“Measuring the Climate Risk Exposure of Insurers” by Hyeyoon Jung, Robert Engle, Shan Ge & Xuran Zeng

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Summary of paper

- This paper studies U.S. insurers' climate risk exposure to both physical risk through P&C insurers' operations and transition risk through life insurers' asset holdings

- Builds on Jung et al. 2021 climate beta and CRISK framework for measuring financial institutions' transition risk exposure through expected capital shortfall in climate stress scenario and extends by:
  - Novel proposed physical risk factor of a portfolio of P&C insurers' stocks, weighted by insurer operational exposure to states with higher natural disaster damages
  - Estimates insurer stock sensitivity to physical climate risk (physical climate beta) and computes insurers' expected capital shortfall physical and transition climate risk exposure under climate stress scenarios

- Using data on P&C operational exposure to risky states and on life insurers' corporate bond exposure to brown industries, the authors find evidence validating their market-based measures align with the non-market measures

Data sources

- Natural disaster event data: Monthly information on property damage from weather from SHELDUS database
- Insurer exposure through premiums by state-year from NAIC and SNL Financial
- Stock and corporate bond data: insurer stock returns from CRSP-Compustat, risk-free rate from Kenneth R. French Data Library, bonds - Mergent Fixed Income Securities Database (FISD and Municipal Bond data base, municipal bond transaction data from MSRB's Municipal Securities Transaction Data (Acharya et al. 2022 crosswalk to link municipal bond issuers to counties)
- Insurer asset holdings – Schedule D Part 1 of the Annual statement

Questions for Authors: Validating market-based physical risk measure

Validation relates market-based physical climate betas at the state-year level with *policy portfolio climate beta*, which captures insurer's policy exposure to each state and state-level risk exposure priced in municipal bond returns (Auh et al. 2022)

1. Interpreting strength of validating evidence – very modest R2, relatively lower than transition validation results
2. How was the threshold selected for counties included in municipal bond data?
   - Municipal bond data sample restriction: 295 counties w/ 10+ transactions/year threshold; do missing counties differ in risk?
   - Robustness of validation results for alternative data screens? (e.g., fewer transactions/year or moving threshold over shorter time periods)

Table 3: P&C Insurer Climate Beta and Policy Portfolio Climate Beta

	(1) Climate Beta	(2) Climate Beta
Policy Portfolio Climate Beta	0.152***	0.106**
	(0.043)	(0.043)
Size		-0.037***
		(0.008)
Leverage		0.010***
		(0.002)
N	279	279
R^2	2.80	13.9

Note: This table shows results from regression 14. Standard errors in parentheses are clustered at the insurer level. Annual data from 2005 to 2020 for all P&C insurers in the U.S.. Significance levels: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Questions for Authors: Using market-based climate risk measures

- How should market-based climate measures be used to complement other approaches to measuring climate risk?
  - Advantage of avoiding uncertainty about appropriate assumptions for climate-science based scenarios
  - Limited to the extent that financial markets fail to accurately price climate risks in insurers' stock returns

Implications of insurer risk management for at-risk communities?

- This paper assesses how physical climate risk exposure affects insurers and, through them, broader financial stability
  - Findings suggest relatively little physical exposure for P&C insurers' compared to life insurers' transition exposure (aggregate physical mCRISK 3 to 15% of market cap, transition: -35% to +27% market cap)
  - What are the implications for insurance sector's adequacy as a tool for the most at-risk communities to hedge natural disaster risk?

- In addition to systemic level, could insurer premium exposure and other market-based physical risk factors also shed light on exposure for localized communities with high natural disaster risk?