

A feasibility study of a global risk pool scheme against tropical cyclones



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Risk Pools:

Group of countries pool their risks with the aim of diversifying losses (thus lowering premiums) and reducing administrative costs (as they are shared among countries). There currently exist three *regional* Nat Cat Risk Pools: CCRIF, ARC and PCRAFI.

Research Problem:

➤ Are there added-benefits in diversifying globally in terms of the pool's overall diversification and each country's benefit of being in the pool?

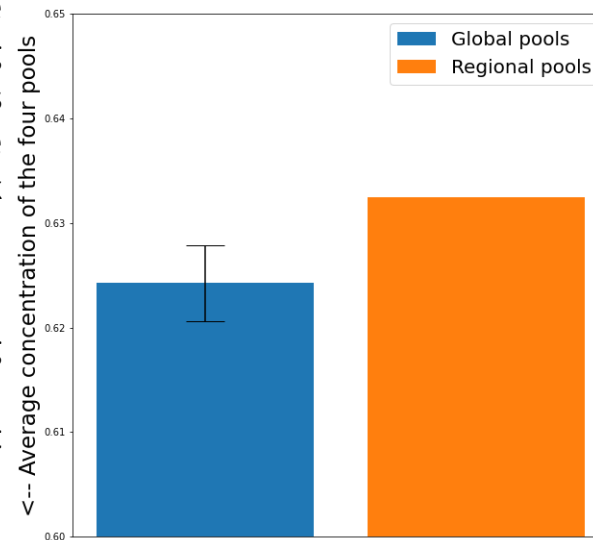
Data and Model:

- Global damages estimated from synthetic track set (Emanuel et al., 2004, 2006) and CLIMADA (Aznar-Siguan and Bresch, 2019).

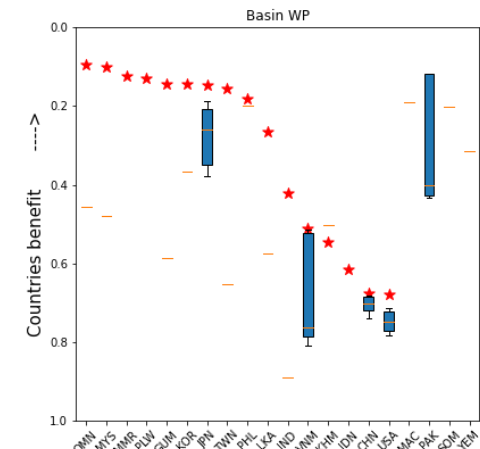
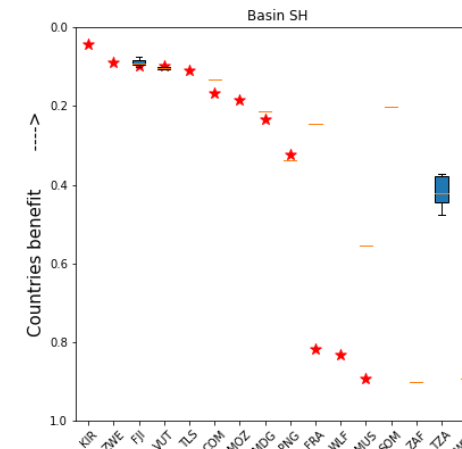
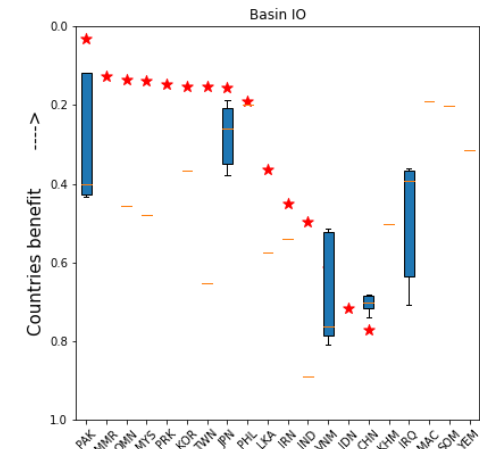
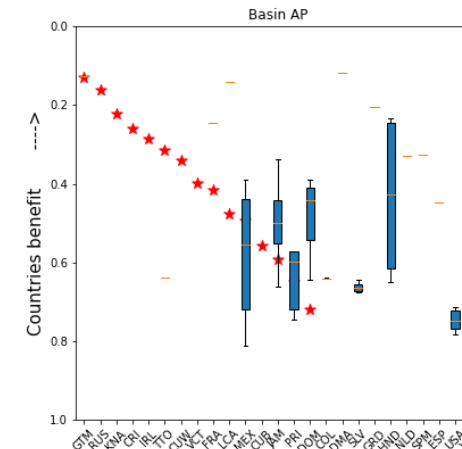
Method:

1. Find *one optimal* regional pool for each of the four basins by minimizing concentration
2. Find *four Pareto-optimal* global pools by minimizing concentration to an average level lower than what found in 1)

Results:



- Difference seems negligible, but one can get a lower diversification by diversifying globally
- For some regions it makes more sense to diversify globally than others
- In all regions, global pools enlarge the cohort of countries that can be part of a pool



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Risk Pools:

A group of countries pool their risks with the aim of diversifying losses (thus lowering premiums) and reducing administrative costs (as they are shared among countries).

There currently exist three *regional* Nat Cat Risk Pools:

- The Caribbean Catastrophe Risk Insurance Facility (CCRIF)
- The African Risk Capacity (ARC)
- The Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)

Research Problem:

- Are there added-benefits in diversifying globally in terms of both the overall pool's diversification and each country's benefit of being in the pool?

Let's compare *optimal* regional pools with *Pareto-optimal* global ones

Method – metrics for risk pools

Pool's concentration (*the lower, the better*):

$$Conc = \frac{ES_{\alpha}}{\sum_i E[L_i | L_i \geq VaR_{\alpha}]}$$

where L_i are individual countries' losses, L is total losses, VaR_{α} is the α -quantile of L and ES_{α} is the pool's expected shortfall at confidence level α :

$$ES_{\alpha} = \sum_i E[L_i | L \geq VaR_{\alpha}]$$

Benefit of country i in joining the pool (*the lower, the better*):

$$Benefit_i = \frac{E[L_i | L \geq VaR_{\alpha}]}{E[L_i | L_i \geq VaR_{\alpha}]}$$

Method – find optimal risk pools

1. Optimal regional pools:

$$\begin{aligned} \min \quad & \text{Conc} \\ & \text{Benefit}_i < 1 \\ & c_i \in \{0,1\} \end{aligned}$$

for each of the four tropical cyclones' basins, one optimal pool is found. Each country in a basin can either be (1) or not be (0) in the pool. A country ends up in a pool if it benefits from it.

2. Optimal global pools:

$$\begin{aligned} \min \quad & \text{Conc1, Conc2, Conc3, Conc4} \\ & \text{Benefit}_i < 1 \\ & \mu_{\text{conc}} < \mu_{\text{regional conc}} \\ & c_i \in \{0,1\} \\ & p_i \in \{1,2,3,4\} \end{aligned}$$

find four potential pools that could lower the average regional pools concentration. Each country in a region can either be (1) or not be (0) in the pool and, in case, it is assigned to one of the four pools. A country ends up in a pool if it benefits from it.

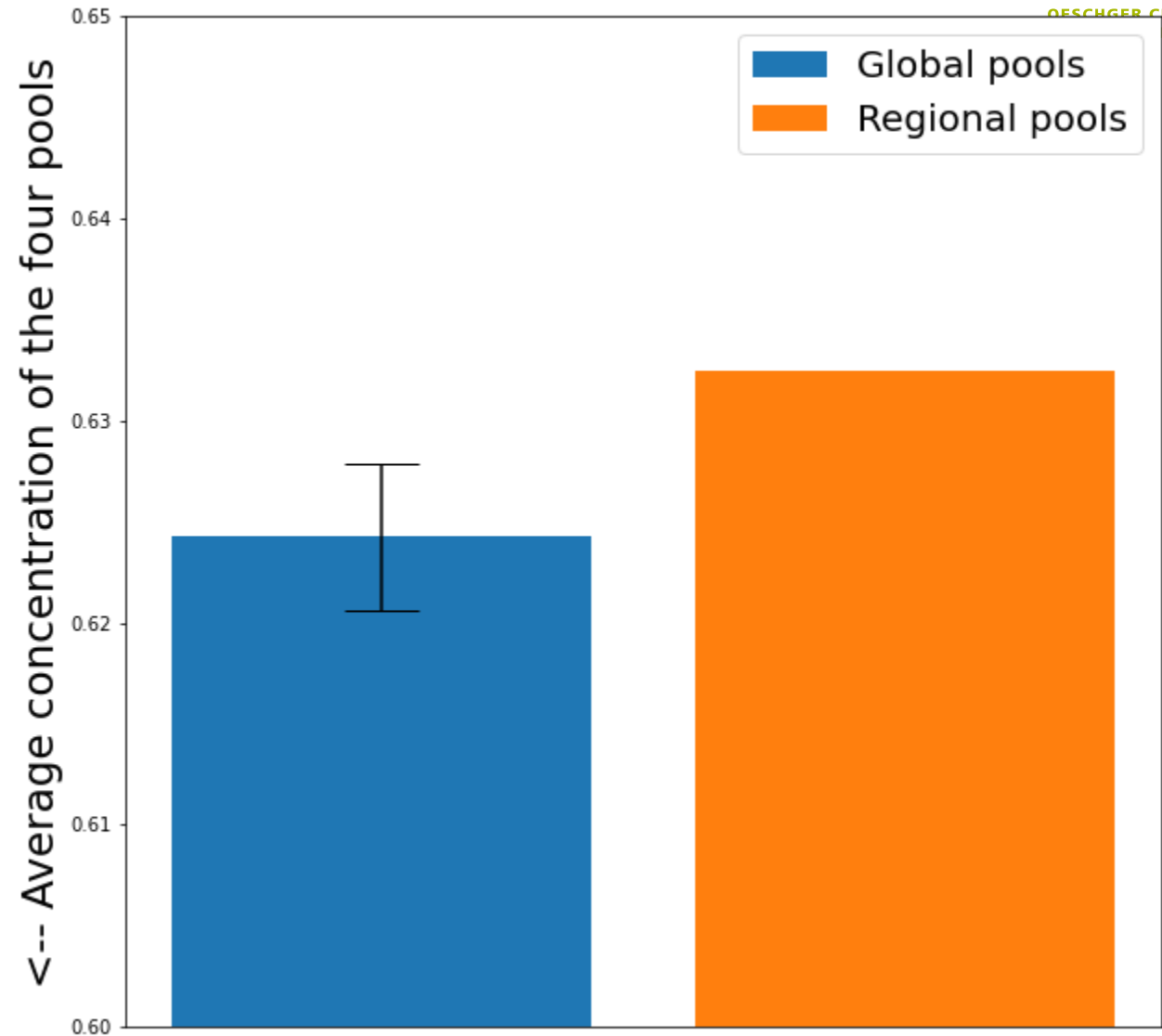
Data and model:

Global damages are estimated from a synthetic tropical cyclones track set (Emanuel et al., 2004, 2006) and by using the CLIMADA modeling framework (Aznar-Siguan and Bresch, 2019).

Results

Pools overall concentration:

- Difference seems negligible, but one can get a lower diversification by diversifying globally



Results

Countries' benefits:

- For some regions it makes more sense to diversify globally than others
- In all regions, global pools enlarge the cohort of countries that can be part of a pool

