Evaluating the Development Impacts of Climate Finance

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Motivation

- Action on climate change: the "development opportunity of this century" (Lankes et al., 2022).
- There may be potential positive impacts on output, employment, and health. (Acemoglu et al., 2012; Stern and Stiglitz, 2023; Fabra et al., 2024).
- A high WACC in the Global South may prevent optimal investment (Ameli et al., 2021).

Defining Climate Finance

- Climate finance refers to financial instruments distributed on projects that are relevant in the adaptation or mitigation of climate change.
- It may be local or national, but this article studies international climate finance.
- While foreign aid is targeted towards development, the same development impacts may results as a positive externality of climate finance (ex: food aid).

Introduction

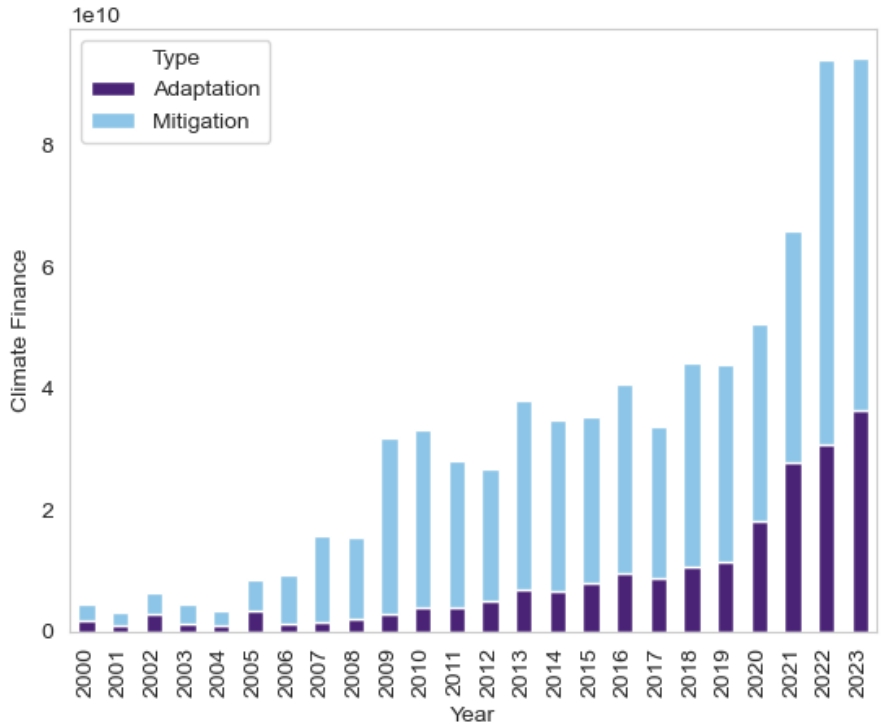

Figure: Climate Finance by MBDs (Commitments, 2023 USD)

Research Gap

- There is no evaluation of the impact of climate finance on key poverty vectors excluding Zhao et al. (2025).
- Fan et al. (2025) recently released a new dataset on MBD climate finance. This represents the majority of (international) climate finance (Naran et al., 2025).
- Other papers use OECD data with Rio Markers, which could be misreported and does not capture most climate finance (Lee et al., 2022; Bayramoglu et al., 2023).

Theory

- Climate finance may enhance productivity through capital accumulation, and Keynesian theory suggests that there may also be job gains from fiscal stimulus incorporating climate goals depending on a few factors (O'Callaghan et al., 2022).
- Output gains through capital accumulation and employment can translate into poverty reduction if inequality is constant (Dollar and Kraay, 2001).

Literature Review

- Climate finance can impact jobs through renewable energy and energy efficiency gains, but employment gains are not equitable across gender (Batini et al., 2022; Wei et al., 2010; Zhao et al., 2025).
- Work by Mishra and Newhouse (2009) and Chay and Greenstone (2003) is suggestive that foreign aid (a similar financial instrument) can have health impacts.
- Similar articles examining impacts on output, poverty, and labor force participation use fixed effects, IV, and/or GMM (Clemens et al., 2012; Alvi and Senbeta, 2012; Bayramoglu et al., 2023; Zhao et al., 2025).

Data

- Data sourcee: the WDI Database, the OECD, the ILO, Fan et al. (2025), the Center for Systemic Peace, the World Intellectual Property Association, the Notre Dame Global Adaptation Initiative, the IMF, the Conference Board, The Heidelberg Institute for International Conflict, and Muravyev (2014).
- Data originally in current USD. It was converted to real values (2023 USD w/ US CPI).

Data

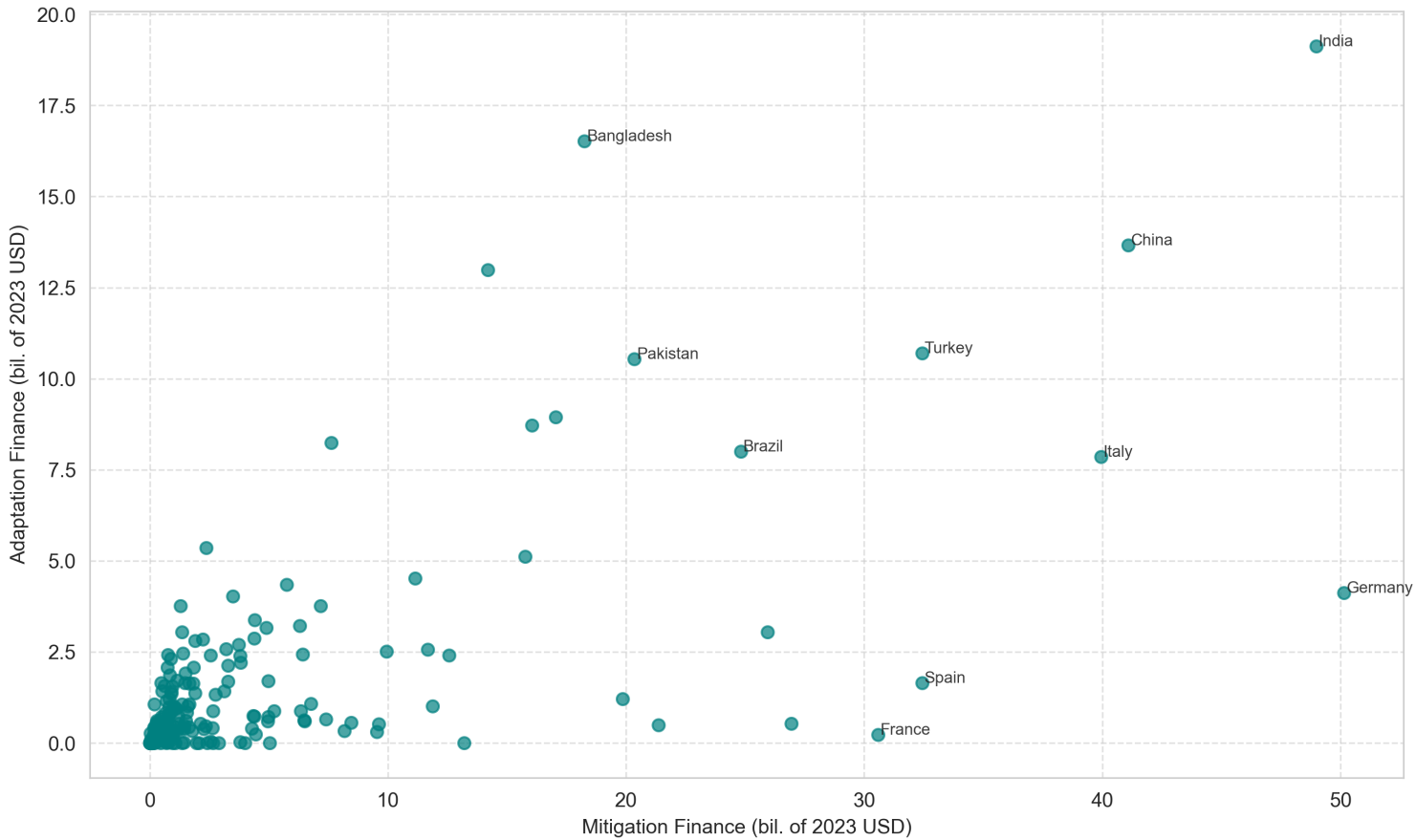

Figure: Adaptation vs. Mitigation Financing

Data

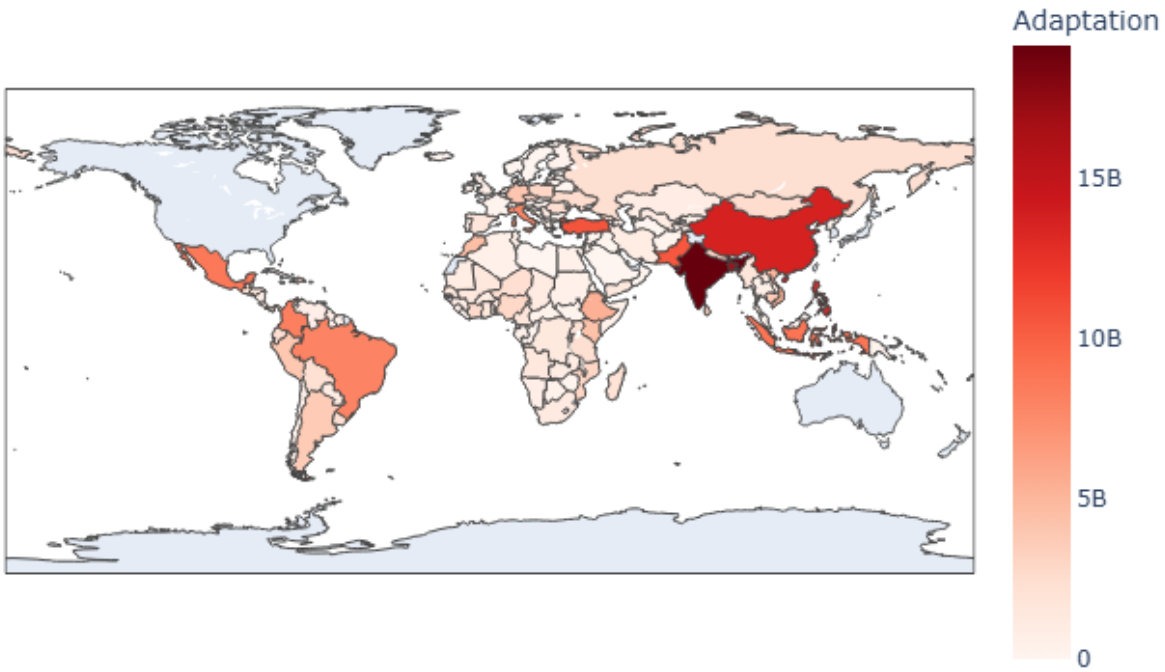

Figure: Adaptation Financing by Country

Data

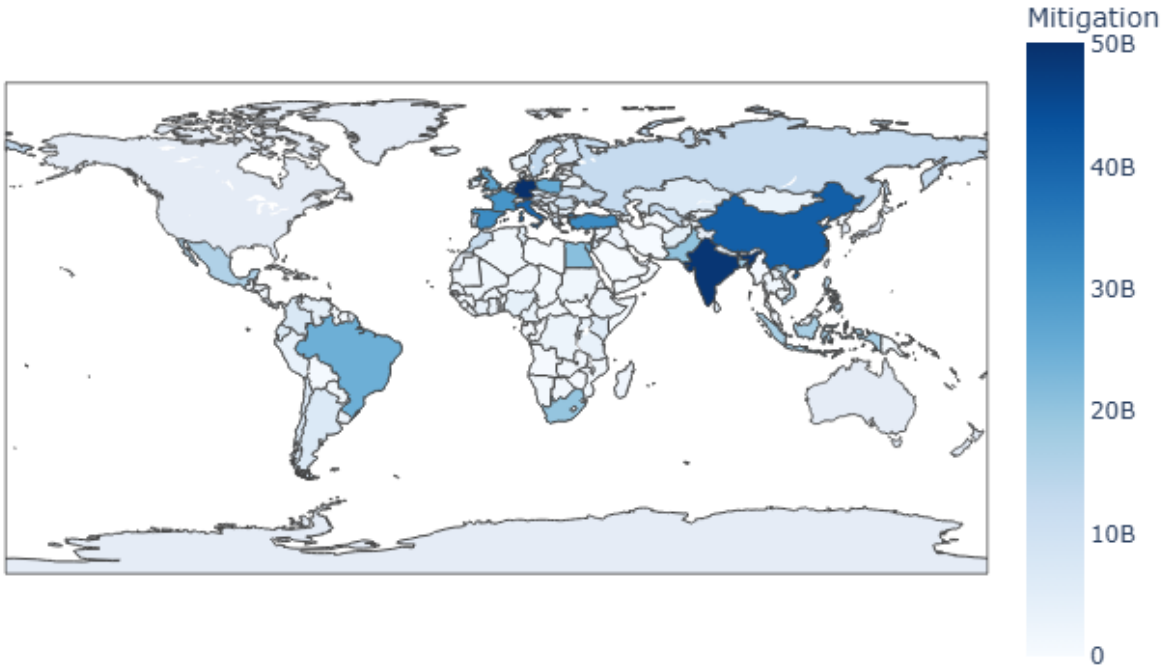

Figure: Mitigation Financing by Country

Regression Model

- The effects of climate finance on capital formation, infant mortality, labor force participation, output, and poverty are estimated using TWFE with clustered standard errors.
- I vary each in controls and transformation of variables.
- I use an IHS transform or log account for right skewed distributions across variables of interest.
- I alter the time horizon across specification using lags or accumulated climate finance across all observed years.

Main Regression Model

$$Y_{it} = \beta_0 + \beta_1 CF_{it} + \beta' X_{it} + \lambda_t + \varepsilon_{it}$$

Definitions:

- Y_{it} log or IHS-transformed development outcome for country i in year t
- CF_{it} IHS-transformed climate finance (aggregate commitments)
- X_{it} vector of control variables
- λ_t year and/or country FE

Note: CF_{it} is occasionally accumulated or lagged to estimate impacts over a longer time horizon.

Health Regressions

$$I_{it} = \beta_0 + \beta_1 H_{it-1} + \zeta' A_{it-1} + \theta' B_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

Definitions:

- I_{it} infant mortality rate in country i at time t
- H_{it-1} lagged climate finance variable
- A_{it-1} lagged control variables
- B_{it} contemporaneous controls
- α_i country FE
- γ_t year FE

Output: Impact on GDP Growth

Table: IHS Climate Finance and GDP per Capita Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IHS Climate Finance	-0.121***	-0.074	0.016				
	0.026	0.143	0.137				
Cumulative Finance				-0.430			
				0.296			
Lagged IHS CF (L1)					-0.224*		
					0.125		
Lagged IHS CF (L5)						-0.031	
						0.089	
Lagged IHS CF (L10)							0.015
							0.050
adj. R^2	0.006	0.143	0.513	0.514	0.519	0.551	0.559
Controls		✓	✓	✓	✓	✓	✓
FE			✓	✓	✓	✓	✓
Observations	4149	357	357	357	357	318	236

Poverty

Table: One-Year Lagged Effect of Climate Finance on Poverty

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Headcount		Poverty Gap		Squared Gap	
Lagged Finance (L1)	-0.002***	-0.000	-0.001**	-0.000	-0.001*	-0.000
	0.001	0.001	0.000	0.000	0.000	0.000
Controls	✓	✓	✓	✓	✓	✓
FE		✓		✓		✓
Observations	130	130	130	130	130	130

Health

Table: Climate Finance and Log Infant Mortality

	(1)	(2)	(3)	(4)	(5)
IHS Climate Finance	-0.000				
	(0.000)				
Cumulative Finance		-0.001			
		(0.001)			
Lagged IHS CF (L1)			-0.000		
			(0.001)		
Lagged IHS CF (L5)				-0.000	
				(0.001)	
Lagged IHS CF (L10)					0.001
					(0.001)
Controls	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
adj. R^2	0.933	0.933	0.933	0.913	0.833
Observations	2314	2314	2314	2090	1522

Unemployment

Table: Climate Finance and Log Unemployment Rate (All, 15+)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IHS Climate Finance	0.011***	0.007**	0.005				
	(0.002)	(0.003)	(0.004)				
Cumulative Finance				0.006			
				(0.009)			
Lagged CF (L1)					0.007*		
					(0.004)		
Lagged CF (L5)						0.004**	
						(0.002)	
Lagged CF (L10)							0.000
							(0.002)
Controls		✓	✓	✓	✓	✓	✓
Year FE			✓	✓	✓	✓	✓
Observations	914	259	259	259	259	218	150

Unemployment

Table: Interaction: Climate Finance, Adaptation Readiness, and Unemployment

	(1)	(2)	(3)	(4)
IHS CF × ND-GAIN	0.000			
Cumulative × ND-GAIN		0.002**		
L1.IHS CF × L1.ND-GAIN			0.001**	
L5.IHS CF × L5.ND-GAIN				0.001**
ND-GAIN (Levels/Lags)	-0.027**	-0.059***	-0.039***	-0.030***
Controls / Year FE	✓	✓	✓	✓
Overall R^2	0.563	0.577	0.584	0.669
Observations	259	259	259	218

Labor Force Participation

Table: One-Year Lagged Climate Finance and Log LFPR

	(1) All 15+	(2) All 55-64	(3) All 15-24	(4) Male 25-54	(5) Female 25-54
IHS Climate Finance (L1)	-0.000	0.002*	0.001	-0.000*	-0.001*
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)
Observations	247	247	247	247	151

Labor Force Participation

Table: Cumulative Climate Finance (IHS) and Log LFPR

	(1) All 15+	(2) All 55-64	(3) All 15-24	(4) Male 25-54	(5) Female 25-54
IHS Cumulative CF	-0.001	0.002	0.002	0.000	-0.003*
	(0.002)	(0.004)	(0.005)	(0.000)	(0.002)
Observations	247	247	247	247	151

Capital Formation: Aggregate Lags

Table: Lagged Climate Finance and Log Gross Capital Formation

	(1)	(2)	(3)
Lagged IHS CF (L1)	0.045***	0.037***	0.006*
	(0.012)	(0.011)	(0.003)
Controls		✓	✓
Country/Year FE			✓
adj. R^2	0.034	0.688	0.645
Observations	3501	586	586

Capital Formation: Flows vs. Cumulative

Table: Climate Finance and Log Gross Capital Formation

	(1)	(2)	(3)
IHS Climate Finance	0.046***	0.047***	0.005
IHS Cumulative CF	0.082***	0.217***	0.065**
Controls		✓	✓
FE			✓
Observations	3614	586	586

Capital Formation: Disaggregated Analysis

Table: Public vs. Private Sector Capital Formation

	(1) Public	(2) Private	(3) PPPs
IHS Climate Finance	-0.005	0.006*	-0.002
Cumulative Finance	-0.004	0.000	0.005
Lagged IHS CF (L1)	-0.000	0.004	-0.006
Controls / FE	✓	✓	✓
Observations	500	500	475

Capital Formation: ND-GAIN Interactions

Table: Interactions: Capital Formation, Adaptation Readiness, and Gross Capital Formation

	(1) Flow	(2) Lag (L1)	(3) Cumulative
CF × ND-GAIN	-0.002***	-0.001***	-0.008***
	(0.001)	(0.000)	(0.002)
IHS Climate Finance	0.095***	0.058***	0.410***
ND-GAIN	0.056***	0.029	0.191***
Controls / FE	✓	✓	✓
Observations	586	586	586

Discussion: Capital Formation and Investment

- **Private Sector Driver:** Heterogeneity analysis reveals potential modest gains capital accumulation driven by the private sector and no major de-risking gains contrary to Stern and Stiglitz (2023).
- **Institutional Context:** Financing constraints in developing economies may increase the marginal effect of climate finance compared to established markets.

Discussion: Labor Market Impacts

- **Frictional Unemployment:** Aggregate findings suggest a small increase in unemployment (0.007% in the subsequent year), potentially reflecting a transition from fossil fuels to renewable sectors.
- **Crowding-Out Effect:** Climate finance possible benefits men at the cost of crowding out women. This may be because stable male employment allows women to leave "low-quality" jobs Zhao et al. (2025).

Discussion: Vulnerability and Health

- **Adaptation Readiness:** The impact of climate finance on capital and unemployment is more potent in countries more vulnerable to climate change.
- **Health and Poverty:** No observed relationship was found between climate finance and health (infant mortality) or poverty measures. This can be explained considering previous results or model misspecification.

Policy Recommendations & Limitations

Policy Recommendations

- **Target Vulnerability:** Donors should increase allocations to climate-vulnerable countries to maximize capital and labor impacts.
- **Equity Guidelines:** Guidelines must be enacted to ensure benefits are disbursed equitably, specifically protecting female labor force participation.

Limitations & Future Research

- **Data Constraints:** Small sample sizes for labor force estimations (OECD restricted) mean results should be interpreted with caution.
- **Methodology:** Future work should utilize GMM, Staggered DiD, or IV to address endogeneity and dynamic panel bias.

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