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Green Finance and Economic Development: Exploring the Fdi Connection

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Abstract

Green Finance, as a method to implement sustainable economic practices, has become quite popular in the past few decades. It is, however, very important to see if this alternate way of financing does actually contribute to the economic success of nations. This paper tries to investigate the relationship between green finance and the flow of foreign direct investment (FDI), and thus, economic development. Data from the top 56 countries with the highest green finance expenditures has been analysed. Findings reveal that green finance does significantly influence the inflow of FDI. This research, therefore, heavily contributes to the ongoing debates on sustainable economic development. Being a relatively new concept, institutions are required to develop strategies to enable green finance to gain momentum in the mainstream commercial sectors. Governments need to explore the reasons behind these results and shape green financial policies in a way that may effectively be able to attract foreign investments.

Keywords: Green Finance, Foreign Direct Investment, Economic Growth

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Chapter 1: Introduction

In the last few decades, the global discussion on economic development has gone through a huge transformation, which has been highlighted by an extraordinary focus on sustainability and environmental conservation. This shift has led to the emergence of green finance as a strong force driving both economic growth as well as ecological potential. The intersection of green finance and high-quality economic development is a crucial topic that requires in-depth research.

There are diverse definitions of green finance, reflecting its multifaceted nature and its role in fostering sustainable economic development. Existing literature presents various perspectives on this concept, shedding light on its scope, components, and implications. Höhne et al. (2012) laid emphasis on the wide scope of green finance, summing up investments in sustainable development, environmentally-conscious commodities, and policies with the goal of building a more sustainable society. Their definition includes climate finance but also studies beyond it, thus advocating for a wide array of environmental objectives such as sanitation, pollution control, and the protection of biodiversity. They also made clear distinctions between mitigation finance (that involves efforts to curb greenhouse gas emissions), and adaptation finance (which concerns the reduction of vulnerability to climate change effects). Zadek and Flynn (2013) further expanded the reach of green finance beyond just investments, highlighting its inclusion of operational expenditures that are associated with green investments. Their study focused on stimulating environmentally conscious investments and promoting low-carbon technologies and industries. Meanwhile, Böhnke et al. (forthcoming) gave an all-inclusive definition that included investment and provided decisions that account for environmental sustainability. Their approach revolved around sustainable investment and banking, encompassing environmental screening and the need for assessment of risks to meet sustainability standards.

The shift towards green finance goes beyond just financial strategies- it is the anchor that promotes a liveable economic landscape. It incorporates a transformative motive, redirecting capital towards

environmentally friendly, low-carbon, and socially dependable advancements and achievements. This switch has become acute, urging nations, institutions, and industries to turn towards sustainable methods that combine economic development along with the protection of the environment. Now, it is crucial to find out if such sustainable financing is really bringing about economic development in the concerned nations. Economic theory tells us that green finance has the potential to attract Foreign Direct Investment (FDI) because it encourages investments in innovative and sustainable technologies (Wang et al. 2023). Investments that are focused on sustainability hint at a growing market for environmentally friendly goods and technologies, and therefore countries that implement green finance policies may lure foreign investors that seek opportunities in eco-friendly markets. It has been widely recognised that green finance has the potential to align with long-term sustainability goals (Berensmann et al. 2017), reducing environmental risks and increasing the stability of investments. This can also attract foreign investors looking for stable and sustainable ventures. Green investments also often receive incentives from the Governments through policies, subsidies, or tax breaks. Additionally, countries embracing green finance may provide access to certain natural resources or renewable energy sources. All of these factors, along with the improved reputation and corporate social responsibility (CSR) image contribute to greater FDI inflows in countries that encourage green finance. Hence, green finance has the ability to attract FDI.

Now, we may also assert that the inflow of FDI in a country implies economic development. The rationale behind using Foreign Direct Investment (FDI) as a measure to assess the economic development of a country is threefold. Firstly, FDI shows the intensity of international integration and the attractiveness of a country's economic landscape to potential foreign investors (Groh & Wich 2012). A higher inflow of FDI generally implies that there is solid trust in the growth prospects, stability, and favourable business conditions in a country(Bissoon 2012, Mengistu & Adhikary 2011). Secondly, FDI brings in capital, technology, as well as better managerial know-how into the country. This generates employment (Abor & Harvey 2008) and inspires innovation, thus encouraging economic growth. Foreign investment inflows typically contribute significantly to the development of infrastructure and expansion of industries. Furthermore, high FDI levels act as an indicator of a nation's competitiveness in the international market (Sabir et al. 2019). Those countries that attract substantial FDI tend to show a stronger ability to compete, which leads to greater productivity, higher exports, and a more stable economy.

Thus, by using FDI as a measure of economic development and examining its relationship with green finance, we may be able to compute the influence of environmentally sound financial policies on a country's ability to bring in foreign investments. Understanding this link is important because it highlights the coordination between sustainable financial practices and the economic prosperity of a country. However, it must be noted that navigating this transition requires clear insights and empirical evidence. This study shall dive into the available literature and empirical data, seeking to understand the intertwining between green finance and high-quality economic development through FDI. The focus is to offer feasible recommendations that may resonate with policymakers at the local, national and international levels. The line of causality as suggested by standard economic theory and several other scholars is as follows-

Green Finance ➞ Foreign Direct Investment ➞ Economic Development

Thus, this paper investigates the central question - How does the level of FDI change with respect to the implementation of Green Finance strategies? With governments around the world rapidly opting for subsidies or other favourable policies such as tax breaks and grants to attract investments for environment-friendly projects, it is crucial to analyse its effectiveness. For instance, the German government provides direct financial subsidies for the construction of renewable energy plants and mandates that power companies pay the external parties a fixed rate for supplying power back into the grid. Such an approach makes Germany an attractive location to foreign firms (Boston, 2009). Several reports such as Chau et al. (2023) suggest an increase in 'green FDI' while Golub et al. (2011) present a less optimistic response to the flow of FDI aids with respect to the implementation of green finance strategies. While the methodology to capture 'green FDI' remains largely debated, it has been claimed to have become the largest part of inward FDI flows. The question remains if this is due to governments' favourable policies as discussed above or

due to the inherent concern among investors for greener growth. Raworth (2017) suggested that most companies tend to take environmental damages as a part of their cost, increased FDI due to inherent concern would hence, be an important positive step towards green high-quality economic growth. On the contrary, blind spending on subsidies by the government can be detrimental given that there is a lack of evidence that such policies lead to accelerated FDI inflow.

This study provides to the existing body of knowledge by contributing valuable insights regarding the relationship between green financial investments and the inpour of international financial resources or FDI. Secondly, the discoveries aim to offer practical implications for policymakers and institutions by explaining how sustainable practices may affect a country's ability to attract foreign investments. Lastly, through this study, we also seek to inform future research directions by recognising avenues for further investigations into the understanding of the role of green finance in forming global financial passages. By analysing empirical data and exploring the existing literature, this study hence, endeavours to contribute to the discussion on sustainable economic development and international financial dynamics.

Chapter 2: Literature Review

Before diving into the empirics, it is essential to study the existing literature on green finance. There have been numerous studies in different regions of the world that have made the effort to explain how green finance is essential in the 21st century in order to ensure steady economic progress along with a liveable environment for future generations. The following section provides extensive literature on green finance. It has been divided into two subsections. In the first subsection, papers on green finance's environmental impact shall be gone through. Subsection 2.2 will examine existing research on the effect of green finance initiatives on the economic growth of countries. Finally, subsection 2.3 will inspect the available literature on how green finance may affect a nation's appeal to foreign investors and bring in foreign direct investment (FDI).

2.1. Green Finance and Environment Impact

With regards to developing nations, Bakry et al. (2023) investigated the impact of green finance on environmental performance in 76 developing nations from 2010 to 2019 using panel cointegration and VECM. On par with their prior research, they explored the role of green finance in reducing carbon emissions along with renewable energy. Their study used the established methodologies to ascertain long-term bonds among green finance, renewable energy, economic factors, and carbon emissions. It also provided insights into the specific dynamics of developing nations, contributing valuable recommendations for policy and sustainable development strategies within these contexts.

Moving now towards the global energy sector, we see that Yu et al. (2021) studied the complex relationship between sustainable investments, energy efficiency (EE), and environmental sustainability in both developed and developing economies from 2008 to 2018. Using data envelopment analysis (DEA), their paper showed a moderate level of EE in the observed economies, with just seven countries showing substantial energy savings. Their research emphasised the pivotal role of financial investment in strengthening EE while also highlighting the effect of open economic structures in impacting ecological conditions and reducing pollution. It focused on the impact of natural resources and technological advancements on EE, reiterating causal links between EE, environmental emissions, financial progress, governance, efficient utilisation of resources, technological innovation, trade, and localisation of industries.

In the Chinese context, Lv (2021) is an important paper that examined China's green finance development across regions using provincial data from 2010 to 2019. Using various analytical tools, the study revealed an increasing yet relatively moderate overall green finance index. The research focused on inter-regional disparities as key contributors to developmental gaps. It revealed a trend of polarisation across the different regions of China and a club convergence occurrence. Therefore, it showed the hierarchical distribution of the evolution of green finance. These findings provided key insights into China's green finance landscape, laying a strong foundation for encouraging more balanced and coordinated development strategies. Along similar lines, Xu et al. (2022) used robust statistical models to show a positive correlation

between corporate-level environmental regulations and the progress of green finance, especially via external financing sources. Their study also elaborated on the challenges that hinder this progress, including unrestricted financing for polluting projects and the 'greenwashing' practices in non-manufacturing enterprises.

Shifting the spotlight now to the Asian landscape, Khan et al. (2022) offered an overall exploration into the Asian Development Bank's (ADB) role in incentivising environmentally sustainable growth across Asia and the Pacific. They focused on climate mitigation finance- an integral part of ADB's initiatives (which the study quantified as 'green finance'), and investigated its effect on reducing ecological footprints across 26 Asian nations. They used OLS and fixed-effects estimation methods, and their findings determined a positive effect of green finance in reducing ecological footprints. These results therefore highlighted the importance of continued investment in green finance in Asia and offered valuable observations to aid policymakers in making strategic decisions to achieve sustainability goals.

2.2 Green Finance and Economic Development

While the above subsection explored works on how green finance has impacted environmental performance in various regions, the following subsection focuses on how green finance may influence the economic growth and development of a nation. There are numerous papers from around the globe that show if and how sustainable financial practices may impact economic progress.

Zhang et al. (2021) analysed the Belt and Road Initiative (BRI) countries' government spending on R&D and its impact on green economic growth. Using GMM and DEA on 2008-2018 panel data, their paper found fluctuating green growth indicators because of inconsistent government policies. It showed that robust public spending in human resources and R&D for green energy nurtures sustainable economies, highlighting the varied effects across countries and income levels. The research thus, bridged gaps in understanding the unique relationship between R&D expenditure and green growth, offering vital acumen for policy formulation in promoting sustainable development in the BRI landscape.

Yang et al. (2021) is a noteworthy Chinese study that conducted thorough research into the bond between green finance, fintech, and high-quality economic development in China. Using data from 30 provinces and municipalities of China, they used panel regression analysis and the two-step generalised method of moments (GMM) to resolve the issue of endogeneity. Their findings highlighted the overall improvement of high-quality economic development through green financing, economic efficiency, and economic structure. The paper also explained fintech's role in expanding the positive impact of finance. They recommended the need for deeper integration between fintech and green finance, and the implementation of constant pro-green finance policies to stimulate more private sector involvement. In a similar direction, Yin (2022) employed a coupling coordination degree model and data from 2008-2020 to quantitatively analyse the coordinated development of green finance and economic growth in China. The findings reveal both variables to have improved over the observed period. However, the green finance composite index of China was found to be consistently trailing behind the economic growth composite index, hinting at a lag in green finance as compared to economic growth. The paper also discovered the coordination between the two variables to be suboptimal, possibly due to the inefficient link of green finance to industrial structural adjustments, environmental protection and economic growth.

In the Southeast Asian domain, Nguyen (2021) studied the role of 'green bonds' within Vietnam's stock market, underlining their significance globally as instruments for businesses to mobilise capital for environmental and societal benefits. The paper analysed investor interest and demand, unmasking a positive inclination for green bonds amidst growing environmental awareness. The paper, however, also highlighted the impediments to their development in Vietnam, stating limitations in legal structures, communication, and the limited scope of available green bond categories. This paper delineated both the prospects and the challenges in utilising green bonds for sustainable growth in Vietnam.

In the South-Asian realm, Zheng et al. (2021) addressed the conceptual ambiguity surrounding green finance (GF) by exploring bankers' points of view and the challenges that affect the implementation of GF

in Bangladesh's financial institutions. Utilising confirmatory factor analysis (CFA) and descriptive statistics on data from 296 banking staff, the paper delineated the key dimensions of GF and identified PCBs as the primary contributors to GF in Bangladesh. Focussing on satisfactory awareness levels but citing limitations like transaction costs and operational inefficiencies, the study provides vital insights for policymakers aiming to enhance the implementation of green finance in Bangladesh.

Now coming to the European Union, one of the most important papers is Chygryn et al. (2019), which explored the European Union's green bonds market, examining its principles, parameters, and players. The paper defined green bonds and delved into their characteristics and perspectives. It also outlined the preconditions for Ukraine's green bonds market development, recognizing the major market directions for investors. Evaluating the benefits and disadvantages, the paper attempted to attract issuer attention by highlighting the potential economic, social, political, and environmental benefits of a blossoming green bonds market in Ukraine.

2.3 Green Finance and Foreign Direct Investment (FDI)

Having discussed the impact of green finance on the economic growth of countries through R&D, fintech, and the green bonds market within its geographical boundaries, it is now appropriate to study existing literature on how green finance may impact economic development by making the concerned country more attractive to investors outside its borders, thereby encouraging inflow of foreign direct investment into the country.

One of the most important papers in this regard is the one by Zhang (2022). The study utilised structural equation modelling to offer a novel approach to comprehending the complicated relationships between green finance, renewable energy investment, environmental performance and economic outcomes in the OECD countries. Their results showed a positive correlation between these aforementioned variables and indicators like increased trade openness, inflow of higher FDI, and growth in the Gross Domestic Product (GDP). An interesting aspect of this research is that it showed the role of environmental performance as a positive moderator that enhances the bond between green finance, investments in renewable energy and the economic output of OECD nations.

A report by Chau et al. (2023) terms FDI that has been impacted by climate change as 'green FDI'- those investments in renewable energy and related industries that build new assets in the receiving country. It states that in developed countries, huge inflows of such green FDI have contributed to large accumulations of domestic capital and are pushing the transition towards green incentives. Very few developing countries, on the other hand, have been able to attract such green FDI.

Looking at this from a different perspective, Xiao et al. (2023) calculated green economic growth data from 30 Chinese provinces and cities from 2004-2009, and built a panel fixed-effect regression model to investigate the impact of FDI on green economic growth. Based on the slacks-based measure (SBM) model and the Global Malmquist-Luenberger (GML) index, this paper found that FDI significantly encouraged green economic development through innovation.

We thus see that the global discussion on economic development has significantly evolved over the decades, and moved towards sustainability. Green finance has emerged as an important driver of environmentally aware investments. Understanding the relationship between green finance investment levels and the inflow of Foreign Direct Investments (FDI) or inter-country financial flows is immensely important to assess how environmentally conscious practices align with the economic attractiveness of nations. In this paper, we aim to highlight the link between green finance initiatives and a country's appeal for foreign investors.

Chapter 3: Data and Methodology

This study uses publicly available secondary data to conduct its research. The data is cross-sectional for the year 2021. We have constructed this new dataset using a number of national and international database cum reports. The study uses data from 56 countries around the world. The data on the adoption of Green

finance policies for these countries have been collected from the International Finance Forum (IFF), Global and Development Report 2021. The data on FDI, the level of Human Capital, and Inflation have been collected from the World Bank datasets. The study also uses Crime Rate data, which has been collected from the World Population Review. Lastly, data on the Market Size of the countries used has been gathered from the official International Monetary Fund (IMF) data and the United Nations (UN) data.

The study uses two different techniques of analysis. First, it uses correlation analysis to see the level of association between our concerned variables of Green Finance and FDI. Next, the study makes use of the Regression model to examine the relationship between Green Finance and FDI. Through regression, the paper aims to establish a causality between the concerned variables. The model is an MLRM (Multiple Regression Linear Model) and uses Ordinary Least Squares (OLS) to estimate and derive the relevant results. The Breusch-Pagan / Cook-Weisberg test has been used to detect heteroskedasticity. The multicollinearity test has been performed using the Variation Inflation Factor (VIF). The model is as follows

FDI = α + β1 Green_fin_exp_rank + β2 Inflation + β3 Crime_Rate + β4 Market_Size + β5 Human_Capital + u

Where α is the constant intercept, βi 's are the slope coefficients and u is the random error.

The explanatory variable of interest is "Green_fin_exp_rank". To study the channel of causality, we have included control variables in parallel to economic theories. These variables include all possible determinants of FDI as suggested by various studies (Mohammad et al., 2023). The variables are, namely, inflation, crime rate, market size and human capital level. The software "STATA" has been used to run the regressions and other descriptive statistics.

The explanatory variable of interest "Green_fin_exp_rank" is the ranking of countries based on their level of adoption of green finance policies. To be precise, the rankings are based on three key aspects of green finance development as stated in the Global Finance and Development Report (2021). It includes: "Policy and Strategy, Product and Market, and International Cooperation, focusing on policy efforts to promote green finance, green finance market dynamics and product innovation, and the commitment of regulatory agencies and market participants to international cooperation in developing green finance, respectively" (GFAD, p. 102, 2021). The exact structure of the indicators has been provided in "Table 1" below. A higher rank in the Green Finance index would mean a greater magnitude of policy and strategies being adopted, while a lower rank would mean a lesser magnitude of the same.

As stated previously, FDI is a good measure of high-quality economic development as established by numerous scholars. With the absence of official Green FDI data, this study considers rather the total FDI data. While we understand that green FDI can change significantly even while total FDI remains the same, it is unlikely to happen. The inward flow of FDI does not cease to exist generally, while there may be some amount of reallocation, on average the magnitude is expected to increase. For eg - countries which provide FDI to produce environmentally dangerous goods in developing countries with less strict environmental laws continue to do so, rather than reallocating it to greener domains. Thus, high-quality economic development necessitates higher overall FDI, or else can be claimed to be underfunded with respect to green FDI.

Furthermore, based on the studied literature, the rankings of countries based on Green finance policies are certainly an appropriate variable which can be used in OLS regression. The theoretical justification and relevance of Green Finance with the dependent variable "FDI" provides the rationale for its consideration as the explanatory variable of interest. While individual data on green bonds or loans could have been used, the rankings as shown through the indicators in Table 1, provide a more holistic measure as it captures bonds, loans and also other factors.

Level 1	Level 2	Level 3	Level 4	Type of indicator
Policy and Strategy	Green development policy and strategy	Green development strategy	• Availability of national green development strategy	Qualitative
			• Availability of green development action plan	Qualitative
			• Availability of green industry-related policy	Qualitative
		Climate mitigation commitment	• Nationally determined contribution	Semi-quantitative
			• Carbon pricing policy	Semi-quantitative
	Green finance-related policy and strategy	Green finance general policy	• Availability of green finance strategy	Qualitative
		Green finance product related policy	• Availability of green bond related policy	Qualitative
			• Availability of green loan related policy	Qualitative
			• Availability of green insurance related policy	Qualitative
			• Availability of green fund related policy	Qualitative
		Green finance risk management related policy	• Availability of climate-related information disclosure policy	Semi-quantitative
			• Availability of financial institution environment stress test policy	Semi-quantitative
Product and Market	Green finance products	Green bonds	• Cumulative value of green bonds issued/GDP	Quantitative
			• Value of new green bonds issued/GDP in 2020	Quantitative
			• Cumulative number of green bond issuances	Quantitative
			• Number of new green bond issuances in 2020	Quantitative
			• Cumulative number of green bond issuers	Quantitative
		Green loans	• Availability of green loans	Qualitative
			• Availability of new green loans in 2020	Qualitative
		Green insurance	• Availability of environment insurance products	Qualitative
			• Availability of other green insurance products	Qualitative
		Green or ESG funds	• Availability of green or ESG funds	Qualitative
			• Availability of new green or ESG funds in 2020	Qualitative
		Carbon finance	• Availability of carbon trading	Qualitative
			• Availability of spot carbon financial products	Qualitative
			• Availability of carbon financial derivatives	Semi-quantitative
	Institutional development of green finance market	National developmental financial institutions	• Green loan commitment	Qualitative
			• Availability of environment and social safeguards	Qualitative
			• Availability of green finance technical assistance	Qualitative
		National green bank or fund	• Availability of national green bank or fund	Qualitative
		Sovereign wealth fund	• Green or sustainable investment commitment	Qualitative
		Commercial financial institutions	• Voluntary climate-related information disclosure requirement	Qualitative
			• Climate risk stress testing requirement	Qualitative
			• Environment and social safeguard compliance requirement	Qualitative
		Securities exchange	• ESG reporting requirements	Qualitative
			• Availability of written guidance on ESG reporting	Qualitative
			• Availability of ESG related training	Qualitative
			• Availability of green finance- or sustainability-related index	Qualitative
International Cooperation	Participation in international sustainable finance platforms or networks by regulatory agencies	Network of Central Banks and Supervisors on Greening the Financial System (NGFS)	• Participation by central bank or regulatory agency	Qualitative
		International Platform for Sustainable Finance (IPSF)	• Participation by regulatory agency	Qualitative
		Sustainable Banking and Finance Network (SBFN)	• Participation by regulatory agency	Qualitative
		Coalition of Finance Ministers for Climate Action	• Participation by the ministry of finance	Qualitative
	Participation in international sustainable finance initiatives by market participants	Sustainable Stock Exchanges Initiative (SSE Initiative)	• Participation by stock exchanges	Qualitative
		International Development Finance Club (IDFC)	• Participation by development banks	Qualitative
		Equator Principles	• Total number of financial institutions signed up	Quantitative
			• Number of financial institutions signed up in 2020	Quantitative
		UNEP Finance Initiative (UNEP FI)	• Number of insurance companies signed up to Principles of Responsible Insurance (PRI)	Quantitative
			• Number of banks signed up to Principles of Responsible Banking (PRB)	Quantitative
			• Number of institutions signed up to UNEP FI in 2020	Quantitative
		Responsible Investing Principle (PRI)	• Total number of institutions signed up	Quantitative
			• Number of institutions signed up in 2020	Quantitative
		Task Force on Climate Change Related Financial Disclosure (TCFD)	• Total number of institutions supporting TCFD	Quantitative
			• New number of institutions supporting TCFD in 2020	Quantitative

Table 1: The indicator system of the GGFDI

Source: Global Finance and Development Report (2021)

Chapter 4: Research Results

The correlation between the dependent variable FDI (measured in billions) and the explanatory variable of interest on Green Finance adaptation shows a negative relation as seen in the Figure 1 below.

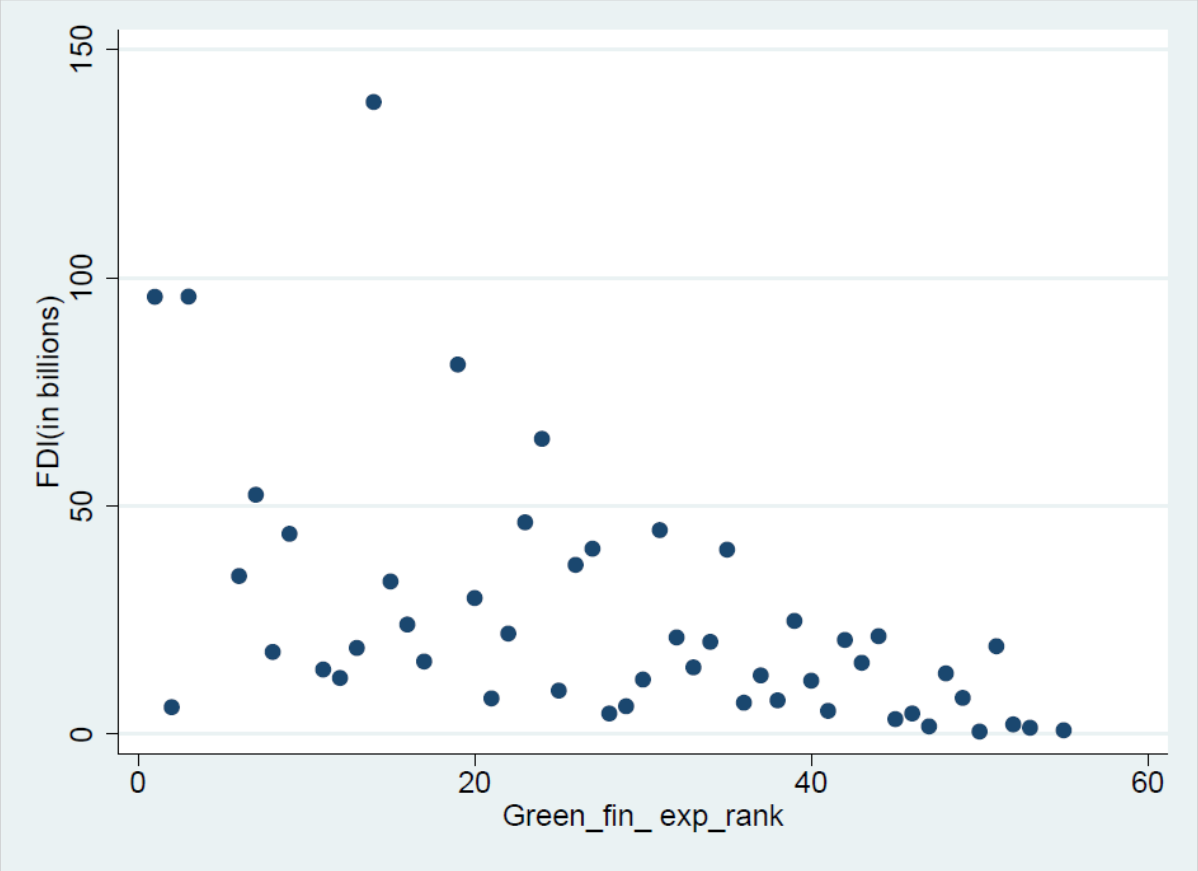

Figure 1: Correlation Analysis

The negative relationship between FDI and Green_fin_exp_rank, although weak, suggests that FDI falls as the ranks of nations in terms of Green Finance increase. Alternatively, a country with a higher rank which has adopted a higher number of policies and strategies etc in terms of Green Finance also has a higher level of Foreign Direct Investment. This association may indeed mean Green Finance attracts FDI and hence, necessitates the investigation of its causality.

Before proceeding into causal inferences, we need to look at the correlation between the variables included in our model. The correlation analysis between FDI and Green finance measured through "Green_fin_exp_rank" along with all the other independent variables stated above gives the following matrix -

Variable	FDI	Green_fin_exp_rank	Inflation	Crime_rate	Market_size	Human_Capital
FDI	1					
Green_fin_exp_rank	-0.4167	1				
Inflation	-0.1687	0.4446	1			

Crime_Rate	-0.0703	0.1989	0.3607	1		
Market_size	0.9454	-0.3838	-0.1251	-0.0839	1	
Human_Capital	0.1821	-0.5905	-0.3432	-0.5558	0.1077	1

Table 2: Correlation Matrix

The matrix validates the findings of the graph as highlighted by the negative correlation coefficient between FDI and Green_fin_exp_rank. Furthermore, as expected inflation and crime rates have a negative association with FDI given that inflation leads to lesser returns and crime rate leads to instability in the economy which is a potential risk for investors. Human capital and bigger markets of course attract FDI and hence, they have positive correlation.

For causality, we use the above-mentioned regression model. It attempts to elaborate on the relationship between green finance and the level of economic development of a country (through FDI). Before proceeding to the regression, it is important that the assumptions of linear regression model are checked. Thus, the Variance Inflation Factor (VIF) has been utilised to assess if there is the presence of perfect multicollinearity. High multicollinearity (correlations between the independent variables), can negatively influence the reliability of the coefficient estimates. The level of correlation between the independent variables is as follows-

Variable	VIF	1/VIF
Human_Capital	2.49	0.40151
Green_fin_exp_rank	2.34	0.427033
Crime_Rate	1.71	0.586048
Inflation	1.39	0.718118
Market_Size	1.21	0.82807
Mean VIF	**1.83**	

Table 3: Test for Multicollinearity

These are relatively low VIF values and they thus suggest an absence of severe and problematic multicollinearity among the predictors in the model. The VIF values above 5 or 10 can indicate troublesome multicollinearity.

Now, using the MLRM stated previously, the regression through OLS gives the following results-

FDI	Coef.	Std. Err.	Coef.2	Robust Std. Err.

Green_fin_exp_rank	**0.14**	**0.35**	**0.14**	**0.28**
Inflation	**-0.38**	**0.40**	**-0.38*** **	**0.14**
Crime_Rate	**0.60**	**0.37**	**0.60***	**0.32**
Market_size	**0.020*** **	**0.00**	**0.020*** **	**0.00**
Human_Capital	**92.94***	**48.54**	**92.94***	**54.47**
_cons	**-81.32**	**49.40**	**-81.32***	**45.59**

Table 4: Regression Analysis

As seen, our explanatory variable of interest **Green_fin_exp_rank** is not significant. Furthermore, crime rate and inflation are insignificant while the market size and human capital are significant determinants of FDI. However, before going through the analysis, it is important to check for the robustness of the results and their compliance with basic assumptions.

A) Test for Heteroskedasticity

The reliability of any regression analysis is based on several assumptions, inclusive of the absence of heteroskedasticity (the unequal variance of residual terms) and multicollinearity between the predictors. It is hence, essential to check for these

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of FDI

chi2(1) = 1.44

Prob > chi2 = 0.2303

The Breusch-Pagan/Cook-Weisberg Test for heteroskedasticity investigates whether the variance of the residuals is constant across all levels of the independent variables. Here, this test has yielded a non-significant p-value of 0.2303. Therefore, there is no crucial evidence of heteroskedasticity, insinuating that the assumption of constant variance of residual terms is not significantly infringed.

While the Breusch-Pagan/Cook-Weisberg Test finds the absence of heteroskedasticity, it is important to use robust regressions. This is because, given the smaller sample size, such tests often fail to detect heteroskedasticity. Thus, we use robust regression and the results have been shown in Table 4 along with robust standard errors.

Contrary to the earlier results, we find all the independent variables except for the explanatory variable of interest, **Green_fin_exp_rank,** to be significant. This validates the results of Mohammad et al.(2023) which state these independent variables to be significant determinants of FDI using evidence gathered from myriads of other studies. However, further robustness checks are required in order to validate our results.

B) Robustness Checks

The model's goodness of fit is evaluated via the R-squared and the Adjusted R-squared values. R-squared is used to measure the proportion of variance in the dependent variable (FDI) that is explained by the independent variables harmoniously. This model explains approximately 90.64% of the variance in FDI.

The Adjusted R-squared accounts for the total number of predictors in the model, which is slightly lower than 89.67%. This justifies a strong overall explanatory power of the included variables.

Residual Plots

Next, we check for the proper specification of the model. An omitted variable bias or overfitting in the regression model would lead to a pattern in the residual plot. Thus, plotting the residuals against fitted values, we have the following result-

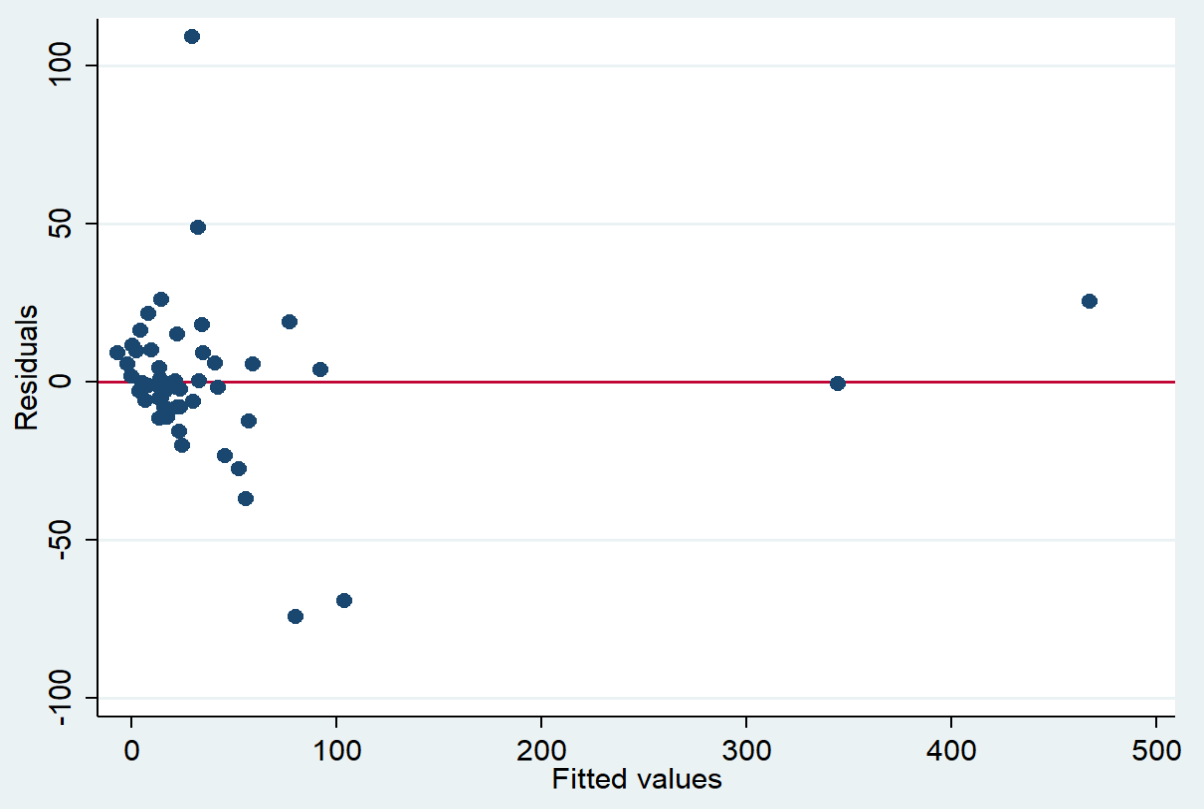

Figure 2: Residual Plot

In Figure 2, we find the presence of outliers in the dataset. The outliers, while being important, may sometimes lead to inaccurate estimates. The outliers if not addressed in a regression analysis can potentially affect the significance of variables. Furthermore, there may be increased standard errors and coefficients leading to faulty hypothesis testings.

Upon removal of the outliers, we run our regression analysis again as specified in the methodology. The regression estimates gives us the following result-

FDI	Coef. Std.	Err.	Coef.	Robust Std. Err.
Green_fin_exp_rank	-0.40	0.35	-0.39*	0.21
Inflation	-0.20	0.36	-0.20	0.14
Crime_Rate	0.38	0.34	0.38	0.26
Market_Size	0.01*	0.00	0.01*	0.00

Human_Capital	73.79*	44.43	73.78*	47.56
_cons	-32.43	46.81	-32.42*	35.59

Table 5: Regression Analysis (without outliers)

The regression results from table 5 shows that our explanatory variable of interest **Green_fin_exp_rank** is not significant. Furthermore, inflation and crime rate are insignificant while the market size and human capital are significant determinants of FDI. However, there is a possibility of heteroskedasticity, violating the basic assumption. The test for heteroskedasticity gives the following result-

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of FDI

chi2(1) = 27.24

Prob > chi2 = 0.0000

The test Breusch-Pagan / Cook-Weisberg test has yielded a significant p-value of 0.0000. Therefore, there is a problem of heteroskedasticity in our analysis, insinuating that the assumption of constant variance of residual terms is significantly infringed. To address the issue, we proceed with robust regression, the results of which are shown in table 5 above.

Thus, after robust regression, we find that our explanatory variable of interest **Green_fin_exp_rank** is significant at 10% level of significance. Furthermore, inflation and crime rate remain insignificant while the market size and human capital remain significant determinants of FDI.

Check the residual plot, the following results (Figure 3) are obtained -

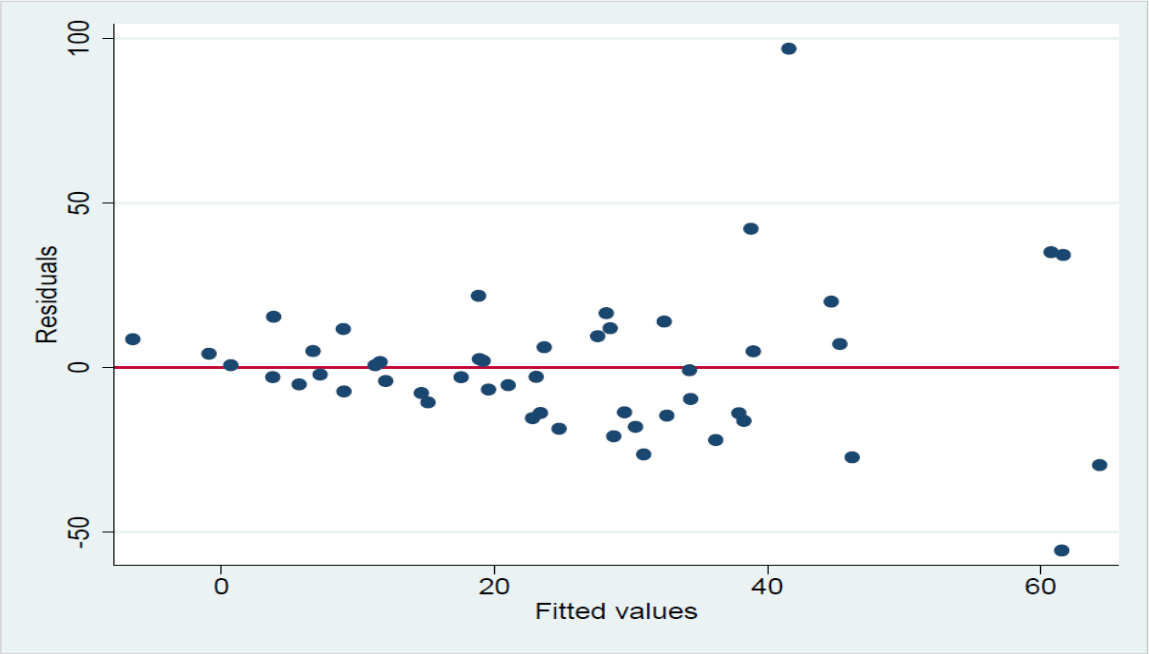

Figure 3: Residual Plot without outliers

The randomness of points around the Y = 0 line validates that the model has been properly specified. The random distribution of points means that the unexplained variance is indeed due to random errors rather than a missed variable. There is no evidence of omitted variable bias or overfitting in the model.

Predicted R-Squared

Frost (2020) stated that predicted R square is an important measure for testing the accuracy of the regression model. It provides more confident backings to the specified model as compared to adjusted R-squared. As per Frost, "A predicted R-squared that is distinctly smaller than R-squared is a warning sign that you are overfitting the model". While this measure is used for models which are made for prediction, it can still provide valuable insight to any other model.

F(5, 46) = 126.34

Prob > F = 0.0000

R-squared = 0.9064

Pred R-squared = 0.8426

Root MSE = 26.539

The predicted R-squared value, although being lower, isn't a point of concern. The slight fall in the predicted R-square is obvious given the smaller dataset. A smaller number of observations makes the difference more pronounced. However, it is not significantly different to be a cause of concern. The small value of Root MSE validates our argument. Hence, the model can be claimed to be well-specified without any errors.

Alternate Model Specifications

A robustness check can be to alter the model's variables. The omission or inclusion of a variable would lead to substantial change or loss in the significance of variables if the results are dependent on a particular specification. Suppose the model is as follows -

FDI = α + β1 Green_fin_exp_rank + β2 Crime_Rate + β3 Human_Capital + u

Upon performing regression analysis, we have the following results -

FDI	Coef.	Std.Err.
Green_fin_exp_rank	-0.78***	0.26
Crime_Rate	0.01	0.27
Market_Size	0.005*	0.00
_cons	42.94***	14.87

Table 6: Regression Analysis

The above results show that the significance of our variables still holds which indicates the robustness of our results. The findings are consistent across model specifications of different kinds.

Alternative Functional Forms

The scatter plot suggests that a linear model would be the most appropriate one for the analysis. However, let us alter the functional form and see if it provides better results. While a curvature can be a part of a non-linear model, it can also be accommodated in a linear one through polynomials. Suppose we add a square term to make a parabolic function, trying to accommodate more data points. The model is as specified below -

FDI = α + β1 Green_fin_exp_rank + β2 Inflation + β3 Crime_Rate + β4 Market_Size + β5 Human_Capital + β5 (Green_fin_exp_rank) ^{2} + u

After the regression, we get the following result-

F(5, 45) = 74.41

Prob > F = 0.0000

R-squared = 0.9084

Adj R-squared = 0.8962

Root MSE = 26.545

The results even after changing the functional form remain the same. This implies that additional complexity, introduced in the form of a curvature, did not lead to increased explanation power of the variability in the model. Thus, the linear specification without higher terms is an efficient and fitting model.

Chapter 5: Discussion and Conclusion

This analysis has found several insights with regard to the relationship between Green Finance and FDI. The study shows Green Finance policies do attract FDI in an economy. The negative coefficient highlights that higher-ranked countries attract more FDI as compared to countries with lower ranks (1 being the highest rank). There can be a number of reasons for the obtained results.

These results can be due to the growing awareness in many countries regarding sustainable practices. Such practices have been encouraged by governments through a variety of policies Apart from government policies, there may be an inherent concern among investors leading to greater adoption and therefore, investments in sustainable projects.

As mentioned above, governments around the globe have implemented certain 'pull' policies starting from tax incentives, and subsidies to favourable regulatory conditions which have led to greater green FDI. Furthermore, these policies often come with a robust risk mitigation framework. Investors are more often than not concerned with financial risk associated with climate change which countries with strong green finance frameworks are better equipped to manage.

Lastly, there is the role of the reputation effect, a popular concept in institutional economics. Countries with a strong green finance framework earn the position of being a forward-thinking actor responsible towards the global economy. This increases the reputation of the country and brings it into the limelight for potential investments. Similarly, investors who invest in sustainable projects also earn a positive reputation which is beneficial for their institutional image in the same way. Thus, these positive feedbacks lead to an increased ability of green finance to attract foreign investments.

While the share of green FDI has been increasing in recent years, it is important to note that this increase is not equally distributed across space. Most of the inflow of green FDI has been in developed nations. Developing countries can be particularly less prone to experiencing the observed results where green finance is not luring in significant amounts of FDI. This is because sustainable methods of production generally require huge investments in infrastructure, for example- solar panels to generate solar energy. If the required infrastructure is inadequate or underdeveloped (high possibility in developing countries), then it obstructs smooth inflows of foreign investment, even when the governments provide sufficient support. Moreover, developed countries may be able to offer higher incentives or a better working environment as compared to developing countries. Hence, potential investors would choose to put their funds in the developed parts of the world, diverting FDI from the developing nations, despite substantial green finance stimuli. This is the reason we see a growth in the inflow of green FDI only in the developed nations as highlighted by Chau et al. (2023).

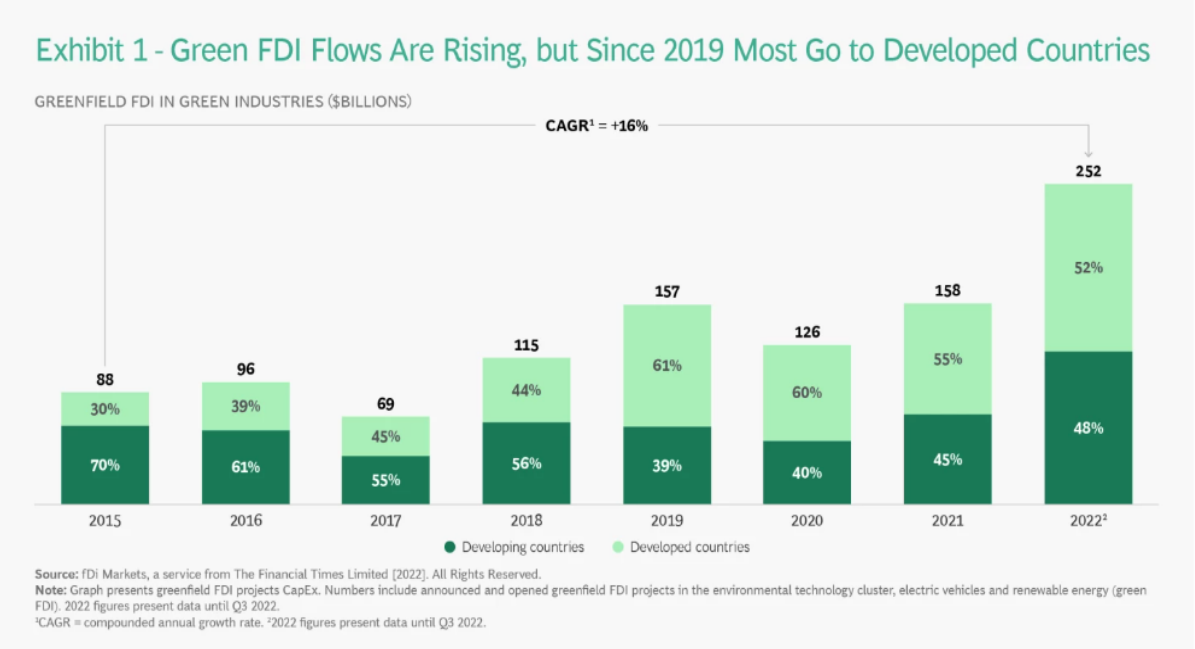

Figure 4: Green FDI Flows

Figure 3 provides testimony to our argument as stated in the previous paragraph. Moreover, the FDI number, although increasing, can be seen to be low which means that Green FDI as a part of overall FDI remains minimal. When both the developed countries and developing countries are taken into the analysis, it is natural to find a weak impact of green finance policies in increasing overall FDI. Even if developed nations have a stronger relationship, it gets nullified with the inclusion of developing countries.

Amongst the other independent variables, it is not surprising that market size and Humanity are statistically significant factors that influence FDI. An expansion in market size is linked to a significant positive impact on FDI, implying that larger markets have a tendency to attract more foreign investment. Obviously, a growing market with increased demand assures a positive GDP growth and a profitable investment opportunity.

Human capital is an important factor for FDI which has been examined a number of times, the studies typically provide contrasting views. Some find human capital to be significant while others don't. However, economic theory tells us that a skilled labour force always attracts FDI as validated in our study. A skilled labour force is highly productive and efficient leading to increased returns from labour. It is worth noting that while skilled labour is important, investors may also look for cheap labour. The nations with lesser skilled workers may attract investment if their affordability outweighs the cost of being less skilled.

Crime rate and Inflation are showing no effect on FDI, suggesting possible complexities in investment patterns or tolerance of risk. While the traditional economic theory does suggest crime to be negatively related to FDI, one cannot ignore the fact that it also provides newer markets or expanded investment opportunities. For eg - It may be profitable to invest in security services companies in areas with high crime rates. Furthermore, the crime rate may not be able to influence investment decisions alone. Investors often see political stability. economic stability etc, along with the crime rate while making a decision. Thus, the benefits may outweigh the risks. It depends on individual investors, how they perceive the information regarding crime rates, its localisation and the potential to disrupt markets. So, the crime rate may not be such a significant determinant of FDI after all.

Inflation is statistically insignificant in their association with FDI. The reason for inflation being insignificant may not be straightforward. Economic theory tells us that high inflation leads to increased production costs. With the increase in production cost, the profit of the firms falls. Hence, lower profits make investment unlikely as foreign investors may get lesser returns. However, this may not always be the

case. If inflation rates are fairly stable or predictable, investors factor them accordingly, minimising the perceived risk. Furthermore, investors engaging in longer-term projects may not focus on inflation at all, but rather on economic stability and market potential.

Limitations

It is appropriate to conclude that this research has provided valuable insights regarding Green finance's relationship with economic development. It has been found that Green Finance policies do not exhibit causalities with FDI. Such policies have not been able to attract foreign investors, especially in developing nations; both as an individual abiding with the intrinsic moral duty to safeguard the environment or as a profit-making economic agent in developing countries. Green Finance policies are definitely integral to fostering environmental sustainability but their direct influence on FDI is limited. This shows the complexity of investment decisions, where factors beyond environmental policies may weigh more while making FDI choices.

It is of utmost importance, while interpreting regression results to take into consideration the broader contextual factors and possible limitations. First, these interpretations derived from statistical models should be contextualised within the specific industry, geographical area, or time period under consideration. The factors that impact FDI can widely vary depending on economic, social, and political conditions. Second, establishing causality based on regression results can be taxing. Correlation does not always imply causation. Further analyses such as controlled experiments or longitudinal studies may be essential to establish causative relationships. Third, this model may not have accounted for all the relevant variables that influence FDI. There were certainly some lesser significant variables which might have been missed along with possible interaction terms.

The availability of limited data on green finance may have led to less strong results. Future works can be carried out with a wider dataset for more robust results. Furthermore, the use of panel data and regression models fitting for such data would provide a better image of the relationship between green finance and FDI. Many studies also use instrument variables to further check for endogeneity.

Concluding, as highlighted above, further research exploring the complex interplay between environmental policies, market dynamics and investment decisions is crucial. A better understanding of the determinants of FDI, and the possibility of green finance being an instrumental factor for economic growth while attaining environmental sustainability will lead to more efficient, effective and comprehensive policies in future.

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