Natural disasters and international financial flows: Global evidence

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Context

- The frequency and impact of natural disasters are growing continuously and globally over time (e.g., Australian bushfires of 2019–2020; hurricanes affecting the Caribbean and the U.S. in 2023)
- Dramatic implications for populations: 26 million people pushed into extreme poverty (Hallegatte et al., 2017)
- Increasing risks to food security (FAO, 2023)
- Natural disasters are costly in terms of economic losses: $350 billion in 2017 and $400 billion in 2011 (United Nations, 2018)

Context: Consequences of natural disasters

- Growing literature on the economic consequences of natural disasters.
  - ➢ Natural disasters and economic growth (Cavallo et al., 2013; Klomp & Valckx, 2014)
  - ➢ Natural disasters and financial markets (Noth & Schüwer, 2023; Ouazad & Kahn, 2022)
  - ➢ Natural disasters and international economic relations, such as trade and supply chains (Gassebner et al., 2010; Tembata & Takeuchi, 2019; Kashiwagi et al., 2021; Freund et al., 2022; Zimmer, 2025)
- Natural disasters and international capital flows $\rightarrow$ relatively limited and underexplored topic (Osberghaus, 2019).

Natural disasters and international financial flows

- Empirical results are mixed and focused on some specific types of flows
  - ➢ Early literature on foreign aid and remittances (Strömberg, 2007; Schumacher & Strobl, 2011; Lueth & Ruiz-Arranz, 2008; Arezki & Brückner, 2012).
  - ➢ Recent literature on FDI at country or regional level (Khan et al., 2020; Katoka, 2021; Doytch, 2020; Neise et al., 2022; Reinhart, 2022; Gu and Hale, 2023) → no consensus.
  - ➢ Only a few articles include multiple types of flows:
    - ➢ Yang (2008): Effect of hurricanes on remittances, ODA, multilateral lending, FDI, portfolio investment, and bank lending → positive effect on remittances and ODA, mixed results for others.
    - ➢ David (2010): Geological, climatological, and human-induced disasters on development aid, remittances, equity, and bank lending flows → positive effect (climatic and geological) on remittances, negative on bank lending.

Contributions

- Overall contribution: Analyzing the effect of natural disasters on several types of international financial flows at the global level.

- Contribution (1): Equity vs. debt flows
  - ➢ Prior work mostly studied FDI, while portfolio investment and cross-border lending have received less attention.
  - ➢ We analyze the effect of natural disasters on various flows, distinguishing equity (FDI, portfolio equity) from debt (portfolio debt, cross-border lending) to identify transmission channels.
  - ➢ Main result: The impact of disasters depends on the type of flows, primarily affecting equity and debt short-term foreign investment.

Contributions

- Contribution (2): Measuring disasters & new composite indicator
  - ➢ Use several measures of natural disasters based on type (meteorological, etc.) and intensity (people affected, financial damages, etc.).
  - ➢ Measurement choice influences how disasters affect capital flows, as investor risk perception varies with disaster characteristics.
  - ➢ Introduce a composite indicator combining intensity and type.
  - ➢ Main result: Mixed outcomes depending on the measure used.

Contributions

- Contribution (3): Country heterogeneity
  - ➢ Countries may be affected differently by natural disasters (Yang, 2008 → poorest countries more affected).
  - ➢ We analyze the effect of disasters on capital flows based on country characteristics: living standards, infrastructure, institutional quality, etc.
  - ➢ Main result: Higher living standards, better infrastructure, and strong government effectiveness mitigate the negative impact of disasters on capital flows.

Data

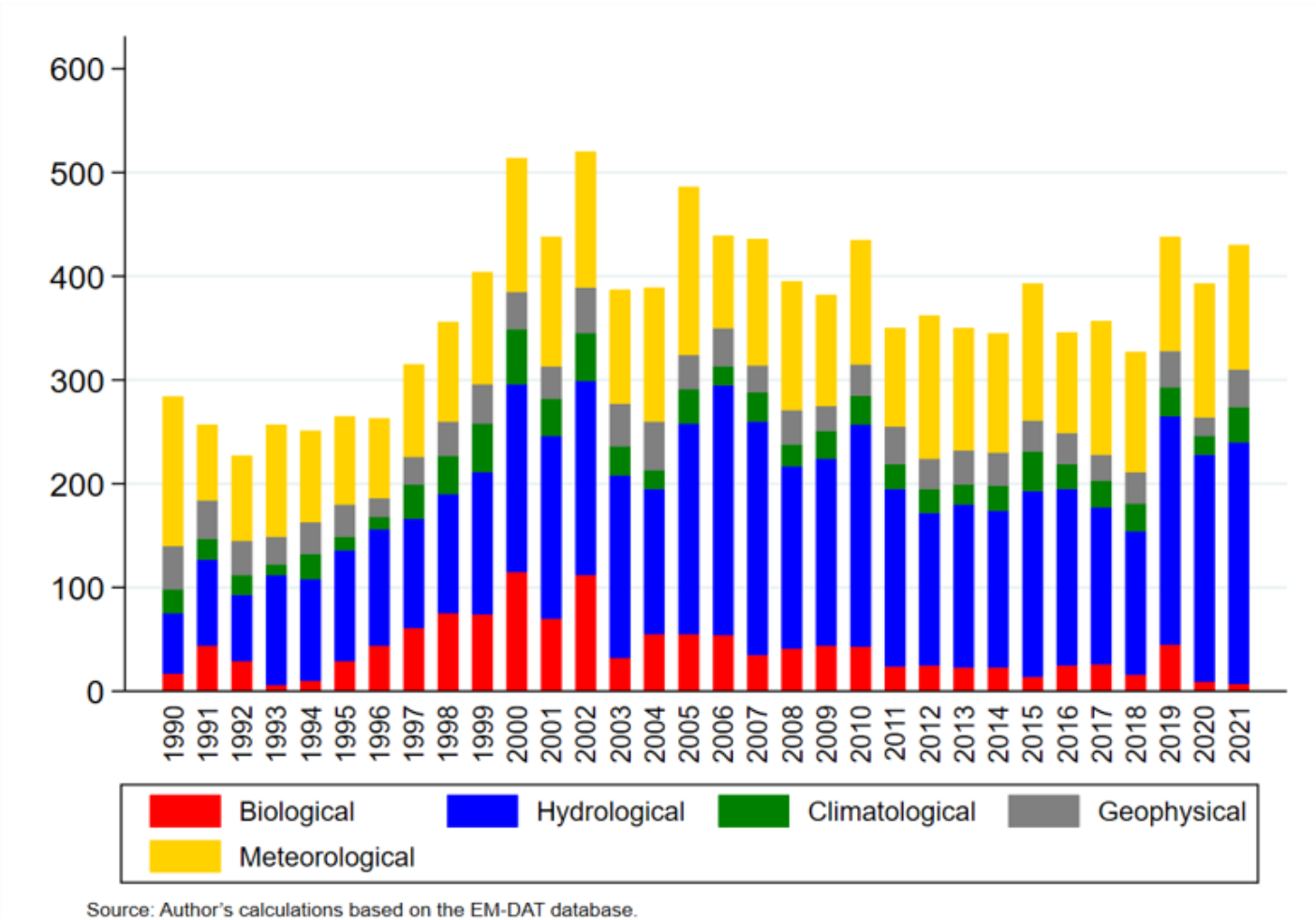
- International financial flows (IMF's Balance of Payment Statistics)
  - ➢ 1990–2021, more than 150 countries.
  - ➢ Equity-based inflows (*Eq. Flows*) = FDI (*FDI*) + Portfolio equity (*Port. Equity*)
  - ➢ Debt-based inflows (*Debt Flows*) = Portfolio debt (*Port. Debt*) + Other investment (*Oth. Debt*)
  - ➢ Total capital inflows (*Fin. Flows*)
- Control variables (classic drivers of capital inflows)
  - ➢ GDP per capita (*GDP*), inflation (*Inflation*), trade openness (*Trade*), mobile subscriptions (*Mobile*): World Bank
  - ➢ Financial openness (*Kaopen*): Aizenman et al. (2008)
  - ➢ VIX (*VIX*): FRED

Natural disasters

- Natural disasters are taken from the Emergency Events Database (EM-DAT)
  - ➢ Total of individuals affected (*Natural disasters*): Total number of injured, homeless and affected or missing individuals for each year and each country
  - ➢ Biological disasters (*Biological*): Epidemic, insect infestation and animal accident
  - ➢ Climatological disasters (*Climatological*): Drought, glacial lake outburst and wildfire
  - ➢ Geophysical disasters (*Geophysical*): Earthquake, mass movement and volcanic activity
  - ➢ Hydrological disasters (*Hydrological*): Flood, landslide and wave action
  - ➢ Meteorological disasters (*Meteorological*): Extreme temperature, fog and storm

Stylized facts

Evolution of the total number of natural disasters (1990-2021)



Source: Author's calculations based on the EM-DAT database.

Empirical model

- We estimate the following panel model:

$$Flows_{it} = \alpha_i + \beta_0 NaturalDisasters_{it} + \beta_1 X_{it} + \delta_t + \epsilon_{it} \quad (1)$$

  - $Flows_{it}$: different categories of gross capital inflows.
  - $NaturalDisasters_{it}$: intensity of disasters (number of affected individuals).
  - X_{it}: vector of traditional control variables.
  - α_i and δ_t: country- and time-fixed effects.

Empirical model

$$Flows_{it} = \alpha_i + \beta_0 NaturalDisasters_{it} + \beta_1 X_{it} + \delta_t + \epsilon_{it} \quad (1)$$

$\beta_0 \rightarrow$ Positive or negative? $\rightarrow$ Transmission channel from natural disasters to capital inflows.

- ➢ Negative: Natural disasters raise risk perception and lower expected returns. Loss of infrastructure and human capital can reduce a country's attractiveness to foreign investors, slowing inflows.
- ➢ Positive: Possible "creative destruction" effects, better disaster preparedness, and improved risk management.

Table 1A : Natural disasters and total capital inflows

	Fin.flows			
	(I)	(II)	(III)	(IV)
Nat. disasters	-0.00003**	-0.00000	-0.00001***	-0.00000*
	[0.00]	[0.00]	[0.00]	[0.00]
GDP		0.000***	0.000	0.000
		[0.00]	[0.00]	[0.00]
Inflation		-0.000	-0.000*	-0.000
		[0.00]	[0.00]	[0.00]
Trade		-0.001	-0.000	-0.003**
		[0.00]	[0.00]	[0.00]
Kaopen		0.248	0.196	0.009
		[0.17]	[0.15]	[0.17]
Mobile		0.012***	0.013***	0.007***
		[0.00]	[0.00]	[0.00]
VIX		0.003	0.003	-0.163***
		[0.00]	[0.00]	[0.03]
Country FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Obs.	3 828	2 766	2 766	2 766
Countries	190	152	152	152
R^2 (w)	0.001	0.349	0.351	0.423

Robust SE in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 1B : Natural disasters and equity-based flows

	FDI				Port. Equity				Eq. Flows			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Natural disasters	-0.0001	0.00001***	0.00000	0.00001	-0.00006***	-0.00003**	-0.00004***	-0.00004***	-0.00001	-0.00000	-0.00000	-0.00000
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	4365	3098	3098	3098	1848	1512	1512	1512	3438	2625	2625	2625
# Countries	193	152	152	152	147	120	120	120	185	147	147	147
R^2 (within)	0.000	0.392	0.394	0.505	0.004	0.091	0.098	0.169	0.000	0.378	0.382	0.503

Robust SE in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Key results: No effect on FDI, negative effect on portfolio equity

Table 1C : Natural disasters and debt-based flows

	Port. Debt				Oth. Debt				Debt flows			
	(II)	(I)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Natural disasters	-0.00008	-0.00004**	-0.00006**	-0.00005**	-0.00005*	-0.00001**	-0.00002**	-0.00002	-0.00004	-0.00002	-0.00002	-0.00002
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	1966	1587	1587	1587	3620	2522	2522	2522	3014	2310	2310	2310
# Countries	151	123	123	123	192	154	154	154	184	148	148	148
R^2 (within)	0.004	0.226	0.234	0.269	0.002	0.199	0.204	0.258	0.001	0.245	0.249	0.297

Robust SE in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Key results : Negative effect on portfolio debt

Transmission channels

Summary: Negative effect on total capital inflows, mainly from portfolio debt and equity; no effect on FDI. Why?

Transmission channels:

- ➢ Portfolio investments are short- to medium-term, more volatile, and speculative than FDI → higher disaster intensity signals lower immediate returns and weaker earnings.
- ➢ Financial markets can be disrupted by disasters (e.g., Pagnottoni et al., 2022; Boungou & Urom, 2023), reducing the appeal of portfolio equity, while FDI is less sensitive to market swings.
- ➢ No effect on FDI → FDI decisions rely on structural factors, not short-term shocks; with long-term commitments and high costs, investors often anticipate disaster risks ex ante.

Further analyses

- We propose two types of further analyses:

➢ Alternative measures of natural disasters and a composite indicator.

➢ Effect of natural disasters on capital inflows depending on country-specific characteristics.

Alternative measure

→ We extend the analysis by examining the **type** of natural disaster and its effect on capital flows.

$$Flows_{it} = \alpha_i + \beta_0 Intensity_{it} + \beta_1 X_{it} + \delta_t + \epsilon_{it} \quad (2)$$

- ➢ *Intensity* = number of people affected by disaster type: Biological, Geophysical, Hydrological, Climatological, and Meteorological.
- ➢ Each type refers to the number of people affected annually in a given country.
- ➢ Climatological and hydrological disasters affect the largest number of people

Total people affected by type of disasters

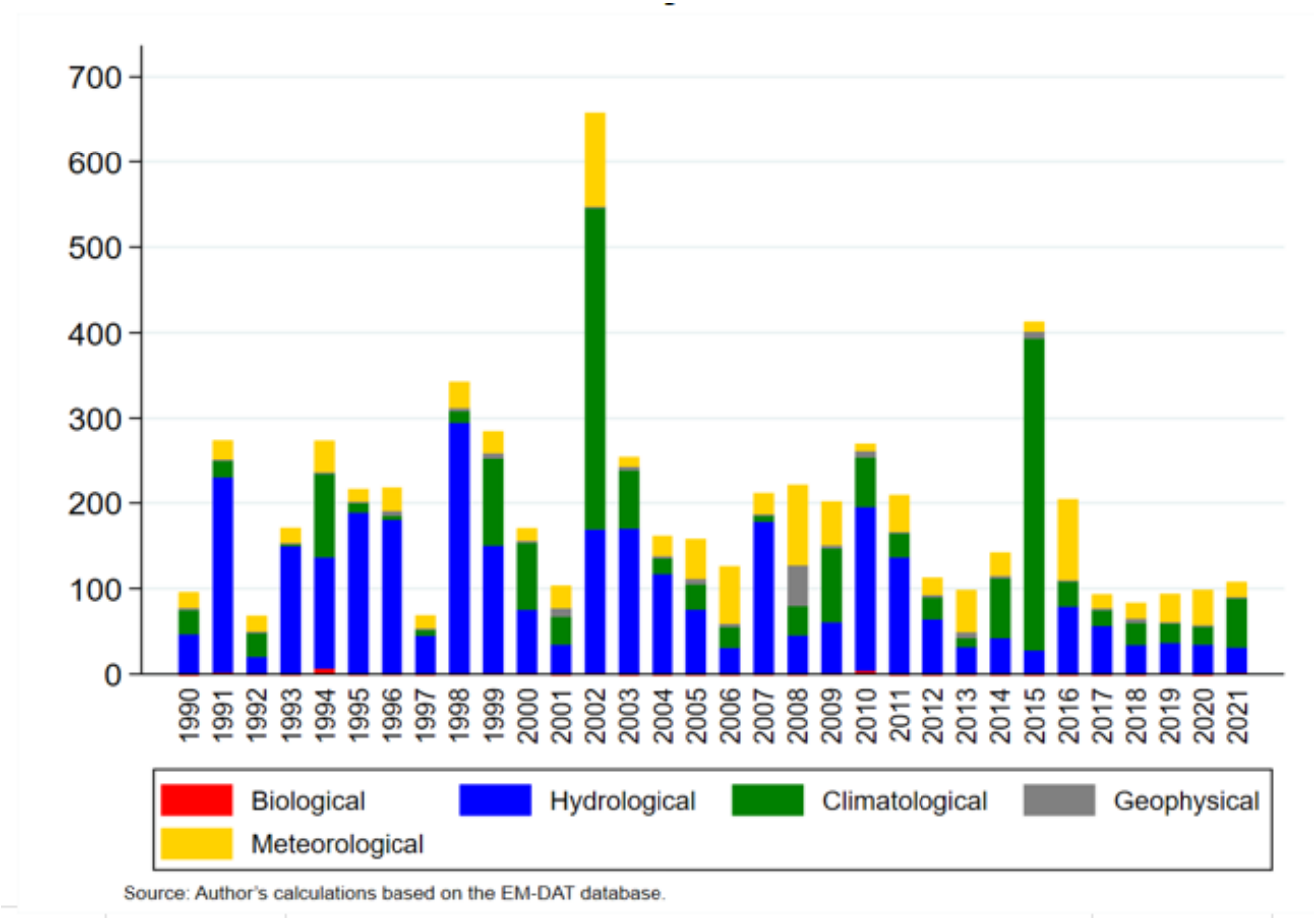


Table 2A : Type of natural disasters and total financial flows

	Fin. Flows					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Biological	0.00059					0.00013
	[0.00]					[0.00]
Geophysical		-0.00011				-0.00014
		[0.00]				[0.00]
Hydrological			-0.00003**			-0.00001
			[0.00]			[0.00]
Climatological				0.00001*		0.00000
				[0.00]		[0.00]
Meteorological					-0.00000	0.00001
					[0.00]	[0.00]
Observations	2969	2989	2894	2888	2716	2472
Number of countries	152	152	152	152	152	152
R^2 (within)	0.409	0.415	0.420	0.423	0.438	0.444

Robust SE in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Country-specific

$\rightarrow$ Test whether the effect of natural disasters on capital flows depends on country-specific characteristics.

$$\begin{aligned} Flows_{it} = \alpha_i + \beta_0 NaturalDisasters_{it} + \beta_1 highX_{it} \\ + \beta_2 \left(NaturalDisasters_{it} \times highX_{it} \right) + \delta_t + \epsilon_{it} \end{aligned} \tag{3}$$

- $highX$ = dummy for high values (1 if above median) of GDP per capita, inflation, trade openness, financial openness, and mobile subscriptions.
- Example: 0 if GDP per capita $<$ \$4017 (low standard of living), 1 otherwise.
- β_0 = effect when dummy = 0 (below median). $\beta_0 + \beta_2$ = effect when dummy = 1 (above median).

Table 3 : Country-specific on capital flows

	Fin. flows				
	(I)	(II)	(III)	(IV)	(V)
Natural disasters	-0.00001*	0.00000	-0.00000*	-0.00000**	-0.00001**
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Affected_GDP	0.00006***				
	[0.00]				
High_GDP	-0.01783				
	[0.14]				
Affected_High_Inflation		-0.00001*			
		[0.00]			
High_Inflation		0.12557**			
		[0.06]			
Affected_High_Trade			-0.00002		
			[0.00]		
High_Trade			-0.13598		
			[0.09]		
Affected_High_Kaopen				-0.00002	
				[0.00]	
High_Kaopen				0.02111	
				[0.08]	
High_Mobile					0.63602***
					[0.09]
Affected_High_Mobile					0.00004***
					[0.00]
Observations	2766	2766	2766	2766	2766
Number of countries	152	152	152	152	152
R^2 (within)	0.424	0.425	0.423	0.423	0.432

Robust SE in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Concluding remarks

- Natural disasters reduce international capital inflows, mainly via portfolio investments (equity and debt), not FDI.
- Effects vary with:
  - Country-specific characteristics
  - Institutional stability
  - Type of natural disaster
- Results are sensitive to the measurement of natural disasters.
- Policy implications: Adverse effects of natural disasters on capital flows can be mitigated through policies that promote economic development, improve infrastructure, and strengthen institutional frameworks.

Concluding remarks

Thanks for your attention !

Institutional stability

→ We test whether institutional quality moderates the impact of natural disasters on capital flows.

$$\begin{aligned} Flows_{it} = \alpha_i + \beta_0 NaturalDisasters_{it} + \beta_1 highZ_{it} \\ + \beta_2 \left(NaturalDisasters_{it} \times highZ_{it} \right) + \delta_t + \epsilon_{it} \end{aligned} \tag{4}$$

- ➢ $highZ$ = dummy for high values (above median) of control of corruption, government effectiveness, regulatory quality, and political stability (World Bank data).
- ➢ Expectation: Weak institutions (low governance scores) → higher risk perception and stronger negative effects of disasters on capital flows.

Table 4 : Institutional variables on financial flows

	Fin. flows			
	(I)	(II)	(III)	(IV)
Natural disasters	-0.00002**	-0.00001***	-0.00001**	0.00005***
	[0.00]	[0.00]	[0.00]	[0.00]
High_Control_Corruption	-0.22218*			
	[0.12]			
Affected_High_Control_Corruption	0.00000			
	[0.00]			
High_Political_Stability		0.04926		
		[0.13]		
Affected_High_Political_Stability		0.00082		
		[0.00]		
High_Regulatory_Quality			0.07658	
			[0.09]	
Affected_High_Regulatory_Quality			0.00000	
			[0.00]	
High_Gov_Effectiveness				-0.09197
				[0.11]
Affected_High_Gov_Effectiveness				0.00004***
				[0.00]
Observations	2114	2114	2111	2111
Number of countries	148	148	148	148
R^2 (within)	0.343	0.341	0.340	0.341

Robust SE in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5 : Total damages on financial flows

	Fin.flows						
	Fin. Flows (I)	FDI (II)	Port. Equity (III)	Eq. Flows (IV)	Port. Debt (V)	Oth. Debt (VI)	Debt flows (VII)
Damages	0.00003***	-0.00002	-0.00005**	-0.00007**	0.00006***	-0.00006	0.00004**
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Observations	1984	2190	1143	1887	1194	1766	1668
Number of countries	151	151	117	145	118	152	146
R^2 (within)	0.423	0.529	0.199	0.511	0.284	0.262	0.298

Robust SE in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.