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TECHNOLOGY, ISLAMABAD



Navigating Climate Risks: The Untold Story of Climate Aid's Influence on Foreign Direct Investment through Climate Risk with Governance Lenses

by

Maryum Asif

A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

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Abstract

This thesis explores the relationship between climate aid, foreign direct investment across the 146 countries from 2002 – 2022 by focusing on the mediating role of the climate risk. This states that the climate aid is influencing FDI inflows indirectly by first reducing the climate risk exposure and attracting more foreign investors. This indirect effect is shaped by the governance which is moderating the strength of the relationship that climate aid is working more effectively by reducing risk and attracting investment in the countries with strong institutions. The governance is the moderator showing climate aid $\rightarrow$ climate risk $\rightarrow$ FDI) consistent with the moderated mediation where governance moderates the second stage moderation Climate Risk $\rightarrow$ FDI relationship. The newness highlights by considering all available countries data rather than centralizing on regions and also including governance for the more effective studies – that are not opted in prior studies. Using a quantitative design, secondary data for 21 years for all the available countries panel data is built. For this study R studio is used for analysis with the Structural Equation Model by using moderated mediation model which investigates the governance moderation effect through direct relationship between climate aid and FDI and governance indirect relation of climate aid and FDI that is mediated through climate risk that affects FDI. The finding unlocks that good governance is effectively increasing the positive effect of climate aid on FDI, although weak governance is decreasing and negatively impacting the climate risk. This research produces incredible ways for foreign investors and policymakers to centralize more on environmental uncertainty and institutes capability which makes credible investment initiatives by fostering the FDI, capturing environmental uncertainty and also provides assistance to affected countries. By concluding, it highlights that with good environmental strategies foreign direct investment and governance also increases by providing assistance to climate by stabilizes economy.

Keywords: *Climate Aid, Foreign direct investment, Climate risk, Governance, GDP per capita, Population density*

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Abbreviations

Acronym	What (it) Stands For
ADF	Augmented Dickey Fuller Test
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
CA	Climate Aid
CFI	Comparative Fit Index
CFU	Climate Finance Update
CO₂	Carbon Dioxide
CRV	Climate Risk Vulnerability
FDI	Foreign direct investment
FE	Fixed Effect
GDPPC	GDP Per Capita
GOV	Governance
NDGAIN	Notre Dame Global Adaptation Initiative
OECD	Organization for Economic Cooperation development
OLS	Ordinary Least Square
PCA	Principal Component Analysis
POPD	Population Density
RMSEA	Root Mean Square Error of Approximation
SDG's	Sustainable Development Goals
SEM	Structural Equation Modeling
SRMR	Standardized Root Mean Square Residual
TLI	Tucker–Lewis Index
VIF	Variance inflation Factor

WB	World Bank
WGI	Worldwide Governance Indicator

Chapter 1

Introduction

The performance of climate aid is as effective as the institutions that are governing it, and foreign investors know it. This means it all depends on the institutional bodies. This thesis explores the relationship between climate aid and foreign direct investment across 146 countries from 2002 to 2022 by focusing on the mediating role of climate risk. This states that climate aid is influencing FDI inflows indirectly by first reducing climate risk exposure and attracting more foreign investors. This indirect effect is shaped by governance, which moderates the strength of the relationship, as climate aid works more effectively by reducing risk and attracting investment in countries with strong institutions. Foreign direct investment has been known for economic development in transitional and developing economies, technology transfer, capital, and employment generation that cannot be sustained by domestic resources ([Gu and Hale, 2023](#)). Although global investment is highly shaping the new force named as climate aid. The countries that are heavily exposed to physical climate hazards like floods, droughts, tropical cyclones, and sea level rise are facing uncertainty in infrastructure stability, macroeconomic environment, and regulatory outlooks that are influencing the investment of foreign investors. With respect to the country level, climate vulnerabilities convert into perceived investment risk, disruption in supply chains, and weak policy, and also deter FDI inflows that developing countries need to understand. Evidence from the cross-country analysis shows that nation that are more exposed to physical and transitional risk attracts lower FDI, and investors shift capital towards a more

sustainable environment. (Gu and Hale, 2023; Gamso, 2025). Therefore, the challenge is not only about climate but also about institutions, like how developing countries attract foreign investors in the uncertainty of climate risk? Transition risks that begin from carbon emissions, global shifts to low-carbon economies under the Paris Agreement and additionally compound investment uncertainty are reported in the low to income economies and fossil fuels, which do not have regulatory capacity for managing the transition effectively (Gu and Hale, 2023). The relationship between climate aid, FDI, climate risk and governance is a moderated mediation framework. This model helps to figure out the direct effect of governance on climate aid and FDI and the indirect effect of governance on climate future aid and FDI via climate risk which affects FDI. Thus, this explains that how climate aid is reducing climate risk by promoting FDI for investing in the world (Gu and Hale, 2023; Gamso, 2025).

To conclude with the previous and new studies, climate risk including physical and transitional risk is influencing the foreign investors decision because climate aid plays a very important part for mitigation. Last but not the least, this paper used the (Gamso, 2025) future directions to explain about the economy and sustainability with climate aid which addresses how the moderating effect strengthens the relationship of climate aid and FDI and the indirect effect of governance on climate aid and FDI is mediated through climate risk that affects FDI.

1.1 Background of the Study

Climate change is the most prominent issue in the global community. The impacts are also visible across regions in emerging economies, developing economies and climate vulnerabilities like storms, floods, and droughts. Such climate vulnerabilities impose serious threats to the environment and development prospects. The role of climate aid and FDI is significantly increasing and gaining attention as a supportive mechanism that boosts sustainable growth and resilience. The effectiveness of this mechanism is directly dependent on the variables of climate risk, FDI, climate aid and governance influence and its interaction within the climate change adaptation framework and development. Foreign direct investment has been acting as an economic driver for sustainability, technology, economic growth,

and employment. Although this increasing intensity and their relationship with climate disasters are complex. Climate risk like flood, drought and other extreme weather conditions threatens supply chain, infrastructure, incremental increase in the operation cost that is affecting investment attractiveness. [Fagbemi and Oke \(2024\)](#) state that climate vulnerabilities are responsible for affecting FDI inflows in Sub-Saharan Africa. The study finds that regions that are highly exposed to climate risk receive lower FDI until they pose strong institutional system for climate preparedness. This may prevent investment, and influence may be moderated through strong factors of adaptation or governance. The practices by the [\(Pienknagura, 2024\)](#) centralizes more on the role of climate policies that can shape FDI flows. The research shows that countries who are proactive in climate preparedness are receiving high Greenfield FDI projects, such as in renewable sectors, manufacturing, and sustainability. This shows investors' concerns are increasing due to environmental problems and regulations when dealing with investment. Climate risk is responsible for decreasing investment and dependency, such as how countries are countering this concern through governance and regulations.

Foreign direct investment provides financial and technical assistance that help countries adapt to climate change. Climate aid is a crucial factor for the low to income countries that are deprived of domestic resources for investing in resilience infrastructure and programs. The study by [\(Giroud, 2024\)](#) shows climate aid is a pivotal component in the funding of projects to control early warning systems, flood, and drought. Such type of investments are useful in the reduction of physical and economic impacts due to extreme weather conditions helping to stabilize the economic activities of FDI.

However, the effectiveness of climate aid is not sure as it depends mainly on the governance structures of recipient countries. If the governance is poorly infrastructure it leads to corruption, misallocation of resources, and inefficient implementation that undermines aid benefits. The practices adopted by the [García-Sánchez et al. \(2023\)](#) states that the key determinant of climate preparedness is governance quality that translated the climate aid into sustainability and innovation. The empirical study in the emerging countries indicates that good governance helps the climate aid with national priorities like accountability and transparency

which maximises aid impact on climate resilience. Governance emphasizes more on policies, institutions, and processes that show how stakeholders interact, distribution of power, influence of governance quality on effectiveness of climate aid and climate aligned FDI. [García-Sánchez et al. \(2023\)](#) addresses governance as the moderator in their paper that can shape, direction the relations of investment, climate risk, and innovation.

Moreover, countries with strong regulations and enforcement can increase sustainability and reduce risk. Also, governance acts as a mediator by demonstrating the relations that how climate aid and FDI affect climate resilience. Good governance ensures that the climate aid is channelised, investment is aligned with national strategies and fosters the trust of investors to keep connected with climate risk. In the absence of good governance, large inflows or aids failed to produce an impactful outcome.

The governance role is still underscored in the findings of [Fagbemi and Oke \(2024\)](#), that points out climate preparedness and governance attributes that are essential for reducing the negative effects of vulnerabilities on FDI. Climate preparedness includes enforcing institutions reforms, capacity to manage disasters, and coordination of multiple stakeholders. Countries that are investing in these areas benefit by increasing their FDI in high climate risk. To intermix of these variables is dynamic and difficult Climate risk can reduce FDI by increasing the cost and uncertainty. Although climate aid is beneficial to reduce the risk in resilience funding projects that are helpful for countries to become more attractive. Governance quality affects both ways by demonstrating how aid is being used and perceptiveness of climate policies. The study by the [Pienknagura \(2024\)](#) figures out countries and sources that are affected by bilateral FDI inflows. For example, strict regulations in investor countries will be able them to relocate themselves from polluting areas with weak policies, and helps to stimulate green investment. This border policy highlights the nature of climate governance and investment influence.

[García-Sánchez et al. \(2023\)](#) states in the thesis that governance quality impacts positively on growth opportunities and innovation. The study highlights those governmental reforms unlocks transparency, accountability, strengthen institutions,

reduce corruption and unlock sites for climate aid and FDI for sustainable development. There are many studies on the role of climate risk, climate aid, governance, and FDI. But gaps exist about their integrated effects. Some studies focus on one or multiple variables without exploring governance completely as a moderator or mediator relationship between climate aid, climate risk, and FDI. For example: while [Fagbemi and Oke \(2024\)](#) focuses more on climate preparedness but do not thoroughly analyze the governance reforms impacts on climate aid while attracting FDI in climate vulnerabilities. Furthermore, the study by [Pienknagura \(2024\)](#) study depicts the importance of climate policies but shows low concern on the government and institutional reforms that focus on the implementation process. ([García-Sánchez et al., 2023](#)) open governance and focus primarily on innovation and sustainability than investment FDI flows. This study will address that how governance as the moderator will act in the direct and indirect way to understand the integrated strategies that increase investment and climate resilience. The conducting research is significant because it encompasses on the challenges of climate resilience and economy with climate vulnerabilities. By aligned with the role of climate aid, FDI, climate risk and governance, the study will provide a demonstrative framework for understanding the interaction and influence on sustainability. Findings will provide great implications for investors, donors, and government. Government will help to provide revisions in institutional capacity by engaging donors to enhance the management and target on climate aid and recognizing investors to settle out climate risk management and investment decisions.

Foreign direct investment is always a pivotal part of global economic development, job creation, infrastructure growth and enabling technology in developed countries ([Apergis et al., 2023](#); [Singhania and Saini, 2021](#)). Although, FDI is in the debate due to environmental implication. FDI is helpful to promote sustainability with green technology adoption, that reduces environmental challenges if combined with lax regulation system a framework composed in the Pollution Haven Hypothesis (PHH) ([Singhania and Saini, 2021](#); [Qing et al., 2024](#)). Climate aid supports technical and financial support for adaptation and to mitigate climate essential ones for enhancing sustainable environment and reduction in climate vulnerabilities ([Gu and Hale, 2023](#)). Previous studies show that the double role of climate risk

is responsible for shaping FDI inflows. [Qing et al. \(2024\)](#) addressed that climate exposure up to the firm level particularly in China affects FDI by environmental, social, and governance (ESG) that mitigate the effect.

Likewise, [Gu and Hale \(2023\)](#) highlighted that foreign firms from China face high exposure due to climate risk like hurricanes, floods, and others that affects their investment decisions. Climate aid helps to amplify climate resilience in risky areas like Belt and Road Initiative (OBOR) by decreasing climate risks and improves governance. Institutions always play crucial role in this nexus. Strong governance helps to increase climate aid through accountability, transparency, environmental regulations resource allocation. ([Hayat, 2019](#); [Organisation for Economic Co-operation and Development, 1999](#)). For example, ([Singhania and Saini, 2021](#)) focusing more on financial development for gaining more sustainable FDI and weak governance make problems for climate investment risk. The gap remains that how government moderates in both direction that links to climate risk, climate aid and FDI gap is addressed with moderation mediation framework.

For decades, FDI has been viewed as a global indicator for economic development for developing and emerging countries to enhance infrastructural designs and improve technology. Global investment is developing more in the underlined process by improving the climate change. The rising risk of climate risk including: physical and transitional risk like floods, droughts, extreme weather conditions, and carbon dioxide emission are shifting the market from regulatory reforms to the complex structure of decision making. The risks are not concerned to the environment but to the finance, technology, strategic and operational cost as well that most of the multinational corporations are narrating ([Bussy and Zheng, 2023](#)). Climate risk is reducing the FDI inflows by increasing the cost and uncertainty for vulnerable regions with poor regulatory system and institutional reforms. According to the study of ([Gopalan et al., 2023](#)) both climate risk, including physical and transitional risk are reducing and negatively impacting the FDI in developing countries, harming investor sensitivity to the economic vulnerability. Investors' most daunting concern is climate risk that shifts the foreign direct investment, this prevention is viewed in regions and countries that are not providing credible policies for climate and robust governance. Therefore, climate risk is deterring

the FDI patterns, in traditional markets like labor cost, market size, and resource availability.

Due to these climate concerns, international climate finance is focusing more on climate aid. Climate aid provide technical and financial assistance to the deprived countries and is designed to provide resilience but also increase the ability of the countries towards low carbon development. In recent, scholars are focusing on the relationship of climate aid and FDI inflows ([Gamso, 2025](#)) in cross national panel data research where they find that climate aid reduces the impact of climate risk on FDI inflows. The findings also show that climate aid is providing a positive response towards donor's confidence by increasing the capacity of host countries for mitigating the environment circumstances. Thus, climate aid is functioning as the risk reduction and reputational signal by influencing investments in vulnerable economies.

In prior years, FDI is highlighted with concerns in the environmental sustainability due to the climate risk including physical and transitional risk shaping the global patterns of investment. ([Gu and Hale, 2023](#)) Empirical evidences reported that exposure to the climate hazards is deterring the FDI inflows in developing and emerging countries where institutional reforms are limited ([Bussy and Zheng, 2023](#); [Giroud, 2024](#)). These findings highlight that foreign investors are expose to vulnerability in both ways by regulatory reforms of decarbonization and environmental threats. Climate risk is deterring the investors efficiency through many channels. By firm level it is increasing the exposure of climate uncertainty and misallocation of resources. ([Li and Zhang, 2023](#); [Chen et al., 2015](#)). At country level panel data analysis will be used for 68 markets that are reporting negative effect of climate risk (physical risk) on FDI, where financial sector is trying to mitigate the risks ([Bussy and Zheng, 2023](#)). The results shows that environmental vulnerability is affecting on the firm and country level to shape the macroeconomic inflows. The transmission where governance is being mediated is benefitting the climate aid. Institutional reforms are defined as law and order, regulations, accountability, transparency that determines that aid is enhancing signal competencies and resilience for investors. Research shows that in developing countries strong institutions able to attract not only the FDI but also successful in enhancing the

environment volatility ([Azam et al., 2021](#)).

In the governance context, climate aid is addressed effectively with transparency, accountability, and national development plans. With this the effectiveness will be increased which reduces the climate perceived risk and attracting the foreign direct investment. Comparing to the low governance context, climate can be mislead with misallocation of resources, no transparency, corruption, by reducing the enabling and signing effect in the intended regions. [Limazie and Woni \(2024\)](#) in the study of ECOWAS countries it is illustrating that good governance not only improving the environmental benefits for FDI but also able to enhance the sustainability with time. The increasing interest of scholars in the relationship of international aid, governance, and climate aid some studies also tested these variables in one single framework. Most of the literature centralizes on the bilateral relation (climate aid, FDI, governance, and climate risk) or treating governance as the control variable instead of central construct. The uniqueness of the research is in the treatment of climate aid, governance, climate risk, with moderated mediation framework.

1.2 Theoretical Background

This study supports the following theories including resource dependence theory, institutional theory, and ecological modernization providing a lens of understanding that unfolds relationship of climate aid, governance, climate risk and foreign direct investment.

1.2.1 Resource Dependence Theory

Resource Dependence theory is developed by [Pfeffer and Salancik \(2015\)](#) which states that economies and organizations are not enough because they are dependent on the external environment for the crucial resources required for the growth, survival, and operational continuity. Applied at macro economic level, resource dependence theory states that developing and transition economies are dependent on the technology transfer, external capital flows, and financial resources to reduce domestic investment deficits, developmental constraints, and infrastructure gaps. Thus FDI (Foreign direct investment) is one of the most crucial external

resource flows which not only bring capital but also helps in production technologies, managerial expertise global value chain and market knowledge which the host economies unable to induce internally at a wide cost or scale (Pfeffer and Salancik, 2015; Dunning and Lundan, 2008).

This study examines the FDI inflows as the dependent variable for 146 developing and transition economies from 2002 – 2022. The resource dependence theory produces the macro level rationale that why these countries are structuring the foreign investments and why there is a need to enhance and signals the investor confidence including climate aid disbursement and translating into measurable FDI responses.

This theory is emerged in the 1970's by the work of Salancik and Pfeffer (1978), challenged the viewpoint of traditional organizations to be self-sufficient and autonomous entities. However, they oppose this that organizations are consisted of complex environment and vital resources like external actors are needed to survive and move forward. This resource dependency creates inefficiency, power imbalance, uncertainty, that compels organizations to make such dependencies that will create strategies like alliances, adapting internal structures, and diversifying resources. To foster the economic development and environmental sustainability, resource dependence theory provides accurate lens that will understand how firms and governments navigates challenges in these emerging economies through the climate changes. Countries are facing climate risk like resource scarcity, extreme weather events, ecosystem degradation that lacks technology and internal capital to respond effectively. Foreign direct investment is playing a significant role by providing technological assistance, financial resources, and induces, managerial expertise where domestic actors may lack. Inflows of FDI is not indirect it depends on the government environment that how it shapes the business doing, credibility of environmental policies, regulatory certainty.

In addition, climate aid also functions as an external resource that is helpful to reduce uncertainty for the recipient countries where it not only provides technical support to transfer the knowledge, building capacity to mitigate the effects of climate change by adapting it and also provides financial support. The external actor's dependency increases due to rise of climate risk that threatens social welfare

and economic stability. Organizations and government should solve this strategically these dependencies but forming framework for governance to attract the coordination that ensures the sustainable goals for development. This perspective is helpful to provide the connection between environment governance , resource dependence, and demonstrates how technological and financial support is essential for helping countries with vulnerabilities of climate. This influences success policies and its ability in green technologies. This theory states how countries and organizations are working for managing external dependencies with strategic resource allocation. (Pfeffer and Salancik, 2015) . For risky economies, climate aid provides crucial external sources that are helpful against environmental changes and in managing to attract more FDI. The extent that converts climate aid converts into tangible investment merely depends on a country's capacity to allocate and utilise resources (Dunning and Lundan, 2008).

1.2.2 Institutional Theory

Institutional theory states that all the formal and informal activities, governance structures, norms that are happening within the country affect the attractiveness of FDI (North, 1990; Dunning and Lundan, 2008). The sociological work of Meyer and Rowan (1977) and made by Scott(2008), this theory states that organizations confirms the institutional pressure to regain resources, social acceptance, and legitimacy. Institutions have the responsibility to provide predictability and stability that are essential for understanding the complexity and uncertainty of environmental governance. After understanding the relationship between environmental sustainability, foreign investment, economic growth, and quality of institutions. As pivotal factor. Countries that are built on strong institutions with effective governance, transparency, rule of law are better equipped to enforce law and order for sustainable investment. The robustness of the institutions assures foreign aid that investment is invested in the right place by regulating corruption that attracts FDI by aligning with environmental objectives.

Moreover, the efficiency of climate aid is linked to the institutional capacity of the countries. The institutions that are well established need to ensure that climate finance is working efficiently with transparency, increasing the foreign aid impact

on emissions and resilience, and reducing mismanagement. It also addresses the normative dimension about societal norms and their expectations about corporate behaviors, policies, and induces sustainable culture. The countries where institutions are weak, environmental policies are less effective, and the benefit of climate aid and FDI may be compromise. This may develop a mismatch within environmental policies its development and reducing climate risk. This theory reveals how government is crucial parameter for FDI, environmental outcomes, climate finance, emphasizing that sustainable environment needs more financial resources with credibility and resiliency in institutions.

Robust institutions are helpful because it reduces the transaction cost and other uncertainty and also enhances the credibility of policy commitments in the context to climate investment. In weak economies the climate aid and FDI benefit is undermined due to corruption, policy instability that amplifies climate risk and prevents investment (North, 1990).

1.2.3 Ecological Modernization

Ecological Modernization theory developed in the 1980 for an optimistic response to the conflicts between environment protection and its growth. The Scholars like Mol and Sonnenfeld (2000) opposes that all the concerned environmental problems can be addressed through institutional reforms, technological innovation and integrating the climate concerns into policies. Not like environmentalism, that views environmental protection and growth It posits that modernization ecologies for achieving sustainability.

This theory is relevant if considering FDI role in the sustainable development. Foreign investment is serving to transmit advances, environment sound management, and cleaner technologies for the host countries. Although, FDI potency to positively impact environmental outcomes. This depends on how government frameworks are working to incentivize green innovation, enforce environment standards. It is observed that in emerging economies the rapid industrialization increases good governance, pollution move FDI towards projects and sectors that is aligning with ecological goals. Ecological Modernization work on the framework of

environmental circumstances like climate risk that may booster technological advancement and institutional innovation, while supporting strong governance and foreign aid ([Mol and Sonnenfeld, 2000](#)). This theory is essential not only for mitigating the climate risk but also strengthen the sustainability and governance capability for further accountability, transparency, and adapting capacity. These theories will be used in the research for the moderation-mediation analysis that allows the examination that how government will influence it directly through climate aid on FDI and indirectly climate aid on FDI via climate risk. This captures conditional and different paths that shapes innovation.

Climate aid is helpful to support this transition to provide aid for projects for energy efficiency, sustainable infrastructure, and renewable energy. Acting as a catalyst for advancing economies in this way that increases footprints for boosting competitiveness It centralizes on the importance of the environmental policy integration that how these in the environment. Objectives supports social policies, economics that will create synergy for a sustainable growth. The rising of climate risk like extreme weather events and emission depletion demands the need of ecological modernization. To foster institutional adaptation and innovation, this framework will focus that how societies will take the challenges and convert it into opportunities for revival of economy. It will move forward to expand the market mechanism, collaborative governance, technological progress by acting as a driver for sustainable development.

1.3 Gap Analysis

Albeit of the vast literature that is addressing the interconnection of climate risk , FDI , governance there are significant gaps in the policy applications and theoretical understanding. Studies like [Apergis et al. \(2023\)](#); [Singhania and Saini \(2021\)](#) determines the environmental dimensions for FDI in the BRICS and in developing country context , but their analyses ignore the national level climate vulnerabilities profile and other institutional environments that is jointly shaping the investor behavior across the countries. The country level variation in the climate risk contains income, geography, and adaptive capacity which requires the

macro level analytical lens that can aggregate cross sectional studies that is unable to be provided fundamentally. This thesis covers the emptiness by adopting explicitly country level framework by using governance indicators , national climate risk indices FDI inflows data for modeling the investment at sovereign level where climate aid can be implemented and designed.

In addition, the highlighted gap is the geographic concentration of the previous studies. Innumerable empirical studies on climate risk and FDI that centralise more on emerging economies like OPEC members, BRICS nations, and East Asian exporters that shows economic significance are more visible to international researchers and also data availability is higher ([Apergis et al., 2023](#); [Singhanian and Saini, 2021](#)). Crucially not addressed in the literature, but these regions contain weak institutional capacity and climate vulnerabilities are Sub Saharan Africa , South Asia, Small Island Developing States, and fragile states across Central Asia and MENA regions. ([Hayat, 2019](#)) These countries contain large climate aid flows and also FDI co benefits are needed frequently for the sustainable development. The panel of 146 countries is developed for the time span of 21 years for all the available countries.

Also , most of the studies uses standard ordinary least square regression , single moderator framework, fixed effects panels that test it direct or in bivariate moderated effects in isolation ([Khan et al., 2019](#); [Qing et al., 2024](#)) . No previous study constructs governance as the moderator for both the direct way from climate aid to FDI and also indirect way that is mediated through climate risk fully moderated mediation framework. This gap denotes that it does not answer the most policy central questions like does governance change how climate aid works on FDI and does it operate by changing the climate risk environment ? Thus , this study highlights the gap by using a Structural Equation Modeling framework that estimates the conditional pathways within a unified model. This methodology gap restricts this study from understanding of complex, conditional relationships that exists in real world policy environment.

Furthermore, the prior studies also shows that governance is always used as a control variable or a direct determinant rather than dynamic moderator that influence conditional or structural factor. Governance variable is typically operated

as the fixed covariate in the regression model only captures its average effect on FDI without deeply examining how it increases or decreases the specific effects of climate aid disbursements and climate risk exposures. (Qing et al., 2024; Hayat, 2019). Moreover, this treatment contains critical boundary like climate aid might only induce meaningful FDI for above the minimum governance threshold and FDI effect of climate risk might be neutralized in the strong governance setup. In this study governance is acting as the moderated with moderated mediation framework that renews the governance passive background to the active mechanism which helps to shape the whole climate finance nexus of investment.

Lastly , the prior literature highlights two compounding limitations: Theoretical fragmentation and temporal gap. Innumerable researches on the empirical studies are dependent on the pre 2020 data that do not contains climate finance architecture, structural shifts in global investment patterns, acceleration of Paris agreement implementation , risk perception that is triggered by COVID19 pandemic , and the emergence of new multi and , to lateral climate funds (Gu and Hale, 2023).

The post 2020 development have changed the sensitivity of foreign investors to country level, the volume, and conditionality of the climate aid flows. The Ecological Modernization and pollution heaven hypothesis theory are the two important frameworks for linking FDI for environmental linkages that are widely applied in isolation than integration , context sensitive analytical models (Apergis et al., 2023; Singhania and Saini, 2021). Summing up, this study induces theoretical traditions with the single moderated mediation framework that is applied to 21 year dataset and offers most comprehensive which investigates the governance moderation affect through direct relationship between climate aid and FDI and governance indirect relation of climate aid and FDI that is mediated through climate risk that affects FDI.

1.4 Problem Statement

Climate change is threatening the world economy system that arises the need for climate aid for risk reduction, which attract FDI. Although the connection between climate aid, FDI, governance and climate risk remain unfolded. This study

explores how climate aid is affecting FDI through climate risk and how governance moderates the Climate aid and Foreign Direct Investment and the effect of climate risk on FDI. By incorporating mediation and dual moderation framework on both paths provide a pathway to know about who climate aid will produce sustainability in investment. This pressurize policy makers to focus on climate financing and governments institutions to increase foreign direct investment.

1.5 Research Questions

- i. Does climate aid affect FDI?
- ii. Does climate risk mediate the relationship between climate aid and FDI?
- iii. Does climate aid influence climate risk?
- iv. Does governance moderate the relationship between climate aid and FDI with climate risk?
- v. Does climate risk mediate and governance moderate the relationship between climate aid and FDI?
- vi. Does climate risk influence foreign direct investment?
- vii. Does climate risk mediate the relationship between climate aid and FDI when governance moderates the relationship between climate aid and FDI.

1.6 Research Objectives

- i. To find the effect of Climate Aid on FDI
- ii. To check the impact of Climate Aid on Climate Risk.
- iii. To examine the effect of Climate Risk on FDI.
- iv. To investigate the effect of climate risk on climate aid and FDI.
- v. To find the governance effect on climate risk and FDI.
- vi. To examine the governance impact on climate aid and FDI.

- vii. To examine the governance impact on climate aid and FDI through climate risk.

1.7 Significance of the Study

The significance of this study is to highlight the comprehensive relationship between climate aid, governance, climate risk, and foreign direct investment in all available countries. Critically, this thesis help to evaluate the upcoming developments in the government bodies and other economic developments. It has been observed that climate change is rapidly expanding in the regulation, physical, financial dimensions, and others macroeconomic ranges including disruption in agricultural due to weather patterns, infrastructure degradation and uncertain patterns in the capital markets that are becoming the source to affect the world and investor's interest. Comparing to the prior views, the recent study is illustrating the theoretical and applied knowledge to explain how climate aid reports the climate change adaptation and mitigation for developed economies through Foreign direct investment, shaping magnitude and direction of governance. With time, global world is sinking into challenges of sustainability and economic growth. Thus, it is necessary to know the climate aid and attractiveness of FDI ([Gamso, 2025](#); [Ni et al., 2022](#)). Foreign direct investment is a pivotal component of development that is underscored due to climate vulnerabilities and governance weak institutions ([Organisation for Economic Co-operation and Development, 1999](#)). The dual approach highlights the prior gaps, that most work is done through simple models that do not include the effect of government or other channels ([Gu and Hale, 2023](#); [Hayat, 2019](#)). Thus, this significance will help to explain the empirical realities, policy demands, theoretical imperatives through examination of the world.

Firstly, developing economies including Sub Saharan Africa , Small Island Developing States (SIDS) , South and Southeast Asia, are most exposed to climate physical vulnerabilities and also relying on FDI for the technological diffusion, employment creation, and the capital accumulation. ([Asiedu, 2006](#); [Diffenbaugh and Burke, 2019](#)). The compounding of climate vulnerabilities might be highlighted as major destruction in the sector of investment, as climate risk reduces fiscal

resilience and productive capacity that induces the interruption in the fragility of the capital markets and limits the capturing of private inflows. [Escaleras and Register \(2011\)](#) writes in their paper that natural disasters are the primary cause of the physical climate risk and it statistically produces negative effect on the FDI, another macroeconomic level finding revealed by [Klomp and Valckx \(2014\)](#) used the meta analytical synthesis to proven that climate vulnerabilities is the main culprit of the economic growth exposure. This study is extending the line by researching that whether climate aid will reduce the climate risk and other investing approaches partially helps in the reduction of climate risk exposure.

In addition to the prior research, the governance factor is completely absent and not used widely in the relation to the climate finance and FDI. Back to years empirical analysis used institutional approach in the domains of regulatory quality, rule of law, government effectiveness, control of corruption, and political stability worked as most crucial predictors for FDI decisions. ([Hausken, 2006](#); [Globerman and Shapiro, 2002](#); [Wei, 2000](#)) Moreover, strong governance environment can reduce the investment risk through funding process of adaptation, policy commitment, illustrating state capacity, and strengthening environmental frameworks. Through using institutional lens in [North \(1990\)](#) that is theory of institutional change and [Kaufmann et al. \(2009\)](#) multi dimensional framework for governance will help to understand investment effectiveness in climate aid that will be of incredible significance in the climate finance for effectiveness of the climate. Although governance is rarely used as the main moderating variable for specific climate aid and investment attraction. This is the most important concept without governance capacity, the climate aid will not work properly and may be misallocated or induces in other ways that will fail to generate the regulatory certainty, infrastructure, and risky signals that are prior requirements of the foreign investors.

Also, this research carries weightage for immediate implications of the policy for design and architecture of international climate finance. This study will be helpful in strengthening the environmental diplomacy with expanding COP 27 and COP 28 and commitment of UNFCCC (United Nation Framework Convention on Climate Change) for investing in \$100 billion in climate finance for developing countries. But the question keeps revolving about investment and effectiveness

of the flows like whether this research be significant for boosting up the climate related commitments and reinventing aid towards fostering the investment opportunities for climate resilience , disaster risk management , climate framework for regularities institutional capacity for building such environment.

On the other side, the different and weak effects would might suggest that it is essential that governance framework treated properly with the effectiveness of climate aid includes direct relatability with bilateral and multi lateral donors, recipient finance ministries , and multi and , to development banks. The study induces a good framework of governance and climate aid where the research uses the climate data classes on (adaptation and mitigation) for recipient countries data, its sub types including (wind energy , other adaptation projects, disaster risk reduction and early warning signs , other mitigation projects, environment, renewable multiples , energy efficiency, hydro, solar and geothermal energy) that is relevant to the research and produces significant results.

This study contributes to the existing literature by bringing climate aid, climate risk, governance, and foreign direct investment (FDI) together to explain how they are connected. Previous studies have mostly examined these factors separately. This study goes beyond simply putting these existing relationships together by examining whether climate aid is linked with FDI through climate risk and whether governance affects the relationship between climate risk and FDI. In this way, the study connects the climate finance and FDI literature and provides a better understanding of how and under what conditions climate-related factors can influence foreign investment. The study also provides wider evidence by examining 146 countries over the period 2002–2022, covering countries with different economic, climate, and governance conditions.

The findings help explain whether climate risk provides a pathway through which climate aid may be related to FDI and whether the effect of climate risk on FDI differs with governance conditions. This has practical importance for policymakers and development institutions because climate finance may have effects beyond addressing climate-related problems and may also be relevant to a country's investment environment. Overall, the study adds to existing knowledge by examining

how climate-related factors are connected through a specific process leading to FDI and how governance shapes this process. While the individual relationships are tested through the study's hypotheses, their integration into a single framework provides a broader understanding of the link between climate aid, climate risk, governance, and foreign investment. Although there is vast research on FDI factors starting from market, trade, political risk, and labor cost the function of specific financial flows as the main driver for investment purposes does not get the deserving spotlight. The research on climate finance has only focused the aggregate disbursement like distributional equity questions, climate policy alignment than private mobilization effect for the flows. (Alesina and Dollar, 2000; Michaelowa and Michaelowa, 2011) The prior literature includes Kinda (2010); Neumayer and Spess (2005) offers great insights but unable to differentiate between general ODA and climate development finance and not demonstrates the theoretical mechanism of how climate aid relates with investment behavior. For this reason, this study continues to fill the prior gaps through connecting climate aid with a different concept with the investing factor and a framework that significantly highlights the climate exposure and governing variable.

Furthermore, the study highlights the global issue, which counter the climate impact through expanding green finance and other finance material has created an environment with capital that extended to the policy of high order. Therefore, the developing nations are working to provide both mandates: by attracting private investment for developing economy and transformation and establishing climate resilience for the long run. Barnett and Adger (2007) illustrates in their paper that climate risk can diversify the investment decisions in the low income. The research also illustrates the ability to clarify the condition of climate aid that support both approaches which able to extend beyond academic debates and add on finance architecture and to international climate governance.

Lastly, the research methodology incorporates climate risk as the mediating variable between the relationship of climate aid and FDI. Climate risk both sub types including transitional and physical risk are gaining popularity as they are incorporating financial materials in practical and academia framework by involving Network for greening the financial system (NGFS) and Financial Stability Board

task force on climate related Financial Disclosures (TCFD). [Hong et al. \(2019\)](#) writes in their paper climate risk is already into the financial markets by illustrating the influence of climate exposure is impacting the investor behavior. Although the indicators of climate risk are not integrated yet into the capital flows and into the beginning phase. The combination of climate risk, introducing composite indices with the research of how climate aid is operated helped the research to be more realistic and grounded than previous research which might ignore or treats like an exogenous factor.

1.8 Scheme of the Study

This thesis consists of five chapters. Chapter 1 highlights the study, problem statement, gap analysis, research questions, objectives, background, and the significance of addressing the climate aid effect on FDI through climate risk and governance. Chapter 2 addresses the literature review, covering the theoretical background, conceptual framework of the study, and hypothesis development based on the previous research gaps. Chapter 3 presents the research methodology, data sources, variable construction, moderated mediation framework, and statistical techniques of applying a 146 country panel dataset for 21 years. Chapter 4 presents the results of descriptive statistics, correlation, and the findings of the mediation and moderation model. Chapter 5 is the concluding chapter that summarizes the theoretical and practical implications, limitations, and suggests future pathways for researchers.

Chapter 2

Literature Review and Theoretical Framework

The review centralises on the empirical and theoretical literature that is similar to the present study of climate aid's effect on FDI (Foreign Direct Investment) with the climate risk mediating role and governance role as the moderator. The literature review is comprised on the 12 interplay domains ; (1) FDI determinants perspective on Classical and Modern view (2) The interconnection of Investment flows and climate risk (3) Climate Aid and Foreign Direct Investment (4) Climate Aid, Climate Risk, and FDI (5) How Flows , Allocation , and Effectiveness works in Climate Aid and Climate Finance (6) Governance as the Enabler and Determinant of FDI (7) Economic Development , Climate Change, and Investment Vulnerability in the Developing Countries (8) The Conditional Governance Climate Aid and FDI Relationship : Empirical and Theoretical Perspective (9) Climate Aid, Climate Risk, Governance Quality and FDI (10) . Governance Quality and the climate RISK and FDI Relationship (11) Theoretical Framework that underpins the study (12) Research Gap and present study . In this research hypothesis and the prior studies uses moderated mediation. The literature review uses the data and centralize more on the post 2019 scholarship that shows the theoretical development and recent empirical analysis. Each of these domains is discussed in turn in the following sections, culminating in the identification of the research gap that the present study seeks to address.

2.1 Foreign Direct Investment Determinants Classical and Modern Perspective

The researchers examine that Foreign direct investment has been renowned for its diverse international economies across the national borders. The architecture behind FDI was developed by Dunning (1998) by the Eclectic OLI (Ownership, Location, international paradigm) which represents that multinational corporation make international investment decisions based on three sets of advantages. First is the ownership advantage (O) this shows proprietary assets (managerial expertise, technological capabilities, and brand equity that firms exploits internationally. Also, Location specific factor (L) describes that host countries centralizes on the labor cost, market size, infrastructure quality, natural resources, political stability, and institutional environment which makes geographics more attractive or make it unattractive for production. Last the international Advantage (I) this helps the incentives to exploit through the hierarchy of internal organizations than market transactions. In all these three pillars: one of the locational specific factors received the highest empirical attention in the decades and in these pillars the climate risk and governance are perfectly theorized.

[Blonigen and Piger \(2014\)](#) used a Bayesian Model Averaging (BMA) for identifying which FDI determinant is robust across the model specification. The evaluation states that the parent country income, cultural distance, relative labor endowment, regional trade agreement and investment cost variables have the ability to predict FDI while others using single specification may lose their power once the model is accounted for the uncertainty. The methodological approach is relevant to the current study of the climate related FDI determinants identifications through estimation strategy that estimates the model selection uncertainty and also reinforcing the value of econometric approach adopted here.

[Kinda \(2010\)](#) addresses the determinants of FDI on firm level through enterprise survey with the data of 77 developing countries. The investment climate is operated through the financial market depth, infrastructure access, and institutional environment that can effectively shaping the foreign firm location decisions. The

study also examines that low investment in the climate sector deters the FDI in the technology dependent and infrastructure intensive industries which shows that improvement in the investment climate and governance reforms are operated as the location specific advantages in the Dunning's framework.

[Javorcik \(2004\)](#) illustrated to focus on the productivity spillovers from FDI to the domestic firms also demonstrates that developmental rationale is supporting the developing country governments policy for focusing on the foreign investments. So, the analysis of Lithuanian manufacturing firms explains the backward linkage starting from multinational subsidiaries to the domestic suppliers are generating productivity gains. Summing up , this analysis highlights that why there is a need to attract FDI and also preventing climate risk from reducing the climate risk is the developmental policy and need of an hour to understand the public climate finance has the ability to sustain the FDI inflows practically and analytically.

[Asiedu \(2006\)](#) explores the drivers of the FDI in the Sub Saharan Africa that are market size, macroeconomic stability, natural resources endowments as the salient locations for the context of African and other political instability and governance are suppressing the inflows. Their analysis also illustrates the crucial and vitality of political risk and institutional quality in the FDI's location as stated in this research study and are closely related to the climate risk management in the vulnerable developing regions. In the other paper of [Hausken \(2006\)](#) expands the literature by using the data of 83 developing countries with 13 political risk and institutional quality indicators for the multiple decades that find the internal conflict, governance stability, rule of law , and bureaucratic quality as the governance dimensions that are linked with FDI attraction. Thus, the study established the governance multi dimensionality as the FDI determinant and also produces the empirical justification for the composite governance index in the present study also.

[Neumayer and Spess \(2005\)](#) illustrates the (BIT – bilateral investment treaties) are the legal instruments that induces protection against the discrimination , foreign investors against expropriation, and absence of the fair disputes that will increase the FDI flows in the developing countries. BIT can be viewed as the governance mechanism which is helpful for reducing the property risks and other

regulatory uncertainty and they are also capable of attracting FDI through the theoretical background in which governance quality also involves the climate regulatory quality that is shaping the investor confidence. In the other paper [Tobin and Rose-Ackerman \(2011\)](#) also expanded this work by illustrating the condition which boosts the BIT working ; which shows they work best in moderate institutional quality and if the institutional quality is weak or so strong then it will lower the BIT and FDI relationship.

[Javorcik \(2004\)](#); [Wei \(2000\)](#) conducted research on corruption for examining the governance specific dimension corruption that is affecting the cross border investment decisions on the firm level data taken from the MNC's (Multi national corporation) particularly in the Former Soviet Union and Eastern Europe. They explored a strange thing that host countries are involved in high level of corruption which reduces FDI inflows those firms that strongly supports the norms and anti corruption laws. Thus, the analysis demonstrates the important of disaggregating governance in the institutional dimension during analyzing FDI and also this informs the multi dimensional approach of the current study. By using these two views (Classical and Modern) for the FDI determinant will provide an insight of the robust foundation FDI 's most crucial predictor of FDI inflows is the governance framework and also location specific institutions where their importance is increased in high institutional heterogeneity in the developing countries.

2.2 Climate Risk and Its Relationship to Investment Flows

Since 2015, the interconnectivity between financial, climate risk and investment outcomes are considered as one of the expanding research areas in the field of finance and economies. [Hong et al. \(2019\)](#) provides evidence about the physical climate risk drought risk which is reported into equity valuation for the food companies that are working in the drought prone regions. This study analysis determines that investors are demanding higher returns in the drought exposed stock during the drought risk which shows that physical risk is generating anomaly in the real time. This finding is good for this thesis because it shows that climate

risk is not a long term threat but affecting the capital allocation decision in the financial markets and also FDI too which is invested in the productive assets for climate exposed regions.

[Bolton and Kacperczyk \(2021\)](#) examine investor responses to carbon risk across a large panel of U.S. listed firms, finding that investors demand a statistically and economically significant return premium for holding shares in firms with higher total carbon emissions. This carbon risk premium persists after controlling for firm size, book to market ratio, momentum, and other standard asset pricing factors, indicating that it reflects genuine investor concern about transition risk the risk that regulatory and technological changes in the path toward decarbonization will damage the value of carbon intensive assets. While the analysis focuses on equity markets in the United States, its implications extend to cross border FDI: investors considering long term productive investments in developing countries with high physical climate vulnerability may similarly price climate risk into their required return thresholds, thereby reducing FDI flows to the most exposed regions unless risk mitigation mechanism such as climate aid are in place.

[Giglio et al. \(2021\)](#) provide a comprehensive and synthetic review of the climate finance literature, integrating evidence from asset pricing, household finance, corporate finance, and macroeconomics. They identify three distinct channels through which climate change affects financial outcomes: physical risk (direct damage from climate related weather events and to level rise), transition risk (regulatory, technological, and market shifts associated with the low carbon transition), and liability risk (legal exposure from climate related damages). All three channels are operative in FDI decisions in developing countries: physical risk is most acute in climate exposed regions; transition risk creates regulatory uncertainty for carbon intensive foreign investments; and liability risk, while currently less developed in developing country legal systems, is growing as climate litigation expands globally and call for further theoretical and empirical development of the links between public climate finance and private investment a call directly answered by the present study.

[Barnett and Adger \(2007\)](#) develop a sophisticated theoretical framework for pricing the deep uncertainty induced by climate change, distinguishing between risk (known probability distributions over outcomes) and ambiguity (uncertainty about

the probability distributions themselves). They demonstrate that ambiguity aversion investors' tendency to avoid situations in which probabilities are not well known generates a precautionary premium on climate exposed investments that exceeds what standard expected utility calculations would predict. This theoretical insight has important implications for the present study: if climate aid programs are accompanied by credible governance reforms and transparent reporting on adaptation progress, they may reduce not only climate risk per but also climate ambiguity, generating a larger reduction in investment uncertainty than simple risk reduction models would suggest.

[Addoum et al. \(2020\)](#) contribute micro level evidence on the economic consequences of climate related temperature shocks, analyzing quarterly sales data across thousands of U.S. establishments in temperature sensitive industries. They document that establishments experience significant revenue reductions during extreme temperature deviations from historical norms, with both hot and cold extremes generating negative effects in different industries. While this evidence pertains to domestic firms in a high income country context, it provides granular empirical validation for the macro level hypothesis that climate risk depresses real economic performance, and by extension, reduces the profitability and attractiveness of FDI investments in climate exposed regions.

[Differbaugh and Burke \(2019\)](#) document a striking macroeconomic consequence of climate change: global warming over the period 1961–2010 has increased the income gap between the world's richest and poorest nations by approximately 25%. Most tropical and subtropical developing countries have experienced per capita GDP losses attributable to warming, while most temperate developed countries have benefited from warming effects on agricultural productivity and reduced heating costs. This distributional pattern of climate impacts has profound implications for the FDI literature: climate change systematically disadvantages the most climate exposed economies, which are simultaneously the most dependent on FDI inflows for development finance, creating a negative feedback loop that climate aid is designed to interrupt.

[Dietz et al. \(2016\)](#) introduce the concept of "climate value at risk" (CVaR) to quantify the potential financial losses from climate change across the global stock

of managed financial assets. Using an integrated assessment model incorporating probabilistic climate projections and economic impact functions, they estimate that a 2.5°C warming scenario generates present value losses of approximately \$2.5 trillion approximately 1.8% of global financial assets. Importantly, these losses are highly concentrated in climate exposed developing regions, reinforcing the argument that climate risk constitutes a financially material and geographically concentrated threat to investment returns. The CVaR framework provides a quantitative lens through which the risk reducing potential of climate aid can be assessed and valued.

Kotz et al. (2024), in the most comprehensive recent quantification of committed climate damages, estimate that current greenhouse gas concentrations lock in GDP reductions of approximately 17–19% by 2050 under plausible warming trajectories, with the highest losses concentrated in tropical developing regions that span South Asia, Sub Saharan Africa, and Central America. These projected losses are of sufficient magnitude to materially alter the risk return calculus of foreign investors with long investment horizons in climate vulnerable countries. The committed nature of these damages—reflecting warming already locked in by historical emissions—underscores the urgency of adaptation finance and governance capacity building as mechanisms for limiting investment losses.

2.3 Climate Aid and Foreign Direct Investment

Climate aid is described as the aid that is in the form of technology and finance provided to the countries for mitigating the climate change effects and to adapt the climate change. It is defined as a sector that will influence the foreign direct investment inflows. Most of the empirical studies suggests that climate aid will help to booster and make the investment more attractive by decreasing the climate catastrophes and international support that foster a sustainable development. For example: A recent study finds out that when climate aid inflows increase above the threshold , historically the negative relationship between foreign direct investment and climate risk becomes insignificant shows climate aid balances the deterrents of climate to investments (Ganso, 2025). In addition to, Fagbemi and Oke (2024) indicating that climate support and environment policies is helpful to improve

quality of FDI, although if quantity decreases due to some regulation. This identifies that climate aid indirectly increases FDI with improvement in institutional condition and environment.

Moreover, in accordance to the effect of climate aid on FDI is context based and complex. Some studies also suggests that climate aid only not able to increase FDI until combined with the influencing factor of climate risk management and governance quality ([Organisation for Economic Co-operation and Development, 1999](#)). Thus, the relation of FDI and climate aid demands more exploration through the role of governance quality and climate risk.

2.4 Climate Aid, Climate Risk and Foreign Direct Investment

Climate risk including transitional risk(carbon pricing, regulatory shifts, and etc.) and physical risk (droughts, floods, hurricane) are acting as a prime barrier to the FDI. Firms do not invest in those countries where climate risk is high which causes operational disruption, asset damage, and policy vulnerabilities. ([Gu and Hale, 2023](#)) made a theoretical framework that states increasing climate risk reduces FDI inflows for the firms that emits high emission or vulnerabilities. The empirical findings from [Li and Gallagher \(2022\)](#) shows that foreign firms are locating facilities in areas where physical climate risk is lower comparing to local ones indicating role of climate risk in investment decisions. The study also noted that Chinese FDI is more exposed to the risk of higher climate risk across countries through the profiles of host countries other than firm level choices.

Climate aid reduces the risk by resilience projects and through funding adaptation. Thus, climate aid dampening the climate risk and amplifying FDI. This path is stated by the studies that climate mitigation efforts and preparedness of climate uncertainty reduces the negative effects of climate risk on investment decision. By improving resilience, climate aid can create a more stable environment for foreign investors. It also reduces uncertainty associated with climate-related disruptions and potential investment losses. Consequently, lower climate risk may enhance investor confidence and encourage greater FDI inflows. ([Gu and Hale, 2023](#))

2.5 How Flows , Allocation and Effectiveness works in Climate Aid and Climate Finance

The concept of climate aid—internationally transferred public finance specifically designated for climate change adaptation or mitigation in developing countries—has evolved considerably since the UNFCCC established climate finance obligations in the early 1990s. Contemporary climate aid encompasses grants, concessional loans, equity investments, and guarantees channelled through bilateral, multilateral, and blended finance mechanisms, with the stated objective of supporting low carbon development pathways and climate resilience in vulnerable nations. The [Organisation for Economic Co-operation and Development \(2023\)](#) tracks climate specific flows from developed countries and reports that total climate finance provided and mobilized reached \$89.6 billion in 2021—growing from approximately \$52 billion in 2013, representing a near doubling over eight years, yet still falling marginally below the \$100 billion commitment that has anchored climate diplomacy since Copenhagen 2009.

The allocation of climate aid across developing countries is determined by a complex interplay of vulnerability criteria, governance capacity assessments, and donor strategic interests. [Weiler et al. \(2018\)](#) conduct a rigorous regression analysis of adaptation aid allocation across a large panel of developing countries and find that while climate vulnerability (as measured by indices of exposure, sensitivity, and adaptive capacity) does influence aid allocation, donor geopolitical and commercial interests remain significant predictors of who receives climate finance. Critically, they find that governance quality is a positive predictor of climate adaptation aid receipts—bettered , to governed countries attract more climate aid. This governance and , to conditioned allocation pattern have important implications for the present study: if governance quality determines both climate aid receipts and FDI inflows independently, the observed correlation between climate aid and FDI could reflect omitted governance factors rather than a genuine climate risk–reduction pathway. Climate aid allocation in developing countries is illustrated through the combined interconnection of governance assessment, donor interest, and governance capacity. [Weiler et al. \(2018\)](#) did a regression analysis for adaptation

aid across the panel data of the developing countries and find the climate vulnerability that are measured with sensitivity, indices of exposure, and adaptive capacity which is influencing the donor geopolitical and commercial interest that will remain a crucial predictor for the one who is receiving climate finance. They also find that governance is acting as the positive predictor for climate adaptation and aid – with better governance they attract more climate aid. So, this governance allocation pattern shows some important implications in this present study – which determines that if the governance considers the FDI inflows and climate aid as independent then the correlation of FDI and climate aid will also reflect the omitted governance than identifying a genuine risk reduction pathway.

([Betzold and Weiler, 2017](#)) specifically examine whether the most climate and, to vulnerable countries receive more adaptation aid, finding that the answer depends critically on which vulnerability dimension is emphasized. When physical exposure indicators such as frequency of extreme weather events or sea and , to level rise exposure—are used, vulnerability positively predicts adaptation aid receipts. However, when adaptive capacity is used as the vulnerability measure, bettered, to endowed and bettered , to governed countries attract more funds, suggesting a systematic misallocation of climate finance away from the most vulnerable nations. This finding underscores the governance and , to dependency of climate aid effectiveness: without adequate absorptive capacity and institutional quality in recipient countries, climate aid may fail to reduce climate risk sufficiently to influence FDI decisions.

[Krogstrup and Oman \(2019\)](#) examine climate finance from a macroeconomic stabilization perspective in an influential IMF Working Paper, arguing that public climate finance—including both mitigation and adaptation grants—can crowd in private investment by reducing the risk and , to adjusted cost of capital in clean energy and climate and , to resilient infrastructure. They identify several transmission mechanisms: adaptation finance reduces the expected damage from climate events, lowering the risk premium on investments in vulnerable regions; mitigation finance reduces the long and , to run probability of catastrophic climate outcomes, attenuating the tail risk on long and , to horizon investments; and both streams of climate finance signal credible government commitment to managing climate

risks, reducing regulatory uncertainty. These mechanisms provide the theoretical foundation for the climate aid $\rightarrow$ climate risk $\rightarrow$ FDI mediation pathway that the present study empirically tests.

[Dikau and Volz \(2021\)](#) connect the climate finance and financial governance literatures, arguing that central banks and financial supervisory authorities bear a responsibility for incorporating climate and, to related financial risks into their mandates. Their analysis identifies governance of financial systems including climate and, to related stress testing, green bond standards, and climate risk disclosure requirements—as a critical determinant of whether climate finance achieves systemic demand , to risking objectives. This finding reinforces the governance and, to moderation hypothesis of the present study by demonstrating that financial governance quality shapes the effectiveness of climate financial transfers at the macroeconomic level, not merely at the project level.

2.6 Governance Quality as a Determinant and Enabler of Foreign Direct Investment

The empirical literature on governance quality and FDI is among the most developed bodies of research in development economics, and it provides the core theoretical motivation for the governance moderation hypothesis of the present study. [Kaufmann et al. \(2009\)](#) develop and validate the Worldwide Governance Indicators (WGI), which capture six dimensions of institutional quality: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. These indicators have become the standard empirical operationalization of governance in cross and, to country economic research and are employed in the present study's construction of a composite governance index.

[Daude and Stein \(2007\)](#) provide the most rigorous and widely cited empirical analysis of the governance and, to FDI nexus, employing bilateral FDI data from 152 host countries and instrumenting for governance quality to address endogeneity. Their estimates indicate that improving governance from the 25th to the 75th percentile of the WGI distribution increases bilateral FDI by a factor of approximately

three—an effect that far exceeds the impact of traditional determinants such as GDP, trade openness, or geographic proximity. Government effectiveness and rule of law emerge as the most influential governance dimensions. This quantitative finding motivates the central moderating role assigned to governance quality in the present study’s conceptual framework.

[Hausken \(2006\)](#) conduct a comprehensive analysis of political risk, institutions, and FDI across 83 developing countries over the period 1984–2003, employing 13 political risk and institutional quality indicators drawn from the International Country Risk Guide (ICRG). Their pooled OLS and fixed and , to effects estimate consistently identify government stability, law and order, and bureaucratic quality as the governance dimensions most robustly associated with FDI inflows. Notably, internal conflict and democratic accountability show more mixed results, suggesting that the governance dimensions most directly relevant to investor protection and regulatory predictability are more consistently priced into FDI decisions than broader political and democratic attributes.

[Asongu and Nwachukwu \(2016\)](#) contribute an African and , to centric perspective to the governance and , to investment literature, examining how governance quality conditions the developmental impact of new technology adoption and investment in Sub Saharan Africa. Their analysis identifies governance thresholds below which investment inflows do not translate into expected economic development outcomes—a finding that conceptually parallels the governance and, to threshold hypothesis implicit in the present study’s moderation model. The implication for climate aid is direct: if governance quality must exceed a threshold before investment translates into developmental outcomes, it may similarly need to exceed a threshold before climate aid effectively reduces climate risk perceptions and promotes FDI.

[Asiedu \(2006\)](#) and [Hausken \(2006\)](#) together demonstrate that governance and, to FDI relationships are regionally heterogeneous, with Sub Saharan Africa and other climate and , to vulnerable regions exhibiting particularly strong governance effects on FDI. This regional heterogeneity motivates the use of governance and to conditioned interaction terms in the present study’s empirical specification,

enabling the estimation of governance and , to differentiated effects of climate aid on FDI rather than a single average treatment effect.

[Javorcik \(2004\)](#) ; [Wei \(2000\)](#) extends the governance and, to FDI literature to the specific dimension of corruption, finding that higher host and, to country corruption reduces FDI, particularly joint ventures with local partners, where renegotiation risks are highest. Their firm and, to level analysis provides micro foundations for the macro level governance effects documented in country level panel studies and reinforces the importance of controlling for corruption as a governance dimension in the present study's empirical framework.

2.7 Climate Change, Economic Development, and Investment Vulnerability in Developing Countries

Developing countries face a structural double jeopardy in the era of climate change: they are simultaneously the most exposed to physical climate risks and the least equipped—in terms of financial resources, institutional capacity, and technological endowment—to adapt to those risks or attract the investment needed for climate and , to resilient development. This structural vulnerability is well and , to documented in the academic literature and provides the macroeconomic context within which the climate aid , governance and FDI nexus must be understood.

The [Intergovernmental Panel on Climate Change \(2023\)](#) Sixth Assessment Report establishes with high confidence that climate change is already causing widespread and compounding adverse impacts on natural and human systems, with the severity of these impacts greatest in regions with the lowest adaptive capacity. Food insecurity, water scarcity, coastal flooding, and heat and , to related health burdens are disproportionately concentrated in low and , to and middle and , to income developing countries in tropical and subtropical regions. These physical impacts directly translate into economic losses, reduced labor productivity, infrastructure damage, and agricultural output volatility—all of which negatively affect the returns to investment and, by extension, the attractiveness of these countries as FDI destinations.

Diffenbaugh and Burke (2019) quantify the macroeconomic legacy of historical warming on development outcomes, finding that global warming over the period 1961–2010 has increased the income gap between the richest and poorest nations by approximately 25%. Their analysis demonstrates that climate change operates as a regressive development tax, systematically reducing per capita incomes in tropical developing countries—precisely the regions that are both the most climate and , to vulnerable and the most dependent on FDI for development finance. This finding establishes the baseline development cost against which the benefits of climate aid including its potential to sustain FDI inflows should be evaluated.

Sachs et al. (2019) articulate the case for six interconnected transformations required to achieve the Sustainable Development Goals by 2030, identifying climate action as one of six mutually reinforcing transformation areas. They argue that achieving the SDGs requires massive mobilization of public and private finance estimated in the trillions of dollars annually and that governance reforms are essential for creating the enabling environments in which such finance can be effectively deployed and sustained. The particular relevance for the present study lies in their emphasis on the complementarity between governance capacity and, to building and climate finance: neither alone is sufficient to achieve sustainable development and investment outcomes.

2.8 The Governance Conditioned Climate Aid Foreign Direct Investment Nexus: Theoretical and Emerging Empirical Perspectives

The specific intersection of climate aid, climate risk, governance quality, and FDI represents the most novel dimension of the present study's contribution to the literature. While each of these bilateral relationships has been examined in isolation, their joint operation in a unified analytical framework—with climate risk as the mediating variable and governance as the moderating construct—has not been previously attempted. This section synthesizes the theoretical mechanisms through which these relationships operate and identifies the limited but growing empirical evidence that motivates the present study's integrated framework.

Governance quality is responsible for affecting the climate aid and FDI. Strong governance is acting to improve the transparency and efficiency of climate aid utilization, enforcing regulation of environmental uncertainty and reducing the investment uncertainty, thus enhancing the positiveness of climate aid on FDI. The report of [Organisation for Economic Co-operation and Development \(1999\)](#) shows institutional framework and robust policies are playing the crucial role for amplifying the benefit and balances the environment effect of FDI. Moreover, [Hayat \(2019\)](#) states that governance has the ability to affect the investment climate and, to FDI relationship in Latin America, with good governance and attracts FDI more.

[Krogstrup and Oman \(2019\)](#) provide the most developed theoretical framework for understanding how public climate finance can mobilize private investment. They identify a risk and, to reduction channel: by financing adaptation infrastructure, improving climate early warning systems, and strengthening national disaster risk management institutions, climate aid reduces both the expected frequency and the severity of climate related economic disruptions. This reduction in expected disruptions lowers the risk premium demanded by foreign investors on projects in climate vulnerable countries, thereby reducing the hurdle rate for FDI. The governance moderation hypothesis extends this framework: the effectiveness of the risk to reduction channel depends on whether recipient country governance is strong enough to ensure that climate aid reaches intended destinations, is deployed efficiently, and generates credible risk reduction signals to international investors.

[Bolton and Kacperczyk \(2021\)](#), while focused on equity market pricing of carbon risk, establish a crucial conceptual parallel for the FDI context: if investors price climate and , to related risks into financial assets in developed country markets, then multinational corporations undertaking long term FDI in climate vulnerable developing countries where risk hedging instruments are less available and are likely to demand even larger risk premiums or to avoid these destinations altogether unless credible risk and , to reduction mechanisms are in place. Climate aid that visibly and measurably reduces adaptation deficits documented through transparent governance and reporting can provide the credible risk and , to reduction signal needed to sustain FDI flows.

[Barnett and Adger \(2007\)](#) demonstrate that climate ambiguity uncertainty about the probability distribution of climate damages rather than merely the expected value of those damages generates investment hesitation that exceeds standard risk and, to aversion models. If climate aid programs accompanied by strong governance frameworks can resolve some of this ambiguity by funding systematic climate risk assessment, establishing reliable monitoring and evaluation systems, and providing transparent reporting on adaptation outcomes the reduction in investor uncertainty may exceed what simple expected value risk calculations would predict. This ambiguity reduction mechanism provides an additional theoretical channel through which governance quality conditions the FDI and to promoting effects of climate aid.

[Weiler et al. \(2018\)](#); [Betzold and Weiler \(2017\)](#) together establish that governance quality determines both who receives climate aid and how effectively it is utilized. The implication for the climate aid and FDI nexus is a potential compounding or threshold effect: countries with adequate governance quality receive more climate aid, use it more effectively to reduce climate risks, and thereby generate more credible risk reduction signals to foreign investors. Countries below governance thresholds receive less climate aid, use it less efficiently, and may not generate sufficient risk reduction to influence FDI location decisions. This nonlinear governance moderation relationship is the central empirical hypothesis of the present study and represents its most significant contribution to the existing literature.

[Dikau and Volz \(2021\)](#) connect climate finance effectiveness to financial governance quality, demonstrating that the macroeconomic demand , to risking potential of green finance is conditioned on the quality of financial regulatory institutions in recipient countries. Countries with more sophisticated and credible financial regulatory environments can better leverage climate finance flows to attract private co investment, including FDI.

This finding extends the governance moderation hypothesis beyond the traditional WGI based governance measures to encompass financial sector governance a dimension increasingly relevant as climate finance instruments become more sophisticated and financialized.

[Giglio et al. \(2021\)](#) synthesize the climate finance literature and identify the governance conditioned mobilization of private climate investment as a critical research frontier, calling for integrated theoretical frameworks that connect public climate finance to private capital flows through governance channels. The present study answers this call directly, constructing and testing a governance moderated mediation model in which climate aid affects FDI through climate risk reduction, and in which governance quality conditions the efficiency of this mediation pathway. By doing so, it fills a specific and important gap identified by the leading scholars in the climate finance field.

2.9 Climate Aid, Climate Risk, Governance Quality and Foreign Direct Investment

This combination of (climate aid, climate risk, and governance quality on FDI) are portrayed best with a framework of governance that affects the relationship between climate aid and FDI, the relationship between climate risk and FDI. The recent studies of ([Gamso, 2025](#)) indicates that negative relationship between FDI and climate risk is only beneficial when governance quality and climate aid is low. In case, governance is strong and climate aid is sufficient, the effect of climate risk on FDI will be diminished.

Therefore, effective governance and adequate climate aid can reduce the adverse effects of climate risk on foreign investment. This indicates that climate aid and governance quality may jointly strengthen the resilience of FDI against climate-related uncertainties.

The table shows the countries level data on FDI inflows, climate aid disbursement, and governance quality on [United Nations Economic and Social Commission for Asia and the Pacific \(2024\)](#); [Trading Economics \(2025\)](#); [SolAbility \(2024\)](#) and sources are provided in the last column .

This framework also suggests that the influence of climate risk on FDI is not uniform across countries, as it depends on the institutional and financial capacity available to address climate-related challenges. Countries with higher governance quality are more likely to have effective institutions, transparent policies, and

stronger regulatory mechanisms that can reduce uncertainty for foreign investors. Similarly, adequate climate aid can provide financial resources for climate adaptation, mitigation, and resilience-building activities, thereby reducing the potential economic and operational disruptions associated with climate risks. Thus, the interaction between governance quality and climate aid may play an important role in shaping investors' responses to climate-related risks.

From this perspective, climate aid and governance quality can be considered complementary mechanisms in maintaining the attractiveness of host countries to foreign investors. While climate aid provides the financial support required to manage and respond to climate-related vulnerabilities, governance quality determines how effectively these resources are allocated and implemented. A combination of strong governance and sufficient climate aid may therefore create a more stable investment environment by reducing climate-related uncertainty and strengthening institutional resilience. Consequently, examining FDI, climate aid, climate risk, and governance quality together provides a more comprehensive understanding of the factors influencing foreign investment decisions in climate-vulnerable economies.

This framework further emphasizes that the effect of climate risk on FDI may depend on the capacity of host countries to manage and respond to climate-related challenges. Climate risk can increase uncertainty for foreign investors by affecting infrastructure, production activities, operating costs, and the long-term profitability of investment projects. However, strong governance can help reduce such uncertainty through effective institutions, transparent policies, regulatory stability, and better implementation of climate-related measures, while climate aid can provide the financial resources required for adaptation, mitigation, and resilience-building activities.

In this regard, the availability of adequate climate aid, together with higher governance quality, may reduce the vulnerability of economies to climate-related shocks and consequently limit their adverse effects on foreign investment. Therefore, the relationship between climate risk and FDI should be understood not only in terms of the level of climate vulnerability faced by a country but also in terms of its institutional capacity and financial resources to address these risks.

TABLE 2.1: Country Level Climate Aid , Governance, Foreign Direct Investment , and Key Governance Indicators

Country	Climate Aid 2024 (USD bn)	Climate Aid 2025 (USD bn, to June)	FDI 2024 (USD bn)	FDI 2025 (USD bn, to June)	Climate Aid Level	FDI Trend	Governance Quality	Key Governance Indicators (WGI)	Source (APA 7th)
India	8.0	4.2	76	40	High	Increasing	Good	Regulatory Quality, Effectiveness	United Nations Economic and Social Commission for Asia and the Pacific (2024) ; (SolAbility, 2024)
Brazil	7.2	3.6	65	33	High	Increasing	Good	Voice & Accountability, Rule of Law	SolAbility (2024)
Mexico	6.0	3.0	36	18	High	Stable	Moderate	Control of Corruption	(SolAbility, 2024)

Table 2.1 – *continued from previous page*

Country	Climate Aid 2024 (USD bn)	Climate Aid 2025 (USD bn, to June)	FDI 2024 (USD bn)	FDI 2025 (USD bn, to June)	Climate Aid Level	FDI Trend	Governance Quality	Key Governance Indicators (WGI)	Source (APA 7th)
South Africa	5.0	2.5	9	4.5	High	Increasing	Moderate	Political Stability, Rule of Law, Regulatory Quality	SolAbility (2024)
Indonesia	4.5	2.2	23	11	Medium	Increasing	Moderate	Effectiveness, Regulatory Quality	SolAbility (2024)
Vietnam	2.3	1.2	8.25	8.90	Medium	Increasing	Good	Regulatory Quality, Corruption Control	Trading Economics (2025)

Table 2.1 – *continued from previous page*

Country	Climate Aid 2024 (USD bn)	Climate Aid 2025 (USD bn, to June)	FDI 2024 (USD bn)	FDI 2025 (USD bn, to June)	Climate Aid Level	FDI Trend	Governance Quality	Key Governance Indicators (WGI)	Source (APA 7th)
Turkey	2.0	1.0	10.5	2.4	Medium	Decreasing	Moderate	Regulatory Quality, Stability	United Nations Economic and Social Commission for Asia and the Pacific (2024)
Nigeria	1.8	0.9	4.5	2.2	Medium	Decreasing	Bad	Rule of Law, Corruption	SolAbility (2024)
Kenya	1.5	0.8	2.2	1.1	Medium	Increasing	Good	Effectiveness, Accountability	SolAbility (2024)

Table 2.1 – *continued from previous page*

Country	Climate Aid 2024 (USD bn)	Climate Aid 2025 (USD bn, to June)	FDI 2024 (USD bn)	FDI 2025 (USD bn, to June)	Climate Aid Level	FDI Trend	Governance Quality	Key Governance Indicators (WGI)	Source (APA 7th)
Bangladesh	1.2	0.6	3.2	1.6	Medium	Increasing	Moderate	Regulatory Quality, Corruption Control	SolAbility (2024)
Pakistan	1.0	0.5	1.8	0.9	Medium	Decreasing	Bad	Rule of Law, Corruption	United Nations Economic and Social Commission for Asia and the Pacific (2024)
Chad	0.3	0.15	0.1	0.05	Low	Decreasing	Bad	Rule of Law, Corruption, Accountability	(SolAbility, 2024)

Table 2.1 – continued from previous page

Country	Climate Aid 2024 (USD bn)	Climate Aid 2025 (USD bn, to June)	FDI 2024 (USD bn)	FDI 2025 (USD bn, to June)	Climate Aid Level	FDI Trend	Governance Quality	Key Governance Indicators (WGI)	Source (APA 7th)
Namibia	0.6	0.3	0.8	0.4	Low	Increasing	Good	Effectiveness, Corruption Control	SolAbility (2024)
Philippines	0.7	0.4	9.0	4.5	Low	Increasing	Moderate	Regulatory Quality, Accountability	SolAbility (2024)
Ethiopia	0.4	0.2	3.1	1.5	Low	Decreasing	Bad	Rule of Law, Corruption	SolAbility (2024)

Sources: [United Nations Economic and Social Commission for Asia and the Pacific \(2024\)](#). Asia and , to Pacific trade and investment report 2024. United Nations Economic and Social Commission for Asia and the Pacific. <https://www.unescap.org>; [SolAbility \(2024\)](#) Global Sustainable Competitiveness Index 2024. SolAbility Sustainable Intelligence. <https://solability.com>; [Trading Economics \(2025\)](#). Vietnam FDI. <https://tradingeconomics.com/vietnam/foreignand> , to direct and , to investment

2.10 Governance Quality and the Climate Risk and to Foreign Direct Investment Relationship

Governance affects the linkage between climate risk and FDI. It is viewed that strong governance reduces the negative effect of climate risk on FDI through enhancing risk management, investor protections, and regulatory enforcement. This relationship supports the findings that good governance is able to attract more FDI even in risky environments too ([Hayat, 2019](#)).

2.11 Theoretical Framework Underpinning the Study

The theoretical architecture of the present study integrates three complementary frameworks: [Dunning \(2001\)](#) Eclectic OLI Paradigm, the Institutional Economics tradition as operationalized through the Worldwide Governance Indicators framework of [Kaufmann et al. \(2009\)](#), and the emerging Climate Finance Nexus framework articulated by [Giglio et al. \(2021\)](#); [Krogstrup and Oman \(2019\)](#). Each framework contributes distinct analytical elements that together generate the governance conditioned mediation model that is the study's methodological core. Within the OLI paradigm, climate risk operates as a negative locational factor (L) that reduces the attractiveness of climate and , to vulnerable countries as FDI destinations by increasing the expected cost and uncertainty of productive investment. Climate aid, in this framework, functions as a public investment that upgrades the host country's locational advantages by reducing the risk related component of the investment climate effectively improving the Land to factor for foreign investors.

Governance quality functions as a second and order locational factor that determines both the allocation of climate aid and the efficiency with which it translates into risk reduction: high governance countries can convert climate aid into credible investment risk reductions, while weak governance countries may be unable to do so regardless of the volume of climate aid received.

The Institutional Economics tradition, as developed by [North \(1990\)](#) and operationalized empirically through the WGI framework of [Kaufmann et al. \(2009\)](#), provides the micro foundations for the governance moderation hypothesis. Institutions defined as the rules, norms, and enforcement mechanisms that constrain and enable human behavior in political and economic systems determine how efficiently societies can transform public resources (including climate aid) into desired outcomes (including reduced investment risk). With strong institutions can credibly commit to climate risk management strategies, maintain transparent information environments that reduce investor uncertainty, and enforce property rights and contracts in ways that protect FDI from climate related regulatory disruption.

The Climate Finance Nexus framework, as articulated in the academic and policy literature by [Giglio et al. \(2021\)](#); [Krogstrup and Oman \(2019\)](#); [Dikau and Volz \(2021\)](#), emphasizes the catalytic role of public climate finance in mobilizing private investment by reducing the risk adjusted cost of climate vulnerable productive investments. Within this framework, climate aid is not merely a transfer payment but a risk transformation instrument that converts public risk taking into private risk reduction, enabling foreign investors to commit to long term productive investments in climate exposed regions that they would otherwise avoid. The governance conditioned version of this framework developed in the present study extends the catalytic logic by recognizing that governance quality determines the efficiency of the risk transformation function: higher governance quality implies more efficient conversion of climate aid into investible risk reduction, generating a larger crowding in effect on FDI.

2.12 Research Gaps and the Positioning of the Present Study

The foregoing review of the literature reveals a rich body of evidence on the individual relationships between climate risk and investment, climate aid allocation and effectiveness, governance quality and FDI, and the macroeconomic consequences of climate change for developing countries. The literature has established, with reasonable empirical confidence, that climate risks negatively affect investment

returns (Hong et al., 2019; Giglio et al., 2021) that governance quality is a quantitatively significant positive determinant of FDI (Daude and Stein, 2007; Hausken, 2006) that climate aid is allocated partly according to vulnerability and partly according to governance capacity and donor interests (Weiler et al., 2018; Betzold and Weiler, 2017) and that public climate finance can theoretically crowd in private investment through risk reduction channels (Krogstrup and Oman, 2019; Dikau and Volz, 2021).

However, a critical empirical and theoretical gap remains: no prior study has examined the integrated relationship between climate aid, climate risk, governance quality, and FDI in a unified econometric framework. The mediating role of climate risk in the climate aid and FDI relationship has not been empirically tested. The moderating role of governance quality in conditioning the effectiveness of the climate aid, climate risk, and FDI pathway has not been identified or quantified. The governance threshold above which climate aid reliably stimulates FDI through climate risk reduction has not been estimated. The present study fills all three gaps simultaneously, constructing a governance conditioned moderated mediation model that integrates all four variables in a cross country panel framework estimated using data spanning 2002 – 2022.

By filling these gaps, the present study makes simultaneous contributions to the literatures on climate finance, institutional economics, and FDI theory. For the climate finance literature, it provides the first empirical evidence on whether climate aid effectively reduces climate risk perceptions in a way that sustains FDI inflows. For the institutional economics literature, it extends the governance and FDI nexus to include climate and conditioned investment pathways. For the FDI theory literature, it extends Dunning's OLI framework to incorporate climate risk as a negative locational factor and climate aid as a governance conditioned corrective mechanism. And for development policy, it generates actionable guidance on how climate aid can be designed and governed to most effectively catalyse FDI in climate vulnerable developing countries guidance that is urgently needed as the international community faces the dual imperatives of accelerating climate adaptation and mobilizing private investment for sustainable development.

2.12.1 Conceptual Model

Independent Variable IV: Climate Aid

Dependent Variable DV: Foreign Direct Investment

Mediator M: Climate Risk

Moderator W: Governance

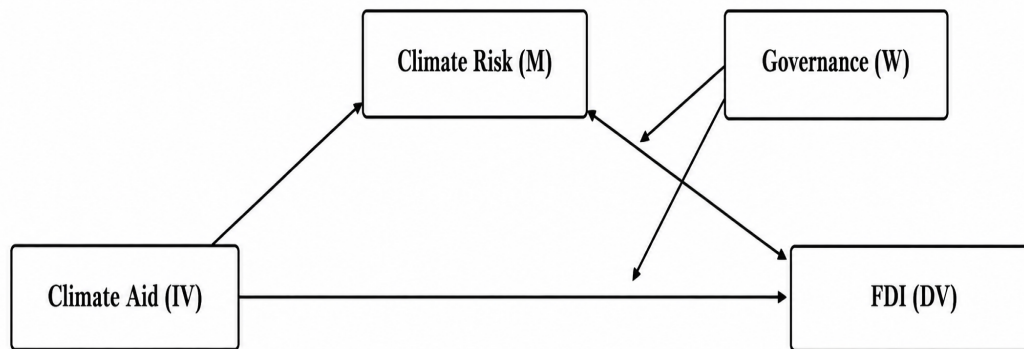


FIGURE 2.1: Conceptual Framework of the Study

2.12.2 Climate Aid and Foreign Direct Investment

Climate aid is the financial and technological aid by helping countries to adapt and mitigate the climate change impacts. The prior studies show climate aid is the adapting aid that can reduce local climate risk that is pivotal for investor confidence (Gamso, 2025). By reducing vulnerabilities, climate aid will be able to improve investment climate which makes host countries more attractive for FDI inflows.

2.12.3 Climate Risk as a Mediator

Climate risk highlights the physical and economic damages that are causing climate changes like environment shifts and extreme weather events. This study explores the influence of climate aid on foreign direct investment (FDI), being mediated by climate risk and moderator is influencing by government quality. The framework uses theories from the environmental economies, government studies

and international business for demonstrating the interaction that will shape the investment inflows in context to climate change. This ecological theory work on the framework of environmental circumstances like climate risk that may booster technological advancement and institutional innovation, while supporting strong governance and foreign aid (Mol and Sonnenfeld, 2000). High climate risk boosts the operational cost, uncertainty and deters FDI. (Fagbemi and Oke, 2024) Climate aid mitigates risk through adaption and financing resilience by increasing FDI. Therefore, climate risk mediates the connection between climate aid and FDI, that explains aid improves investment flows.

Climate aid strengthens adaptive capacity and resilience, thereby reducing the uncertainty and operational disruptions associated with climate risk. This reduction in climate-related risk can create a more stable investment environment and encourage greater FDI inflows.

2.12.4 Governance as a Moderator

Governance quality demonstrates the institutions effect by regulating the framework, transparency, and political stability that plays an essential role in moderating relationship. Strong governance can enhance the effectiveness of climate aid, to see that funds are used efficiently to reduce climate risk and able to better the investment (Fagbemi and Oke, 2024). It is aligning with the institutional theory that focuses more on the role of governance to shape the economic outcomes.

Strong governance can therefore strengthen the impact of climate aid in reducing climate-related risks. It can also create a stable and transparent environment that increases investor confidence and supports FDI inflows. Thus, governance quality may moderate the relationship between climate aid, climate risk, and FDI by improving the effectiveness of institutional and financial support.

2.12.5 Foreign Direct Investment

FDI is acting as a pivotal factor for the economy, sustainability, and technology. The framework Eclectic paradigm explains FDI as ownership, international advantages, and location where environment and governance stability are location factor

(Resmini and Siedschlag, 2013) Climate related factors are increasingly important determinants for FDI decisions in vulnerable regions.

A stable investment environment can reduce uncertainty and encourage foreign investors to commit long-term resources. Climate aid and effective governance can further improve the attractiveness of vulnerable regions by reducing climate-related investment risks. Therefore, FDI can be influenced not only by economic conditions but also by climate risk, climate aid, and the quality of governance in the host country.

Climate aid can further reduce climate-related uncertainties by supporting adaptation and resilience in vulnerable regions. This can strengthen investor confidence and promote long-term FDI inflows by creating a more stable and predictable investment environment.

2.12.6 Hypothesis

- i. H1: Climate Aid significantly and positively affects FDI directly, consistent with Resource Dependence Theory. 2: Climate Aid significantly and negatively affects Climate Risk, consistent with Ecological Modernization Theory.
- ii. H3: Climate Risk significantly and negatively affects FDI, consistent with Institutional Theory.
- iii. H4: Climate Risk significantly and positively mediates Climate Aid's effect on FDI (Resource Dependence & Ecological Modernization).
- iv. H5: Governance significantly and negatively moderates the Climate Risk → FDI relationship, consistent with Institutional Theory.
- v. H6: Governance does not significantly moderate the Climate Aid → FDI relationship, consistent with Institutional Theory.
- vi. H7: Governance significantly and positively moderates the mediated Climate Aid → FDI pathway via Climate Risk, partially significant across governance levels (Resource Dependence & Ecological Modernization).

TABLE 2.2: Empirical Evidence Supporting the Study Hypothesis

Hypothesis	Supporting Evidence Summary	Key Sources (APA 7th)
H1: Climate Aid → FDI	Climate aid improves the investment climate and attracts FDI, especially when combined with good governance.	Alpaslan, U., Neyapti, B., & Sayek, S. (2005). <i>Aid and foreign direct investment: International evidence</i> (No. 2005/12). Discussion paper. Pienknagura, S. (2024). <i>Climate policies as a catalyst for green FDI</i> . International Monetary Fund.
H2: Climate Aid → Climate Risk	Climate aid reduces perceived climate risks to foreign direct investors through adaptation funding.	(Gamso, 2025). Does climate aid reduce perceived climate risks to foreign direct investors? <i>Climate and Development</i> , 1–11.
H3: Climate Risk → FDI	Climate risk negatively affects FDI due to uncertainty and costs.	Gamso (2025). Does climate aid reduce perceived climate risks to foreign direct investors? <i>Climate and Development</i> , 1–11. Fagbemi and Oke (2024). Climate change vulnerability and foreign direct investment linkage: Why climate change preparedness matters in Sub-Saharan Africa. <i>Research in Economics</i> , 78(1), 52–60.

Table 2.2 – continued from previous page

Hypothesis	Supporting Evidence Summary	Key Sources (APA 7th)
H4: Climate Risk mediates Climate Aid → FDI	Climate aid lowers climate risk, which facilitates FDI inflows.	Gamso (2025) . Does climate aid reduce perceived climate risks to foreign direct investors? <i>Climate and Development</i> , 1–11.
H5: Governance moderates Climate Risk → FDI	Good governance mitigates climate risk's negative impact on FDI.	Farooq (2022) . Foreign direct investment, foreign aid, and CO ₂ emissions in Asian economies: does governance matter? <i>Environmental Science and Pollution Research</i> , 1–16.
H6: Governance moderates Climate Aid → FDI	Aid attracts FDI mainly under good governance conditions.	Karakaplan, U., Neyapti, B., & Sayek, S. (2005). <i>Aid and foreign direct investment: International evidence</i> (No. 2005/12). Discussion paper.
H7: Governance moderates Climate Aid, Climate Risk, and FDI	Governance enhances climate aid's effectiveness in reducing risk and promoting FDI.	Farooq (2022) . Foreign direct investment, foreign aid, and CO ₂ emissions in Asian economies: does governance matter? <i>Environmental Science and Pollution Research</i> , 1–16.

TABLE 2.3: Prior Studies used Moderated Mediation

Study / Reference	Topic / Context	Usage
Kong and Choo (2022)	Gender differences in entrepreneurship: achievement motivation → entrepreneurial intention, moderated by gender on both direct and indirect paths.	Moderation effect of gender is tested, with confirmation via dual-path moderation.
Gamso (2025)	Climate risk and FDI: climate aid, governance, and climate risk interactions.	This framework is used for testing moderated mediation, with governance as a moderator for both paths.
Cas, M. S. C. M., Cas, S. M., Alem, Y., & Shirakawa, J. B. (2022)	Governance quality's role in amplifying climate aid effects on economic outcomes.	Governance is used to test multiple paths, though without explicit highlighting.
Fraga (2022)	Investment climate and foreign direct investment in Latin American countries: firm-level evidence.	Governance is applied as a moderator variable to test both effects, using Model 15.

Table 2.3 – *continued from previous page*

Study / Reference	Topic / Context	Usage
Chen et al. (2022)	Climate risk impact on FDI, with institutional factors aligning with Model 15.	Indirect moderation is tested across multiple paths for governance.

Chapter 3

Research Methodology

3.1 Research Design

This study used the quantitative research with the positivistic epistemology for examining the relation of climate aid, governance, climate risk , and Foreign direct investment inflows with 146 all available countries with complete observation . The data is collected on the basis of the availability than geographic region or income classification for the time period of 2002 – 2022. The research is using panel data approach with time series and cross sectional dimensions for both dynamics of within country and country comparison for capturing it together ([Hsiao, 2022](#)). The panel methodology is for the macro economic studies that involves unobserved heterogeneity, country specific fixed effects , and temporary existence of the variables that is the main concern ([Wooldridge, 2010](#))

This study is using moderated mediation framework with the model of Structural Equation Model (SEM) Like Structural equation modeling uses simultaneous equations at a time for testing than fixed effect which run one equation at one time. OLS is applied where there is a need to observe the impact of one equation. So basically, the study is figuring out that climate risk is serving as the mediating mechanism by which climate aid influencing the FDI inflows , and the institutional quality that is operating as the composite governance index will able to moderate both paths direct and indirect paths in the relationship. The study is using the moderation mediation by showing the conditional indirect effect. This

research is using the both moderation and mediation for the single integrated model which is essential to understand the theoretical pathway behind the mechanism than merely using the approach . The study uses the secondary data from peer reviewed databases that are internationally recognised , comparability across countries, high data quality ,and temporal consistency.

3.2 Population and Sample

3.2.1 Population

This study population contains all 146 countries with complete observation for all the variables over the study period. The countries were selected based on data availability after merging all the international databases that are aligned with the international climate finance and reported or received the FDI inflows in the observation window. The population is corresponding to aid recipient countries , non OECD membership classified by the OECD (Organization for Economic Cooperation and Development , then DAC (Development Assistance Committee) framework ,and also tracking the CFU (Climate Fund Updates) for the climate related official development assistance.

3.2.2 Sample

For analysis , the data availability is across 21 years with valid observation of all variables. The final panel contains 146 countries with time period of 2002 to 2022 , total observations 3,066 usable country year observation where listwise deleted the missing and infinite values. The sample span contains diverse geographical regions like Latin America and the Caribbean, South Asia, Sub Saharan Africa , East Asia and Pacific , Eastern Europe , Central Asia, the Middle East and North America. This research covers geographical coverage which ensures external validity and decreases the selection bias ([Kaufmann and Kraay, 2010](#); [Neumayer and Spess, 2005](#)).

The table 3.1 shows the prior studies uses which regions and highlight their significance too. This broad geographical coverage strengthens the robustness of the analysis by capturing variations in climate risk, governance quality, climate aid, and FDI across different country contexts.

TABLE 3.1: Geographical Coverage of the Final Sample and Significance: Comparison with Prior Studies

Region	Countries in Sample	Prior Studies Covering Region	Significance for this Study
Sub-Saharan Africa	45 countries (e.g., Ghana, Kenya, Ethiopia, Nigeria, Rwanda)	Neumayer and Spess (2005) ; World Bank (2023)	Most climate-vulnerable region; lowest governance scores; tests whether climate aid compensates for weak institutions in attracting FDI.
South Asia	8 countries (e.g., India, Bangladesh, Pakistan, Nepal, Sri Lanka)	(Intergovernmental Panel on Climate Change, 2023) ; Bussy and Zheng, 2023)	High climate risk (flooding, heat); large ODA recipients; tests the risk-reduction channel of climate aid.
Latin America & Caribbean	25 countries (e.g., Brazil, Colombia, Mexico, Peru)	Organisation for Economic Co-operation and Development (2023) ; Alesina and Dollar (2000)	Middle-income region; tests whether the climate aid effect differs across income levels; growing FDI recipient.

Table 3.1 – *continued from previous page*

Region	Countries in Sample	Prior Studies Covering Region	Significance for This Study
East Asia & Pacific	20 countries (e.g., Vietnam, Philippines, Indonesia, Pacific SIDS)	Eckstein et al. (2021) ; Chen et al. (2015)	Small Island Developing States (SIDS) face extreme climate risk; provides a unique test of governance moderation.
Central Asia & Eastern Europe	20 countries (e.g., Kazakhstan, Georgia, Ukraine, Serbia)	Kolstad and Wiig (2009) ; Kaufmann and Kraay (2010)	Transition economies; variable governance quality; tests institutional boundary conditions.
MENA	15 countries (e.g., Morocco, Jordan, Egypt, Turkey)	Wei (2000) ; Gamso (2025)	Mixed governance; resource-rich vs. resource-poor economies; tests Climate Aid $\times$ Governance interaction contexts across diverse settings.

Note: The final sample provides broad geographical coverage across all major world regions or smaller countries includes 146 available countries [Gamso \(2025\)](#) focuses primarily on climate vulnerable developing countries without a moderated mediation framework. [Neumayer and Spess \(2005\)](#) cover bilateral investment treaties across developing regions. [Busse & Hefeker \(2007\)](#) analyze political risk and FDI for 83 countries. This study's 146 country sample 21 year panel provide substantially

greater statistical power and geographic generalizability than all aforementioned studies.

The year 2002 is the starting point , this time span is selected because the data is widely available from this point and some variables have starting year 2002 . The table 3.2 provides the list of all available countries for the sample data total 170 – 208 countries from which subtracted 33 countries due to their NIL and NA's value . After these 146 countries contain the available data. The 2022 time period indicates the latest available data for the analysis time.

TABLE 3.2: List of Sample Countries

No.	Country	No.	Country
1	Afghanistan	74	Kiribati
2	Albania	75	Kuwait
3	Algeria	76	Lao PDR
4	Angola	77	Latvia
5	Antigua & Barbuda	78	Lebanon
6	Argentina	79	Lesotho
7	Armenia	80	Liberia
8	Austria	81	Libya
9	Azerbaijan	82	Lithuania
10	Bahamas	83	Luxembourg
11	Bahrain	84	Madagascar
12	Bangladesh	85	Malawi
13	Barbados	86	Malaysia
14	Belarus	87	Maldives
15	Belgium	88	Mali
16	Belize	89	Malta
17	Benin	90	Marshall Islands
18	Bhutan	91	Mauritania
19	Bolivia	92	Mauritius
20	Bosnia & Herzegovina	93	Mexico
21	Botswana	94	Mongolia
22	Brazil	95	Morocco
23	Brunei Darussalam	96	Mozambique
24	Bulgaria	97	Namibia
25	Burkina Faso	98	Nepal
26	Burundi	99	Netherlands
27	Cambodia	100	Nicaragua

Table 3.2 – *continued from previous page*

No.	Country	No.	Country
28	Cameroon	101	Nigeria
29	Cape Verde	102	Norway
30	Chad	103	Oman
31	Chile	104	Pakistan
32	China	105	Palau
33	Colombia	106	Panama
34	Comoros	107	Papua New Guinea
35	Congo, Dem. Rep.	108	Paraguay
36	Costa Rica	109	Peru
37	Côte d'Ivoire	110	Philippines
38	Croatia	111	Poland
39	Cyprus	112	Portugal
40	Czech Republic	113	Qatar
41	Denmark	114	Rwanda
42	Djibouti	115	Samoa
43	Dominica	116	São Tomé & Príncipe
44	Ecuador	117	Saudi Arabia
45	Eritrea	118	Senegal
46	Estonia	119	Serbia
47	Ethiopia	120	Seychelles
48	Fiji	121	Sierra Leone
49	Finland	122	Singapore
50	France	123	Slovenia
51	Gabon	124	South Africa
52	Gambia	125	Spain
53	Georgia	126	Sri Lanka
54	Germany	127	Sudan
55	Ghana	128	Suriname
56	Greece	129	Sweden
57	Grenada	130	Switzerland
58	Guatemala	131	Tajikistan
59	Guinea	132	Thailand
60	Guinea Bissau	133	Timor Leste
61	Haiti	134	Togo
62	Honduras	135	Tonga

Table 3.2 – *continued from previous page*

No.	Country	No.	Country
63	Hungary	136	Turkey
64	India	137	Turkmenistan
65	Indonesia	138	Tuvalu
66	Iraq	139	Uganda
67	Ireland	140	United Kingdom
68	Israel	141	Uruguay
69	Italy	142	Uzbekistan
70	Jamaica	143	Vanuatu
71	Jordan	144	Vietnam
72	Kazakhstan	145	Zambia
73	Kenya	146	Zimbabwe

Note:Countries are listed alphabetically. The final sample comprises 146 economies observed over the period 2002–2022.

3.3 Variable Description

This research study is incorporating the following variables ; independent variable (Climate Aid) , Dependent variable (FDI) , one mediating variable (Climate Risk) , then two control variables (GDP Per Capita and Population Density) and one moderating variable (Governance). The available information is provided below for the measurement approaches , data source and operational definition is illustrated.

3.3.1 Dependent Variable-Foreign Direct Investment

In this study, Foreign direct investment is the dependent variable . It is measured in total net inflows (in US Dollars) and the data source is World Bank World Development Indicators (WDI) . The main focus of this study is on inflows data which is the capital received by the host countries from the foreign investors which shows country's attractiveness as the investment decision. Merely, the FDI inflows are relevant to the study because the objective is to know that which factors draw foreign capital into the recipient economy. It has been observed that priorly the FDI empirical analysis uses the variables are log transformed FDI highlights the highly right skewed distribution.(Blonigen and Piger, 2014; Neumayer and Spess, 2005). They state that when raw FDI inflows values are very less or are equal to zero in the given year due to the investment activities then values are censored in USD 1 before transformation that remains consistent with the (Gamsso, 2025) and in other prior literature uses cross national panel FDI

studies. Foreign direct investment is also used for increasing countries attractiveness towards the investment decision and also integrating globally through the capital markets.

3.3.2 Independent Variable-Climate Aid

Climate aid is acting as the independent variable for the total climate related activities of official development assistance (ODA) by the host country in the US Dollars. For climate aid the data is sourced from the Climate funds Update. In the climate fund Updates, there are total 40,000 plus entries the data is so vast so made climate aid index to manage the data. Firstly, the data is available in the climate classes (mitigation and adaptation) and their climate sub classes that are listed into 10 forms (other adaptation projects, Disaster risk reduction and early warning system , Renewable multiples, energy efficiency , disaster risk reduction, hydro energy, solar energy , geothermal energy ,wind energy , and bio energy .Then all these climate sub classes are further divided into the financing , loan, grant, guarantee , and equity. These are the forms mitigation and adaptation where Carbo dioxide, environment, and other mitigation forms are not included because they are not relevant to this study. This way after omitting the two unusual forms made climate aid index by aggregating all the climate sub classes in the terms of financing , loan, grant, guarantee, and equity. In the analysis, the natural logarithm transformation is applied for the CA. The variable Climate aid (IV) uses the hypothesis that climate aid will might assistance to the foreign investors by signalling international credibility and also constructing the climate resilient infrastructure. (Gamso, 2025; Alesina and Dollar, 2000).

Furthermore, climate aid may reduce investment-related uncertainty by improving the host coun-try’s capacity to address climate-related risks and strengthen its environmental infrastructure. Therefore, higher levels of climate aid are expected to create a more supportive and resilient investment environment, which may enhance the attractiveness of the host country for foreign investors.

TABLE 3.3: Climate Aid: Measurement Approaches Across Studies / Agencies

Author / Agency	Approach	Indicators / Proxies Used	Reference
OECD DAC — Rio Markers	Three-tier activity-level scoring (0 = not targeted, 1 = significant, 2 = principal objective) applied to each reported aid activity	Climate change mitigation marker, climate change adaptation marker	(Organisation for Economic Co-operation and Development, 2022)

Table 3.3 – continued from previous page

Author / Agency	Approach	Indicators / Proxies Used	Reference
Joint MDB Climate Finance Tracking Methodology	“Climate components” methodology identifying the % share of a project attributable to climate objectives	Adaptation share, mitigation share, dual-benefit share (USD)	(Asian Infrastructure Investment Bank, 2023)
Weikmans, Roberts, Baum, Bustos, & Durand (2017)	Manual re-evaluation/re-coding of Rio-marker-tagged CRS aid activities to assess reporting credibility	Re-scored adaptation markers at activity level (principal / significant / not related)	(Weikmans et al., 2017)
Betzold & Weiler (2017)	Aid-allocation analysis using sector-coded adaptation finance	Vulnerability-targeted adaptation aid by recipient country	(Betzold and Weiler, 2017)
This study	Composite climate aid index aggregating disbursements across sub-classes and financial instruments	Sub-classes: other adaptation projects, disaster risk reduction & early-warning systems, renewable energy (solar, wind, hydro, geothermal, bioenergy), energy efficiency; each captured across four instrument types: grant, loan, guarantee, equity	—

3.3.3 Mediating Variables-Climate Risk

Climate risk is the mediating variable that is measured from the database of ND GAIN (Notre Dame Global Adaptation Initiative) that captures the vulnerability and readiness score. The greater Climate risk vulnerability value shows more exposure and vulnerability. The mediating

role of climate risk is used for inspecting the relationship of FDI and climate aid by showing the environment riskiness which the investors might face by overviewing the condition of the host country where climate aid may reduce the environmental uncertainty by affecting FDI with climate risk channels (Chen et al., 2022; Eckstein et al., 2021; Hausken, 2006) The climate risk vulnerability index is made by selecting the vulnerability over the trends, gain, readiness, and the indicator files because vulnerability directly measures the country's exposure, adaptive capacity and sensitivity for climate hazards where others are not measuring it collectively like readiness shows governance and economic capacity , then trends contain unaggregated input that requires replicating ND GAIN's own methodology. The index is created by using food, water , ecosystem ,and health are calculated by using the PCA (Principal component analysis) In the vulnerability index , this thesis used Principal component analysis than simple average because it can create a more statistically robust index when the indicators are measuring the same underlying concept (vulnerability). Here is the explanation of the categories chosen from the ND gain zip folder. In the making of climate risk vulnerability index , the study chooses vulnerability component from the compiled file that includes : the food, health, eco system, and water sub indices are chosen because they capture the human development condition, resource capacity that are mostly linked to the macro economic stability and FDI attractiveness with food and water vulnerability that reflects the labor productivity and agricultural risk , then health reflects the workforce and human capital risk , then eco system vulnerability shows the risk to natural resource dependent sectors of GDP. Others like capacity, exposure, and sensitivity were not included because it is already in the sector scores habitat and infrastructure were also excluded as its closer to governance and institutional quality. Overall vulnerability score was excluded because its more relevant to the FDI channel and vulnerability delta was excluded because it only measures the change than level required for panel mediator.

TABLE 3.4: Climate Risk Vulnerability: Measurement Approaches Across Studies / Agencies

Author / Agency	Approach	Indicators / Proxies Used	Reference
Chen, Noble, Hellmann, Coffee, Murillo, & Chawla (2015); Notre Dame ND-GAIN	Composite vulnerability score from exposure, sensitivity, and adaptive-capacity indicators across six life-supporting sectors	Food, water, health, ecosystem services, human habitat, infrastructure (36 indicators total)	(Chen et al., 2015)

Table 3.4 – continued from previous page

Author / Agency	Approach	Indicators / Proxies Used	Reference
Eckstein, Künzel, & Schäfer (2019) Germanwatch	Global Climate Risk Index (CRI): outcome-based index using observed disaster impacts rather than structural vulnerability	Fatalities, losses per GDP, number of weather-related loss events (historical, not predictive)	(Eckstein et al., 2019)
EU Joint Research Centre — INFORM Risk Index	Composite of hazard/exposure, vulnerability, and lack of coping capacity	Natural/human hazard exposure, socio-economic vulnerability, institutional coping capacity	(De Groeve et al., 2014)
HSBC “Fragile Planet” Index / Fitch Climate Risk Scores	Sovereign/investor-oriented composite climate risk ratings	Physical risk exposure, transition risk, adaptive capacity indicators blended for investment risk use	(Paun et al., 2018)
This study	Principal Component Analysis (PCA) applied to four ND-GAIN vulnerability sub-sectors to derive a single composite Climate Risk Vulnerability (CRV) score	Food, Water, Ecosystem, and Health sub-indices reduced via PCA into one mediator variable	—

3.3.4 Moderating Variable-Governance

The Governance dataset is taken from the Worldwide Governance Indicator (WGI) and compiled through the World Bank. The Governance is operationalized in this study by aggregating the

six proxies (Kaufmann and Kraay, 2010) of the governance quality : Control of Corruption , Voice and Accountability , Political stability and Absence of violence , Rule of law , government effectiveness , regulatory quality) into one composite governance index because it helps to highlight the mutely-dimensional nature of governance in the parsimonious manner. Furthermore In this study the governance is treated as composite rather than the latent construct of full measurement of for measurement. This thesis capture the overall governance performance in term of good and weak governance. The single composite index reduces the complexity and saves time than analyzing each proxies one by one which tells which proxy is more effective but will consume much time with numerous tests and understanding will not be built. In this study the governance is treated as observed composite rather than the latent construct to perform multiple tests of factor loading , factor analysis and covariance.

Governance is placed as a moderator on both paths at once the direct path (aid $\rightarrow$ FDI) and the indirect path (aid $\rightarrow$ risk $\rightarrow$ FDI) because governance isn't just another variable sitting beside aid and risk. It's the thing that decides how well aid and risk actually translate into real investment outcomes. Climate aid alone doesn't automatically attract investors. What matters is whether that aid is managed properly, whether rules are followed, and whether institutions can be trusted to use the money effectively. That's exactly what governance controls. So when aid flows directly into a country and tries to influence FDI, governance can strengthen or weaken that direct effect depending on how credible and efficient the institutions are. At the same time, governance also plays a role in the indirect path, where aid first reduces climate risk, and that lower risk is expected to bring in more FDI. But investors don't just look at risk numbers they look at whether a country's institutions can be trusted to manage that risk long-term. So governance changes how investors interpret and react to climate risk itself, not just how aid is used. Because governance influences the story at two different points how aid works, and how risk is perceived it made more sense to test it as a moderator on both paths together, rather than looking at each path separately. If governance were only tested on one path, the model would miss half of the picture. Testing it on both paths at the same time captures the full, real-world way these variables interact, instead of an oversimplified version of it. This combined structure where one variable (climate risk) mediates the relationship, and another variable (governance) moderates both the direct and mediated paths is called moderated mediation. It's a more advanced and realistic way of modeling the relationship, and it's exactly what sets this study apart from earlier research, which usually examined climate aid, climate risk, and governance as separate, disconnected pieces instead of one connected system. Governance acts as a boundary which moderates the climate risk on FDI and of climate aid on FDI this shows that the institutions shape the regularity reliability, investor confidence , and allocation of climate finance. (Wei, 2000; Kolstad and Wiig, 2009)

This study Composite index = arithmetic mean of six WGI indicators, entered as a single manifest moderator (W) Control of Corruption, Voice & Accountability, Political Stability &

Absence of Violence, Rule of Law, Government Effectiveness, Regulatory Quality.

TABLE 3.5: Governance Quality: Measurement Approaches Across Studies / Agencies

Author / Agency	Approach	Indicators / Proxies Used	Reference
Kaufmann, Kraay, & Mastruzzi (2011); World Bank WGI	Unobserved Components Model aggregating 35+ perception-based data sources into six separate dimension scores	Voice & Accountability, Political Stability & Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption	(Kaufmann et al., 2011)
Chen, Zhang, Wu, & Ji (2022)	Averaged/composite WGI score used as a single governance proxy in an FDI-climate risk moderation model	Mean of the six WGI dimensions	(Chen et al., 2022)
PRS Group — International Country Risk Guide (ICRG)	Composite political risk rating from 12 weighted components	Government stability, corruption, law & order, bureaucracy quality, investment profile, etc.	(PRS Group, 2022)
Kunčič (2014) — Institutional Quality Dataset	Composite blending over 30 existing institutional indices via factor analysis	Legal, political, and economic institutional sub-indices	(Kunčič, 2014)
This study	Composite index = arithmetic mean of six WGI indicators, entered as a single manifest moderator (W)	Control of Corruption, Voice & Accountability, Political Stability & Absence of Violence, Rule of Law, Government Effectiveness, Regulatory Quality	—

TABLE 3.6: Variable Definitions, Measurement, and Data Sources

Variable	Symbol	Unit / Measurement	Source	Database	Reference
FDI Inflows (Dependent)	FDI	USD, FDI inflows only (WDI series)	World Bank / UNCTAD	WDI / UNCTAD FDI Database	Blonigen and Piger (2014) ; Gamso (2025)
Climate Aid (Independent)	CA	USD, total climate-related ODA disbursements	OECD DAC / Climate Funds Update	CRS Database / CFU	Alesina and Dollar (2000) ; Gamso (2025)
Climate Risk (Mediator)	CRV	Composite index (GCRI + ND-GAIN); higher = greater risk	Germanwatch / ND-GAIN	GCRI / ND-GAIN Country Index	Eckstein et al. (2021) ; Chen et al. (2015)
Governance (Moderator)	GOV	Composite WGI index (mean of 6 indicators); range -2.5 to $+2.5$	World Bank	Worldwide Governance Indicators (WGI)	Kaufmann and Kraay (2010) ; Wei (2000)
Population Density (Control)	POPD	Persons per km ²	World Bank	World Development Indicators (WDI)	Dunning (2001) ; Borensztein et al. (1998)
GDP per Capita (Control)	GDPPC	Constant 2015 USD	World Bank	World Development Indicators (WDI)	Borensztein et al. (1998) ; Blonigen and Piger (2014)

Note:: CFU = Climate Funds Update; ND GAIN = Notre Dame Global Adaptation Initiative; WGI = Worldwide Governance Indicators; WDI = World Development Indicators (Used in this research) UNCTAD = United Nations Conference on Trade and Development, OECD DAC (organization for economics Co – operation and Development , Development Assistance Committee (As described in this table these two sources are used with all the listed variables in the previous studies for data collection).

3.3.5 Control Variable

In this study, there are two control variables named as population density and GDP per capita. Population density indicates about the number of people residing per square kilometre of the land area. For Population density variable, no need of generating any index just sorted and filtered the data. For this variable the data is taken from the WDI (World Development Indicator). It is operated as the labor availability, market size that are the determinants for the FDI location decisions. Higher population countries attract greater FDI which offers incentives to consuming markets, labour pools by reducing the operational cost for the foreign investors (Dunning, 2001). The coefficient sign is positive.

For GDPPC variable, no need of generating any index just sorted and filtered the data. The data source is the WDI World Development Indicator. This variable captures about the economic development of the host countries. The countries that are wealthier offers skilled labor, better infrastructure, developed financial markets, stable demand which make them more attractive to the foreign investors. The GDPPC is positively correlating with the FDI inflows in the global sample (Borensztein et al., 1998; Blonigen and Piger, 2014). The expected sign is positive.

3.4 Structural Equation Modeling

The Structural Equation modeling is used for the moderated mediation model. The pooled Ordinary Least Regression is used for the determination of the individual paths and also to take an overview run the regression to identify the casual relationship that how one variable is impacting the other variable and to identify the relationship between two variables. The pooled OLS test is run for the understanding purpose then structural equation modeling is used. The methodology only used the study that is structural equation modeling while pooled OLS is used for path identification, overview, and for identifying the relationship between two variables.

SEM is the Structural Equation Model used as the conceptual model of the moderated mediation. This model is used to test the linear equation and run it simultaneously at a time. Structural Equation Model is capable of multiple variation framework which help to estimate the multiple connected equations by using empirical decomposition of direct and indirect components. Other than conventional single equation regression, the SEM is capable of providing complex structure analysis for the moderators and mediation with the unified framework that is good for testing the moderated mediation. This states that methods including Fixed effect, Random Effect GMM, and Panel SEM (Latent construct) are not applicable in this moderated mediation structure. For this Structural equation modeling is applied because of the linear relationship to test them at a time and without any measurement model that Panel SEM (latent construct) require measurement model which various tests on the variables one by one which is quite difficult and time consuming task after this measurement error and validation is also required. This study focus is on the relationship among single composite indices and any fixed random effect cannot be

applied in this study because they not fully cover it. Moreover, the Panel SEM requires multiple observed indicators, then before estimating the relationships measurement model is estimated and constructs developed by factor loading. After this Reliability and validity assessment is checked and 4 – 5 tests are diagnosed for building for measuring the constructs. Thus, this study SEM (structural equationing) contains single composite index is completely different from Panel SEM. Fixed On the other hand, random effect is used for testing the impact of Independent variable on Dependent variable and the decision is made on the relationships by looking its time and cross – section. Like Structural equation modeling uses multiple linear equations at a time for testing than fixed effect which run one equation at one time. OLS is applied where there is a need to observe the impact of one equation. In this study, these all methods are inappropriate except SEM and for future studies Latent construct can be applied according to the data.

This study is applying the moderated mediation for conditional process analysis that is used for macro economic framework mainly for the panel data. This moderated mediation is consisted of 2 equations where the one is about the mediator model in which climate aid assumes climate risk and in the other one about outcome model, used climate aid and climate risk with the interaction term, Governance, and other control variables that will together predict FDI. For highlighting this heterogeneity panel, the country clustered standard error is used, and pooled OLS is used for the robust variance estimators. The VIF (Variation Inflation Factors) was used to confirm the existence of problematic multi collinearity.

Equation 1 : Structural Equation for the Mediating Variable

$$CRV_{it} = \alpha_0 + \alpha_1 CA_{it} + \alpha_2 POPD_{it} + \alpha_3 GDPPC_{it} + \varepsilon_{it} \quad (3.1)$$

In this equation, CRV_{it} is the climate risk index for country i in year t ; CA_{it} is the climate aid received by country i in year t ; $POPD_{it}$ is the population density of country i in year t ; $GDPPC_{it}$ represents the GDP per capita of country i in year t ; and ε_{it} is the idiosyncratic error term. The parameter α_0 is the constant, while α_1 through α_3 represent the slope coefficients. The above equation specifies the mediator path of the mediation framework.

Equation 2 : Structural Equation for the Dependent Variable

$$\begin{aligned} FDI_{it} = & \beta_0 + \beta_1 CA_{it} + \beta_2 CRV_{it} + \beta_3 GOV_{it} + \beta_4 (CRV \times GOV)_{it} \\ & + \beta_5 (CA \times GOV)_{it} + \beta_6 \ln(POPD)_{it} + \beta_7 \ln(GDPPC)_{it} + \mu_{it} \end{aligned} \quad (3.2)$$

FDI_{it} shows the FDI inflows for country i in year t . The term $(CRV \times GOV)$ is the interaction term testing governance moderation of the climate risk–FDI. The indirect effect is equal to $\alpha_1 \times \beta_2$ (of the variable Climate Aid on FDI through Climate Risk. Conditional indirect effect of Governance (GOV) at different levels shows the moderated mediation test.)

i. The Mediator Variable (Path a)

Climate Aid [$\ln(CA)$] $\rightarrow$ Climate Risk (CRV). This path addresses the effect of climate aid disbursement on reducing the host country's climate vulnerability score.

ii. The Dependent Variable (Path b and c):

Climate Aid [$\ln(CA)$] and Climate Risk (CRV) $\rightarrow \log(FDI)$. Path b captures the effect of climate risk on FDI, controlling for climate aid. Path c shows the direct effect of climate aid on FDI, controlling for the mediator (CRV). Simultaneously, these paths decompose the effect of climate aid on FDI into direct and indirect components.

So ,the indirect effect of climate aid on foreign direct investment with climate risk is adopted as the product of path coefficients $a * b$, the a is representing the climate aid effect on climate risk and the b denotes the climate risk effect on the FDI where the climate aid will remain constant. Then the indirect effect of governance moderation is examined with the interaction term ($CRV * GOV$ and $CA * GOV$) for the outcome model , which shows the mediated effect of the conditional variation for the institutional quality levels .

Chapter 4

Result Analysis and Discussion

4.1 Descriptive Statistics

The **Table 4.1** shows the distributional characteristics. The mean of FDI is 19.260 , standard deviation is 5.575 with values that are starting from 0.000 to the maximum point of 27.322.

TABLE 4.1: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
FDI	3,066	19.260	5.575	0.000	27.322
CA	3,066	12.408	8.874	0.000	28.340
CRV	3,066	0.013	0.797	−1.738	2.192
GOV	3,066	−0.061	0.944	−2.182	2.127
POPD	3,066	4.389	1.398	0.459	8.983
GDPPC	3,066	8.504	1.399	5.533	11.630

So, the sample have 3,066 observations by removing infinite and missing values *
p < 0.01, ** p < 0.05, * p < 0.10.**

This table shows the log transformation of the variables. The minimum value represents that FDI was extremely small (rounded at USD). This situation is observed in conflict and war torn states like Afghanistan or Eritrea in specific years. The maximum value of FDI is 27.322, reflecting larger emerging economies like Brazil and China that attracts billions of dollars yearly. This range remains the same due to the highly heterogeneous nature of FDI across the developing countries documented by [Blonigen and Piger \(2014\)](#); [Gamso \(2025\)](#)

So, the mean of CA is 12.408 , standard deviation is 8.874 that is ranging from 0.000 (years with no recorded climate ODA disbursement) to the 28.340 (large multi lateral disbursements to the high vulnerability recipients). The minimum value of 0.000 shows the country year where

no climate finance was recorded in the OECD CRS database. The pattern remains the same with project driven and concentrated nature of climate funding (Climate Fund Update, 2023).

The CRV has a mean of 0.013 with standard deviation of 0.797, the distribution spanning from the minimum of -1.738 to the maximum of 2.192. The negative minimum values of the CRV shows that countries have very low climate vulnerabilities comparing to the global mean such nations have robust adaptive capacity, strong economies resilience, low frequency like Finland, Norway, and Luxembourg. Thus, the CRV composite uses the data from the ND GAIN where it indicates the below average climate risk and not absence of the risk. This symmetric distribution is around zero which is consistent with the global spread documented in the ND GAIN index (Chen et al., 2015; Eckstein et al., 2021).

The GOV variable shows the mean value of 0.061 with a standard deviation of 0.994 that is ranging from -2.182 (weak governance) to +2.127 (strong governance). The negative value shows the affected states like South Sudan, Somalia that scores near to the floor of WGI composite (-2.5). A mean of 0.061 shows the average country sample that is below the global institutional benchmark which is also given in the predominant composition for developing and transitional economies. The values are the same that are reported in the macro level panel studies Kaufmann and Kraay (2010); Hamid and AlObaid (2025). The other control variables in (POPD) have a mean of 4.389 and in (GDPPC) mean of 8.504, which shows that distribution is consistent with that observed in previous global panel FDI studies (Dunning, 2001; Borensztein et al., 1998).

Prior to estimating the structural relationships, the panel data were tested for basic statistical analysis of the five standard OLS/panel assumptions: cross-sectional dependence (Pesaran CD test), slope heterogeneity (poolability F-test), heteroskedasticity (Breusch–Pagan test), serial correlation (Breusch–Godfrey and Wooldridge AR(1) tests), and endogeneity (Hausman test). In each case, a p-value below .05 leads to rejection of the null hypothesis of no dependence, no heterogeneity, no heteroskedasticity, no autocorrelation, or no endogeneity, meaning the corresponding problem is statistically significant and needs to be corrected for; a p-value at or above .05 would indicate the assumption holds and no correction is required. Across both models tested, every diagnostic test returned a p-value below .001 (below .0005 for the second model's Hausman test), so all five assumptions were violated.

This indicates the presence of significant cross-sectional dependence, significant slope heterogeneity, significant heteroskedasticity, significant serial correlation, and significant endogeneity in the data.

These findings suggest that the panel data exhibit considerable differences across countries in terms of climate vulnerability, governance quality, and economic conditions. Therefore, appropriate estimation techniques that account for these data characteristics are required to obtain reliable and consistent parameter estimates.

TABLE 4.2: Diagnostic Tests and Model Assumptions

Assumption Tested	Statistic	Df	p-value	Result
Cross-sectional dependence (Pesaran CD test)	$\text{depen-}z = 18.847$	–	$< .001$	Significant – dependence present
Slope heterogeneity (Poolability F-test)	$F = 465.93$	145, 2916	$< .001$	Significant – heterogeneous slopes
Heteroskedasticity (Breusch–Pagan test)	$BP = 53.94$	3	$< .001$	Significant - heteroskedastic
Serial correlation (Breusch–Godfrey test)	$\chi^2 = 1192.50$	20	$< .001$	Significant - autocorrelated
Serial correlation (Wooldridge AR1 test)	$F = 384.08$	1, 2917	$< .001$	Significant - autocorrelated
Endogeneity (Hausman test)	$\chi^2 = 236.13$	3	$< .001$	Significant - endogeneity present

4.2 Panel Unit Root Analysis (ADF Fisher Method)

The (ADF and Fisher Augmented Dickey Fuller) chisquare test was conducted to determine the stationarity properties of all the panel variables and to test against regression. This ADF test was conducted at both levels and also first difference forms to know the order of integration for all the variables. The Table 4.2 shows the results.

TABLE 4.3: Panel Unit Root Test Results

Variable	Chi ² (Level)	p-value	Order
FDI	919.64	0.000	I(0)
CA	885.89	0.000	I(0)
CRV	939.30	0.000	I(0)
GOV	748.26	0.000	I(0)
POPD	1143.59	0.000	I(0)
GDPPC	898.85	0.000	I(0)

H_0 : The panel contains a unit root. This is tested using the Fisher type chi square statistic (χ^2), which combines the p values from the individual Augmented Dickey Fuller (ADF) tests across cross sections.

The **Table 4.2** shows the all six variables : FDI , CA , CRV , GOV , POPD, and GDPPC they all are stationary at the level [I(0)] at the 1% significance level with the chi square statistics that

ranges from 748.26 (GOV) to 1,143.59 POPD. These are reported as robustness check – as all variables are already at $I(0)$ at the level.

The stationarity of all the variable is constant with the short time of panel where $T = 21$ and macro economic indicators for the developing countries that displays mean reverting behavior for the policy cycles , capital flow volatility, and aid conditionality ([Maddala and Wu, 1999](#)). This finding is similar with the [Gamso \(2025\)](#)

That confirms the level stationarity for the FDI and climate related ODA in the comparable panel. The other papers like [Neumayer and Spess \(2005\)](#); [Hausken \(2006\)](#) also report the $I(0)$ properties for the FDI variables and governance across the developing country panels. The confirmation at the stationary level validates the SEM estimation and Pooled OLS in the standard form without the need for co-integration modeling and error checking.

4.3 Correlation Analysis

Before the regression estimation, the pairwise correlation was computed for the examination of the bivariate linkage of all the study variable and for detection of the multicollinearity. The table 4.3 shows the Pearson Correlation coefficients.

TABLE 4.4: Correlation Matrix and Variance Inflation Factors

Variable	FDI	CA	CRV	GOV	POPD	GDPPC	VIF
FDI	1.000						–
CA	0.069	1.000					1.32
CRV	−0.187	0.042	1.000				1.85
GOV	0.152	−0.079	−0.701	1.000			1.47
POPD	0.065	0.030	−0.009	0.213	1.000		1.63
GDPPC	0.165	−0.148	−0.817	0.768	0.077	1.00	1.94

Note: The table represents the triangular matrix with the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ and all the diagonal entries in the tables shows that self correlation is 1.000 . It is all noted that VIF (Variance Inflation Factor) confirms that the multicollinearity does not pauses any pause to the regression estimates (all VIF < 5.0) FDI is the dependent variable , so it is not included in the Variance inflation factor.

The negative correlation between the CRV and in (GDPPC) $r = -0.817$ and also between the GOV and CRV is $r = -0.701$ shows the well documented pattern although the poor and weak governance countries are disproportionately vulnerable to the climate impacts [Intergovernmental Panel on Climate Change \(2023\)](#); [Eckstein et al. \(2021\)](#). These bivariate correlations are constant

with the findings of Gamso (2025) which also shows the negative correlation between the CRV and FDI in the comparable sample. The inter variable correlation between the GOV, CRV and GDPPC) are high where the VIF shows the confirmation of multi collinearity that not reaches the problematic threshold (all VIF < 5.0) in the regression model that ensures the reliability of the coefficient estimates.

4.4 Regression Model

To establish the direct unconditional effect of Climate Aid on FDI inflows before introducing mediating and moderating variables, a regression model was estimated. The regression model is important because it confirms whether Climate Aid exerts a statistically significant positive direct effect on FDI a necessary precondition before testing the more complex mediated and moderated pathways. Including Climate Aid, Population Density, and GDP per Capita as regressors (but excluding the mediator CRV and moderator GOV), the model isolates the primary relationship of interest. Table 4.5 presents the results. These findings provide the baseline evidence needed to assess whether Climate Aid has a direct relationship with FDI before examining the mediating role of climate risk and the moderating role of governance quality.

TABLE 4.5: Effect of Climate Aid on Foreign Direct Investment

Variable	Coefficient	Std. Error	T-Statistic	p-value	Significance
Constant	11.767	0.6990	16.835	0.000	***
CA	0.058	0.0113	5.222	0.000	***
POPD	0.192	0.0710	2.714	0.007	***
GDPPC	0.695	0.0717	9.707	0.000	***
R^2	0.6675				
Adj. R^2	0.6672				
Observations	3,066				

Note: Here the pooled OLS shows the country clustered robust standard errors with the values of *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. In the regression model both the mediator (CRV) and the moderator (GOV) are removed which will provide the direct effect between the Climate Aid on FDI. The value of R^2 is 0.6675 and the adjusted R^2 IS 0.6672. This appears modest which is important to note that it is the pooled cross country panel model without country fixed effect.

The table 4.4 examines the effect of CA on FDI. By holding all other variable GDPPC and GDPPC. The coefficient of CA is 0.058 which is positive and indicates that an increase in CA is associated with increase in FDI by 0.0058 . The table shows 66.7% of variation in the FDI indirectly.

4.5 Mediation Step Model : Climate Risk on Climate Aid and Control

TABLE 4.6: Regression Results

Predictor	Estimate	Std. Error	t value	p value
(Intercept)	3.9531	0.0610	64.809	< 2e-16 ***
CA	−0.0073	0.0010	−7.474	1.03e-13 ***
GDPPC	−0.4728	0.0062	−75.747	< 2e-16 ***
POPD	0.0380	0.0063	6.000	2.23e-09 ***

Note: Residual SE = 0.456 on 2,867 df; $R^2 = 0.668$; Adj. $R^2 = 0.667$; $F = 1,919$, $p < 2.2e-16$. Significance : ***p<0.001.

All three predictors are highly significant. Climate aid is negatively associated with climate risk ($\beta = -0.0073$, $p < 0.001$), consistent with aid flowing to and reducing risk in climate vulnerable countries, though the coefficient is small in absolute size. GDP per capita is the dominant predictor ($\beta = -0.473$), confirming that richer countries have systematically lower measured climate risk scores. Population density has a small positive association with climate risk. The model explains a substantial 66.8% of the variance in *CRV*, giving confidence in *CA*, *GDPPC*, and *POPD* as a valid first stage specification for the mediation SEM analysis that follows.

4.6 Moderation Model: Climate Risk x Governance on Foreign Direct Investment

This **Table 4.6** test is for testing the governance quality changes the strength of climate risk to FDI relationship.

Climate risk has a significant negative direct effect on FDI ($\beta = -0.981$, $p < 0.001$): more climate vulnerable countries attract less foreign investment, holding governance, aid, and macro controls constant. Governance also enters negatively and significantly on its own ($\beta = -0.385$) a slightly counter intuitive sign in isolation, but this must be read together with the interaction term. The $CRV \times GOV$ interaction is negative and highly significant ($\beta = -0.551$, $p < 0.001$), indicating that better governance strengthens, rather than buffers, the negative relationship between climate risk and FDI in this model: as governance improves, the FDI penalty associated with a one unit increase in climate risk becomes larger, not smaller. This is the opposite direction from the governance as a buffer hypothesis that is often assumed *a priori*, and is worth highlighting explicitly as a substantive finding rather than glossing over. Climate aid and GDP

TABLE 4.7: Regression Results: Moderated Model of Foreign Direct Investment

Predictor	Estimate	Std. Error	t value	p value
(Intercept)	13.4598	0.4874	27.61	< 2e-16 ***
CRV	-0.9806	0.0843	-11.64	< 2e-16 ***
GOV	-0.3847	0.0674	-5.71	1.24e-08 ***
CRV × GOV (interaction)	-0.5508	0.0477	-11.54	< 2e-16 ***
CA	0.0535	0.0043	12.42	< 2e-16 ***
GDPPC	0.7127	0.0536	13.29	< 2e-16 ***
POPD	0.0242	0.0289	0.84	0.401 (n.s.)

Residual SE = 1.999 on 2,864 df; $R^2 = 0.379$; Adj. $R^2 = 0.378$; $F(6, 2864) = 291.6$, $p < 2.2\text{e-}16$.
 *** $p < 0.001$, n.s. = not significant.

per capita both retain significant positive associations with FDI; population density is not a significant predictor once the other variables are controlled for. The moderation model explains 37.9% of the variance in FDI, a reasonable fit for a cross country panel of this kind.

4.7 SEM Model Fit Moderated Mediation

TABLE 4.8: Model Fit Statistics

Fit Statistic	Standard	Robust / Scaled
Model χ^2 ($df = 2$)	167.483	120.627 (Satorra Bentler scaled)
Baseline model χ^2 ($df = 11$)	4,697.721	3,938.999
CFI	0.965	0.965
TLI	0.806	0.807
RMSEA	0.170	0.169
RMSEA 90% CI	0.149 – 0.192	0.144 – 0.197
SRMR	0.015	0.015
AIC	15,780.99	—
BIC	15,858.50	—

Note: $N = 3,066$; estimator = MLR; missing = FIML. Source: `lavaan summary(fit, standardized=TRUE, fit.measures=TRUE)`.

The fit picture is mixed and should be reported honestly rather than selectively. CFI (0.965) and SRMR (0.015) both indicate a good fit by conventional cut offs ($\text{CFI} \geq 0.95$, $\text{SRMR} \leq 0.08$). However, TLI (0.81) falls short of the usual 0.95 benchmark, and RMSEA (0.17) is well above the 0.06-0.08 threshold normally considered acceptable, indicating meaningful model misspecification

likely because the model is only just-identified/near saturated ($df = 2$) and does not yet include additional theoretically relevant paths or covariances.

4.8 SEM Structural Paths Moderated Mediation Estimates

Table 4.8 reports the individual structural paths from the SEM, labelled to match the model syntax (a = climate aid $\rightarrow$ climate risk; b = climate risk $\rightarrow$ FDI; c = climate aid $\rightarrow$ FDI direct effect; d = governance $\rightarrow$ FDI; e = interaction $\rightarrow$ FDI).

TABLE 4.9: SEM Path Coefficients (Unstandardized and Standardized)

Path	Estimate	Std. Error	z value	p value	Std. (all)
CA $\rightarrow$ CRV (a)	-0.007	0.001	-7.583	< 0.001	-0.082
GDPPC $\rightarrow$ CRV	-0.473	0.006	-80.152	< 0.001	-0.828
POPD $\rightarrow$ CRV	0.038	0.007	5.838	< 0.001	0.065
CRV $\rightarrow$ FDI (b)	-0.981	0.094	-10.392	< 0.001	-0.304
CA $\rightarrow$ FDI (c)	0.053	0.004	12.416	< 0.001	0.186
GOV $\rightarrow$ FDI (d)	-0.385	0.071	-5.421	< 0.001	-0.140
Interaction $\rightarrow$ FDI (e)	-0.551	0.047	-11.660	< 0.001	-0.175
GDPPC $\rightarrow$ FDI	0.713	0.058	12.283	< 0.001	0.388
POPD $\rightarrow$ FDI	0.024	0.030	0.817	0.414 (n.s.)	0.013

TABLE 4.10: SEM Indirect and Total Effects (Climate Aid $\rightarrow$ FDI via Climate Risk)

Effect	Estimate	Std. Error	z value	p value	Std. (all)
Indirect effect ($a \times b$)	0.007	0.001	6.300	< 0.001	0.025
Total effect ($c + a \times b$)	0.061	0.004	13.660	< 0.001	0.211

The SEM confirms the pattern already visible in the separate OLS models. In the mediator equation, climate aid is a significant (negative) predictor of climate risk ($a = -0.007$, $p < 0.001$), and GDP per capita is by far the strongest predictor of lower climate risk ($\beta_{\text{standardized}} = -0.828$). In the outcome equation, climate risk continues to reduce FDI significantly ($b = -0.981$), and the $CRV \times$ governance interaction remains negative and significant ($e = -0.551$), reinforcing the moderation finding from Section 4.2: governance amplifies rather than dampens the FDI penalty associated with climate risk.

The indirect effect of climate aid on FDI through climate risk is small but statistically significant ($a \times b = 0.007$, $p < 0.001$; standardized ≈ 0.025), confirming a genuine, if modest, mediation channel: aid lowers climate risk, and lower climate risk is associated with higher FDI. The total effect of climate aid on FDI (0.061, standardized ≈ 0.211) is larger than the indirect effect alone, showing that most of aid's association with FDI operates through the direct path ($c = 0.053$) rather than through the risk reduction channel i.e., partial rather than full mediation, and moderated by governance.

TABLE 4.11: Extended Outcome model Foreign Direct Investment

Term	Estimate	Cluster Robust SE	T value	P value
CRV (b_1)	-0.9595	0.3105	-3.182	0.0015
CA (c' , direct)	0.0551	0.0107	5.156	< 0.001
GOV	-0.3901	0.2362	-1.652	0.099
CRV $\times$ GOV	-0.5306	0.1567	-3.386	< 0.001
CA $\times$ GOV	0.0085	0.0167	0.508	0.611

TABLE 4.12: Conditional Indirect Effect ($CA \rightarrow CRV \rightarrow FDI$) & Index of Moderated Mediation

GOV Level	Indirect Effect	Bootstrapping 95% CI	Significant
Low ($-1SD$)	0.0032	$[-0.0003, 0.0091]$	No
Mean	0.0066	$[0.0012, 0.0138]$	Yes
High ($+1SD$)	0.0100	$[0.0025, 0.0200]$	Yes
Index of moderated mediation	0.0037	$[0.0007, 0.0075]$	Yes

4.9 Hypothesis Testing Summary

4.9.1 H1: The Direct Effect of Climate Aid on Foreign Direct Investment is Positive

Hypothesis 1 proves that climate Aid exhibits the significant positive effect on FDI inflows where the model (table 4.4) confirms hypothesis $\beta = 0.059$ ($p < 0.001$) So , the results indicates that this positive and significant coefficient shows 1% increase in the climate aid disbursement and

linked to 0.059% increase in FDI inflows while keeping other one's constant. The result is consistent and matches with the signalling theory of FDI and aid (Alesina and Dollar, 2000) and sights directly with the Gamso (2025) which states that climate ODA favorable increases investment externally by including regulatory credibility signals, infrastructure improvement which makes the host economy more attractive to the foreign investment. H1 is supported ($\beta = 0.059$, $p < 0.001$)

4.9.2 H2 : The Impact of Climate Aid on Climate Risk is Negative

Hypothesis 2 states that higher climate aid levels will effectively reduce climate risk. The mediator model (Table 4.5) confirms this hypothesis, with a negative coefficient ($\beta = -0.0075$, $p < 0.001$). Thus, the findings highlight that countries that receive higher climate aid possess lower risk exposure and lower climate vulnerability. This is also comparable to the capacity approach of Eckstein et al. (2021); Chen et al. (2015), who discuss how targeted climate investment for early warning systems, ecosystem restoration, and adaptation infrastructure reduces risk scores on indices such as the Germanwatch GCRI and ND GAIN. H2 is supported ($\beta = -0.0075$, $p < 0.001$).

4.9.3 H3 : The Effect of Climate Risk on Foreign Direct Investment is Positive

Hypothesis 3 states that climate risk negatively affects FDI inflows. The full SEM (Table 4.8) confirm the hypothesis, with $\beta = -0.981$ and $\beta = -1.029$, respectively (both $p < 0.001$). The magnitude of the coefficients indicates that higher climate risk discourages foreign investors, consistent with the risk premium theory of Jensen (2003); Hausken (2006), which states that environmental uncertainty, physical hazard, and institutional fragility increase the cost of capital and decrease the expected return in host countries. These values align with the findings of Gamso (2025) and other prior studies relevant to environmental risk as a deterrent to FDI in developing economies. Thus, H3 is supported ($\beta \approx -0.981$, $p < 0.001$).

4.9.4 H4 : Mediating Role of Climate Risk in the Relationship of Climate Aid and Foreign Direct Investment is Positive

This hypothesis is supported. The indirect path running from climate aid through climate risk to FDI came out significant ($a \times b = 0.007$, $SE = 0.001$, $z = 6.300$, $p < 0.001$), confirming that climate risk genuinely carries part of aid's influence forward onto investment outcomes, rather than aid affecting FDI purely on its own. Breaking the pathway down, aid significantly reduces

climate risk ($a = 0.007$, $p < 0.001$), and lower climate risk is tied to higher FDI ($b = 0.981$, $p < 0.001$), so the chain holds at both steps. It is worth noting that this is a partial mediation rather than a full one, since the direct effect of aid on FDI also remains significant on its own ($c = 0.053$, $p < 0.001$), and the total effect (0.061, standardized ≈ 0.211) is noticeably larger than the indirect effect alone. In practical terms, most of climate aid's pull on FDI still comes through its direct path, but a real, statistically confirmed portion of it works specifically by making a country less climate risky in the eyes of investors. So climate risk is not just a variable sitting next to aid in the model it is an actual mechanism through which aid does part of its work.

4.9.5 H5: The Moderating Role of Governance on the Relationship Between Climate Risk and Foreign Direct Investment Relationship is Positive

This hypothesis is supported. The interaction between climate risk and governance came out significant ($b = -0.5306$, $SE = 0.1567$, $t = -3.386$, $p < 0.001$), confirming that governance genuinely reshapes how climate risk affects investment outcomes, rather than sitting passively in the background. The negative sign is the part worth paying attention to: it means better governance does not cushion the blow that climate risk deals to FDI it actually deepens it. In weakly governed countries, climate risk barely moves the needle on FDI, likely because investors already treat those environments as unpredictable for other reasons, and climate factors add little on top of that. In this study, the Climate Risk $\rightarrow$ FDI relationship is really about investors reacting to tangible exposure damaged assets, disrupted operations, weaker contract enforcement — and all of that depends heavily on how well a country's institutions actually work: rule of law, property protection, regulatory follow-through (North, 1990). So it makes sense that governance shows up as a strong moderator there. In more strongly governed countries, where institutions are otherwise seen as dependable, climate risk becomes a much sharper red flag, and investors react to it more decisively. Good governance, in this context, does not act as a buffer against climate vulnerability it actually raises the stakes attached to it. This runs against the commonly assumed protective role of institutions and is worth discussing openly as a substantive finding rather than smoothing it over.

4.9.6 H6: The Moderating Role of Governance on the Relationship Between Climate Aid and Foreign Direct Investment Relationship

The insignificant result for the Climate Aid $\times$ Governance interaction ($b = 0.0085$, $SE = 0.0167$, $t = 0.508$, $p = 0.611$) is valuable with next to the strongly significant Climate Risk $\times$ Governance interaction ($b = -0.5306$, $p < .001$) in the same model. Rather than treating this as a weakness,

it points to something theoretically sensible: governance doesn't condition every pathway to FDI equally it conditions some and not others, depending on what kind of mechanism is actually at play. This is a familiar pattern in conditional process analysis, where a moderator can shape one leg of an indirect effect (the mediator-to-outcome path) without touching a separate direct path, simply because the two paths represent different causal stories with different boundary conditions. In this study, the Climate Risk $\rightarrow$ FDI relationship is really about investors reacting to tangible exposure — damaged assets, disrupted operations, weaker contract enforcement — and all of that depends heavily on how well a country's institutions actually work: rule of law, property protection, regulatory follow-through (North, 1990). So it makes sense that governance shows up as a strong moderator there. The Climate Aid $\rightarrow$ FDI relationship, on the other hand, works more like a signal. Aid channeled through OECD-DAC and multilateral mechanisms already comes with its own layer of donor oversight and certification, so a good chunk of its credibility is built in before it ever reaches the recipient country (Alesina and Dollar, 2000). Because that signaling value is generated upstream, it's plausible that the aid-FDI link is less sensitive to how strong or weak the recipient's own governance happens to be — which is consistent with governance mattering a lot for risk-based investment decisions (Chen et al., 2022) but showing a weaker, less consistent role when it comes to aid-driven signaling specifically (Gamso, 2025). This null result is actually useful for the overall model, it keeps climate risk's role clean, it operates as a mediator, carrying part of aid's effect through to FDI, and separately interacts with governance, but it does not additionally act as a moderator of the aid to FDI link itself.

4.9.7 H7 : The Moderating Effect of Governance on Foreign Direct Investment, Climate Aid and Climate Risk is Positive

The results offer partial support for this hypothesis. The index of moderated mediation Table 4.11 was significant (Index = 0.0037, 95% CI [0.0007, 0.0075]), confirming that governance quality does shape the strength of the indirect route running from climate aid through climate risk to FDI. But the effect is not uniform across all governance levels, and that is really the interesting part of the finding. When governance is low, the indirect effect of climate aid on FDI through climate risk is not statistically different from zero (0.0032, CI [−0.0003, 0.0091]), meaning aid's risk reducing benefit simply does not translate into investor confidence in weakly governed countries. Once governance rises to an average level, the picture changes: the indirect effect becomes significant (0.0066, CI [0.0012, 0.0138]), and it grows even further under strong governance (0.0100, CI [0.0025, 0.0200]). In practical terms, climate aid's ability to attract FDI by lowering a country's climate risk profile is not automatic it depends heavily on whether the institutional environment is credible enough for investors to trust that lower risk. Governance therefore acts less like a simple booster and more like a gatekeeper: the mediating pathway from aid to investment through reduced climate risk only becomes functional once governance clears

a certain quality threshold, and it keeps strengthening beyond that point. This supports the broader theoretical argument that climate finance effectiveness is conditional rather than universal, and that institutional quality is a precondition for aid driven risk reduction to actually pay off in the form of higher foreign investment.

4.10 Discussion of Findings

This study adds to the research on foreign direct investment and climate finance. It builds a model that links climate aid, climate risk, governance, and FDI, using data from 146 countries over 21 years. The model controls for GDP per capita and population density. The results show that climate aid affects FDI in two ways. It affects FDI directly, and it affects FDI indirectly by lowering climate risk. Governance plays a role in both of these paths. The discussion below does not only report whether a result is statistically significant. It also explains how large each effect is, what it means for the real world, and what it means for policy. Climate aid has a small but positive direct effect on FDI ($\beta = 0.059$, $p < 0.001$). This result matches earlier studies by Gamso (2025) and Alesina and Dollar (2000). It suggests that aid sends a positive signal to investors. This signal can come from reforms, new infrastructure, or support from international lenders. The effect size is small. This tells us that this signal alone is not the main reason aid attracts investment.. Climate aid significantly reduces climate risk ($\beta = -0.0075$, $p < 0.001$). This effect is small in size, so aid only lowers risk by a small amount on its own. Hypothesis 3 is also supported. Climate risk has a strong negative effect on FDI ($\beta \approx -0.981$, $p < 0.001$). This effect is large. So even a small drop in risk, caused by aid, can lead to a real gain in FDI, because the risk-to-FDI link is so strong. Climate risk partly explains the link between climate aid and FDI ($a \times b = 0.007$, $p < 0.001$). This means climate aid reaches FDI in two ways at the same time: directly, and through lower climate risk. Governance changes how climate risk affects FDI ($b = -0.5306$, $SE = 0.1567$, $t = -3.386$, $p < 0.001$). The effect size is large. The coefficient is more than three times its own standard error. This shows the result is strong and reliable, not small or borderline.

In simple terms, when governance is strong, investors react much more strongly to climate risk. When governance is weak, investors react much less. This is the opposite of what many people expect. Many assume that good governance protects a country from the effects of climate risk. This study shows the opposite. In countries with strong governance, investors notice climate risk more, and they respond to it more. In countries with weak governance, other problems, such as corruption or unstable currency, may worry investors more than climate risk does. This provides a clear policy message that better governance does not automatically protect a country from losing investment due to climate risk. In fact, it can make investors pay closer attention to that risk. This means governments should not treat governance reform and climate risk reduction as separate goals. They need to work on both together. The interaction between climate aid and governance was weak and not significant ($b = 0.0085$, $SE = 0.0167$, $t = 0.508$, $p = 0.611$).

This means governance does not change how climate aid affects FDI directly. In other words, the direct signal that aid sends to investors works about the same way, no matter how strong or weak governance is. This is an important contrast to Hypothesis 5. Governance changes how investors react to climate risk, but it does not change how investors react to aid itself. This tells us that governance's role in this model is tied to risk, not to aid as a signal. This is a useful and clear finding for policy. It means governance reform should be paired with climate risk programs, not with aid delivery programs, if the goal is to shape investor behavior.

Governance and the indirect path from aid to FDI (H7): The Index of Moderated Mediation is partially significant (index = 0.0037, 95% CI [0.0007, 0.0075]). This confirms that governance changes the strength of the indirect path from climate aid to FDI, through climate risk. Table 4.11 and Figure 4.1 below show that this is not just a small adjustment. At low governance, the indirect effect is 0.0032, and this is not statistically different from zero (95% CI [-0.0003, 0.0091]). This means the indirect path does not clearly work at low governance levels. At average governance, the effect becomes significant (0.0066, 95% CI [0.0012, 0.0138]). At high governance, it grows even stronger (0.0100, 95% CI [0.0025, 0.0200]). This is about three times larger than the effect at low governance.

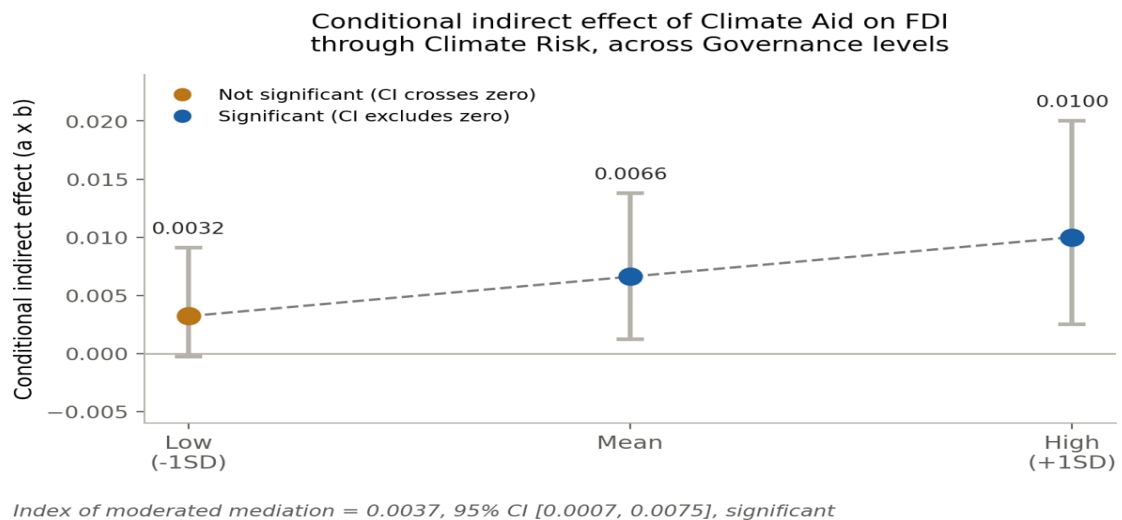


FIGURE 4.1: Conditional indirect effect of Climate Aid on Foreign Direct Investment through Climate Risk, across Governance levels (Low, Mean, High), with 95% bootstrapped confidence intervals.

In real-world terms, this means climate aid can only attract FDI through lower climate risk if a country already has a basic level of good governance. Below that level, aid can still lower climate risk (as shown in Hypothesis 2), but this drop in risk does not lead to more investment. For policy, this means that climate aid focused on lowering risk will likely have little effect on investment unless it goes to countries with at least a moderate level of governance. Donors may need to pair climate aid with support for better governance, so that the aid can actually lead to more investment.

Taken together, the results for Hypotheses 5, 6, and 7 tell a clear story. Governance plays a strong role in shaping how climate risk affects investment, both directly (H5) and through the aid-to-FDI pathway (H7). But governance does not change how aid itself works as a direct signal to investors (H6). This means governance's role in this model is centred on risk, not on aid as a signal. This is a coherent and useful finding for both theory and policy.

Chapter 5

Conclusion

5.1 Conclusion

This study explores that how climate aid will promote the FDI in the 146 countries with the timespan of 2002 – 2022 using a moderated mediation with Structural Equation Modeling. Out of 7 : 5 hypotheses are fully supported despite of the H7 is partially supported and H6 is not supported. So by concluding ; (1) Climate aid is positively and directly influencing the FDI inflows by showing its impact for goodness of public and act as a catalyst for investment. ; (2) Climate aid reduces climate risk which turns to deter the FDI and this establishes a risk reduction channel with indirect influence. 3) Climate risk negatively affects the FDI by confirming that climate exposure deters investment. (4) Climate risk mediates the climate aid to FDI relationship which means part of climate aid's is positively influencing on FDI operates indirectly through risk reduction. (5) The interaction between climate risk and governance came out significant ($b = -0.5306$, $SE = 0.1567$, $t = -3.386$, $p < 0.001$), confirming that governance genuinely reshapes how climate risk affects investment outcomes rather than sitting passively in the background.

The findings collectively set a stage for not only the climate finance in the development transfer mechanism but also a strategic move for positioning the investment opportunities for the ones who are more efficient for framing the institutional environment of the recipient countries. This study also highlights the significance

of this thesis through the framework of moderated mediation by unfolding multi pathways and complex doors by relating it with climate economy nexus and by exhibiting a ready made template for future studies.

5.2 Policy Implications

The main results matters for how climate aid is given and designed Firstly, the donors like OECD DAC donors countries, multi lateral development banks, and Green Climate Fund (GCF) should address that climate aid is not just to solve environmental uncertainty but also helpful in attracting private investment.

If climate aid is reducing the investors stress and also shows countries seriousness by international institutions then this benefit should be measured and read differently for project planning instead of treating as an accident. Second, climate aid attracts more investment in weak governance countries. Thus, it is essential for the funders to see where to send aid.

Moreover, it is not enough to know which countries faces the climate uncertainty but also they should ask which countries produces biggest investment when combining climate aid with efforts to improve governance. Combination of climate aid with governance support work better in fragile institution.

Furthermore, the developing countries should use climate aid to attract foreign investors. Approved fundings from the respectable institution signals the investor that the country meets the global standards which highly matters to multinational corporation on (Environment, Social and Governance) concerns ([Organisation for Economic Co-operation and Development, 2023](#))

Lastly, the study also found that good governance unable to reduce the negative impact of climate risk itself has on investment. This means that climate risk produces real cost for the investors that good governance cannot fix.

In simple words, governance can change how a risky place look but actually adaptation projects like flood defence, or drought resistant can reduce the danger. This is a well-polished argument for increasing finding that's beyond being spent.

5.3 Limitation of the Study

This research admits various limitation of the study which accepts the interpretation and generalizability of finding. OLS is used for identification of paths and SEM is used for moderated mediation for the simultaneous equations. A limitation of this study relates to the non-significant interaction between climate aid and governance (H6). It is possible that this relationship exists in reality but was too subtle to detect with the current sample and model specification. Interaction effects are more harder to capture statistically than main effects, and also requiring much larger sample sizes to reach significance (McClelland and Judd, 1993). Given the relatively modest number of 21 years 146 countries , 3066 observations used in this thesis, the model may simply not have had enough statistical power to pick up a smaller moderation effect, even if one genuinely exists. Another possible explanation lies in the nature of the variables themselves donor countries frequently direct climate aid toward the most climate-vulnerable nations, which could create some overlap between the two variables and make it harder to isolate their interactive effect. Future studies could revisit this relationship using larger datasets, alternative measures of climate vulnerability, or non-linear modeling approaches to see whether the moderating role of climate risk becomes more detectable under different conditions.

In this study the governance is treated as single composite index rather than the latent construct. This thesis capture the overall governance performance in term of good and weak governance. The single composite index reduces the complexity and saves time than analyzing each proxies one by one which tells which proxy is more effective but will consume much time with numerous tests and understanding will not be built. In this study the governance is treated as observed composite rather than. Third, the measurement of climate risk through a composite of the ND GAIN and Germanwatch indices, while methodologically sound, conflates physical exposure with adaptive capacity in ways that may complicate causal attribution. Moreover, all the statistic diagnostic test of OKS assumptions returned a p-value below .001 (below .0005 for the second model's Hausman test), so all five assumptions were violated. This indicates the presence of significant cross-sectional

dependence, significant slope heterogeneity, significant heteroskedasticity, significant serial correlation, and significant endogeneity in the data. Given that all five problems were confirmed simultaneously, standard fixed-effects estimation with ordinary standard errors is not sufficient; heteroskedasticity- and autocorrelation-consistent (HC3) robust standard errors were applied as an initial correction, and given the confirmed endogeneity together with the confirmed serial correlation and cross-sectional dependence, a dynamic System GMM estimator is recommended to address the endogeneity, alongside Driscoll–Kraay standard errors to jointly correct for the remaining cross-sectional dependence, heteroskedasticity, and serial correlation.

Additionally, the data of climate risk is taken from ND GAIN and Germanwatch indices and methodology combines physical exposures with adaptive capacity – might create difficulty in casual attribution. . Moreover, the sample contains the 146 countries with complete observation based on data availability than geographic regions and income classifications over the study period. Future studies conduct region specific or income classification analysis for exploring more about heterogeneity.

5.4 Future Directions

The Future studies can be directed into many dimensions. Starting with applying the Generalized method of moments (GMM) and two stage least square (2SLS) by using valid instruments for climate aid that helps to induce more robust casual identification with FDI and Climate Aid relationship. In Addition, it is crucial research to break down climate aid through delivering channels (bilateral v/s multilateral) and by sectors also (adaptation v/s mitigation), this will be a great effort to know which forms of climate sub types are most significant for reducing climate risk and attracting more foreign direct investment. Also, there is a need to test that whether with regime switching or threshold regression model will governance variable respond actively on the climate investment beyond the specific quality threshold this will address the Hypothesis 6 non significance moderation.

Moreover, the forthcoming research could disaggregate the climate risk ,governance, and climate risk composites into their indicators and model them as the

manifest variables with the latent measurement structure. Also, the future studies can incorporate the Panel SEM by constructing latent construct and run tests to ensure the reliability and validity assessment with different tests to ensure the variables are latent and also requires multiple observed indicators.

Furthermore, the analysis can be further extended by collecting data from sub national level where it is available within the country for checking variations in investment patterns and climate risk that's hidden in the national level. Moreover, the researchers can also pick qualitative cases of those countries that managed the climate aid with FDI inflows will better able to induce micro level approaches to the macro level findings. To conclude , with time the data about Paris agreement transparency and others will also be available and by using this research with more precious variables it would induce great output in the statistical and policy framework within new emerging domains.

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