Flight to climatic safety: local natural disasters and global portfolio flows

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4th LTI@UniTO and Bank of Italy Workshop

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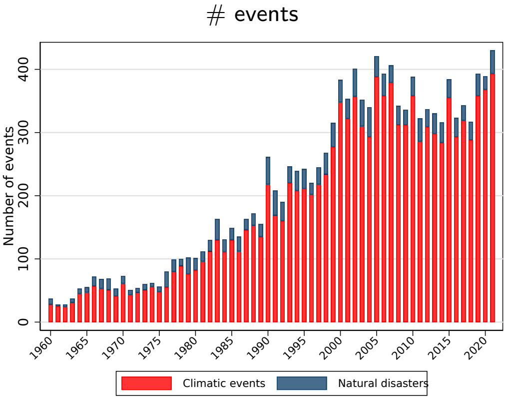
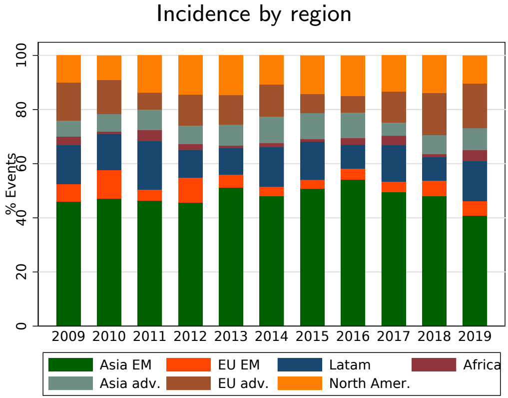
Climatic disasters on the rise...but unevenly across countries





Climatic events: extreme temperature, drought, wildfire, flood, landslide, storm.

Non-climatic events: earthquake, volcano eruption.

This paper

Questions:

- Do international investors respond to local climate-related disasters?
  Yes

- Rationale?
  Climatic risk

- Spillovers beyond country borders?
  Flight to climatic safety

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- Rationale?
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- Spillovers beyond country borders?
  Flight to climatic safety

Empirical tools

- Local projections (panel and time series)
- Key dependent variable: Country-level portfolio flows
- Key regressor: natural disasters

Literature & Contribution

1. Climate macro and finance

- **Macro**: Jones and Olken 2010, Dell et al 2014, Desmet and Rossi-Hansberg 2015, Gu and Hale 2022, Hale 2022.
- **Finance**: Giglio et al. (2021), Choi et al. (2020), Alok et al. (2020), Alekseev et al. (2021).

→Global effects of climate-related disasters via investment

2. Natural disasters

- Noy (2009), Raddatz (2009), Cavallo and Noy (2011); Klomp and Valckx (2014), Botzen et al. (2019) for a survey

→New transmission channel

3. Capital flows and flight to safety

- **Cap flows**: Yang (2008), David (2011), Fratzscher (2012), Forbes and Warnock (2012), Milesi-Ferretti and Tille (2014), Ananchotikul and Zhang (2014), Rey (2015), Miranda-Agrippino and Rey (2020), Koepke (2019) and Osberghaus (2019) for a survey
- **Flight to safety**: Brunnermeier and Pedersen 2008, Caballero and Krishnamurty 2008, Miranda-Agrippino and Rey 2020, Kekre and Lenel 2021

→Novel pull factor and flight to safety motive

Data

- **EM-DAT**: largest natural **disasters** worldwide (by University of Louvain)
  - Criterium: ($>$ 10 deaths) OR ($>$ 100 affected) OR state of emergency OR international assistance
  - Event date /country/characteristics/damage (US dollars)/affected etc
  - Most comprehensive database and daily Events

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- **EPFR**: financial investment into equity mutual funds by country EPFR
  - (1) net flows (inflows - outflows); (2) total end-of-period Assets Under Management (AUM)
  - Weekly and wide country coverage
  - Investors breakdown (active vs passive, retail vs institutional)

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- Sample
  - panel country $\times$ week, 2009-2019
  - 39 countries = 16 ADVs + 23 EMEs (criterion: at least 1 disaster per year + EPFR availability)

Econometric strategy

Dynamic effect of disasters with panel local projection:

$$y^i_{t+h} = \frac{\sum_{j=0}^{h} f^i_{t+j}}{A^i_{t-1}} = \beta_h D^i_t + \gamma_h X^i_t + \alpha^i_h + \delta_{t,h} + \varepsilon^i_{t+h} \quad (1)$$

- y^i_{t+h} are **cumulated net inflows** f^i_t to country i from week t to $t+h$ normalized by AUM at the end of $t-1$ (A^i_{t-1})
- $D_{i,t}$ is a dummy equal to 1 if at least one **natural disaster occurs** in country i week t

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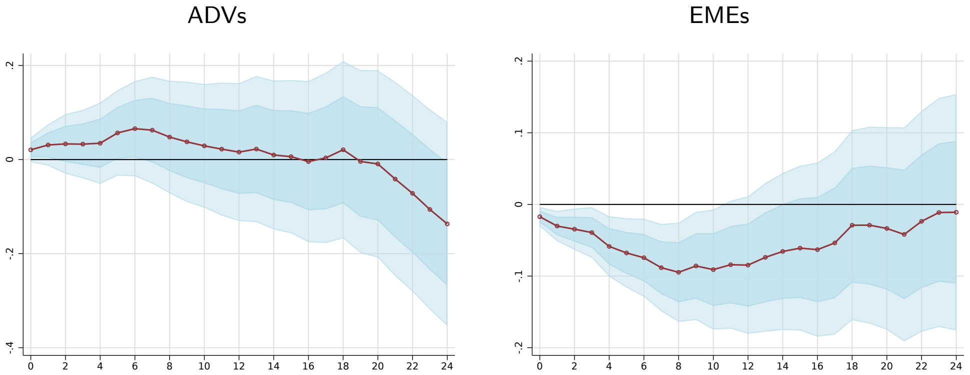
Other details:

- $X_{i,t}$ domestic controls $\Rightarrow$ equity prices and vol, fx vs dollar, IP, PMI index
- $\alpha_{i,h}$ are country FE; $\delta_{t,h}$ time (week) dummy
- Horizon $h = 0, \ldots, 24$ weeks
- 68% and 90% confidence interval based on Driscoll-Kraay std err

Finding# 1: Direct effect in the hit country



- Net flows fall only when disasters strike EMEs
- Down by 0.1 pp after 8 weeks. . . sizable! (avg weekly net flows in EMEs: 0.16% of AUM)

Climatic risk

Behavioral effects of climate-related disasters:
wake-up call on longer-run climatic risks (Busse et al 2015, Choi et al 2020, etc)

$\rightarrow$ Are the effects heterogeneous within EMEs based on their exposure to Climatic Risk (CR)?

Climatic risk

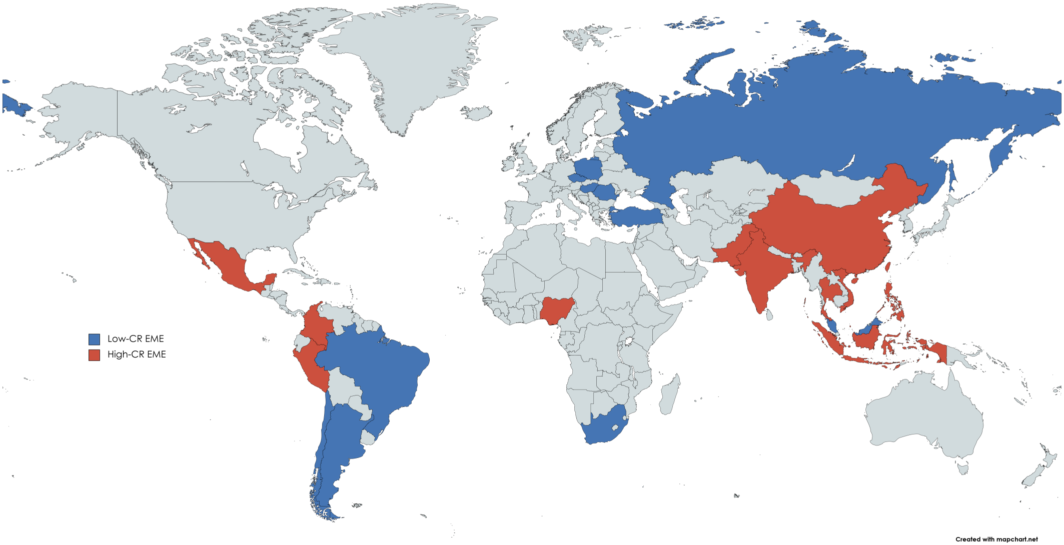
Behavioral effects of climate-related disasters:
wake-up call on longer-run climatic risks (Busse et al 2015, Choi et al 2020, etc)

→ Are the effects heterogeneous within EMEs based on their exposure to Climatic Risk (CR)?

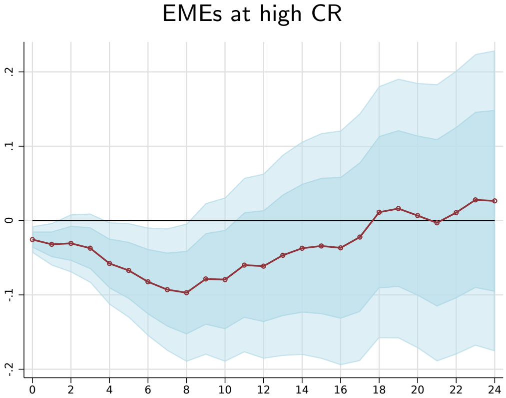
- Split EMEs in two groups: high CR vs low CR
- Climate Vulnerability Index from Univ of Notre Dame Global Adaptation Initiative (ND-GAIN)
  - annual risk index on: food, water, health, ecosystem services, human habitat, and infrastructure
  - We consider average country ranking 1995-2008
  - Above (below) median countries labeled at high (low) CR

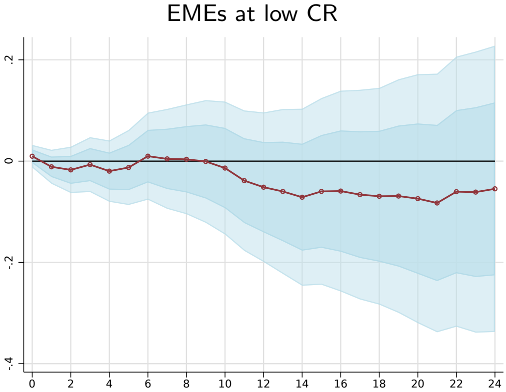
World Map

EME at high and low CR (ND-Gain)



Within EMEs heterogeneity





Severity

- The effect comes entirely from EMEs at high CR
- Fall in net inflows is temporary

Finding #2: Climatic risk channel

Results potentially mix 2 channels:

1. **Direct economic impact**: ambiguous sign
   - $\downarrow$ if investors expect damages lead to lower returns
   - $\uparrow$ if investors expect new investment opportunities (e.g., to rebuild the capital stock)
2. **Climatic risk**: negative sign
   - After observing a climatic disaster, investors update beliefs on climatic riskiness of the country
   - $\downarrow$ to reduce their exposure to CR

To isolate CR channel:

- Explore effect of disasters on flows to **unaffected countries** in the same region:

  disaster in high-CR EME $\rightarrow$ effect on high-CR **neighboring countries**
- Exercise on Asia and LatAm

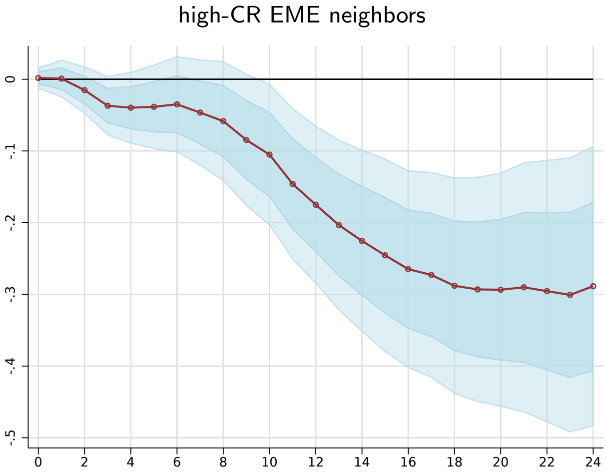
Empirical strategy

2 exercises by modifying baseline panel LP:

1. **Disasters abroad**
   Substitute dummy with $\tilde{D}$=1 if at least 1 disaster in high-CR neighbor but **not** in country i

$$\tilde{D}_{it} = \begin{cases} 1 & \text{if} \quad \sum_{j \in G} D_{j,t} > 0 \quad \& \quad D_{i,t} = 0 \\ 0 & \text{if} \quad \sum_{j \in G} D_{j,t} = 0 \quad \text{or} \quad D_{i,t} > 0 \end{cases} \qquad j \neq i \quad j, i \in G(region) \tag{2}$$

IRF (1)



- Disasters reduce net inflows to unaffected, high-CR countries
- More (and more persistently) than in the hit country → direct effect maybe positive on avg

Empirical strategy

2 exercises by modifying baseline panel LP:

2. **Control for trade linkages**

   Augment specification (2) with DT variable

$$DT_{i,t} = \begin{cases} \sum_{j \in G} w_{j,i} D_{j,t} & \text{if} \quad D_{i,t} = 0 \\ 0 & \text{if} \quad D_{i,t} > 0 \end{cases} \qquad j \neq i \quad j, i \in G$$

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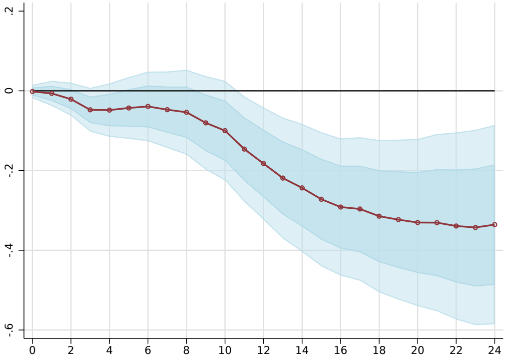
Rationale:

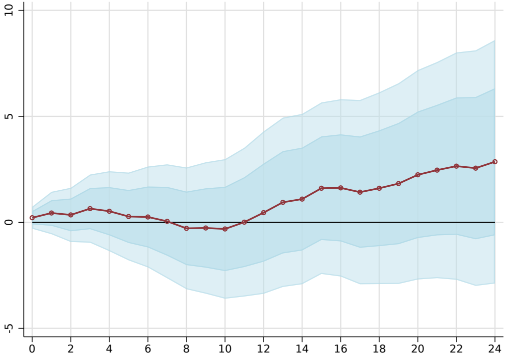
- Fall in net inflows can be proportional to trade linkages with the hit country
- $\tilde{D}$ captures climate risk motive, DT the trade motive

IRF(2)

Main effect ($\tilde{D}$)



Interaction term (DT)



- Interaction non significant, trade linkages seem not matter
- Overall: direct effect looks positive; climate risk channel is larger and persistent in high-CR EME

Finding #3: Spillovers to ADV

1. What happens to flows into advanced economies when disasters strike high-CR EMEs?
   - Investors may simply pull out money ...
   - ...or they may reshuffle funds to other countries
2. We explore whether they do that within the same asset class of equity mutual funds
3. Provides an additional test of our behavioral channel

Empirical strategy

2 exercises:

1. **Aggregate spillovers**:

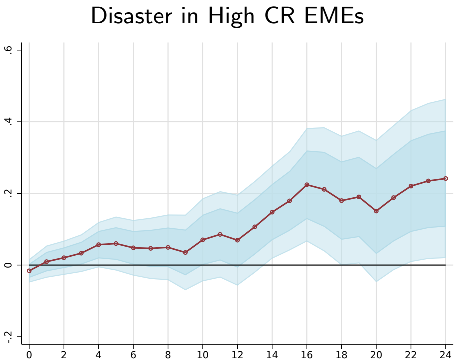
   Pooled (time series) estimation:

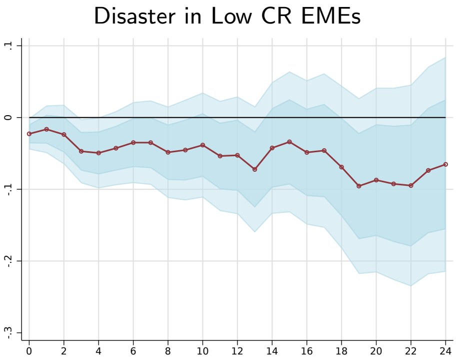
$$y_{t+h} = \frac{\sum_{0:h} f_{t+j}}{A_{t-1}} = \alpha_h + \beta_h D_t + \gamma_h X_t + \varepsilon_t \qquad h = 0, 1, 2...24 \tag{3}$$

- y_{t+h} is the cumulated net **aggregate inflows** to all ADVs
- D_t is one if there is at least one disaster **in one group of EMEs**
- X_t is a set of controls including global push factors and domestic conditions

We test spillovers from disasters coming from high-CR vs low-CR EMEs

IRF(1) - Spillover to ADVs





→ Increase in net inflows to ADV following disasters in high-CR EMEs only

Empirical strategy

2 exercises:

2. **Climate-related heterogeneity within ADV**:

   Panel estimation for ADV:

$$y_{t+h}^{i} = \frac{\sum_{k=0}^{h} f_{t+k}^{i}}{A_{t-1}^{i}} = \alpha_h^i + \delta_{t,h} + \beta_h D_t^j + \eta_h D_t^j CR_t^i + \theta_h D_t^j Ins_t^i + \gamma_h X_t^i + \varepsilon_{t+h}^i \quad (4)$$

- y_{t+h}^{i} are cumulated net inflows f_t^i to country $i \in$ ADV from week t to $t+h$ normalized by AUM
- D_t is one if at least one disaster occurs in one country $j \in$ High-CR EME

Empirical strategy

2 exercises:

2 **Climate-related heterogeneity within ADV**:

Panel estimation for ADV:

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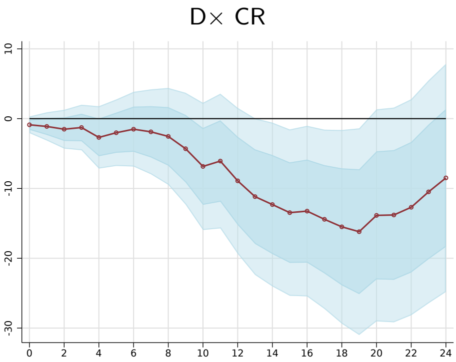
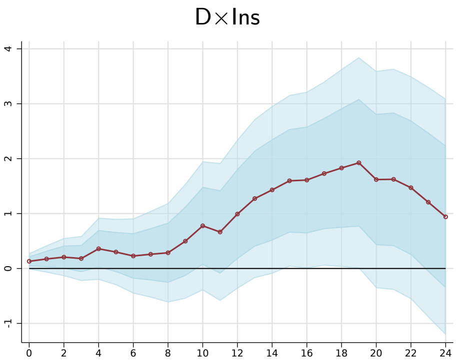
- CR^i_t is the ND-GAIN climate vulnerability index for ADVs
- Ins^i_t is the **non-life insurance premium** over GDP (from WB, proxies clim insurance coverage)

η and θ capture how the spillovers are influenced by the *CR* and *Ins* of the recipients ADVs

IRF(2) - Role of risk and insurance coverage





→ Spillovers smaller for climate riskier ADV and larger for more insured ADV

Climatic vulnerability redesigns safe havens

Table: **Rankings of ADV (from safer to riskier)**

Ranking	Country	Insurance (high to low)	Ranking	Country	Climatic Risk (low to high)
1	**United States**	3.362	1	Switzerland	0.268
2	**United Kingdom**	2.823	2	Austria	0.291
3	Australia	2.619	3	**United Kingdom**	0.293
4	Korea, Republic of	2.601	4	Germany	0.305
5	**Canada**	2.421	5	Spain	0.307
6	Spain	2.287	6	**Canada**	0.309
7	France	2.269	7	France	0.317
8	Austria	2.245	8	Australia	0.329
9	Belgium	2.229	9	Italy	0.330
10	Switzerland	2.187	10	New Zealand	0.334
11	Portugal	2.090	11	Greece	0.336
12	Germany	2.080	12	**United States**	0.339
13	Italy	2.023	13	Portugal	0.353
14	New Zealand	1.649	14	Belgium	0.353
15	**Japan**	1.519	15	**Japan**	0.379
16	Greece	0.741	16	Korea, Republic of	0.399

→ "Climatic safe" havens: UK, Canada – "Climatic risky" havens: Japan – US and Ger in between

Robustness

Our results are robust to the following variations of the [baseline]:

1. Using only **climatic events** [all natural disasters] Climate
2. Using equity portfolio flows from low frequency datasets (BoP data or OECD tracker) BoP
3. Using alternative **climatic indicators**
   - Using Germanwatch climate risk index [ND-GAIN] GCRI
   - Insurance: OECD indicator [IMF-WB] OECD
4. Estimation based on USD **damages** over GDP [disaster dummy] Damages
5. **Control** for trade/GDP and fiscal capacity Controls
6. **Investors' breakdown** (1) retail vs institutional, (2) active vs passive mutual funds Breakdowns

Conclusions

- **Natural disasters** reduce **capital inflows** in EMEs (at high climatic risk)

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  - . . . going away from countries at high climatic risk after a disaster . . .

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- Policy implications:

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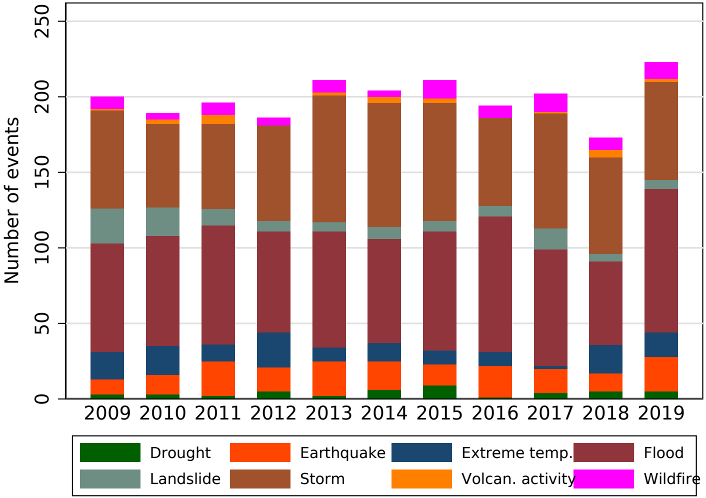
  - ... going away from countries at high climatic risk after a disaster ...
  - ... and flying to safer economies from a climatic risk standpoint
- Policy implications:
  - Increasing volatility in capital flows
  - Pull factor in EMEs: capital requirements & climatic risk

Distribution of event types



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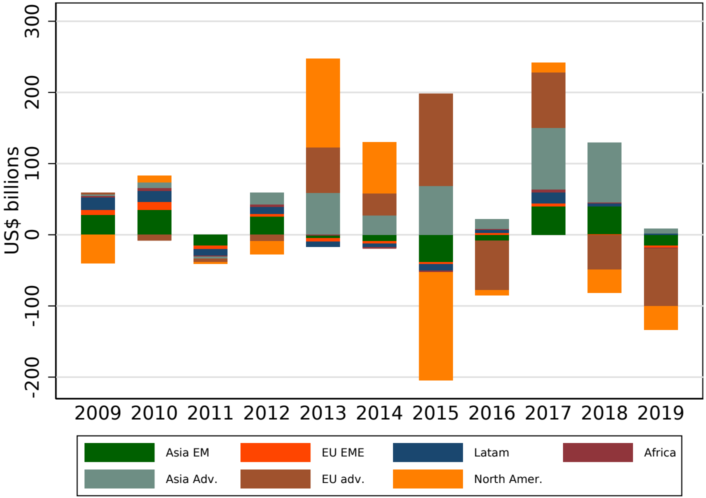
EPFR snapshot



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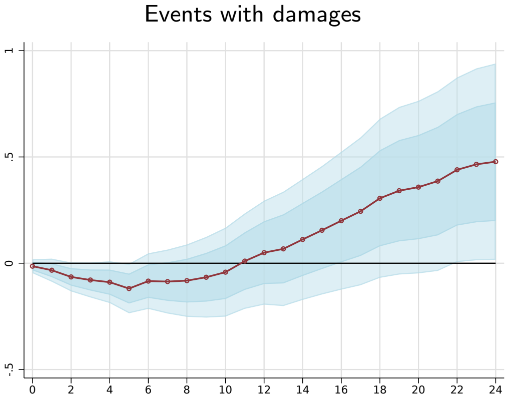
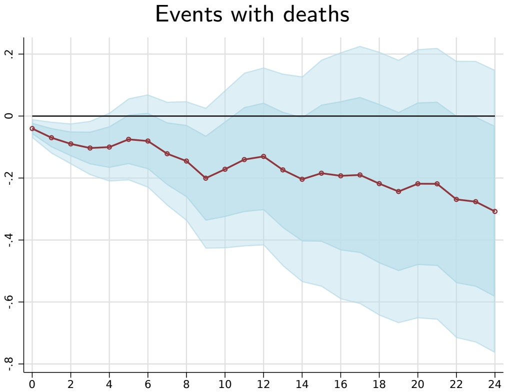
Amplification in case of damages





Note. Displayed coefficients are marginal effects. Coefficients represent p.p. Shaded areas display 68 and 90% confidence intervals.

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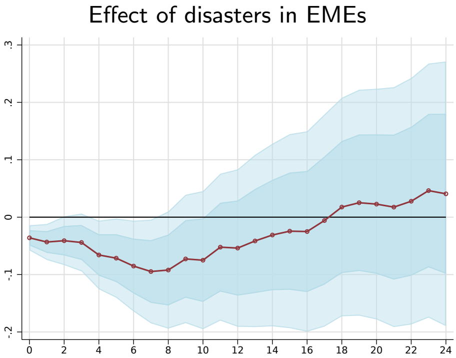
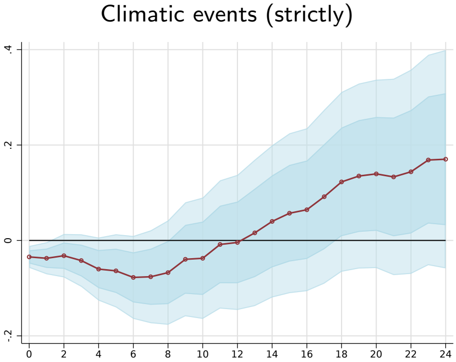
Only climatic events





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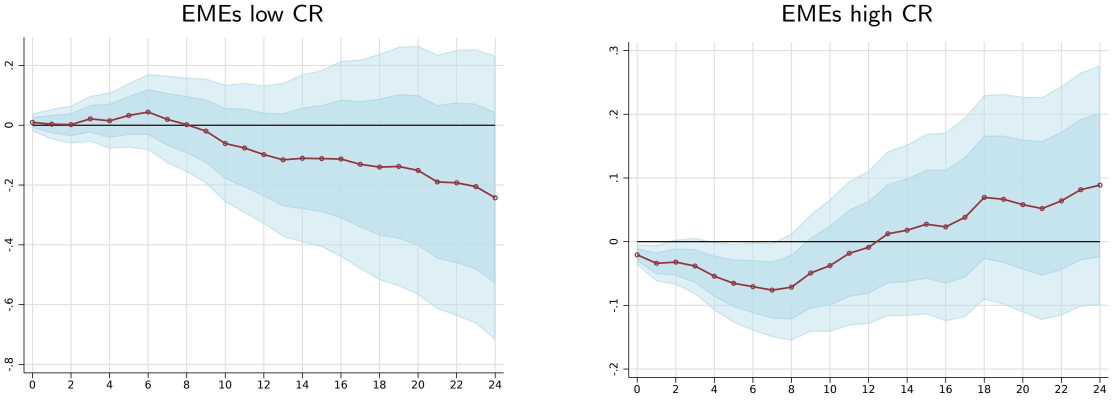
Panel estimation of spillovers

$$y_{i,t+h} = \frac{\sum_{1:h} f_{i,t+h}}{A_{i,t-1}} = \alpha_{i,h} + \delta_{t,h} + \beta_h D_{j,t} + \eta_h D_{j,t} CR_{i,t} + \theta_h D_{j,t} Ins_{i,t} + \gamma_h X_{i,t} + \varepsilon_{i,t+h}$$

- $y_{i,t}$ are net cumulated flows $f_{i,t}$ to country i in week t normalized by the assets under management $A_{i,t-1}$; $i \in$ ADVs
- $D_{j,t}$, is a dummy equal to 1 if at least one natural disaster occurs in $j \in$ EMEs
- $CR_{i,t}$ is the climatic risk index
- $Ins_{i,t}$ is the non-life insurance normalized by GDP
- η and θ capture how the spillovers are influenced by the *CR* and *Ins* of the recipients ADVs countries

Germanwatch Climatic Risk Index



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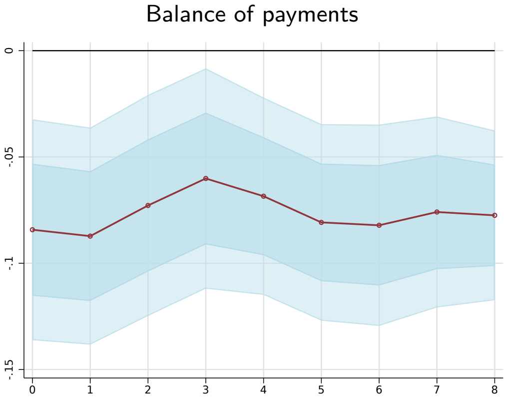
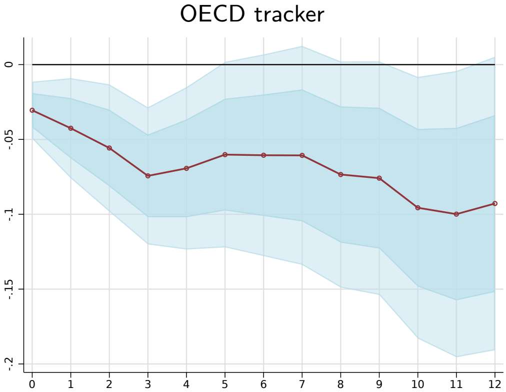
Low frequency dataset





Note. Coefficients represent USD.
Shaded areas display 68 and 90% confidence intervals.

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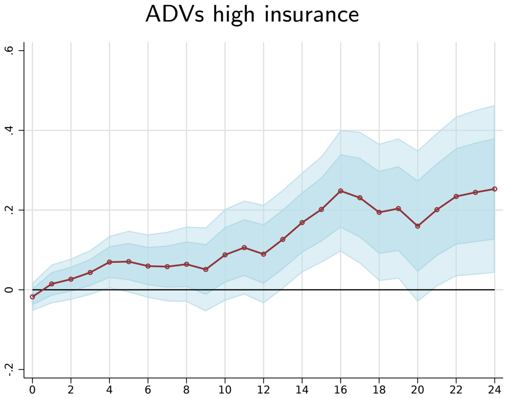
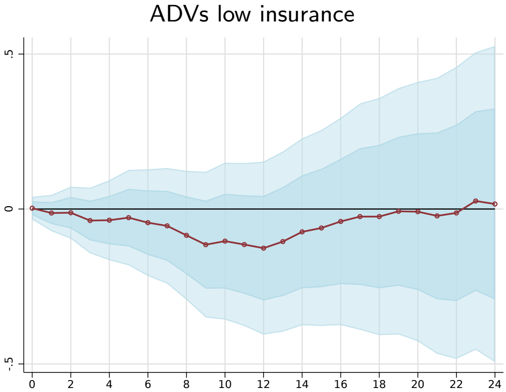
Spillovers using OECD insurance data





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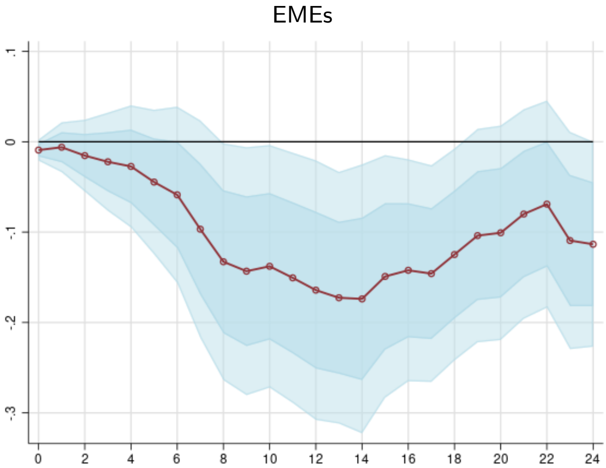
Estimation based on USD damages



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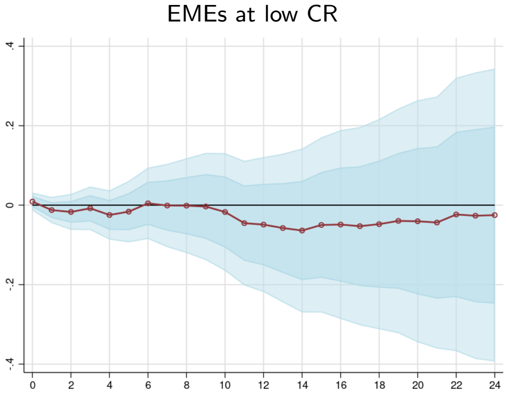
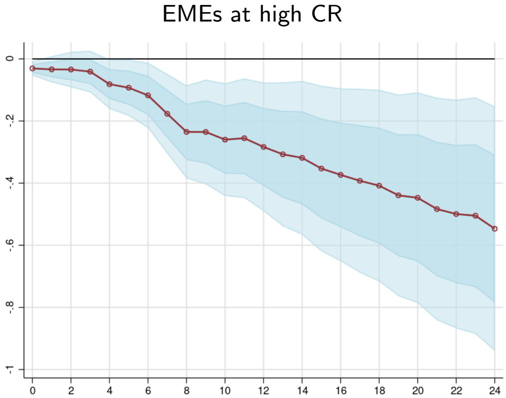
Control for trade and fiscal capacity





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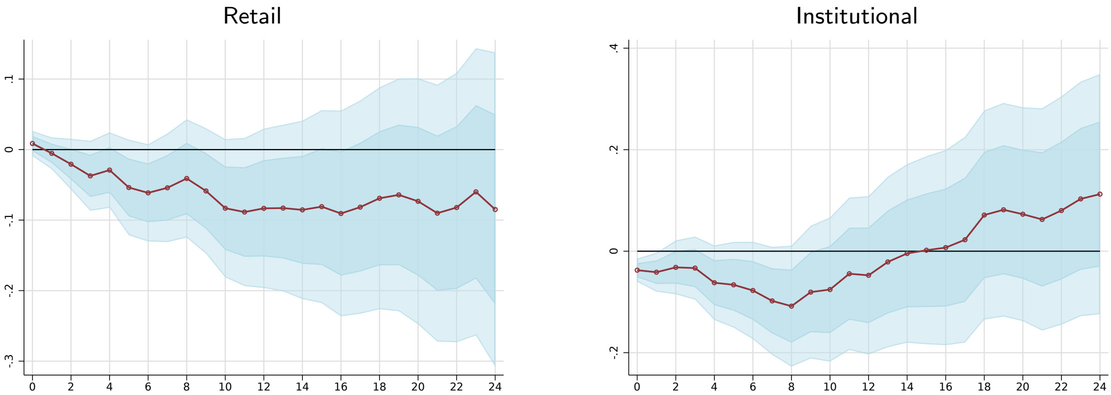
Breakdown for high-risk EMEs: 1) retail vs institutional



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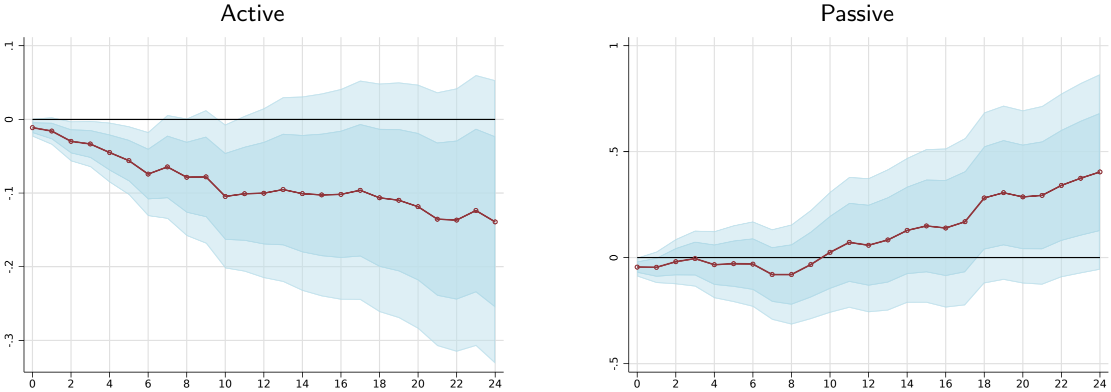
Breakdown for high-risk EMEs: 2) active vs passive



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