Flight to climatic safety: local natural disasters and global portfolio reallocation*

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Preliminary version

Using data for a rich panel of countries on natural disasters and net financial flows, we uncover significant effects of adverse catastrophic events on global portfolio allocation. First, disasters induce a marked and persistent shortfall in investors' net inflows to the affected country, revealing the importance of a pull factor previously disregarded in the literature. The impact is significant only for those emerging economies where disasters are more frequent and severe, suggesting that the occurrence of new events can raise climate risk awareness. Second, global investors reallocate funds from the impacted economies to safer advanced countries, in particular to those in which non-life insurance penetration is highest: this evidence suggests investors taking care of *climatic safety*. Natural disasters increasing in frequency and intensity due to climate change might induce higher volatility in international capital flows, potentially calling for a domestic policy response and adding evidence in favor of a globally coordinated climate policy action.

JEL classification: C32, C33, E44, F3, Q54

Keywords: climate change, natural disasters, capital flows, flight to safety, emerging markets

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1 Introduction

It is widely documented that adverse natural events may cause direct losses and indirect damage to economic activity (see Botzen et al., 2019 for a review of the literature). Whereas the direct effects, generated by physical damages and disruptions, are straightforward, the indirect effects are multifaceted. For instance, the local impacts of natural disasters spread out within countries also due to a decrease in bank loans in non-damaged areas (Koetter et al., 2020; Rehbein and Ongena, 2022), possibly increasing fiscal vulnerability (Mallucci, 2020). Less is known about how climate-related shocks can affect investment at global level. For example, if those shocks are also able to put local market profitability under threat, financial investors might reduce inflows or divest and reallocate funds elsewhere, exacerbating the domestic impacts and channeling disaster effects through the international capital markets.

We take up this issue and investigate whether natural disasters shape the global portfolio allocation. As for the set of extreme events, we rely on the EM-DAT database, which tracks the occurrence and damages produced by high-impact disasters worldwide. To disentangle country-level portfolio flows, we consider net inflows into equity mutual funds from the EPFR database, which conveniently re-bundles net flows to mutual funds by nationality of the invested countries at weekly frequency, offering a reliable proxy of global portfolio investment in each country. We then use these variables to estimate, for a set of countries encompassing both advanced and emerging economies, the average effect of the unexpected occurrence of extreme natural events on country-specific financial inflows.

We estimate the dynamic causal effect of natural disasters on portfolio allocation by means of panel local projections (Jordà, 2005). The occurrence of a natural disaster generates, on average, a decrease in net financial inflows in the affected country, which persists at least 12 weeks after the shock. These effects are significant only when considering flows towards emerging economies, in particular to those classified as at high climate risk, suggesting that the occurrence of climate-related adverse events can shape investors' belief about climate risks looming ahead.[1] The response of portfolio flows are also heterogeneous with respect to the fund management strategy. Indeed, significant effects show up only for flows into active investment funds, suggesting that portfolio managers could exacerbate portfolio volatility in the aftermath of a natural disaster. On the contrary, we do not find any statistical significant difference with respect to the investor type (retail vs institutional), with very similar response recorded for both categories after the event. Not less important, we document the ability of investors to discriminate across natural disasters in terms of severity, with more substantial outflows recorded for extremely catastrophic events such as the ones characterized by the presence of dead people or significant economic damages.

We then investigate whether natural disasters in one country also induce a reallocation of funds elsewhere. To test these spillover effects, we run local projections in a time series framework, evaluating the response of aggregated inflows to non-affected countries to shocks occurring in other countries. We find that international spillovers do exist, as investors flight beyond countries' borders in response to the deteriorating economic environment caused by local shocks. In particular, fund reallocation occurs exclusively towards advanced economies and, in particular, to the subset of countries in which non-life insurance penetration is highest: this evidence suggests that investors value the physical risks related to climate change, and tend to recompose their portfolios towards economies that are expected to be most resilient to future climate-related shocks. This attitude, which complements the traditional risk-off behavior in times of stress, might be related to an increase in climate risk awareness spurred by the shock itself . We name this behavior of financial investors as a "flight to *climatic safety*",hinting to a shift in the longer-run climate risk perception affecting short-run portfolio decisions.

This paper contributes to the international finance literature by uncovering a previously disregarded trigger of capital flights – a pull factor – suggesting a new perspective in defining safe haven countries

[1] We employ the country climate risk on the classification by Germanwatch.

(for the flight to safety literature, see Caballero and Krishnamurthy, 2008 and Brunnermeier and Pedersen, 2008, among others). In recent years, the literature has mainly focused on global push factors, such as investors' global risk aversion, as drivers of capital flows patterns (see for instance Koepke 2019), whereas we shed light on a novel relevant pull factor arising from countries' heterogeneous exposure to climate risk. Going ahead, these portfolio movements might become more frequent and grow in size, as natural disasters increase in frequency and intensity over time because of climate change, raising uncertainty about financial capital availability at country level. Our findings could be relevant for the policy debate on the design of effective mitigation and adaptation policies at regional scale. Our paper also contributes to the growing climate finance literature, notably on the strand investigating investors' reaction to weather-related shocks (Choi et al., 2020; Alok et al., 2020; Alekseev et al., 2021), offering insights about the international spillovers linked to global portfolio rebalancing.

The paper is organized as follows. Section 2 reviews different strands of literature related to our work highlighting the novelty and contribution of the paper, and illustrates possible transmission mechanisms of natural disasters to portfolio flows. Section 3 describes the data used in the analysis. Section 4 shows the estimated effects of natural disasters on net inflows into equity securities in the hit country. Section5 presents findings about how financial investment in foreign countries reacts to a disaster occurred in the domestic country. Section 6 concludes.

2 Related literature

The analysis presented in this paper stands at the intersection of three streams of the literature.

First, we contribute to the strand exploring the macroeconomic implications of natural disasters (see Noy 2009, Raddatz, 2009, Cavallo and Noy 2011; Klomp and Valckx, 2014 and Botzen et al., 2019 offer a meta-analysis and a review of the main findings). An established result from this literature is that natural disasters have, at least in the short run, a negative and significant impact on economic growth in the affected countries, and that developing economies incur larger output losses than advanced countries following events of similar relative magnitude.[2]

Second, we contribute to the strand of literature that investigates the determinants of capital flows to emerging markets, with the aim of disentangling the relative importance of push (external) vs. pull (domestic) factors (see Koepke, 2019 for a review of the literature). Push factors - and in particular fluctuations in global risk aversion - have been found to be the main driver of inflows and outflows to emerging markets in the short run, while pull factors related to fundamentals of the recipient country should make the difference in the longer term (Fratzscher, 2012; Milesi-Ferretti and Tille, 2014; Ananchotikul and Zhang, 2014; Rey, 2015). Quite surprisingly, studies documenting the link between natural disasters and capital flows are scant, with most of them focusing on the implications for foreign direct investments (Gu and Hale, 2022), foreign aid and remittances, disregarding portfolio flows (see Osberghaus, 2019 for a review of the empirical literature). Two exceptions are Yang (2008) and David (2011), both investigating the effect of disasters on different types of financial flows in a multi-country setting. In these papers, portfolio flows are analyzed in the broader context of public and private capital flows mobilized in the aftermath of natural disasters; regarding equity flows, the authors find that foreign investments fall significantly after a disaster, amplifying the initial negative impact. We add new evidence on the debate by focusing on private investments into mutual funds, which are known to be highly reactive to aggregate shocks, identifying a new pull factor that is able to shape global portfolio flows also in the short run. More specifically, our paper also links to the literature studying the drivers of capital flights and, in particular, flight to safety movements. Flight to safety, or risk-off periods, characterize movements in global liquidity in times of crisis or following country-specific shocks (Brunnermeier and Pedersen, 2008; Caballero and Krishnamurthy, 2008; Miranda-Agrippino and Rey, 2020; Kekre and Lenel, 2021). This reshuffling in portfolio allocation can occur across markets within the same country- i.e., from stocks to government bonds -

[2] Evidence on longer run effects is more mixed, as some papers argue that the consequences of disasters propagate and persist over time, while others claim the existence of a Schumpeterian creative destruction effect that would eventually reverse the initial negative impact (Cavallo et al. (2013) and Roth Tran and Wilson (2020), among others).

or in the form of a global reallocation towards securities traded in safer countries, like the United States. Our analysis provides a new driver for flight to safety, which is the occurrence of natural disasters. Moreover, if this flight away from the hit country is motivated by a fundamental shift in the perceived climate riskiness of the country - a belief change -, we also offer a new motive for flight to safety, which is searching for climate safety. As climate change increases the frequency and intensity of adverse natural events over time, the pull factor highlighted in this analysis is set to become an increasingly relevant driver of capital flows in the years to come.

Third, our paper is also connected to the emerging literature on climate finance (Giglio et al., 2021), in particular to that exploring investors' attitude in response to weather-related shocks (Choi et al., 2020; Alok et al., 2020; Alekseev et al., 2021). Alok et al. (2020) find that fund managers react to disasters by under-weighting disaster zone stocks in their portfolios, and that their reaction is larger the more closely they are physically located to a disaster zone, due to a salience bias. Alekseev et al. (2021) propose a way to construct portfolios to hedge climate change risk by investigating the respose of fund managers to some belief shocks related to climate risk, such as heatwaves or language shifts in shareholders reports. They find that different shocks changing climate-related risk appetite stimulate fund managers to trade stocks in some specific industries, which are possibly considered as more or less climate resilient in the longer term. We contribute to this stream of literature by documenting the macroeconomic effects of climate-related disasters on financial investment, in particular on foreign investment demand, disentangling the behavior of different categories of investors and of different types of invested funds.

2.1 Transmission channels

International portfolio inflows are commonly considered as expansionary for the target country (Reinhart and Reinhart, 2009; Blanchard et al., 2017). Following shocks such as natural disasters, those flows may either increase or decrease, therefore working as an amplification or attenuation device in many ways. In principle, natural disasters might cause an increase in private capital inflows in the damaged country if the reduction in the capital stock due to the disaster had raised the marginal product of capital: in this situation, capital would fly to the damaged country finding profitable investment opportunities to rebuild the capital stock. However, if disasters also deteriorate complementary inputs such as infrastructure and human capital, the returns to physical capital might decrease instead of increase, inducing no inflows or even capital outflows following a disaster. Another reason to observe capital outflows from the damaged country is that natural disasters could shrink total factor productivity of firms, deteriorating their longer-term growth prospects (Loayza, 2009). in addition, large disasters might create political instability, one reason more to expect private capital to flow out of the country. All in all, these explanations for capital flying away from the hit country point to an increase in the risk profile of the investment caused by the disaster. Noy (2009) finds that natural disasters have more severe consequences for output in countries with higher degree of capital account openness, suggesting that, overall, private capital flows amplify rather than alleviate the real effects of disasters on economic growth.

An additional mechanism through which financial flows can respond to a natural disaster is the change in risk aversion triggered by the event itself. Natural disasters are indeed found to cause a significant increase in risk aversion at the local level, inducing people living in damaged areas to take sub-optimal investment decisions or refrain to open new business (Bourdeau-Brien and Kryzanowski, 2020). Moreover, disasters can increase risk aversion related to financial investment: for example, after experiencing natural disasters US-based fund managers that oversee international funds are found to act in a more risk averse way, reducing funds' volatility across the board (Bernile et al., 2021).

Extreme climatic phenomenon are also able to raise attention about the financial risks related to climate change and climate policy: as shown by Choi et al. (2020), unusual temperatures induce investors to recompose their portfolios towards low-carbon-intensive firms, irrespective of variations in firms fundamentals. In this perspective, climate-related disasters in one country might trigger a wake-up call effect about the risk of future disasters due to climate change, pushing global investors to divert their funds to safer places. At the root of this mechanism might lie some form of rational inattention on the side of financial investors, as documented by Huang and Liu (2007)and Maćkowiak et al. (2021), among others.

3 Data

3.1 Disaster data

We rely on disaster data taken from the The Emergency Events Database (EM-DAT) of the University of Louvain. EM-DAT database, which contains weekly data on the largest natural disasters occurred worldwide. For a disaster to be included in the EM-DAT database, at least one of the following criteria must apply: 10 or more people died, 100 or more people have been affected, the government of the hit country declared the state of emergency or it called for international assistance. The EM-DAT database is the primary source used to build internationally acknowledged data platforms assessing the interlink between climate change and macroeconomic and financial stability, such as the IMF Climate Change Indicators Dashboard, and it is commonly used in academic research (Gu and Hale, 2022; Avril et al., 2021, among others).

Our period of analysis covers the years 2009-2019. This time span includes several volatility episodes in global financial markets (e.g. taper tantrum, sovereign debt crisis, Brexit..), but excludes the global financial crisis and the Covid-19 crisis where unprecedented turmoil caused extreme volatilities in portfolio flow data which are difficult to accommodate, see Lenza and Primiceri (2020). For the aim of this study we exclude events belonging to the class of "technological" and "complex disasters" to focus on natural disasters only. Natural disasters are grouped into the following event types: drought, landslide, earthquake, storm, extreme temperature, volcanic activity, flood and wildfire. For each disaster, the EM-DAT specifies the geographical location and timing of the event; moreover, for most of the events, the EM-DAT also provides details about the disaster magnitude (e.g. Richter scale for earthquakes), the number of deaths and affected people, and the amount of damages caused by the events in terms of US dollars.[3] To ensure a minimum level of comparability across regions, we only keep countries affected by at least 10 events in the period 2009-2019 which corresponds to an average of 1 disaster per year.[4]

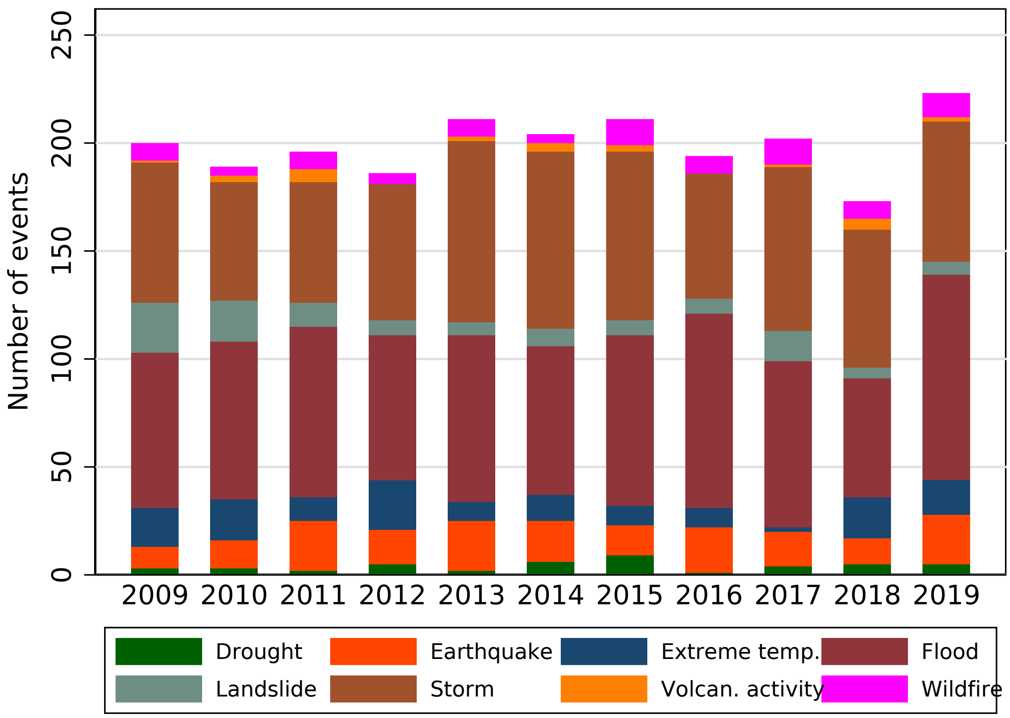


Figure 1: *Distribution of disaster classified with respect to the type of event.*

Our sample includes a list of 39 countries, of which 15 are classified as advanced economies (AUS, AUT, BEL, CAN, CHE, DEU, ESP, FRA, GBR, GRC, ITA, JPN, NZL, PRT, USA) and the remaining belong to the emerging market economies aggregate (ARG, BRA, CHL, CHN, COL, CZE, HUN, IDN, IND, KOR, MEX, MYS, NGA, PAK, PER, PHL, POL, ROU, RUS, THA, TUR, TWN, VNM, ZAF). Figure

[3]Affected people are defined as people requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance.

[4]We also exclude from the sample countries where equity portfolio flows and financial variables used as controls in the empirical analysis are either not available or extremely unsmooth during the period 2009-2019. Countries in this category mainly include less developed countries frequently hit by war and other major conflicts or countries with less developed financial markets; the full list of ISO3 codes is available from the authors upon request.

1 presents the time series of disasters broken down by event type. The total number of occurrences is approximately 200 per year, with floods and storms accounting for the vast majority of observations; events more directly related to climate change (i.e. all but earthquakes and volcan eruptions) are on average 90% of all disasters included in the sample. Figure 2 displays the distribution of disasters across multiple geographical regions. The share of events across geographical areas is quite stable, with most of them occurring in emerging market economies, notably in Emerging Asia.

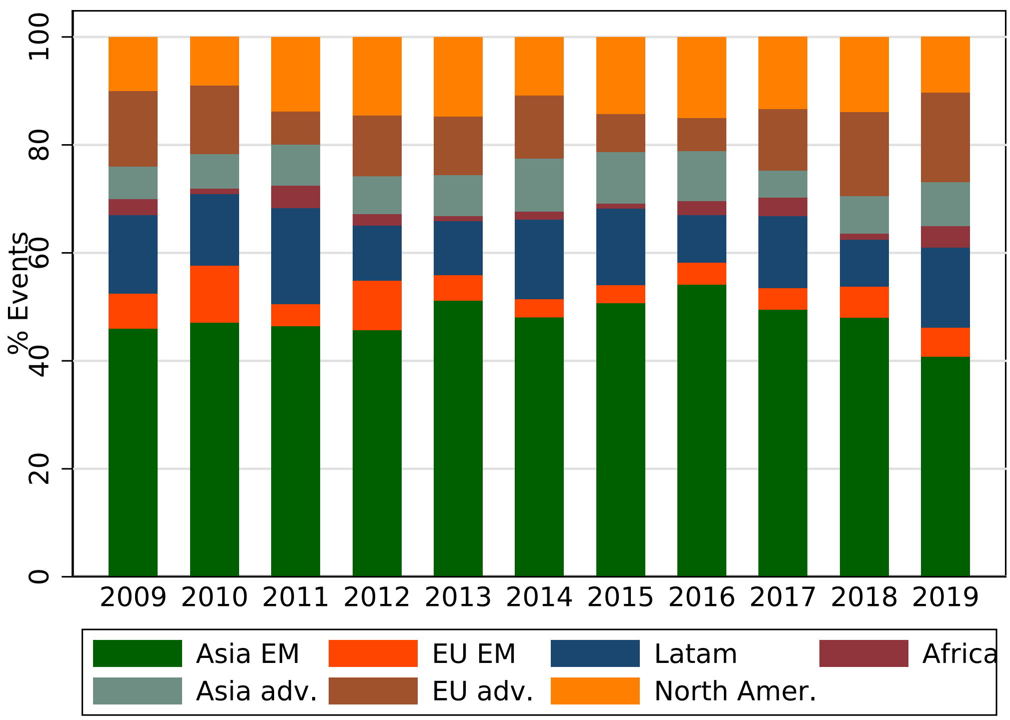


Figure 2: *Distribution of disaster classified with respect to the type of event.*

3.2 Equity portfolio flows

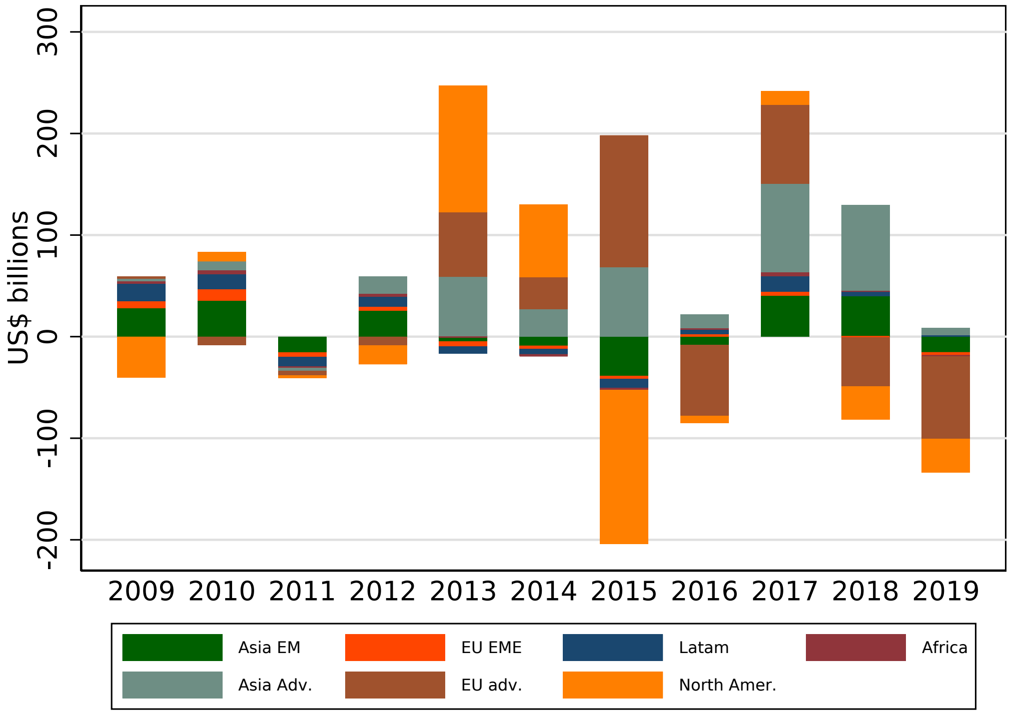
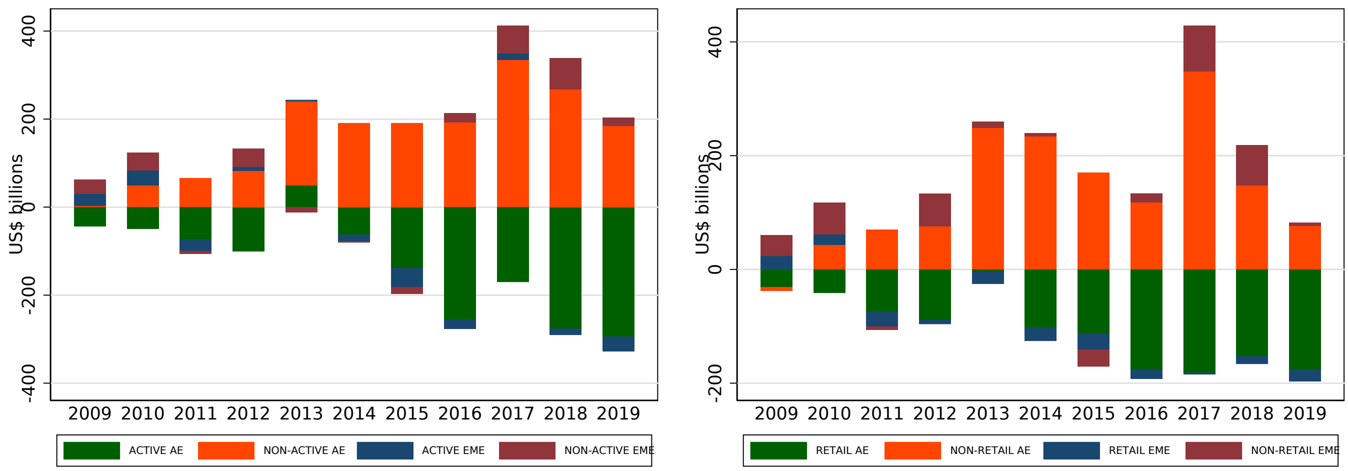


Figure 3: *Total yearly amount of net flows across geographical areas. The amount is computed as the simple arithmetic sum of the weekly net flows recorded in all the countries of each geographical area. Countries in each geographical group are as follows: Asia EME (CHN, IDN, IND, MYS, PAK, PHL, THA, TWN, VNM), Europe EME (CZE, HUN, POL, ROU, RUS, TUR), Latam (ARG, BRA, CHL, COL, MEX, PER), Africa (NGA, ZAF), Asia advanced (AUS, JPN, KOR, NZL), Europe advanced (AUT, BEL, CHE, DEU, ESP, FRA, GBR, GRC, ITA, PRT), North America (CAN, USA).*

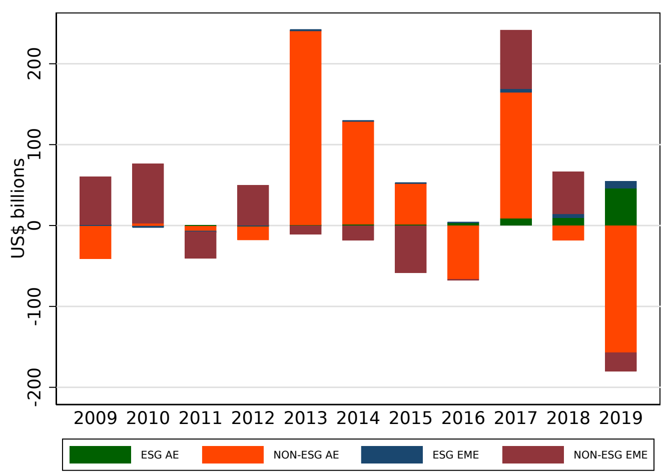
We use Emerging Portfolio Fund Research (EPFR) data on equity portfolio inflows to each country included in our sample. More precisely, we focus on country flows which combines mutual fund flows and country allocations to estimate how much money is going into each destination country. The main advantage of EPFR data relies on its high-frequency availability (weekly observations) which makes this dataset most suitable to analyse sudden shifts in investors' interest towards a specific countries following a major disaster. Moreover, despite not covering all types of investors but essentially mutual funds and exchange traded funds, the EPFR data have been found to be a highly reliable proxy of more comprehensive dataset available at lower frequencies (BoP portfolio data), see on this point Puy (2016) or Koepke and Paetzold (2020).[5] For each country in the sample we obtain weekly data on aggregate equity country flows as well as multiple breakdowns with respect to the management strategy (active vs passive), type of investors (institutional vs retail), and portfolio sustainability (where some funds are flagged as Socially Responsible Investment/Environmental Social and Governance - SRI/ESG - funds).[6] Figure 3 displays the yearly total net amount of flows across different years and geographical areas, whereas Figure 4 shows the yearly total net amounts partitioned per country type (AE vs EME) as well as management strategy, type of investors and level of portfolio sustainability. Finally, some descriptive statistics on both equity fund flows and climate events are reported in Table 1.

[5]EPFR data are commonly used in academic research, see for example Raddatz and Schmukler (2012); Jotikasthira et al. (2012); Forbes et al. (2016); Ciminelli et al. (2022)

[6]According to EPFR definition SRI/ESG funds are funds that are explicitly marketed as such or funds indicating that investing in SRI/ESG is one of their main objectives based on their fact-sheet or prospectus.



(a) *Total yearly amount of net flows broken down per class of countries (AE vs EME) and type of management strategy (left plot) or type of investor (right plot).*



(b) *Total yearly amount of net flows broken down per class of countries (AE vs EME) and level of portfolio sustainability*

Figure 4: *Total yearly amount of net flows-breakdown partition*

4 The impact of natural disasters on portfolio flows

We estimate the dynamic causal effects of natural disaster on portfolio flows via panel local projections (Jordà, 2005). The baseline equation that we estimate at country level and weekly frequency, for

Table 1: Descriptive statistics

	Mean	St.Dev.	25p	50p	75p
Net flows (bln US$)	0.02	1.25	-0.02	0.00	0.04
Net flows/Asset allocation (%)	0.05	0.37	-0.13	0.03	0.20
Event duration (weeks)	2.31	8.30	0.14	0.57	1.29
Number of affected people	1046.51	10348.55	0.75	9.19	88.57
Number of dead people	117.63	1563.80	4.00	12.00	33.00
Damages (bln US$)	1.57	9.11	0.03	0.20	1.01
Earthquake - magnitude	6.35	1.00	6.00	6.00	7.00
Temperature - magnitude	11.90	34.35	-22.00	35.00	42.00
Area - magnitude	153.72	288.86	20.12	55.14	145.00
Wind - magnitude	167.29	78.71	119.00	150.00	206.00

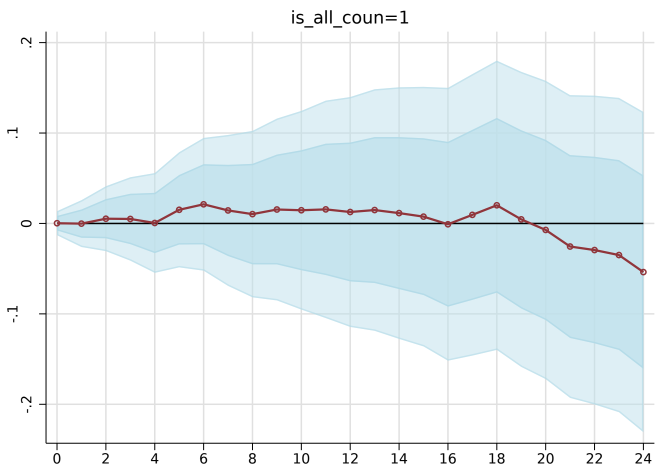
Descriptive statistics. The statistics on the magnitude of each event are measured in terms of Richter Scale for earthquakes, °C degree for extreme temperature events, thousands of square KM for droughts, floods, and landslides, KM/h of wind speed for storms.

each horizon h, is as follows:

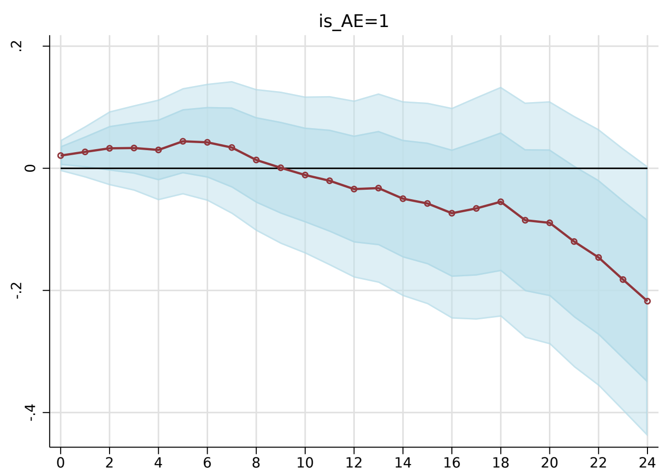
$$y_{i,t+h} = \frac{\sum_{1:h} f_{i,t+h}}{A_{i,t-1}} = \alpha_{i,h} + \delta_{t,h} + \beta_h D_{i,t} + \gamma_h X_{i,t} + \varepsilon_{i,t} \qquad h = 0, 1, 2...23$$

where $y_{i,t}$ are net flows $f_{i,t}$ to country i in week t normalized by the assets under management $A_{i,t-1}$ related to the same country one week before; $D_{i,t}$, our main variable of interest, is a dummy equal to 1 if at least one natural disaster occurs in country i during week t, $X_{i,t}$ is a set of controls, $\alpha_{i,h}$ and $\delta_{t,h}$ are country-specific and time (week) fixed effects, and $\varepsilon_{i,t}$ is a standard error term. The underlying assumption behind our identification strategy is that, apart few exceptions, adverse natural events that show up as disasters, in terms of severity or induced losses, are generally very difficult to predict - so mostly unexpected; moreover, in a short time span as a single week, disasters producing immediate damages dominate headline news, so they can be considered as a principal market mover, especially in emerging countries. The set of controls include local (country-level) equity market index and its implied volatility, the VIX, the foreign exchange rate vis-à-vis the dollar and lags of the asset under management. Impulse responses are estimated for 24 horizons, with h ranging from 0 (impact effect) to 23 weeks ahead. Inference is based on Driscoll-Kraay standard errors that account also for spatial autocorrelation.

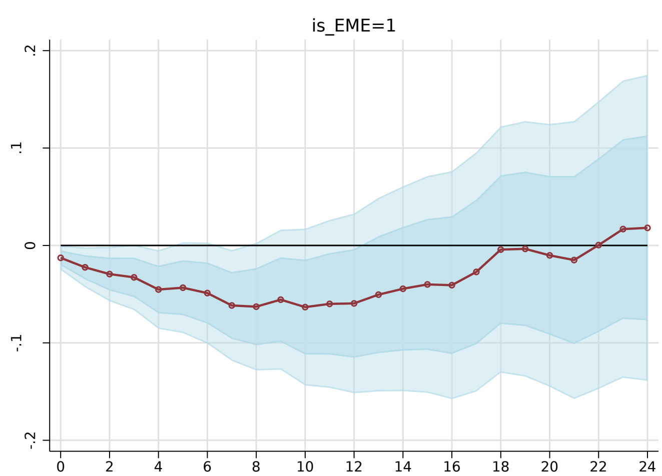
Aggregate effects by country groups. Figure 5 reports the results of the estimation for aggregate portfolio flows by group of countries (panel (a) for the whole set of 39 countries; (b) for advanced economies and (c) for emerging economies). Considering the whole set of countries in the dataset, the occurrence of a natural disaster seems not having detectable impact on portfolio flows, at least in the short run (panel (a)). However, the breakdown into advanced and emerging economies show a fundamentally different behavior: while the effect on net inflows into advanced countries appears to be mildly significant only at longest horizons, inflows to EMEs countries drop as soon as disasters unfold, with inflows remaining persistently subdued for about 3 months. The elasticity of financial flows to natural disasters in emerging countries is quite sizable: the cumulated impact of each event at its maximum is, on average, associated with a 0.06 p.p. decrease in net portfolio flows (scaled by asset under management) to emerging economies.



(a) *All countries*



(b) *Advanced economies*

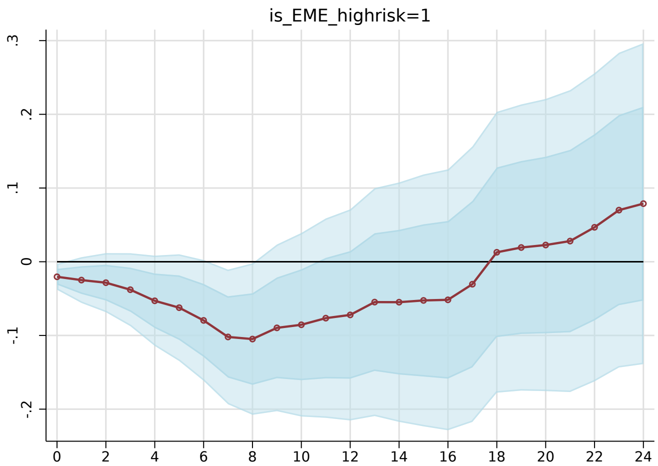


(c) *Emerging market economies*

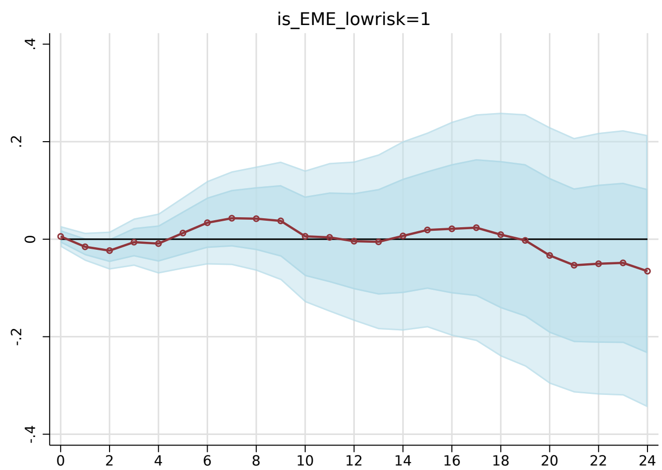
Figure 5: *Impact of natural disaster on equity portfolio flows, geographical breakdown*
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

Focusing on EMEs. We then turn to further investigate whether there is some heterogeneity across emerging economies in terms of exposure to climate risk. To this purpose we follow the classification developed by Germanwatch and rank EMEs in our sample with respect to the value of the average Germanwatch Global Climate Risk Index computed over the period of analysis; countries with a value of the index above the median threshold are labeled as countries at high climate risk (high-risk EME henceforth),[7], whereas the remaining EMEs are classified as countries at low climate risk. Figure 6 presents the impacts of a natural disaster on portfolio flows for the two groups of EME countries. We find that aggregate effect of natural events on the subset of EMEs is mainly driven by the subset of countries more exposed to climate risk. The cumulated effect has a dynamics similar to the one observed for the whole group of EMEs, but its magnitude is almost double at the trough (0.1 p.p.).

[7] EME countries in this group include: PHL, PAK, THA, VNM, IND, RUS, TWN, COL, CHN, ROU, PER, MEX.



(a) *High-risk EME countries*



(b) *Low-risk EME countries*

FIGURE 6: *Impact of natural disaster on equity portfolio flows, only EMEs classified with respect to country exposure to climate risk*

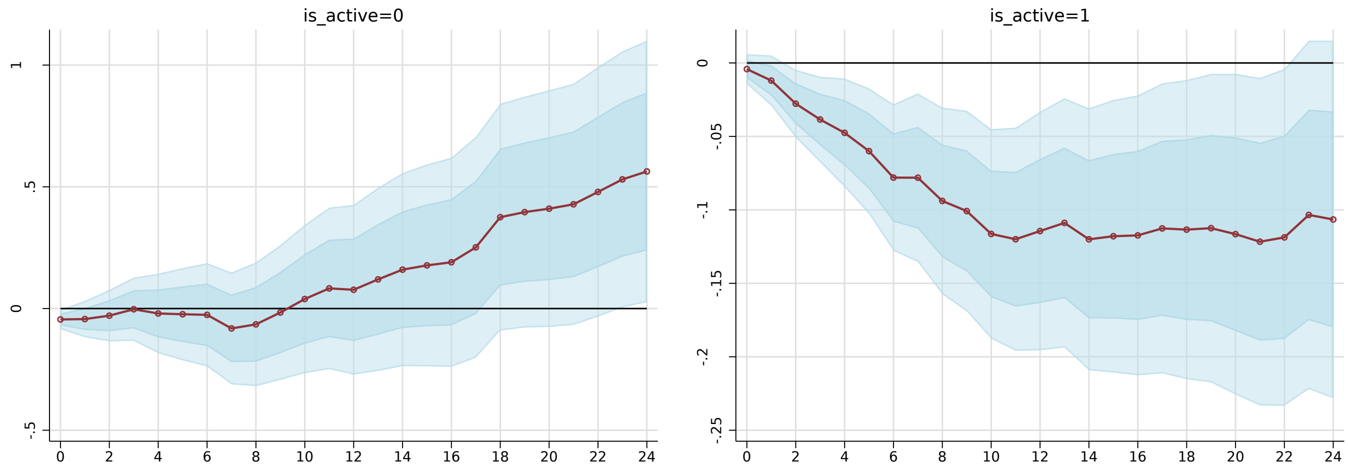
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

4.1 Portfolio flows breakdown for EMEs at climatic risk

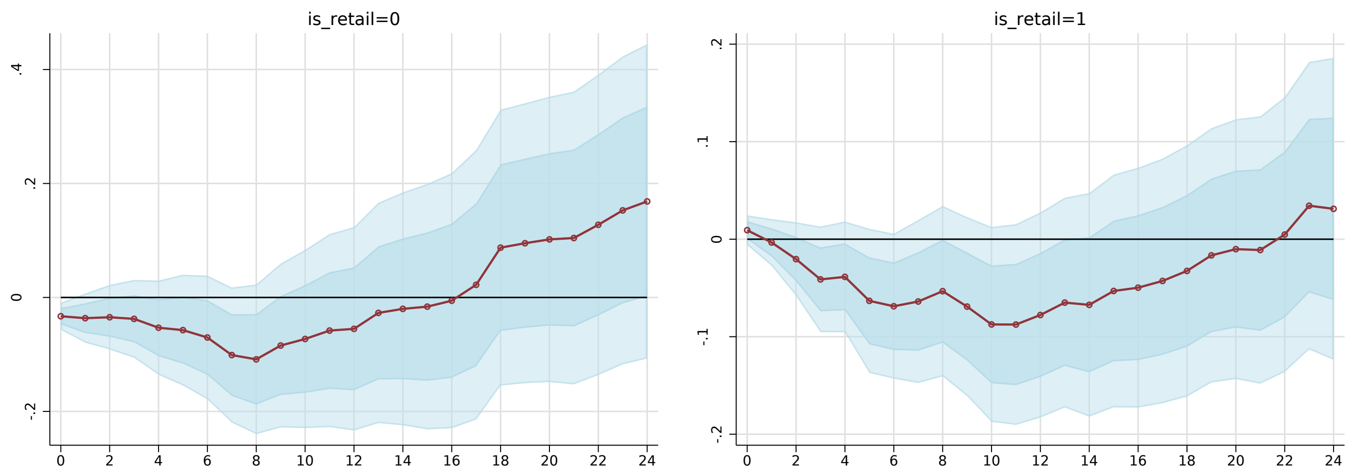
In this section we further investigate the reaction of high-risk EME countries to a natural disaster and re-run the estimation considering multiple breakdowns of equity portfolio flows; the results are displayed in Figure 7.

Active and passive funds. The first panel distinguishes between funds where fund managers can modify the funds' allocation in the short-run (active funds) and those in which the portfolio essentially replicates the composition of some benchmark index (passive funds). Only active funds respond to natural disasters, displaying a cumulated effect equal to 0.12 p.p., whereas passive funds do not respond significantly. This result likely reflects the constraints in the portfolio composition of mutual funds pursuing a passive management strategy (such as ETF or index funds), with portfolio managers having only limited room to adjust the relative weight of the country hit by the natural disaster. The opposite holds for the portfolio managers of active mutual funds, which in turn tend to overreact and potentially exacerbate portfolio volatility after the adverse event.

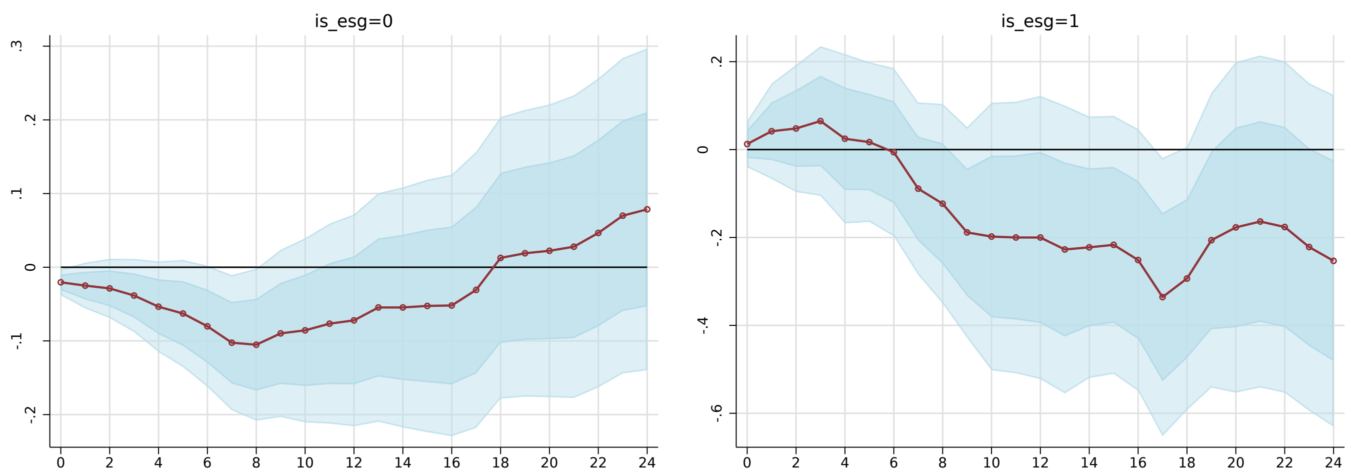
Other heterogeneity analyses. The second panel of 7 shows the IRFs distinguishing across investor categories. In principle, a different reaction of portfolio flows could be related to a more emotional response of retail investors to the occurrence of a natural disaster or to informational advantages of institutional investors, who can be more able to foresee its impact on the local economy and on equity asset prices. In turn, our results seem to rule out this possibility and we do not find major differences in redemption dynamics across investors. The third panel shows that the response of ESG funds is qualitatively similar to non-ESG funds but their timing is different, as inflows to non-ESG funds fall quicker than those towards ESG-labelled funds.



(a) *Active funds (left plot) vs passive funds (right plot), only high-risk EME*



(b) *Retail funds (left plot) vs institutional funds (right plot), only high-risk EME*



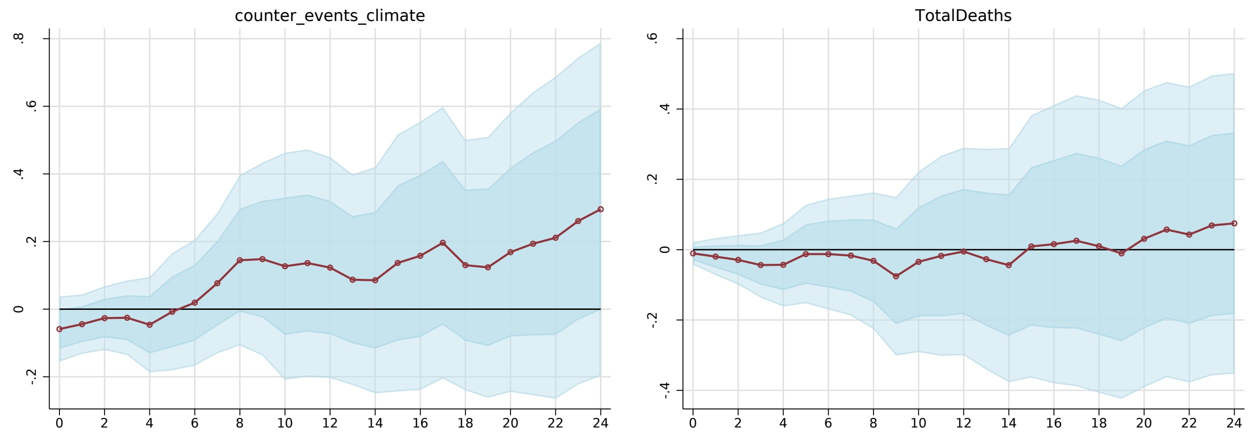
(c) *SRI/ESG funds (left plot) vs non SRI/ESG funds (right plot), only high-risk EME*

Figure 7: *Impact of natural disaster on equity portfolio flows, breakdowns with respect to management strategies, type of investors and portfolio sustainability*

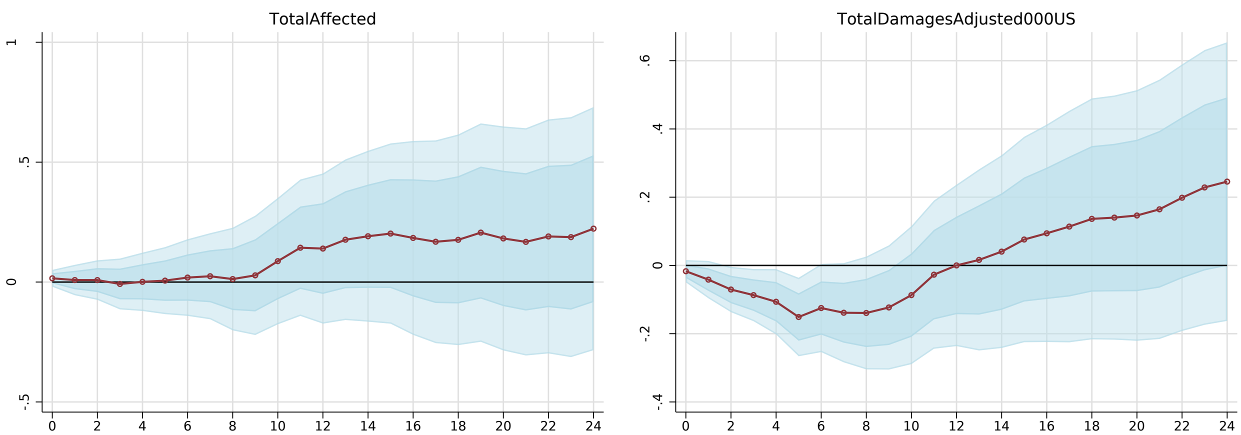
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

4.2 Events Severity

In this section we maintain our focus on the high-risk EME countries, investigating whether investors' response is amplified when severe natural disasters occur. To enhance results comparability we plot the marginal impact of severe natural disasters with respect to the baseline IRFs reported in Figure 6. Our estimates are reported in Figure 8 showing the IRFs of aggregate portfolio flows to natural disasters lasting more than one day (approximately 75% of the sample, IRF in panel a left plot), events reporting dead people (panel a, right plot), events with affected people (panel b, left plot), and events with quantified economic losses (panel b, right plot). Events falling in the last category, supposedly the ones with largest economic impact, are found to reduce inflows to the affected countries reatively more: the total effect in this case is quite sizable, moving portfolio flows by 0.2 p.p..



(a) *Only climate events (left plot) and events with deaths (right plot), only high-risk EME*



(b) *Events with affected people (left plot) and events with reported damages (right plot), only high-risk EME*

FIGURE 8: *Impact of natural disaster on equity portfolio flows, most severe events. The IRFs display the marginal impact on top of the baseline effect reported in Figure 6.*
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

5 Spillover analysis

Results in the previous section have shown that the occurrence of natural disasters in emerging countries, especially in those classified at high climate risk, lead to a slowdown in net equity inflows to the affected country. A natural question that arises is whether these funds are channeled elsewhere, maybe within the same asset class but in a different country. We explore this possibility by evaluating possible spillover effects of natural disaster occurred in a high-risk emerging economy towards countries that are perceived as safer, namely advanced economies. For this purpose, we rely on local projections but in a time series framework; more precisely, at each horizon h we estimate

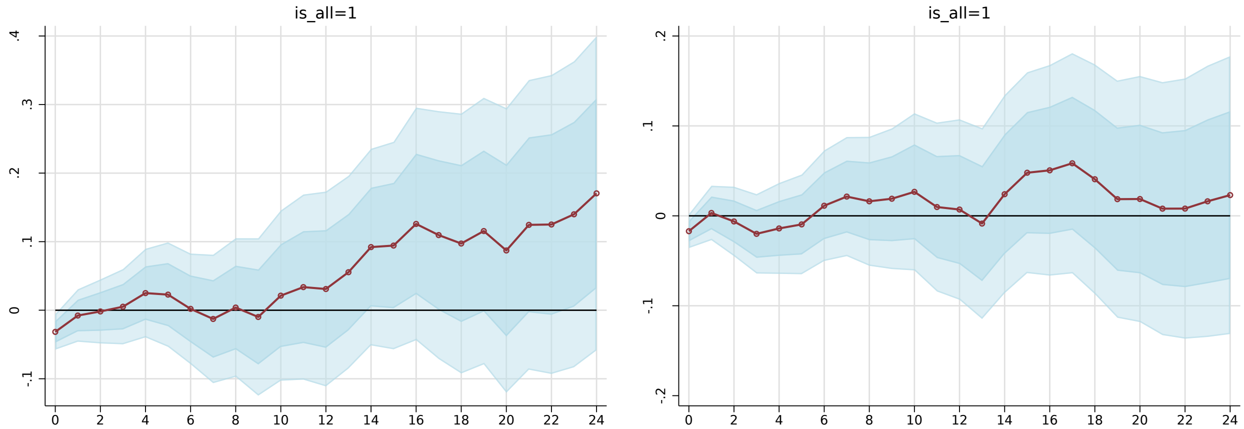
$$y_{t+h} = \frac{\sum_{1:h} f_{t+h}}{A_{i,t-1}} = \alpha_h + \beta_h D_t + \gamma_h X_t + \varepsilon_t \qquad h = 0, 1, 2...23$$

where y_{t+h} are aggregate net inflows f_t towards a group of countries (such as advanced economies, see below for details) in week t normalized by their total asset allocation A_{t-1} observed before the occurrence of the event; α is the constant, D_t is a dummy variable equal to 1 if at least one natural disaster occurs in at least one of the high-risk EME countries during week t, X_t is a set of financial controls[8] and ε_t is a standard error term; as in the previous specification, index h goes from 0 to 23 weeks ahead. As dependent variable, we construct aggregate flows for all advanced countries, which are the natural choice for fund investors to lower financial risk in portfolio. The first set of results is displayed in Figure 9, where panel (a) shows portfolio spillovers towards AEs from high-risk EMEs (left plot) and from low-risk EMEs (right plot), respectively. Only in the first case, a gradual increase in net inflows towards advanced economies shows up: the effect is quite persistent and tends to develop over several weeks (around 0.2 p.p. after 6 months), which is somehow consistent with the assumption that portfolio rebalancing is gradually implemented after the shock. We then make a specific focus on shocks originated in high-risk EMEs to evaluate their spillover effects to specific subsets. First, following natural disasters in high-risk EMEs, private capital significantly flights towards the US equity market, the quintessential safe haven for investors (Figure 9).

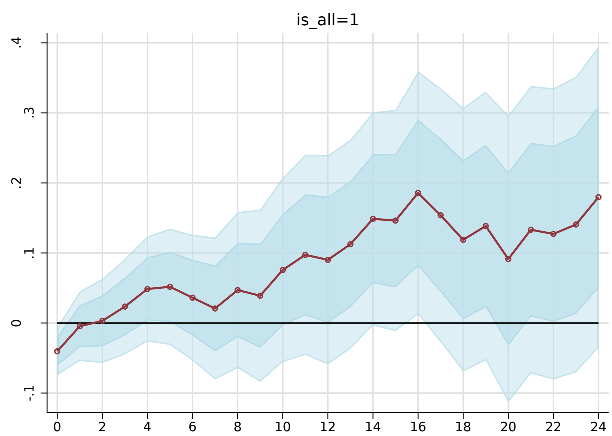
Second, Figure 10 shows even more pronounced spillover effects to advanced economies when disasters are restricted to events with dead people (left plot) and reported economic costs (right plot). The results are in line to the baseline spillover estimates to advanced economies in terms of magnitude, but they are more significant for the events reporting economic losses (around 0.23 p.p. after 6

[8] We include the VIX, a dollar index, the S&P 500 equity index, the MSCI EM equity index, a linear and a quadratic trend.

months), consistently with the effect on domestic outflows shown in section 4.2.



(a) *Spillover to AEs: high-risk EME (left plot) vs low-risk EME (right plot)*



(b) *Spillover from high-risk EME to US equity funds*

Figure 9: *Spillover of natural disasters from EME to advanced economies*
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

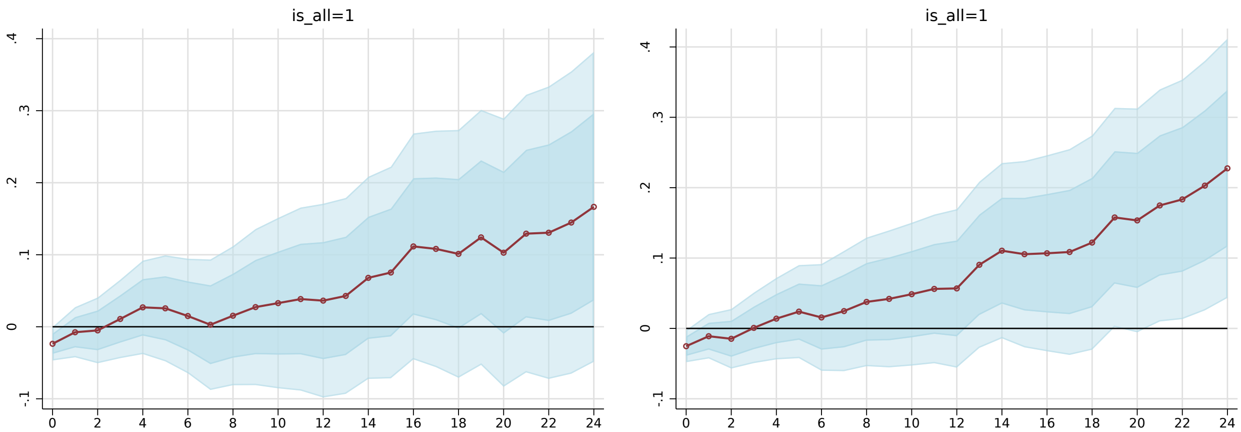
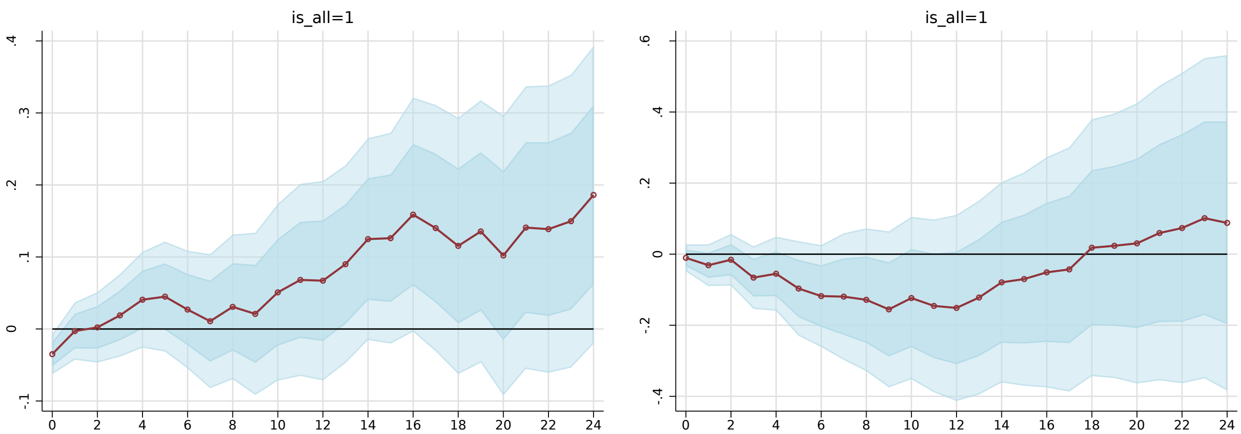


Figure 10: *Spillover from high risk-EME to AEs, events with dead people (left plot) and events with reported damages (right plot)*

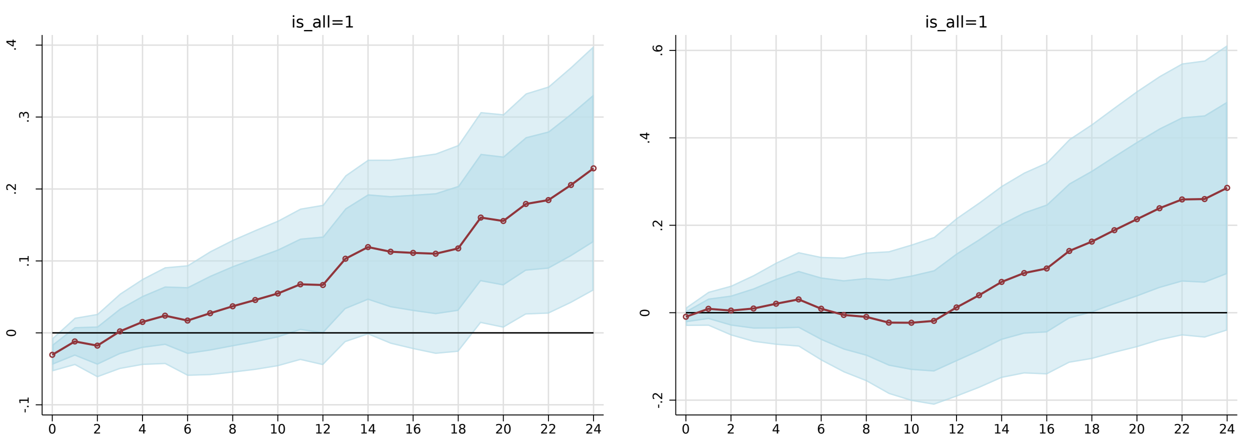
Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

5.1 Flight to climatic safety

In this subsection we repeat our exercise on the spillover effects but we focus explicitly on the mechanism that we define as flight to climatic safety. We discriminate countries in terms of climatic safety on the basis of their level of non-life insurance premium to GDP. This choice is consistent with the IMF Climate dashboard, that employs information collected from the World Bank, and helps us to identify countries whose businesses and individuals are more likely to have an insurance that hedges against adverse climate events. We split advanced economies, i.e. those countries where investors generally tend to reallocate their funds following a catastrophic event in EMEs, on the basis of their level of non-life insurance premium to GDP: countries with a value larger than the sample median include AUS, AUT, CAN, ESP, FRA, GBR, KOR, USA, whereas a lower level of this indicator is found for BEL, CHE, DEU, GRC, ITA, JPN, NZL, PRT. Figure 11 in panel a) shows that countries with high level of non-life insurance premium to GDP catalyze most of the spillover effect. In other words, investors tend to reallocate their funds towards countries that are safer in terms of future climate risks, identified as those showing better adaptation to deal with future adverse climatic events. As a robustness, we show in panel b) of Figure 11 (left plot) that this result survives if we exclude the United States from the recipient countries, suggesting that a more narrow channel related to the search of climatic safety, on top of the traditional risk-off behavior, is at play. Finally, consistently with the analysis on the domestic outflows, the magnitude of the spillover effect is larger when we restrict the analysis to events with economic damages.



(a) *Spillover from high risk-EME to AEs with high level of non-life insurance premium to GDP (left plot) vs low level of non-life insurance premium to GDP (right plot)*



(b) *Spillover from high risk-EME to AEs with high level of non-life insurance premium to GDP only considering events with reported damages (left plot) vs spillover from high risk-EME to AEs with high level of non-life insurance premium to GDP excluding the US (right plot)*

Figure 11: *Spillover of natural disasters from EME to advanced economies - breakdown per level of non-life insurance premium to GDP*

Note. Local projections for a 24 week period horizon, 68% and 90% confidence bands.

6 Conclusions

We uncover a novel and relevant pull factor for the global portfolio allocation previously disregarded in the international finance literature. The occurrence of a natural disaster in EMEs generates a significant decrease in net financial inflows in the affected country which persists at least 12 weeks after the shock. The pull factor is particularly strong for EME countries at high climate risk, suggesting that the occurrence of disasters triggers climate risk awareness. The impacts on portfolio flows are more sizable for active funds and for events that involve substantial economic losses. As a mirror image of the domestic portfolio outflows, we find that natural disasters spark international spillovers towards advanced economies characterized by higher level of non-life insurance often employed as a proxy of financial resilient against climate risk. Natural disasters increasing in frequency and intensity due to climate change might induce higher volatility in international capital flows, potentially calling for a domestic policy response and adding evidence in favor of a globally coordinated climate policy action.

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