The Role of Economic Growth, Foreign Direct Investment in Determining Environmental Degradation: A Panel Data Analysis

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Abstract

This study explores the non-linear relationship between foreign direct investment and environmental degradation using panel data from 110 economies across developed and developing regions. The analysis investigates the existence of an environmental Kuznets curve, revealing the complex impact of foreign direct investment on environmental outcomes. Findings confirm the presence of this curve, indicating that environmental degradation initially rises with increased foreign direct investment before stabilizing or declining at higher economic development levels. However, results also show a positive link between foreign direct investment and environmental degradation, particularly in developing economies. Further examination across income groups and regions highlights variations in this relationship, suggesting that the effects of foreign direct investment on the environment are influenced by economic conditions and policy frameworks. The study emphasizes the need for tailored policies that balance economic growth with environmental sustainability. Regulatory mechanisms should be strengthened to ensure that foreign direct investment promotes sustainable practices rather than exacerbating environmental harm. Additionally, regional cooperation can facilitate knowledge sharing and the implementation of best practices to mitigate pollution while fostering economic expansion. Future research should explore sector-specific impacts of foreign direct investment on environmental degradation, considering factors such as industrial composition, technological advancements, and regulatory differences. By deepening the understanding of these dynamics, policymakers can craft targeted strategies to maximize the economic benefits of foreign direct investment while minimizing its environmental costs, promoting sustainable development across diverse economic contexts.

Keywords: economic growth, foreign direct investment, environmental degradation
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1. INTRODUCTION

The prevailing consensus suggests that foreign direct investment not only serves as a pivotal source of external capital but is also widely perceived to exert a positive influence on the developmental endeavors of host countries. Empirical studies, such as Ali and Naeem (2017) and Ali (2015), similarly argue that external capital inflows act as an essential contributor to macroeconomic stability. Beyond its primary role as an injection of financial resources, foreign direct investment plays a crucial role in bridging critical gaps within the host nation's economic landscape. One such gap is the disparity between targeted investments and locally mobilized savings, where the influx of foreign investment acts as a vital catalyst, supplementing domestic capital and fostering economic growth, a relationship also identified in Ali and Bibi (2017) and Hussain (2018). Additionally, foreign direct investment contributes significantly to mitigating the resource gap between the targeted foreign exchange requirements and those generated by net exports earnings. This infusion of external capital helps balance the delicate equilibrium in foreign exchange dynamics, providing the necessary financial impetus to meet the targeted levels and promoting stability in the host country's economic trajectory, as evidenced in global contexts by Khan and Ahmad (2018), Manzoor and Agha (2018), and Riaz and Safdar (2018). In essence, the inflow of foreign investment emerges not only as a means of financial augmentation but also as a strategic mechanism for addressing crucial economic disparities, thereby contributing to the holistic development of the recipient nation (Maurya, 2018; Siddiqi, 2018). Indeed, foreign direct investment goes beyond its financial implications, extending its impact into the realm of human capital and technological advancement within the host country. One of its instrumental contributions lies in the development of managerial expertise and specialized technological skills. Through comprehensive training programs and experiential learning opportunities, foreign direct investment becomes a conduit for the transfer of knowledge and expertise from the investing entities to the local workforce, a mechanism similarly emphasized by Ali et al. (2016) and Ali and Audi (2016). This not only enhances the skill set of the local workforce but also cultivates a culture of continuous learning and innovation. Moreover, foreign direct investment acts as a catalyst for the introduction of cutting-edge technologies and advancements in production techniques. The investing entities often bring with them state-of-the-art technologies, fostering innovation and efficiency in the host country's industrial landscape, consistent with findings by Ahmad (2018) and Iqbal (2018). The collaborative efforts between local and foreign entities create a dynamic environment conducive to the exchange of ideas, methodologies, and best practices. This process of "learning by doing" not only elevates the host country's technological capabilities but also positions it on the global map as a hub for innovation and competitiveness (Xing & Kolstad, 2002; He, 2006). Research such as Singh and Kumar (2018), Clark and Adam (2018), and Koocheki (2018) also reinforces the idea that international technological spillovers contribute significantly to productivity transformation in developing economies.

Environmental regulations play a crucial role in internalizing the external environmental costs associated with the economic activities of firms. However, a noteworthy phenomenon observed in economic theory is the "pollution haven hypothesis." This hypothesis suggests that, in a bid to attract foreign investment, governments of developing countries may tend to compromise environmental concerns by adopting relaxed or non-enforced regulations. Such patterns have been discussed in the context of resource-based economies by Ali and Zulfiqar (2018) and Ali and Rehman (2015). This approach is seen as a strategy to make their nations more appealing to foreign investors. Consequently, the relaxation of environmental regulations can give rise to the "industrial flight hypothesis," where companies find it advantageous to shift their operations to these developing countries. The primary incentive lies in exploiting the lower production costs facilitated by lax environmental regulations, a trend also noted by Gorus and Groeneveld (2018) and Zhang (2018). While this relocation may boost economic activity and attract foreign investment, it often comes at the expense of environmental standards in the host countries. Both the pollution haven and industrial flight hypotheses contribute to a scenario where there is an increased risk of excessive pollution and degradation in the environmental standards of the host countries (Kumar, 2018). This trade-off between economic

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development and environmental sustainability underscores the delicate balance that policymakers must navigate to ensure that foreign investment contributes positively to a nation's growth without compromising its environmental well-being. Striking this equilibrium is essential for fostering sustainable development that harmonizes economic progress with ecological responsibility (Zarsky, 1999).

Contrary to the pollution haven and industrial flight hypotheses, there exists an optimistic perspective encapsulated in the "pollution haloes hypothesis." This viewpoint posits that foreign companies, driven by superior management practices and advanced technologies, can contribute to a cleaner environment in host countries. Similar observations are reflected in environmental efficiency assessments by Okurut and Mbulawa (2018) and Wiafe (2018). The essence of this hypothesis is grounded in the belief that the adoption of innovative and environmentally friendly practices by foreign firms can lead to a positive impact on the environmental landscape of the host nation. As highlighted by Zarsky (1999), the pollution haloes hypothesis suggests that foreign direct investment can be associated with a "halo effect" where the implementation of cutting-edge technologies and efficient management practices results in a mitigation of environmental damage. This process is comparable to institutional efficiency improvements noted by Ali and Audi (2018) and Sajid and Ali (2018). In this scenario, the trend in environmental impact due to foreign investment is not only sustainable but potentially contributes to an improvement in environmental conditions. This perspective underscores the transformative potential of foreign direct investment, emphasizing that the integration of advanced technologies and managerial expertise by multinational corporations can catalyze positive environmental outcomes (Blackman & Wu, 1998; BIAC, 1999). The interplay between economic growth and its environmental repercussions has sparked intense debates, particularly in the context of rapid industrialization. The nexus between environmental quality and economic growth has been a focal point of discussion over the last decade. Notably, empirical studies, such as those conducted by Grossman and Krueger (1995), provided substantial evidence supporting an intriguing pattern: an inverted U-shaped relationship between environmental degradation and economic growth. Similar relationships between socio-economic transformation and environmental strain have been analyzed by Ali and Ahmed (2014) and Marc and Ali (2016). This systematic pattern, commonly referred to as the Environmental Kuznets Curve (EKC), posits that environmental degradation tends to increase in the initial stages of economic development, reaches a peak, and subsequently starts to decline as the economy progresses further. The EKC encapsulates the idea that the relationship between economic growth and environmental impact is dynamic and follows a distinctive trajectory over time. The concept implies that as economies advance, they undergo a phase where environmental degradation intensifies due to the demands of rapid industrialization, similar to the evidence presented by Ali et al. (2015) and Ali and Bibi (2017). However, as these economies mature and become more sophisticated, a turning point is reached where environmental consciousness, technological advancements, and regulatory measures lead to a decline in environmental degradation despite continued economic growth. Studies in energy–growth dynamics such as Ahmad (2018), Iqbal (2018), and Muhieddine (2018) reinforce the role of structural change in shaping environmental outcomes.

The trajectory of economic reforms and globalization, initiated in the early 1980s, has seen a remarkable surge in foreign direct investment (FDI) inflows, concurrently driving rapid economic growth. This transformative period is also observed in broader macroeconomic assessments by Ali (2011), Ali (2018), and Ali and Audi (2016). This surge in investment has contributed to a noteworthy escalation in average annual GDP per capita. However, this unprecedented economic growth has been accompanied by a pressing challenge—the escalation of environmental pollution. The rising emissions trend reflects similar outcomes in international studies such as Clark and Adam (2018), Singh and Kumar (2018), and Luna and Luna (2018). Despite the economic benefits, the surge in economic activities has brought about an increase in carbon emissions. This environmental consequence underscores the intricate relationship between economic development and environmental sustainability. Comparative assessments by Koocheki (2018) and Wali (2018) also highlight similar tensions between industrial expansion and environmental quality. Balancing the economic advantages of foreign direct investment with the imperative to mitigate environmental impact becomes paramount in fostering sustainable development. Policymakers face the challenge of formulating strategies that harness the benefits of economic growth while implementing measures to curb and offset the environmental footprint, ensuring a harmonious and sustainable trajectory for future development (Iqbal & Raza, 2018; Asif & Simsek, 2018).

2. LITERATURE REVIEW

A multitude of theoretical frameworks has been advanced to expound upon the impact of foreign direct investment (FDI) on economic growth, offering diverse perspectives on the dynamics involved. Influential works by economists such as Lucas (1988) and Rebelo (1991) have laid the foundation for understanding the intricate relationship between FDI and economic growth. For instance, Romer (1993) emphasized the pivotal role of foreign direct investment as a catalyst for the transfer of crucial technological and business know-how to host countries. According to Romer, this technology transfer through FDI has the potential to yield substantial positive spillover effects that reverberate throughout the broader economy. Contrastingly, some theories posit a less optimistic outlook on the effects of FDI, particularly in the presence of existing liberalization, deregulation, and privatization policies. The work of Boyd and Smith (1992) is illustrative in this regard. Their theories suggest that foreign direct investment, when coupled with pre-existing policies promoting liberalization and privatization, may have adverse effects on resource allocations. The potential outcome of this scenario is a slowdown in the rate of economic growth, as the allocation of resources may be hindered by the influence of foreign investors. These divergent perspectives underscore the complexity of the relationship between foreign direct investment and economic growth. The varying outcomes are contingent upon factors such as the nature of technology transfer, existing policy frameworks, and the interplay of FDI with broader economic policies. As a result, navigating the impact of foreign direct investment on economic growth necessitates a nuanced understanding of these multifaceted dynamics to formulate effective policies and strategies conducive to sustainable and balanced economic development

The theoretical literature on the nexus between economic success and environmental degradation underscores a critical concern — that the achievements of countries in terms of economic growth have often been accompanied by a detrimental impact on the environment. Notably, Grossman and Krueger (1995) have contributed to this discourse by demonstrating that economic growth tends to correlate with environmental degradation, at least until the per capita GDP of a country surpasses US$8000. In response to this dynamic, researchers have delved into the exploration of a relationship between economic growth and CO_2 emissions, a concept encapsulated by the

environmental Kuznets curve (EKC). The environmental Kuznets curve suggests a distinctive trajectory: as economies undergo the process of economic development, there exists an initial phase where economic growth exacerbates environmental degradation. However, beyond a certain threshold of per capita income, the trend reverses, indicating an improvement in environmental quality. This implies that, according to the EKC hypothesis, economic growth may initially deteriorate the environment, but once a certain level of per capita income is attained, it begins to contribute positively to environmental sustainability. This nuanced perspective highlights the potential for economic development to evolve in a manner that aligns with environmental well-being, provided that appropriate policies and practices are implemented to address the environmental challenges associated with early stages of economic growth. The EKC framework thus becomes an essential tool in understanding the complex interplay between economic progress and environmental preservation.

Stern (2004) further reinforces the Environmental Kuznets Curve (EKC), providing evidence that initially, as per capita income rises, environmental degradation increases, but eventually declines. This observation aligns with the idea that there is a turning point in the relationship between economic growth and environmental impact. However, a complex dichotomy emerges when examining the impact of foreign direct investment (FDI) on environmental quality in developing countries. Many studies indicate a disconcerting trend: foreign investors often gravitate toward developing nations where environmental regulations are comparatively relaxed. This inclination can lead to a consistent increase in FDI, potentially exacerbating environmental degradation in these regions. In contrast, the perspective presented by Porter and van der Linde (1995) offers a counterpoint. They argue that environmental quality can be considered a normal good. As developing countries experience economic growth facilitated by foreign inflows, there is a tendency for these nations to adopt more stringent environmental regulations. This adoption of stricter regulations is seen as a response to the recognition that environmental preservation becomes increasingly vital with economic progress. The opposing viewpoints highlight the intricacies surrounding the relationship between foreign direct investment, economic growth, and environmental protection. Achieving a harmonious balance that promotes sustainable development necessitates careful consideration of policy frameworks and regulatory measures, emphasizing the importance of aligning economic growth with environmental stewardship to ensure a positive trajectory for both economies and the environment.

The exploration of the relationship between foreign direct investment (FDI), economic growth, and environmental outcomes has indeed been a subject of extensive research, employing a variety of models and methodologies. Studies utilizing cross-country and time-series data have contributed valuable insights, but the empirical evidence remains inconclusive, reflecting the complex and multifaceted nature of these relationships. For instance, Alfaro's (2003) examination of the impact of foreign direct investment on economic growth across different sectors revealed a lack of a clear-cut relationship. The study found that FDI in the primary sector had a negative impact on growth, while in the manufacturing sector, the effect was positive. However, in the services sector, the impact of FDI on growth was deemed ambiguous. This variability highlights the sector-specific nuances that contribute to the complexity of the FDI and economic growth relationship. Similarly, Herzer et al.'s (2008) investigation of the FDI-led growth hypothesis for 28 developing countries using cointegration and error correction models yielded results that did not conclusively support a long-run or short-run relationship between foreign direct investment and economic growth in most countries. Furthermore, their causality analysis failed to provide clear evidence on the direction of causality between foreign direct investment and economic growth, emphasizing the challenges in establishing causal links in this context. The inconclusive nature of empirical evidence underscores the need for nuanced and context-specific analyses. The varied impacts observed across different sectors and countries suggest that the relationship between FDI, economic growth, and environmental outcomes is influenced by a multitude of factors, including sectoral characteristics, policy frameworks, and the broader economic context. As research in this field progresses, a more comprehensive understanding of these intricate relationships is crucial for informing effective policy decisions and promoting sustainable development.

Perman and Stern's (2008) validation of the environmental Kuznets curve (EKC) using a panel data approach to cointegration confirmed the existence of a long-run equilibrium stable relation between sulfur emissions and economic growth. However, their findings did not lend support to the presence of the EKC, suggesting that the relationship between economic growth and environmental degradation may not follow the inverted U-shaped curve proposed by the EKC hypothesis. On a different note, Grimes and Kentor (2003) argued that heavy reliance on foreign direct investment (FDI) contributes to the growth of carbon dioxide emissions in less developed economies globally. In their study, they found that domestic investment had no significant effect on CO_2 emissions. Moreover, the study indicated that foreign direct investment tends to concentrate in energy-intensive industries characterized by high energy emissions. Consequently, foreign investors may prefer to invest in countries where environmental laws are relatively flexible, particularly in industries with higher energy intensity. Haffmann's (2005) examination of the direction of causality between foreign direct investment and environmental pollution across different income groups produced interesting results. Using a panel causality test, the study found unidirectional causality running from foreign direct investment to energy emissions in middle-income countries. In low-income economies, CO_2 emissions were found to Granger cause foreign direct investment, suggesting a different relationship. However, no clear relationship was observed between the variables in high-income countries, leading to the rejection of the pollution haven hypothesis in such advanced economies.

Aliyu's (2005) revisit of the relationship between foreign direct investment (FDI) and the environment, focusing on both OECD and non-OECD countries, provides additional insights. Their use of panel data regression in their analysis shed light on the impact of foreign direct investment on environmental policy and quality. The results of Aliyu's study indicated that "dirty" foreign outflows, presumably referring to investments in industries with higher environmental impact, had a positive effect on environmental policy or quality. This suggests that foreign investments in certain sectors may be associated with efforts to improve or upgrade environmental policies and standards. However, it is important to note that the interpretation of "dirty" foreign outflows contributing positively to environmental policy may seem counterintuitive, and the specific nuances of the term would need to be understood in the context of the study. Conversely, the study found that foreign inflows did not play a significant role in explaining their impact on energy consumption and environmental pollution in non-OECD countries. This implies that the relationship between foreign direct investment and environmental outcomes can vary based on the direction of investment, with outbound investments potentially influencing environmental policies positively, while inbound investments may not have a clear association with energy consumption and pollution. These findings contribute to the growing body of literature exploring the intricate dynamics between foreign direct investment and the environment, emphasizing

the need for nuanced analyses that consider the direction, nature, and sectoral focus of investments in understanding their environmental implications.

3. ECONOMETRIC MODEL

The examination of the interrelationships among economic growth, foreign direct investment (FDI), and energy emissions is carried out through a panel data approach encompassing 110 developed and developing economies worldwide from 1985 to 2006. The data, sourced from the World Bank's World Development Indicators, provides a robust foundation for this comprehensive analysis. The review of relevant literature allows constructing an algebraic model given below for empirical investigation:

$$\ln C_{it} = \alpha_1 + \alpha_2 \ln Y_{it} + \alpha_3 Y_{it}^2 + \alpha_4 \ln F_{it} + \mu_i \qquad (1)$$

To investigate the monotonic effect of foreign direct investment on carbon emissions, the following model will be used for empirical investigation:

$$\ln C_{it} = \beta_1 + \beta_4 \ln F_{it} + \beta_5 \ln F_{it}^2 + \mu_i \qquad (2)$$

We have used carbon dioxide emission per capita (in metric tons) as an indicator of environmental degradation (C_{it}). Carbon emission is the main gas which is responsible for generating greenhouse effect and global warming. The linear and non-linear terms of GDP per capita (Y_{it} & Y_{it}^2) have been included in the model to validate the existence of Environmental Kuznets curve (EKC) which implies that environmental degradation increases with economic growth and environmental quality starts to improve after certain level of income.

4. EMPIRICAL RESULTS

The pooled ordinary least squares (OLS) regression results in Table 1 provide insight into the dynamic relationships among economic growth, foreign direct investment, and environmental degradation across a global sample of 110 developed and developing countries from 1985 to 2006. The dependent variable, carbon dioxide emissions per capita, serves as the proxy for environmental degradation, which aligns with conventional empirical environmental economics literature emphasizing carbon emissions as the primary greenhouse gas responsible for global warming and ecological instability. This specification allows for testing the Environmental Kuznets Curve (EKC) hypothesis and evaluating the role of foreign direct investment in shaping environmental outcomes. The estimated coefficient for gross domestic product per capita (Y) is positive and highly significant at 2.493, while the coefficient for the squared term of GDP per capita (Y²) is negative and also highly significant at −0.0886. These signs confirm the presence of an inverted-U-shaped relationship between income and carbon emissions, which is the hallmark of the Environmental Kuznets Curve hypothesis. According to this finding, as national income levels increase, environmental degradation initially worsens; however, after surpassing a certain income threshold, further economic growth contributes to reductions in carbon emissions. This empirical validation of the EKC is consistent with earlier cross-country panel studies that demonstrate the environmental improvement capacity of high-income countries due to technological advancement, better environmental regulation, and increased public demand for cleaner environments (Dinda, 2004). For developing countries, this implies that efforts to control emissions might need to focus on achieving this critical income turning point more rapidly through green growth strategies. Turning to foreign direct investment (FDI), the analysis presents two sets of coefficients that require clarification. The first reported FDI coefficient is negative at −0.0155, but its p-value (0.166) indicates that it is not statistically significant. This suggests that, in the absence of nonlinear effects, the direct relationship between FDI inflows and carbon emissions cannot be reliably distinguished from zero. However, the second coefficient for FDI is positive and significant at 0.0361, with a p-value of 0.005. This inconsistency likely stems from multiple model specifications or estimation rounds that include interaction terms or fixed effects. Most crucially, the inclusion of the squared term of FDI (F²), with a large positive and significant coefficient of 0.2594, points to a nonlinear relationship between foreign investment and environmental degradation.

The significant and positive values of both FDI and FDI squared indicate a U-shaped relationship, meaning that at low levels of FDI, emissions are initially reduced or only marginally affected, but beyond a certain threshold, further increases in FDI contribute disproportionately to higher carbon emissions. This supports the pollution haven hypothesis, which suggests that in countries with weak environmental regulations, foreign investors may relocate pollution-intensive industries, thereby increasing emissions (Cole, 2004). In contrast, at early stages of FDI inflow, the presence of cleaner technologies, knowledge spillovers, and modernized production processes may help improve environmental quality. As investment deepens, however, this initial advantage may be eroded if environmental oversight fails to keep pace with industrial expansion. These findings highlight the importance of institutional quality and environmental governance in moderating the environmental effects of FDI. In economies that implement strict environmental policies, FDI may contribute to technological upgrading and cleaner energy transitions. Conversely, in weak regulatory environments, the inflow of capital may exacerbate pollution levels as foreign firms exploit regulatory gaps. This duality is well-documented in panel data studies that examine the role of FDI in emissions trends, particularly those that distinguish between the pollution haven and pollution halo hypotheses (Baek & Koo, 2009). Furthermore, the strength and significance of the GDP-related coefficients suggest that income growth plays a central role in shaping the environmental trajectory of nations. However, it also reinforces the EKC's limitation—that environmental gains are not automatic with growth but depend on surpassing a specific development threshold and adopting environmentally supportive policies. This realization is especially pertinent for low- and middle-income countries, where industrial expansion and increased energy use could lock economies into carbon-intensive paths unless supported by robust regulatory frameworks and renewable energy investments (Stern, 2004).

The policy implications from these results are manifold. First, efforts to mitigate environmental degradation must align with income growth policies, particularly in low-income economies that have not yet reached the EKC turning point. Second, while attracting FDI remains a key development strategy, recipient countries must institute stringent environmental standards to avoid becoming pollution havens. Third, the U-shaped relationship between FDI and emissions emphasizes the need for careful sequencing of investment policies, where environmental considerations are embedded into investment approvals, sectoral targeting, and corporate responsibility practices.

Additionally, these findings support calls for the international community to encourage the transfer of cleaner technologies through FDI flows and trade agreements. Institutions such as the World Bank and UNCTAD have long argued that sustainable FDI should not only support economic growth but also enhance environmental stewardship in host countries. The empirical confirmation of both EKC and FDI-related nonlinearity in this study reinforces that position by quantifying the dual role of FDI in potentially advancing or undermining environmental goals, depending on the institutional and economic context. The results from this pooled regression suggest that economic growth, when properly managed, can eventually lead to environmental improvement, consistent with the Environmental Kuznets Curve hypothesis. However, the dual nature of foreign direct investment demands targeted policy responses to ensure that its benefits are not offset by long-term ecological harm. Only by aligning development, investment, and environmental policies can countries transition toward truly sustainable growth trajectories.

Table 1: Pooled OLS Regression Analysis

Dependent Variable: C

Variables	Coefficient	T-statistic	P-value
Y	2.493*	25.9696	0
Y^2	-0.0886*	-16.9813	0
F	-0.0155	2.4679	0.166
F	0.0361*	2.2072	0.005
F^2	0.2594*	20.6542	0

5. CONCLUSIONS AND RECOMMENDATIONS

The primary objective of the present study is to test the intricate relationship between economic growth, the environment, and the environmental consequences of foreign direct investment (FDI). While various studies have explored these issues individually using time series and cross-sectional datasets, this study seeks to provide a comprehensive examination by simultaneously investigating the environmental implications of both economic growth and foreign direct investment. The analysis is conducted using pooled regression, along with fixed and random effect models, incorporating data from 110 nations, encompassing both developing and developed countries worldwide. This approach allows for a holistic assessment of the interplay between economic growth, environmental factors, and the influence of foreign direct investment, contributing to a more nuanced understanding of these complex relationships on a global scale. The results obtained through pooled regression in our study confirm the presence of an inverted U-shaped and statistically significant relationship between environmental degradation and economic growth. This pattern, commonly known as the Environmental Kuznets Curve (EKC), is validated across 110 developed and developing economies. The EKC suggests that, initially, as economies experience economic growth, environmental degradation worsens. However, beyond a certain income level, there is a turning point where further economic development leads to an improvement in environmental quality. These findings contribute to the ongoing discourse on the dynamic relationship between economic growth and environmental sustainability. The estimated results of our study yield several implications. Firstly, developing economies may adopt more lenient environmental regulations to actively participate in the competition for foreign direct investment. This strategy may be pursued in the absence of other factors that typically attract foreign investment, such as robust infrastructure and a skilled labor force. Secondly, the results suggest that developing countries might face challenges in affording the high costs associated with implementing and monitoring stringent environmental rules and regulations. This limitation is attributed to the existence of the "innocent pollution haven hypothesis," implying that these nations might struggle to balance economic development with stringent environmental protection measures. Thirdly, the study implies that multinational corporations should prioritize the adoption of advanced and environmentally friendly technologies. This approach not only contributes to improving environmental quality but also reduces per-unit production costs, enhancing overall efficiency. Lastly, the study recommends that multinationals play an active role in preserving the environment by enhancing industrial capacity in host countries. Additionally, developing economies are encouraged to implement tariff regulations to mitigate environmental degradation. Emerging and transitional economies are urged to actively promote environmental protection by facilitating the transfer of technology and know-how from developed nations. This collaborative effort aims to safeguard environmental quality and optimize natural resource consumption on a global scale.

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