
Essays in sustainable finance and international investment

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Abstract

This thesis investigates the relationship between foreign direct investment (FDI), climate finance, and environmental, social, and governance (ESG) performance across developing and developed economies. It examines how sustainability considerations, through public climate finance and private ESG commitments, influence the scale, composition, and geography of global capital flows. The research is driven by the need to understand how both international financial mechanisms and firm-level sustainability strategies influence the transition towards a low-carbon and resilient global economy.

Chapter 2 analyses whether climate finance, disaggregated into adaptation and mitigation categories, influences aggregate FDI inflows into emerging markets and developing economies (EMDEs). Using cross-country panel data for 2000–2020, the study finds that adaptation finance exerts significant positive effects on FDI, suggesting that resilience-building and infrastructure enhancement reduce perceived risks and improve host-country attractiveness. Mitigation finance, primarily aimed at reducing greenhouse gas emissions, shows no significant effect at this level.

Chapter 3 explores sectoral and firm-level dynamics by examining whether adaptation and mitigation finance promote greenfield investment in environmental-technology sectors. Drawing on data from 1,931 multinational firms investing across 110 countries between 2003 and 2021, the results indicate that mitigation finance, with the objective of reducing greenhouse gas emissions, significantly stimulates green investment. Adaptation finance, however, shows little direct influence on such projects. These findings reveal that while adaptation finance enhances stability and attract FDI at the macro level, mitigation plays a catalytic role at the project level by mobilising private investment in green technologies.

Chapter 4 focuses on assessing whether firm-level ESG performance influences outward greenfield FDI from North America. Using a panel of 7,145 firm–country pairs covering 2003–2023, the study finds that firms with stronger ESG performance invest more abroad, particularly when financially unconstrained. Collectively, the findings demonstrate that climate finance and ESG performance are central to the evolving geography of global investment, linking sustainability commitments to international capital mobilisation. Chapter 5 synthesises these findings, discusses their implications, and outlines directions for future research.

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Declaration

I hereby declare that this thesis, entitled *Essays in Sustainable Finance and International Investment*, is entirely my own work and has not been submitted, in whole or in part, for any degree or other qualification at this or any other university or institution.

Where the work of others has been used or cited, it has been duly acknowledged and referenced.

This thesis is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (PhD) in Finance at Essex Business School, University of Essex.

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1 Introduction

1.1 Background and motivation

Climate change has become one of the defining global challenges of the twenty-first century (Stavins 2011). Its impacts are wide-ranging and increasingly severe, including rising temperatures, more frequent natural disasters, and persistent disruptions to economic systems (Huang et al. 2018; Kumar et al. 2021; CRED 2022; Gu and Hale 2023). These effects threaten economic growth, development, and social stability (Kumar 2021; Zhou et al. 2023), with emerging markets and developing economies (EMDEs) facing particularly high levels of vulnerability (Zhao et al. 2022). Limited adaptive capacity, dependence on climate-sensitive sectors, and institutional constraints expose these economies disproportionately to climate-related shocks. Addressing these challenges requires the large-scale mobilisation of both public and private financial resources to support climate adaptation and mitigation efforts (Songwe et al. 2022; Zhao et al. 2022; Leal et al. 2023). Climate finance refers to local, national, and international financial resources mobilised from public, private, and alternative sources to support climate change mitigation and adaptation efforts. It includes investments undertaken by governments, corporations, and households to facilitate the transition of the global economy towards a low-carbon pathway, reduce greenhouse gas emissions, and strengthen resilience to the impacts of climate change (Hong et al. 2020). Mitigation finance supports initiatives aimed at lowering greenhouse gas emissions through investments in renewable energy, clean technologies, and energy efficiency. In contrast, adaptation finance focuses on enhancing resilience to climate-related risks by supporting infrastructure development, disaster preparedness, and the establishment of climate-resilient systems (Pauw et al. 2022; Hong et al. 2020).

As part of global climate action, the international community has pledged substantial transfers of climate finance from developed to developing countries. The Paris Agreement formalised the commitment of advanced economies to mobilise USD 100 billion annually to support adaptation, mitigation, and resilience-building in EMDEs (Carfora and Scandurra 2019; Songwe et al. 2022). However, this target has yet to be achieved (Tyson and Weiss 2025). Climate finance has since become a central component of the global climate regime, reinforced through the successive United Nations Framework Convention on Climate Change (UNFCCC) and related international initiatives. Despite these commitments, actual flows remain well below estimated needs, with projections suggesting that trillions of dollars will be required annually by 2030 to limit global warming to well below 2°C (Tyson and Weiss 2025).

Foreign direct investment (FDI) represents another critical channel of economic development. Beyond providing capital, FDI facilitates the transfer of knowledge, technology, and managerial expertise, integrates host economies into global production networks, and supports industrial upgrading (Doytch and Uctum 2011; Garriga and Phillips 2014). This role is particularly important in EMDEs, where domestic savings and public resources are often constrained. However, FDI is inherently sensitive to risk, and a growing body of evidence indicates that climate-related risks can discourage foreign investment (Gu and Hale 2023; Shear et al. 2023). Extreme weather events, supply-chain disruptions, and climate-related policy uncertainty increase perceived investment risk and can reduce capital inflows (Gopalan et al. 2023; Pankratz and Schiller 2024).

At the same time, sustainability considerations are increasingly reshaping investment behaviour, particularly in advanced economies. Environmental, social, and governance (ESG) performance has evolved from a reputational concern into a strategic factor influencing competitiveness, access to finance, and international expansion (Khurram et al. 2024; Wang et al. 2024). Firms with stronger ESG performance often benefit from lower financing costs, enhanced credibility, and greater stakeholder trust (Asimakopoulos et al. 2023; Khurram et al. 2024). Outward greenfield FDI, which involves establishing new operations abroad, is especially relevant in this context because it is capital-intensive and long-term in nature. This makes it a suitable setting for examining how sustainability considerations influence firms' international investment strategies. Taken together, these developments raise an important question: can public climate finance and private ESG performance jointly shape the scale, direction, and composition of global FDI by influencing risk perceptions, financial capacity, and sustainability commitments?

1.2 Research gap and questions

Despite growing scholarly interest in climate change and investment, the relationship between climate finance and FDI remains underexplored. Much of the existing literature treats these domains separately. Research on FDI typically focuses on determinants such as climate risks, market size, cost of capital, trade openness, and institutional quality (Demena and Afesorgbor 2020; Drabo 2021; King et al. 2021; Gopalan et al. 2023; Gu and Hale 2023; Shear et al. 2023). Similarly, studies on climate finance largely examine allocation patterns, governance issues, and environmental outcomes (Cichocka and Mitchell 2022; Islam 2022; Lee et al. 2022; Leal et al. 2023). Yet climate finance may also influence cross-border investment by improving infrastructure, enhancing resilience, and signalling host-country commitment to managing climate vulnerability. If climate finance fails to mobilise private capital, its broader developmental impact may remain limited (Cichocka and Mitchell 2022; Songwe et al. 2022).

Recent evidence suggests that climate-related aid can moderate the deterrent effects of climate related risk on FDI by signalling a country's fiscal and institutional capacity to address adaptation costs (Gamso 2025). This implies that climate finance may operate not only as a source of funding but also as a signal that reduces perceived investment risk. However, most existing studies rely on aggregate measures of climate finance, which may obscure important differences between adaptation and mitigation finance. Distinguishing between these categories is therefore essential for understanding how different forms of climate finance affect investment decisions, because adaptation and mitigation finance pursue different objectives and operate through distinct economic channels, with potentially different implications for private investors.

Beyond the volume of FDI, its composition also matters. Greenfield investment in environmental technologies, renewable energy, energy efficiency, and sustainable infrastructure plays a central role in aligning economic development with climate objectives. Assessing whether climate finance stimulates such investment provides a more targeted measure of its effectiveness. At the same time, in developed economies, firm-level ESG performance increasingly shapes internationalisation strategies (Wang et al. 2024). ESG has become a strategic determinant of competitiveness, access to finance, and long-term growth (Krueger et al. 2020; Khurram et al. 2024; Yuan et al. 2025). Understanding how ESG influences outward greenfield FDI, therefore, contributes to a more comprehensive account of sustainability's role in global investment behaviour.

1.3 Overview of studies

This thesis is grounded in the broader literature linking sustainability-related mechanisms to international investment decisions. It argues that both public sustainability finance and private sustainability commitments influence FDI through several interconnected channels, including risk reduction, signalling effects, financial capacity, institutional credibility, and market creation. At country level, climate finance may reduce investors' exposure to climate-related risks by strengthening infrastructure, resilience, and policy credibility. At the firm level, ESG performance may influence outward investment by improving access to finance, reducing reputational risks, and strengthening firms' competitive positioning in international markets. Although the three empirical chapters examine different dimensions of investment, they are connected through a common conceptual argument: sustainability-related mechanisms increasingly shape the allocation and direction of global capital flows.

Chapter 2 focuses on emerging markets and developing economies as the primary recipients of climate finance and investigates how climate finance, disaggregated into adaptation and mitigation objectives, influences aggregate FDI inflows. Using a country-level panel, the chapter provides a macroeconomic perspective on how public climate finance can influence private capital flows by shaping host-country conditions and investor perceptions. Chapter 3 shifts the analysis to the sectoral and firm levels and examines whether adaptation and mitigation climate finance stimulate greenfield investment in environmental-technology sectors. By focusing on project-level investment in low-carbon and environmentally oriented activities, this chapter offers a more granular assessment of how climate finance translates into concrete investment outcomes within specific sectors. Chapter 4 moves to firm-level analysis in advanced economies and examines whether the ESG performance of North American firms influences their outward greenfield FDI across global destinations. This chapter explores the financial and strategic mechanisms through which ESG performance affects international expansion, with particular attention to firms' internal financial capacity and constraints.

Collectively, the three empirical chapters develop a unified sustainability–investment framework in which public climate finance and private sustainability commitments influence investment through interconnected mechanisms operating at different levels. At the macro level, climate finance shapes investment conditions and risk perceptions; at the sectoral level, it influences the allocation of capital towards environmentally oriented activities; and at the firm level, ESG performance affects international expansion through financial and strategic channels. Chapter 2 highlights the role of adaptation climate finance in improving the overall investment environment by reducing risk and enhancing resilience. Chapter 3 shows how

mitigation finance supports investment in environmentally oriented, technology-intensive projects. Chapter 4 demonstrates how firm-level ESG performance shapes outward investment decisions and complements public sustainability efforts. This structure reflects the multi-level approach adopted by Gu and Hale (2023), combining country-level and firm-level perspectives to capture both macroeconomic and microeconomic dimensions of climate-related investment.

Endogeneity concerns differ across the three empirical settings, and the thesis adopts identification strategies that are tailored to the structure of each dataset and the nature of the baseline specifications. In Chapter 2, investment decisions exhibit persistence over time at the country level, and current FDI is plausibly related to past inflows. A dynamic panel framework is therefore appropriate, and the chapter complements fixed effects estimates with a dynamic Generalised Method of Moments (GMM) approach to address reverse causality and unobserved heterogeneity using internal instruments.

Chapter 3 relies on a high-dimensional fixed-effects specification that absorbs firm effects, destination-country effects, sector effects, year effects, and firm-by-year effects. The inclusion of firm-by-year fixed effects is central to the baseline model because it controls for unobserved firm-level shocks that vary over time and affect all destinations simultaneously. Although the underlying sources of endogeneity are conceptually similar to those in Chapter 2, applying a standard dynamic-panel GMM estimator in this setting is not appropriate. Conventional Arellano–Bond or system GMM frameworks are designed for panels with a single unit-specific effect, such as country or firm fixed effects, and can accommodate time effects. However, they are not suited to specifications that require multi-way fixed effects and interaction fixed effects, such as firm-by-year effects. Implementing dynamic GMM would therefore require imposing strong restrictions on the fixed-effects structure or substantially altering the baseline specification. Following the firm-level empirical literature, Chapter 3 instead estimates a static structural equation using instrumental-variables Generalised Method of Moments (IV-GMM). This approach preserves the high-dimensional fixed-effects structure of the baseline model while addressing endogeneity through internal lagged instruments for the relevant regressors. Put differently, the choice of estimator is driven by the need to maintain the chapter’s identifying fixed-effects structure, which dynamic-panel GMM estimators cannot accommodate in this context.

Chapter 4 focuses on firm-level ESG performance and outward FDI and uses an instrumental-variables approach estimated by two-stage least squares (2SLS). In this setting, valid external instruments for ESG performance are available, allowing the identification of exogenous variation in ESG while maintaining the fixed-effects framework. Consequently, the

choice of empirical strategy reflects the nature of the data, the feasibility of implementing the baseline fixed effects, and the availability of valid instruments in each chapter, rather than a reliance on a single estimation technique. This approach allows each empirical setting to be analysed using the most appropriate identification strategy.

1.4 Findings and contributions

In general, this thesis provides additional evidence on how sustainability considerations shape international investment at the macroeconomic, sectoral, and firm levels. By combining country-level, sectoral, and firm-level analyses, it offers a multi-layered account of how public climate finance and private ESG performance influence FDI through distinct yet interconnected channels. Beyond the individual findings of each chapter, the thesis contributes by demonstrating that sustainability-related mechanisms affect international investment differently across levels of aggregation.

Chapter 2 shows that adaptation climate finance is positively associated with aggregate FDI inflows to emerging markets and developing economies. This finding is consistent with the role of adaptation finance in enhancing resilience, supporting infrastructure development, and signalling a host country's capacity to manage climate-related risks. In contrast, mitigation finance does not exhibit a statistically significant effect on aggregate FDI inflows. These results are consistent with the signalling hypothesis advanced by Gamso (2025), according to which climate-related financial support can reassure foreign investors even when underlying climate vulnerabilities persist. The analysis further shows that climate related condition the relationship between climate finance and FDI inflows, with adaptation finance exhibiting a weaker association with FDI in more climate-vulnerable countries, while no comparable conditioning effect is observed for mitigation finance. In addition, the analysis finds no evidence that the relationship between climate finance and FDI inflows changed following the adoption of the Paris Agreement, suggesting that the climate finance and FDI nexus at the country level remained broadly stable in the post-Paris period.

Chapter 3 shifts the focus to sectoral and firm-level investment and finds that mitigation climate finance significantly promotes greenfield investment in environmental-technology sectors, while adaptation finance does not have a direct effect at the project level. This pattern complements the aggregate findings from Chapter 2 and highlights the differentiated roles of climate finance objectives. Viewed collectively, the results suggest that adaptation and mitigation finance influence investment through complementary mechanisms. Adaptation

finance operates primarily by improving the general investment environment through resilience-building and risk reduction, thereby supporting broader capital inflows across sectors. Mitigation finance, by contrast, channels investment more directly into commercially viable, technology-intensive projects where revenue prospects and policy alignment are clearer. This distinction helps explain why mitigation finance matters more at the project level, while adaptation finance is more influential at the aggregate level.

Chapter 4 extends the analysis to firm-level sustainability in advanced economies and shows that stronger ESG performance among North American firms is associated with greater outward greenfield FDI, particularly among firms facing fewer financial constraints. Internal financial strength amplifies this relationship, whereas high research and development intensity reduces the marginal effect of ESG, indicating a trade-off between innovation and sustainability when resources are limited. These findings demonstrate that ESG performance functions as a strategic firm-level attribute that shapes international expansion decisions by affecting financial capacity, risk perception, and investment readiness. Collectively, the findings show that sustainability considerations influence international investment through multiple, interconnected pathways. Public climate finance affects investment primarily by shaping host country conditions and sectoral opportunities, while private ESG performance influences firm-level investment decisions and outward expansion strategies. The interaction of these mechanisms underscores the importance of analysing sustainability and investment at multiple levels of aggregation.

This thesis makes three main contributions. First, it extends the study of the determinants of FDI by incorporating sustainability-related factors, specifically climate finance and ESG performance, into analyses of both inward and outward investment. Second, it adds to the existing empirical evidence on the different roles of climate finance objectives, showing that adaptation climate finance supports aggregate FDI by improving investment conditions, while mitigation finance stimulates greenfield investment in environmental-technology sectors. Third, it demonstrates that firm-level ESG performance plays a significant role in shaping outward greenfield investment decisions, particularly for financially unconstrained firms, highlighting the growing importance of sustainability commitments in corporate internationalisation strategies.

1.5 Thesis Structure

Chapter 2 examines how adaptation and mitigation climate finance influence aggregate FDI inflows into emerging markets and developing economies. Building on these aggregate investment effects, Chapter 3 investigates whether climate finance translates into greenfield investment in environmental-technology sectors at the firm and project levels. Chapter 4 shifts attention to developed economies and examines how firm-level ESG performance influences outward greenfield FDI from North America. Chapter 5 synthesises the findings across chapters, discusses their theoretical and policy implications, and outlines directions for future research.

2 Foreign direct investment, climate vulnerability and significance of climate finance

2.1 Introduction

A growing body of literature demonstrates that climate change increasingly shapes economic activity, particularly cross-border investment across diverse sectors and regions (Barua et al. 2020; Drabo 2021; Gu and Hale 2023; Pankratz and Schiller 2024). Huang et al. (2018) note that worsening climatic conditions have introduced greater systemic risks for firms worldwide, with these challenges especially pronounced in developing countries where limited adaptive capacity heightens vulnerability (Zhao et al. 2022). As climate related risks intensify, both foreign direct investment (FDI) and climate finance have become central to discussions on sustainable development and resilience (Demena and Afesorgbor 2020; Lee et al. 2022). FDI remains a key channel for capital, technology transfer, and productivity growth, yet it is sensitive to climate-related uncertainty (Gu and Hale 2023; Gamso 2025). In contrast, climate finance seeks to mitigate these risks by strengthening resilience and supporting low-carbon transitions, thereby improving the investment environment and potentially stimulating cross-border capital flows into vulnerable economies (Gamso 2025; Tyson and Weiss 2025). Despite growing recognition of its importance, climate finance remains significantly below required levels. According to the Climate Policy Initiative (2021), emerging market and developing economies (EMDEs) will require approximately USD 4.35 trillion annually by 2030 to address climate impacts, whereas only USD 321 billion was mobilised in 2019/2020, with over half sourced from public institutions. Although the Conference of the Parties (COP), particularly COP28, marked progress, the need for greater financial mobilisation, particularly from the private sector, remains urgent. This raises a central question: to what extent can climate finance help EMDEs address climate related risks and enhance their attractiveness to foreign investors?

This study seeks to answer this question by examining how FDI responds to climate finance in recipient countries.

The importance of FDI in promoting development in EMDEs is well established. FDI contributes to growth through spillover effects, project financing, and technology transfer, while supporting human-capital development and innovation (Doytch and Uctum 2011; Friedt and Toner-Rodgers 2022; Xie et al. 2020; Dicken 2015). Multinational corporations (MNCs) can enhance export performance, provide trade credit to financially constrained firms, and improve liquidity for foreign-acquired enterprises (Manova et al. 2015; Han et al. 2022). Drabo (2021) further observes that FDI, official development assistance, and migrants' remittances contribute positively to growth and absorptive capacity. However, high sunk costs and long investment horizons make investors cautious in high-risk environments. Climate change introduces additional uncertainty, and empirical evidence shows that climate related risks can deter FDI inflows (Escaleras and Register 2011; Anuchitworawong and Thampanishvong 2015). These risks stem from rising frequencies of extreme weather events, sectoral vulnerabilities, and potential supply-chain disruptions (Shear et al. 2023). In this context, climate-related financial assistance may reduce investor risk perceptions. For example, Gamso (2025) finds that climate aid mitigates the negative effect of climate vulnerability on FDI inflows, suggesting that climate finance can function as a risk-buffering mechanism.

The human and economic costs of climate-related disasters have increased substantially over time. According to CRED (2022), 387 natural disasters were recorded globally in 2022, compared with an annual average of approximately 200 events during the 1980s. Economic losses have also increased sharply over recent decades because of greater exposure and asset concentration. In 2022 alone, Hurricane Ian generated losses estimated at USD 100 billion, heatwaves contributed to more than 16,000 excess deaths across Europe, and drought affected nearly 89 million people in Africa (CRED 2022). These patterns suggest that climate-related shocks are becoming increasingly economically significant, particularly for countries with limited adaptive capacity. Diffenbaugh and Burke (2019) argue that global warming is widening economic disparities between richer and poorer economies. The International Energy Agency (IEA 2021) further stresses that decisions made in EMDEs will shape global climate trajectories, given that they collectively account for two-thirds of global carbon emissions.

In response to these challenges, climate finance has become a critical mechanism for reducing emissions and strengthening adaptive capacity (UNFCCC 2014). Mitigation finance focuses on reducing greenhouse gas emissions through renewable energy, clean technologies, and energy-efficiency measures (Haque and Rashid, 2022; Rashid et al., 2023). Adaptation

finance supports resilience-building initiatives, including infrastructure development, disaster preparedness, and community-based adaptation (OECD 2014). Infrastructure is especially significant for attracting FDI. Asiedu (2002) finds that infrastructure development positively influences FDI, particularly in developing regions. This underscores the potential of adaptation finance to facilitate FDI indirectly by reducing climate-related vulnerabilities and improving investment fundamentals.

This study addresses a notable gap in the literature by examining the relationship between climate finance and FDI using a panel of 140 EMDEs from 2000 to 2020. While closely related study largely focusses on aggregate climate aid (example, Gamso 2025), this study disaggregates climate finance into adaptation and mitigation categories, allowing for a more nuanced assessment of their differential effects on investment flows. The empirical analysis begins with fixed-effects specifications that control for unobserved country heterogeneity and common time shocks. Recognising, however, that FDI inflows are highly persistent and that climate finance may be endogenously determined, the study further employs a dynamic panel approach using the system Generalised Method of Moments (GMM) to address potential endogeneity, reverse causality, and dynamic adjustment. The results consistently show that adaptation finance has a positive and statistically significant association with FDI inflows, whereas mitigation finance does not exhibit a comparable effect. These findings remain robust after accounting for endogeneity, dynamics, and a range of robustness checks, including the exclusion of China from the sample. The analysis also explores whether climate vulnerability conditions the climate-finance–FDI relationship and whether the Paris Agreement altered this nexus, finding limited evidence of a structural shift following the Agreement.

The study makes three key contributions. Firstly, it advances the climate finance literature (Leal et al. 2023; Lee et al. 2022; Islam et al. 2022; Zhao et al. 2022; Gamso 2025) by examining the economic spillover effects of climate finance, particularly its role in shaping aggregate FDI inflows to emerging markets and developing economies. Secondly, it highlights the heterogeneous effects of climate finance by distinguishing between adaptation and mitigation funding, showing that adaptation finance is more closely associated with investment outcomes in climate-vulnerable economies. Thirdly, the study provides additional evidence on how climate vulnerability conditions the climate finance and FDI relationship, showing that higher exposure to climate vulnerability weakens the association between adaptation finance and foreign investment.

The remainder of this chapter is organised as follows. Section 2.2 reviews the relevant literature and develops the hypotheses. Section 2.3 describes the data and presents descriptive statistics. Section 2.4 outlines the empirical methodology. Section 2.5 reports the main findings. Section 2.6 presents robustness checks, and Section 2.7 concludes with policy implications.

2.2 Background of the study and literature review, and hypothesis development

2.2.1 Background of the study and literature review

The climate emergency is currently unfolding, and feedback loops are accelerating changes faster than most scientists predicted (Ripple et al. 2022). In recent decades, climate related risks have increased, evidenced by more frequent extreme weather events and the implementation of policies to curb the impact of climate change (Gu and Hale 2023). A similar observation by Esclateras and Register (2011) indicates that the world has seen a substantial rise in FDI flows over the past few decades; however, climate disasters have become more severe.

With increasing concern over the impact of climate change, various international mechanisms and organisations have established climate finance initiatives, including adaptation finance, to support climate-resilient projects in developing countries (OECD 2017; Lee et al. 2022). There is also a growing interest in finding solutions to address the adverse effects of climate change in both the public and private sectors (European Investment Bank 2023; Leal et al. 2023; OECD 2014). Lee et al. (2022) argue that climate finance has become a viable solution for fighting climate change and its environmental impacts while also supporting adaptation efforts. Climate finance involves financial activities aimed at tackling the impacts of climate change, focusing on both mitigation and adaptation (Leal et al. 2023). Investing in modern infrastructure, including energy, water supply, sanitation, waste management, communication, and mobility services, is vital for driving economic growth and essential for reaching sustainable development goals (OECD 2017).

Sarkodie and Strezov (2019) argue that investment from foreign sources, including the transfer of clean technology and improvements in labour and environmental management practices, can support developing nations in achieving their sustainable development goals. Furthermore, reducing greenhouse gas emissions depends on enhancing energy efficiency, adopting modern and clean energy technologies such as renewable energy and nuclear power, and utilising carbon capture and storage for fossil fuel and biomass energy production processes. The Kyoto Protocol incorporated several mechanisms as part of its mitigation

finance measures, including the Clean Development Mechanism (CDM), which aims to promote economic development through environmentally friendly FDI in developing countries (Zhang and Maruyama 2001).

Climate finance is a form of international aid under Official Development Assistance (ODA) recognised by the OECD. In a related study, Yasin (2005) assesses the significance of ODA for FDI and finds that bilateral ODA has a substantial impact on FDI. However, the effect is more modest in the relationship between multilateral development assistance and FDI. Similarly, Bhavan et al. (2011) found empirical evidence that aid directed towards both physical capital and human and infrastructure development is strongly associated with attracting FDI flows into recipient countries. Donaubauer et al. (2016) conducted a comprehensive study encompassing FDI, ODA, and aid and concluded that providing infrastructure assistance is effective in enhancing recipient countries' infrastructure endowment. Meanwhile, Kimura et al. (2010) show that aid does not have a significant influence on FDI into recipient countries. However, when singling out Japan as a case study, the results indicate that Japanese aid attracts FDI only from Japan, not from other countries. Infrastructural support and enhancement are part of the adaptation objectives as stipulated in the Rio Handout.

Effective climate finance is achieved when it successfully supports its targeted objectives. A key element of this effectiveness lies in aligning funding with climate change goals, particularly in supporting developing countries as they address the challenges posed by climate change. Consequently, to enhance the effectiveness of funding directed towards climate objectives, there is a need for improved clarity and accountability (Nunez-Mujica et al. 2023). Nunez-Mujica et al. (2023) examined the World Bank's climate portfolio at the project level between 2000 and 2022 and revealed that overall funding is skewed towards mitigation projects. However, some projects failed to demonstrate the relevance of reducing greenhouse gas emissions, and there was no standardised basis for reporting GHG estimates within the portfolio. Beata and Mitchell (2022) explore the challenges associated with the effective utilisation of international public climate finance aimed at transitioning to low-carbon and resilient growth in lower- and middle-income countries. The study acknowledges the distinction between climate finance and other forms of development finance. Beata and Mitchell (2022) further argue that insufficient evaluations and systematic reviews, low disbursement ratios, and the sacrifice of programmatic approaches in favour of extensive reliance on project-based modalities can undermine the effectiveness of such finance. Furthermore, certain challenges are specific to mitigation finance and do not extend to

adaptation finance. This difference can be attributed to the nature of climate mitigation, which is regarded as a global public good, leading to funding allocation to regional and global programmes rather than to low-income countries (LICs). In contrast, adaptation finance is generally perceived as a national or regional public good (Beata and Mitchell 2022).

The reviewed literature suggests that although the impact of general development assistance on FDI has been widely examined, the specific role of climate finance remains less studied, especially regarding its distinct effects on adaptation and mitigation. Climate finance, as a specialised form of development aid, can influence investment patterns through mechanisms like risk mitigation, institutional credibility, and infrastructure development. Building on this foundation, the next section develops hypotheses to explore the relationships among the elements of climate finance, adaptation and mitigation climate finance, and FDI inflows at the country level.

2.2.2 Hypothesis development

2.2.2.1 Climate finance and FDI inflows

Climate finance has become an essential tool for tackling the complex challenges posed by climate change, especially in developing economies. It covers both adaptation and mitigation initiatives aimed at reducing greenhouse gas emissions and enhancing resilience to climate-related shocks, respectively (Ripple et al. 2022). As nations adopt strategies aligned with global climate objectives, access to financial resources becomes crucial not only for meeting environmental targets but also for fostering broader economic growth (Ripple et al. 2022; Scandurra et al. 2020). From the perspective of international investment theory, multinational firms evaluate host-country attractiveness by balancing expected returns against investment risks and adjustment costs (Li et al. 2017). Adaptation climate finance may influence this calculation by improving infrastructure resilience, reducing exposure to climate-related disruptions, and signalling government commitment to managing environmental risks. These improvements reduce uncertainty surrounding future operating conditions and lower expected adaptation costs borne by foreign investors (Zhang and Muruyama 2001; Nawaz et al. 2021; Aberg and Jeffs 2022). As a result, adaptation finance can increase the expected net return to investment and strengthen the attractiveness of climate-vulnerable economies for long-term capital allocation.

Moreover, the effective deployment of climate funds can signal institutional quality and policy commitment, demonstrating a host country's capacity to manage environmental risks

and pursue sustainable growth strategies (Beata and Mitchel 2022). These qualities tend to create a more stable and predictable investment environment, making the country more attractive to long-term foreign capital. However, the impact of climate finance on FDI is unlikely to be uniform across its different components. Adaptation finance may directly lower investment risk by strengthening resilience to physical climate impacts, thereby increasing investor confidence. Conversely, mitigation finance might involve substantial technological and capital requirements, with benefits accruing over longer periods (Castellani et al. 2022; Dissanayake and Camps 2022).

Climate related risks are deterring MNCs from investing in climate-vulnerable developing countries (Chen et al. 2022; Shear et al. 2023; Gamso 2025). Investors generally aim to minimise costs and maximise profits, which remains their primary goal. The reluctance to invest is mainly driven by concerns that MNCs will have to bear the costs of climate adaptation themselves. However, MNCs may be less hesitant to invest when host governments assume these costs on their behalf (An et al. 2022; Gamso 2025).

The international community has provided billions of dollars in grants and loans to developing countries to strengthen climate resilience (Weiler et al. 2018). MNCs, which are often attentive to signals indicating their investments will be protected from non-commercial risks in host countries (Garriga and Phillips 2014; Raff and Srinivasan 1998), are likely to respond positively to such initiatives. In this context, adaptation climate finance plays a crucial role by supporting projects that enhance countries' capacity to prepare for and recover from climate-related shocks (Beata and Mitchel 2022). Examples include investments in climate-resilient infrastructure, disaster preparedness systems, and community-based adaptation initiatives. These projects reduce vulnerability, improve investor confidence, and contribute to a more stable and predictable economic environment. Empirical evidence suggests that stronger adaptive capacity encourages economic growth and facilitates investment recovery following climate-induced disruptions (Scandurra et al. 2020; Adom and Amoani 2022; Lee et al. 2022). Gamso (2025) examines how climate aid impacts MNCs' concerns about investing in climate-vulnerable countries. The study finds that although climate risk discourages FDI inflows to countries receiving limited climate aid, this adverse effect diminishes as the level of climate aid increases. Consequently, countries with greater access to adaptation finance are more likely to attract higher levels of FDI.

Hypothesis 1a: Adaptation climate finance has a strong positive influence on FDI inflows at the country level.

Castellani et al. (2022) argue that environmental sustainability has become an unavoidable global priority, prompting increasing interest in developing green technologies that reduce pollution and promote efficient use of natural resources. Mitigation finance supports efforts to lower greenhouse gas emissions through renewable energy, energy efficiency, and low-carbon technologies (Beata and Mitchel 2022). While such finance can deliver significant local benefits, including improved energy security, sustainable land use, and enhanced economic stability (Gamso 2025), its direct effect on overall FDI inflows might be limited.

Dissanayake and Camps (2022) highlight that mitigation projects often require sophisticated technology and substantial capital investments, which can be difficult for developing countries to execute effectively. Although investing in environmental technologies, especially in the energy sector, helps reduce emissions (Sarkodie et al. 2020), these projects typically entail high initial costs and long-term returns. Consequently, mitigation finance might not immediately foster the investment conditions needed to attract widespread FDI inflows at a national level. Instead, its impact may be more visible in specific sectors or at the firm level, particularly in initiatives that are aligned with environmentally friendly investments.

Hypothesis 1b: Mitigation climate finance is not expected to have an effect on FDI inflows at the country level.

2.2.2.2 Climate finance and climate vulnerability

In a regional study of predominantly Asian countries, Kukulka (2014) investigates the impact of catastrophic climate disasters on FDI and finds that such events negatively affect FDI in Thailand and Malaysia but not in Indonesia, Vietnam, and the Philippines. Focusing on manufacturing and service sector FDI, Doytch (2019) examines how FDI flows respond to natural disasters within one to two years of their occurrence. Using sector-level data from 69 countries between 1980 and 2011, the study categorises natural disasters into meteorological, climatic, hydrological, and geophysical events, while also differentiating geographical regions. The results indicate that natural disasters deter manufacturing FDI in the short term but promote it in the long term, whereas service sector FDI shows the opposite pattern. Meteorological disasters have a neutral effect on the service sector, while climatic and hydrological disasters tend to have similar long-term negative impacts. Geophysical disasters, however, exert a long-term positive influence on both manufacturing and service sectors.

A more recent contribution by Gu and Hale (2023) analyses both country- and firm-level data to assess how firms respond to climate-related risks when making investment decisions. They classify these risks into physical risks, which stem from extreme weather events, and transition risks, which arise from policy measures designed to mitigate climate change. Their theoretical framework evaluates the effects of these risks on FDI across both intensive and extensive margins. The results show that physical and transition risks negatively affect FDI, although the magnitude and significance vary by context. Empirically, they find that while country-level evidence remains mixed, firms highly exposed to climate risks tend to react adversely to physical risks, particularly in the post-Paris Agreement period.

Similarly, Barua et al. (2020) examine the relationship between climate change and international investment flows, finding that temperature and precipitation have opposing effects on FDI. On average, higher temperatures have a long-term negative effect on FDI, while increased precipitation exerts a positive effect. Their results reveal that temperature changes increase FDI inflows in developed economies but reduce them in developing ones. Neise et al. (2022) analyse data from 181 countries over a 13-year period, categorised into four economic sectors. Using mixed-panel regression, they show that the impact of natural disasters on FDI varies across sectors, with a short-term positive association between climate-related disasters and FDI inflows.

Chen et al. (2021) also document that both physical and transition risks deter FDI flows. Gopalan et al. (2023) analyse FDI inflows to developing and emerging economies from 1995 to 2017 and find that high exposure to climate related risks substantially reduces investment. Shear et al. (2023) report that FDI inflows are significantly lower in climate-vulnerable countries, particularly in upper- and middle-income economies with stronger market institutions. Likewise, Anuchitworawong and Thampanishvong (2015) present evidence from Thailand showing that catastrophic natural disasters decrease FDI inflows. An et al. (2022) examine industrial vulnerability and smart city resilience to climate risks, focusing on cross-border investment, and find that significant differences in climate exposure between home and host cities deter FDI by increasing adaptation costs. These effects are strongest in environmentally sensitive industries that are more exposed to climate-related risks. Shahbaz et al. (2019) examine the relationships among carbon emissions decomposition, FDI, and trade openness in the United States. Their results reveal that rising FDI is associated with increased carbon emissions, suggesting that without technological transformation or stricter environmental regulation, investment expansion can worsen environmental degradation. This

underscores the importance of aligning investment with environmental sustainability and adaptation objectives.

A growing body of literature highlights that climate finance and institutional quality can mitigate the adverse effects of climate related risks on investment. Zhao et al. (2022) find that a stable political environment is essential for the effective utilisation of climate finance. Khurana et al. (2022) argue that enhancing adaptation across sectors requires an integrated approach combining climate risk mitigation policies with foreign assistance mechanisms. They emphasise the importance of institutional strengthening in improving climate disaster preparedness. Chen et al. (2022) provide evidence that effective governance, measured through indicators such as voice and accountability, political stability, regulatory quality, and control of corruption, can reduce the impact of climate related risks and attract FDI inflows. Similarly, Shear et al. (2023) find that the interaction between climate vulnerability and climate preparedness suggests that countries can offset the negative effects of vulnerability by improving institutional, economic, and social resilience. Globerman and Shapiro (2002) argue that investment in governance infrastructure not only attracts inward FDI but also enables domestic firms to become multinational corporations and expand across borders.

Building on this literature, climate finance is expected to play a central role in moderating the adverse impact of climate related risks and promoting foreign investment. Financial assistance targeted at adaptation is likely to have the most immediate and direct influence on FDI by enhancing infrastructure resilience, reducing uncertainty, and strengthening investor confidence. Mitigation finance, by contrast, primarily aims to achieve long-term global emission reductions, which may have weaker effects on local investment decisions. Accordingly, the following hypotheses are proposed:

Hypothesis 2a: The positive effect of adaptation-related climate finance on FDI inflows diminishes with higher climate vulnerability.

Hypothesis 2b: Mitigation-related climate finance does not significantly moderate the relationship between climate vulnerability and FDI inflows.

2.3 Data

The study compiles an unbalanced panel dataset covering 140 emerging markets and developing economies over the period 2000–2020.¹ The choice of sample period is dictated by

¹ The full list of countries included in the analysis is reported in Table 2.8.

data availability, particularly for the core explanatory variables capturing adaptation and mitigation climate finance. The analysis focuses on 140 emerging markets and developing economies (EMDEs) over the period 2000–2020. EMDEs are particularly relevant for this study because they generally face greater development financing constraints and higher exposure to climate-related challenges than advanced economies, making climate finance an important source of support for adaptation and mitigation activities. The classification of the countries follows the OECD and World Bank classification of EMDEs, resulting in a panel of 140 countries. The OECD and World Bank classification reflects economies characterised by lower levels of income, more limited fiscal capacity, and relatively greater exposure to development and climate-related challenges. Climate finance is measured using OECD DAC recipient-reported climate-related development finance and is disaggregated into adaptation and mitigation components using the Rio Markers classification.

To enhance the reliability of the empirical analysis, standard data-cleaning procedures were applied. Specifically, the dataset was winsorised at the 1st and 99th percentiles to mitigate the influence of extreme values while preserving the underlying distribution of the data. The initial dataset comprised 140 countries observed over twenty-one years, yielding a total of 2,940 observations. As the analysis progressed, the number of observations declined primarily due to missing climate finance data and the inclusion of country and year fixed effects. Consequently, the final estimation sample consists of 2,315 observations, reflecting the stringent data requirements and modelling framework employed in the study.

2.3.1 FDI

Data on inward FDI flows are obtained from the World Bank’s World Development Indicators (WDI), which provides one of the longest and most comprehensive annual time series of FDI statistics. The sample period is restricted to 2000–2020 to align with the availability of the main explanatory variables of interest, namely adaptation and mitigation climate finance.

2.3.2 Climate finance

Climate finance data are obtained from the OECD Development Assistance Committee (DAC), ODA external finance statistics from the recipient perspective for the period 2000 to 2020. Since the early 2000s, the OECD has employed the Rio Markers methodology to collect and publish data on official development assistance, with the aim of supporting the goals of the Rio Conventions on biodiversity, climate change, and desertification. The development finance

statistics provide comprehensive information on funding for climate-related development projects from both bilateral and multilateral sources. These data cover a wide range of climate-related finance flows, typically categorised into two groups: mitigation and adaptation climate finance.

Funding is classified according to its underlying objectives. Mitigation finance focuses on technological change and substitution that reduce resource inputs and emissions per unit of output. Adaptation finance aims to strengthen a country's capacity to respond to climate-related challenges and minimise the adverse effects of climate change. This includes supporting infrastructure development, improving disaster preparedness and response systems, and promoting climate-resilient initiatives. A few studies have used climate finance as an explanatory variable to assess its role in promoting environmental sustainability or reducing climate-related risks (Lee et al. 2022; Scandurra et al. 2020; Zhao et al. 2022). However, our approach differs in that we examine the impact of climate finance on FDI inflows and its contribution to mitigating climate change-related risks.

2.3.3 Control variables

To ensure the robustness of the empirical analysis and to isolate the specific effect of climate finance on FDI inflows, a set of control variables commonly identified in the FDI literature is included. These variables capture essential macroeconomic and institutional factors that influence investment decisions. Climate vulnerability, proxied by the vulnerability index, reflects a country's environmental and structural exposure and can deter investment by increasing perceived risks. Governance is incorporated to account for institutional quality, as stronger governance frameworks tend to attract higher levels of foreign investment by reducing policy uncertainty and transaction costs (Shear et al. 2023). Economic growth, measured by real GDP growth, indicates market potential and investment opportunities. Trade openness, on the other hand, reflects a country's integration into the global economy (Gu and Hale 2023), which typically promotes FDI inflows. Finally, inflation is included to control for macroeconomic stability, as volatile price levels may signal economic instability and discourage investment.

Following related literature, five control variables are included in the analysis: governance, climate risk (proxied by the vulnerability index), GDP growth, inflation, and trade as a share of GDP. All control variables are obtained from the World Development Indicators (WDI) for the period 2000–2020.

The vulnerability index is sourced from the Notre Dame Global Adaptation Index (ND-GAIN), compiled by the University of Notre Dame, for the period 2000–2020. The index serves as a measure of a country’s susceptibility to the adverse effects of climate change, with particular focus on vulnerability. It captures a country’s exposure, sensitivity, and adaptive capacity to climate-related impacts. To calculate the overall vulnerability score, the index evaluates six key sectors: food, water, health, ecosystem services, human habitat, and infrastructure. The index ranges from 0 to 1, where lower values indicate lower vulnerability and greater adaptive capacity. This dataset has been widely used in empirical studies, including Gu and Hale (2023), Shear et al. (2023), and Chen et al. (2022).

The governance variable is derived from the Worldwide Governance Indicators (WGI) project, which provides composite indicators covering six dimensions: voice and accountability, political stability and absence of violence or terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. Each dimension ranges from -2.5 to +2.5, where lower values indicate weaker governance performance and higher values indicate stronger governance performance. To construct the governance measure used in this study, the six indicators are aggregated and averaged to form a single composite index, denoted as 'governance'. This approach follows previous studies such as Shear et al. (2023) and Chen et al. (2022). Real GDP growth represents the annual percentage change in an economy’s real gross domestic product. Trade openness (trade) measures the value of a country’s international trade relative to the size of its domestic economy and is calculated as the ratio of total trade (exports plus imports) to GDP. Finally, inflation, measured by the GDP deflator, reflects the annual percentage change in the overall price level of goods and services produced in an economy. It is a common control variable in empirical research, used to account for the effects of price fluctuations on macroeconomic performance (Mazumder 2017; Ha et al. 2023).

2.3.4 Summary statistics and correlation analysis

Table 2.1 presents the descriptive statistics for the variables used in the analysis, covering 140 emerging and developing economies from 2000 to 2020. The variables include FDI inflows (as a percentage of GDP), the two categories of climate finance: adaptation and mitigation climate finance, and the control variables: vulnerability index, governance, GDP growth, inflation, and trade openness. The descriptive results indicate substantial variation across countries and over time, reflecting the diverse economic and institutional structures of the sampled economies. Among the climate finance measures, mitigation finance has the highest mean, suggesting that

more resources are directed towards emission-reduction projects than to adaptation objectives. Trade openness displays the largest variation, consistent with differing levels of global economic integration. In contrast, the vulnerability index shows relatively limited variability, suggesting that while exposure to climate related risks exists across all countries, the degree of vulnerability variation remains moderate.

[Insert Table 2.1 here]

Table 2.2 shows the pairwise correlations among the variables. FDI inflows have a weak negative correlation with the three types of climate finance, indicating that total FDI inflows do not necessarily increase with climate-related funding. However, these bivariate relationships might hide more complex interactions explored later in the regression analysis. A strong positive correlation is seen between adaptation and mitigation climate finance, reflecting their interconnectedness within global climate funding mechanisms. This close link raises concerns about multicollinearity. To address this, the two policy variables are modelled separately in all specifications to mitigate potential multicollinearity concerns and to allow for a clearer interpretation of their individual effects. Governance is positively associated with FDI and trade openness and negatively related to inflation and climate vulnerability. These relationships align with theoretical expectations that stronger institutions boost investor confidence and support economic stability.

[Insert Table 2.2 here]

2.4 Methodology

2.4.1 Baseline model

Our empirical analysis examines the influence of climate finance on FDI inflows. Building on the framework developed by Gu and Hale (2023), we adopt their country-level regression specification, which incorporates interaction terms between physical and transition risks and emission productivity. We extend this framework by introducing climate finance categorised into adaptation and mitigation as key explanatory variables affecting FDI. The analysis employs annual FDI flow data to match the temporal frequency of the available dataset.

Given the forward-looking nature of FDI decisions and the central role of risk assessment in shaping investor behaviour, all right-hand-side variables in the baseline

specification are lagged by one year. This lag structure reflects the typical time required for climate finance commitments and climate vulnerability conditions to be assessed by investors and translated into investment outcomes. In addition, delays associated with project planning, approval, and implementation are characteristic of FDI inflows. Accordingly, climate finance variables, climate vulnerability measures, and all macroeconomic control variables, including governance, real GDP growth, trade openness, and inflation, are entered in the model with a one-period lag. This approach follows standard practice in the empirical FDI literature and helps to mitigate potential simultaneity concerns (Gu and Hale 2023).

The econometric specification is estimated using a fixed effect panel regression model, where FDI inflows, expressed as a ratio of GDP, serve as the dependent variable. The FDI series measures net inflows, capturing transactions related to the acquisition or divestment of domestic assets by foreign investors within each period. The subscripts c and t denote country and year, respectively.

$$FDI_{ct} = a_c + a_t + \beta_1 AD_{c,t-1} + \beta_2 MI_{c,t-1} + \beta_3 VU_{c,t-1} + \beta_4 GOV_{c,t-1} + \beta_5 GDP_{c,t-1} + \beta_6 INF_{c,t-1} + \beta_7 TGDP_{c,t-1} + e_{ct} \quad (2.1)$$

We take the log values of two distinct climate finance categories, adaptation (AD) and mitigation (MI), as the key explanatory variables in the regression model. We expect β_1 to be positive (+) and significant, indicating a positive association between adaptation related climate finance and the FDI inflows (hypothesis 1a), whereas β_2 is not expected to be statistically significant (hypothesis 1b). The variable VU represents the ND-GAIN vulnerability index, which captures exposure and sensitivity to climate vulnerability. The coefficient β_3 is expected to be negative (-), as investors typically assess climate-related risks before committing capital and may avoid countries with high vulnerability to climate change, leading to lower FDI inflows.

Additional control variables include governance (GOV), real GDP growth (GDP), trade openness (TGDP), and inflation (INF). Governance, GDP growth, and trade openness are expected to be positively associated with FDI inflows, reflecting higher FDI inflows with stronger institutional quality, favourable macroeconomic conditions, and greater integration into global markets. Inflation is expected to be negatively associated with FDI, as higher inflation may signal macroeconomic instability and increase investment uncertainty. All control variables are lagged by one year to mitigate simultaneity bias and ensure that

macroeconomic conditions precede changes in investment flows. The terms α_c and α_t denote country and year fixed effects, respectively, which control for unobserved heterogeneity across countries and for common temporal shocks affecting all economies. The term e_{ct} denotes the idiosyncratic disturbance term, assumed to have a zero mean and to vary across countries and over time, capturing unobserved shocks to FDI inflows not explained by the model.

2.4.2 Climate finance and climate vulnerability

In this section, we examine the interaction between climate finance variables and vulnerability index. The analysis is based on the hypothesis that the effect of climate vulnerability on FDI inflows may differ depending on the level of climate finance received by a country. By incorporating an interaction term, we aim to identify how climate finance moderates the relationship between climate risks and FDI (Gamso 2025), thereby capturing potential variations in investment responses across different risk and funding contexts. Equation (2.1) is extended to include the interaction between each category of climate finance and a dummy variable representing climate vulnerability, as follows:

$$\begin{aligned}
 FDI_{ct} = & \alpha_c + \alpha_t + \beta_1(AD_{c,t-1} * VUD_{c,t-1}) + \beta_2(MI_{c,t-1} * VUD_{c,t-1}) + \beta_3AD_{c,t-1} \\
 & + \beta_4MI_{c,t-1} + \beta_5VU_{c,t-1} + \beta_6GOV_{c,t-1} + \beta_7GDP_{c,t-1} + \beta_8INF_{c,t-1} \\
 & + \beta_9TGDP_{c,t-1} + e_{ct}
 \end{aligned} \tag{2.2}$$

where VUD denotes a dummy variable for climate vulnerability. It takes a value of 1 for the country c in the year t if the vulnerability index is equal to or below the median value, and 0 otherwise. This variable interacts with each of the climate finance measures to capture whether the influence of climate finance on FDI depends on the degree of climate vulnerability exposure. The interaction coefficients, β_1 and β_2 , capture how climate vulnerability conditions the relationship between climate finance and FDI. The interaction with adaptation finance is expected to be negative and significant (hypothesis 2a), while the interaction with mitigation climate finance is not expected to be statistically significant (hypothesis 2b). All control variables, fixed effects, and lag structures remain consistent with those in the baseline specification, ensuring methodological consistency and comparability across models.

2.5 Empirical analysis

2.5.1 Baseline regression results

Table 2.3 reports baseline fixed-effects regression results examining the relationship between climate finance and FDI inflows as a share of GDP. Columns (1) and (2) estimate the effects of climate adaptation and mitigation separately, while column (3) includes both variables jointly. All specifications include country and year fixed effects, and all explanatory variables are lagged by one year.

The results show that adaptation finance is positively and statistically significantly associated with FDI inflows. In column (1), the coefficient on lagged adaptation is positive and significant at the 1% level. When both adaptation and mitigation are included jointly in column (3), the coefficient on adaptation remains positive and statistically significant, although slightly reduced in magnitude. Economically, the coefficient implies that a one per cent increase in adaptation finance is associated with approximately a 0.09 percentage-point increase in FDI inflows. Although modest in magnitude, this effect is economically meaningful given the scale and persistence of annual FDI flows across EMDEs. This finding is consistent with the argument advanced by Gamso (2025), who shows that aggregate climate finance is associated with higher FDI inflows by reducing climate-related risks. By distinguishing between adaptation and mitigation finance, we extend this insight by showing that the positive association with FDI is primarily driven by adaptation-related finance. The positive effect indicates that investors are more likely to commit capital when host countries exhibit improved adaptive capacity and lower exposure to climate-related risks.

The second variable of interest is mitigation climate finance, and, unlike the adaptation climate finance, it does not exhibit a statistically significant relationship with FDI inflows. The coefficient on mitigation is positive but insignificant when entered alone in column (2) and remains insignificant when included alongside adaptation in column (3). This suggests that mitigation-related funding does not have a significant effect on aggregate FDI inflows. This is consistent with theoretical expectations, as mitigation finance primarily targets the reduction of global greenhouse gas emissions rather than local investment conditions. Nevertheless, mitigation finance may affect more targeted forms of investment, particularly those related to low-carbon innovation, clean energy, and environmental technology investments.²

Among the control variables, GDP growth has a positive, statistically significant impact on FDI inflows across all the specifications, underscoring the strong link between economic

² This is studied in Chapter 3.

expansion and foreign investment. The finding aligns with earlier research (Shear et al. 2023; Gu and Hale 2023; Cevik and Jalles 2023). Governance and trade openness also display positive coefficients, with trade demonstrating strong significance, confirming that more open economies tend to attract higher investment (Morrissey and Udomkerdmongkol 2012). Inflation and climate vulnerability, however, are not statistically significant in any of the models. This indicates that macroeconomic stability and climate vulnerability are not primary determinants of overall FDI once other factors are considered. The results support the view that FDI decisions may be influenced by a wide range of factors beyond climate related risks, which appear to play a less dominant role in shaping investment trends. Gu and Hale (2023) and Shear et al. (2023) report similar findings. Gu and Hale (2023) observe a negligible or slightly negative effect of climate related risks on FDI in emerging economies, while Shear et al. (2023) reach a comparable conclusion for low-income countries.

[Insert Table 2.3 here]

The results reported in Table 2.4, based on Equation (2.2), support hypotheses 2a and 2b. The coefficient on adaptation-related climate finance is positive and statistically significant, indicating a positive association between adaptation finance and FDI inflows at the country level. This suggests that, on average, higher levels of adaptation finance are associated with increased FDI inflows. However, the interaction term between adaptation finance and vulnerability index is negative and statistically significant (-0.110), indicating that the strength of this association declines as climate vulnerability increases. In other words, while adaptation finance is positively associated with FDI inflows, its relationship with FDI becomes weaker in countries that face higher levels of climate vulnerability. This finding highlights the conditioning role of climate vulnerability in shaping the climate finance–FDI relationship. Although adaptation finance is designed to enhance resilience and reduce exposure to climate-related shocks, higher levels of vulnerability may still limit its effectiveness in sustaining investor confidence. As climate vulnerability intensify, the positive association between adaptation finance and FDI appears to diminish, suggesting that vulnerability remains an important constraint on investment outcomes even in the presence of adaptation-related financial support.

By contrast, neither mitigation-related climate finance nor its interaction with the vulnerability index is statistically significant. The interaction coefficient is negative but insignificant (-0.003), suggesting that mitigation finance does not meaningfully alter the

relationship between climate vulnerability and FDI inflows. Likewise, the direct effect of mitigation finance remains insignificant, indicating that mitigation-related climate finance is not associated with aggregate FDI inflows at the country level. Overall, these findings suggest that the role of climate finance differs across its components. Adaptation finance exhibits a positive association with FDI inflows that weakens as climate vulnerability increases, whereas mitigation finance does not appear to moderate the relationship between climate vulnerability and FDI.

[Insert Table 2.4 here]

Table 2.5 presents supplementary estimates examining whether the association between climate finance and FDI inflows differs before and after the adoption of the Paris Agreement. The results show that adaptation finance retains a positive and statistically significant association with FDI inflows. However, the interaction term between adaptation finance and the post-Paris Agreement dummy is statistically insignificant, indicating no meaningful change in this relationship following the Agreement. Likewise, mitigation finance and its interaction with the post-Paris dummy are not statistically significant. Taken together, the findings suggest that the Paris Agreement did not materially alter the relationship between climate finance and aggregate FDI inflows at the country level.

[Insert Table 2.5 here]

2.6 Robustness checks

In this section, we perform various robustness checks for the main finding that adaptation climate finance is positively associated with FDI, while mitigation climate finance has no impact.

2.6.1 Endogeneity and dynamic panel estimation

Although the baseline fixed effects specifications control for unobserved country heterogeneity and common time shocks, they may remain biased in the presence of dynamic persistence and endogenous regressors. FDI inflows exhibit strong persistence over time, and climate policy measures may be endogenously determined through reverse causality or omitted time-varying factors (Islam 2022). The system GMM estimator is therefore well suited to this setting and is robust to omitted variables, heteroscedasticity, and missing values in the data (Roodman, 2009).

To address these concerns, this study employs a two-step system Generalised Method of Moments (system GMM) estimator, following Arellano and Bover (1995) and Blundell and Bond (1998). The estimated specification includes a lagged dependent variable to capture dynamic adjustment. In addition to addressing the endogeneity of the lagged dependent variable, the system GMM framework also allows for potential endogeneity in other regressors that are not strictly exogenous (Islam 2022). Accordingly, the climate finance variables and the lagged dependent variable are treated as endogenous, while the remaining controls are treated as predetermined conditional on the dynamic specification and fixed effects. Lagged levels are used as instruments for the differenced equation, while lagged differences instrument the level equation. To limit instrument proliferation and enhance identification, the instrument matrix is collapsed, and the lag depth is restricted to lags 3–4 for the differenced equation and lag 3 for the level equation.

Table 2.6 reports dynamic panel estimates that account for persistence in FDI and address endogeneity using system GMM. The coefficient on lagged FDI is positive and statistically significant in both specifications, confirming strong persistence in investment inflows. Adaptation climate finance remains positively associated with FDI in the dynamic specification, whereas mitigation climate finance remains statistically insignificant. The diagnostic tests support the validity of the estimation strategy. The Arellano–Bond tests indicate statistically significant first-order serial correlation in differenced residuals (AR(1) p-values = 0.001 and 0.004), which is expected in dynamic panel models. By contrast, the tests for second-order serial correlation are not significant (AR(2) p-values = 0.362 and 0.615), suggesting that the lag structure is appropriately specified and supporting the validity of the instruments. Instrument proliferation was controlled by collapsing the instrument matrix and restricting lag depth. The model generates 31 GMM instruments for 126 country groups, keeping the instrument count well below the number of groups and reducing concerns regarding overfitting. The Hansen test does not reject the null hypothesis of instrument validity (p-values = 0.334 and 0.744), supporting the appropriateness of the instrument set. However, the relatively high p-values should be interpreted cautiously, as they may also reflect lower power in detecting instrument invalidity.

[Insert Table 2.6 here]

2.6.2 Exclusion of China from the sample

Table 2.7 reports the results of robustness checks conducted to examine the sensitivity of the estimates to China. Given China's economic scale and its dominant position within the group of EMDEs, its inclusion may exert disproportionate influence on the estimated coefficients. Excluding China, therefore, provides a clearer indication of whether the observed relationships are representative of the broader set of EMDEs. The results remain qualitatively similar to the baseline estimates. In particular, the positive and statistically significant association between adaptation finance and FDI inflows persists, indicating that the main findings are not driven by China's presence in the sample. This result strengthens confidence in the robustness of the empirical results.

[Insert 2.7 here]

2.7 Conclusion

This study examines how distinguishing between climate adaptation and mitigation finance affects foreign direct investment (FDI) inflows across countries with varying levels of climate vulnerability. Using a comprehensive panel dataset covering 140 emerging markets and developing economies from 2000 to 2020, the analysis shows that adaptation finance is positively and significantly associated with FDI inflows. These findings suggest that adaptation-related investments not only reduce climate vulnerability but also enhance countries' attractiveness to foreign investors by strengthening resilience and supporting macroeconomic stability (Gamso, 2025). In contrast, mitigation finance does not influence FDI.

To address concerns related to endogeneity and dynamic adjustment, the study complements baseline fixed effects estimate with dynamic panel estimations using the system Generalised Method of Moments (GMM). The GMM results confirm the presence of strong persistence in FDI inflows and show that the positive association between adaptation finance and FDI remains robust after accounting for potential reverse causality and unobserved dynamics. By contrast, mitigation finance does not exhibit a robust relationship with FDI once endogeneity and dynamics are explicitly addressed. These findings strengthen confidence in the interpretation that adaptation finance plays a more immediate role in shaping investment decisions in climate-vulnerable economies. The results are further supported by the exclusion of China from the sample. Given China's economic scale and dominant position among

emerging and developing economies, its exclusion ensures that the findings are not driven by country-specific effects.

The results contribute to the growing body of evidence linking sustainable finance to international capital flows. The findings provide important insights for policymakers and development practitioners. They highlight the dual role of climate finance in promoting environmental resilience while also supporting economic development through enhanced investment attractiveness. By aligning climate objectives with investment priorities, adaptation finance emerges as a particularly effective instrument for strengthening the climate–investment nexus and advancing sustainable development in the developing world.

Table 2-1 Descriptive statistics

Variable	Unit	N	Mean	Std. Dev	Min	Max
FDI	% GDP	2798	4.298	4.919	-3.950	26.880
Log of Adaptation	Log (1+USD)	2940	5.024	5.380	0.000	14.966
Log of Mitigation	Log (1+USD)	2940	7.903	4.228	0.000	15.862
Vulnerability index	Index (0-1)	2854	0.482	0.081	0.336	0.688
Governance	Index (-2.5-2.5)	2940	-0.4003	0.647	-1.898	1.109
GDP growth	Annual %	2860	3.728	4.693	-14.144	17.291
Inflation	Annual %	2859	7.679	10.338	-11.162	60.987
Trade	% GDP	2508	78.334	35.913	23.043	199.356

Note: The table reports summary statistics of the dependent and control variables spanning from 2000 to 2020 for 140 countries. N is the number of observations for each variable. Mean is the average of each variable; Std. Dev. is the standard deviation. Min and Max represent minimum and maximum values of the variables.

Table 2-2. Correlation matrix

Variable	1	2	3	4	5	6	7	8
1 FDI	1.000							
2 Log of Adaptation	-0.041*	1.000						
3 Log of Mitigation	-0.105*	0.623*	1.000					
4 Vulnerability index	-0.088*	0.037	0.041*	1.000				
5 Governance	0.189*	-0.123*	-0.158*	-0.396*	1.000			
6 GDP growth	0.133*	-0.084*	0.054*	0.094*	-0.109*	1.000		
7 Inflation	-0.056*	-0.114*	-0.057*	0.015	-0.258*	0.030	1.000	
8 Trade	0.385*	-0.127*	-0.263*	-0.209*	0.285*	0.062*	-0.083*	1.000

Notes: The table reports pairwise correlation coefficients. * Indicates statistical significance at the 5% level. All variables are defined as in the main text.

Table 2-3. Baseline regression

	Dependent variable: FDI		
	(1)	(2)	(3)
	Adaptation	Mitigation	Both
Log of Adaptation (t-1)	0.098*** (0.024)		0.093** (0.030)
Log of Mitigation (t-1)		0.034 (0.029)	0.015 (0.032)
Vulnerability index (t-1)	-8.498 (6.308)	-10.911 (5.928)	-8.669 (6.101)
Government (t-1)	0.620 (0.396)	0.659 (0.402)	0.618 (0.397)
GDP growth (t-1)	0.073** (0.024)	0.076** (0.025)	0.073** (0.024)
Inflation (t-1)	0.019** (0.008)	0.020** (0.007)	0.019** (0.008)
Trade (t-1)	0.047*** (0.009)	0.047*** (0.009)	0.047*** (0.009)
Constant	3.622 (3.134)	4.615 (3.014)	3.619 (3.135)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	2313	2313	2313
R-squared	0.109	0.107	0.109

Notes: Columns (1) – (3) report the estimated coefficients. The dependent variable is the ratio of net FDI inflows to GDP. The key explanatory variables are measures of climate finance, expressed as the logarithm of (1 + current USD value), and the vulnerability index obtained from the Notre Dame Global Adaptation Initiative (ND-GAIN). All right-hand-side variables are lagged by one year. Statistical significance is denoted at the 1% (***), 5% (**), and 10% (*) levels, respectively. Standard errors are clustered at the regional level and are reported in parentheses below the regression coefficients.

Table 2-4. Interaction between vulnerability index dummy with climate finance variables

Dependent variable: FDI		
	(1)	(2)
	Adaptation	Mitigation
Log of Adaptation (t-1) * Vulnerability index	-0.110** (0.037)	
Log of Mitigation (t-1) * Vulnerability index		-0.003 (0.071)
Log of Adaptation (t-1)	0.145** (0.052)	
Log of Mitigation (t-1)		0.020 (0.061)
Vulnerability index (t-1)	-10.990 (8.708)	-12.525* (6.037)
Governance (t-1)	0.895 (0.528)	0.859 (0.505)
GDP growth (t-1)	0.048* (0.022)	0.053* (0.024)
Inflation (t-1)	0.016 (0.012)	0.017 (0.012)
Trade (t-1)	0.048*** (0.008)	0.052*** (0.009)
Constant	4.801 (4.755)	5.412 (3.488)
Country FE	Yes	Yes
Year FE	Yes	Yes
N	2315	2315
R-squared	0.085	0.079

Notes: Columns (1) – (2) report the estimated coefficients. The dependent variable is the ratio of net FDI inflows to GDP. The key explanatory variables are measures of climate finance, expressed as the logarithm of (1 + current USD value), and the vulnerability index obtained from the Notre Dame Global Adaptation Initiative (ND-GAIN). All right-hand-side variables are lagged by one year. Statistical significance is denoted at the 1% (***), 5% (**), and 10% (*) levels, respectively. Standard errors are clustered at the regional level and are reported in parentheses below the regression coefficients.

Table 2-5. Interaction between the Paris Agreement dummy with climate finance variables

Dependent variable: FDI		
	(1)	(2)
	Adaptation	Mitigation
Log of Adaptation (t-1)	0.108** (0.041)	
Log of Adaptation (t-1) * PA	-0.023 (0.077)	
Log of Mitigation (t-1)		0.014 (0.038)
Log of Mitigation (t-1) * PA		0.021 (0.052)
Vulnerability index (t-1)	-8.260 (6.936)	-9.810 (6.178)
Governance (t-1)	0.830 (0.563)	0.861 (0.539)
GDP growth (t-1)	0.050* (0.024)	0.053* (0.024)
Inflation (t-1)	0.016 (0.012)	0.017 (0.012)
Trade (t-1)	0.052*** (0.009)	0.051*** (0.009)
Constant	3.164 (3.430)	3.856 (3.114)
Country FE	Yes	Yes
Year FE	Yes	Yes
N	2315	2315
R-squared	0.081	0.079

Notes: Columns (1) – (2) report the estimated coefficients. The dependent variable is the ratio of net FDI inflows to GDP. The key explanatory variables are measures of climate finance, expressed as the logarithm of (1 + current USD value), and the vulnerability index obtained from the Notre Dame Global Adaptation Initiative (ND-GAIN). PA is the post-Paris agreement dummy. All right-hand-side variables are lagged by one year. Statistical significance is denoted at the 1% (***), 5% (**), and 10% (*) levels, respectively. Standard errors are clustered at the regional level and are reported in parentheses below the regression coefficients.

Table 2-6. Endogeneity and dynamic panel estimation

Variable	(1) Adaptation	(2) Mitigation
FDI (t-1)	0.538*** (0.203)	0.636*** (0.210)
Log of Adaptation (t-1)	0.156* (0.093)	
Log of Mitigation (t-1)		0.700 (0.959)
Vulnerability index (t-1)	-0.105 (1.233)	1.230 (3.674)
Government (t-1)	0.434* (0.251)	0.309 (0.395)
GDP growth (t-1)	0.033 (0.033)	-0.066 (0.124)
Inflation (t-1)	0.003 (0.009)	0.010 (0.018)
Trade (t-1)	0.018** (0.009)	0.033 (0.034)
F statistics p-value	0.000	0.000
Year FE	Yes	Yes
Country FE	Yes	Yes
N	2,307	2,307
No. of groups	126	126
No. of instruments	31	31
AR (1) p-value	0.001	0.004
AR (2) p-value	0.362	0.615
Hansen test p-value	0.334	0.744

Notes: FDI denotes FDI as a percentage of GDP. FDI (t-1) is the one-period lag of the dependent variable. Log of adaptation and log of mitigation represent the natural logarithm of climate adaptation and mitigation finance, respectively. All explanatory variables are lagged by one year. Estimates are obtained using a two-step system GMM estimator. The lagged dependent variable and climate finance variables are treated as endogenous. Internal instruments are constructed using lags 3-4 for the differenced equation and lag 3 for the level equation, with the instrument matrix collapsed to limit instrument proliferation. Robust standard errors are reported in parentheses. Statistical significance is denoted at the 1% (***), 5% (**), and 10% (*) levels, respectively.

Table 2-7. Exclusion of China from the sample

Dependent variable: FDI		
	(1)	(2)
	Adaptation	Mitigation
Log of Adaptation (t-1)	0.098** (0.042)	
Log of Mitigation (t-1)		0.017 (0.032)
Vulnerability index (t-1)	-8.027 (6.818)	-10.260 (6.424)
Governance (t-1)	0.826 (0.556)	0.876 (0.536)
GDP growth (t-1)	0.050* (0.023)	0.053* (0.024)
Inflation (t-1)	0.016 (0.012)	0.017 (0.012)
Trade (t-1)	0.052*** (0.009)	0.052*** (0.009)
Constant	3.033 (3.373)	4.036 (3.229)
Country FE	Yes	Yes
Year FE	Yes	Yes
N	2295	2295
R-squared	0.081	0.079

Notes: Columns (1) – (3) report the estimated coefficients. The dependent variable is the ratio of net FDI inflows to GDP. The key explanatory variables are measures of climate finance, expressed as the logarithm of (1 + current USD value), and the vulnerability index obtained from the Notre Dame Global Adaptation Initiative (ND-GAIN). All right-hand-side variables are lagged by one year. Statistical significance is denoted at the 1% (***), 5% (**), and 10% (*) levels, respectively. Standard errors are clustered at the regional level and are reported in parentheses below the regression coefficients.

Table 2-8. List of countries

Afghanistan	Djibouti	Libya	Sao Tome & Principe
Albania	Dominica	Madagascar	Saudi Arabia
Algeria	Dominican Republic	Malawi	Senegal
Angola	Ecuador	Malaysia	Serbia
Antigua and Barbuda	Egypt	Maldives	Seychelles
Argentina	El Salvador	Mali	Sierra Leone
Armenia	Equatorial Guinea	Mauritania	Slovenia
Azerbaijan	Eritrea	Mauritius	Solomon Islands
Bahrain	Ethiopia	Mexico	Somalia
Bangladesh	Fiji	Micronesia	South Africa
Barbados	Gabon	Moldova	Sri Lanka
Belarus	Gambia	Mongolia	Sudan
Belize	Georgia	Montenegro	Suriname
Benin	Ghana	Morocco	Syrian Arab Republic
Bhutan	Grenada	Mozambique	Tajikistan
Bolivia	Guatemala	Myanmar	Tanzania
Bosnia and Herzegovina	Guinea	Namibia	Thailand
Botswana	Guinea-Bissau	Nauru	Timor-Leste
Brazil	Guyana	Nepal	Togo
Burkina Faso	Haiti	Nicaragua	Tonga
Burundi	Honduras	Niger	Trinidad and Tobago
Cambodia	India	Nigeria	Tunisia
Cameroon	Indonesia	Oman	Türkiye
Cape Verde	Iran	Pakistan	Turkmenistan
Chad	Iraq	Palau	Tuvalu
Chile	Jamaica	Panama	Uganda
China	Jordan	Papua New Guinea	Ukraine
Colombia	Kazakhstan	Paraguay	Uruguay
Comoros	Kenya	Peru	Uzbekistan
Congo	Korea DPR	Philippines	Vanuatu
Costa Rica	Kyrgyzstan	Rwanda	Venezuela
Côte d'Ivoire	Lao PDR	St. Kitts and Nevis	Viet Nam
Croatia	Lebanon	St. Lucia	Yemen
Cuba	Lesotho	St. Vincent and the Grenadines	Zambia
DR Congo	Liberia	Samoa	Zimbabwe

3 Climate finance and cross-border investment: Firm-level analysis

3.1 Introduction

The accelerating rate of climate change driven by global warming has become a substantial concern and is increasingly recognised as a real-world phenomenon (Alam et al. 2019). As its impacts become increasingly severe, the urgency of identifying solutions that enhance resilience and reduce greenhouse gas emissions has intensified (Eyckmans et al. 2016; Gu & Hale 2023). Governments and policymakers worldwide are increasingly acknowledging the need to proactively address climate change (Zhao et al. 2024). In response, many have introduced stricter environmental regulations aimed at safeguarding ecosystems and improving environmental quality (Lin et al. 2024). These policies often impose higher pollution abatement costs on certain firms, thereby motivating them to adopt and innovate in green technologies (Alam et al. 2019). Porter and Linde (1995) further argue that such regulatory pressures can transform compliance challenges into opportunities for competitive advantage by fostering the development of environmentally sustainable innovations.

The rising demand for environmentally friendly investments has spurred technological progress in green technologies aimed at decreasing pollution and optimising natural resource use (Castellani et al. 2022). This trend is also evident in international investment patterns, which present both benefits and drawbacks. For example, Gu and Hale (2023) explore the different climate risks faced by source and destination countries, discovering that stricter emissions regulations in source countries often lead to increased FDI flows by multinational corporations (MNCs) to destination countries. Their results highlight the cross-border economic effects of domestic environmental policies. Similarly, Barua et al. (2020) note how climate change impacts investment directly and indirectly. For instance, damage to infrastructure can create opportunities for rebuilding, while environmental issues like water scarcity may deter investments in sectors such as agriculture and energy. Indirect effects, such as reduced labour productivity and lower exports, can decrease overall investment levels. Furthermore, policy and regulatory changes aimed at addressing climate change play a crucial

role in shaping investment flows. These changes not only discourage investments in fossil fuels but also promote sustainable or "green" investments, aligning economic activities with environmental goals. The interaction between climate finance, FDI, and green technologies forms the foundation of this research, which investigates how adaptation and mitigation climate financing influence FDI in environmental technology projects. Our focus is on greenfield FDI, referring to investments that establish new production or service facilities in a host country (Qiu and Wang 2011).³

When making strategic decisions, particularly those involving cross-border investment, firms may increasingly account for the risks of climate change and the potential need for mitigation strategies. According to fDi Markets figures, global greenfield investment projects were valued at USD 1.337 trillion in 2023, showing a 16% increase from the previous year's USD 1.155 trillion. The environmental technology sector ranks among the top five investment clusters. This rise marks the highest level of capital investment recorded since the global financial crisis. Furthermore, global energy investment is forecasted to exceed USD 3 trillion in 2024 for the first time, with approximately USD 2 trillion allocated to clean energy technologies and infrastructure. Since 2020, investment in clean energy has increased significantly, with spending on renewable power, grids, and storage surpassing the combined expenditure on oil, gas, and coal (Fatih 2024). This shift underscores a significant change in global energy priorities, highlighting a growing commitment to sustainable and environmentally friendly energy sources. Nonetheless, these investments remain below the current estimated annual climate finance requirement of USD 8 trillion, which is expected to rise to USD 10 trillion after 2030 (Songwe 2022).

In this chapter, we analyse an unbalanced panel dataset of 1,931 firms investing in emerging markets and developing economies (EMDEs) between 2003 and 2021. Our focus is to study the impact of adaptation and mitigation climate finance on greenfield FDI projects, specifically within the environmental technology investment cluster, which includes sectors such as renewable energy, industrial equipment, and electronic components. Castellani et al. (2022) characterise this cluster as comprising cross-border investments in specialised industries where innovation in environmental technologies is particularly critical. Emphasising the role of climate finance, Friedman (2023) highlights that climate-resilient development is increasingly framed as a global policy strategy that integrates mitigation and adaptation

³ In this chapter, greenfield FDI is operationalised as firm-level capital expenditure associated with environmental-technology investment projects.

objectives into broader sustainable development efforts. This perspective reinforces the importance of understanding how targeted climate finance can shape firm-level investment decisions in environmental technologies across developing regions.

Climate finance can influence FDI decisions through several interrelated channels. First, it can help ease financial constraints in developing economies by enhancing local capacity to support green infrastructure and environmental projects, thereby improving the investment environment (Corfee-Morlot et al. 2012; Lee et al. 2022; Khan et al. 2024). In addition, international climate finance signals policy credibility and long-term commitment to low-carbon development, reducing policy uncertainty and perceived risks for investors (Corfee-Morlot et al. 2012). It also contributes to strengthening regulatory and institutional frameworks that facilitate clean technology investment, such as feed-in tariffs and green procurement policies (UNCTAD 2022). Furthermore, climate finance supports climate-resilient infrastructure and systems (Khan et al. 2023), reducing systemic risks associated with climate shocks and enhancing overall investment stability (Corfee-Morlot et al. 2012; Huang et al. 2018; Stroebel and Wurgler 2021; Pienknagura 2024). These mechanisms are particularly relevant in the context of MNCs, which increasingly assess climate related risks and sustainability commitments in their investment decisions (Stroebel and Wurgler 2021).

We construct a firm-country-year panel dataset using project-level data from fDi Markets: Cross-Border Investment Monitor, a database provided by The Financial Times. The original dataset contains detailed information on individual greenfield FDI projects, including the identity of investing firms, their sectors, geographic destinations, investment categories, and associated capital expenditure. To align with the structure of the climate finance data and enable consistent empirical analysis, the project-level data are aggregated to the firm-country-year level. The study focuses on the environmental technology cluster, which is central to global sustainability transitions. We restrict the sample to inward FDI targeting EMDEs, as these countries are the primary recipients of international climate finance for mitigation and adaptation purposes. While the data include multinational investors from developed economies, the exclusive focus on EMDEs reflects the direction of climate finance flows, rather than limitations in the underlying FDI dataset. The climate finance data, categorised into adaptation and mitigation, serve as the explanatory variables in our analysis and are sourced from the OECD. Adaptation climate finance refers to funding aimed at strengthening resilience and reducing vulnerability to the impacts of climate change, for example, through infrastructure, disaster preparedness, or agricultural adjustments. In contrast, mitigation climate finance funds activities aimed at reducing greenhouse gas emissions, such as renewable

energy and energy efficiency projects. Additionally, we add country-level data from the World Development Indicators (WDI) and the World Bank's global database for control variables such as GDP growth, trade as a percentage of GDP and producer price index. Ultimately, the final dataset comprises 1,931 multinational firms investing across 110 target countries, spanning the period from 2003 to 2021.

Using a panel specification with firm, destination-country, sector, year, and firm-by-year fixed effects, the results show that mitigation climate finance is positively related to the flow of environmental technology foreign investment projects to recipient countries. Meanwhile, the impact adaptation climate finance is insignificant. Mitigation finance may significantly influence green investments and environmental FDI because of incentives for firms. Green investments align with global sustainability goals and are supported by initiatives like carbon credits and green bonds. Conversely, adaptation finance aimed at increasing resilience to climate change may not generate immediate returns and mainly functions as a public good that attracts limited foreign investment.⁴ For example, the greater effect of mitigation finance on FDI aligns with evidence from advanced economies. The United States' Inflation Reduction Act of 2022, for instance, allocated nearly USD 400 billion to mitigation efforts, primarily through subsidies, tax credits, and concessional loans – which have been found to double the pace of emissions reductions by motivating private investment in clean energy and low-carbon technologies (Bistline et al. 2023). This incentive may attract more investments and provide firms with greater flexibility to invest further. In contrast, adaptation finance generally targets public goods such as disaster preparedness or resilient infrastructure, which, while essential, offer limited direct returns to foreign investors.

Our findings are consistent across alternative specifications, including models with and without control variables, the simultaneous incorporation of both variables of interest, and the use of high-dimensional fixed effects to help mitigate concerns about omitted variable bias. Nonetheless, endogeneity may still arise through various channels, including simultaneity, measurement error, and unobserved confounding factors that influence both climate finance allocations and FDI flows. To address these issues, we conduct a robustness check with an instrumental variable (IV – GMM) approach (Lv et al. 2024), utilising lagged values of the key

⁴ This result differs from Chapter 2, where adaptation finance was positively associated with aggregate FDI inflows. The distinction reflects differences in the level of analysis. At the macro level, adaptation finance may improve overall investment conditions through infrastructure development and resilience-building. At the firm and sector level examined here, however, adaptation finance appears less directly connected to capital-intensive investment in environmental technologies, where commercial incentives are more closely aligned with mitigation objectives.

explanatory variables. This method helps correct for potential reverse causality and omitted variable bias by exploiting exogenous variation in climate finance (Lee et al. 2022). The results demonstrate that mitigation climate finance significantly increases firm-level capital expenditure in recipient countries, whereas adaptation finance does not have a statistically significant effect. Hence, these findings confirm the robustness of the main results and highlight the distinct roles of mitigation and adaptation finance in promoting greenfield investment in environmental technologies. Furthermore, we perform a robustness check by substituting our dependent variable, foreign investment in projects measured as capital expenditure, with the number of jobs created by each foreign project in a destination country, in accordance with King et al. (2021). Our findings remain qualitatively unchanged when employing this alternative measure of foreign investment.

This study makes three main contributions to the literature on FDI, green technology, and climate finance. First, it provides novel empirical evidence on the relationship between climate finance, disaggregated into adaptation and mitigation, and firm-level greenfield FDI in environmental technologies across EMDEs. While existing research has examined various determinants of FDI (e.g., Gu & Hale 2023; Kellard et al. 2022), less is known about how international climate finance, particularly in disaggregated form, influences firm-level green investment decisions. This micro-level perspective clarifies how financial support for climate objectives shapes multinational firms' capital allocation. Second, the study distinguishes between adaptation and mitigation finance rather than relying on aggregate measures. The results show that mitigation finance has a stronger effect on green capital investment, whereas adaptation finance is less directly associated with firm-level outcomes. This distinction helps clarify how different forms of climate finance influence private-sector investment behaviour. Third, the study informs policy by identifying the conditions under which climate finance most effectively catalyses private investment in green technologies. The findings indicate that mitigation-focused finance plays a larger role in attracting firm-level environmental technology FDI, offering practical insights for international donors, development finance institutions, and policymakers designing climate finance strategies in EMDEs.

The rest of the study is organised as follows: Section 3.2 reviews the background literature and formulates the hypotheses. Section 3.3 describes the data and explores the variables. Section 3.4 outlines the empirical methods. Section 3.5 presents the main results, while Section 3.6 discusses additional robustness checks. Finally, Section 3.7 offers the conclusion.

3.2 Background and hypothesis development

3.2.1 Sustainable investment

Governments and policymakers are increasingly framing climate protection within the broader narrative of green growth, suggesting that economic development and environmental sustainability are not only compatible but also mutually reinforcing (Schmidt et al. 2024). This paradigm has driven growing interest in understanding the financial, regulatory, and institutional conditions that support environmentally sustainable investment. A growing body of research highlights several factors that influence corporate green investment. Miao et al. (2017) identify environmental regulations, government subsidies, and financial sector development as key drivers of such investments. Similarly, Ding et al. (2023) show that digital finance promotes green investment in pollution-intensive industries, while Li et al. (2023) find that green credit policies significantly improve investment efficiency. Although these studies primarily focus on domestic investment behaviour, their findings are relevant to the cross-border context. They suggest that strong financial institutions and supportive policy frameworks in host countries may enhance the effectiveness of international climate finance in attracting greenfield FDI in environmental technologies.

Climate finance increasingly plays a key role in environmental protection and economic change. Carfora and Scandurra (2019) argue that climate funds have become essential tools for financing mitigation and adaptation efforts. Similarly, Rokhmawati (2021) emphasises that successful emissions reduction projects need significant capital investment, highlighting the importance of targeted economic incentives. Liargovas et al. (2017) support this view, noting that international and government funding strategies are crucial for helping firms undertake climate-related investments. Fankhauser et al. (2016) further argue that addressing climate change requires substantial investment in low-carbon and climate-resilient technologies in both developed and developing nations. This highlights the significance of access to finance as a key element of climate policy. Kalantzis et al. (2025) also emphasise that efficiency improvements, especially in how companies manage energy and resource use, are vital for reducing greenhouse gas emissions, thereby strengthening the case for investing in environmental technologies.

Climate change also creates new opportunities for sustainable investment and innovation. Krueger et al. (2020) argue that climate risk encourages the development and adoption of green technologies while also presenting disruption risks for traditional business models. For example, the shift towards electric and fuel-cell vehicles may challenge

conventional automotive manufacturers. At the same time, global climate issues provide opportunities for technologically advanced countries to invest in less-developed regions, fostering both FDI and international climate cooperation. In this context, Demena and Afesorgbor (2020) highlight the potential of FDI to improve environmental sustainability, especially through technology transfer and spillovers to domestic industries. Our dependent variable, FDI, encompasses investment projects across sectors such as business services, communications, finance, renewable energy, and transportation. Due to the limited empirical literature on the relationship between climate finance and cross-border green investment, this study seeks to expand current knowledge by examining how climate finance affects greenfield FDI in environmental technologies within emerging markets and developing economies.

3.2.2 Hypothesis development

Tackling the dual challenges of economic development and climate change has become a central focus for policymakers and international institutions, especially in emerging and developing economies (Tyson and Weiss 2025). Investment in environmentally sustainable technologies is increasingly viewed as a key pathway toward green growth (Fankhauser et al., 2016). In this context, international climate finance, particularly its two primary components, adaptation and mitigation, has emerged as a critical tool for supporting low-carbon transitions and strengthening climate resilience in developing countries. Although both types of finance aim to support climate-related goals, they operate through different mechanisms and may have distinct implications for FDI. Mitigation finance typically targets emissions reduction and supports capital-intensive projects such as renewable energy, energy efficiency, and low-carbon infrastructure. These initiatives closely align with the technological and commercial interests of multinational firms engaged in greenfield investments. In contrast, adaptation finance focuses on enhancing resilience through investments in infrastructure, disaster risk reduction, agriculture, and water management. While such investments may help stabilise the broader economic environment, they may not directly incentivise firm-level investment in environmental technologies.

Climate finance may shape firm investment decisions in different ways. In particular, mitigation climate finance may encourage firm-level greenfield investment in the environmental technology sector by reducing investment costs through support for low-carbon infrastructure and complementary public investment, signalling commitment to environmental transition and thereby reducing regulatory uncertainty for multinational firms and expanding

market opportunities for environmental technologies by generating demand for cleaner production systems. Collectively, these channels may increase expected project returns and strengthen incentives for multinational firms to undertake green investment. Recognising this conceptual distinction, the next section outlines hypotheses that explore the differential effects of adaptation and mitigation climate finance on greenfield FDI in environmental technologies.

3.2.2.1 Mitigation climate finance and FDI

Mitigation climate finance aims to stabilise greenhouse gas concentrations by supporting low-carbon energy systems, reducing emissions, and promoting sustainable infrastructure (Fankhauser et al., 2016). As noted by Lee et al. (2022), most mitigation funding is channelled into renewable energy projects, such as solar photovoltaic and wind power, as well as low-carbon transport. These capital-intensive sectors are well aligned with the characteristics of environmental-technology FDI, which typically involves the deployment of clean technologies and the construction of supporting infrastructure. Recent empirical evidence further underscores the importance of climate policy in shaping investment flows. Pienknagura (2024), using cross-border project-level data, finds that countries with a greater number of active climate policies tend to attract significantly higher inflows of green FDI.

Empirical evidence supports the role of mitigation finance in fostering a favourable investment climate. Nakhooda et al. (2016) argue that emission reductions are more likely under mitigation finance because it targets high-emission industries. Giglio et al. (2021) further show that financial markets reallocate capital towards green investments, thereby promoting FDI in clean technologies (Pienknagura 2024). In addition, mitigation finance may encourage governments to adopt clearer regulatory frameworks and long-term climate strategies, thereby reducing regulatory uncertainty for investors. By signalling policy commitment and enabling institutional reform, it can make host countries more attractive for foreign firms seeking stable investment conditions (Bistline et al. 2023). By investing in energy-efficient systems and supporting renewable energy infrastructure, mitigation finance directly advances the objectives of environmental-technology investors. Consequently, countries that receive substantial mitigation finance might experience increased inflows of greenfield FDI, as companies respond to a more favourable enabling environment and reduced climate-related risks.

Hypothesis 1: Mitigation climate finance has a positive and significant impact on firms' investments in environmental technology.

3.2.2.2 Adaptation climate finance and FDI

In contrast, adaptation climate finance primarily aims to enhance resilience against the negative impacts of climate change (Eyckmans et al. 2016). Its focus includes investments in disaster risk management, infrastructure resilience, water resource management, agriculture, and coastal protection. While these measures are essential for reducing social and economic vulnerabilities, their connection to FDI, particularly in technology-driven sectors, is more indirect. Adaptation finance supports the overall stability of the host country, which can boost investor confidence. For example, Friedman (2023) and OECD (2017) emphasise the importance of resilient infrastructure in attracting investment. Adaptation initiatives such as transportation upgrades and water systems can lower operational risks and improve logistical efficiency. Mawdsley and Taggart (2022) further argue that adaptation economies offer strategic opportunities for redefining vulnerability and fostering socio-economic transformation.

However, because adaptation projects often focus on public goods and social infrastructure, the immediate incentives for firm-level investment in environmental technology may be limited. Unlike mitigation finance, which is linked to market-based, revenue-generating sectors, adaptation finance frequently lacks short-term commercial gains. As a result, its impact on greenfield FDI might not be statistically significant, even if it has a positive effect on the overall investment climate.

Hypothesis 2: Climate finance adaptation has a limited impact on firms' investment in environmental technology.

3.3 Data

To build our firm-country level dataset covering 110 emerging markets and developing economies (EMDEs) for the period from 2003 to 2021, we rely on multiple data sources. Firm-level information is derived from individual greenfield investment projects recorded in the fDi Markets database. Climate finance data, sourced from the OECD, reflect multiple disbursements or commitments within a year. To ensure consistency with the FDI data and other macroeconomic indicators, we aggregate all climate finance flows into a single annual figure per recipient country. Likewise, we aggregate the firm-level investment data to the firm-country-year level.

3.3.1 Dependent variable

The dependent variable in this study is the greenfield FDI of 1,931 firms across 110 target countries and 75 source countries. We collect project-level data from fDi Markets, covering the period from the database inception in 2003 up to 2021, with a specific focus on firms investing in the environmental technology sector. This sector encompasses various fields dedicated to developing and implementing technologies that address environmental challenges and promote sustainability. The data, compiled by fDi Intelligence, a division of the Financial Times, provides real-time information on cross-border investments through live feeds of project announcements and global investment statistics. fDi Markets grants instant access to the most comprehensive and current database of greenfield FDI projects worldwide. This dataset has been widely used in global business and economic research (King et al. 2021; Castellani and Lavoratori 2020; Desbordes and Wei 2017; Duanmu 2014). With over 60,000 active investor profiles, fDi Markets offers a detailed understanding of how companies plan and structure their activities and value chains globally. Notably, there is no upper or lower limit for the investment amount to be included in the data; however, the foreign investors' equity stake must not fall below 10% (Desbordes and Wei 2017).

The dataset includes firm- and project-level variables such as the investing firm's home country, destination country, year of investment, capital expenditure, firm revenue, and jobs created. These variables support a comprehensive analysis of the relationship between climate finance and FDI in environmental technologies. Individual greenfield project deals are compiled by firm, aggregated by year and country to align with the frequency of other variables in the dataset.

3.3.2 Independent variables

The study concentrates on two main explanatory variables: adaptation and mitigation climate finance. Data are sourced from the climate-related development finance section of the OECD, covering the period 2003 to 2021. The OECD DAC records development finance related to climate change using two Rio markers: climate change mitigation and climate change adaptation. These markers classify activities based on whether the objectives are the principal focus of the project or a significant secondary component. Development finance provided by bilateral and multilateral institutions supports these two objectives, as well as other environmental goals such as biodiversity conservation. Moreover, climate finance mobilised

by developed countries to help developing countries respond to climate change is categorised into two main objectives: adaptation and mitigation.

According to Hong et al. (2020), climate finance encompasses investments made by governments, corporations, and households that support the global transition to a low-carbon economy, reduce greenhouse gas (GHG) emissions, and enhance resilience to climate impacts. Lee et al. (2022) note that mitigation finance primarily targets the stabilisation of atmospheric GHG levels, and the reduction of economic risks associated with severe climate disruptions caused by human activity. Most mitigation investments are concentrated in the renewable energy sector, particularly solar photovoltaic and onshore wind power, as well as low-carbon transport, both of which facilitate the shift to a low-emission economy. In contrast, adaptation finance focuses on enhancing the resilience of economies and societies by building adaptive capacity in key sectors such as agriculture, water resource management, ecosystems, ocean conservation, and disaster risk reduction. These investments aim to reduce the financial and social vulnerabilities of both natural and human systems to the current and anticipated effects of climate change. All amounts are expressed in current USD.

The dual objectives of climate finance, namely mitigation and adaptation, represent distinct yet complementary strategies for addressing global climate challenges. To maintain consistency with the annual structure of the analysis, project-level climate finance records are aggregated by recipient country and year, based on reported funding allocations

3.3.3 Macroeconomic control variables

We collect a set of macroeconomic control variables for 110 destination countries from the World Development Indicators (WDI) for the period 2003-2021. Specifically, we include GDP growth and the trade-to-GDP ratio, both of which are widely recognised as important determinants of FDI flows (Asiedu 2002; Chakrabarti and Wang 2013; Gu and Hale 2023). GDP growth serves as a proxy for market potential and economic performance, signalling growth opportunities to foreign investors. The trade-to-GDP ratio reflects the openness of an economy, which affects the ease of doing business and the potential for integration into global value chains. Additionally, we utilise the Producer Price Index (PPI) as a measure of inflationary pressure, following Gu and Hale (2023). PPI is preferred over the Consumer Price Index (CPI) because it captures supply-side cost dynamics that directly affect firms' production costs and profitability, which are critical to investment decisions. The PPI data are sourced from the World Bank Global Database of Inflation (Ha 2023). In summary, we construct an

unbalanced panel dataset at the firm-country-year level, resulting in 2,796 unique identifiers. This dataset includes 1,931 investing firms operating across 110 destination countries and originating from 75 source countries.

3.3.4 Summary statistics

This section provides the descriptive statistics and correlation analysis for the variables used in the empirical study.

Table 3.1 reports the descriptive statistics for the variables based on 53,078 firm-year observations from 1,931 firms across 110 countries between 2003 and 2021. The variables exhibit considerable variation across firms and countries. Logged capital expenditure $\ln(FDI)$, mitigation, and adaptation finance show wide ranges, indicating different levels of investment and climate finance across firms and time. Macroeconomic indicators such as GDP growth, trade openness, and PPI also vary significantly, reflecting diverse economic conditions within the sample.

[Insert Table 3.1 here]

Table 3.2 shows the pairwise Pearson correlations among the variables used in the empirical analysis. These correlations provide initial insights into the relationships between FDI, climate finance, and macroeconomic controls. The dependent variable $\ln FDI$ is positively and significantly correlated with adaptation finance (0.0558) and mitigation finance (0.0434), although these associations are relatively modest. The high correlation between adaptation and mitigation finance (0.6283) highlights the overlapping nature of climate finance portfolios across many countries. To prevent potential multicollinearity between adaptation and mitigation finance, we estimated the models for each variable independently.

[Insert Table 3.2 here]

GDP growth is negatively related to adaptation finance (-0.0793) but positively associated with mitigation finance (0.1105), implying that faster-growing economies might receive more mitigation-related funding. Trade openness shows negative correlation coefficients with both adaptation and mitigation finance, suggesting that more globally

integrated economies may receive less external climate funding. The PPI has a weak correlation with all variables, indicating limited interaction with FDI-related activity. The variable *Ln Jobs*, used solely in the robustness analysis and not in the baseline regressions, is highly related to *Ln FDI* (correlation coefficient = 0.9646). This strong correlation confirms its validity as an alternative proxy for the scale of investment projects, since both capital expenditure and job creation reflect the magnitude and economic footprint of a given greenfield FDI project.

3.4 Methodology

3.4.1 Baseline model

Our panel structure is determined by the firm (*f*) undertaking the green FDI in the host country (*i*), the year (*t*), and the sector (*k*). We follow the general framework of Gu and Hale (2023), adding two modifications. First, while their model is bilateral and includes both source- and destination-country variables, our approach focuses only on the destination country because of the nature of the variable of interest, climate finance. Second, although Gu and Hale (2023) include firm-level control variables, our dataset does not permit this due to limited financial disclosure, particularly for privately held firms. Instead, we employ a comprehensive set of fixed effects to account for unobserved heterogeneity. We estimate the following equation:

$$\begin{aligned}
 FDI_{fkit} = & \alpha_f + \gamma_i + \delta_k + \theta_t + \lambda_{ft} + \beta_1 MI_{it-1} + \beta_2 AD_{it-1} + \beta_3 GDPG_{it-1} \\
 & + \beta_4 TGDP_{it-1} + \beta_5 PPI_{it-1} + e_{it}
 \end{aligned} \tag{3.1}$$

where FDI_{fkit} denotes the log of total capital investment made by firm (*f*) in sector (*k*) of destination country (*i*) during year (*t*). *MI* represents mitigation climate finance received by country *i*, measured as $\log(1 + \text{mitigation finance in USD})$. *AD* refers to adaptation climate finance, also measured as $\log(1 + \text{adaptation finance in USD})$. *GDPG* denotes the real GDP growth rate of the destination country, capturing overall macroeconomic performance and market potential. *TGDP* is the trade-to-GDP ratio, serving as a proxy for economic openness and integration into global value chains. *PPI* stands for the Producer Price Index, reflecting supply-side inflationary pressures that influence firms' production costs and investment decisions. The $\log(1 + x)$ transformation is applied to all variables containing financial flows to address skewness and accommodate zero values. The model includes five types of fixed effects α_f , γ_i , δ_k , θ_t and λ_{ft} . Firm fixed effects (α_f) capturing time-invariant characteristics

specific to each firm (e.g. ownership structure or internal capacity). Country fixed effects (γ_i) account for persistent host-country characteristics, such as institutional quality or infrastructure. Sector fixed effects (δ_k) absorb unobserved sectoral heterogeneity, while year fixed effects (θ_t) control for global shocks and time trends common to all countries and sectors.

Finally, firm-time fixed effects (λ_{ft})

All right-hand-side variables are lagged by one year to reduce simultaneity bias and reverse causality concerns and to allow time for the effects of climate finance to materialise in the host economy. Standard errors are two-way clustered (Gu and Hale 2023) by firm and country to account for within-group correlation and heteroskedasticity.

The coefficients of interest are β_1 and β_2 , which measure the effect of lagged adaptation and mitigation climate finance on FDI. Based on hypothesis 1, the coefficient on mitigation climate finance is expected to be positive and significant ($\beta_1 > 0$), reflecting the role of mitigation funding in encouraging environmentally focused investments through incentives for adopting low-carbon technologies and policy-driven market opportunities. Conversely, the coefficient on adaptation climate finance is hypothesised to be statistically insignificant ($\beta_2 = 0$), as adaptation funding, although essential for resilience-building, is less directly connected to capital-intensive, technology-driven FDI (hypothesis 2). When both types of climate finance are included in the model, their differing objectives suggest that mitigation finance will exert a more substantial marginal impact on greenfield investment than adaptation finance. Furthermore, the coefficients on the macroeconomic control variables, such as GDP growth and trade openness, are expected to have positive signs, indicating that favourable economic conditions further attract environmentally focused FDI. We hypothesise a negative relationship between PPI and FDI, as higher producer price inflation signals rising input costs and macroeconomic instability, which may discourage capital-intensive foreign investment by increasing production costs and reducing expected profitability.

3.5 Empirical results

3.5.1 Baseline results

Four specifications of equation (1) are estimated and reported in Table 3.3. Column (1) includes mitigation finance as the sole explanatory variable. The coefficient is positive and statistically significant at the 5% level (0.017), indicating that a one per cent increase in mitigation finance is associated with a 0.017 per cent increase in the size of greenfield FDI projects, holding other factors constant. This suggests that mitigation-focused climate finance directly supports firm-level investment in environmental technologies. Column (2) focuses exclusively on adaptation finance and reports a negative but statistically insignificant coefficient, implying that adaptation-related funding does not have a measurable effect on cross-border firm-level investment. While adaptation finance is important for strengthening resilience and institutional capacity, it may not directly incentivise capital-intensive, technology-orientated FDI.

Column (3) incorporates both mitigation and adaptation finance alongside macroeconomic controls, including GDP growth, trade openness, and producer price inflation (PPI). The coefficient on mitigation finance remains positive and statistically significant, confirming the robustness of the baseline relationship. Adaptation finance continues to be insignificant. Among the controls, GDP growth is positive and weakly significant, suggesting that stronger macroeconomic conditions modestly encourage foreign investment. Trade openness is also positive and significant, consistent with the view that more integrated economies attract greater foreign capital through improved market access and participation in global value chains. In contrast, PPI is positive but statistically insignificant, indicating that short-term input cost pressures or producer price fluctuations do not materially influence firms' investment decisions in this context.

Column (4) excludes the macroeconomic controls and focuses only on the core climate finance variables. The coefficient on mitigation finance remains positive and statistically significant at 5% level, demonstrating that the effect is not driven by the inclusion of controls. Adaptation finance again shows no significant relationship with FDI. The stability of the mitigation coefficient across specifications highlights the consistency of its impact. Across all models, the R-squared values are high (approximately 0.71), indicating strong explanatory power. Overall, the results provide robust evidence that mitigation finance plays an important role in attracting environmental technology FDI, whereas adaptation finance appears to support resilience-building rather than directly stimulating capital-intensive private investment.

[Insert Table 3.3 here]

3.6 Robustness checks

To assess the robustness of the baseline results, several additional analyses are conducted. These include alternative measures of investment outcomes, interaction specifications, and IV-GMM estimation. Across specifications, the main finding that mitigation finance is positively associated with environmental-technology investment remains qualitatively unchanged. Overall, these results provide further support for the baseline findings and suggest that the estimated effects are not driven by model specification or estimation approach.

3.6.1 Addressing endogeneity

Endogeneity is a concern in empirical analyses of FDI, arising when explanatory variables are correlated with the error term. Such correlation may result from omitted variable bias, measurement error, or simultaneity, leading to biased estimates and invalid inference. In the context of climate finance and FDI, reverse causality may arise if higher levels of investment influence the allocation of climate finance, while unobserved policy or macroeconomic conditions may jointly affect both climate finance and investment outcomes. To address these concerns, the chapter estimates a static instrumental-variables Generalised Method of Moments (IV-GMM) model following Hansen (1982). Unlike dynamic panel GMM estimators, the specification does not include a lagged dependent variable and therefore does not model dynamic adjustment. Instead, the objective is to address potential simultaneity and omitted-variable bias while preserving the high-dimensional fixed-effects structure. Estimation is implemented within a static structural equation framework, with GMM used to obtain efficient estimates under heteroskedasticity and clustered error structures rather than to exploit dynamic panel identification (Lv et al. 2024; Asimakopoulos et al. 2023).

Following this approach, climate finance variables are treated as endogenous to account for potential simultaneity between investment decisions and climate-related financial support. In addition, macroeconomic controls, namely GDP growth, trade openness, and producer price inflation, are treated as potentially endogenous because they may be jointly determined with investment activity in policy-responsive and rapidly adjusting economies, making strict exogeneity assumptions difficult to justify. Endogeneity is addressed using internal instruments constructed from the second and third lags of these variables. The validity of these instruments relies on the assumption that historical values are correlated with current explanatory variables

but do not directly affect contemporaneous investment outcomes beyond their influence through current values. Lagged climate finance is expected to predict current climate finance because climate allocations typically follow multi-year funding commitments and institutional planning cycles. This approach mitigates endogeneity concerns without relying on external instruments, which are often difficult to identify in cross-country investment settings (see Giu et al. 2023).

Instrument validity is assessed using standard IV diagnostics appropriate for static IV-GMM estimation. These include the Kleibergen–Paap LM statistic for under-identification, the Kleibergen–Paap Wald F-statistic for weak instruments, which is robust to clustering, and the Hansen J test of over-identifying restrictions. Together, these tests provide evidence on both the relevance and exogeneity of the instruments employed. The specification further includes a rich set of fixed effects, capturing firm, year, country, sector, and firm-year variation, to control for unobserved heterogeneity across multiple dimensions. Standard errors are two-way clustered at the firm and destination-country levels to account for heteroskedasticity and within-cluster correlation.

Table 3.4 reports static GMM estimates for the log of greenfield FDI, with all right-hand-side variables lagged one year and a rich set of fixed effects. Columns (1) to (3) differ by whether mitigation finance, adaptation finance, or both are included. In column (1), the coefficient on *Ln Mitigation* is 0.080 and positively significant at the 1 per cent level. Interpreted as an elasticity, this implies that a 1 per cent increase in mitigation finance is associated with about a 0.08 per cent increase in FDI, holding constant the macro controls and fixed effects. In column (3), where mitigation and adaptation enter together, the mitigation coefficient remains positive and significant at the 1 per cent level (0.070), indicating that the mitigation result is not driven by omitted adaptation finance and is robust to including both objectives in the same specification. By contrast, adaptation finance is not statistically significant in the IV specifications in both column (2) and column (3). This suggests that, after accounting for endogeneity using lag-based instruments and controlling for fixed effects, there is no evidence that adaptation finance directly raises FDI in environmental-technology projects in your dataset. The macro controls, GDP growth, trade openness, and PPI, are not statistically significant across the specifications. Their coefficients are small in magnitude, suggesting that, conditional on the fixed effects structure, short-run variation in these macro indicators does not explain firm-level FDI in this setting.

Turning to diagnostics, the Kleibergen–Paap rk LM p-values around 0.06 to 0.09 and 0.08 provide marginal evidence against under-identification at the 10 per cent level, meaning

instrument relevance is present but not especially strong. The Hansen J test values reported (0.791, 0.271, 0.553) indicate that the over-identifying restrictions are not rejected, which supports the joint validity of the instrument set.

[Insert Table 3.4 here]

3.6.2 Jobs created through FDI as an alternative investment measure

To verify the robustness of the baseline findings, Table 3.5 re-estimates the relationship between climate finance and greenfield FDI using an alternative dependent variable: the natural logarithm of employment generated by each FDI project. Following King et al. (2021), this variable acts as an alternative proxy for investment scale, capturing the labour dimension of foreign investment. The explanatory variables, adaptation and mitigation climate finance, remain in their log-transformed and lagged form, and the same high-dimensional fixed effects structure is maintained across all four specifications.

Consistent with the baseline results, mitigation climate finance remains positively associated with the scale of greenfield FDI, as shown by job creation. The coefficient for mitigation finance is positive and statistically significant across all models where it is included, ranging from 0.009 to 0.010. These results indicate that a one per cent increase in mitigation finance is associated with approximately a 0.009 to 0.010 per cent rise in FDI-related employment. Although the effect size is small, the consistent significance across different models reinforces the conclusion that mitigation-focused climate funding helps promote the growth of environmentally relevant foreign investments. Meanwhile, adaptation climate finance continues to show no statistically significant connection with FDI employment, even after accounting for macroeconomic variables. This further supports the earlier inference that adaptation finance, while crucial for enhancing resilience to climate related risks, may not directly influence the scale of firm-level investment decisions, particularly in projects that are technology- or employment-intensive.

Additionally, the control variables, GDP growth, remain positively and significantly related to FDI, indicating that expanding economies are more likely to attract job-creating foreign investment. Trade openness also shows a small but consistent positive effect, while the PPI does not exhibit a significant relationship in any of the specifications.

[Insert Table 3.5 here]

3.6.3 Climate finance before and after the Paris climate agreement

Table 3.6 incorporates interaction terms to assess whether the 2015 Paris Agreement influenced the responsiveness of FDI to climate finance directed towards mitigation and adaptation objectives. The coefficient on mitigation finance remains positive and statistically significant, while the interaction term (Mitigation Finance \times Paris Agreement) is insignificant. This suggests that the Paris Agreement did not materially alter the strength of the relationship between mitigation finance and FDI. Similarly, the interaction between adaptation finance and the Agreement is also statistically insignificant. In summary, these findings indicate that the impact of climate finance on environmentally friendly FDI has remained broadly stable before and after the Paris Agreement. One possible explanation is that the Paris Agreement, while symbolically significant (Cichocka and Mitchell 2022; Islam 2022), did not immediately transform the underlying financial mechanisms or investment incentives driving green capital flows. Many of its commitments rely on voluntary national contributions and gradual implementation, which may explain the limited shift in investment responsiveness observed in the data. The results further imply that mitigation finance remains more effective at catalysing green FDI. In contrast, adaptation finance exhibits weaker effects across the sample.

[Insert Table 3.6 here]

3.6.4 Interaction between mitigation and adaptation climate finance

As an additional robustness check, the baseline specification was extended to include an interaction term between mitigation and adaptation climate finance to account for potential overlap between the two financing objectives. The results, reported in Table 3.7, show that mitigation climate finance remains positively and significantly associated with environmental-technology investment, while adaptation climate finance remains statistically insignificant. Economically, the estimates suggest that a 1% increase in mitigation climate finance is associated with approximately a 0.026% increase in investment expenditure. The interaction term is negative but statistically insignificant, indicating limited evidence that adaptation and mitigation finance jointly influence investment outcomes. The findings suggest that the baseline results are not driven by treating the two forms of climate finance as separate mechanisms.

[Insert Table 3.7 here]

3.7 Conclusion

This study investigates the impact of climate finance, focusing on both adaptation and mitigation objectives, on attracting FDI into environmental technologies. Using a unique dataset of firm-level greenfield FDI projects in EMDEs from 2003 to 2021, the analysis offers empirical evidence on how different types of climate finance influence firm-level investment patterns in greenfield capital projects. The findings indicate that mitigation climate finance is positively and significantly associated with investment in environmental technologies. Conversely, adaptation finance shows no statistically significant relationship with greenfield FDI. These results emphasise the importance of differentiating between mitigation and adaptation finance when evaluating the role of climate-related financial flows in encouraging sustainable investment. While mitigation finance appears to reduce perceived investment risks and facilitate firms' transitions to low-carbon activities, adaptation finance, primarily targeted at resilience-building and public infrastructure, does not directly promote firm-level investment in capital-intensive green technologies.

The study makes several contributions to the existing literature. It disaggregates climate finance into mitigation and adaptation categories at the firm-country level, enabling a more detailed understanding of how climate-related funding influences foreign investment decisions. Previous research often treats climate finance as an aggregated variable or focuses on macro-level outcomes. By adopting a firm-level analytical approach and distinguishing between the two types of finance, the study fills a critical gap in the literature. It offers a more nuanced perspective on how targeted financial flows impact private sector investment behaviour. Additionally, the analysis highlights the mechanisms through which mitigation finance supports FDI in environmental technology, specifically by reducing investment risk, enhancing regulatory incentives, and signalling long-term policy commitment to decarbonisation. These channels can boost investor confidence and promote capital allocation to greenfield projects, thereby contributing to the broader discussion on sustainable finance and low-carbon development.

The policy implications of the findings are clear. Governments in EMDEs aiming to attract foreign investment in low-carbon and environmental technologies should prioritise mitigation-focused climate finance. Enhancing regulatory frameworks, implementing targeted fiscal incentives, and increasing institutional capacity are likely to improve the investment

environment and support national climate targets. Support from international donors and development finance institutions can be more effectively allocated when the different investment-related outcomes of mitigation and adaptation finance are appropriately recognised. Although adaptation finance does not directly boost FDI in environmental technologies, it plays a vital role in improving national resilience and economic stability. Complementary policies, such as improvements in infrastructure, governance, and climate related management systems, may be required to enhance its indirect influence on investment flows. Future research could explore the interaction between mitigation and adaptation finance and their joint impact on innovation, technology adoption, and firm competitiveness. In addition, further investigation into the institutional conditions under which climate finance is most effective would be valuable for both academics and policymakers.

In summary, the study emphasises the varied influence of adaptation and mitigation climate finance on greenfield FDI in environmental technologies. By examining the different roles of these financial flows, the analysis offers both empirical and conceptual clarity on how climate finance can be more effectively aligned with investment-driven sustainable development strategies.

Table 3-1 Descriptive statistics

Variable	N	SD	Mean	Min	Max
FDI	53078	1.041	0.241	0	6.544
Mitigation	53077	2.502	4.785	0	7.972
Adaptation	53077	2.781	2.879	0	7.090
GDP growth	53077	3.440	4.735	-3.276	10.341
Trade	53075	31.792	64.728	24.685	138.314
PPI	52908	5.463	4.232	-3.317	17.830
Jobs	53078	0.652	0.164	0	2.833

Notes: FDI, Adaptation, and Mitigation are calculated as $\log(1 + \text{FDI})$, $\log(1 + \text{adaptation finance})$, and $\log(1 + \text{mitigation finance})$, respectively. GDP growth refers to the annual percentage change in real GDP, while the trade-to-GDP ratio represents the sum of exports and imports of goods and services as a percentage of GDP. PPI is the Producer Price Index. The sample comprises 1,931 firms across 110 countries, spanning the period from 2003 to 2021.

Table 3-2 Correlation Matrix

Variable	1	2	3	4	5	6	7
1 FDI	1.0000						
2 Adaptation	0.0558*	1.0000					
3 Mitigation	0.0434*	0.6283*	1.0000				
4 GDP growth	-0.0224*	-0.0793*	0.1105*	1.0000			
5 Trade	-0.0055	-0.1930*	-0.3094*	0.0156*	1.0000		
6 PPI	-0.0014	-0.0418*	-0.0373*	-0.0010	-0.0998*	1.0000	
7 Jobs	0.9646	0.0567*	0.0470*	-0.0215*	-0.0080	-0.0023	1.000

Notes: This table reports the pairwise correlation coefficients among the main variables used in the analysis. FDI denotes the log of one plus firms' FDI; Adaptation and Mitigation denote the log of one plus adaptation finance and mitigation finance, respectively. GDP growth is the annual percentage change in real GDP; Trade is the ratio of total trade (exports plus imports) to GDP; PPI is the Producer Price Index; and Ln Jobs is the log of one plus firm-level employment. The sample comprises 1,931 firms across 110 countries from 2003 to 2021.

Table 3-3 Baseline results

	Dependent variable: FDI			
	(1)	(2)	(3)	(4)
Mitigation	0.017** (0.007)		0.019** (0.007)	0.019** (0.007)
Adaptation		-0.005 (0.007)	-0.008 (0.008)	-0.006 (0.008)
GDP Growth	0.005* (0.003)	0.005* (0.003)	0.005* (0.003)	
Trade	0.001* (0.000)	0.001* (0.000)	0.001* (0.000)	
PPI	0.003 (0.003)	0.004 (0.003)	0.003 (0.003)	
Constant	0.085 (0.054)	0.176*** (0.040)	0.096* (0.055)	0.177*** (0.035)
Firm * year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
<i>N</i>	50102	50102	50102	50273
R-squared	0.713	0.712	0.713	0.713

Notes: FDI, Adaptation, and Mitigation climate finance are calculated as $\log(1 + \text{FDI})$, $\log(1 + \text{Adaptation finance})$, and $\log(1 + \text{Mitigation finance})$, respectively. All the right-hand-side variables are lagged by one year. The model employs high-dimensional fixed effects to account for the extensive number of fixed effects in the regression. Unbalanced firm–country–year panel covering 2003–2021. Robust standard errors, clustered two ways (by firm and by country), are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3-4 GMM estimation result

	Dependent variable: FDI		
	(1)	(2)	(3)
Mitigation	0.080*** (0.022)		0.070*** (0.021)
Adaptation		-0.016 (0.013)	-0.024 (0.015)
GDP Growth	-0.000 (0.021)	-0.007 (0.022)	-0.008 (0.021)
Trade	0.002 (0.001)	0.002 (0.011)	0.002 (0.001)
PPI	0.006 (0.007)	0.010 (0.008)	0.008 (0.007)
Firm * year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Kleibergen-Paap rk LM statistic-P-Value	0.06	0.09	0.08
Hansen J. test	0.791	0.271	0.553

Notes: The dependent variable is the natural logarithm of capital expenditure, $\ln(1 + \text{FDI})$. Climate finance variables are measured as the natural logarithm of one plus mitigation or adaptation finance. All explanatory variables are lagged by one year. The model is a static structural specification estimated using instrumental variables Generalised Method of Moments (IV-GMM). The specification includes firm, firm–year, country, year, and sector fixed effects to account for multi-dimensional unobserved heterogeneity. Standard errors are two-way clustered at the firm and destination-country levels. Potentially endogenous regressors are instrumented using their second and third lags. Instrument relevance and validity are assessed using the Kleibergen–Paap LM test for under-identification and the Hansen J test for over-identifying restrictions. As the model does not include a lagged dependent variable, serial-correlation tests such as AR(1) and AR(2) are not applicable. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3-5 Alternative measure of cross-border investments

	Dependent variable: Jobs			
	(1)	(2)	(3)	(4)
Mitigation	0.009*		0.010**	0.010**
	(0.004)		(0.005)	(0.005)
Adaptation		-0.006	-0.007	-0.008
		(0.005)	(0.005)	(0.005)
GDP Growth	0.003**	0.004**		0.004**
	(0.002)	(0.002)		(0.002)
Trade	0.000*	0.001*		0.001**
	(0.000)	(0.000)		(0.000)
PPI	0.001	0.002		0.002
	(0.002)	(0.002)		(0.001)
Constant	0.077**	0.130***	0.142***	0.088***
	(0.033)	(0.022)	(0.021)	(0.032)
Firm * year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
<i>N</i>	50102	50102	50273	50102
R-squared	0.725	0.725	0.725	0.725

Notes: The dependent variable, jobs, refers to the number of jobs created by each greenfield investment project, as reported in the original dataset (jobs created). It is measured as the natural logarithm of one plus the number of jobs: $\log(1 + \text{jobs created})$. Adaptation and mitigation climate finance are expressed in log-transformed form: $\log(1 + \text{adaptation finance})$ and $\log(1 + \text{mitigation finance})$, respectively. All explanatory variables are lagged by one year. The model includes firm, country, year, sector, and firm-country fixed effects. Robust standard errors clustered by firm and country are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3-6 Climate finance before and after the Paris climate agreement

	Dependent Variable: FDI	
	(1)	(2)
Mitigation * PA	-0.005 (0.010)	
Adaptation * PA		-0.001 (0.013)
Mitigation	0.019*** (0.007)	
Adaptation		-0.004 (0.009)
GDP Growth	0.005* (0.003)	0.005* (0.003)
Trade	0.001* (0.000)	0.001* (0.000)
PPI	0.003 (0.003)	0.003 (0.003)
Constant	0.086 (0.054)	0.176*** (0.039)
Firm * year FE	Yes	Yes
Firm FE	Yes	Yes
Country FE	Yes	Yes
Year FE	Yes	Yes
Sector FE	Yes	Yes
<i>N</i>	50102	50102
R-squared	0.713	0.712

Notes: This table presents the interaction effects between mitigation and adaptation climate finance and the Post-Paris Agreement (PA). The dependent variable is log-transformed capital investment, calculated as $\log(1 + \text{FDI})$. Mitigation and adaptation finance are also expressed as $\log(1 + \text{value})$. GDP growth, trade-to-GDP ratio, and producer price index (PPI) are included as additional control variables. All right-hand-side variables are lagged by one year. The regressions include firm-year, firm, country, sector, and year fixed effects. Standard errors are two-way clustered by firm and country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3-7 Interaction between mitigation and adaptation climate finance

	Dependent Variable: FDI (1)
Mitigation	0.026** (0.013)
Adaptation	-0.004 (0.031)
Mitigation * Adaptation	-0.001 (0.003)
GDP Growth	0.010* (0.006)
Trade	0.002 (0.001)
PPI	0.002 (0.003)
Constant	-0.029 (0.110)
Firm * year FE	Yes
Firm FE	Yes
Country FE	Yes
Year FE	Yes
Sector FE	Yes
<i>N</i>	39,853
R-squared	0.736

Notes: This table presents the interaction effects between mitigation and adaptation climate finance. The dependent variable is log-transformed capital investment, calculated as $\log(1 + \text{FDI})$. Mitigation and adaptation finance are also expressed as $\log(1 + \text{value})$. GDP growth, trade-to-GDP ratio, and producer price index (PPI) are included as additional control variables. All right-hand-side variables are lagged by one year. The regressions include firm-year, firm, country, sector, and year fixed effects. Standard errors are two-way clustered by firm and country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

4 Firms' ESG performance and greenfield foreign direct investment

4.1 Introduction

The strategic importance of Environmental, Social, and Governance (ESG) performance has shifted from a peripheral concern to a core element of corporate strategy, shaping how firms compete, communicate, and expand internationally (UNCTAD 2020; Kandpal et al. 2024; Carreno 2024). ESG has moved beyond its ethical or reputational origins to become a strategic imperative that affects financial performance, investor trust, and exposure to regulatory and market risks (Krueger et al. 2020; Singhanian and Saini 2023; Carreno 2024). In parallel, outward FDI through greenfield projects remains a critical pathway for market entry, capability building, and long-term global competitiveness (Qiu and Wang 2011).

Although ESG and greenfield FDI have each been widely studied (Duanmou 2014; Friede et al. 2015; King et al. 2021; Valacchi et al. 2021), research at their intersection is limited. Recent firm-level work suggests that ESG performance can influence international investment, partly by easing financing constraints and supporting innovation (Khurram et al. 2024; Wang et al. 2024; Yuan et al. 2025). However, the existing literature largely relies on proxies of foreign investment or aggregate FDI, with limited attention to the actual monetary value of FDI or to greenfield projects specifically. Greenfield investments involve higher risk, longer commitment horizons, and greater reputational exposure, so the ESG-investment link may be particularly salient. This study addresses that gap by examining how ESG performance relates to the FDI decisions of North American firms undertaking outward greenfield FDI. The focus is timely given the historical responsibility of the United States and Canada as large cumulative emitters, the United States' leading role in outward FDI (UNCTAD 2023), and prominent positions in sustainable finance (IEA 2023; Climate Bonds Initiative 2024). Early and intensive industrialisation, sustained growth, and high energy use heighten the case for

leadership in climate mitigation, international adaptation, and more sustainable development pathways.

Greenfield FDI is highly capital-intensive because it requires establishing new operations from the ground up (Ashraf et al. 2017). Implementation demands substantial financing and careful navigation of host-country regulations, including environmental and social obligations. Domestic slowdowns and rising protectionism add to the challenge, as security reviews, environmental rules, and consumer protection regimes may act as hidden barriers to investment (Qiu and Wang 2011; Ashraf et al. 2017; De Noni et al. 2024; Yuan et al. 2025). Firms with credible ESG credentials can obtain easier market access, better financing conditions, lower reputational risk, and stronger stakeholder support (Eccles et al. 2014; Gillan et al. 2021; Wang et al. 2024; Yuan et al. 2025). As more countries adopt ESG-related regulation and guidance, such as the EU's Sustainable Finance Disclosure Regulation (SFDR), incentives to improve transparency and standards are increasing (Drempetic et al. 2020; Gillan et al. 2021; Zhai et al. 2022; Yang et al. 2024). At the same time, concerns about greenwashing remain: some firms may appear sustainable while providing misleading claims, which risks undermining trust (Furlow 2010; Delmas and Burbano 2011).

The growing empirical literature links ESG initiatives to firm outcomes, including financing access, alignment with international standards, and competitiveness (Ng et al. 2020; Gholami 2022; Bilyay-Erdogan et al. 2024). These findings can be viewed through competing perspectives. Portfolio theory and the classical view of the firm warn that ESG may constrain diversification and raise costs, potentially lowering returns (Chegut et al. 2011). In contrast, the social theory of the firm predicts that ESG can improve performance through stakeholder trust, better information, and stronger long-term positioning (El Goul et al. 2011; Cheng et al. 2014). Recent empirical studies support this latter view, showing that strong ESG performance enhances firm competitiveness, financial resilience, and international expansion by building stakeholder trust and reducing risk (Friede et al. 2015; Gillan et al. 2021; Wang et al. 2024; Yuan et al. 2025).

We bring additional evidence to this debate by testing whether stronger ESG performance is associated with greater outward greenfield FDI capital expenditure at the firm–country level and by exploring financial conditions under which this association is stronger. We assemble a merged dataset from fDi Markets, Refinitiv, and Compustat covering 1,207 North American listed firms from 2003 to 2023. The sample contains 150,045 firm–country–year observations and 7,145 unique firm–country identifiers. FDI in the host country is the main outcome. The key explanatory variable is the ESG score of firms, lagged by one year; all

other right-hand-side variables are also lagged by one year to reduce simultaneity concerns. The baseline specification includes firm–country fixed effects to capture time-invariant bilateral heterogeneity and country-by-year fixed effects to absorb destination-country shocks. Standard errors are clustered at the firm–country level.

The baseline estimates show that higher ESG performance is linked to increased outward FDI capital expenditure. We then examine two main channels through which this relationship operates: financial constraints and internal financial strength. Using the Whited–Wu (WW) index to divide the sample, we find that the positive ESG–FDI relationship is concentrated among financially unconstrained firms, while it weakens for firms facing tight financing frictions. Internal financial strength also amplifies the effect of ESG on outward investment: interaction models indicate that the marginal impact of ESG is larger for firms with stronger cash flow, higher profitability (EBITDA/Assets), and faster asset turnover (Sales/Assets), suggesting that financial slack enables firms to leverage ESG commitments as part of their internationalisation strategy. We further investigate the role of innovation. Although R&D intensity is itself positively associated with outward investment, its interaction with ESG is negative, indicating that ESG and innovation compete for firms' financial and managerial resources.

To address potential endogeneity, we employ an instrumental variables (two-stage least squares) approach. The instrument performs strongly in the first stage, and ESG remains positive and significant in the second stage, confirming the robustness of the results. As an additional robustness check, we use an alternative outcome variable that proxies international investment through the number of jobs created in each greenfield project. Across all specifications, with and without the full set of controls and including firm–country and country-year fixed effects, the coefficient on ESG remains positive and statistically significant. This confirms that the main finding is not sensitive to how investment is measured and that ESG-intensive firms tend to undertake projects that are larger in both capital and employment terms.

This study contributes to the literature on ESG and corporate international investment in three main ways. First, it establishes a robust positive link between ESG performance and outward greenfield FDI at the intensive margin, showing that firms with stronger ESG engagement commit larger amounts of capital to new foreign projects. Second, it uncovers the mechanisms that condition this relationship: the effect of ESG is concentrated among financially unconstrained firms and is amplified by internal financial strength, suggesting that financial slack enables firms to translate sustainability commitments into outward investment. Third, it reveals a trade-off between ESG and innovation. While R&D intensity independently

supports outward investment, it dampens the marginal impact of ESG, indicating that these two strategic priorities compete for limited financial and managerial resources. By combining rich project-level data aggregated to the firm–country–year level with interaction models and an instrumental variable strategy, the study provides a rigorous empirical foundation for understanding how ESG influences the internationalisation behaviour of firms.

This chapter also complements Chapters 2 and 3 by shifting the focus from country-level climate finance and project-level environmental investment to firm-level sustainability performance. While Chapters 2 and 3 examine how climate-related financial conditions shape foreign investment outcomes at aggregate and project levels, this chapter investigates whether firms' own sustainability capabilities influence international investment decisions.

The remainder of this study is organised as follows. Section 4.2 reviews the background and develops testable hypotheses; Section 4.3 documents the data sources and sample construction; Section 4.4 sets out the identification strategy and empirical model; Section 4.5 presents the findings; Section 4.6 offers robustness checks; and Section 4.7 concludes.

4.2 Research background and hypothesis development

4.2.1 Research background

Sustainability issues, central to ESG, have become key factors shaping corporate strategy, risk management, and international investment decisions in recent years (Crifo et al. 2015; UNCTAD's World Investment Reports 2020; 2023; Khurram et al. 2024). Many stakeholders, such as investors, regulators, and business partners, rely on ESG ratings, which are quantitative assessments of a company's non-financial performance, to evaluate sustainability practices and governance quality (Singhania and Saini 2023). The extensive literature on ESG and its connection to firm value, access to capital, and financial performance is well-established, yet the role of ESG in guiding outward greenfield FDI choices, particularly among North American firms, remains underexplored. Greenfield FDI, involving the creation of new subsidiaries, plants, or facilities in foreign markets, is characterised by high capital requirements, lengthy payback periods, and significant regulatory and operational risks (Qiu & Wang, 2011). Such investments can serve as strategies for market entry, technology diffusion, and long-term internationalisation for North American MNEs expanding abroad. However, these investments occur in countries with varying institutional qualities, high stakeholder scrutiny, and where legitimacy must be established (Qiu and Wang 2011). In these contexts, a firm's ESG performance can be viewed as a crucial non-market asset, signalling its commitment to

responsible business conduct, building reputational capital, and earning the trust of host-country stakeholders (Singhania and Saini 2023; Wang et al. 2024).

The following is an overview of the relevance of ESG in this context as proposed by institutional theory: firms that expand into new environments must comply with the expectations and norms of the host context to gain legitimacy (Meyer and Rowan 1977; Kostova and Zaheer 1999). Given that U.S. and Canadian firms face relatively strict ESG disclosure requirements (Singhania and Saini 2023), it is possible that they transport this institutional ownership into their outward FDI decisions using ESG performance as a legitimacy mechanism. Research evidence also suggests that ESG is linked with better financial and investment results. Friede et al. (2015), in a meta-analysis of over 2,000 studies, reveal that around 90% of the studies reported a non-negative relationship between ESG performance and corporate financial performance, while most of them reported positive effects. Flammer (2021) also shows that credible ESG practices, such as the issuance of certified green bonds, enhance the environmental performance of firms and increase their appeal to long-term investors. This suggests that ESG-aligned firms may not only be more financially robust but also more competitive as international investment vehicles.

At the macro level, the UNCTAD (2020; 2023) reports show that sustainability concerns are becoming increasingly important in the context of global capital flows. The 2023 World Investment Report also highlights a significant increase in FDI in ESG-aligned industries, including renewable energy, green infrastructure, and sustainable agriculture. These trends indicate that there is a shift in how MNEs, especially from the Global North, are adjusting their international investment strategies to address global sustainability challenges. Although ESG is becoming a buzzword in both corporate and policy circles, there is limited research on the relationship between firm-level ESG performance and greenfield FDI. This study aims to fill this gap by examining whether ESG performance influences outward greenfield FDI and through which mechanisms this relationship operates. Building on the broader literature on ESG and internationalisation, the following section develops the theoretical channels underpinning this relationship,

4.2.2 Channels linking ESG performance to outward FDI

Firms' sustainability performance may influence international investment decisions through several interconnected mechanisms (Wang et al. 2024). Although outward FDI is traditionally explained by market opportunities, firm resources, and ownership advantages, ESG

performance may shape firms' ability and incentives to expand internationally by affecting financing conditions, reputation, and stakeholder relationships. This chapter focuses on three channels through which ESG performance may influence outward greenfield investment.

4.2.2.1 ESG performance and cost of capital

One mechanism through which ESG performance may influence outward investment is by improving firms' financing conditions. Greenfield foreign investment often requires substantial upfront expenditure and long investment horizons, making access to finance particularly important (Gorg 2000). Firms with stronger ESG performance may experience lower financing costs because sustainability practices reduce information asymmetry, strengthen transparency, and lower perceived investment risk (Maruyama and Wu 2015; Kong 2023; Bilyay-Erdogan et al. 2024). Investors and lenders may therefore view highly rated ESG firms as more stable and less exposed to environmental, regulatory, and governance-related uncertainties. Improved access to external finance and lower capital costs may enable firms to undertake larger and more capital-intensive international investments (Wang et al. 2024). Under this channel, ESG performance influences outward FDI by improving firms' financial capacity and reducing the cost of undertaking capital-intensive international expansion

4.2.2.2 ESG performance and reputational advantage

A second channel relates to corporate reputation and legitimacy. Investors, regulators, and consumers increasingly reward firms with stronger ESG performance, creating incentives for expansion into markets where sustainability considerations increasingly influence investment decisions. The literature suggests that ESG practices implemented in host countries can function as strategic mechanisms that reduce the liability of foreignness and support firms' internationalisation outcomes (Attig et al. 2016; Bondy and Starkey 2014). MNCs often incur social and institutional costs when entering foreign markets because of information asymmetry and legitimacy deficits (Maruyama and Wu 2015). In this context, proactive ESG engagement may help firms strengthen relationships with external stakeholders, enhance corporate legitimacy, and reduce uncertainty associated with operating abroad (Gorostidi-Martinez and Zhao, 2017; Pesque-Cela et al., 2023). These advantages can improve firms' ability to establish and expand foreign operations, thereby supporting outward investment decisions.

4.2.2.3 ESG performance and stakeholder pressure

A third mechanism operates through stakeholder expectations. Institutional investors, regulators, employees, and consumers increasingly incorporate sustainability considerations

into their evaluations of firm behaviour (Renneboog 2008). As a result, firms face growing pressure to align investment decisions with environmental and social objectives. Strong ESG performance may signal responsiveness to these expectations and strengthen firms' competitive positioning in foreign markets where sustainability standards are increasingly important (Lee et al. 2025; Maruyama and Wu 2015). At the same time, ESG engagement may facilitate access to strategic partnerships and reduce regulatory frictions in international operations (Jia 2026). Through this channel, ESG performance may improve firms' access to investment opportunities and strengthen incentives for international expansion.

4.2.3 Literature review and hypothesis development

4.2.3.1 ESG and outward greenfield FDI

A growing body of theoretical and empirical research suggests that ESG performance plays a significant role in shaping the international investment decisions of firms, particularly FDI (Khurram et al. 2024; Wang et al. 2024; Yuan et al. 2025). Greenfield investments, which involve the establishment of new operations abroad, are capital-intensive, reputationally sensitive, and institutionally complex (Qiu and Wang 2011; Duanmu 2014; King et al. 2021).

In this context, ESG ratings serve as signals of organisational commitment to transparency, responsible governance, and long-term sustainability, which are crucial for navigating unfamiliar regulatory environments and building stakeholder trust (Chan 2025). Although originally developed in the context of labour markets, signalling theory has since been applied to explain how high ESG scores act as credible, observable indicators of non-financial quality (Spence 1978; Flammer 2021), thereby reducing reputational risk and enhancing legitimacy in host countries. Institutional theory further supports this perspective by emphasising that ESG-aligned organisations are better positioned to adapt to institutional norms abroad, particularly in environments characterised by strong regulatory oversight and active civil society engagement (Kostova and Zaheer 1999). ESG performance, therefore, serves as a form of institutional compatibility, reducing the liability of foreignness and facilitating smoother market entry. Empirical studies also confirm the enabling role of ESG in FDI. Friede et al. (2015) show that firms with strong ESG performance achieve greater financial stability and profitability, which enhances their capacity to pursue large-scale international investments. UNCTAD (2023) highlights that sustainability-focused firms attract more cross-border capital, supported by regulatory incentives and evolving investor preferences. The trend is especially evident among North American firms, where ESG

disclosures often align with international standards, thereby strengthening attractiveness in foreign markets.

The literature also highlights the financial and reputational consequences of ESG disclosure. Crifo et al. (2015) and Broadstock et al. (2021) find asymmetric market reactions to ESG news, with negative disclosures triggering stronger investor responses. Eccles et al. (2014) and Gillan et al. (2021) show that strong ESG firms outperform their peers in long-term returns and stakeholder outcomes. Similarly, Gholami (2022) and Ferrero et al. (2016) identify ESG alignment as a source of improved financial performance and resilience. Research by Ng et al. (2020) and Asimakopoulos (2023) also supports the notion that ESG ratings reduce information asymmetry and improve financing terms, which is especially important for FDI. Finally, Bilyay-Erdogan et al. (2024) demonstrate that ESG improves investment efficiency by mitigating overinvestment and reducing financial frictions, benefits particularly relevant for cross-border investments. ESG, therefore, not only signals strategic reliability but also improves firms' capacity to mobilise capital, manage risk, and operate effectively in foreign markets. Accordingly, existing literature suggests that ESG performance strengthens a firm's reputational credibility, improves access to capital, and facilitates alignment with institutional expectations in host countries, factors that are particularly important for high-risk, capital-intensive greenfield FDI.

Yuan et al. (2025) develop a theoretical and empirical model linking ESG performance with firms' outward FDI intentions. Using data on Chinese A-share listed companies, the study finds a positive relationship between ESG performance and outward FDI willingness, highlighting that sustainability considerations enhance firms' propensity to expand internationally. Importantly, the analysis identifies two mechanisms through which ESG strengthens OFDI: by alleviating financing constraints and by lowering productivity thresholds that might otherwise restrict internationalisation. The heterogeneity analysis further shows that the ESG-outward FDI link is stronger for firms with advanced digital transformation, foreign equity participation, or operation in particular industries, underscoring that ESG impacts are not uniform across all firms. Moreover, better ESG performance is associated not only with a greater scale of outward FDI but also with binary marginal expansion, meaning that ESG enhances both the likelihood of undertaking outward FDI and the volume of investment projects. Similarly, Khurram et al. (2024) document that ESG enhances the positive influence of FDI on digital transformation, underscoring the strategic role of sustainability in promoting innovation and global expansion. In a study which is also closely related to ours, Wang et al.

(2024) examine Chinese firms and find that firms with stronger ESG performance not only participate more actively in FDI but also invest at a greater scale.

Consequently, the related studies suggest that ESG shapes firms' foreign strategies by relaxing financial frictions and enhancing their capacity to undertake large-scale foreign projects (Wang et al. 2024; Yuan et al. 2025). Prior research has largely concentrated on proxies of foreign investment, such as dummies or aggregate FDI, or on EMDEs, rather than examining greenfield projects and the monetary value of capital expenditure. Building on this literature, our study extends the analysis by focusing specifically on North American firms. Based on these theoretical and empirical insights, we therefore propose the following hypothesis.

Hypothesis 1: Higher ESG performance is associated with a greater scale of firms' outward greenfield investment.

4.2.3.2 Financial constraint

Corporate investment plays a vital role in shaping broader economic and capital market activity. While it is widely recognised that financial constraints influence the investment decisions of firms, there is ongoing debate about the nature of this relationship, and the evidence remains mixed (Cleary 2006). Financial constraints refer to a firm's limited ability to secure external financing for investment and operational needs. Lamont et al. (1997) succinctly stated that financial constraints arise when a firm is unable to fund all the projects it wishes to undertake. This may result from credit constraints, inability to borrow or issue equity, dependence on bank loans, illiquid assets, or similar financial limitations. These constraints can significantly influence strategic decisions, particularly in capital-intensive activities such as outward FDI. Buch (2014) finds that financial constraints shape firms' foreign investment decisions, especially among those most inclined to expand internationally. Cheng et al. (2014) argue that firms with superior performance face lower capital constraints due to the mitigation of agency problems and reduced information asymmetry.

Prior studies have demonstrated that enhanced ESG ratings can alleviate corporate financing constraints and improve access to funding opportunities for firms (Maaloul et al. 2023; Yuan et al. 2025). These ratings encourage greater trust between companies and their investors, restrain self-interested behaviour among corporate executives, and align executives' personal incentives with the strategic objectives of both the corporation and its shareholders (Lins et al. 2017). Furthermore, ESG ratings can reduce the risk of corporate stock price collapse and encourage investors to provide greater financial support, thereby enabling

corporations to obtain financing at lower interest rates (Maaloul et al. 2023). Moreover, studies have increasingly shown that ESG-oriented firms enjoy improved access to financial resources, as sustainability performance is positively associated with lower capital costs and more favourable financing terms (Chava 2014; Giese et al. 2019; Kruger 2015). ESG strength also reduces the level of risk to firms and enhances investor confidence, contributing to long-term value creation (Crifo et al. 2015; Friede et al. 2015; Flammer 2021). In line with these findings, we support that firms with greater financial flexibility are better equipped to convert ESG performance into increased foreign investment, whereas financially constrained firms may struggle to do so, as limited internal resources must be allocated toward sustaining ESG commitments; thus:

Hypothesis 2: The positive relationship between ESG performance and outward greenfield FDI is stronger for firms with lower financial constraints.

4.2.3.3 ESG and financial indicators

ESG engagement reflects the long-term commitment of a firm to stakeholder and sustainability objectives, yet the successful implementation of ESG-aligned strategies, such as international expansion, depends heavily on financial capacity. FDI is capital-intensive and typically involves delayed returns (King et al. 2021; Valacchi et al. 2021), making it particularly sensitive to the internal financial health of a firm. According to the pecking order theory (Myers and Majluf 1984), firms prefer internal funding sources, such as operating cash flow, over external capital due to concerns about information asymmetry and higher financing costs. Fazzari et al. (1988) likewise find that financially constrained firms rely more on internal cash flow to fund investment, suggesting that liquidity not only supports investment directly but also enables broader strategic initiatives. In support of this reasoning, Duchin et al. (2017) show that firms with higher internal liquidity are less constrained by financial frictions and more likely to pursue investment opportunities when they arise. Their findings reinforce the view that financial capacity enables firms to respond to strategic demands, particularly in settings characterised by risk, long-term commitment, and delayed returns.

Financial flexibility has also been recognised as a determinant of ESG engagement, as firms with stronger internal resources are better positioned to commit to sustainability-related projects. For instance, Li et al. (2025) show that financial flexibility, measured by net cash flow, is significantly and positively associated with ESG performance. These insights indicate that financial capacity can magnify the extent to which ESG commitments are translated into

substantive, resource-intensive investments, consistent with pecking order theory and the broader literature on financial constraints. Given this reasoning, the positive influence of ESG performance on outward greenfield FDI capital expenditure is expected to be moderated by financial capacity, such that the relationship is stronger among firms with greater liquidity, profitability, and operating cash flow.

Hypothesis 3a: Firms with higher operating cash flow is expected to intensify the positive link between ESG performance and outward greenfield FDI capital expenditure.

Hypothesis 3b: Firms with higher cash-to-asset ratios are expected to experience a stronger positive association between ESG performance and outward greenfield FDI capital expenditure.

Hypothesis 3c: Firms with higher EBITDA-to-asset ratios are expected to experience a stronger positive association between ESG performance and outward greenfield FDI capital expenditure.

4.2.3.4 ESG and innovation intensity

ESG activities and innovation both require substantial long-term resource commitments (Crifo et al. 2015; Drempetic et al. 2020; Dang et al. 2022). While ESG performance enhances access to financing and promotes international expansion, R&D activity absorbs considerable financial and managerial resources, potentially crowding out other investment initiatives (Lins et al. 2017; Asimakopoulos et al. 2023; Carreno 2024; Wang et al. 2024). Dang et al. (2022) emphasise that when firms face mandatory sustainability commitments - e.g., abatement or ESG spending, resource reallocation can constrain investment in other strategic domains such as innovation or capital expenditure. Recent research on ESG decoupling further highlights this tension. Sun et al. (2025) show that firms which overstate ESG (greenwashing) reduce R&D investment, consistent with resources being diverted to symbolic sustainability actions, while firms that understate ESG (brown washing) increase R&D investment as a strategic substitute. These effects are particularly strong among financially constrained and high-tech firms. This evidence supports our expectation that R&D intensity weakens the ESG–FDI relationship.

Hypothesis 4. The positive relationship between ESG performance and outward FDI is weaker for firms with higher R&D intensity.

4.3 Data and research design

4.3.1 Data sources

This study draws on three primary sources of firm-level data: fDi Markets for outward FDI project data, Refinitiv for environmental, social, and governance (ESG) performance metrics, and Compustat North America for financial information. The dataset structure is based on FDI data and integrates additional variables from multiple databases. The sample is restricted to firms headquartered in North America (the United States and Canada) over the period 2003 to 2023, allowing for the analysis of long-term trends and variations in corporate behaviour related to outward capital expenditures and greenfield FDI activities. The final dataset includes 1,207 firms and whose stock is publicly traded, with 7,145 unique firm–country identifiers and investment activity spanning 163 destination countries. The fDi Markets database contains a rich description of greenfield investment projects around the world, including information on the type of FDI, project location, industry sector, capital investment and job creation. At first, we collected data containing 70,918 daily project-level observations, which were then aggregated to annual observations at the firm–country level. The firm-country level observations capture firms' FDI activities across different sectors and regions and are the primary source of our dependent variable on outward FDI. The fDi Markets dataset has been used in global business and economic research (Duanmu 2014; Desbordes and Wei 2017; Castellani and Lavoratori 2020; King et al. 2021)

The Refinitiv database provides firm-level ESG performance information based on publicly available data. This dataset is divided into three main dimensions: The environmental dimension, which includes carbon emissions, renewable energy use, and waste management; the social dimension, which includes workforce diversity, employee training and human rights policies; and the governance dimension, which includes metrics on board independence, executive compensation and shareholder rights. Refinitiv's ESG scores are commonly employed in academic research to ensure that the data is consistent and comparable across firms (Asimakopoulos et al. 2023).

Financial data, including sales, revenue, profitability, assets, research and expenditure, and other financial ratios, are obtained from the Compustat North America database. These financial indicators are included to control for firms' ability to invest and financial policies while making outward FDI decisions. Our study concentrates on North American firms to ensure compatibility with the financial data and to use consistent ESG reporting standards.

4.3.2 Matching process

The matching of the ESG and financial datasets was performed using the CUSIP code, which is a standard identifier of publicly traded securities in the United States and Canada. The ESG and financial datasets were merged by matching firms with the same CUSIP code and retaining only those present in both datasets. This resulted in a combined sample of 6,260 firms with ESG and financial information between 2003 and 2023, although only 3,701 of these firms had at least one ESG observation during the study period. Because the fDi Markets dataset does not contain a common firm identifier such as the CUSIP code, it was not possible to directly link the FDI data to the Refinitiv–Compustat dataset. To this end, the FDI data were linked to the Refinitiv–Compustat database by company names. This matching was done using the VLOOKUP function in Excel, and where possible, company names were cleaned up to make them consistent. Some specific efforts were made in the data cleaning and transformation of the company names, which involved the following: removing or adding special characters and abbreviations (e.g., "Inc." or "Ltd."); trimming spaces and correcting formatting issues; adopting a single, consistent name for companies, for instance, where a company underwent name changes over time (Table 4.1). All partial matches were verified by hand to decrease the chances of incorrect classifications. Although the use of name matching may lead to some potential errors, the application of the automated approach in conjunction with the subsequent verification helped to achieve a high level of accuracy when matching the FDI data to the Refinitiv–Compustat database.

[Insert Table 4.1 here]

4.3.3 Sample construction

After the matching was over, the number of firms was reduced from 3,701 to 1,207. This reduction occurs because not all firms with ESG and financial information had outward FDI activities during the sample period. Therefore, the final sample consists only of firms that had at least one reported valid FDI project over the sample period. These firms also have ESG and financial information. The final dataset includes North American public companies that are involved in greenfield FDI projects, as the data was merged with Compustat, which only covers public firms.

During data cleaning, outliers across all variables were addressed by winsorising at the 1st and 99th percentiles. This process was applied to reduce the impact of extreme values.

4.3.4 Dependent variable

The dependent variable in this study is the log of FDI capital expenditure. This variable reflects the financial magnitude of a firm's commitment to cross-border investment and serves as a measure of the scale of international expansion activity. The FDI data are sourced at the project level and are measured in millions of USD. Following standard empirical practice in the international business and corporate finance literature, the variable is log-transformed to account for skewness in the distribution and to facilitate the interpretation of regression coefficients as elasticities (King et al. 2021; Duanmu 2014). Using a logged specification also enables better comparison across firms of varying sizes and sectors.

4.3.5 Explanatory variable

The main explanatory variable of interest is the firm's ESG performance score, which captures the extent to which a firm aligns with environmental sustainability, social responsibility, and sound governance practices. ESG scores are obtained from Refinitiv, a standardised third-party data provider that compiles ESG metrics based on over 450 company-reported data points. These scores reflect a combination of quantitative indicators (such as emissions intensity, board diversity, and employee turnover rates) and qualitative assessments (such as the presence of environmental policies or codes of business ethics) across the three ESG pillars. A higher ESG score indicates stronger performance in these areas and signals to external stakeholders, including regulators, investors, and host-country authorities, a firm's commitment to responsible business conduct and long-term value creation. The inclusion of ESG as an explanatory variable is motivated by emerging literature suggesting that sustainable firms enjoy reputational benefits, reduced costs of capital, and preferential access to markets and regulatory treatment (Kruger 2015; Albuquerque et al. 2019). In the FDI context, firms with superior ESG profiles may be more likely to undertake larger capital investments in host countries that prioritise sustainability and institutional transparency, whereas firms with lower ESG orientation may prefer jurisdictions with less stringent compliance environments.

ESG ratings and scores suffer from few limitations. ESG ratings may vary across providers because of differences in weighting schemes, indicator construction, and disclosure methodologies. Prior research documents substantial disagreement across ESG rating agencies arising from variation in scope, measurement, and aggregation procedures (Berg et al. 2022). Such divergence may introduce measurement error and sector-specific bias, particularly

because industries differ in environmental exposure, governance structures, and disclosure intensity. ESG scores are widely used to assess firms' sustainability performance and broader environmental, social, and governance practices; however, uncertainty surrounding the interpretation of rating scales and limited transparency regarding underlying methodologies may complicate investors' decision-making processes (González-Pozo et al. 2025).

4.3.6 Control Variables and Fixed Effects

To ensure that the estimated relationship between ESG performance and FDI capital expenditure is not confounded by financial or operational factors, the model includes a comprehensive set of control variables at the firm level. Firm size is proxied by the log of total assets, which captures scale economies and internal resource availability. Tobin's Q serves as a proxy for investment opportunities and managerial growth expectations (Kaplan and Zingales 1997). Profitability is proxied by EBITDA over total assets. Operational efficiency is captured using the ratio of sales to total assets, and liquidity is reflected in the ratio of cash holdings to total assets. The ability to service debt is represented by the interest coverage ratio, calculated as EBITDA over interest expenses. Additionally, leverage, measured as total debt over total assets, is included to control for the firm's capital structure and potential financial constraints that may impact investment behaviour (King et al. 2021).

Given the panel structure of the dataset, which is organised at the firm–country–year level, several sources of unobserved heterogeneity may influence FDI outcomes. To address this, the analysis incorporates fixed effects that are consistent with the level of data aggregation. Specifically, firm–country fixed effects are included to control for all time-invariant characteristics associated with a given firm operating in a particular host country, such as long-term strategic orientation, governance practices, technological capabilities, or persistent country-specific institutional exposure. These effects are particularly important given that both ESG performance and investment behaviour may be deeply rooted in stable firm–country relationships. In addition, country–year fixed effects are included to absorb time-varying national-level shocks that affect all firms operating within a given country in a particular year, including changes in macroeconomic conditions, regulatory frameworks, political stability, or FDI-related policies. This is especially relevant in a cross-country investment setting, where firms may respond to evolving host-country environments. Jointly, the inclusion of firm–country and country–year fixed effects ensures that the estimated effects are identified from within–firm–country variation over time, net of both persistent firm–country characteristics and contemporaneous country-level shocks. This specification strengthens causal

interpretation by reducing concerns that observed variation in FDI capital expenditure is driven by unobserved heterogeneity rather than changes in ESG performance or other explanatory variables.

Additionally, the KZ and WW indices are used to classify firms by their degree of financial constraint, following Fazzari et al. (1988) and Whited and Wu (2006). Firms are categorised as financially constrained or unconstrained based on whether their index values fall above or below the respective sample median. These indices are not included as control variables in the principal regression; instead, they are used to support hypothesis 2, which examines whether the impact of ESG performance on investment varies with firms' financial capacity. This classification enables the analysis to capture heterogeneity in the ESG-investment relationship across firms with differing levels of financial flexibility. The R&D intensity measures, R&D/Sales and R&D/Assets, are introduced in the analysis of Hypothesis 4, where they serve as key variables to test whether innovation activity moderates the relationship between ESG performance and investment.

4.3.7 Descriptive statistics

Figure 4.1 displays the average ESG scores and capital expenditures (FDI, in millions of USD) from 2003 to 2023, plotted in separate panels to preserve their original units. ESG scores, which range from 0 to 100, exhibit a steady upward trend over the two-decade period, suggesting increasing attention to sustainability practices among firms. In contrast, FDI demonstrates considerable volatility, with pronounced peaks and declines that likely reflect shifts in investment cycles, macroeconomic conditions, and firm-level strategic adjustments.

[Insert Figure 4.1 here]

Table 4.2 presents descriptive statistics for the variables used in the empirical analysis. The data encompass a large and diverse panel of North American firms, showing significant variation in both investment and firm characteristics. $\ln(FDI)$ has a relatively low average (0.25) but a relatively wide standard deviation ($SD = 0.93$), indicating that while most firm–country–year observations involve modest project outlays, some projects are very large. ESG scores also display meaningful cross-sectional variation (mean = 3.91, $SD = 0.50$), highlighting substantial differences in firms' sustainability efforts rather than clustering around a single level. Firms in the sample are typically large and well-established, yet they vary considerably in operational profiles: profitability ($EBITDA/Assets$) averages 10 per cent, whilst cash

holdings average 12 per cent of total assets, suggesting differing levels of internal financing capacity. Measures of financial constraints (KZ and WW indices) also show broad dispersion, supporting the use of these metrics to capture heterogeneity.

[Insert Table 4.2 here]

Table 4.3 reports the pairwise correlation coefficients among the main variables. Overall, the correlations are moderate, with all absolute values well below the conventional multicollinearity threshold of 0.8, indicating that the variables capture distinct firm characteristics. As expected, $\ln(FDI)$ and FDI jobs $\ln(Jobs)$ are highly correlated, reflecting their reflection of FDI activity. ESG performance $\ln(ESG)$ shows a positive association with firm size and profitability but a weak negative correlation with growth opportunities (Tobin's Q). The financial-constraint indices (KZ and WW) display negative correlations with size and profitability, confirming that smaller and less profitable firms tend to face tighter financial conditions. Overall, the correlation structure aligns with theoretical expectations and suggests no serious multicollinearity concerns.

[Insert Table 4.3 here]

4.4 Empirical model specification

4.4.1 Baseline model

This study investigates the relationship between firm ESG performance and capital expenditure in greenfield outward FDI in North America. The empirical strategy is conceptually motivated by King et al. (2021), who analyse FDI using capital expenditure as the dependent variable in a project-level, pooled dataset. While their work offers valuable insights into the influence of capital structure and political risk on FDI behaviour, their reliance on individual project observations prevents them from capturing persistent firm-level heterogeneity or examining how firm characteristics shape investment decisions across host countries over time. In contrast, our study constructs a panel dataset aggregated at the firm–country–year level, where each observation captures the total capital expenditure that a firm allocates to FDI projects in a specific host country during a given year. This structure allows for the inclusion of firm–country fixed effects, enabling a more precise examination of how time-varying firm-level

characteristics, particularly ESG performance, relate to international investment behaviour across host countries and over time. The empirical model is specified as follows:

$$\text{Ln}(FDI_{ict}) = \beta_1 \text{Ln}(ESG_{i,t-1}) + \beta' X_{i,t-1} + \alpha_{ic} + \delta_{ct} + e_{ict} \quad (4.1)$$

where the dependent variable is the log of capital expenditure $\text{Ln}(FDI_{ict})$ capturing the financial commitment of firm i in host country c during year t . The key independent variable is natural logarithm of the ESG score of the firm in year $t-1$, denoted $\text{Ln}(ESG_{i,t-1})$ which captures its level of commitment to sustainability principles and responsible corporate conduct. The coefficient on this variable, β_1 , is the main coefficient of interest, and it is expected to be positive ($\beta_1 > 0$), indicating that higher ESG performance should be associated with greater outward FDI capital expenditure (hypothesis 1). The model includes a vector of firm-level control variables ($X_{i,t-1}$) commonly used in corporate investment research, with β' denoting the corresponding vector of coefficients. These controls include firm size $\text{Ln}(\text{Assets})$, growth opportunities (*Tobin's Q*), profitability ($\text{EBITDA}/\text{Assets}$), liquidity ($\text{Cash}/\text{Assets}$), operational efficiency ($\text{Sales}/\text{Assets}$), leverage ($\text{Debt}/\text{Assets}$), interest coverage ($\text{Interest}/\text{EBITDA}$), and operating cash flow scaled by PPE ($\text{Cash flow}/\text{PPE}$), capturing internal cash generation relative to the capital stock. All right-hand-side variables are lagged by one year to mitigate simultaneity bias and ensure that explanatory variables are determined prior to investment decisions.

To address potential confounding from unobserved heterogeneity, the model includes two key sets of fixed effects. Firm–country fixed effects (α_{ic}) absorb all time-invariant characteristics specific to each firm–host country pair, such as ownership structure, geographic strategy, long-term market familiarity, and home-country institutional conditions. Country–year fixed effects (δ_{ct}) are included to account for time-varying macroeconomic, political, and regulatory dynamics within each host country, factors that could systematically influence FDI investment decisions each year. The idiosyncratic error term (e_{ict}) captures unobserved firm–country–year-specific shocks not explicitly modelled. Standard errors are clustered at the firm level to account for within-firm serial correlation. This specification aligns with previous empirical studies that utilise firm–country–year panel data to analyse outward investment behaviour. For example, Ding et al. (2021) adopt a similar structure, aggregate their dataset at firm-country-year and employ country-year fixed effects to examine how foreign investment experience shapes export performance.

4.4.2 Financial constraints

To investigate whether the relationship between ESG performance and FDI varies according to the financial flexibility of firms, we adopt a sub-sample estimation strategy using the Whited–Wu (*WW*) Index as our primary measure of financial constraints, with the Kaplan–Zingales (*KZ*) Index employed as a robustness check. Both indices are well-established in the literature and are constructed using firm-level financial data obtained from the Compustat database. The *WW* index, based on the structural investment model of Whited and Wu (2006), combines six financial variables to capture financing frictions. The index is computed as follows:

$$\begin{aligned} WW = & -0.091 * CF - 0.062 * \text{Dividend Dummy} + 0.021 * \text{Long - Term Debt} - 0.044 \\ & * \text{Ln (Assets)} + 0.102 * \text{Sales Growth} - 0.035 \\ & * \text{Industry Sales Growth} \end{aligned} \quad (4.2)$$

In this formulation, cash flow (*CF*) is defined as net income plus depreciation, divided by total assets. The dividend dummy equals one if the firm pays cash dividends and zero otherwise. Long-term debt is measured as a percentage of total assets. Firm size is proxied by the natural logarithm of total assets, while sales growth refers to the firm’s annual percentage change in sales revenue. Industry sales growth is computed as the average growth rate of firms within the same industry classification. A higher *WW* index indicates a higher degree of financial constraint.

For robustness, we also compute the *KZ* index, following the specification outlined in Lamont et al. (2001). This index aggregates five financial indicators as follows:

$$\begin{aligned} KZ = & -1.002 * CF + 0.283 * Q + 3.139 * \text{Leverage} - 39.368 * \text{Dividends} - 1.315 \\ & * \text{Cash} \end{aligned} \quad (4.3)$$

Here, cash flow (*CF*) is calculated as operating income before depreciation minus interest, taxes, and common dividends, divided by capital, where capital is defined as gross property, plant, and equipment (*PPE*). Tobin’s *Q* (*Q*) is proxied by the market-to-book ratio. Leverage is the ratio of total debt to total assets. Both dividends and cash are scaled by capital. Similar to the *WW* index, a higher *KZ* value reflects a more financially constrained position. Index values

are computed annually for each firm-year observation. Firms are then classified into high and low financial constraint groups depending on whether their index value is above or below the annual sample median. This classification is applied independently for both indices. To reduce potential multicollinearity in the regressions, especially since the indices include components such as leverage, profitability, and firm size, we do not include the indices directly in the models. Instead, they are used for subsample splitting. We then re-estimate the baseline ESG–FDI model separately for the two resulting subsamples: firms with low WW scores (WW-L, unconstrained), high WW scores (WW-H, constrained). This allows us to assess our hypothesis 2, namely whether the effect of ESG performance on foreign investment varies systematically with financial flexibility. All explanatory variables, including ESG scores and financial controls, are lagged by one period. We also maintain firm-country and country-year fixed effects to account for unobserved heterogeneity.

4.4.3 ESG and financial indicators

In the baseline analysis, we examine the relationship between ESG engagement and corporate investment by estimating a firm-level investment model that includes ESG performance and a standard set of financial controls. While this specification captures the general effect of ESG on investment, it does not account for potential heterogeneity in this relationship across firms facing different financial conditions. To address this, we extend the original model by introducing a classification based on firms' financial constraint status. Specifically, we investigate whether the ESG–investment relationship differs between firms that are financially constrained and those that are not. This forms the basis of our third hypothesis, which is motivated by the notion that ESG initiatives, while potentially value-enhancing, may require upfront financial resources and longer investment horizons. Consequently, firms with greater financial flexibility may be better equipped to pursue ESG-aligned investments, whereas financially constrained firms may lack the capacity to act on ESG priorities in a meaningful way.

To assess whether financial capacity influences the relationship between ESG performance and FDI, the analysis employs three firm-level indicators: operating cash flow, which reflects the availability of internal funds; the cash-to-asset ratio, which indicates liquidity; and the EBITDA-to-asset ratio, which measures profitability. Together, these indicators capture complementary aspects of firm-level financial flexibility, consistent with the financial literature (Lins et al. 2017; Asimakopoulos et al. 2023). Following the standard

approach used to test moderating effects, each financial capacity indicator is interacted with ESG performance in separate regression models. Moreover, to address potential simultaneity and endogeneity concerns and to maintain consistency with the baseline model, all right-hand-side variables are lagged by one year. This lag structure ensures that the explanatory variables precede the investment decision, thereby strengthening causal interpretation.

$$\begin{aligned} \text{Ln}(FDI_{ict}) = & \beta_1 \text{Ln}(ESG_{i,t-1}) + \beta_2 \text{FinCap}_{i,t-1} + \beta_3 (\text{Ln}(ESG_{i,t-1}) * \text{FinCap}_{i,t-1}) \\ & + \beta' X_{i,t-1} + \alpha_{ic} + \delta_{ct} + \mu_{ict} \end{aligned} \quad (4.4)$$

where *FinCap* denotes one of the three financial capacity measures, *X* represents the vector of control variables, α_{ic} and δ_{ct} are firm–country and country–year fixed effects, and μ_{ict} is the error term. The interaction coefficient β_3 captures the extent to which the effect of ESG performance on outward greenfield FDI varies with financial indicators. A positive and statistically significant β_3 supports the corresponding hypothesis (3a, 3b, and 3c), indicating that greater financial capacity strengthens the ESG–FDI relationship.

4.4.4 ESG and innovation intensity

This section explores whether firm-level innovation capacity, combined with financial constraints, influences the relationship between ESG performance and outward greenfield FDI investment. The extension examines how ESG affects international investment differently across firms based on their technological capabilities and financing conditions. We evaluate this innovation-based mechanism by interacting ESG performance with R&D intensity, defined as *R&D/Sales*. This measure indicates a firm’s commitment to innovation relative to its revenue, thus reflecting its strategic focus on technological development and innovation capabilities. R&D intensity is a common proxy for a firm’s innovation capacity in the literature (Padgett 2010; Cassiman and Golovko 2011).

To formally test this mechanism, we extend the baseline regression model by including an interaction term between ESG performance and R&D intensity. The estimated model is specified as follows:

$$\begin{aligned} \text{Ln}(FDI_{ict}) = & \beta_1 \text{Ln}(ESG_{i,t-1}) + \beta_2 (RD_{i,t-1}) + \beta_3 (\text{Ln}(ESG_{i,t-1}) * RD_{i,t-1}) \\ & + \beta' X_{i,t-1} + \alpha_{ic} + \delta_{ct} + \mu_{ict} \end{aligned} \quad (4.5)$$

In both models, the dependent variable remains unchanged from the baseline specification, and all control variables are retained. R&D intensity, measured as total R&D expenditure relative to total sales, is the variable of interest in this specification. The interaction term between ESG performance and R&D intensity captures whether a firm's innovation orientation moderates the ESG–FDI relationship. In line with our hypothesis 4, we expect the coefficient on the interaction term (β_3) to be negative and statistically significant, indicating that the positive impact of ESG on FDI is weaker for firms with higher R&D intensity. This reflects the notion that R&D and ESG may compete for internal resources, limiting firms' capacity to convert ESG commitments into foreign investment.

4.5 Empirical results

4.5.1 Baseline regression results

This section presents the baseline empirical analysis of the effect of ESG performance on the outward greenfield FDI capital expenditure of North American firms. Table 4.4 presents OLS estimates based on three specifications of equation (4.1). In column (1), without controls or fixed effects, the coefficient on ESG is positive and highly significant (0.068, $p < 0.001$), indicating that stronger ESG performance is associated with higher outward investment. In column (2), the inclusion of firm–country and country–year fixed effects, which absorb time-invariant firm–host characteristics and host-country time shocks, strengthens the ESG effect (0.108, $p < 0.001$). This suggests that once unobserved heterogeneity is controlled for, the link between ESG and FDI becomes even more pronounced.

Column (3), our preferred specification, presents the fully specified model, incorporating a comprehensive set of firm-level financial controls. The ESG coefficient remains positive and significant (0.046, $p < 0.001$), confirming the robustness of the relationship. These findings support hypothesis 1, which proposed that stronger ESG performance is associated with higher outward FDI investment by North American firms. The finding is also consistent with previous studies (Wang et al. 2024; Yuan et al. 2025). The control variables generally behave as expected and align with previous research: larger firms (\ln Assets), firms with stronger growth prospects (Tobin's Q), and firms generating higher cash flows ($EBITDA/Assets$) tend to invest more in FDI (Duanmu 2014; Lins et al. 2017; King et al. 2021; Dang et al. 2022). Liquidity ($Cash/Assets$) also supports FDI (King et al. 2021), whereas higher operating cash flow relative to existing capital stock ($Cashflow/PPE$) is negatively related to investment, consistent with diminishing additional capital requirements

in already asset-intensive firms. Overall, the results demonstrate a consistent and economically meaningful relationship: ESG performance is positively associated with outward FDI capital expenditure across all model specifications.

[Insert Table 4.4 here]

4.5.2 Channels through which ESG influences FDI Capex

This section examines the mechanisms through which ESG performance may influence firms' outward greenfield investment. ESG engagement can affect international expansion through several channels related to firms' financial capacity and strategic resource allocation. Firms with stronger ESG performance may face fewer financial constraints and have better financial conditions, which can support large and capital-intensive foreign investments. ESG engagement may also interact with firms' innovation activities, particularly when resources must be allocated between sustainability initiatives and research and development. The following subsections explore these channels in more detail.

4.5.2.1 Financial constraints – subsample analysis

Table 4.5 examines whether the relationship between ESG performance and outward greenfield FDI differs between firms facing low (*WW-Low*) and high (*WW-High*) financial constraints, based on the Whited–Wu index (WW index). In column (1), which represents financially unconstrained firms (*WW-Low*), the coefficient on ESG is positive and highly significant (0.087, $p < 0.001$). This indicates that among firms with greater financial flexibility, stronger ESG performance is associated with higher capital expenditure on FDI projects. In contrast, column (2) shows that for financially constrained firms (*WW-High*), the ESG coefficient is small and statistically insignificant, suggesting that when financing frictions are present, ESG performance does not translate into greater outward investment.

Again, the control variables behave largely as expected. Firm size $\ln(Assets)$, growth opportunities (*Tobin's Q*), and profitability ($EBITDA/Assets$) are positively associated with FDI investment in both subsamples. However, the magnitude is consistently more substantial among unconstrained firms. Liquidity (cash/assets) significantly predicts FDI in unconstrained firms but not in constrained ones, reinforcing the importance of financial flexibility for undertaking foreign projects. Other variables, such as leverage, interest coverage, and cash flow relative to existing capital stock, show weaker or inconsistent effects. In brief, the results

show that ESG performance boosts outward investment mainly for firms that are not financially constrained. These findings support hypothesis 2, which suggests that the positive link between ESG performance and outward greenfield FDI is stronger for firms with fewer financial restrictions.

[Insert Table 4.5 here]

4.5.2.2 ESG and financial indicators

Table 4.6 reports the estimation of equation (4) and investigates whether the internal financial strength of firms moderates the relationship between ESG performance and outward greenfield FDI. The analysis introduces interaction terms between ESG and three financial indicators, operating cash flow (*Cashflow/PPE*), profitability (*EBITDA/Assets*), and operational efficiency (*Sales/Assets*), in separate regression models. The results show that the effect of ESG on FDI becomes stronger as financial capacity increases, thereby supporting hypotheses 3a, 3b, and 3c. In the first specification, column (1), the interaction between ESG and operating cash flow is positive and highly significant (0.014, $p < 0.01$), suggesting that firms with more abundant internal funds are better able to translate ESG engagement into outward investment. Column (2) reports a similarly strong and positive interaction between ESG and profitability (0.434, $p < 0.001$), indicating that financially successful firms can leverage ESG commitments to support additional international investment. The third specification in column (3) finds a positive and significant interaction between ESG and asset turnover (0.062, $p < 0.001$), showing that firms that use their assets more efficiently are also better positioned to convert ESG commitments into foreign capital expenditure.

In all models, standard control variables behave as expected: firm size, growth opportunities, and liquidity are positively associated with FDI, while other indicators, such as interest burden and leverage, play a limited role. Importantly, once the interaction terms are included, the main effect of ESG becomes small and statistically insignificant, indicating that ESG performance alone is not sufficient to drive foreign investment without adequate financial strength. These results support the hypothesis that internal financial capacity amplifies the positive effect of ESG on outward FDI, implying that sustainability-driven expansion is most effective when supported by strong internal financial resources. The findings also align with large-scale evidence from the NYU Stern and Rockefeller Asset Management meta-analysis of over 1,000 empirical studies, which reports that sustainability initiatives often improve

financial outcomes through mediating channels such as better risk management, innovation, and operational efficiency, with 59% of studies finding a positive link between operational efficiency and financial performance (NYU Stern Centre for Sustainable Business & Rockefeller Asset Management, 2021). The meta-analysis further highlights the resource-based view, emphasising that internal resources, including financial and intangible assets, can enable firms to gain a competitive advantage. Consistent with this perspective, the present results suggest that financial capacity not only supports the implementation of ESG-aligned strategies but also enhances their impact on high-commitment, long-term projects such as outward greenfield FDI. In this way, ESG engagement and financial flexibility seem to work together, helping firms to overcome the risks and delays involved in establishing new international operations.

[Insert Table 4.6 here]

4.5.2.3 ESG and innovation intensity

Lastly, Table 4.7, based on Equation (5), examines whether firms' innovation intensity moderates the relationship between ESG performance and outward FDI capital expenditure. The model includes an interaction term between ESG and R&D intensity (measured as R&D expenditure relative to sales) to capture potential trade-offs between sustainability initiatives and innovation-orientated investment strategies. The findings show that ESG performance alone is positively and significantly associated with outward FDI (0.070, $p < 0.001$), whereas the interaction between ESG and R&D intensity is negative and statistically significant (-0.525 , $p < 0.001$).

The negative interaction suggests that the investment benefits associated with ESG weaken as firms become more innovation intensive. One explanation is a resource allocation trade-off: although both sustainability and innovation support long-term competitiveness, they require substantial financial and managerial commitment. Firms with intensive R&D programmes may prioritise technology development over ESG-driven international expansion, reducing the incremental effect of ESG on outward investment. An alternative interpretation is that innovation-intensive firms rely more heavily on proprietary technological capabilities than on reputational signalling when entering foreign markets, lowering the strategic value of ESG performance. It is also possible that firms with stronger innovation capacity already possess sufficient competitive advantages, making additional ESG improvements less influential in

shaping investment decisions. Overall, the results suggest that innovation intensity moderates the ESG–FDI relationship by weakening the marginal contribution of ESG to outward investment, consistent with Hypothesis 4.

The main effect of R&D intensity is positive and statistically significant (1.899, $p < 0.001$), indicating that innovation-orientated firms generally undertake greater outward investment. However, the negative interaction suggests that stronger innovation activity does not fully complement ESG-led expansion and may instead redirect resources towards technology development. Among the control variables, larger firms, firms with higher market valuations (Tobin’s Q), and firms generating stronger operating cash flows exhibit greater investment abroad. By contrast, cash flow relative to capital stock (Cashflow/PPE) is negatively associated with outward investment, suggesting lower demand for additional capital expenditure among firms with stronger internal capital positions.

[Insert Table 4.7 here]

4.6 Robustness checks

4.6.1 Endogeneity

A potential concern in this analysis is that firms’ ESG performance may be endogenous. The main sources of endogeneity include reverse causality, whereby firms may enhance their ESG performance in anticipation of outward FDI, as well as unobservable firm-level characteristics, such as managerial quality or long-term strategic orientation, that may jointly influence both ESG engagement and international expansion (Yuan et al. 2025; Khurram et al. 2024). In addition, self-selection and sample-selection bias may further affect the estimated relationship. To address these concerns, this chapter employs an instrumental variables (IV) approach estimated using two-stage least squares (2SLS). Following Benlemlih and Bitar (2016), Samet and Jarboui (2017), and Bilyay-Erdogan et al. (2024), we aim to isolate the exogenous component of ESG performance using an industry-level instrument.

The endogeneity correction is deliberately targeted at ESG performance, which is the primary explanatory variable of interest. Other firm-level controls, including Tobin’s Q, firm size, profitability, leverage, liquidity, and asset turnover, are included to condition on observable firm characteristics that are standard determinants of investment behaviour. These variables are not the focus of causal interpretation and are treated as exogenous or predetermined, consistent with established practice in the firm-level FDI and corporate finance

literature (Yuan et al. 2025; Khurram et al. 2024; Asimakopoulos et al. 2023; King et al. 2021). Accordingly, the IV strategy focuses on correcting endogeneity where it is most theoretically and empirically relevant, namely ESG performance, ensuring a parsimonious and well-identified empirical specification.

Following the above studies (Benlemlih and Bitar 2016; Samet and Jarboui 2017; Bilyay-Erdogan et al. (2024), the instrument is defined as the industry–year mean of the ESG score in the previous year, denoted $ESGMean_{j,t}$. For each industry j and year t , we compute the simple arithmetic average of firms’ natural logarithm of ESG scores measured in $t - 1$ and assign this value to all firms in industry j in year t . Formally,

$$ESGMean_{j,t} = \frac{1}{N_{j,t-1}} \sum_{i \in j} \ln (ESG_{i,t-1}) \quad (4.6)$$

where $N_{j,t-1}$ is the number of firms in industry j in year $t - 1$, $\ln (ESG_{it})$ is the natural logarithm of ESG score of firms i in year t .

The first stage of the estimation expresses the logarithm of ESG performance as a function of the proposed instruments, the set of firm-level controls, and fixed effects. Formally, the model is specified as:

$$\ln (ESG_{it}) = \pi_0 + \pi_1 ESGMean_{j,t-1} + \pi'X_{i,t-1} + \alpha_{ic} + \delta_{ct} + v_{ict} \quad (4.7)$$

where, $\ln (ESG_{it})$ denotes the log of ESG performance score for firm I in year t . The term $ESGMean_{j,t-1}$ represents the industry-year mean ESG score, capturing the average ESG performance of all firms operating in industry j during year $t - 1$ as reported in equation (4.6) (El Ghouli et al. 2011; Benlemlih and Bitar 2018; Samet and Jarboui 2017). This variable reflects broader industry-level sustainability practices and peer influences that are external to any individual firm’s investment decisions and therefore provides a plausible source of exogenous variation in firm-level ESG performance. The $\pi'X_{i,t-1}$ is the vector of coefficients on the lagged firm control variables, same as the baseline control variables. The terms α_{ic} and δ_{ct} denote firm x country and country x year fixed effects, respectively, which control for time-invariant firm-specific heterogeneity and country-level macroeconomic or policy shocks that vary across years. The disturbance term v_{ict} captures all remaining unobserved factors influencing ESG performance.

The relevance condition requires industry-level ESG norms to be correlated with firm-level ESG performance. This assumption is supported by the tendency of firms to align their sustainability practices with industry standards, investor expectations, disclosure norms, and peer behaviour. The exclusion restriction assumes that industry-level ESG affects outward FDI only indirectly through its influence on the firm's own ESG performance. Conditional on firm-level controls and the fixed-effects structure, industry-wide ESG variation is not expected to directly determine firms' foreign investment expenditure.

In the second stage, the predicted values of ESG performance obtained from Equation (4.7) are substituted into the investment equation to estimate the causal effect of ESG performance on outward investment behaviour.

$$\text{Ln}(FDI_{ict}) = \beta_0 + \beta_1 \text{Ln}(\widehat{ESG}_{it}) + \beta'X_{i,t-1} + \alpha_{ic} + \delta_{ct} + \mu_{ict} \quad (4.8)$$

In this specification, $\text{Ln}(FDI_{ict})$ represents firm i capital expenditure in the country c and year t , while $\text{Ln}(\widehat{ESG}_{it})$ denotes the fitted values of ESG performance obtained from the first stage. The coefficient β_1 captures the impact of ESG performance on investment after controlling for endogeneity, X is the vector of firm-level control variables and μ_{ict} represents unobserved shocks to investment decisions. Both stages are estimated using identical firm–country and year \times country fixed effects, ensuring that the identification of β_1 relies exclusively on within-firm variation over time after accounting for country-level and temporal heterogeneity. Standard errors are robust to heteroskedasticity and clustered at the firm level to correct for serial correlation.

Table 4.8 reports the two-stage least squares estimate of the relationship between ESG performance and capital expenditure. The first-stage results indicate that the instrument, the lagged industry–year mean ESG score, is a strong and statistically significant predictor of firm-level ESG performance. The estimated coefficient on ESG-industry is 0.755, and the associated first-stage F-statistic is 290.62, comfortably exceeding conventional thresholds and ruling out concerns about weak instruments. In the second stage, the coefficient on the instrumented ESG variable remains positive and statistically significant ($\beta=0.201$, $p=0.001$), indicating that firms with higher ESG performance exhibit higher levels of capital investment. The Kleibergen–Paap LM statistic of 64.080 ($p<0.001$) rejects the null hypothesis of under-identification, confirming that the model is properly identified. In summary, the IV estimates are consistent with a causal interpretation of the relationship between ESG performance and firms'

investment behaviour. These findings reinforce the baseline results and suggest that the positive association between ESG and capital expenditure is not driven solely by reverse causality or omitted variable bias.

[Insert Table 4.8 here]

4.6.2 Alternative investment measure

To evaluate the robustness of the main findings, several complementary tests are conducted. First, the baseline specification is re-estimated using an alternative measure of project-level investment: the natural logarithm of one plus the number of jobs created by each greenfield FDI project (Ln Jobs), following King et al. (2021). The results, reported in Table 4.9, show that the coefficient on ESG remains positive and statistically significant across all specifications, with and without the full set of controls and fixed effects. This confirms that the main conclusion is not sensitive to the choice of investment measure and that ESG-intensive firms tend to initiate larger projects both in terms of capital and FDI employment.

[Insert Table 4.9 here]

Second, Table 4.10 examines the sensitivity of the results to alternative measures of financial constraints and investment. Columns (1) - (2) replicate the financial constraint analysis using the Kaplan–Zingales Index (KZ) in place of the Whited-Wu Index (WW), while keeping capital expenditure as the dependent variable. The ESG coefficient remains positive and statistically significant among unconstrained firms (KZ-Low) but not among constrained firms (KZ-High), closely mirroring the baseline results. Columns (3)-(4) retain the WW-based sample split but replace capital expenditure with FDI employment as the dependent variable. The results again show that ESG is strongly associated with outward investment for unconstrained firms (WW-Low) but not for constrained firms (WW-High), indicating that the main finding is robust to alternative outcome measures and alternative indices of financial constraints.

[Insert Table 4.10 here]

Third, Table 4.11 investigates the relationship between ESG performance and three indicators of internal financial strength, cashflow-to-PPE, EBITDA-to-assets, and sales-to-assets, using FDI employment as the dependent variable. In all cases, the interaction terms are positive and statistically significant, indicating that the marginal effect of ESG on outward investment is greater for firms with ample internal resources. This confirms that the moderating role of internal financial strength is not limited to the capital expenditure measure.

[Insert Table 4.11 here]

Finally, Table 4.12 assesses whether the adverse moderating effect of innovation on the ESG–FDI relationship remains consistent when using alternative measures. Column (1) substitutes R&D-to-sales with R&D-to-assets as a different measure of innovation intensity, while column (2) employs employment as the dependent variable. In both models, the interaction between ESG and R&D intensity stays negative and statistically significant, reinforcing the conclusion that innovation and ESG present competing demands on firms’ financial and managerial resources. In summary, the results from these robustness tests consistently support the main findings. The positive influence of ESG on outward FDI, its concentration among financially unconstrained firms, its enhancement by internal financial strength, and its reduction under high R&D intensity are maintained across different outcome measures, sample classifications, and variable definitions.

[Insert Table 4.12 here]

4.7 Conclusion

This chapter examines the role of ESG performance in shaping outward FDI by North American firms. Whereas much of the relevant existing studies have focused on emerging markets such as China (Khurram et al. 2024; Wang et al. 2024; Yuan et al. 2025), this study extends the literature by highlighting developed economies and incorporating firm-level heterogeneity in financial strength and innovation intensity. Drawing on a large panel of US and Canadian firms and employing fixed effects, interaction models, and an instrumental variables approach, the findings provide robust evidence that ESG performance has a causal influence on international investment decisions. Consistent with Yuan et al. (2025), the results demonstrate that ESG engagement not only shapes domestic outcomes but also enhances firms’

willingness and capacity to invest abroad. The results show that ESG performance is consistently associated with greater outward FDI. This relationship is strongest among firms with greater internal financial strength, indicating that financial slack enables firms to translate ESG commitments into larger foreign investment projects. Interaction models further reveal that innovation intensity moderates this relationship. While R&D spending on its own promotes outward investment, high R&D intensity dampens the marginal contribution of ESG, suggesting that ESG and innovation compete for scarce financial and managerial resources. This trade-off is evident in the main specification and remains robust when innovation is measured as either R&D-to-sales or R&D-to-assets.

A series of robustness tests supports the validity of these findings. The positive effect of ESG on outward investment remains when investment is measured by project-level employment rather than capital expenditure, and when financial constraints are proxied using the Kaplan–Zingales Index rather than the Whited–Wu Index. The instrumental variables analysis also confirms that ESG has a causal impact on foreign capital allocation, ruling out concerns about reverse causality or omitted variables. This chapter contributes to the literature in three main ways. First, it establishes the link between ESG performance and the scale of outward greenfield FDI in a developed market setting, showing that ESG acts as a driver of international expansion even outside emerging economies. Second, it identifies two key channels that condition this relationship: internal financial strength, which amplifies ESG’s effect, and innovation intensity, which weakens it by diverting resources away from ESG-driven investment. Third, it strengthens causal inference in the ESG–FDI literature by employing an instrumental variables strategy and demonstrating that the results hold across alternative measures and sample classifications.

The findings have important implications for both corporate managers and policymakers. For managers, they underscore that ESG engagement is not merely symbolic but a strategic lever for international expansion, particularly when supported by strong internal financial capacity. Firms that align sustainability objectives with robust financial management are better positioned to secure financing and commit larger resources to foreign projects. For policymakers, the results highlight the need to enhance the credibility and comparability of ESG ratings, reduce capital market frictions, and promote access to finance for ESG-active firms. By fostering transparent ESG disclosure standards and supporting capital market incentives for sustainable firms, regulators can encourage outward investment that aligns with broader environmental and social objectives.

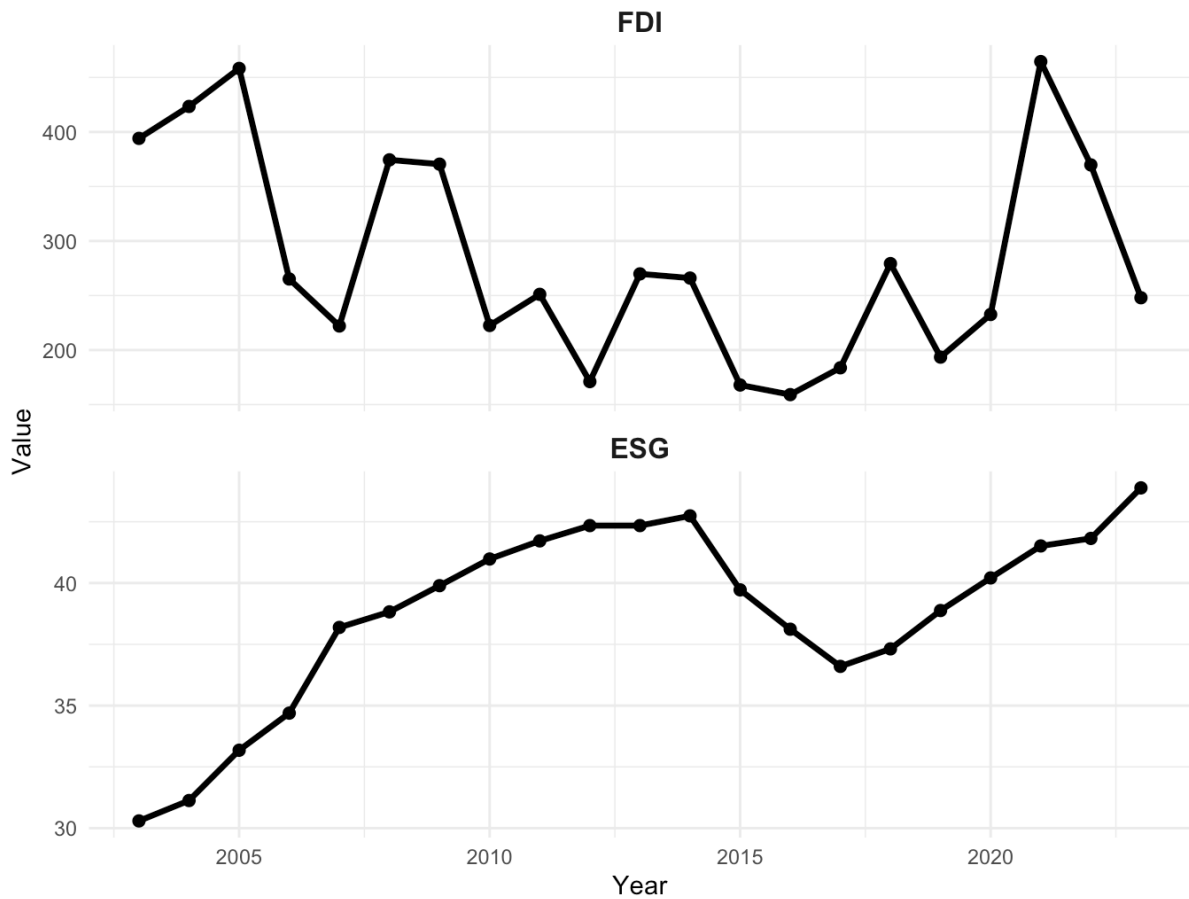


Figure 4-1 ESG and FDI trends

Note: The figure displays yearly averages for ESG scores and FDI from 2003 to 2023. ESG scores range from 0 to 100 and measure firms' ESG performance. FDI values represent capital expenditures measured in millions of USD. Values shown in the figure correspond to annual averages across firms in the sample.

Table 4-1 Sample of standardisation of company names across the fDi Markets and Refinitiv datasets

	fDI market	Refinitiv
1	Aflac (American Family Life Assurance Company)	Aflac Inc
2	Axon (Taser International)	Axon Enterprises Inc
3	Blackberry (Research in motion)	Blackberry Ltd
4	Gentherm (Amerigon)	Gentherm Inc
5	John Wiley & Sons (Wiley)	John Wiley & Sons Inc
6	Teck Resources (Teck Cominco)	Tech Resources Ltd
7	Teledoc Heath	Teledoc Health Inc
8	Tesla Motors	Tesla Inc
9	TJX Companies	The TJX Companies
10	The Trade Desk	Trade Desk Inc
11	Transdigm	Transdigm Inc
12	FIC (Fair Isaac)	Fair Isaac Corp
13	Trinseo (Styron)	Trinseo Plc
14	Vertiv (Emerson Network Power)	Vertiv Holding Co
15	Viavi Solutions (JDS Uniphase)	Viavi Solutions Inc
16	VSE Corporation	VSE Corp
17	Wabash National Corporation (Wabash)	Wabash National Corp
18	Wayfair (CSN Stores)	Wayfair Inc
19	Workiva (webfilings)	Workiva Inc
20	WSP Global (Genivar)	WSP Global Inc
21	Zimmer Biomet Holdings (Zimmer)	Zimmer Biomet Holdings Inc

Table 4-2 Descriptive statistics

Variable	N	SD	Mean	Min	Max
Ln FDI	150045	.9310506	.2527074	0	5.096201
Ln ESG	101969	.4992727	3.906744	2.264883	4.51426
Ln Assets	121655	2.200164	9.193081	3.821486	14.44908
Tobin's Q	121655	1.864369	1.945799	.0006505	10.70312
EBITDA/Assets	121655	.1137553	.1053392	-.4040963	.3699122
Interest/EBITDA	108768	.1947414	.0990948	-.6814443	1.12825
Cash/Assets	121655	.1203246	.1239683	0	.6158301
Leverage	111591	.6013004	.3140817	0	4.185501
Sales/Assets	121655	.5642674	.7692111	0	2.831793
Cashflow/PPE	122512	9502.629	3896.883	-29219	112583
KZ Index	119643	26.61709	5.003222	-71.4139	162.1065
WW Index	101942	.1812847	-.4087814	-.9279759	.5041412
R&D/Sales	121655	.0506782	.0346431	0	.2647922
R&D/Assets	108426	.0947732	.0623647	0	.5775066
Ln Jobs	150045	1.239856	.3537643	0	6.137727

Notes: This table reports descriptive statistics for the variables used in the empirical analysis. Ln FDI is the natural logarithm of project-level FDI capital expenditure (USD millions). Ln ESG is the natural logarithm of the firm's ESG score. Ln Assets is the natural logarithm of total assets (USD millions). Tobin's Q proxies growth opportunities. EBITDA/Assets capture operating profitability, while Interest/EBITDA measures interest coverage. Cash/Assets reflects liquidity, and Leverage is total debt scaled by total assets. Sales/Assets is a measure of output intensity, and Cashflow/PPE is operating cash flow relative to net property, plant, and equipment, indicating investment capacity. KZ Index (Kaplan–Zingales) and WW Index (Whited–Wu) proxy for financial constraints. R&D/Sales and R&D/Assets capture firms' innovation effort. Ln Jobs is the natural logarithm of the number of jobs created by each greenfield FDI project.

Table 4-3 Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Ln FDI	1															
2 Ln ESG	0.0465*	1														
3 Ln Assets	0.0850*	0.5174*	1													
4 Tobin's Q	0.0024	-0.0884*	-0.2131*	1												
5 PPE/Assets	0.0285*	0.0818*	0.0265*	-0.0349*	1											
6 Interest/EBITDA	0.0167*	0.1857*	0.1590*	0.1992*	0.1937*	1										
7 Sales/Assets	-0.0041	-0.0406*	-0.2767*	0.1157*	0.1531*	0.3548*	1									
8 Cash/Assets	-0.0299*	-0.2429*	-0.4551*	0.3251*	-0.1972*	-0.1780*	0.1049*	1								
9 Interest/EBITDA	0.0012	-0.0098*	0.0916*	-0.2100*	0.0871*	0.0080*	-0.0441*	-0.1785*	1							
10 Leverage	0.0181*	0.0469*	0.1067*	-0.2605*	0.1869*	-0.1060*	-0.0346*	-0.1660*	0.3915*	1						
11 Cashflow/PPE	0.0665*	0.3033*	0.4875*	0.0670*	0.1463*	0.2419*	-0.0281*	-0.1580*	-0.0605*	0.0022	1					
12 KZ Index	0.0090*	-0.0320*	0.1204*	-0.0826*	-0.1730*	-0.2806*	-0.2008*	-0.0729*	0.1372*	0.1171*	-0.1057*	1				
13 WW Index	-0.0411*	-0.2837*	-0.5315*	-0.0007	0.1293*	-0.5519*	0.0518*	0.2031*	-0.0215*	0.0235*	-0.3259*	0.2702*	1			
14 R&D/Sales	-0.0029	-0.0552*	-0.2509*	0.3610*	-0.1772*	-0.1770*	0.0109*	0.3840*	-0.1844*	-0.1427*	0.0124*	-0.0435*	0.1898*	1		
15 R&D/Assets	-0.0103*	-0.0598*	-0.1517*	0.2998*	-0.2782*	-0.3717*	-0.3146*	0.3230*	-0.1845*	-0.1639*	0.0002	0.0880*	0.2201*	0.8529*	1	
16 Ln Jobs	0.9546*	0.0425*	0.0792*	0.0076*	0.0118*	0.0197*	0.0077*	-0.0197*	-0.0035	0.0128*	0.0612*	0.0047	-0.0436*	0.0041	-0.0075*	1

Notes: This table reports pairwise correlation coefficients for the main variables used in the analysis. Ln FDI is the log of FDI capital expenditure; Ln ESG is the natural logarithm of the firm's ESG score; Ln Assets is firm size; Tobin's Q captures growth opportunities; PPE/Assets measures capital intensity; EBITDA/Assets captures profitability; Interest/EBITDA is the interest coverage ratio; Sales/Assets reflects output intensity; Cash/Assets measures liquidity; Leverage is total debt scaled by assets; Cashflow/PPE proxies investment capacity; KZ and WW indices capture financial constraints; R&D/Sales and R&D/Assets are alternative measures of innovation input; Ln Jobs is the natural logarithm of FDI-related employment. * Indicates significance at the 5% level.

Table 4-4 The effects of ESG performance on FDI capital expenditure

	Dependent variable: Ln FDI		
	(1)	(2)	(3)
Ln ESG	0.068*** (0.007)	0.108*** (0.014)	0.046*** (0.015)
Ln Assets			0.179*** (0.012)
Tobin's Q			0.028*** (0.004)
EBITDA/Assets			0.287*** (0.091)
Interest/EBITDA			-0.034 (0.026)
Cash/Assets			0.114* (0.061)
Leverage			-0.002 (0.013)
Sales/Assets			0.013 (0.027)
Cashflow/PPE			-0.011*** (0.003)
Constant	0.028 (0.028)	-0.210*** (0.062)	-1.870*** (0.137)
Firm*country FE	No	Yes	Yes
Country*year FE	No	Yes	Yes
N	96582	96582	80527
R-squared	0.000	0.038	0.049

Notes: This table reports the estimates of the effect of ESG performance on FDI capital expenditure. The dependent variable is the log of project-level FDI capital expenditure. The main explanatory variable, Ln ESG, is the natural logarithm of the firm's ESG score, lagged one period. All other right-hand-side variables are also lagged one period to mitigate simultaneity bias and to capture the temporal ordering of investment decisions. Ln Assets is the natural logarithm of total assets (USD millions). Tobin's Q is a proxy for growth opportunities. EBITDA/Assets measures cash flow generation; Interest/EBITDA captures interest coverage; Cash/Assets is the ratio of cash holdings to total assets; Leverage is total debt scaled by total assets; Sales/Assets reflects output intensity; and Cashflow/PPE is operating cash flow divided by net property, plant, and equipment, indicating investment capacity. Firm-country fixed effects control for time-invariant unobserved heterogeneity specific to each firm-host country pair. Country-year fixed effects control for unobserved time-varying host-country characteristics. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4-5 The role of financial constraints

	Dependent variable: Ln FDI	
	(1)	(2)
	<i>WW-Low</i>	<i>WW-High</i>
Ln ESG	0.087*** (0.026)	0.012 (0.023)
Ln Assets	0.237*** (0.018)	0.101*** (0.018)
Tobin's Q	0.014** (0.006)	0.048*** (0.007)
EBITDA/Assets	0.747*** (0.192)	0.271** (0.114)
Interest/EBITDA	0.024 (0.072)	0.003 (0.029)
Cash/Assets	0.320*** (0.097)	-0.035 (0.088)
Leverage	-0.026 (0.026)	0.008 (0.015)
Sales/Assets	-0.023 (0.052)	-0.018 (0.037)
Cashflow/PPE	-0.006 (0.006)	-0.003 (0.006)
Constant	-2.830*** (0.219)	-0.855*** (0.177)
Firm*country FE	Yes	Yes
Country*year FE	Yes	Yes
N	43647	34552
R-squared	0.068	0.084

Notes: This table reports OLS estimates of the effect of ESG performance on FDI capital expenditure. The dependent variable is the natural logarithm of project-level FDI capital expenditure. The main explanatory variable, Ln ESG, is the natural logarithm of the firm's ESG score, lagged one period. All other right-hand-side variables are also lagged one period to mitigate simultaneity bias and to capture the temporal ordering of investment decisions. Ln Assets is the natural logarithm of total assets (USD millions). Tobin's Q is a proxy for growth opportunities. EBITDA/Assets measures cash flow generation; Interest/EBITDA captures interest coverage; Cash/Assets is the ratio of cash holdings to total assets; Leverage is total debt scaled by total assets; Sales/Assets reflects output intensity; and Cashflow/PPE is operating cash flow divided by net property, plant, and equipment, indicating investment capacity. Firm–country fixed effects control for time-invariant unobserved heterogeneity specific to each firm–host country pair. Country–year fixed effects control for unobserved time-varying host-country characteristics. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4-6 Interaction between ESG and financial indicators

	Dependent variable: Ln FDI		
	(1)	(2)	(3)
Ln ESG	0.036** (0.016)	-0.013 (0.020)	-0.010 (0.024)
Ln ESG*Cashflow/PPE	0.014*** (0.005)		
Ln ESG* EBITDA/Assets		0.434*** (0.094)	
Ln ESG* Sales/Assets			0.062*** (0.020)
Ln Assets	0.178*** (0.012)	0.180*** (0.012)	0.181*** (0.012)
Tobin's Q	0.028*** (0.004)	0.028*** (0.004)	0.029*** (0.004)
EBITDA/Assets	0.294*** (0.091)	-1.323*** (0.355)	0.261*** (0.090)
Interest/EBITDA	-0.034 (0.026)	-0.033 (0.026)	-0.032 (0.026)
Cash/Assets	0.112* (0.061)	0.114* (0.061)	0.118* (0.061)
Leverage	-0.000 (0.013)	0.002 (0.013)	0.000 (0.013)
Sales/Assets	0.011 (0.027)	0.010 (0.028)	-0.208*** (0.080)
Cashflow/PPE	-0.062*** (0.018)	-0.010*** (0.003)	-0.011*** (0.003)
Constant	-1.821*** (0.138)	-1.655*** (0.145)	-1.679*** (0.138)
Firm*country	Yes	Yes	Yes
Country*year	Yes	Yes	Yes
N	80527	80527	80527
R-squared	0.049	0.049	0.049

Notes: This table reports OLS estimates of the effect of ESG performance on FDI capital expenditure. The dependent variable is the log of project-level FDI capital expenditure. The main explanatory variable, Ln ESG, is the natural logarithm of the firm's ESG score, lagged one period. All other right-hand-side variables are also lagged one period to mitigate simultaneity bias and to capture the temporal ordering of investment decisions. Ln Assets is the natural logarithm of total assets (USD millions). Tobin's Q is a proxy for growth opportunities. EBITDA/Assets measures cash flow generation; Interest/EBITDA captures interest coverage; Cash/Assets is the ratio of cash holdings to total assets; Leverage is total debt scaled by total assets; Sales/Assets reflects output intensity; and Cashflow/PPE is operating cash flow divided by net property, plant, and equipment, indicating investment capacity. Firm-country fixed effects control for time-invariant unobserved heterogeneity specific to each firm-host country pair. Country-year fixed effects control for unobserved time-varying host-country characteristics. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4-7 R&D and the effect of ESG on FDI

	Dependent variable: Ln FDI
	(1)
Ln ESG	0.070*** (0.017)
Ln ESG*R&D Intensity	-0.525*** (0.107)
R&D Intensity	1.899*** (0.399)
Ln Assets	0.183*** (0.012)
Tobin's Q	0.027*** (0.004)
PPE/Assets	0.049 (0.106)
EBITDA/Assets	0.313*** (0.092)
Interest/EBITDA	-0.023 (0.026)
Leverage	-0.003 (0.013)
Sales/Assets	0.017 (0.028)
Cash/Assets	0.113* (0.061)
Cashflow/PPE	-0.011*** (0.003)
Constant	-2.008*** (0.145)
Firm*country	Yes
Country*year	Yes
N	80403
R-squared	0.049

Notes: This table reports the estimates of the effect of ESG performance on outward FDI. The dependent variable is the log of project-level FDI capital expenditure - Ln (FDI). The main explanatory variable is Ln ESG, the natural logarithm of the firm ESG score, lagged one period. R&D Intensity is measured as total R&D expenditure relative to sales, and its interaction with ESG (Ln ESG \times R&D Intensity) captures the moderating role of innovation. All other right-hand-side variables are lagged one period and include firm size (Ln Assets), growth opportunities (Tobin's Q), capital intensity (PPE/Assets), profitability (EBITDA/Assets), interest coverage (Interest/EBITDA), liquidity (Cash/Assets), leverage, output intensity (Sales/Assets), and investment capacity (Cashflow/PPE). The specification includes firm-country and country-year fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4-8 Endogeneity test

Variable	First stage Dependent variable = Ln ESG	Second stage Dependent variable = Ln FDI
ESG - Industry	0.755*** (0.044)	
Ln ESG (instrumented)		0.201*** (0.074)
Ln Assets	0.123*** (0.016)	0.149*** (0.024)
Tobin's Q	0.005 (0.005)	0.026*** (0.005)
EBITDA/Assets	0.142 (0.124)	0.270* (0.147)
Interest/EBITDA	-0.002 (0.026)	-0.062 (0.044)
Cash/Assets	0.213** (0.082)	0.083 (0.105)
Leverage	0.017 (0.015)	0.014 (0.018)
Sales/Assets	0.066 (0.042)	-0.004 (0.056)
Cashflow	-0.007* (0.004)	-0.005 (0.006)
Firm*country	Yes	Yes
Country*year	Yes	Yes
N	81,247	81,247
R-squared	0.174	0.190
Kleibergen-Paap rk Wald F	290.620 (P = 0.0000)	
Kleibergen-Paap rk LM	64.080 (P = 0.0000)	

Notes: Two-stage least squares (2SLS) regression. The dependent variable is the log of capital expenditure (Ln FDI), and the endogenous regressor is the log of ESG performance (Ln ESG). Control variables include lagged firm-level financial characteristics such as Tobin's Q, profitability, leverage, liquidity, and cash flow. Instrument is the industry-year mean ESG (ESG - Industry). Standard errors are robust to heteroskedasticity and clustered at the firm level. Firm-country and year \times country fixed effects are included. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4-9 Alternative FDI measure

	Dependent variable: Ln Jobs		
	(1)	(2)	(3)
Ln ESG	0.083*** (0.010)	0.150*** (0.019)	0.073*** (0.021)
Ln Assets			0.241*** (0.016)
Tobin's Q			0.039*** (0.005)
EBITDA/Assets			0.379*** (0.121)
Interest/EBITDA			-0.045 (0.034)
Cash/Assets			0.120 (0.081)
Leverage			-0.014 (0.017)
Sales/Assets			0.016 (0.036)
Cashflow/PPE			-0.013*** (0.005)
Constant	0.087** (0.037)	-0.300*** (0.083)	-2.541*** (0.179)
Firm*country FE	No	Yes	Yes
Country*year FE	No	Yes	Yes
N	96582	96582	80527
R-squared	0.000	0.039	0.050

Notes: This table reports OLS estimates where the dependent variable is the log of the number of jobs created by each FDI project (Ln jobs), used as an alternative measure of project-level investment. The main explanatory variable, Ln ESG, is the natural logarithm of the firm's ESG score, lagged one period. All other right-hand-side variables are also lagged one period to mitigate simultaneity bias and capture the temporal ordering of investment decisions. Ln Assets is the natural logarithm of total assets (USD millions). Tobin's Q serves as a proxy for growth opportunities. EBITDA/Assets measures cash flow generation; Interest/EBITDA is the interest coverage ratio; Cash/Assets is the ratio of cash holdings to total assets; Leverage is total debt scaled by total assets; Sales/Assets reflects output intensity; and Cashflow/PPE is operating cash flow divided by net property, plant, and equipment, indicating investment capacity. Firm–country fixed effects control for time-invariant unobserved heterogeneity specific to each firm–host country pair. Country–year fixed effects control for unobserved time-varying host-country characteristics. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4-10 Alternative FDI proxy - financial constraints

	Dependent variable: Ln FDI		Dependent variable: Ln Jobs	
	(1)	(2)	(3)	(4)
	<i>KZ-Low</i>	<i>KZ-High</i>	<i>WW-Low</i>	<i>WW-High</i>
Ln ESG	0.089*** (0.023)	0.030 (0.025)	0.153*** (0.035)	0.012 (0.031)
Ln Assets	0.199*** (0.020)	0.183*** (0.018)	0.310*** (0.024)	0.136*** (0.023)
Tobin's Q	0.025*** (0.008)	0.031*** (0.005)	0.021** (0.008)	0.066*** (0.009)
EBITDA/Assets	0.348** (0.169)	0.096 (0.125)	0.890*** (0.252)	0.414*** (0.153)
Interest/EBITDA	-0.202** (0.083)	-0.022 (0.029)	-0.010 (0.094)	0.010 (0.038)
Cash/Assets	0.176* (0.092)	0.052 (0.097)	0.351*** (0.131)	-0.049 (0.115)
Leverage	-0.140*** (0.050)	-0.004 (0.015)	-0.047 (0.035)	0.009 (0.021)
Sales/Assets	0.095** (0.046)	-0.055 (0.039)	-0.031 (0.068)	-0.019 (0.049)
Cashflow/PPE	0.001 (0.007)	-0.013*** (0.004)	-0.003 (0.009)	-0.008 (0.009)
Constant	-2.359*** (0.230)	-1.679*** (0.191)	-3.838*** (0.289)	-1.134*** (0.227)
Firm*country FE	Yes	Yes	Yes	Yes
Country*year FE	Yes	Yes	Yes	Yes
N	43780	36747	43647	34552
R-squared	0.068	0.080	0.070	0.081

Note: This table reports OLS estimates of the moderating role of financial constraints in the ESG–FDI relationship. The dependent variable is the log of FDI capital expenditure (columns 1–2) or the natural logarithm of FDI employment (columns 3–4). Financial constraints are measured using the Kaplan–Zingales (KZ) index in columns 1–2 and the Whited–Wu (WW) index in columns 3–4, with firms classified as either less constrained (KZ-Low, WW-Low) or more constrained (KZ-High, WW-High). The main coefficient of interest is Ln ESG, the natural logarithm of the firm's ESG score lagged one period, which captures the effect of sustainability performance on outward investment across constraint regimes. All other explanatory variables are lagged one year to mitigate simultaneity concerns. Controls include firm size (Ln Assets), growth opportunities (Tobin's Q), profitability (EBITDA/Assets), liquidity (Cash/Assets), leverage, output intensity (Sales/Assets), and investment capacity (Cashflow/PPE). Firm–country fixed effects account for unobserved heterogeneity within firm–host country pairs, while country–year fixed effects absorb host-country shocks over time. Robust standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4-11 Alternative FDI proxy - interaction between ESG and financial indicators

	Dependent variable: Ln Jobs		
	(1)	(2)	(3)
Ln ESG	0.058*** (0.021)	-0.003 (0.027)	0.005 (0.031)
Ln ESG*Cashflow/PPE	0.020*** (0.007)		
Ln ESG* EBITDA/Assets		0.558*** (0.129)	
Ln ESG* Sales/Assets			0.074*** (0.027)
Ln Assets	0.240*** (0.016)	0.242*** (0.016)	0.244*** (0.016)
Tobin's Q	0.039*** (0.005)	0.038*** (0.005)	0.040*** (0.005)
EBITDA/Assets	0.389*** (0.121)	-1.693*** (0.492)	0.348*** (0.120)
Interest/EBITDA	-0.045 (0.034)	-0.044 (0.034)	-0.042 (0.034)
Cash/Assets	0.117 (0.081)	0.120 (0.081)	0.125 (0.081)
Leverage	-0.012 (0.017)	-0.009 (0.018)	-0.012 (0.017)
Sales/Assets	0.014 (0.036)	0.012 (0.037)	-0.248** (0.105)
Cashflow/PPE	-0.087*** (0.025)	-0.011** (0.005)	-0.012** (0.005)
Constant	-2.474*** (0.181)	-2.269*** (0.191)	-2.317*** (0.183)
Firm*country FE	Yes	Yes	Yes
Country*year FE	Yes	Yes	Yes
N	80527	80527	80527
R-squared	0.050	0.050	0.050

Notes: This table reports OLS estimates of the moderating role of firm-level financial indicators in the relationship between ESG performance and outward FDI. The dependent variable is the log of FDI employment (jobs created). The variables of interest are the interaction terms between ESG performance (Ln ESG, lagged one period) and three separate measures of financial capacity: operating cash flow relative to capital stock (Cashflow/PPE, column 1), profitability (EBITDA/Assets, column 2), and asset turnover (Sales/Assets, column 3). These coefficients capture whether financial strength amplifies the ESG–FDI relationship. All other explanatory variables are lagged one year to mitigate simultaneity bias. Controls include firm size (Ln Assets), growth opportunities (Tobin's Q), liquidity (Cash/Assets), leverage, and investment capacity (Cashflow/PPE), among others. Firm–country fixed effects account for time-invariant unobserved heterogeneity, while country–year fixed effects control for host-country shocks over time. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Table 4-12 Alternative FDI proxy - R&D and the effect of ESG on FDI

	Dependent variable: Ln FDI (1)	Dependent variable: Ln Jobs (2)
Ln ESG	0.059*** (0.017)	0.107*** (0.022)
Ln ESG*R&D/Assets	-0.461** (0.220)	
Ln ESG*R&D/Sales		-0.739*** (0.143)
R&D/Assets	2.097*** (0.788)	
R&D/Sales		2.540*** (0.533)
Ln Assets	0.184*** (0.012)	0.246*** (0.016)
Tobin's Q	0.029*** (0.004)	0.038*** (0.006)
PPE/Assets	0.038 (0.102)	0.044 (0.132)
EBITDA/Assets	0.330*** (0.091)	0.390*** (0.123)
Interest/EBITDA	-0.031 (0.026)	-0.030 (0.034)
Cash/Assets	-0.002 (0.013)	0.115 (0.081)
Leverage	-0.002 (0.029)	-0.016 (0.018)
Sales/Assets	0.115* (0.061)	0.021 (0.036)
Cashflow/PPE	-0.010*** (0.003)	-0.013*** (0.005)
Constant	-1.976*** (0.141)	-2.717*** (0.190)
Firm*country FE	Yes	Yes
Country*year FE	Yes	Yes
N	80527	80403
R-squared	0.050	0.050

Notes: This table reports OLS estimates of the moderating effect of R&D intensity on the relationship between ESG performance and outward FDI. The dependent variable is the log of FDI capital expenditure in column (1) and the natural logarithm of FDI employment (jobs created) in column (2). The main variables of interest are the interaction terms between ESG performance (Ln ESG, lagged one period) and R&D intensity, measured alternatively as R&D/Assets column (1) and R&D/Sales column (2). These coefficients capture whether innovation strategies weaken the marginal effect of ESG on FDI. All other right-hand-side variables are lagged one year to address simultaneity concerns. Controls include firm size (Ln Assets), growth opportunities (Tobin's Q), operating profitability (EBITDA/Assets), interest coverage (Interest/EBITDA), liquidity (Cash/Assets), leverage, sales intensity (Sales/Assets), and investment capacity (Cashflow/PPE). Firm–country fixed effects absorb time-invariant heterogeneity, while country–year fixed effects account for host-country shocks over time. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5 Conclusion

5.1 Summary of the thesis

This thesis examines how sustainability considerations shape international investment decisions, focusing on the roles of climate finance and environmental, social, and governance (ESG) performance across emerging and developed economies. Using three empirical chapters that operate at different levels of aggregation, the thesis shows that sustainability influences foreign direct investment (FDI) through multiple channels.

Chapter 2 provides a country-level analysis of the relationship between climate finance and aggregate FDI inflows to emerging markets and developing economies. By disaggregating climate finance into adaptation and mitigation objectives, the chapter moves beyond existing studies that treat climate finance as a single aggregate flow. The results show that adaptation-related climate finance is positively associated with aggregate FDI inflows. This finding is consistent with the idea that adaptation finance supports resilience and infrastructure and signals a country's capacity to manage climate-related risks, thereby improving overall investment conditions. In contrast, mitigation finance does not exhibit a statistically significant association with aggregate FDI, suggesting that its effects are not readily observable at the macroeconomic level.

Chapter 3 shifts the analysis from the country level to the sectoral and firm levels, focusing on greenfield investment in environmental-technology sectors. This chapter shows that mitigation-related climate finance is associated with increased greenfield investment in these sectors, indicating that mitigation finance is linked to project-level investment activity in commercially oriented, low-carbon technologies. Adaptation finance does not display a direct effect at the firm level. When considered alongside the results from Chapter 2, these findings

suggest that adaptation finance operates primarily through broader investment conditions, while mitigation finance is more closely associated with targeted investment in specific sectors.

Chapter 4 extends the analysis to firm-level sustainability in developed economies by examining outward greenfield FDI by North American firms. The results show that firms with stronger ESG performance are more likely to invest abroad and to undertake larger greenfield investments. This relationship is particularly pronounced among firms facing fewer financial constraints, while high research and development intensity moderates the effect, reflecting a trade-off between innovation and sustainability when financial resources are limited. These findings indicate that ESG performance functions as an important firm-level characteristic associated with international expansion decisions.

Taken together, the three chapters demonstrate that sustainability-related factors influence international investment at different stages and levels. Adaptation climate finance is associated with aggregate investment conditions, mitigation finance is associated with sector-specific project activity, and ESG performance is associated with firm-level outward investment capacity. This layered structure highlights how public and private sustainability mechanisms jointly shape the geography and composition of global FDI.

5.2 Contributions

This thesis makes several contributions to the literature on international investment and sustainability.

First, it contributes empirically by extending the determinants-of-FDI framework to incorporate sustainability-related factors, specifically climate finance and ESG performance, into analyses of both inward and outward investment. The thesis provides a comprehensive account of how sustainability considerations are associated with investment outcomes in different contexts. Second, the thesis offers new evidence on the distinct roles of adaptation and mitigation climate finance. The results show that adaptation finance is associated with higher aggregate FDI inflows at the country level, while mitigation finance is associated with greenfield investment in environmental-technology sectors at the firm level. These findings clarify why previous studies have reported mixed results when analysing climate finance in aggregate form and demonstrate the importance of distinguishing between different climate finance objectives. Third, the thesis contributes to the growing literature on ESG and internationalisation by providing firm-level evidence that ESG performance is associated with outward greenfield FDI. The results show that this relationship depends on firms' financial

capacity and innovation intensity, highlighting the conditions under which sustainability commitments are more likely to translate into international expansion.

Methodologically, the thesis adopts a multi-level empirical design that combines country-level, sectoral, and firm-level data. Identification strategies are tailored to each empirical setting, using dynamic panel methods where investment persistence is relevant and static instrumental variable approaches where high-dimensional fixed effects or external instruments are available. This approach allows the thesis to address endogeneity concerns while preserving the structure of the baseline models, thereby strengthening causal interpretation.

5.3 Policy implications

The findings of this thesis have several implications for policy and practice. For emerging markets and developing economies, the results suggest that adaptation-related climate finance is associated with improved aggregate investment conditions. Climate finance directed towards resilience and infrastructure appears relevant for sustaining investor confidence in environments exposed to climate-related risks. While institutional quality is not examined directly, the findings indicate that adaptation finance may complement broader development efforts aimed at improving investment conditions.

For donor governments, development finance institutions, and international climate funds, the results highlight the importance of differentiating between adaptation and mitigation objectives when designing climate finance instruments. Mitigation-related finance is more closely associated with sector-specific investment in environmental technologies, while adaptation finance is associated with broader investment conditions. Recognising these differences may help improve the effectiveness of climate finance in mobilising private capital. For multinational enterprises, the findings suggest that ESG performance is associated with outward investment capacity, particularly for firms with strong financial positions. This indicates that sustainability considerations are increasingly relevant to international investment strategies, not as a substitute for public climate finance, but as a firm-level factor associated with expansion decisions.

5.4 Limitations and future research

Despite the robustness of the results, several limitations remain. Cross-country variation in climate-finance reporting constrains the comparability of international data and may introduce

measurement noise in cross-country analyses. In addition, the focus on environmental-technology investment excludes other sectors that may also respond to climate finance through different channels.

The ESG analysis concentrates on North American firms. This focus reflects the region's substantial contribution to global outward FDI and its leading role in the development of ESG standards and sustainable finance, rather than a data limitation. North American firms represent a large share of global greenfield investment flows, making them a particularly relevant setting for examining the relationship between ESG performance and international expansion. Nevertheless, caution is warranted when extrapolating the findings to firms headquartered in regions with different institutional, regulatory, or disclosure environments.

Future research could extend the analysis to firms in other advanced and emerging economies to assess whether the ESG–FDI relationship varies across institutional settings. Additional work may employ quasi-experimental or natural experiment designs to strengthen causal inference and examine interactions between climate finance and private investment at the project level. Expanding the analysis to sectors such as manufacturing, services, and agriculture would provide a broader understanding of sustainability's role in international investment. Further research may also explore alternative financing mechanisms, including blended finance and public–private partnerships, to better understand how public and private capital interact in climate-related investment. Finally, future studies could investigate whether environmental, social, and governance dimensions exert heterogeneous effects on outward greenfield FDI.

5.5 Concluding remarks

This thesis shows that sustainability-related factors are increasingly associated with international investment outcomes, although their influence varies across levels of analysis and forms of engagement. Climate finance and ESG performance affect investment through distinct but interconnected channels that reflect the roles of public finance, investment incentives, and firm-level capabilities. Taken together, Chapters 2–4 suggest that sustainability-related investment outcomes emerge through complementary mechanisms operating at different levels of analysis: country-level climate finance shapes investment conditions and resilience, project-level climate incentives influence the allocation of capital towards environmental investment, and firm-level sustainability capabilities affect international expansion decisions. By integrating country-level, sectoral, and firm-level evidence, the thesis provides a coherent

empirical account of how public climate finance and private sustainability practices jointly shape the evolving geography of foreign direct investment.

In summary, the findings indicate that sustainability considerations are associated with investment outcomes through different pathways rather than a single mechanism. Adaptation climate finance appears more closely linked to aggregate investment conditions; mitigation finance plays a stronger role in shaping environmentally orientated investment decisions, and stronger ESG performance is associated with greater outward greenfield investment, particularly where firms face fewer financial constraints. In doing so, the thesis provides a clearer understanding of the conditions under which sustainability considerations are associated with international investment in a changing global economy.

References:

- Aberg, A. and Jeffs, N. (2022). Loss and Damage finance in the climate negotiations. *Chatham House, the Royal Institute of International Affairs*.
- Adom, P.K. and Amoani, S. (2021). The role of climate adaptation readiness in the economic growth and climate change relationship: An analysis of the output/income and productivity/institution channels. *Journal of Environmental Management*, 293, 1-12.
- Agrawal, A. and Matsa, D.A. (2013). Labour Unemployment Risk and Corporate Financing Decisions. *Journal of Financial Economics*, 108(2), 449–470.
- Aivazian, V., Ge, Y. and Qiu, J. (2005). The impact of leverage on firm investment: Canadian evidence. *Journal of Corporate Finance*, 11(1–2), 277–291.
- Alam, M.S., Atif, M., Chien-Chi, C. and Soytaş, U. (2019). Does corporate R&D investment affect firm environmental performance? Evidence from G-6 countries. *Energy Economics*, 78, 401-411.
- Albuquerque, R., Koskinen, Y. and Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, 65(10), 4451–4469.
- Aleksynska, M. and Havrylchyk, O. (2013). FDI from the south: The role of institutional distance and natural resources. *European Journal of Political Economy*, 29, 38-53.
- Almeida, H. and Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *Review of Financial Studies*, 20(5), 1429–1460.
- Amiti, M. and Khandelwal, A.K. (2013). Import competition and quality upgrading. *Review of Economics and Statistics*, 95(2), 476-490.
- An, Y., Liu, N., Zhang, L. and Zheng, H. (2022). Adapting to climate risks through cross-border investments: industrial vulnerability and smart city resilience. *Climatic Change*, 174(1-2), 10.
- Anuchitworawong, C. and Thampanishvong, K. (2015). Determinants of foreign direct investment in Thailand: Does natural disaster matter? *International Journal of Disaster Risk Reduction*, 14, 312-321.
- Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, 68(1), 29-51.
- Ashraf, A., Herzer, D. and Nunnenkamp, P. (2017). Greenfield FDI, cross-border M&As, and government size. *The Journal of International Trade & Economic Development*, 26(5), 566-584.
- Asiedu, E. (2002). On the determinants of foreign direct investment to developing countries: is Africa different? *World development*, 30(1), 107-119.

- Asimakopoulos, P., Asimakopoulos, S. and Li, X. (2023). The role of environmental, social, and governance ratings on corporate debt structure. *Journal of Corporate Finance*, 83, 1-21.
- Attig, N., Boubakri, N., El Ghouli, S., & Guedhami, O. (2016). Firm internationalization and corporate social responsibility. *Journal of Business Ethics*, 134(2), 171–197.
- Balkevicius, A., Sanctuary, M. and Zvirblyte, S. (2020). Fending off waste from the west: The impact of China's Operation Green Fence on the international waste trade. *The World Economy*, 43(10), 2742-2761.
- Barua, S., Colombage, S. and Valenzuela, E. (2020). Climate change impact on foreign direct investment inflows: A dynamic assessment at the global, regional and economic level. *Regional and Economic Level*. SSRN Working Paper 3674777.
- Bazilian, M., Nakhooda, S. and Van de Graaf, T. (2014). Energy governance and poverty. *Energy Research & Social Science*, 1, 217-225.
- Beata, C. and Mitchell, I. (2022). Climate Finance Effectiveness: Six Challenging Trends. Centre for Global Development. <https://www.cgdev.org/sites/default/files/climate-finance-effectiveness-six-challenging-trends.pdf>.
- Benlemlih, M. and Bitar, M. (2018). Corporate social responsibility and investment efficiency. *Journal of Business Ethics*, 148(3), 647-671.
- Berg, F., Kölbel, J.F. and Rigobon, R. (2022) ‘Aggregate confusion: The divergence of ESG ratings’, *Review of Finance*, 26(6), 1315–1344.
- Bhavan, T., Xu, C. and Zhong, C. (2011). The relationship between foreign aid and FDI in South Asian economies. *International Journal of Economics and Finance*, 3(2), 143-149.
- Bilyay-Erdogan, S., Danisman, G.O. and Demir, E. (2024). ESG performance and investment efficiency: The impact of information asymmetry. *Journal of International Financial Markets, Institutions and Money*, 91, 1-19.
- Bistline, J., Blanford, G., Brown, M., Burtraw, D., Domeshek, M., Farbes, J., Fawcett, A., Hamilton, A., Jenkins, J., Jones, R. and King, B. (2023). Emissions and energy impacts of the Inflation Reduction Act. *Science*, 380(6652), 1324-1327.
- Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.
- Bogmans, C., Pescatori, A. and Prifti, E. (2024). The impact of climate policy on oil and gas investment: Evidence from firm-level data. *European Economic Review*, 165, 1-18.
- Bondy, K., & Starkey, K. (2014). The dilemmas of internationalization: Corporate social responsibility in the multinational corporation. *British Journal of Management*, 25(1), 4–22.

Bouchmel, I., Ftiti, Z., Louhich, W. and Omri, A. (2024). Financing sources, green investment, and environmental performance: Cross-country evidence. *Journal of Environmental Management*, 353, 1-12.

Broadstock, D. C., Chan, K., Cheng, L. T. and Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, 38, 1-11.

Buch, C.M., Kesternich, I., Lipponer, A. and Schnitzer, M. (2014). Financial constraints and foreign direct investment: firm-level evidence. *Review of World Economics*, 150, 393-420.

Campello, M., Graham, J.R. and Harvey, C.R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, 97(3), 470-487.

Carfora, A. and Scandurra, G. (2019). The impact of climate funds on economic growth and their role in substituting fossil energy sources. *Energy Policy*, 129, 182-192.

Carreno, A.M. (2024). Strategic Integration of ESG in Business Transformation: A Roadmap for Sustainable Success. Available at SSRN 4986686.

Cassiman, B. and Golovko, E. (2011). Innovation and internationalisation through exports. *Journal of International Business Studies*, 42, 56-75.

Castellani, D. and Lavoratori, K. (2020). The lab and the plant: offshore R&D and co-location with production activities. *Journal of International Business Studies*, 51(1), 121-137.

Castellani, D., Marin, G., Montresor, S. and Zanfei, A. (2022). Greenfield foreign direct investments and regional environmental technologies. *Research Policy*, 51(1), 1-17.

Catalano, M., Forni, L. and Pezzolla, E. (2020). Climate change adaptation: The role of fiscal policy. *Resource and Energy Economics*, 59, 1-19.

Cevik, S. and Jalles, J.T. (2022). This changes everything: climate shocks and sovereign bonds. *Energy Economics*, 107, 1-11.

Cevik, S. and Jalles, J.T. (2023). Feeling the heat: Climate shocks and credit ratings. *Review of Development Finance*, 13(2), 21-34.

Chakrabarty, S. and Wang, L. (2013). Climate change mitigation and internationalisation: the competitiveness of multinational corporations. *Thunderbird International Business Review*, 55(6), 673-688.

Chan, E.Y. (2025). Moral Signaling in Startups: How ESG Claims Shape Stakeholder Judgments and Ethical Legitimacy. *Journal of Business Ethics*, 1-15.

Chava, S. (2014). Environmental externalities and cost of capital. *Management science*, 60(9), 2223-2247.

Chegut, A., Schenk, H. and Scholtens, B. (2011). ‘Assessing SRI fund performance research: best practices in empirical analysis’. *Sustainable Development*, 19, 77–94.

Chen, Y., Zhang, D., Wu, F. and Ji, Q. (2022). Climate risks and foreign direct investment in developing countries: The role of national governance. *Sustainability Science*, 17(5), 1723-1740.

Cheng, B., Ioannou, I. and Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategy Management Journal*. 35 (1), 1–23

Cichocka, B. and Mitchel, I. (2022). Climate finance effectiveness: Six challenging trends. *Center for Global Development* (No. 281).

Cigna, S., Meinen, P., Schulte, P. and Steinhoff, N. (2022). The impact of US tariffs against China on US imports: Evidence for trade diversion? *Economic Inquiry*, 60(1), 162-173.

Cleary, S., 2006. International corporate investment and the relationships between financial constraint measures. *Journal of Banking & Finance*, 30(5), 1559-1580.

Climate Bonds Initiative (2024). *Sustainable debt market summary Q3 (2024)*.

Climate Policy Initiative (2021). Global landscape of climate finance 2021. *San Francisco: Climate Policy Initiative*. Available at: <https://www.climatepolicyinitiative.org/wp-content/uploads/2021/10/Full-report-Global-Landscape-of-Climate-Finance-2021.pdf>

Corfee-Morlot, J., Marchal, V., Kauffmann, C., Kennedy, C., Stewart, F., Kaminker, C. and Ang, G. (2012). Towards a green investment policy framework: The case of low-carbon, climate-resilient infrastructure. *OECD Environment Working Papers*, 48.

CRED (2022). Disasters in numbers. Brussels: CRED; 2023. https://cred.be/sites/default/files/2022_EMDAT_report.pdf

Crifo, P., Forget, V.D. and Teyssier, S. (2015). The price of environmental, social and governance practice disclosure: An experiment with professional private equity investors. *Journal of Corporate Finance*, 30, 168-194.

Dang, T.V., Wang, Y. and Wang, Z. (2022). The role of financial constraints in firm investment under pollution abatement regulation. *Journal of Corporate Finance*, 76, 1-21.

De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research policy*, 41(3), 614-623.

De Noni, I., Belussi, F. and Gu, Y. (2024). Greenfield FDI as a catalyst for technological collaborations between European regions and emerging countries. *European Planning Studies*, 32(9), 1982-2002.

De Souza Cunha, F.A.F., Meira, E., Orsato, R.J., Klotzle, M.C. & Lucena, A.F. (2021). Do low-carbon investments in emerging economies pay off? Evidence from the Brazilian stock market. *International Review of Financial Analysis*, 74, 1-10

Delmas, M.A. and Burbano, V.C. (2011). The drivers of greenwashing. *California management review*, 54(1), 64-87.

Demena, B.A. and Afesorbor, S.K. (2020). The effect of FDI on environmental emissions: Evidence from a meta-analysis. *Energy Policy*, 138, 1-17.

Denis, D.J. and Osobov, I. (2008). Why do firms pay dividends? International evidence on the determinants of dividend policy. *Journal of Financial Economics*, 89(1), 62–82.

Denis, D.J. and Sibilkov, V. (2010). Financial constraints, investment, and the value of cash holdings. *Review of Financial Studies*, 23(1), 247–269.

Desbordes, R. and Wei, S.J. (2017). The effects of financial development on foreign direct investment. *Journal of Development Economics*, 127, 153–168.

Dicken, P. (2015). *Global Shift: Mapping the Changing Contours of the World Economy*, 7th Edition, Guilford Press, 238.

Diffenbaugh, N.S. and Burke, M. (2019). Global warming has increased global economic inequality. *Proceedings of the National Academy of Sciences*, 116(20), 9808-9813.

Ding, Q., Huang, J. and Chen, J. (2023). Does digital finance matter for corporate green investment? Evidence from heavily polluting industries in China. *Energy Economics*, 117, 1-9.

Ding, Y., Ge, Y. and Isaksson, A. (2021). The internationalisation of Chinese firms: Impact of FDI experience on export performance. *The World Economy*, 44(3), 653–676.

Dissanayake, R. and Camps, B. (2022). Building a Portfolio of Pull Financing Mechanisms for Climate and Development. *Centre for Global Development*.

Donaubauer, J., Meyer, B. and Nunnenkamp, P. (2016). Aid, infrastructure, and FDI: Assessing the transmission channel with a new index of infrastructure. *World Development*, 78, 230-245.

Doytch, N. (2019). Upgrading destruction? How do climate-related and geophysical natural disasters impact sectoral FDI. *International Journal of Climate Change Strategies and Management*, 12(2), 182-200.

Doytch, N. and Uctum, M. (2011). Does the worldwide shift of FDI from manufacturing to services accelerate economic growth? A GMM estimation study. *Journal of International Money and Finance*, 30(3), 410-427.

Drabo, A. (2021). How do climate shocks affect the impact of FDI, ODA and remittances on economic growth? *International Monetary Fund*, Working Paper 193.

- Drempetic, S., Klein, C. and Zwergel, B. (2020). The influence of firm size on the ESG rating: Corporate sustainability ratings under review. *Journal of Business Ethics*, 167, 333–360.
- Duanmu, J.L. (2014). State-owned MNCs and host country expropriation risk: the role of home state soft power and economic gunboat diplomacy. *Journal of International Business Studies*, 45(8), 1044–1060.
- Duchin, R., Gilbert, T., Harford, J. and Hrdlicka, C. (2017). Precautionary savings with risky assets: When cash is not cash. *The Journal of Finance*, 72(2), 793-852.
- Eberhart, A.C., Maxwell, W.F. and Siddique, A.R. (2008). A re-examination of the trade-off between R&D and capital expenditures and the link to firm value. *Financial Management*, 37(4), 643–680.
- Eccles, R.G., Ioannou, I. and Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management science*, 60(11), 2835-2857.
- Egli, F., Polzin, F., Sanders, M., Schmidt, T., Serebriakova, A. and Steffen, B. (2022). Financing the energy transition: four insights and avenues for future research. *Environmental Research Letters*, 17(5), 1-4
- El Ghouli, S., Guedhami, O., Kwok, C.C. and Mishra, D.R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, 35(9), 2388-2406.
- Escaleras, M. and Register, C.A. (2011). Natural disasters and foreign direct investment. *Land Economics*, 87(2), 346-363.
- European Investment Bank (2023). What drives firms' investment in climate action? Evidence from the 2022-2023 EIB Investment Survey. <https://doi.org/10.2867/048422>
- Eyckmans, J., Fankhauser, S. and Kverndokk, S. (2016). Development aid and climate finance, *Environmental and resource economics*, 63(2), 429-450.
- Fankhauser, S. and Stern, N. (2016). Climate change, development, poverty, and economics. *The State of Economics, the State of the World*, (284).
- Farza, K., Ftiti, Z., Hlioui, Z., Louhichi, W. and Omri, A. (2021). Does it pay to go green? The environmental innovation effect on corporate financial performance. *Journal of Environmental Management*, 300, 1-8.
- Fatih, B., 2024. World Energy Outlook 2024.
- Fazzari, S., Hubbard, R.G. and Petersen, B.C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 141–195

- Ferrero-Ferrero, I., Fernández-Izquierdo, M.A. and Muñoz-Torres, M.J. (2016). The effect of environmental, social and governance consistency on economic results. *Sustainability*, 8(10), 1-16.
- Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2), 499–516.
- Freidt, L. and Toner-Rodgers, A. (2022). Natural disasters, intra-national FDI spillovers and economic divergence: evidence from India, *Journal of Development Economics*, 157, 1-21.
- Friede, G., Busch, T. and Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Friedman, E. (2023). Constructing the adaptation economy: Climate resilient development and the economisation of vulnerability. *Global Environmental Change*, 80, 1-12.
- Furlow, N.E. (2010). Greenwashing in the new millennium. *The Journal of Applied Business and Economics*, 10(6), 22.
- Gamso, J. (2025). Does climate aid reduce perceived climate risks to foreign direct investors? *Climate and Development*, 1–11.
- Garriga, A. C. and Phillips, B. J. (2014). Foreign aid as a signal to investors: Predicting FDI in post-conflict countries. *Journal of Conflict Resolution*, 58(2), 280–306.
- Gholami, A., Murray, P.A. and Sands, J. (2022). Environmental, social, governance & financial performance disclosure for large firms: is this different for SME firms? *Sustainability*, 14(10), 6019.
- Giese, G., Lee, L.E., Melas, D., Nagy, Z. and Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *Journal of portfolio management*, 45(5), 69-83.
- Giglio, S., Kelly, B. and Stroebe, J. (2021). Climate finance. *Annual Review of Financial Economics*, 13(1), 15–36.
- Gillan, S. L., Koch, A. and Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 1-16.
- Ginglinger, E. and Moreau, Q. (2023). Climate risk and capital structure. *Management Science*, 69(12), 7492-7516.
- Globerman, S. and Shapiro, D. (2002). Global foreign direct investment flows: The role of governance infrastructure. *World development*, 30(11), 1899-1919.
- Goncalves, T.C., Dias, J. and Barros, V. (2022). Sustainability performance and the cost of capital. *International Journal of Financial Studies*, 10(3), 63.

- González-Pozo, R., Arenas-Parra, M., Quiroga-García, R. and Bilbao-Terol, A. (2025). A proposal for refining the ESG methodology used by rating agencies. *International Transactions in Operational Research*, 32(4), 2003-2033.
- Gopalan, S., Gupta, B. and Rajan, R.S. (2023). Do climate risks influence foreign direct investment inflows to emerging and developing economies? *Climate Policy*, 23(6), 722-734.
- Görg, H., 2000. Analysing foreign market entry—the choice between greenfield investment and acquisitions. *Journal of Economic Studies*, 27(3), 165-181
- Gorostidi-Martinez, H., & Zhao, X. (2017). Strategies to avoid liability of foreignness when entering a new market. *Journal of Advances in Management Research*, 14(1), 46–68.
- Gu, G.W. and Hale, G. (2023). Climate risks and FDI. *Journal of International Economics*, 146, 1-65.
- Gui, R., Meierer, M., Schilter, P. and Algesheimer, R. (2023). REndo: internal instrumental variables to address endogeneity. *Journal of Statistical Software*, 107, 1-43.
- Ha, J., Kose, M.A. and Ohnsorge, F. (2023). One-stop source: a global database of inflation. *Journal of International Money and Finance*, 137, 1-13.
- Han, W., Wang, J. and Wang, X. (2022). FDI and firm productivity in host countries: The role of financial constraints. *Journal of International Money and Finance*, 124, 1-20.
- Hansen, L.P. (1982) ‘Large sample properties of generalised method of moments estimators’, *Econometrica*, 50(4), 1029–1054.
- Haque, N. and Rashid, S. (2022). Effects of cumulative energy aid projects on renewable energy generation capacity. *Environmental Development*, 42, 1-11.
- Hong, H., Karolyi, G.A. and Scheinkman, J.A. (2020). Climate finance. *The Review of Financial Studies*, 33(3), 1011–1023.
- Hong, H., Karolyi, G.A. and Scheinkman, J.A. (2020). Climate finance. *The Review of Financial Studies*, 33(3), 1011-1023.
- Huang, H.H., Kerstein, J. and Wang, C. (2018). The impact of climate risk on firm performance and financing choices: An international comparison. *Journal of International Business Studies*, 49, 633–656.
- IEA (2021). *World Energy Outlook 2021*. Paris: International Energy Agency. <https://www.iea.org/reports/world-energy-outlook-2021>
- IEA (2023). <https://www.iea.org/reports/co2-emissions-in-2023/the-changing-landscape-of-global-emissions>
- IMF (2019). <https://www.imf.org/en/Topics/climate-change/climate-and-the-economy>

- Ioannou, I. and Serafeim, G. (2015). The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal*, 36(7), 1053–1081.
- IPCC (2023). Sections. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 35-115.
- Irwin-Hunt, A. (2020). A signal for Morocco's development. *FDI Intelligence*. Available at: <https://www.fdiintelligence.com/content/locations/global/middle-east-africa/morocco/a-signal-for-morocco-s-development-79117>.
- Islam, M.M. (2022). Distributive justice in global climate finance – Recipients' climate vulnerability and the allocation of climate funds. *Global Environmental Change*, 73, 1-15.
- Jensen, M.C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, 76(2), 323–329.
- Jia, W., Tsang, A., Yu, D.B. and Zhao, J. (2026). Peer Effects in Corporate ESG: Evidence from Mandatory Disclosure and Philanthropic Giving. *Journal of Business Ethics*, 1-24
- Jiang, W., Chai, H., Shao, J. and Feng, T. (2018). Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. *Journal of Cleaner Production*, 198, 1311-1323.
- Kalantzis, F., Khalid, S., Solovyeva, A. and Wolski, M. (2025). Firms' response to climate regulations: Empirical investigations based on the European Emissions Trading System. *Energy Policy*, 206, 1-15.
- Kandpal, P.C. (2024). *Environmental policy, governance and politics: a South Asian perspective*. Routledge India.
- Kaplan, S.N. and Zingales, L. (1995). Do financing constraints explain why investment is correlated with cash flow?
- Karim, A.E., Albitar, K. and Elmarzouky, M. (2021). A novel measure of corporate carbon emission disclosure, the effect of capital expenditures, and corporate governance. *Journal of Environmental Management*, 290, 1-8.
- Keenan, J.M. (2019). *Climate Adaptation Finance and Investment in California*, Taylor & Francis.
- Kellard, N.M., Kontonikas, A., Lamla, M.J., Maiani, S. and Wood, G. (2022). Risk, financial stability and FDI. *Journal of International Money and Finance*, 120, 1-20.

Khan, M.A., Ahmed, M. and Hull, R. (2024). The impact of climate mitigation finance on greenhouse gas. *Journal of Environmental Planning and Management*, 67(14), 3581-3599.

Khurana, R., Mugabe, D. and Etienne, X. L. (2022). Climate change, natural disasters, and institutional integrity. *World Development*, 157, 1-15.

Khurram, M.U., Abbassi, W., Chen, Y. and Chen, L. (2024). Outward foreign investment performance, digital transformation, and ESG performance: Evidence from China. *Global Finance Journal*, 60, 1-18.

Kimura H. and Todo Y. (2010). Is Foreign Aid a Vanguard of Foreign Direct Investment? A Gravity-Equation Approach, *World Development*, 38(4), 482-497.

King, T., Loncan, T. and Khan, Z. (2021). Investment, leverage, and political risk: Evidence from project-level FDI. *Journal of Corporate Finance*, 67, 1-22.

Kong, Wen. "The impact of ESG performance on debt financing costs: Evidence from Chinese family business." *Finance Research Letters* 55 (2023): 103949.

Kostova, T., and Zaheer, S. (1999). Organizational legitimacy under conditions of complexity: The case of the multinational enterprise. *Academy of Management Review*, 24(1), 64–81.

Krueger, P., Sautner, Z. and Starks, L.T. (2020). The Importance of Climate Risks for Institutional Investors. *The Review of Financial Studies*, 33(3), 1067-1111.

Kruger, P. (2015). Corporate goodness and shareholder wealth. *Journal of Financial Economics*, 115(2), 304–329.

Kukułka, A. (2014). Natural disasters and FDI inflow in the developing countries of South-Eastern Asia. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, (370), 208-216.

Kumar, N., Poonia, V. Gupta, B.B. and Goyal, M.K. (2021). A novel framework for risk assessment and resilience of critical infrastructure towards climate change. *Technological Forecasting and Social Change*, 165, 120532.

Lamont, O., Polk, C. and Saaá-Requejo, J. (2001). Financial constraints and stock returns. *The review of financial studies*, 14(2), 529-554.

Lamperti, F., Bosetti, V., Roventini, A., Tavoni, M. and Treibich, T. (2021). Three green financial policies to address climate risks. *Journal of Financial Stability*, 54, 1-31.

Leal, P.H., Marques, A.C. and Shahbaz, M. (2023). Does climate finance and foreign capital inflows drive decarbonisation in developing economies? *Journal of Environmental Management*, 347, 1-12.

Lee, C.C., Li, X., Yu, C.H. and Zhao, J. (2022). The contribution of climate finance toward environmental sustainability: New global evidence. *Energy Economics*, 111, 1-10.

- Lee, M.J., Kim, Y., Roh, T. and Lee, M. (2025). Multinational enterprises' ESG strategy against institutional pressures in emerging markets: the moderating effect of digitalization capability. *Business Strategy and the Environment*, 34(8), 10373-10394.
- Li, C., Brodbeck, F.C., Shenkar, O., Ponzi, L.J. and Fisch, J.H. (2017). Embracing the foreign: Cultural attractiveness and international strategy. *Strategic Management Journal*, 38(4), 950-971.
- Li, L., Qiu, L., Xu, F. and Zheng, X. (2023). The impact of green credit on firms' green investment efficiency: Evidence from China. *Pacific-Basin Finance Journal*, 79, 1-17.
- Li, Y. (2025). SOE's ESG Performance on Financial Flexibility: The Evidence from the Hong Kong Stock Market. *2502.14261*.
- Li, Z., Liao, G. and Albitar, K. (2020). Does corporate environmental responsibility engagement affect firm value? The mediating role of corporate innovation. *Business Strategy and the Environment*, 29(3), 1045-1055.
- Liargovas, P., Apostolopoulos, N., Pappas, I. and Kakouris, A. (2017). SMEs and green growth: The effectiveness of support mechanisms and initiatives matters. In: *Green Economy in the Western Balkans: Towards a Sustainable Future*, 79–108. Emerald Publishing Limited.
- Lin, J., Cao, X., Dong, X. and An, Y. (2024). Environmental regulations, supply chain relationships, and green technological innovation. *Journal of Corporate Finance*, 88, 1-28.
- Lins, K.V., Servaes, H. and Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *Journal of Finance*, 72 (4), 1785–1824.
- Lundan, S. and Cantwell, J. (2020). The local co-evolution of firms and governments in the Information Age. *Journal of International Business Studies*, 51(9), 1516-1528.
- Lv, Z., Zheng, K. and Tan, J. (2024). Revisiting the relationship between natural resources and environmental quality—can ICT break the “resource curse” in the environment? *Journal of Environmental Management*, 357, 1-14.
- Maaloul, A., Zéghal, D., Ben Amar, W. and Mansour, S. (2023). The effect of environmental, social, and governance (ESG) performance and disclosure on cost of debt: The mediating effect of corporate reputation. *Corporate reputation review*, 26(1), 1-18.
- Manova, K., Wei, S.J. and Zhang, Z. (2015). Firm exports and multinational activity under credit constraints. *Review of economics and statistics*, 97(3), 574-588.
- Maruyama, M. and Wu, L. (2015). Overcoming the liability of foreignness in international retailing: A consumer perspective. *Journal of International Management*, 21(3), 200-210.

- Mawdsley, E. and Taggart, J. (2022). Rethinking development. *Progress in Human Geography*, 46(1), 3–20.
- Mazumder, S. (2017). The Impact of Globalization on Inflation in Developing Countries. *Journal of Economic Development*, 42(3), 41-60.
- Meyer, J.W., and Rowan, B. (1977). Institutionalised organisations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340–363.
- Miao, C., Fang, D., Sun, L. and Luo, Q. (2017). Natural resources utilization efficiency under the influence of green technological innovation. *Resources, Conservation and Recycling*, 126, 153-161.
- Morrissey, O. and Udomkermongkol, M. (2012). Governance, private investment, and foreign direct investment in developing countries. *World development*, 40(3), 437-445.
- Myers, S.C. and Majluf, N.S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.
- Nakhoda, S., Norman, M., Barnard, S., Watson, C., Greenhill, R., Caravani, A. and Banton, G. (2016). Climate finance: is it making a difference? A review of the effectiveness of multilateral climate funds. *Overseas Development Institute*.
- Nawaz, M.A., Seshadri, U., Kumar, P., Aqdas, R., Patwary, A.K. and Riaz, M. (2021). Nexus between green finance and climate change mitigation in N-11 and BRICS countries: empirical estimation through the difference in differences (DID) approach. *Environmental Science and Pollution Research*, 28, 6504-6519.
- Neise, T., Sohns, F., Breul, M. and Revilla Diez, J. (2022). The effect of natural disasters on FDI attraction: a sector-based analysis over time and space. *Natural Hazards*, 110(2), 999-1023.
- Ng, A.C. and Rezaee, Z. (2020). Business sustainability factors and stock price informativeness. *Journal of Corporate Finance*, 64, 1-29.
- Nunez-Mujica, G., Ramachandran, V. and Moris, S. (2023). What Counts as Climate? Preliminary Evidence from the World Bank's Climate Portfolio. Centre For Global Development. <https://www.cgdev.org/publication/what-counts-climate-preliminary-evidence-world-banks-climate-portfolio>.
- OECD (2014). DAC Statistics. Climate Related Aid. <https://www.oecd.org/dac/environment-development/Climate-related%20aid%20Flyer%20-%20March%202014%20v3%20final.pdf>.
- OECD (2017), Investing in Climate, Investing in Growth, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264273528-en>.

- OECD (2021). Climate-related Official Development Assistance: A Snapshot. <https://www.oecd.org/dac/climate-related-official-development-assistance.pdf>.
- Padgett, R.C. and Galan, J.I. (2010). The effect of R&D intensity on corporate social responsibility. *Journal of Business Ethics*, 93, 407-418.
- Pankratz, N.M. and Schiller, C.M. (2024). Climate change and adaptation in global supply-chain networks. *The Review of Financial Studies*, 37(6), 1729-1777.
- Pauw, W.P., Moslener, U., Zamarioli, L.H., Amerasinghe, N., Atela, J., Affana, J.P.B., Buchner, B., Klein, R.J., Mbeva, K.L., Puri, J. and Roberts, J.T. (2022). Post-2025 climate finance target: how much more and how much better? *Climate Policy*, 22(9-10), 1241-1251
- Pesqué-Cela, V., Li, J., & Kim, Y. K. (2023). Overcoming the liability of foreignness in US capital markets: The case of Alibaba and Coupang. *Asia Pacific Business Review*, 29(2), 323–349.
- Pienknagura, S. (2024). Climate policies as a catalyst for green FDI. *International Monetary Fund*. WP/24/46.
- Pienknagura, S. (2024). Trade in low-carbon technologies: The role of climate and trade policies. *IMF Working Paper*, WP/24/75.
- Porter, M.E. and Linde, C.V.D. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118.
- Qiu, L.D. and Wang, S. (2011). FDI policy, greenfield investment and cross-border mergers. *Review of International Economics*, 19(5), 836-851.
- Raff, H., and Srinivasan, K. (1998). Tax incentives for import-substitution foreign investment: Does signalling play a role? *Journal of Public Economics*, 67(2), 167–193.
- Ragosa, G. and Warren, P. (2019). Unpacking the determinants of cross-border private investment in renewable energy in developing countries. *Journal of Cleaner Production*, 235, 854–865.
- Rashid, S., Khan, M.R. and Haque, N. (2023). Does climate finance enhance mitigation ambitions of recipient countries? *Earth System Governance*, 17, 1-7.
- Renneboog, L., Ter Horst, J. and Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of banking & finance*, 32(9), 1723-1742.
- Reurink, A. and Garcia-Bernardo, J. (2021). Competing for capital: the great fragmentation of the firm and varieties of FDI attraction profiles in the European Union. *Review of International Political Economy*, 28(5), 1274–1307.

Ripple, W.J., Moomaw, W.R., Wolf, C., Betts, M.G., Law, B.E., Gregg, J. and Newsome, T.M. (2022). Six steps to integrate climate mitigation with adaptation for social justice. *Environmental Science & Policy*, 128, 41-44.

Rokhmawati, A. (2021). The nexus among green investment, foreign ownership, export, greenhouse gas emissions, and competitiveness. *Energy Strategy Reviews*, 37, 1-11.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, 9 (1), 86–136.

Samet, M. and Jarboui, A. (2017). How does corporate social responsibility contribute to investment efficiency? *Journal of Multinational Financial Management*, 40, 33-46

Sarkodie, S.A. and Strezov, V. (2019). Effect of foreign direct investments, economic development, and energy consumption on greenhouse gas emissions in developing countries. *Science of the Total Environment*, 646, 862-871.

Sarkodie, S.A., Adams, S. and Leirvik, T. (2020). Foreign direct investment and renewable energy in climate change mitigation: does governance matter? *Journal of Cleaner Production*, 263, 1-11.

Scandurra, G., Thomas, A., Passaro, R., Bencini, J. and Carfora, A. (2020). Does climate finance reduce vulnerability in Small Island Developing States? An empirical investigation. *Journal of Cleaner Production*, 256, 1-12.

Schmidt, L., Apergi, M., Eicke, L. and Weko, S. (2024). Who believes in green growth? Strategic framing and technology leadership in the UNFCCC negotiations. *Climate Policy*, 24(2), 177-192.

Shahbaz, M., Gozgor, G., Adom, P.K. and Hammoudeh, S. (2019). The technical decomposition of carbon emissions and concerns about the effects of FDI and trade openness in the United States. *International Economics*, 159:56-73.

Shear, F., Ashraf, B.N. and Butt, S. (2023). Sensing the heat: Climate change vulnerability and foreign direct investment inflows. *Research in International Business and Finance*, 66, 1-13.

Singhania, M. and Saini, N. (2023). Institutional framework of ESG disclosures: comparative analysis of developed and developing countries. *Journal of Sustainable Finance & Investment*, 13(1), 516-559.

Site Selectors Guild (2016). *Site Selectors Survey*.

Songwe, V., Stern, N. and Bhattacharya, A. (2022). Finance for climate action: Scaling up investment for climate and development. *London: Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science*.

Spence, M. (1978). Job market signalling. In *Uncertainty in economics*. *Academic Press*, 281-306.

Stavins, R.N. (2011). The problem of the commons: still unsettled after 100 years. *American Economic Review*, 101(1), 81-108.

Stavropoulos, S., Burger, M.J. and Dufourmont, J. (2020). Urban circular policies and employment through greenfield FDI. *Sustainability*, 12(4), 1458.

Stroebel, J. and Wurgler, J. (2021). What do you think about climate finance? *Journal of Financial Economics*, 142(2), 487-498.

Sun, Y., Tao, Q., Wang, D. and Zhang, W. (2025). Corporate ESG decoupling and R&D investment. *The North American Journal of Economics and Finance*, 75, 1-15.

Tang, D.Y. and Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance*, 61, 1-18.

Tyson, L.D. and Weiss, D. (2025). Climate Finance: Progress, Challenges, and Opportunities on the Path to a Sustainable Planet. *California Management Review*, 67(2), 5-39.

UNCTAD (2021). *Targeted Policies Needed to Boost Investment in the Climate Change Fight*. United Nations Conference on Trade and Development. Available at: <https://unctad.org/es/isar/news/targeted-policies-needed-boost-investment-climate-change-fight>

UNCTAD (2022). *International Investment in Climate Change Mitigation and Adaptation: Trends and Policy Developments*. United Nations Conference on Trade and Development. Available at: <https://investmentpolicy.unctad.org/publications/1273/international-investment-in-climate-change-mitigation-and-adaptation-trends-and-policy-developments>

UNCTAD. (2020). *World Investment Report 2020: International production beyond the pandemic*. Geneva: United Nations.

UNCTAD. (2023). *World Investment Report 2023: Investing in sustainable energy for all*. Geneva: *United Nations*.

UNFCCC (2014) Standing Committee on Finance: Biennial Assessment and Overview of Climate Finance Flows Report.

UNFCCC (2022). Assessment and Overview of Climate Finance Flows. Standing Committee on Finance Fifth Biennial. <https://unfccc.int/topics/climate-finance/resources/biennial-assessment-of-climate-finance>.

UNFCCC (2023). <https://unfccc.int/topics/introduction-to-climate-finance>.

- Valacchi, G., Doytch, N. and Yonzan, N. (2021). Impact of outward foreign direct investments on patent activity of greenfield multinationals. *Technological Forecasting and Social Change*, 173, 1-12.
- Wang, J., Chen, X., Li, X., Yu, J. and Zhong, R. (2020). The market reaction to green bond issuance: Evidence from China. *Pacific-Basin Finance Journal*, 60, 1-19.
- Wang, X., Ren, K., Li, L., Qiao, Y. and Wu, B. (2024). How does ESG performance impact corporate outward foreign direct investment? *Journal of International Financial Management & Accounting*, 35(2), 534-583.
- Weiler, F., Klöck, C. and Dornan, M. (2018). Vulnerability, good governance, or donor interests? The allocation of aid for climate change adaptation. *World Development*, 104, 65–77.
- Whited, T.M. and Wu, G. (2006). Financial constraints risk. *The review of financial studies*, 19(2), 531-559.
- Xie, Q., Wang, X. and Cong, X. (2020). How does foreign direct investment affect CO₂ emissions in emerging countries? New findings from a nonlinear panel analysis. *Journal of Cleaner Production*, 249, 1-10.
- Yang, C., Zhu, C. and Albitar, K. (2024). ESG ratings and green innovation: AU-shaped journey towards sustainable development. *Business Strategy and the Environment*, 33, 4108-4129.
- Yang, X., Li, Z., Qiu, Z., Wang, J. and Liu, B. (2024). ESG performance and corporate technology innovation: Evidence from China. *Technological Forecasting and Social Change*, 206, 1-12.
- Yasin, M. (2005). Official development assistance and foreign direct investment flows to Sub-Saharan Africa. *African Development Review*, 17(1), 23-40.
- Yuan, W., Li, M., Lu, W. and Fan, M. (2025). Research on ESG performance and OFDI willingness: Based on the fusion of financing constraints and productivity threshold. *Journal of Environmental Management*, 373, 1-18.
- Zhai, Y., Cai, Z., Lin, H., Yuan, M., Mao, Y., and Yu, M. (2022). Does better environmental, social, and governance induce better corporate green Innovation: The mediating role of financing constraints. *Corporate Social Responsibility and Environmental Management*, 29(5), 1513–1526.
- Zhang, Z. and Maruyama, A. (2001). Towards a private–public synergy in financing climate change mitigation projects. *Energy Policy*, 29(15), 1363-1378.

Zhao, C., Dong, K., Wang, K. and Nepal, R. (2024). How does artificial intelligence promote renewable energy development? The role of climate finance. *Energy Economics*, 133, 1-12.

Zhao, J., Zhou, B. and Li, X. (2022). Do good intentions bring bad results? Climate finance and economic risks. *Finance Research Letters*, 48, 1-7.

Zhou, F., Endendijk, T. and Botzen, W.W. (2023). A review of the financial sector impacts of risks associated with climate change. *Annual Review of Resource Economics*, 15(1), 233-256.