDI_t + \beta_2 REGQ_t + \beta_3 FDI_t{*}REGQ_t + \beta_4 IND_t + \varepsilon_t \quad (2)$$

The abbreviations ECF, FDI, REGQ, and IND from the equations are defined previously. α is the constant and β represents the coefficients of the independent variables. *t* and ε signify the time period and error term respectively.

To estimate our models, we use the fully modified least squares (FMOLS) method. In comparison to other least-squares techniques, the FMOLS technique produces better results and addresses the issue of biased estimates (Yakubu et al., 2022). The FMOLS method is also resistant to serial correlation.

4. Results and Discussions

Descriptive Statistics

The summary statistics for the variables are shown in Table 1. Ecological footprint has an average value of 1.065 in terms of gha per person. The mean of FDI inflows is 5.093 percent and it ranges from 0.956 percent to 9.517 percent. The mean value of regulatory quality is -0.072. The average value of manufacturing value added which measures industrialization is 8.945 percent with minimum and maximum values of 5.661 percent and 11.745 respectively.

Table 1: Descriptive Statistics

	ECF	FDI	REGQ	IND
Mean	1.065	5.093	-0.072	8.945
Maximum	1.278	9.517	0.128	11.745
Minimum	0.800	0.956	-0.448	5.661
Std. Dev.	0.142	2.801	0.163	1.826
Skewness	-0.151	-0.063	-0.786	-0.124
Kurtosis	1.805	1.662	2.837	2.009
Jarque-Bera	4.559	5.420	7.489	3.131
Probability	0.102	0.067	0.024	0.209

Unit Root Test Results

If the time series variables are non-stationary, a study can produce inaccurate regression results. To avoid this problem, stationary tests should be performed to establish the unit root properties of the variables. In this study, the Augmented Dickey-Fuller (ADF) unit root test is employed, and the results are reported in Table 2. We find that none of the variables are integrated at level. They are all stationary at the first difference. This satisfies one of the conditions for the application of the FMOLS technique.

Table 2: Unit Root Test Results

Variable	Level		First Difference	
	t-statistic	Prob.	t-statistic	Prob.
ECF	-1.140	0.696	-9.703	0.000
FDI	-1.213	0.665	-8.260	0.000
REGQ	-1.913	0.325	-8.248	0.000
IND	-1.640	0.457	-8.256	0.000

Cointegration Test Results

In line with the empirical works of Kwakwa and Adusah-Poku (2019) and Yakubu et al. (2021), the study employs the ARDL bound test approach to cointegration to determine whether the variables have a long-run relationship. As shown in Table 3, the F-statistics value is greater than the upper bound critical values at 1% significance level. This demonstrates that there exists a long-run relationship among the variables.

Table 3: Cointegration Test

F-Statistics	Significance	I(0)	I(1)
7.117***	1%	3.65	4.66
	5%	2.79	3.67
	10%	2.37	3.2

*** indicates 1% significance

Regression Results

Table 4 shows the long-run regression estimates on the impact of FDI on environmental pollution. While Model 1 examines the direct effect of FDI on ecological footprint, the moderating effect of regulatory quality on the FDI-pollution relationship is analyzed in Model 2.

From Model 1, the results show that FDI exerts a positive significant impact on ecological footprint. This suggests that FDI aggravates environmental pollution in Ghana. In other words, Ghana's FDI inflows might not be as focused on environmentally benign projects and might involve the transfer of technologies that negatively impact the environment. The relationship between regulatory quality and ecological footprint is negative albeit insignificant. The results establish that industrialization has a positive significant effect on pollution, suggesting that an increase in industrial activities upsurges pollution levels in the country. This finding is in line with the results of Anwar et al. (2020) and Ahmed et al. (2022).

From the estimates in Model 2, FDI maintains its positive and significant effect on pollution. The influence of regulatory quality on pollution is negative and significant. Similar to Model 1 results, industrialization exhibits a detrimental effect on the environment. The interactive effect of FDI and regulatory quality on environmental pollution is positive and significant at 10%. This suggests that, despite attempts to formulate and implement sound regulatory mechanisms to enhance sustainable economic activities, including regulations on trade flows, FDI undermines environmental quality in Ghana. Therefore, it is plausible to conclude that the pollution haven hypothesis (PHH) is valid in Ghana.

Table 4: FMOLS estimates

Variables	Model 1	Model 2
FDI	0.046*** (0.000)	0.052*** (0.000)
REGQ	-0.076 (0.600)	-0.376* (0.087)
FDI*REGQ		0.093* (0.0905)
IND	0.040*** (0.000)	0.055*** (0.000)
C	0.465*** (0.000)	0.295** (0.046)
R^2	0.628	0.661
Adj. R^2	0.612	0.640
S.E. of regression	0.087	0.083
Long-run variance	0.020	0.018

Notes: *p*–values are in parentheses *** p<0.01 ** p<0.05 * p<0.1

5. Conclusion and Recommendations

The relationship between FDI and environmental pollution is still up for contention in the environmental economics literature. This debate, which has been discussed under the themes "pollution halo hypothesis" and pollution haven hypothesis" is focused on whether an increase in FDI is beneficial or detrimental to the environment. Several empirical studies have resulted from these competing hypotheses with divergent findings. This study examines the link between FDI and environmental pollution with the aim of testing the validity of the pollution haven hypothesis in Ghana. Aside from investigating the direct effect of FDI on pollution, we investigate the role of regulatory quality in the FDI-pollution linkage. The study employs quarterly data covering from 2000Q1 to 2017Q4 and applies the fully modified least squares (FMOLS) technique. The results establish that FDI inflows significantly and positively drive environmental pollution in Ghana. This result holds in the presence of regulatory quality. In a nutshell, we confirm the presence of the pollution haven hypothesis in Ghana. The study also finds that industrialization has a detrimental effect on pollution given its significant positive relationship with ecological footprint.

The study provides some recommendations for policymakers. In the quest to attract FDI, policymakers must strengthen the regulatory regime and devise effective strategies to critically scrutinize FDI inflows and assess their potential environmental repercussions. This will lessen the transfer of investments that are not environmentally sustainable. To minimize the over-reliance on non-renewable forms of energy, foreign direct investments in cleaner energy sources like solar and wind should be promoted. For future studies, using sectoral data would enable a more in-depth analysis given that the present study is based on country-level time series data.

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