Climate Finance and Green Growth: The Influence of Democratic Governance in Recipient Countries

Thao Ngoc Nguyen [a] [1], Trinh Hoang Anh Nguyen [b]

[a] *Nottingham Business School, Nottingham Trent University, UK*
[b] *Association of Vietnamese Scientists and Experts, France*

Abstract

Drawing on an extensive national-level dataset spanning 145 countries from 2000 to 2022, we examine the impact of international climate finance on sustainable economic growth in the developing countries. Our findings indicate that both mitigation and adaptation funding significantly promote overall green growth. We incorporate the Polity V democracy index, which assesses the degree to which executive leaders are elected through open, multi-party, and competitive elections, operate under institutional constraints, and face competitive political participation. The results highlight that climate finance delivers stronger environmental outcomes when aligned with higher levels of democratic governance in recipient countries. These insights suggest that policymakers should focus on enhancing institutional capacities and tailoring financial strategies to local governance contexts.

Keywords: Climate Finance, Climate Change Mitigation and Adaptation; Democracy Index.

1. Introduction

[1] Corresponding author.
Email addresses: thao.nguyen@ntu.ac.uk (Thao Nguyen), trinhhoanganh.nguyen@avseglobal.org (T.H.A. Nguyen).

Green economic growth and environmentally sustainable development are inherently connected and mutually reinforcing. Green economic growth seeks to drive economic expansion through environmentally responsible practices, while sustainable development ensures that this growth does not jeopardize the well-being of future generations. Advancing green economic growth is therefore of critical practical importance: it provides a pathway to long-term prosperity that safeguards natural resources, promotes social equity, and reduces environmental risks. The green economy is widely regarded as an effective approach to achieving sustainability because it simultaneously emphasizes economic progress, resource efficiency, and environmental stewardship.

The rising concentration of greenhouse gases (GHGs) in the atmosphere remains a major obstacle to these ambitions. Climate change—driven primarily by carbon dioxide and other GHG emissions—is accelerating environmental degradation across the globe. Its consequences include increasing global temperatures, more frequent and intense natural disasters, melting polar ice, and substantial biodiversity loss. These disruptions affect both ecosystems and human societies, threatening food and water security, displacing communities, burdening public health systems, and undermining national economic stability (IPCC, 2021). In doing so, they erode the very foundations required for green economic growth and environmental sustainability.

The challenges are even more acute in climate-vulnerable countries, where limited financial resources, institutional constraints, and technological deficits hinder effective climate responses. In this context, promoting green economic growth requires not only a fundamental rethinking of development pathways but also the seamless integration of climate policy, financial mechanisms, and sustainable innovations (Lee et al., 2022; Leal et al., 2023; Zhang et al., 2025).

Apart from CO_2 emissions, other factors reflecting environmental indicators have been employed including energy vulnerability (Njangang et al., 2024, Weiler etal., 2021); ESG factors (Pineu et al., 2022). Recently, the role of democracy in climate finance has attracted attention from both academics and practitioners because democratization spread like wildfire across countries (Acemoglu et al., 2019). This paper sheds light on how democracy affects firm climate change exposure. Polity 5 estimates the extent to which open, multi-party, and competitive elections choose a chief executive who faces comprehensive institutional constraints, and political participation is competitive. The index ranges from -10 to 10 (fully

democratic). The main purpose of this study is to investigate the effects of this democracy index on climate finance. To address our initial objective, we analyze a global dataset of 145 countries from 2000 to 2022. We quantify democracy using the Polity V (2020) measure.

Achieving environmental sustainability and advancing green economic growth depend on a suite of strategic approaches, including the global carbon trading market—built on international emissions trading and the Clean Development Mechanism (CDM)—and the widespread diffusion of low-carbon technologies. Among these efforts, climate finance has become a central focus of international climate negotiations (Leal et al., 2023). Broadly understood, climate finance refers to capital flows that support low-carbon and climate-resilient development, generating direct or indirect mitigation and adaptation benefits. In doing so, it contributes to the net-zero ambitions of the Paris Agreement while simultaneously promoting sustainable development.

Climate finance encompasses a diverse mix of public and private, domestic and international sources mobilised to address the adverse impacts of climate change and to foster resilient, sustainable growth. Recognising that many countries lack the resources to adequately respond to environmental challenges, climate finance was conceived as a critical mechanism for reducing global emissions. It helps nations navigate the trade-offs between sustaining economic growth and lowering GHG emissions, while providing incentives for transitioning to a low-carbon development model (Lee et al., 2022). In this way, climate finance operates not only as an environmental policy instrument but also as a vehicle for promoting climate justice and more equitable patterns of global development.

Typically, climate finance is organised around two complementary pillars: adaptation and mitigation. Adaptation finance supports societies in adjusting to current or expected climate impacts through investments in resilient infrastructure, improved water management, disaster risk reduction, and climate-smart agriculture. Mitigation finance, by contrast, aims to reduce or prevent GHG emissions by backing initiatives such as renewable energy deployment, energy efficiency improvements, sustainable transport systems, and efforts to curb deforestation and land degradation (Njangang et al., 2024; Tenant et al., 2022).

In this paper, we examine the impacts of international climate finance in fostering green growth, measured through reductions in per GDP CO_2 emissions. The findings show that both mitigation and adaptation funds significantly reduce CO_2 emissions, underscoring the pivotal

role of climate finance in advancing global decarbonization. This paper makes several important contributions to the literature on climate finance and green growth.

The remainder of the paper is structured as follows. The next section offers a summary of the empirical literature on the effects of climate finance on environmental sustainability. Section 3 focuses on data and variable construction. Empirical results are presented in Section 4, and Section 5 provides a conclusion.

2. Literature review and hypothesis development

Environmental sustainability is a broad, multidimensional concept that incorporates several principles of green development, with climate action at its core. Reducing GHG emissions to mitigate global warming is essential for meeting sustainability objectives. Efforts to address climate change also present significant opportunities to advance environmental protection and inclusive development (IPCC, 2021). Within this broader agenda, climate finance plays a pivotal role. It comprises public and private financial resources mobilised at national, regional, and global scales to support both mitigation and adaptation initiatives. A key milestone was reached in December 2015 when 195 countries adopted the Paris Agreement, committing to limit the rise in global average temperature to well below 2°C above pre-industrial levels (Njanggang et al., 2024). This collective commitment underscores the indispensable contribution of climate finance to advancing the green economy and ensuring long-term environmental sustainability.

Although empirical research on the relationship between climate finance—across both adaptation and mitigation dimensions—and environmental sustainability remains relatively limited, an emerging body of work has begun to shed light on this connection (Islam, 2022; Lee et al., 2022; Leal et al., 2023; Njangang et al., 2024; Zhang et al., 2025). Using panel data from 133 developing countries covering 2000–2018, Lee et al. (2022) show that climate finance significantly reduces carbon emissions, with mitigation finance having a stronger effect than adaptation finance. The emission-reduction impact is found to be especially pronounced in small island developing states and in countries with higher economic development. Similarly, Leal et al. (2023), analysing data for 36 developing countries from 2001 to 2019, reveal that climate finance mitigates environmental degradation, with particularly strong effects in lower-middle-income economies, where regulatory quality plays a key role in shaping outcomes.

Njangang et al. (2024) examine the role of global climate finance—disaggregated into adaptation and mitigation funding—in reducing energy vulnerability across 74 developing countries between

2000 and 2019. Their findings show that climate finance substantially alleviates energy vulnerability, with mitigation finance again exhibiting a larger effect than adaptation finance. Complementing this, Islam (2022), drawing on a comprehensive dataset of over 100,000 approved climate-related projects in 133 countries between 2000 and 2018, finds that both adaptation and overlapping finance (addressing simultaneous mitigation and adaptation objectives) generate significant positive effects. The study also observes that the most vulnerable countries tend to receive more adaptation and overlap funding, suggesting that global climate finance allocation reflects relative need.

Building on these insights, Zhang et al. (2025) assess the impact of climate finance on CO_2 emissions using a panel dataset of 140 developing countries from 2002 to 2022. Their analysis indicates that climate finance has a negative and statistically significant effect on CO_2 emissions: a one-standard-deviation increase in climate finance is associated with an approximately 3.31% reduction in CO_2 emissions per unit of GDP. These findings collectively suggest that climate finance strengthens countries' mitigation and adaptation capacities, contributing to reductions in GHG emissions and ultimately helping to ease the impacts of global warming. In line with this reasoning, our first hypothesis in its alternative form is stated as follows:

H_1: Climate finance—through both adaptation and mitigation—plays a critical role in reducing carbon emissions and, in turn, enhancing environmental sustainability

A growing body of research suggests that democracy tends to enhance firm performance through multiple channels. Tran (2022) provides evidence that democratic environments strengthen corporate governance practices, which in turn help firms curb excessive investment in research and development (R&D) activities. The study further documents that democracy's positive influence on both R&D investment and investment efficiency is amplified in institutional contexts where shareholder rights are strongly protected. These effects are also more pronounced among larger firms and those with higher leverage, suggesting that democracy plays a particularly important role in disciplining firms facing greater agency problems or financial constraints.

Beyond corporate governance, democratic institutions also shape financial market participation and credit allocation. Osei-Tutu and Weill (2023) show that democracy reduces borrower discouragement, increasing firms' willingness to apply for bank loans and leading to higher loan approval rates. Similarly, Delis et al. (2020) identify lower borrowing costs as a key mechanism through which democratization fosters broader economic development. In capital markets, improvements in a country's democratic institutions have been shown to enhance

market liquidity and improve the quality of non-US equities, ultimately benefiting investors and contributing to overall financial market stability and efficiency (Kim et al., 2024).

In the context of climate change, empirical studies generally indicate that democracy can support progress toward decarbonization. However, the effectiveness of democratic governance in reducing emissions is mediated by factors such as economic growth patterns, income inequality, energy composition, state capacity, and corruption. These structural characteristics can either reinforce or undermine the impact of democratic decision-making on climate outcomes. Lindvall and Karlsson (2023) argue that as economies scale up investment in renewable energy, economic activities become progressively less reliant on fossil fuels, thereby weakening the political influence of carbon-intensive industries. This shift not only facilitates the energy transition but also strengthens democracies' ability to implement and sustain ambitious climate policies. Their findings suggest that coupling renewable energy investments with governance reforms targeting corruption and income inequality can unlock the full transformative potential of democracy in steering economies toward a low-carbon future. This leads to our second hypothesis in the alternative form as follows:

H_2: *The effect of climate finance on carbon emissions becomes more pronoun when aligned with higher levels of democratic governance in recipient countries*

3. Model and empirical strategy

In this section, we first describe the model on the impact of climate funds on green growth. Next, we explain the empirical strategy, which addresses the effect of democracy index.

3.1. Model

To examine the impact of climate funds on green growth, we estimate the baseline model in which green growth - proxied by CO_2 emission per GDP - is a function of climate-related Official Development Assistant (ODA) and a set of control variables. The model is as followed:

$$CO2ce_{it} = \alpha_0 + \alpha_1 climatefund_{it-1} + \alpha_2 X_{it-1} + \epsilon_{it} (1)$$

$$\epsilon_{it} = k_i + \mu_{it}$$

Where i represent the country, and t represents each period, which is measured in years. $CO2_{it}$ is a measure of country's CO2 emissions per GDP; $climatefund_{it-1}$represents the climate fund that the country receives. Climate finance includes mitigation, adaptation and global funds; X_{it-1} is a vector of control variables that can affect a country's CO2; ϵ_{it} captures the country's unobserved time-invariant characteristics, k_i and time-variant shocks μ_{it} that may influence country's CO2; α_0 is the intercept, and α_1 are the parameters to be estimated.

3.2. Data and variable selection

3.2.1. Data

The empirical analysis draws upon a multi-source panel dataset covering 145 countries over the period 2000–2022. The dataset integrates information from several high-quality, internationally recognized sources. Climate finance data—distinguishing between adaptation and mitigation flows—are sourced from the OECD, providing harmonized measures of international financial support for climate action. Core macroeconomic variables, including GDP growth, GDP per capita, population, and FDI inflows are obtained from the World Bank's World Development Indicators (WDI).

3.2.2. Dependent variable

To measure environmental performance and, by extension, green growth, we rely on per capita CO_2 emissions, defined as the natural logarithm of annual emissions (in metric tons) divided by population. This metric offers a standardized, cross-country comparable indicator that captures both emission intensity and population-adjusted environmental burden (Tennant et al., 2024; Zhang et al., 2025). The indicator also aligns with the "polluter pays" principle, as climate finance is frequently channeled toward countries with elevated per capita emissions (Ghattassi et al., 2025).

3.2.3. Independent variable

Our primary measure of democratic institutions (Democ) is the Polity V country-year index of institutional democracy. According to Polity V (2020), democracy comprises three

key, interrelated components. First, the presence of institutions and procedures that enable citizens to express effective preferences regarding policies and leadership. Second, the existence of institutionalized constraints on executive power. Third, the protection of civil liberties for all citizens in daily life and political participation. Other elements of plural democracy—such as the rule of law, checks and balances, and press freedom—serve as means to, or manifestations of, these core principles. The index ranges from 0 to 10, where 0 represents no institutional democracy and 10 indicates the highest level. Accordingly, Democracy is an institution-based (rather than perception-based) measure, allowing us to capture the effect of constitutional and institutional democracy while minimizing perception bias. It is therefore the preferred dependent variable in our study (Delis et al., 2020).

3.2.4. Control variables

A comprehensive set of control variables is included to mitigate omitted variable bias and align with established determinants of environmental outcomes and aid allocation. GDP per capita captures economic development, purchasing power, and baseline adaptive capacity. To account for potential non-linearities in the income–emissions nexus, we include both GDP growth rate and GDP per capita (Tennant et al., 2024; Weiler et al., 2018). Next, we include population size as a control variable to account for emissions driven by demographic scale. Larger populations are often linked to greater energy consumption and more extensive infrastructure, both of which contribute to increased emissions (Alharbi et al., 2023; Zhang et al., 2025). Population size may also affect the distribution of climate finance, with more populous countries potentially receiving greater total funding but relatively less on a per capita basis (Tennant et al., 2024). We use Foreign Direct Investment (% of GDP) to capture financial flows which are considered the most significant FCI sources in most of the recipient countries (Leal et al., 2023).

3.3. Descriptive statistics

Table 1 presents the descriptive statistics for our sample while the description of each variable is provided in Appendix I. All variables exhibit substantial variation around their respective cross-sectional means. For example, production-based CO_2 intensity, measured as energy-related CO_2 emissions per GDP, ranges from a minimum of 0.042 to a maximum of 1.079, with an average of 0.243 and a standard deviation of 0.184. Regarding climate finance, the average mitigation fund is 11.868, while the adaptation fund averages 12.133. The democracy indicator has a mean value of 3.794 and a standard deviation of 6.285. Finally, descriptive statistics show that the average GDP per capita is 4.589, and the average FDI (% of GDP) is 4.392. For the pairwise correlation among variables, we report in Table 2.

[Insert Table 1]

4. Empirical results

4.1. Baseline results.

The results are summarised in Table 3. Columns 1, 2, and 3 present the estimated effects of CO_2 emissions per GDP on adaptation, mitigation, and total climate finance flows, respectively. Across all specifications, the coefficients on adaptation, mitigation, and global climate funds are negative and statistically significant, indicating that higher levels of climate finance are associated with reductions in CO_2 emissions per unit of GDP. These findings are consistent with recent evidence that international climate finance supports greener growth trajectories by enabling investment in low-carbon technologies and climate-resilient infrastructure (Lee et al., 2022).

[Insert Table 3]

4.2. Effect from the Democracy Index

Table 4 reports the results on the moderating role of democracy (measured by the Democracy Polity V) on the association between CO2 emissions and climate finance. We find that the interaction terms between democracy index and climate finance (i.e., *AF x democracy; MF x democracy*; *CF x democracy*) are statistically significant and negative, suggesting that higher democracy index can generally increase the negative impacts of climate finance on CO2 emissions. In other words, our main results are more driven by

countries with a higher democracy index. This underscores the importance of democracy in national management and suggests that countries with strong democracy index performance are better equipped to manage climate risks.

[Insert Table 4]

4.3. Endogeneity treatment and robustness tests

Endogeneity in our analysis may arise from two primary sources: omitted variable bias and reverse causality. First, omitted variable bias occurs when relevant factors that influence both the dependent and independent variables are excluded from the model. We mitigate this concern by incorporating fixed effects into our empirical specifications, thereby controlling unobserved heterogeneity across countries and over time. Second, reverse causality may occur if climate risk (CO_2 emissions) influences climate finance flows, potentially biasing the estimated effect of climate finance on emissions. A further concern is self-selection bias, which can also generate endogeneity if countries receiving climate finance differ systematically from those that do not. To address reverse causality and selection issues, we employ a treatment-effects model.

To assess the robustness of our main results, we conducted several sensitivity analyses. First, we replace our primary indicators of climate finance with alternative measures expressed as a share of GDP (AFgdp, MFgdp, and CFgdp). As shown in Table 5, the negative and statistically significant association between climate finance and CO_2 emissions persists across all specifications. Second, we test the sensitivity of our findings to an alternative measure of climate risk by using the natural logarithm of CO_2 emissions ($lnCO_2$). Table 6 demonstrates that the coefficients associated with AFgdp, MFgdp, and CFgdp remain negative and statistically significant, reaffirming the core relationship identified in our baseline models.

Overall, the consistency of the results across multiple measures of both climate finance and climate risk reinforces the robustness of our findings. Regardless of the specific metric employed, adaptation, mitigation, and total climate funds consistently exhibit a significant and negative impact on CO_2 emissions.

[Insert Tables 5 and 6]

We also retest the main models by clustering standard errors at the national level. The results,

presented in Table 7, show a significant and negative relationship between *AF and CF* and CO2 emissions, confirming our main findings. These results suggest that our findings are generally robust to potential within-country correlations.

[Insert Table 7]

5. Conclusion

Climate finance plays a pivotal role in shaping environmental and economic outcomes by directing financial resources toward clean technologies, sustainable infrastructure, and environmentally responsible production practices. By easing financial constraints and incentivising low-carbon investments, climate finance serves as a key policy instrument for advancing global climate goals and supporting the transition to greener growth trajectories.

In this study, we examine the influence of international climate finance—specifically mitigation, adaptation, and global climate funds—on green growth, proxied by CO_2 emissions per unit of GDP, using an extensive panel of 145 countries spanning the years 2000 to 2022. Our empirical analysis yields several important insights. First, we document that mitigation, adaptation, and aggregate climate funds are all significantly and negatively associated with CO_2 emissions per GDP. These findings provide strong support for the view that climate finance facilitates greener economic development by enabling countries to invest in cleaner energy systems, improve climate resilience, and adopt environmentally sustainable practices. Second, we find that the strength of democratic institutions further enhances the effectiveness of climate finance. Higher democracy scores—reflecting stronger accountability mechanisms, greater transparency, reduced information asymmetry, and more inclusive policy processes—intensify the negative relationship between climate finance and CO_2 emissions. In other words, democratic governance appears to amplify the environmental returns to climate finance by promoting better monitoring, more effective allocation of funds, and greater public oversight of climate-related initiatives. Together, these results underscore not only the importance of climate finance as a tool for supporting green growth, but also the critical role of

institutional quality in ensuring that such financial flows translate into meaningful environmental improvements.

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Table 1.
Descriptive Statistics

	N	Mean	Std.	Min	Max	Skewness	Kurtosis	p25	p75
CO2_GDP	3904	0.243	0.184	0.042	1.079	2.068	8.163	0.125	0.296
lnCO2	2717	8.744	2.386	3.786	14.462	0.087	2.385	7.021	10.332
lnAF	4191	12.133	8.025	0.000	21.576	-0.730	1.765	0.000	18.243
lnMF	4191	11.868	7.885	0.000	21.097	-0.726	1.747	0.000	17.893
lnCF	4191	12.556	8.276	0.000	22.058	-0.750	1.772	0.000	18.819
AFgdp	2945	0.017	0.048	0.000	0.530	5.816	44.135	0.000	0.012
MFgdp	2945	0.011	0.036	0.000	0.468	7.900	78.424	0.000	0.007
CFgdp	2945	0.028	0.081	0.000	0.999	6.736	60.119	0.000	0.019
democracy	3123	3.794	6.285	-10.000	10.000	-0.782	2.167	-2.000	9.000
GDPG	2953	3.794	6.034	-50.339	86.827	0.845	30.910	1.690	6.365
GDPCA	2949	4.589	4.495	0.338	19.884	1.557	4.955	1.279	6.217
lnPopulation	3045	15.519	2.261	9.302	20.970	-0.558	3.202	14.371	17.081
FDI	2889	4.392	6.283	-37.173	103.337	4.984	54.898	1.191	5.731

This table reports descriptive statistics of all variables employed in our main models. Variables are defined and measured in Appendix 1.

Table 2.

Pearson Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
CO2_GDP	1												
lnCO2	0.310***	1											
lnAF	-0.0659***	0.154***	1										
lnMF	-0.0661***	0.193***	0.992***	1									
lnCF	-0.0659***	0.155***	1.000***	0.994***	1								
AFgdp	0.0156	-0.359***	0.196***	0.141***	0.183***	1							
MFgdp	0.0467*	-0.282***	0.161***	0.173***	0.163***	0.836***	1						
CFgdp	0.0303	-0.340***	0.189***	0.161***	0.182***	0.970***	0.945***	1					
democracy	-0.223***	-0.105***	-0.272***	-0.270***	-0.272***	0.0957***	0.102***	0.104***	1				
GDPG	-0.0580**	0.0628**	0.124***	0.122***	0.121***	0.0175	0.00870	0.0143	-0.0481*	1			
GDPCA	0.276***	0.146***	-0.557***	-0.566***	-0.563***	-0.169***	-0.133***	-0.160***	0.0370	-0.0626***	1		
lnPOP	-0.0812***	0.815***	0.397***	0.430***	0.397***	-0.264***	-0.221***	-0.256***	-0.126***	0.114***	-0.305***	1	
FDI	0.0265	-0.169***	-0.0309	-0.0431*	-0.0315	-0.00126	0.00279	0.000488	0.0119	0.111***	0.117***	-0.228***	1
N	4576												

*This table reports the Pearson correlation among all independent and control variables employed in our main models. Variables are defined and measured in Appendix 1. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.
Baseline Regression: CO2 emissions and Climate Finance

VARIABLES	(1) CO2_GDP	(2) CO2_GDP	(3) CO2_GDP
lnAF	**-0.002***** **(0.000)**		
lnMF		**-0.002***** **(0.000)**	
lnCF			**-0.002***** **(0.000)**
GDPG	-0.000 (0.135)	-0.000 (0.143)	-0.000 (0.135)
GDPCA	-0.018*** (0.000)	-0.018*** (0.000)	-0.018*** (0.000)
lnPOP	0.049*** (0.000)	0.048*** (0.001)	0.049*** (0.000)
FDI	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Constant	-0.414* (0.060)	-0.411* (0.062)	-0.416* (0.059)
Observations	2,830	2,830	2,830
R-squared	0.940	0.940	0.940

*This table reports regression results on the association between country CO2 and climate finance. Variables are defined and measured in Appendix 1. *** p<0.01, ** p<0.05, * p<0.1*

Table 4.
Moderating Effects from Democracy Index.

VARIABLES	(1) CO2_GDP	(2) CO2_GDP	(3) CO2_GDP
lnAF	-0.002***		
	(0.001)		
lnMF		-0.002***	
		(0.003)	
lnCF			-0.002***
			(0.001)
c.lnAF#c.democracy	**-0.001****		
	(0.010)		
c.lnMF#c.democracy		**-0.002****	
		(0.019)	
c.lnCF#c.democracy			**-0.001****
			(0.021)
democracy	0.003***	0.003**	0.003**
	(0.007)	(0.013)	(0.014)
GDPG	-0.000	-0.000	-0.000
	(0.401)	(0.406)	(0.406)
GDPCA	-0.019***	-0.019***	-0.019***
	(0.000)	(0.000)	(0.000)
lnPOP	0.073***	0.072***	0.071***
	(0.001)	(0.001)	(0.001)
FDI	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)
Constant	-0.854**	-0.847**	-0.825**
	(0.017)	(0.017)	(0.020)
Observations	1,950	1,950	1,950
R-squared	0.951	0.951	0.951

*This table reports moderating effect from Democracy Index on the association between country CO2 and alternative climate finance measures. Variables are defined and measured in Appendix 1. *** p<0.01, ** p<0.05, * p<0.1*

Table 5.
Alternative independent variables

VARIABLES	(1) CO2_GDP	(2) CO2_GDP	(3) CO2_GDP
AFgdp	**-0.074****		
	(0.016)		
MFgdp		**-0.075***	
		(0.051)	
CFgdp			**-0.042****
			(0.021)
GDPG	-0.000	-0.000	-0.000
	(0.122)	(0.124)	(0.121)
GDPCA	-0.017***	-0.017***	-0.017***
	(0.000)	(0.000)	(0.000)
lnPOP	0.050***	0.052***	0.051***
	(0.000)	(0.000)	(0.000)
FDI	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
Constant	-0.467**	-0.497**	-0.485**
	(0.034)	(0.025)	(0.028)
Observations	2,830	2,830	2,830
R-squared	0.940	0.940	0.940

*This table reports regression results on the association between country CO2 and alternative climate finance measures. Variables are defined and measured in Appendix 1. *** p<0.01, ** p<0.05, * p<0.1*

Table 6.
Alternative dependent variables

VARIABLES	(1) lnCO2	(2) lnCO2	(3) lnCO2
AFgdp	-0.695***		
	(0.000)		
MFgdp		-0.402***	
		(0.010)	
CFgdp			-0.325***
			(0.000)
GDPG	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)
GDPCA	0.039***	0.038***	0.039***
	(0.000)	(0.000)	(0.000)
lnPOP	1.280***	1.288***	1.289***
	(0.000)	(0.000)	(0.000)
FDI	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)
Constant	-11.367***	-11.495***	-11.499***
	(0.000)	(0.000)	(0.000)
Observations	2,571	2,571	2,571
R-squared	0.994	0.993	0.993

*This table reports regression results on the association between alternative CO2 and climate finance. Variables are defined and measured in Appendix 1. *** p<0.01, ** p<0.05, * p<0.1*

Table 7.
Model with Cluster.

VARIABLES	(1) CO2_GDP	(2) CO2_GDP	(3) CO2_GDP
lnAF	**-0.002***		
	(0.084)		
lnMF		**-0.002**	
		(0.109)	
lnCF			**-0.002***
			(0.090)
GDPG	-0.000	-0.000	-0.000
	(0.465)	(0.476)	(0.466)
GDPCA	-0.018***	-0.018***	-0.018***
	(0.002)	(0.002)	(0.002)
lnPOP	0.049	0.048	0.049
	(0.211)	(0.214)	(0.210)
FDI	0.001*	0.001*	0.001*
	(0.051)	(0.053)	(0.052)
Constant	-0.414	-0.411	-0.416
	(0.503)	(0.504)	(0.501)
Observations	2,830	2,830	2,830
R-squared	0.940	0.940	0.940

Appendix 1.
Description of variables.

Variable	Description	Source and references
Dependent variables		
CO2 GDP	CO2 emissions per GDP (kg per PPP $)	Global Carbon Atlas
lnCO2	Natural logarithm of CO2 emissions (kt).	Global Carbon Atlas
Independent variable: Climate change exposure		
lnAF	Natural logarithm of adaptation climate finance funds (constant 2022 US$, million)	OECD-DAC
lnMF	Natural logarithm of mitigation climate finance funds (constant 2022 US$, million)	OECD-DAC
lnCF	Natural logarithm of global climate funds (constant 2022 US$, million)	OECD-DAC
AFgdp	Adaptation finance funds (% of GDP)	OECD-DAC
MFgdp	Mitigation finance funds (% of GDP)	OECD-DAC
CFgdp	Global finance funds (% of GDP)	OECD-DAC
Country specific control variables		
GDPG	GDP growth rate (annual %)	WB
GDPCA	GDP per capita (one thousand dollars, constant 2015 US$)	WB
FDI	Foreign Direct Investment (% of GDP)	WB
Other variables		
Democracy	The index ranges from 0 to 10, where 0 represents no institutional democracy and 10 indicates the highest level.	Polity V