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Revisiting the Pollution Haven Hypothesis: Analyzing the Interplay Between FDI Inflows, Environmental Policies, and Sustainability in Bangladesh

重新审视污染避风港假说：分析孟加拉国外国直接投资流入、环境政策与可持续发展之间的相互作用

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Abstract:

This study investigates the potential existence of the Pollution Haven Hypothesis (PHH) in Bangladesh, examining how lax environmental policies influence FDI inflows and subsequent pollution levels. Using a mixed-methods approach, it combines quantitative analyses—Johansen cointegration, Vector Error Correction Model (VECM), and Granger causality tests—with qualitative insights from 12 Key Informant Interviews (KII). The Johansen test indicates a long-run relationship between CO_2 emissions and FDI, though not statistically robust. VECM results show FDI is shaped by economic and environmental factors, with inflation as a key

Keywords:
pollution haven hypothesis, foreign direct investment, environmental policy.

关键词：
污染避风港假说, 外国直接投资, 环境政策

deterrent. Granger causality reveals FDI significantly impacts GDP per capita and electricity consumption but not CO_2 emissions. Qualitative findings highlight low labour costs, market size, and geopolitical factors as FDI drivers while noting environmental risks in polluting industries. The study's novelty lies in integrating quantitative and qualitative methods to analyze FDI's long-run economic and environmental effects in Bangladesh. Limited evidence supports PHH, suggesting weak environmental regulations are not the main FDI attractor. Policy recommendations include strengthening environmental enforcement and promoting cleaner technologies to achieve sustainable industrial growth.

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摘 要：

本研究探讨孟加拉国污染避风港假说（PHH）**的潜在存在，分析**宽松的环境政策如何影响外国直接投资（FDI）**流入及其后**续的污染水平。研**究采用混合方法，将定量分析—包括**约翰森协整检验、向量误差修正模型（VECM）和格兰杰因果检验—与来自12位关键受访者的定性访谈（KII）相结合。约翰森检验显示二氧化碳排放与FDI之间存在长期关系，但统计上不够稳健。VECM结果表明，FDI受经济和环境因素影响，其中通货膨胀是主要抑制因素。格兰杰因果检验显示，FDI对人均GDP和电力消耗有显著影响，但对二氧化碳排放没有显著影响。定性研究发现，低劳动力成本、市场规模和地缘政治因素是吸引FDI的关键，而污染行业的环境风险亦不可忽视。本研究的新颖之处在于整合定量与定性方法，分析FDI对孟加拉国经济和环境的长期影响。有限的证据支持PHH，这表明环境法规宽松并非FDI**的主要吸引因素。政策建**议包括加强环境执法及推广清洁技术，以实现可持续的工业发展。

1. Introduction

Investment is a cornerstone of economic growth, particularly in developing economies where it drives productivity, employment, and technological advancement (Anwar et al., 1999; Kasyanenko et al., 2023). While its significance has been recognized historically, the 20th century marked a pivotal period as globalization and economic liberalization redefined global markets (Taylor, 2003). Structural Adjustment Programs (SAPs), promoted by international financial institutions such as the IMF and World Bank, emphasized private investment by advocating for market-oriented reforms and minimizing government intervention (Zattler, 1989; Serven et al., 1991). In response, developing nations implemented targeted policies to attract investment, including fiscal incentives, the establishment of Special Economic Zones (SEZs), and relaxed regulatory frameworks (Zampetti et al., 2018; Sauvant et al., 2015).

Investment in these economies generally takes two forms: domestic investment, which supports infrastructure development and essential services, and foreign direct investment (FDI), which introduces external capital, advanced technologies, and access to international markets (Ali, 2014). While FDI is widely regarded as a catalyst for industrialization and integration into global value chains, its environmental consequences remain a subject of growing concern (Gregorio, 2003; Kukaj et al., 2016).

The environmental implications of FDI are often framed within the Pollution Haven Hypothesis (PHH), which posits that firms from countries with stringent environmental regulations may relocate pollution-intensive industries to nations with weaker standards, thus exacerbating environmental degradation in the host countries (Garsous et al., 2017; Gill et al., 2018). Empirical findings on the PHH remain inconclusive: while some studies confirm its validity, others highlight positive spillovers from FDI, such as the introduction of cleaner technologies and improved resource efficiency (Xi et al., 2011; Ahmed et al., 2020). These dynamics align with the Environmental Kuznets Curve (EKC), which theorizes that environmental degradation initially increases with economic growth but declines at higher

income levels as stricter environmental policies are enacted (Moreno et al., 2021).

Bangladesh exemplifies the complexities of balancing FDI-driven economic growth with environmental sustainability. FDI has significantly contributed to GDP growth and industrialization in sectors such as textiles and energy but has also intensified environmental challenges, particularly through air and water pollution (Haque, 2013). Weak enforcement of environmental regulations compounds these issues, while the absence of comprehensive environmental data—such as metrics for PM2.5 levels and water contamination—hinders an accurate assessment of FDI's long-term impact.

This study critically examines these dynamics, challenging the conventional assumptions of the PHH by demonstrating that lax environmental policies are not statistically significant determinants of FDI inflows in Bangladesh. Focusing on the country's unique economic and environmental context, it offers a nuanced analysis of FDI-driven industrialization using a mixed-methods approach that integrates quantitative data with qualitative insights from Key Informant Interviews (KIIs). The findings underscore the potential environmental risks associated with increasing FDI and highlight the need for strengthened environmental governance. While limited by the absence of longitudinal data and sector-specific environmental metrics, the study provides actionable policy recommendations for aligning FDI attraction strategies with sustainable development goals, contributing to both academic discourse and evidence-based policymaking.

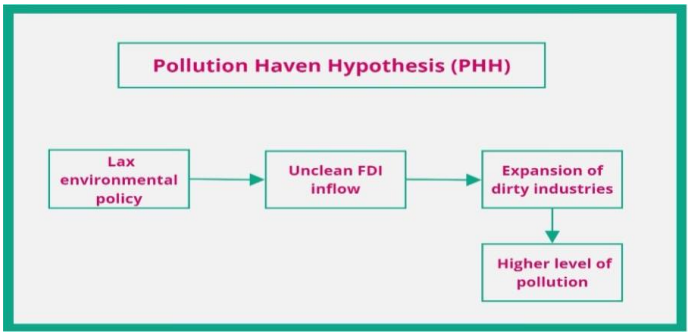
Bangladesh was selected as the research focus due to its unique economic and environmental dynamics. Over the past few decades, the country has witnessed a consistent rise in foreign direct investment (FDI), particularly in pollution-intensive sectors such as textiles, leather, and manufacturing. At the same time, Bangladesh faces mounting environmental challenges, including air and water pollution, which are often linked to weak enforcement of environmental regulations. Moreover, the availability of long-term national data on FDI, CO_2 emissions, and related macroeconomic indicators makes Bangladesh a suitable case for empirically examining the relationship between FDI inflows and environmental outcomes under a relatively lax regulatory framework.

2. Conceptual Framework and Research Methodology

2.1 Theoretical Framework

This study is grounded in the Pollution Haven Hypothesis (PHH), initially proposed by Walter et al. (1979) and later refined by Baumol and Oates (1988), which posits that firms from developed countries with stringent environmental regulations relocate pollution-intensive industries to developing countries with more lenient policies (Yi et al., 2023; Gill et al., 2018).

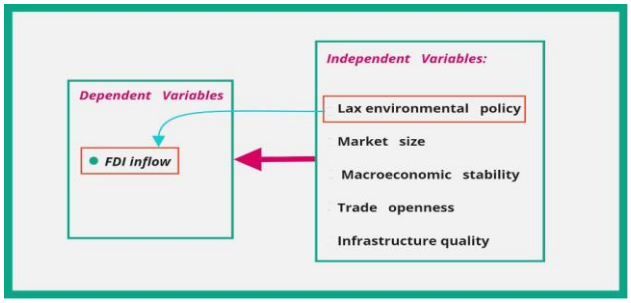
Figure 2.1.1 A conceptual diagram of the Pollution Haven Hypothesis as applied to Bangladesh.



Source: Author's own compilation

Facilitated by Foreign Direct Investment (FDI), this relocation allows firms to establish operations in regulatory environments that are less stringent, often at the cost of increased environmental degradation, including higher CO_2 emissions and adverse ecological impacts (Hassaballa, 2014; Randaccio et al., 2011). Such dynamics are particularly evident in North-South trade and investment flows, where pollution-intensive industries from the global North exploit the lenient environmental policies of the global South, transforming developing nations into pollution havens (Khcarslan et al., 2017). By drawing on the econometric framework of Hassaballa (2014), which analyzed the cointegration and causality between environmental regulations and FDI inflows, this study refines and applies the model to the specific context of Bangladesh to examine the impact of lax environmental policies on FDI inflows and the subsequent environmental consequences.

Figure-2.1.2: Graphical representation of the theoretical framework



Source: Perceived framework, adopted and modified from Hassaballa (2014))

The theoretical framework depicted in Figure-2.1.2 is adapted from Hassaballa (2014), who examined

the impact of lax environmental regulations on FDI inflows in developing countries. Hassaballa (2014) employed a panel cointegration test and panel Granger causality test to analyze the cointegration and causality among variables. While this study utilizes Hassaballa's (2014) econometric model, it specifically focuses on Bangladesh as the country of interest.

2.2 Data and Method

To address the research objectives—specifically, the impact of lax environmental policies on FDI inflows and the effect of FDI inflows on pollution levels in Bangladesh—this study employs both quantitative and qualitative methodologies. This mixed-methods approach ensures a comprehensive understanding of the research topic, integrating quantitative data analysis with qualitative insights from key stakeholders.

For the quantitative analysis, secondary data spanning 46 years (1973–2019) were utilized, sourced from reputable institutions such as the World Bank, UNCTAD, and government publications, including the Ministry of Environment, Forest and Climate Change and the Bangladesh Bureau of Statistics. Due to the unavailability of quarterly data, annual data were used. Key variables, such as FDI inflows and CO_2 emissions, were sourced from UNCTAD and the World Bank, respectively. Additional explanatory variables, including population size, inflation (GDP deflator), electricity consumption, and trade openness, were obtained from the World Bank's World Development Indicators (WDI). Advanced time series econometric techniques were applied, including a cointegration test to identify short- and long-run relationships, followed by the Vector Error Correction Model (VECM) to examine long-term equilibrium dynamics. Granger causality testing was also conducted to assess causal relationships among the variables.

For the qualitative component, key informant interviews (KIIs) were employed to collect expert perspectives on the interactions between environmental policies, FDI inflows, and pollution levels. KIIs were conducted with a purposive sample of stakeholders, including policymakers, environmental experts, industry leaders, and academics. These interviews provided valuable insights into the practical and contextual factors influencing the relationship between the variables, capturing elements such as political motivations, stakeholder interests, and gaps in regulatory enforcement that may not be quantifiable through statistical methods. A semi-structured interview guide was used, with interviews conducted both face-to-face and via Zoom.

This methodological design enhances the rigor, validity, and reliability of the study by systematically triangulating quantitative evidence with qualitative insights from key stakeholders. The integrated framework combines statistical robustness with contextual depth, enabling a comprehensive examination of the interactions between FDI, environmental policy, and pollution in Bangladesh. All data sources are publicly accessible, and the statistical techniques employed—such as unit root testing, cointegration analysis, VECM, and Granger causality—are widely recognized and standard in empirical economic research. The qualitative component adheres to established social research ethics and applies rigorous validation procedures, including the use of a purposive sampling strategy. By providing detailed descriptions of the data, analytical procedures, and qualitative protocols, this study ensures transparency, reproducibility, and methodological rigor, allowing future researchers to replicate or adapt the framework in comparable contexts.

3. Results and Discussion

3.1 Outcome of the Quantitative Analysis

To satisfy the study's objectives: — to examining the impact of lax environmental policies on FDI inflows in Bangladesh and the effect of FDI inflows on pollution levels in Bangladesh—a quantitative technique is used. For the quantitative analysis, all data have been checked and some missing values have been identified. Hence a 3MA has been used to deal with the missing values. Then augmented dickey fuller (ADF) test has been applied to find out whether all variables are stationary or not. ADF test helps us to make formal diagnosis which is warranted for further statistical analyses. To find out whether the variables of interest are correlated in the long-run, Johansen's co-integration test has been performed. After finding long-run relationship among variables, VECM is employed to estimate the long-run equilibrium relationships among the variables. Finally, the Granger causality test is conducted to examine causal relationships among the variables,

revealing a unidirectional causal relationship. Data analysis was conducted using EViews 12.

3.1.1 Augmented Dickey-Fuller (ADF) test

The ADF test shows that only INGDPD is stationary at the levels form. Except FDI inflow all variables, are stationary at the first difference (I(1)). FDIinflow become stationary after second difference. Since VCEM doesn't provide accurate result in I (2), so we have to convert I (2) into I (1) to apply VCEM.

3.1.2 Johansen cointegration test

The Johansen cointegration test results reveal the presence of cointegrating relationships among the variables, indicating that they are in long-run equilibrium. Both the Trace Test and Max-Eigenvalue Test suggest that there are four cointegrating relationships at the 5% significance level. This indicates the existence of long-term equilibrium relationships among the variables, although not all of them are cointegrated. These findings are critical when modeling the system, as a Vector Error Correction Model (VECM) would be suitable for capturing both the short-term dynamics and long-term relationships between the variables.

3.1.3 Vector Error Correction Estimation

Table-3.1.3.1 **Long run relationship from VCEM model**

Variable	Coefficient	t-statistics	Standard errors
CO2 (-1)	2140.354	0.56219	3807.16
EC(-1)	7.273136	1.54350	4.71209
GDPPC(-1)	-0.637405	0.45302	-1.40701
INFGDPD(-1)	-60.75906	-19.0414	3.19089
TO(-1)	-35.12850	-1.97115	17.8213
FDI_{inflow}(-1)	1.0000		
C	-142.1522		
R-squared	0.789627		
Adj. R-squared	0.747552		
F-statistic	18.76727		

Here,

CO2 = Carbone dioxide emission (proxy variable of lax environmental policy)

EC = electricity consumption (proxy variable of infrastructure quality)

GDPPC = GDP per capita (proxy variable of market size)

INFGDPD = Inflation GDP deflator (proxy variable of macroeconomic stability)

TO = trade openness

FDI_{inflow} = foreign direct investment inflow

D(FDIinflow)= - 0.551901523194*(1.0000× FDIinflow (−1) + 2140.354* CO2(−1) + 7.2731* EC (−1)− 0.6374* GDPPC(−1) − 60.7591*INFGDPD(−1) − 35.1285*TO (−1) − 142.1522)

Table 3.1.3.1 presents the long-run relationships among FDI inflows, CO2 emissions, GDP per capita (GDPPC), inflation (GDP deflator), trade openness (TO), and electricity consumption (EC). The coefficients reveal the influence of each variable on FDI inflows.The positive coefficient of CO2 emissions (2140.354) suggests a potential long-term relationship between CO2 emissions and FDI inflows, which could indicate that higher emissions are associated with increased foreign investment, possibly supporting the pollution haven hypothesis. However, the low t-statistic (0.56219) indicates this relationship may not be statistically significant.Energy consumption shows a positive coefficient, indicating a direct relationship with FDI inflows, likely driven by increased industrial activity. However, the t-statistic (1.54350) suggests weak statistical significance.The negative coefficients for GDP per capita (-0.6374) and inflation (-60.7591) imply that higher GDP per capita and inflation may deter FDI inflows, though the t-statistics (-1.4070 and -19.0414) indicate these relationships are not strongly significant.Trade openness has a negative coefficient (-35.1285), suggesting a marginally significant inverse relationship with FDI, with a t-statistic of -1.9712.The model explains 79.96% of the variance in FDI inflows (R-squared), and 74.76% after adjusting for the number of predictors (Adjusted R-squared). The F-statistic (18.76727) confirms that the model is statistically significant and provides a meaningful explanation of FDI inflows.

Table-3.1.3.2 **Short run relationship from VCEM model**

Variable	Coefficient	t-statistics	Standard errors	p-value
D(CO2 (-1))	3185.022	0.40436	7876.60	0.6864
D(EC(-1))	35.46114	2.90676	12.1996	0.0040
D(GDPPC(-1))	-0.046668	-0.01591	2.93276	0.9873
D(INFGDPD(-1))	-11.70938	-1.79577	6.52054	0.0740

D(TO(-1))	-94.96830	-3.25315	29.1927	0.0013
$D(FDI_{inflow}(-1))$	-0.311463	-2.45376	0.12693	0.0150
C	-68.17082	-0.64112	106.330	0.5221
R-squared	0.789627			
Adj. R-squared	0.747552			
F-statistic	18.76727			

D(FDIinflow) = - 0.311462824154*D(FDIinflow (-1)) + 3185.02240178*D(CO2(-1)) + 35.4611376236*D(EC(-1)) - 0.0466678069632*D(GDPPC(-1)) - 11.7093822966*D(INFGDPD (-1)) - 94.9682979285*D(TO(-1)) - 68.1708159506

Table 3.1.3.2 presents the short-run relationships among FDI inflows, CO2 emissions, GDP per capita, inflation, trade openness, and electricity consumption.

The positive coefficients for CO2 emissions and energy consumption indicate a short-run positive relationship with FDI inflows. However, the large standard error and high p-value (0.6864) for CO2 emissions suggest the relationship is not statistically significant. In contrast, the low p-value (0.0040) for energy consumption confirms its significant short-term effect on FDI inflows.Negative coefficients for GDP per capita and inflation suggest that higher GDP per capita and inflation reduce FDI inflows in the short run. The very high p-value (0.9873) for GDP per capita renders this relationship insignificant, while inflation (p-value 0.0740) has a marginally significant short-term negative effect.Trade openness exhibits a statistically significant negative relationship with FDI inflows in the short run (p-value 0.0013), with a coefficient of -94.9683. The coefficient for previous FDI inflows (-0.3115) also indicates a significant negative effect, suggesting a corrective adjustment mechanism in the short term (p-value 0.0150).The model explains 78.96% of the variance in FDI inflows (R-squared), with 74.76% after adjusting for the number of predictors (Adjusted R-squared). The high F-statistic (18.76727) confirms the model's overall statistical significance.

In conclusion, while the long-run analysis suggests that FDI is positively related to CO2 emissions and energy consumption, it is negatively influenced by GDP, inflation, and trade openness, the short-run analysis highlights significant effects of energy consumption and trade openness on FDI. The positive, albeit statistically insignificant, relationship between CO2 emissions and FDI provides weak support for the pollution haven hypothesis, suggesting that relaxed environmental regulations may attract foreign investment, potentially contributing to increased pollution.

3.1.4. Granger Causality Results

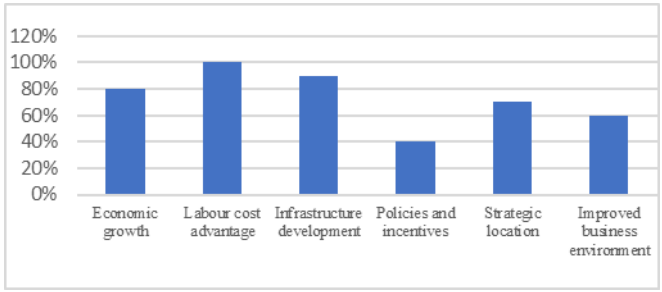
The Granger causality test results show that, in the short term, CO2 emissions do not predict FDI inflows, suggesting that relaxed environmental regulations do not attract foreign investment. Similarly, GDP per capita does not Granger-cause FDI, but FDI inflows significantly contribute to economic growth (GDP). Inflation and trade openness do not have a significant impact on FDI inflows. However, FDI does lead to higher electric power consumption, suggesting that foreign investment increases energy use, potentially contributing to future environmental stress. In summary, FDI inflows do not directly affect pollution but influence economic growth and energy consumption, which could indirectly impact the environment over time.

3.2 Outcome of the Qualitative Analysis

3.2.1 Summary of the informants' interview

Since the 1980s, Foreign Direct Investment (FDI) has been a key focus of Bangladesh's economic strategy. Although FDI inflows have risen since 1971, they remained modest until the 1990s. Experts attribute this upward trend to factors such as low labor costs, improved infrastructure, political stability, favorable investment policies, and trade practices. Additionally, some highlight the role of geopolitical factors and Bangladesh's lax environmental policies, which reduce operational restrictions and may attract foreign investors. Figure 3.2.1.1 illustrates expert perspectives on the factors driving FDI inflows in Bangladesh

Figure-3.2.1.1 Expert Opinion Regarding Rising Trend of FDI inflow in Bangladesh.



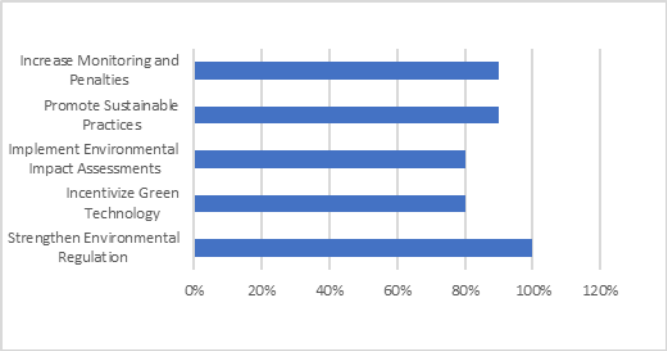
Source: Compiled by the author based on primary survey data

Figure 3.2.1.1 highlights that 100% of experts identify low labor costs as the primary driver of rising FDI in Bangladesh, followed by infrastructure development (90%), strategic location (70%), improved business environment (60%), and investment incentives (40%). However, experts caution that FDI in pollution-intensive "red" industries, such as textiles, food products, and cement, may worsen environmental degradation due to weak regulatory enforcement.

To mitigate these risks, experts recommend strategies summarized in figure 3.2.1.2, including strengthening

environmental regulations, promoting green technologies, conducting impact assessments, encouraging sustainable practices, and enhancing monitoring and enforcement mechanisms.

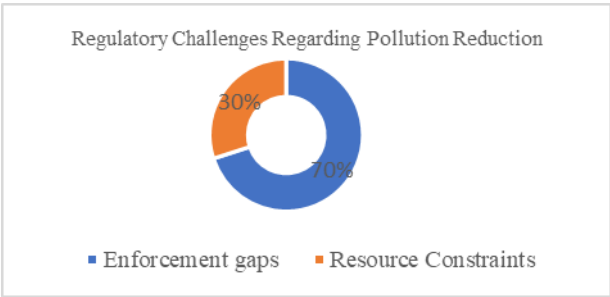
Figure-3.2.1.2 Expert Opinion Regarding Pollution Reduction Strategies While Promoting FDI



Source: Compiled by the author based on primary survey data

Figure 3.2.1.2 shows that 100% of experts advocate for strengthening environmental regulations while promoting FDI, with 90% emphasizing sustainable practices and increased monitoring, and 80% recommending green technology incentives and environmental impact assessments. However, regulatory challenges persist, including weak enforcement, outdated policies, and limited resources for oversight, particularly in managing pollution from high-polluting industries. These issues, illustrated in figure 3.2.1.3, hinder the effectiveness of current pollution reduction strategies.

Figure-3.2.1.3 Expert Opinion Regarding Regulatory Challenges in Reducing Pollution

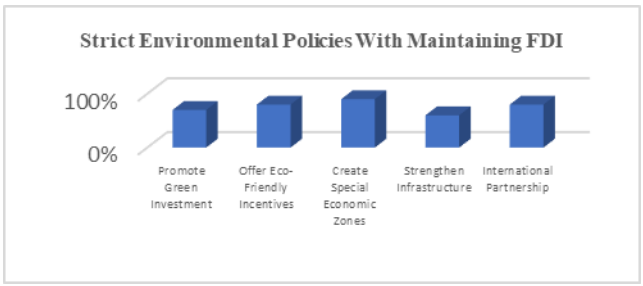


Source: Compiled by the author based on primary survey data

Figure 3.2.1.3 highlights enforcement gaps (70%) and resource constraints (30%) as key challenges in reducing pollution from highly polluting industries. While FDI supports economic growth through job creation, infrastructure development, and technology transfer, experts caution against overreliance, which may lead to resource exploitation and environmental harm. They emphasize that strong environmental safeguards are essential to prevent pollution and ecological degradation.

Figure 3.2.1.4 illustrates expert recommendations for balancing strict environmental policies with maintaining FDI inflows, including promoting green investments, offering eco-friendly incentives, developing special economic zones, enhancing infrastructure, and fostering international partnerships.

Figure-3.2.1.4 Expert Suggestion Regarding Strict Environmental Policies with Maintaining FDI

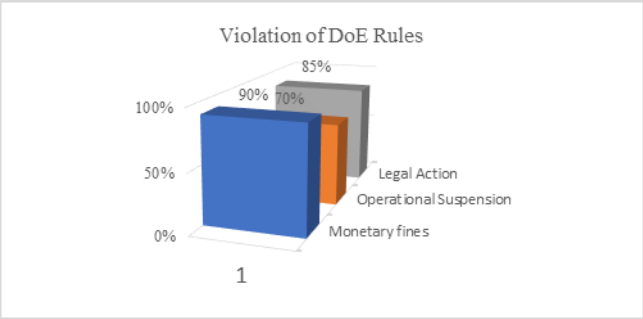


Source: Compiled by the author based on primary survey data

According to figure 3.2.1.4, 90% of experts recommend establishing special economic zones to balance environmental policies with FDI inflows, while 80% emphasize eco-friendly incentives and international partnerships. Additionally, 70% highlight green investments, and 60% stress infrastructure development.

Experts caution that weak enforcement of environmental regulations may attract FDI but risk environmental degradation. Policies such as the National Environmental Policy (1992), Environmental Conservation Act (1995), and Rules (1997) rely on the Department of Environment (DoE) for enforcement. Expert recommendations for addressing violations, as shown in figure 3.2.1.5, include fines (90%), legal actions (80%), and operational suspensions (70%).

Figure-3.2.1.5 Expert recommendations for addressing violations



Source: Compiled by the author based on primary survey data

According to figure 3.2.1.5, 90% of experts recommend monetary fines for violations of DoE rules, 80% advocate legal action, and 70% support operational suspensions. Experts also emphasize the lack of

coordination between the National Trade, Investment, and Environmental Policies, where the former prioritize economic growth and FDI, often at the expense of environmental considerations. Effective policy integration is essential to balance economic development with environmental sustainability.

4. Conclusion

This study examines the impact of lax environmental policies on foreign direct investment (FDI) inflows and their subsequent effects on pollution in Bangladesh, employing a mixed-methods approach that combines quantitative analyses—Johansen cointegration, Vector Error Correction Model (VECM), and Granger causality—with qualitative insights from Key Informant Interviews (KII). Unlike prior research relying solely on quantitative methods, this study triangulates statistical evidence with expert perspectives, providing a nuanced understanding of FDI determinants and environmental outcomes. Focusing on Bangladesh, a developing economy with unique industrial dynamics and evolving environmental governance, it explores both short- and long-run interactions, revealing that FDI is positively associated with CO_2 emissions and energy consumption but negatively related to inflation, GDP, and trade openness, while energy consumption significantly drives FDI in the short run. Granger causality results indicate no direct causal link between FDI and pollution, suggesting that environmental degradation is not primarily driven by foreign investment. Qualitative findings emphasize that low labor costs and market potential, rather than weak environmental regulations, attract FDI, though uncontrolled industrial expansion could exacerbate pollution in resource-intensive sectors.

The study recommends strengthening law enforcement, developing sector-specific environmental standards, promoting clean FDI, incentivizing low-carbon technologies, and adopting digital pollution monitoring. Its originality lies in the integrated methodological approach, context-specific analysis, and nuanced challenge to the conventional Pollution Haven Hypothesis in Bangladesh.

5. Limitations and Further Study

A key limitation of this study lies in the restricted access to comprehensive industrial field data, which poses challenges in accurately capturing real-time pollution metrics. Additionally, the lack of detailed sector-specific environmental data complicates the analysis of industry-specific pollution patterns. Furthermore, this study's reliance on secondary data sources may limit the precision of its findings, and the absence of longitudinal data constrains the ability to assess the long-term impact of FDI on environmental degradation in Bangladesh. Finally, the scope of this study is limited by the exclusion of certain pollution indicators, such as PM 2.5 emissions and water and soil pollution, due to data unavailability.

Author Contribution

The author conceptualized the study, developed the research framework, and conducted a comprehensive review of relevant literature. Data collection, analysis, and interpretation were carried out by the author, utilizing both qualitative and quantitative methods. The author also prepared the manuscript, integrating feedback from advisors and peer reviewers to enhance the study's rigor and relevance. Furthermore, the author actively engaged with stakeholders to ensure the study's findings address practical challenges and contribute to policy discourse.

Funding

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Institional Review Board Statement

Not applicable.

Informed Consent Statement

Informed consent was obtained from all participants involved in the study. Prior to the Key Informant Interviews (KIIs), each participant was informed about the purpose of the research, the voluntary nature of participation, and their right to withdraw at any stage without any consequence. Confidentiality and anonymity were assured, and no personally identifiable information has been disclosed in this publication.

Data Availability Statement

The quantitative data used in this study were obtained from publicly accessible sources, including the World Development Indicators (World Bank), Bangladesh Bank, and the Bangladesh Bureau of Statistics (BBS). Qualitative data were collected through Key Informant Interviews (KIIs) conducted under informed consent. To protect participants' confidentiality, the interview transcripts are not publicly available but can be provided by the corresponding author upon reasonable request and with appropriate ethical considerations.

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Conflict of Interest

The author declares that there are no competing interests that could have influenced the research, analysis, or conclusions presented in this study. All efforts were made to ensure transparency and objectivity throughout the research process.

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