

Incorporating Climate into Macroeconomic Modeling

Workshop | June 14–15, 2023

Session 5:

Public and Financial Sector Climate Risks and Responses, and their Macroeconomic Implications

- **Laura Bakkensen**, University of Arizona **3**
- **Daryl Fairweather**, Redfin **8**
- **Yanjun (Penny) Liao**, Resources for the Future **22**



Public and Financial Sector Climate Risks and Responses

Laura Bakkensen
June 15, 2023

Incorporating Climate into Macroeconomic Modeling: A Workshop
National Academies of Sciences, Engineering, and Medicine



Bridging the Micro-Macro Gap

- Bakkensen, L., & Barrage, L. (Conditionally Accepted). Climate shocks, cyclones, and economic growth: bridging the micro-macro gap. *The Economic Journal*.
 - Empirical-structural approach to quantify impact of tropical cyclones on macroeconomy under changing climate
 - Revisit empirical findings surrounding cyclone impacts on growth
 - Estimate impact of cyclones on structural determinants of growth and incorporate in stochastic growth model
 - Project welfare costs including adaptation responses
- Benefits for micro-empirical literature
 - Structural lens to inform empirical specification and interpretation
 - Resolve some disagreement in empirical findings as estimating different parts of the growth equation
- Benefits for macro-structural literature
 - Directly integrate careful empirical findings and data

Climate Risk in Collateralized Debt Markets

- Bakkensen, L., Phan, T., and Wong, T. N. Leveraging the Disagreement on Climate Change: Theory and Evidence. *R&R at JPE*.
 - Develop theoretical debt model with belief heterogeneity
 - Pessimists more likely to leverage and for longer maturity debt contracts
 - Option to default is implicit insurance against climate risk
 - Counter to common finding that optimists more likely to leverage
 - Default channel theoretical substitute for incomplete insurance markets
 - Empirically confirm using case of sea level rise risk across US Eastern Coast
 - Highlight role of Government Sponsored Enterprises
 - Significant effect among conforming loans
 - Securitization policy does not currently price in many climate risks
 - Open question to what extent climate risk impacts financial sectors including collateralized debt (e.g., mortgage) markets and (quasi-)public sector (e.g., GSEs)

Responses to Climate Risk: Public Insurance and Behavior

- Bakkensen, L., & Ma, L. (2020). Sorting over flood risk and implications for policy reform. *Journal of Environmental Economics and Management*, 104, 102362.
 - Examine sorting over flood risk in South Florida using property sales data
 - Low income, Black, and Hispanic residents more likely to move into (inland) flood risk
 - Examine (counterfactual) price reforms to US National Flood Insurance Program
 - Parallels to Risk Rating 2.0 reforms
 - Low income, Black, and Hispanic residents less likely to move out of harm's way after reforms concentrating cost burdens of reforms on vulnerable residents in harm's way
 - Important to be attentive to unanticipated distributional consequences
 - Better quality information helps these vulnerable groups
 - More work needed to understand implications of insurance market incompleteness and consequences for the macroeconomy
 - Low demand for flood insurance, limits to policy coverage (supply)
 - Parallel: Increasing demand for state-run (non-flood) insurance

Thank you

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REDFIN

Housing and Climate Change

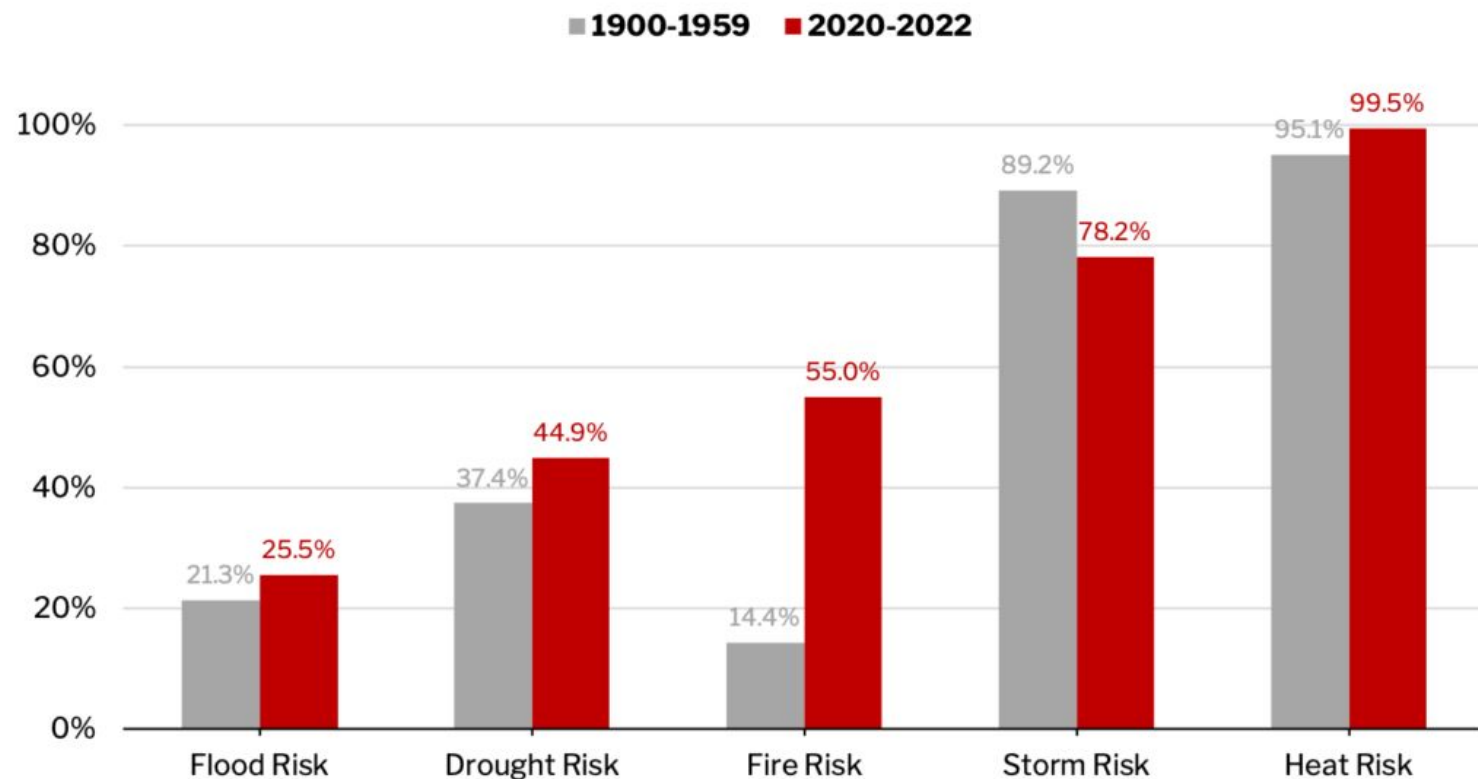
Chief Economist Daryl Fairweather



America Is Increasingly Building Homes in Disaster-Prone Areas

America's Homes Are Increasingly Being Built in Disaster-Prone Areas

Share of existing U.S. single-family homes that face different climate risks, by decade built



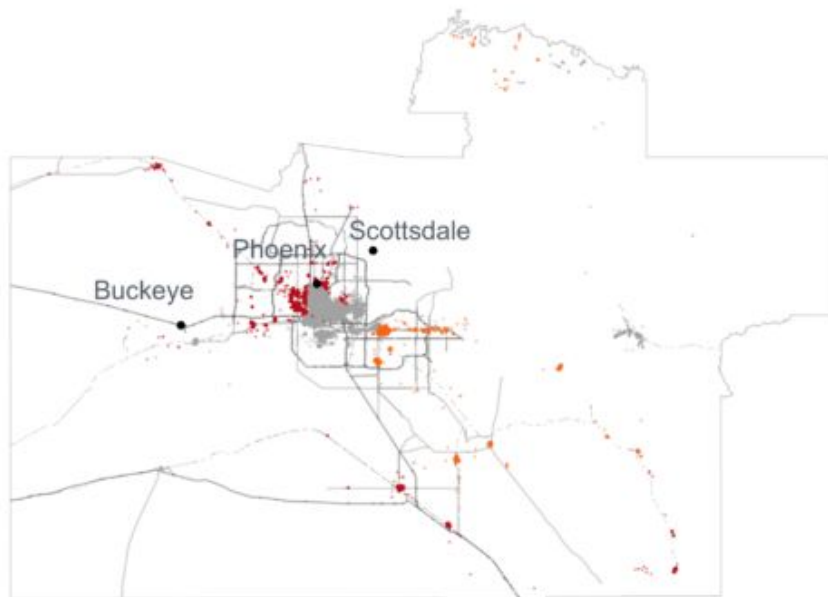
Source: Redfin analysis of data from ClimateCheck, county records

In Phoenix, Homes Are Being Built in Drought-Prone Areas Outside City Center

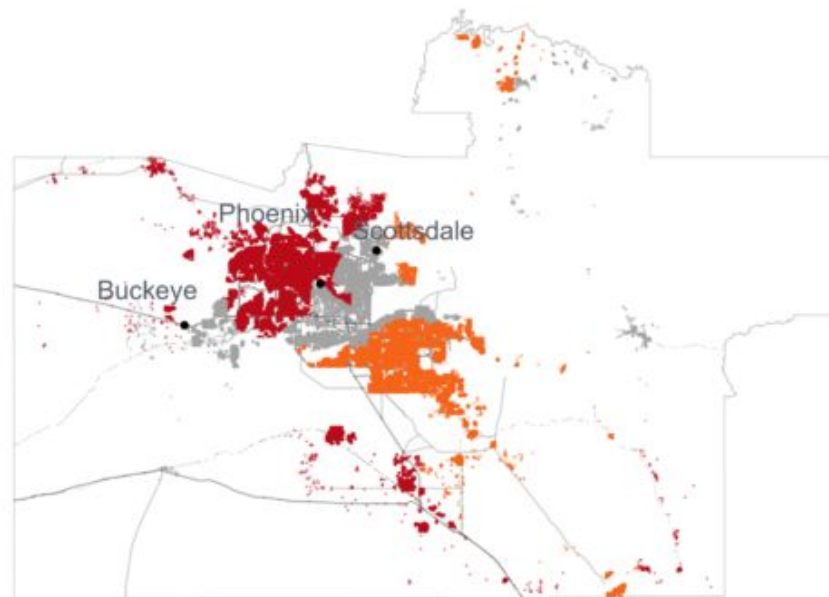
Single-family homes built in the Phoenix metro area, by drought-risk level

● Low Risk ● Moderate Risk ● High Risk

Built From 1900 - 1959



Built Since 1960



Sources: ClimateCheck; County Records; Redfin

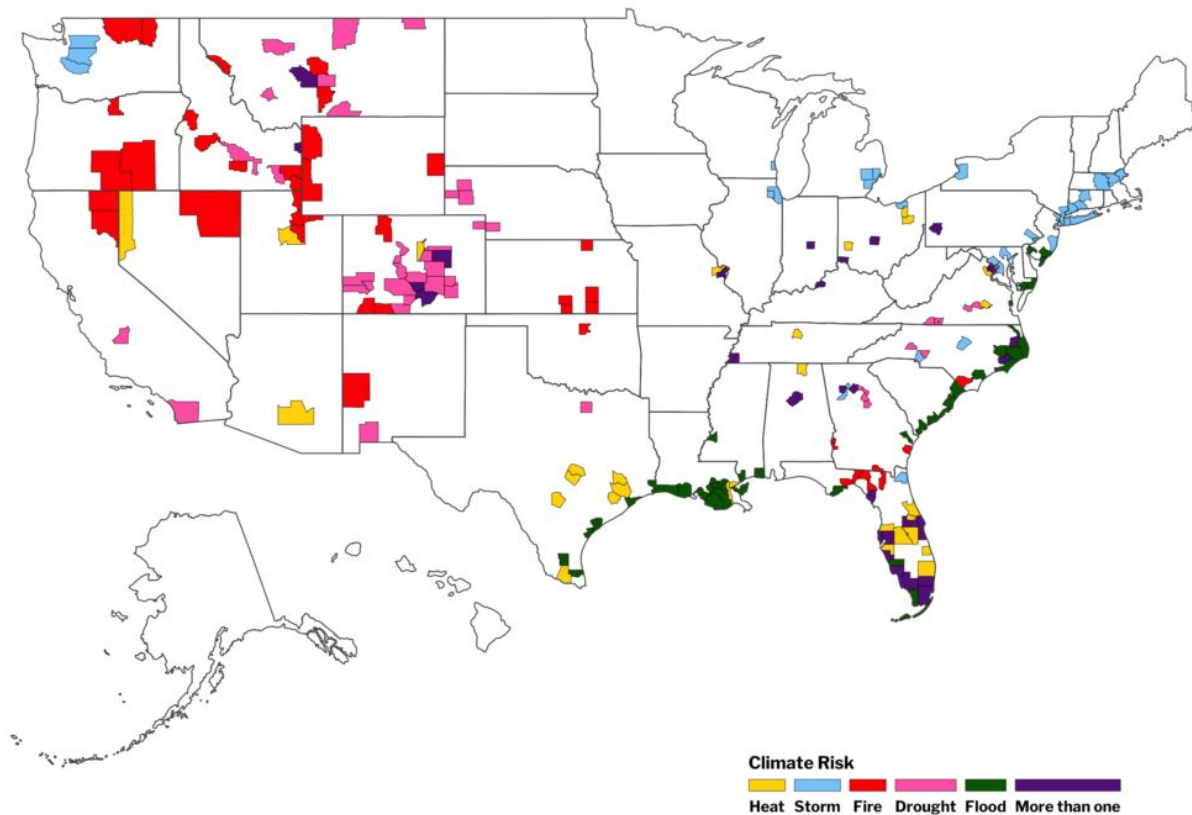
Analysis by @TaylorAMarr

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Climate Risk

Top counties with highest percentage of properties facing high climate risk



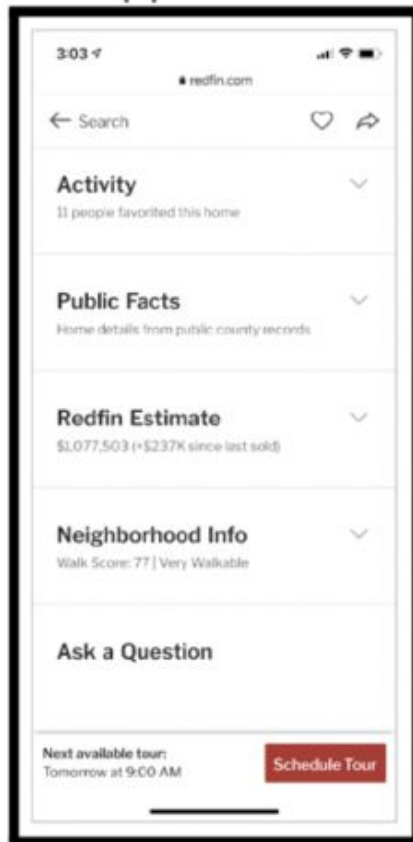
Source: ClimateCheck, county property records, MLS data, and 2020 population estimates from U.S. Census Bureau.

Note: A property is classified as having high climate risk when it faces a high, very high, or extreme climate risk score from ClimateCheck.

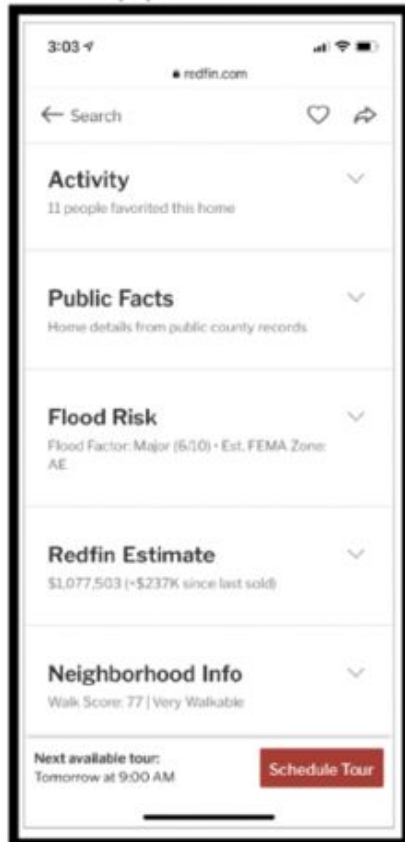


Homebuyers With Access to Flood-Risk Data Bid on Lower-Risk Homes

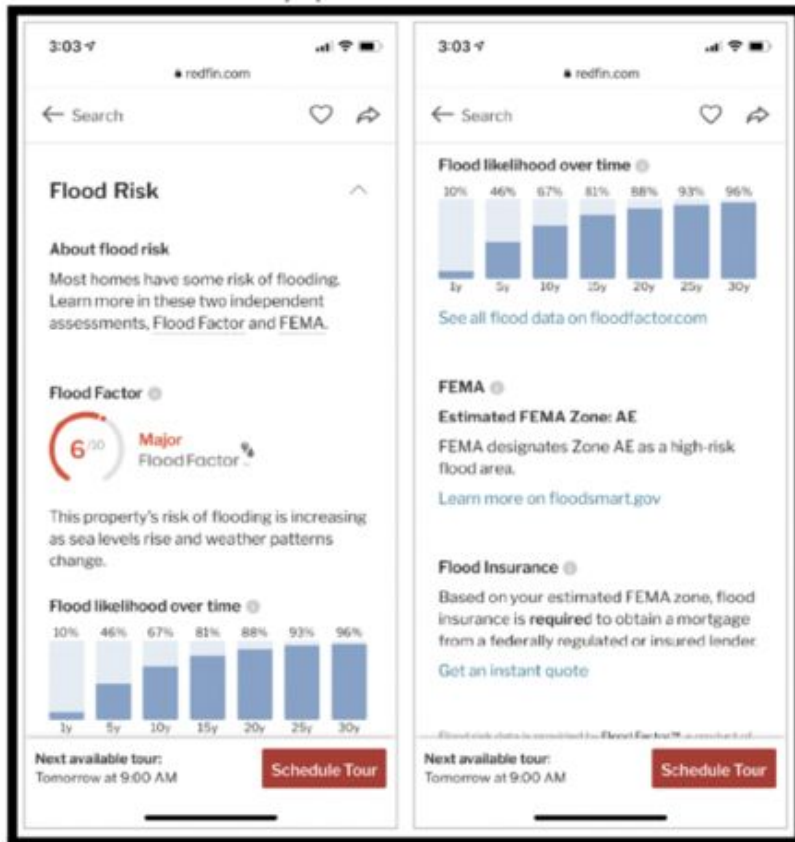
Control View



Treatment View



Expanded Treatment View



Homebuyers With Access to Flood-Risk Data Bid on Lower-Risk Homes

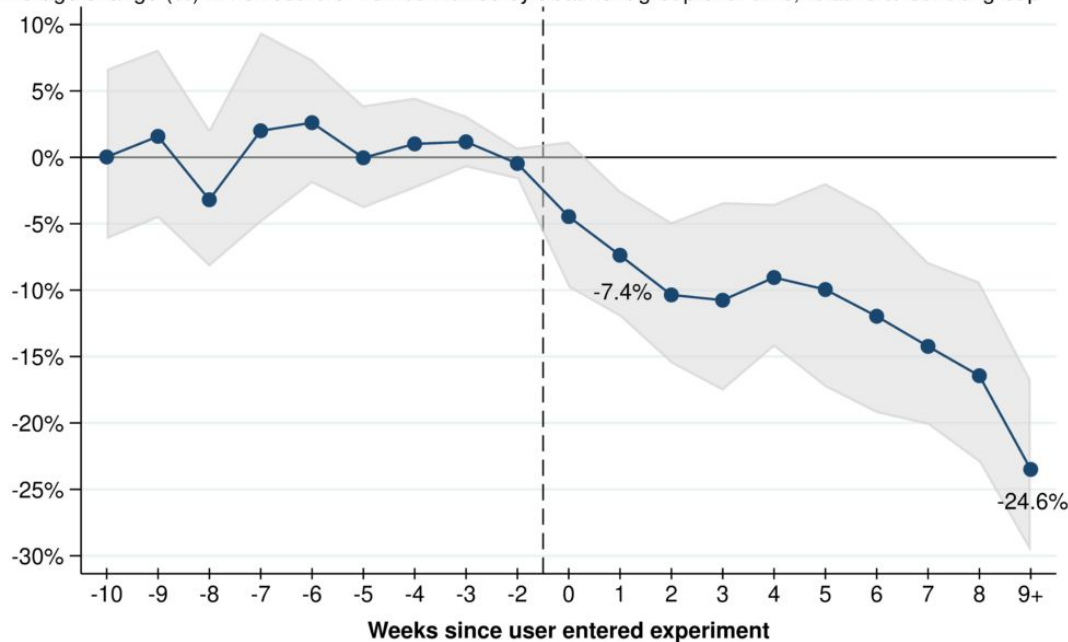
- **Redfin users who viewed homes with severe and/or extreme flood risk** prior to a Redfin experiment proceeded to **bid on homes with 54% less risk** after gaining access to risk data.
- Redfin users in flood-prone **Cape Coral, FL, Houston and Baton Rouge, LA** were most likely to **click** into the flood-risk section within home listings.
- **Home values in flood-prone areas could drop** as more people become aware of the risks. Authorities should respond by adding denser housing to low-risk cities.



Flood-Risk Data Also Impacted Which Homes Buyers Viewed Online

House Hunters Viewed Homes With 25% Less Flood Risk After 9 Weeks in Experiment

Average change (%) in risk score of homes viewed by treatment group over time, relative to control group



Source: Redfin user trial; Flood Factor

Note: Includes only registered users who on average viewed homes with extreme risk prior to study. Blue dots represent coefficients. Grayed-out areas represent 95% confidence intervals.

58% of Homeowners Have Spent Money to Protect Their Homes From Climate Threats

- One-third of homeowners have spent \$5,000 or more to make their homes more resilient to climate risk.
- Overall, extreme temperatures are the most common climate risk homeowners invest to protect against, followed by flooding and hurricanes/other major tropical storms.
- 36% of homeowners say they have an insurance policy covering flooding—a higher share than other climate risks.



Policy Implications

Ethical concerns

- **Who is protected?** Wealthy people and corporations will be best able to protect themselves and their investments against climate change. Local and federal governments may also prioritize protecting the most economically productive property and people.
- **Who pays?** The damage from climate change will be felt by everyone, but the magnitudes will not be equal. Insurance and taxes/subsidies can spread the costs, but may incentivize the wrong behaviors.
- **Who is allowed to stay, and who is forced to move?** We can choose to make investments in cities/towns to make them more resilient to climate change, but in some cases it would be less costly to relocate residents.

What can the government do now?

- **Limit building in high-risk places** This can be done by financially compensating communities that *don't* rebuild, which can help ease the burden of lost tax revenue, or taxing the land or building types with the highest risk. Governments can also purchase land where homes have been destroyed and [repurpose](#) it for another use, such as a nature preserve.
- **Eliminate single-family zoning:** Banning single-family zoning and other restrictive zoning practices in cities that are resilient to climate change allows for more dense housing, and therefore more people, in those relatively safe areas.
- **Raise awareness about risk:** In places with high fire danger, authorities should provide resources that make clear the level of risk a person faces by moving to the area. Redfin now [publishes](#) climate-risk information for every location page on its website. Local leaders should also provide proactive [guidance](#) on how homeowners can fortify their properties against fires, and detailed escape routes for residents to follow in the event of fires.

REDFIN

Thank you!

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Physical Climate Risk and Municipal Finance

Remarks for “Incorporating Climate into Macroeconomic Modeling: A Workshop”

Yanjun (Penny) Liao, Fellow, Resources for the Future

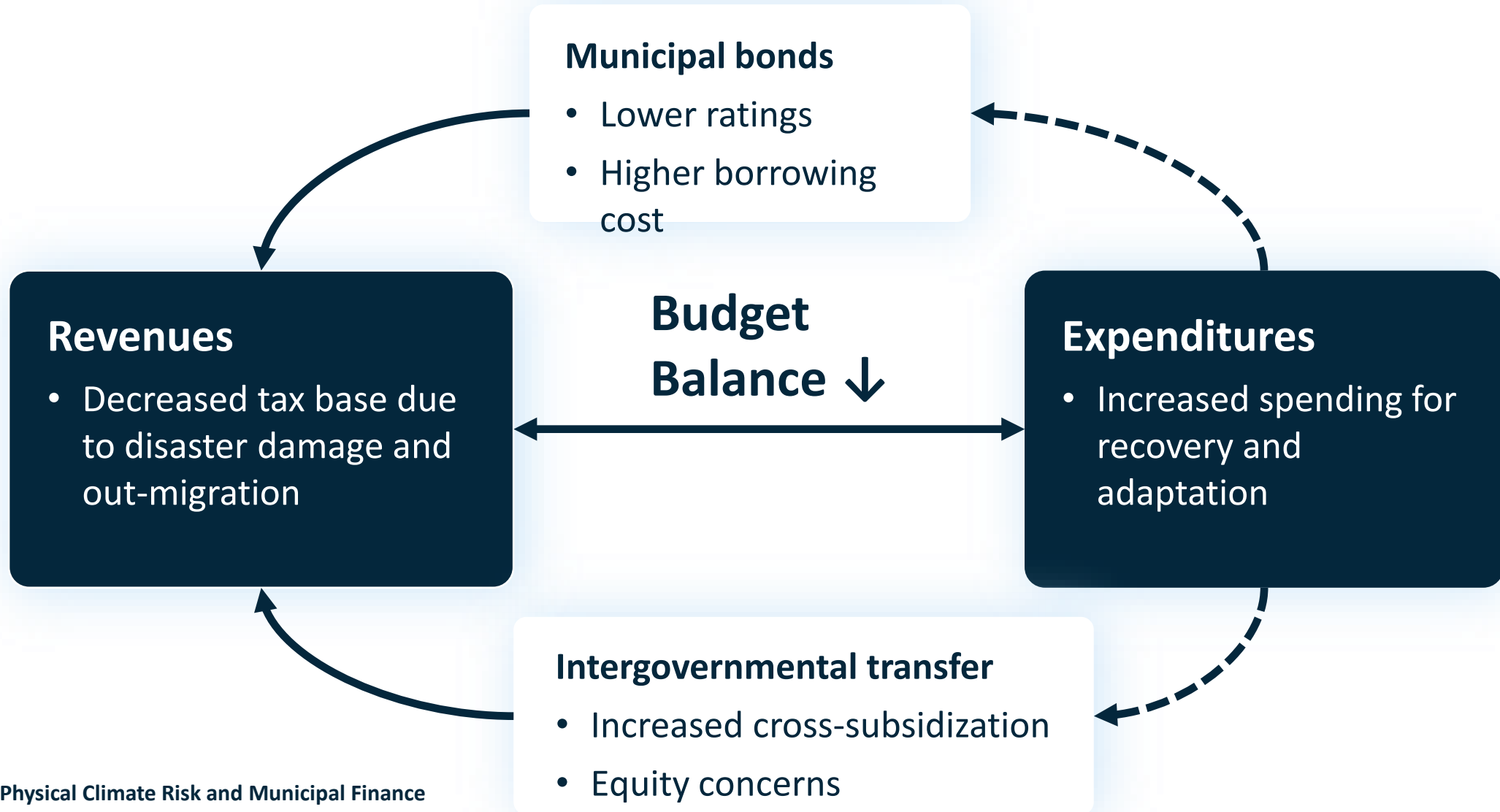
June 15, 2023

Fiscal Health and Capacity of Local Governments

- Physical risks are highly localized
- Disaster impacts, response, and adaptation depend on local government capacity
- In this remark:
 - Fiscal stress pathways
 - Distributional issues
 - Potential surprises: overvaluation risk, insurance availability and affordability



Fiscal Stress Pathways



Distributional Issues

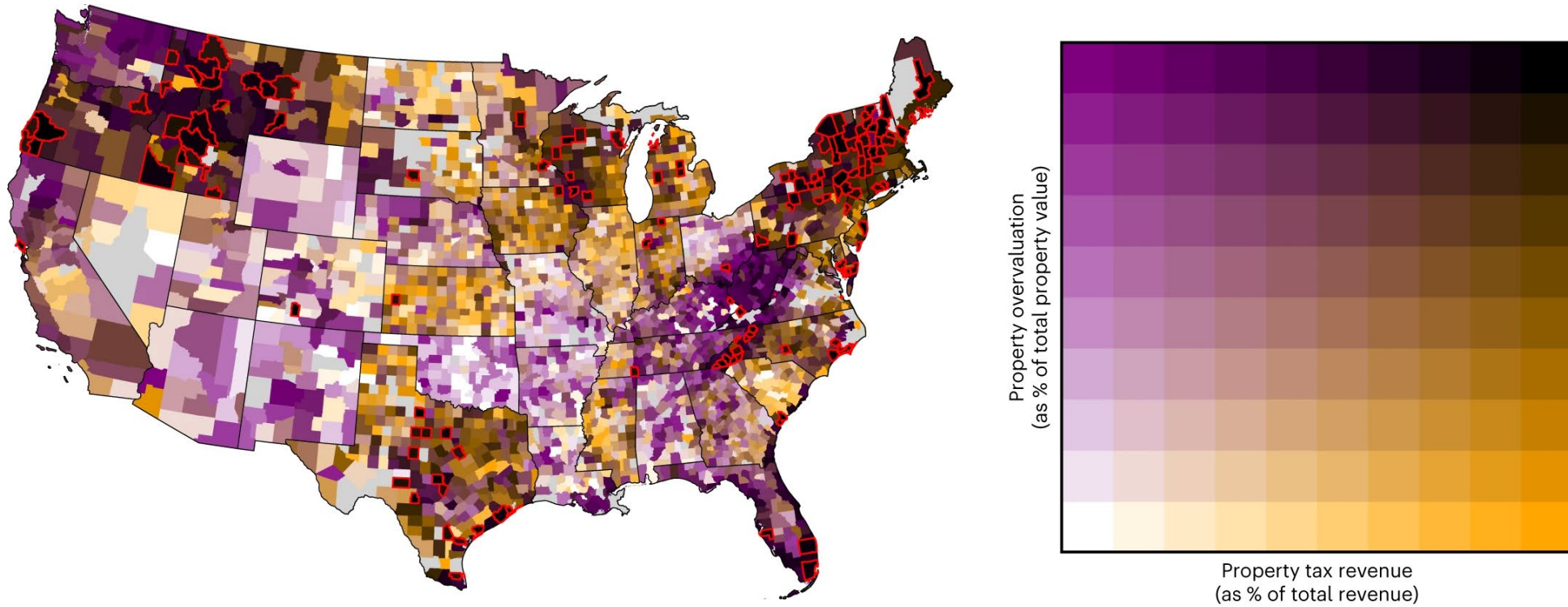
- High- vs. low-income counties

	Spending	Tax Revenues	Debt
High income	↑	↑	↓
Low income	No change	↓	↑

- High-income counties also receive more intergovernmental transfers
- Diverging trajectories for communities with different capacities
 - Equity concerns
 - Implications for the spatial distribution of population and production



Overvaluation Risk



Source: Gourevitch, J.D., Kousky, C., Liao, Y. *et al.* Unpriced climate risk and the potential consequences of overvaluation in US housing markets. *Nat. Clim. Chang.* **13**, 250–257 (2023). <https://doi.org/10.1038/s41558-023-01594-8>



Insurance Availability and Affordability

- Insurance is a critical source of funding for homeowners to rebuild
- However, increasing trend in insurance affordability and availability issues
- The coverage gap might intensify fiscal stress on local governments

Insurer-Initiated Nonrenewal Rate in 2019



Source: RFF issue brief, [Insurance Availability and Affordability under Increasing Wildfire Risk in California](#).





Thank you.

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