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

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The views expressed here are those of the author and do not necessarily reflect those of the Bank of Italy.
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
This paper

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  Flight to climatic safety

Empirical tools

• Local projections (panel and time series)

• Key dependent variable: Country-level portfolio flows

• Key regressor: natural disasters
1. Climate macro and finance

- **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


→ Novel pull factor and flight to safety motive
• **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
Data

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• **EPFR**: financial investment into equity mutual funds by country
  ▶ (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)
Data

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- **Sample**
  - panel country × 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:

\[ y_{i,t+h} = \frac{\sum_{j=0}^{h} f_{i,t+j}}{A_{i,t-1}^i} = \beta_h D_{i,t}^i + \gamma_h X_{i,t} + \alpha_h + \delta_{t,h} + \varepsilon_{t+h} \]  

(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 \( t - 1 \) \( (A_{i,t-1}^i) \)

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

- \( D_{i,t} \) is a dummy equal to 1 if at least one **natural disaster occurs** in country \( i \) week \( t \)

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)
**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)?
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
EME at high and low CR (ND-Gain)
Within EMEs heterogeneity

- 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
   - ▼ if investors expect damages lead to lower returns
   - ▲ 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
   - ▼ 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 → 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 $i$

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

   \[
   DT_{i,t} = \begin{cases} 
   \sum_{j \in G} w_{j,i} D_{j,t} & \text{if } D_{i,t} = 0 \\
   0 & \text{if } D_{i,t} > 0 
   \end{cases} 
   \]

   \[j \neq i, j, i \in G\]
Empirical strategy

2 exercises by modifying baseline panel LP:

2. **Control for trade linkages**

   Augment specification (2) with DT variable

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

   \[ j \neq i \quad j, i \in G \]

   Rationale:

   • Fall in net inflows can be proportional to trade linkages with the hit country

   • $\bar{D}$ captures climate risk motive, $DT$ the trade motive
• 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:

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

   - $y_{t+h}$ 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:

\[
y_{t+h}^i = \frac{\sum_{k=0}^{h} f_{t+k}^i}{A_{t-1}^i} = \alpha_h^i + \delta_{t,h} + \beta_h D_t^i + \eta_h D_t^i CR_t^i + \theta_h D_t^i Ins_t^i + \gamma_h X_t^i + \varepsilon_{t+h}^i
\]

- \(y_{t+h}^i\) are cumulated net inflows \(f_t^i\) to country \(i \in \text{ADV}\) from week \(t\) to \(t + h\) normalized by AUM

- \(D_t\) is one if at least one disaster occurs in one country \(j \in \text{High-CR EME}\)
Empirical strategy

2 exercises:

2 Climate-related heterogeneity within ADV:

Panel estimation for ADV:

\[ y^i_{t+h} = \sum_{k=0}^{h} f^i_{t+k} A^i_{t-1} = \alpha^i_t + \delta_{t,h} \beta^i_t + \eta^i_t CR^i_t + \theta^i_t Ins^i_t + \gamma^i_t X^i_t + \varepsilon^i_{t+h} \]  

- \( CR^i_t \) 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)

\( \eta \) and \( \theta \) capture how the spillovers are influenced by the \( CR \) and \( Ins \) of the recipients ADVs
IRF(2) - Role of risk and insurance coverage

$D \times CR$

$D \times Ins$

→ Spillovers smaller for climate riskier ADV and larger for more insured ADV
Climatic vulnerability redesigns safe havens

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Country</th>
<th>Insurance (high to low)</th>
<th>Ranking</th>
<th>Country</th>
<th>Climatic Risk (low to high)</th>
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<td>Switzerland</td>
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</tr>
</tbody>
</table>

→ “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]
2. Using equity portfolio flows from low frequency datasets (BoP data or OECD tracker)
3. Using alternative climatic indicators
   - Using Germanwatch climate risk index [ND-GAIN]
   - Insurance: OECD indicator [IMF-WB]
4. Estimation based on USD damages over GDP [disaster dummy]
5. Control for trade/GDP and fiscal capacity
6. Investors’ breakdown (1) retail vs institutional, (2) active vs passive mutual funds
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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  ▶ . . . going away from countries at high climatic risk after a disaster . . .
  ▶ . . . and flying to safer economies from a climatic risk standpoint
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- Policy implications:
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  - . . . 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

Number of events:

- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019

Event types:
- Drought
- Earthquake
- Extreme temp.
- Flood
- Landslide
- Storm
- Volcan. activity
- Wildfire

Bar chart showing the distribution of event types from 2009 to 2019.
Amplification in case of damages

Events with damages

Events with deaths

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

Effect of disasters in EMEs

Climatic events (strictly)
Panel estimation of spillovers

\[ y_{i,t+h} = \frac{\sum_{1:h} f_{i,t+h}}{A_{i,t-1}} = \alpha_{i,h} + \delta_{t,h} + \beta_{t}D_{j,t} + \eta_{h}D_{j,t}CR_{i,t} + \theta_{h}D_{j,t}Ins_{i,t} + \gamma_{h}X_{i,t} + \varepsilon_{i,t+h} \]

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

EMEs low CR

EMEs high CR

Shaded areas display 68 and 90% confidence intervals.
Low frequency dataset

Balance of payments

OECD tracker

Note. Coefficients represent USD. Shaded areas display 68 and 90% confidence intervals.
Spillovers using OECD insurance data

Shaded areas display 68 and 90% confidence intervals.
Estimation based on USD damages

Shaded areas display 68 and 90% confidence intervals.
Control for trade and fiscal capacity

EMEs at low CR

EMEs at high CR

Shaded areas display 68 and 90% confidence intervals.
Breakdown for high-risk EMEs: 1) retail vs institutional

Note. Coefficients represent p.p. Shaded areas display 68 and 90% confidence intervals.
Breakdown for high-risk EMEs: 2) active vs passive

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