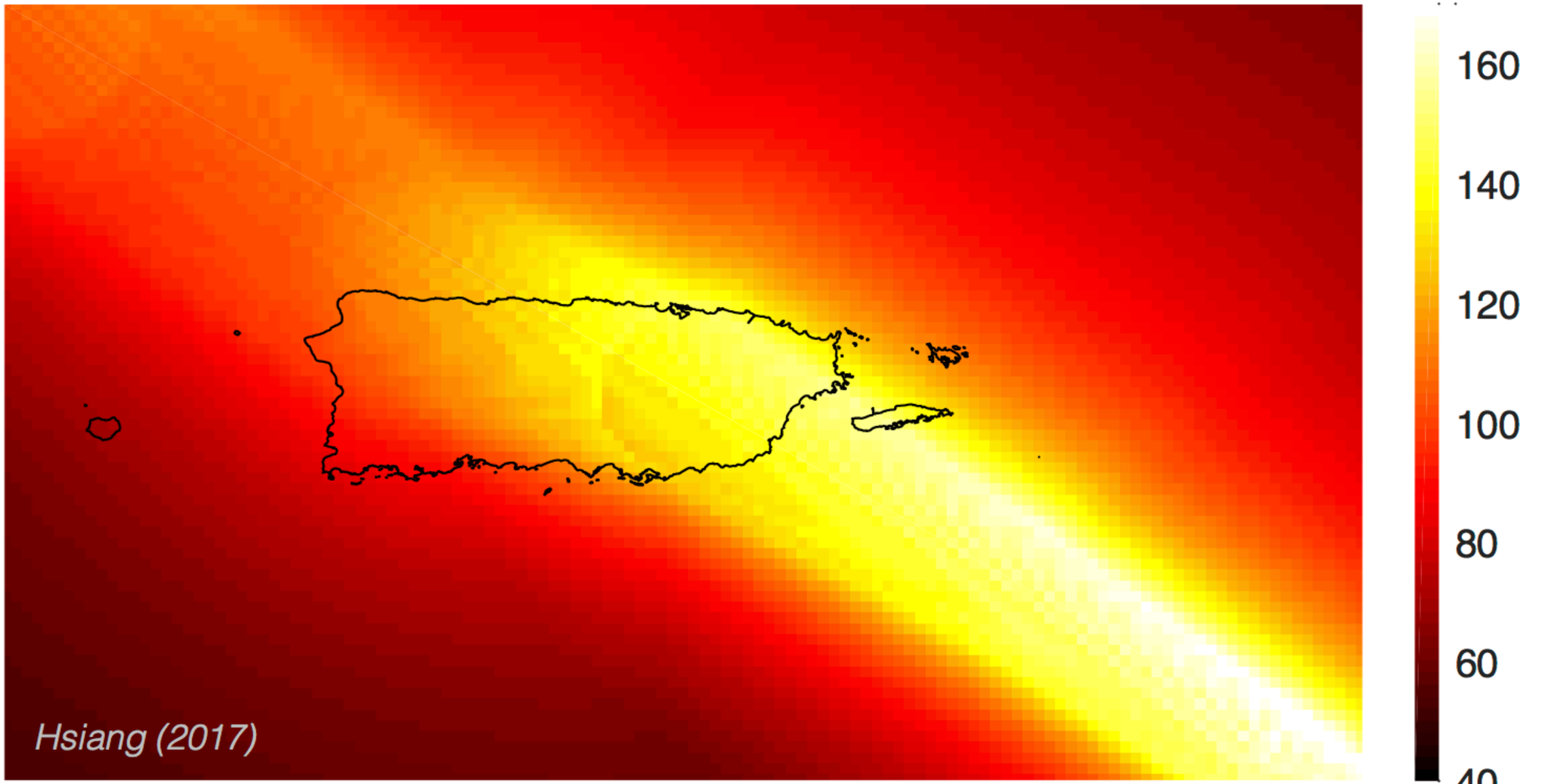
Financial Impacts of Extreme Weather

President's Council of Advisors on Science and Technology
November 9, 2022

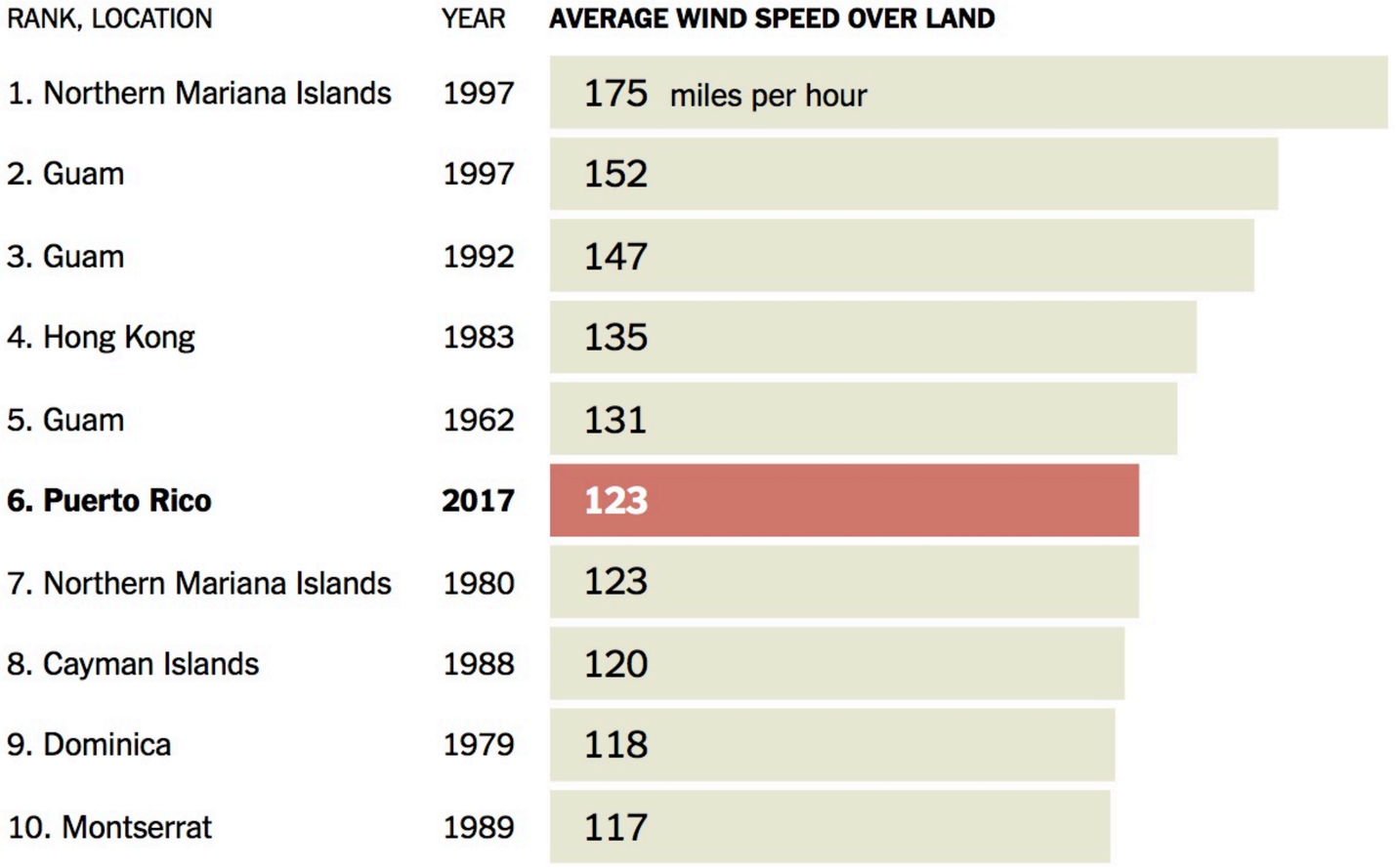
Solomon Hsiang, UC Berkeley

Maximum surface wind speed during Hurricane Maria



Maria: The Worst Atlantic Storm on Record

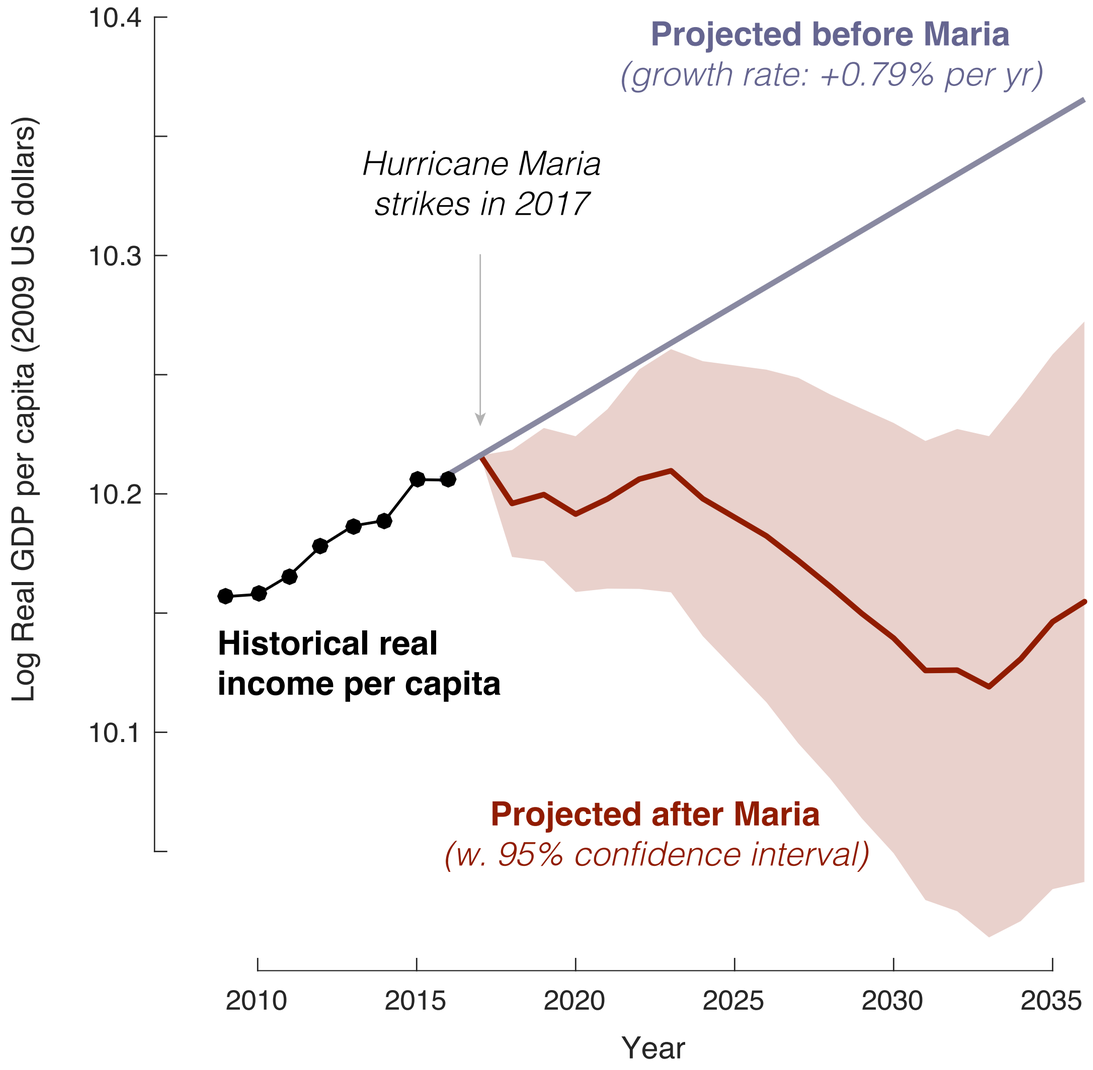
The ten strongest cyclone events since 1950.



By The New York Times | Sources: Solomon Hsiang, University of California, Berkeley, and Amir Jina, University of Chicago

Hsiang & Houser (NYT, 2017)

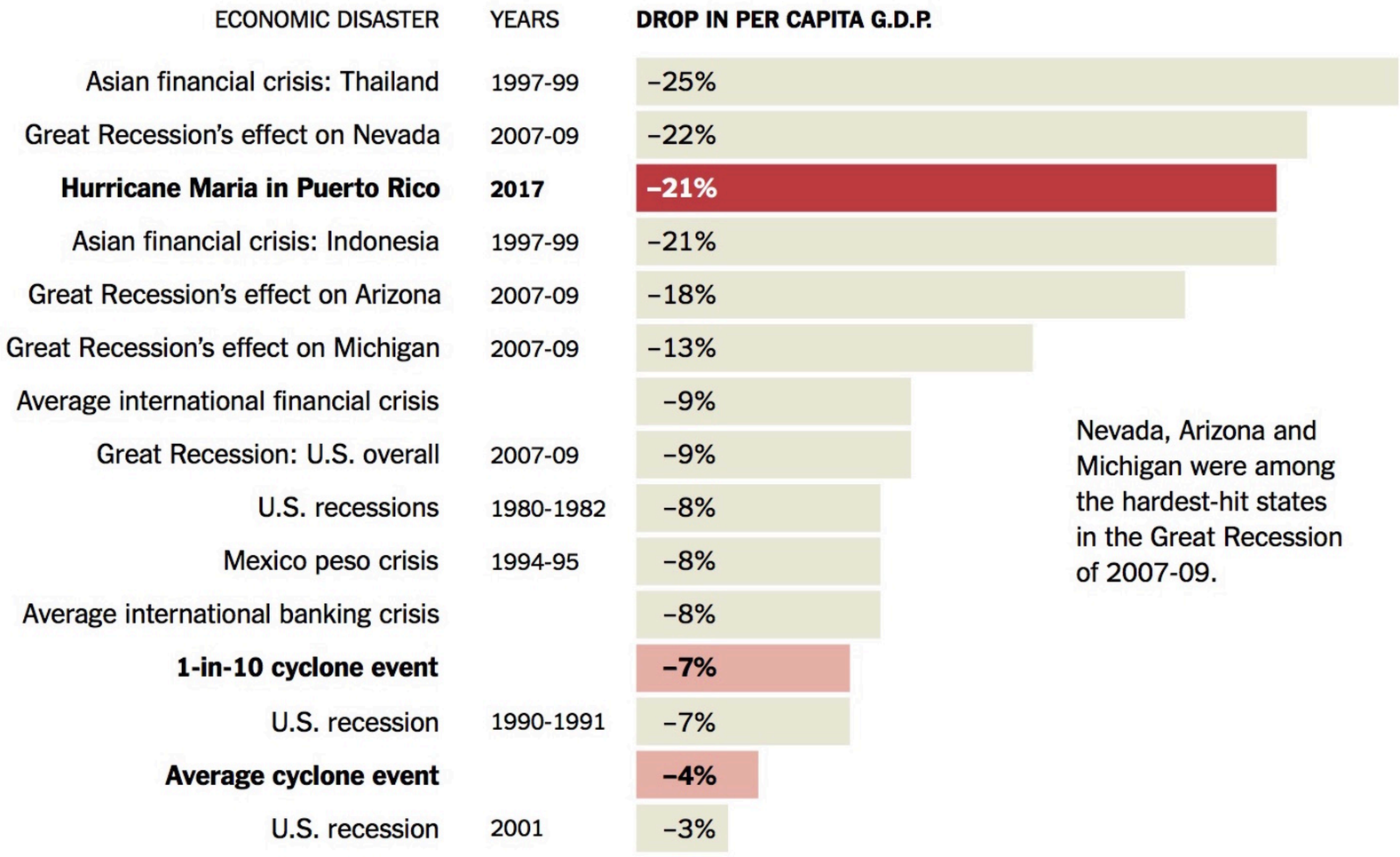
Undoing 23 years of economic progress in 12 hours



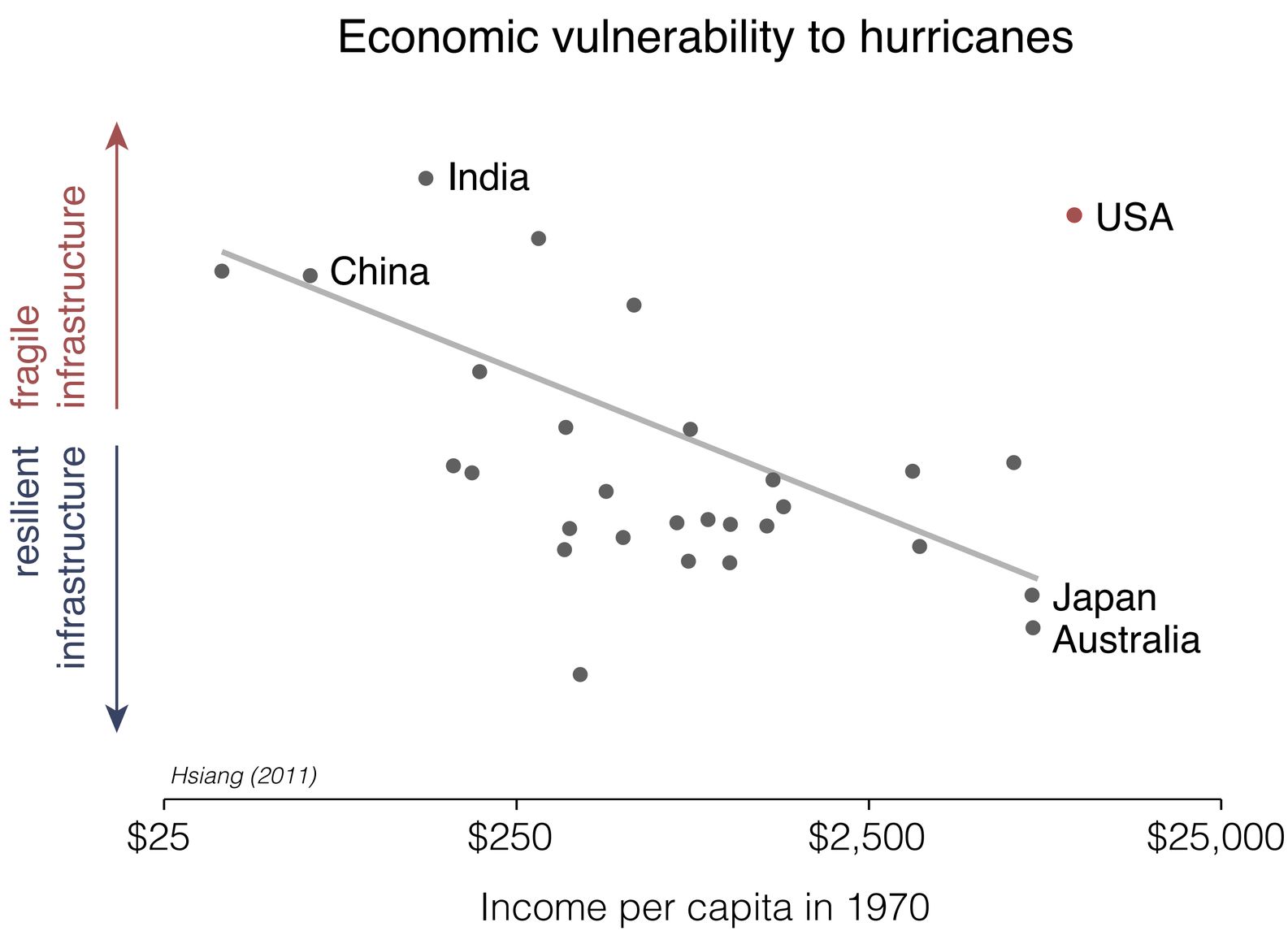
Hsiang & Houser (NYT, 2017)

In Just 12 Hours, an Economic Wipeout

Hurricane devastation in Puerto Rico is expected to have much worse economic effects than many other recent crises that unfolded over months or years.

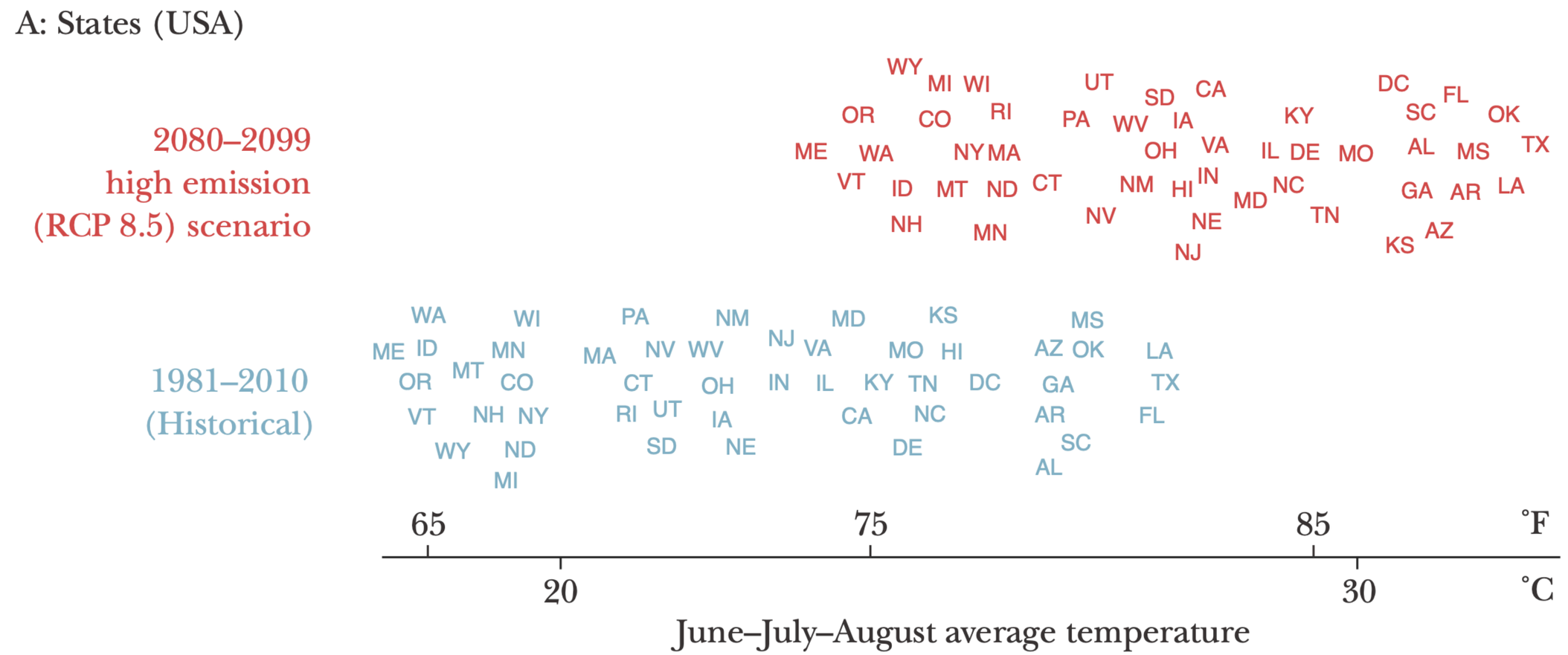


Hsiang & Houser (NYT, 2017)



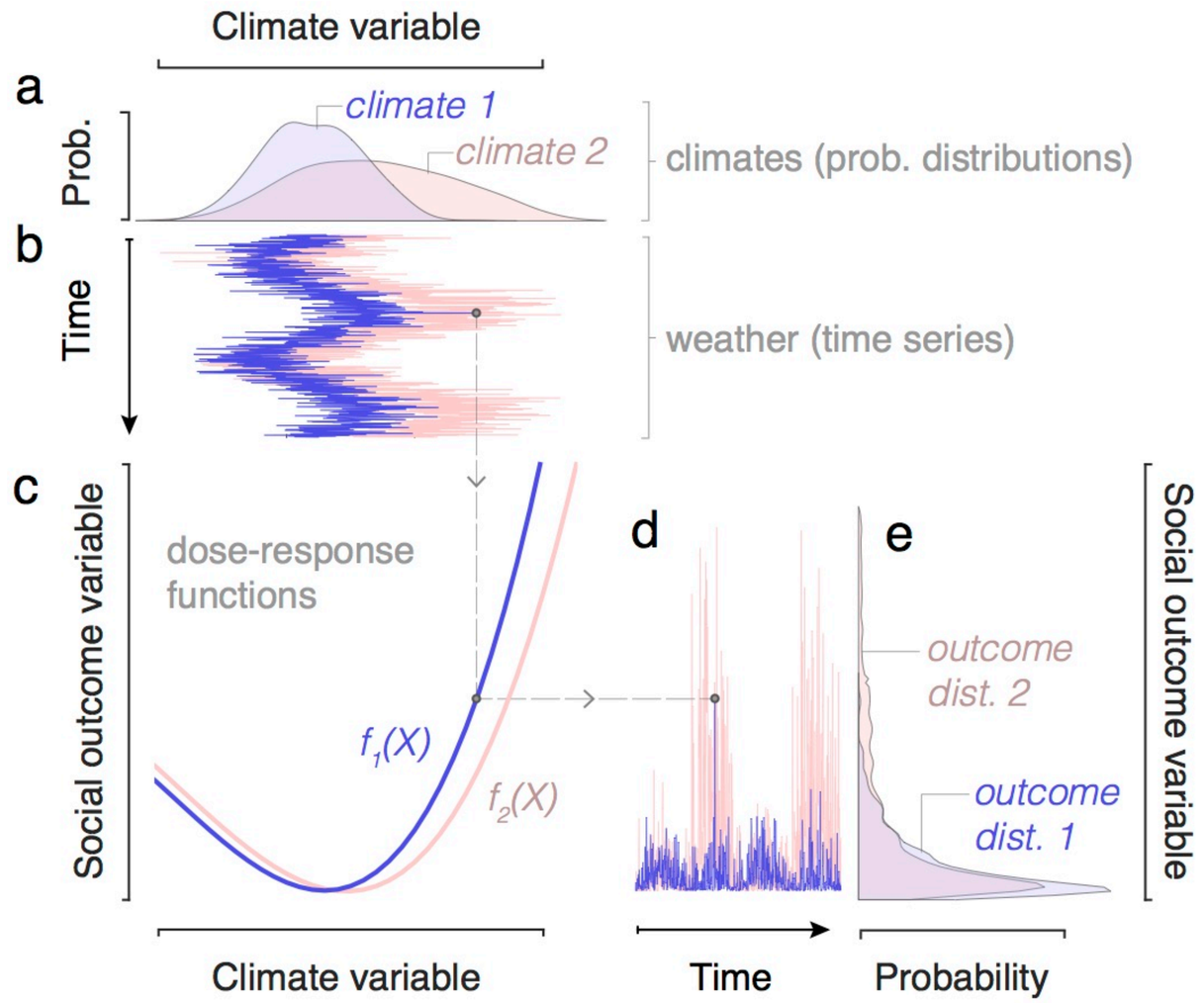
Hsiang (Columbia Univ., 2011)

Average Temperatures for Lower 48 US States Observed during 1981–2010 and Projected for 2080–2099 in a High Emission (RCP 8.5) Scenario.



Hsiang & Kopp (J. Econ Perspectives, 2018)

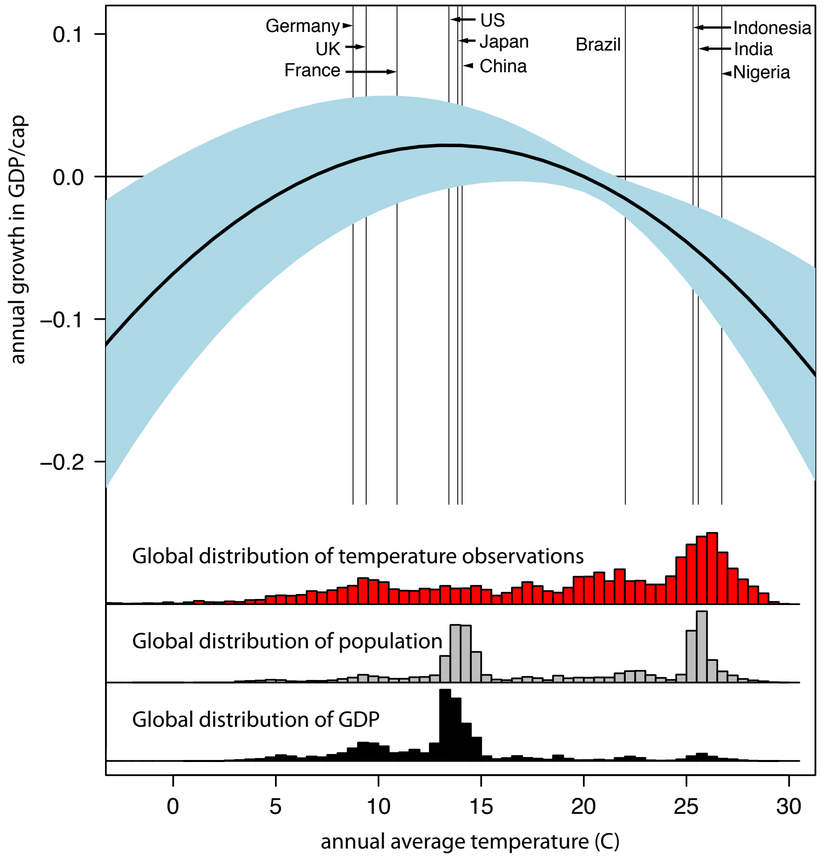
Measuring impacts



Carleton & Hsiang (Science, 2016)

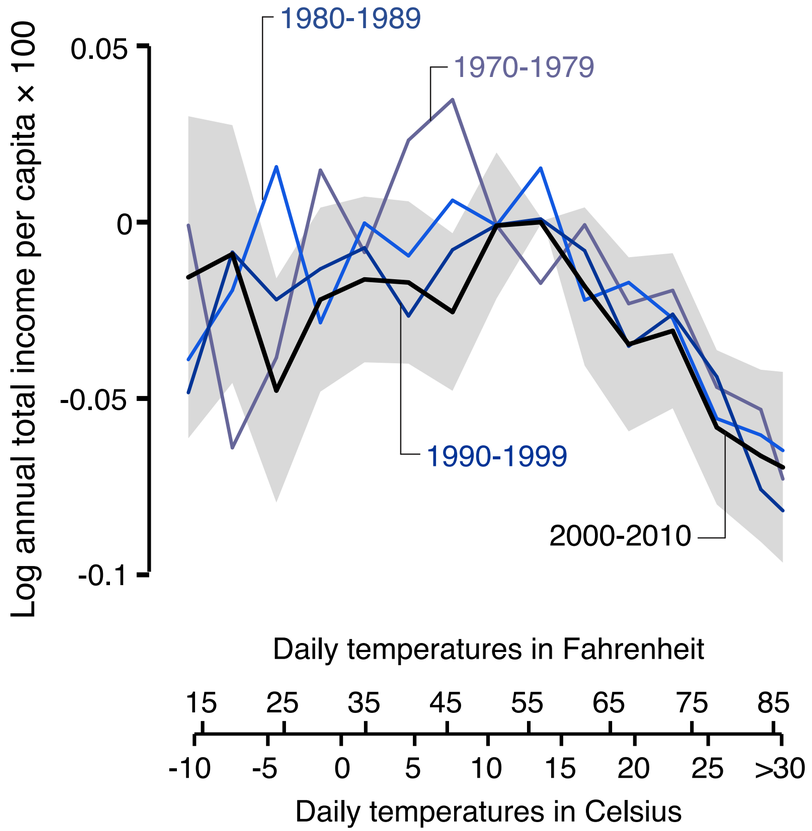
Climate change and economic output

World



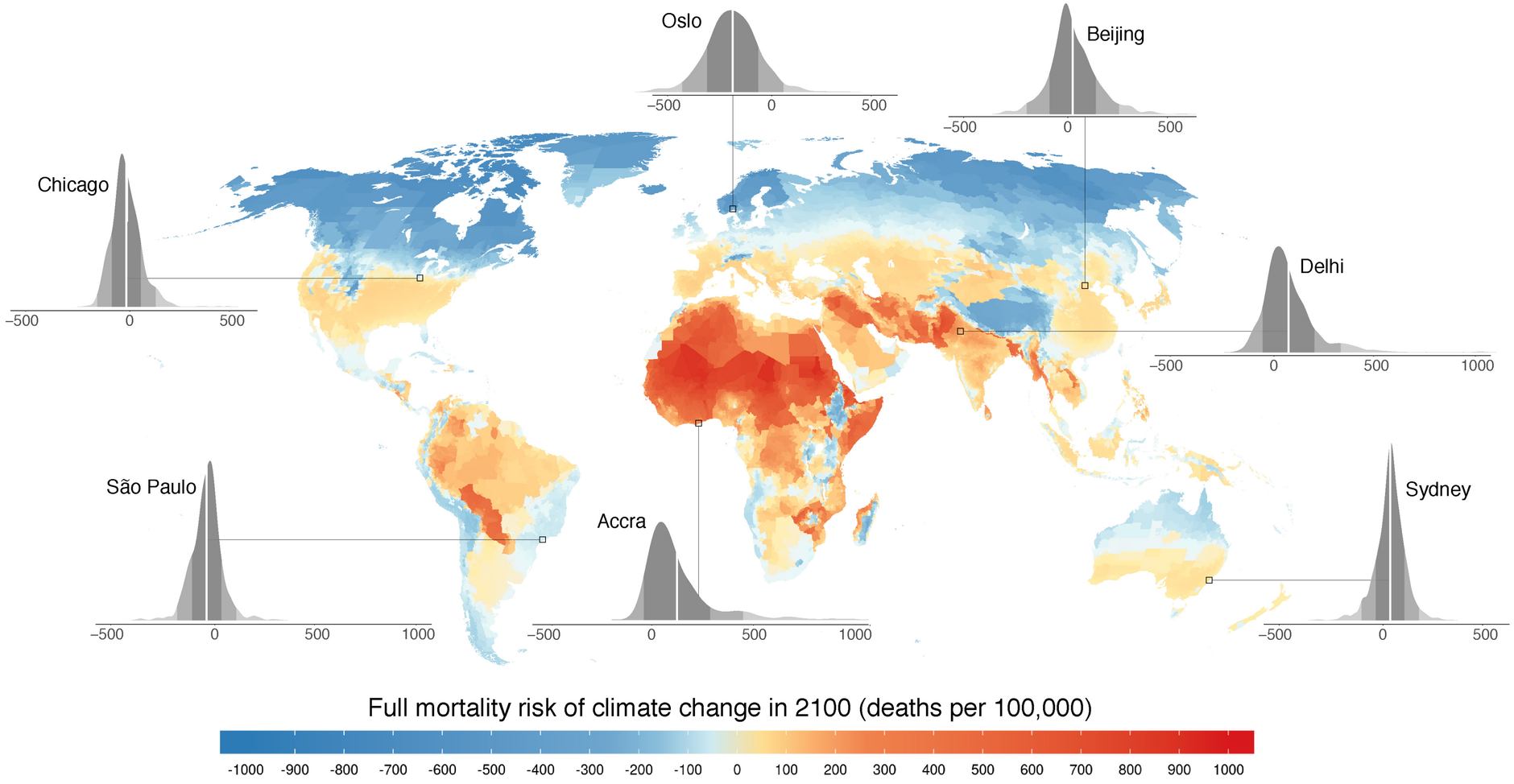
Burke, Hsiang, Miguel (Nature, 2015)

USA counties



Deryugina & Hsiang (NBER, 2016)

Impacts on human health



Carleton et al. (QJE, 2022)

Fiscal Costs > Disaster payments

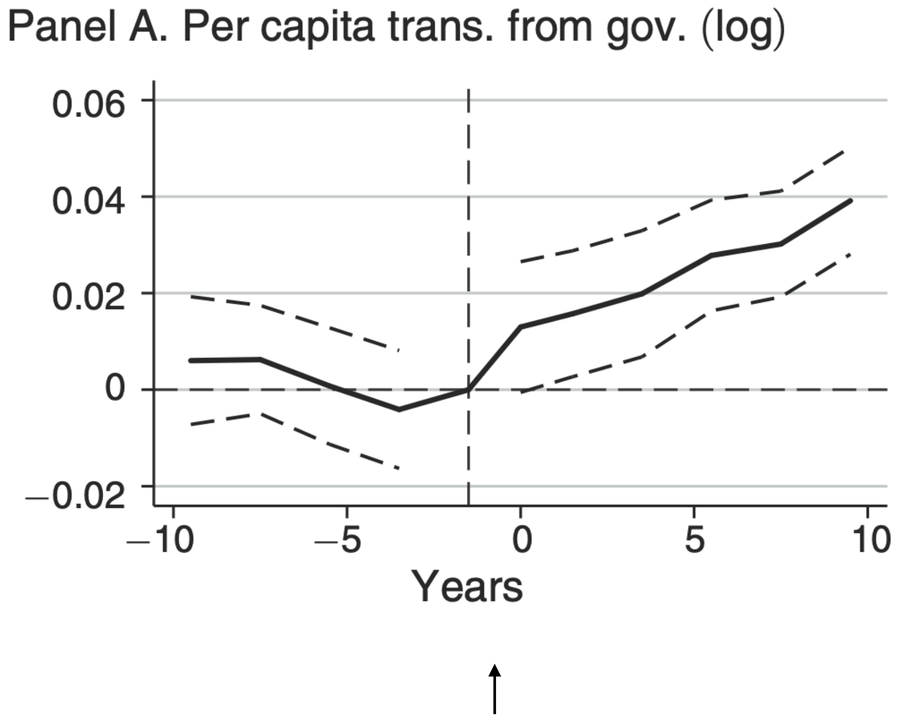


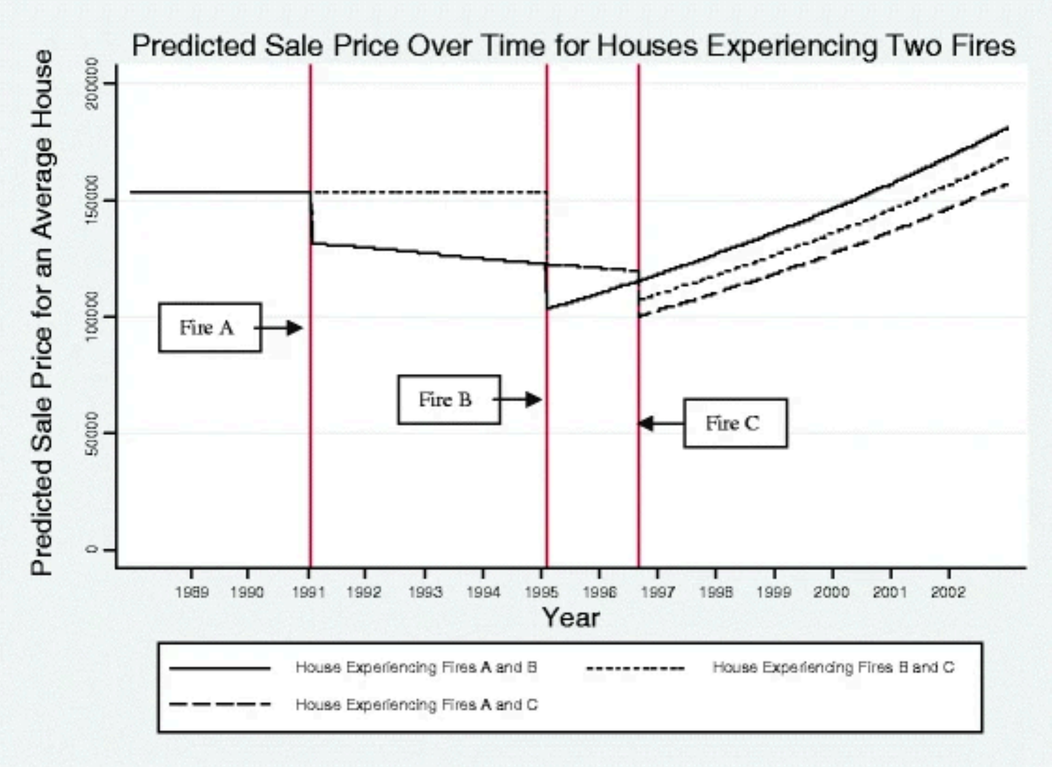
Table 11—Total Change in Transfer Components by Hurricane Category
(*present discounted value*)

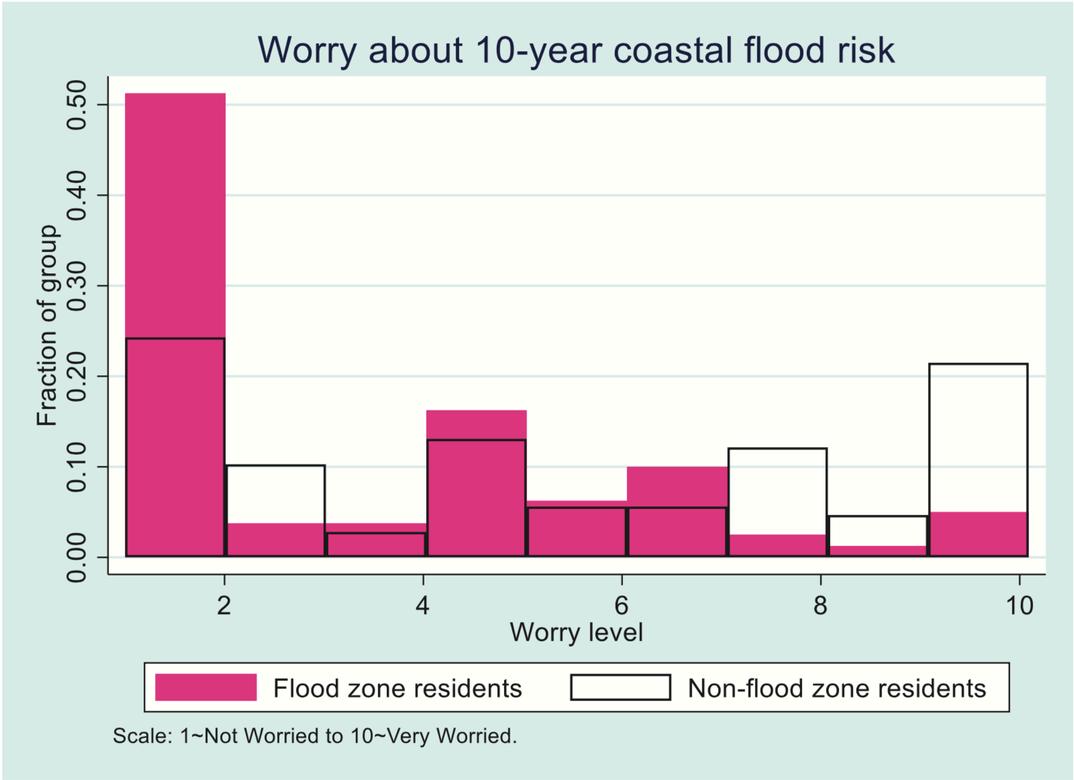
	Category 1 (1)	Category 2 (2)	Category 3+ (3)
Average wage/salary	−492	−800	−4,333
	(582)	(1,041)	(1,456)
Transfers from businesses (private insurance)	17	20	86
	(9)	(13)	(43)
All non-disaster transfers from government =	1,107	1,100	1,698
	(291)	(511)	(718)
Unemployment payments +	46	66	421
	(57)	(75)	(131)
Public medical benefits +	633	583	361
	(178)	(250)	(344)
Medicare benefits +	353	211	140
	(100)	(145)	(221)
Retirement and disability insurance benefits +	164	119	402
	(129)	(233)	(458)
Federal educational assistance +	−33	−28	−45
	(16)	(30)	(46)
Income maintenance =	188	−84	515
	(84)	(134)	(260)
SSI benefits +	−23	66	128
	(26)	(46)	(68)
Food stamps +	94	38	383
	(45)	(65)	(151)
Family assistance	38	95	138
	(24)	(40)	(71)

Notes: The table shows the present discounted value of additional inflows of various transfers zero to ten years after the hurricane by hurricane category. Standard errors (in parentheses) are clustered spatially, allowing for spatial correlation of up to 200 km around the county's centroid and for autocorrelation of order 5. Assumed interest rate is 3 percent. Data are estimated with a nonlinear combination of coefficients from equation (3).

Deryugina (AEJ Policy, 2017)

Revaluation of real estate assets



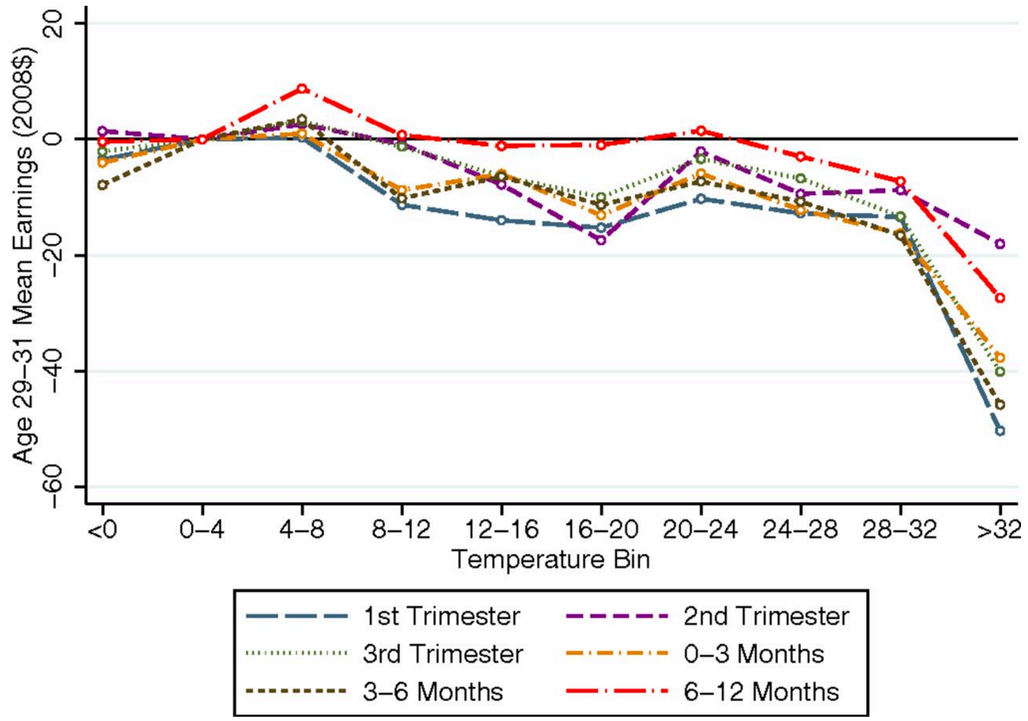


Mueller et al (J. Real Estate Finance & Econ, 2009)

Bakkensen & Barrage (Rev. Financial Studies, 2021)

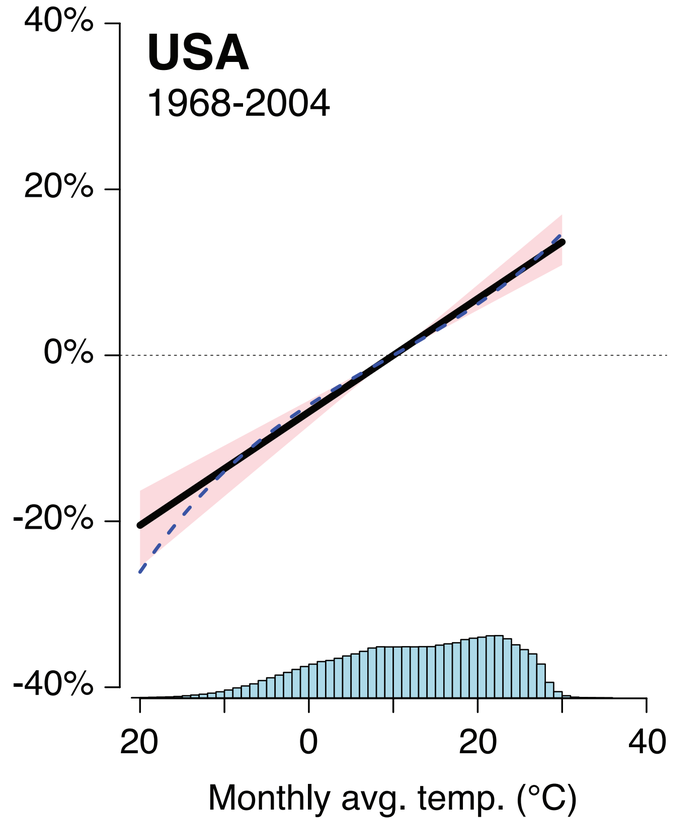
Impacts within the home

Adult income vs extreme heat during child development



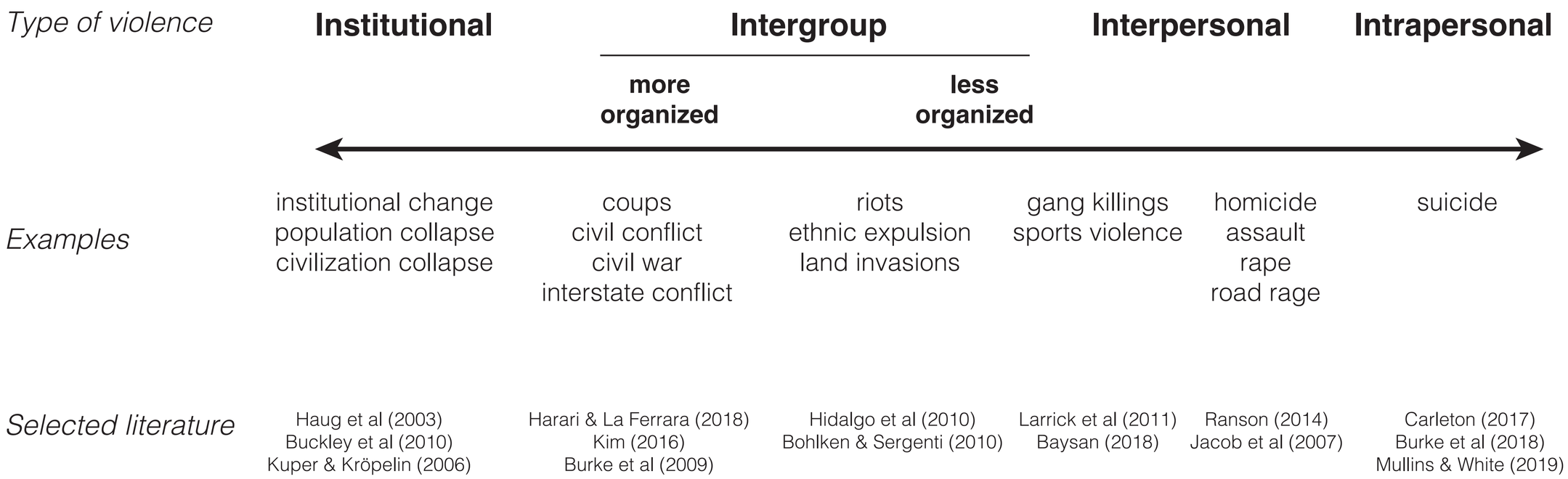
Isen et al (PNAS, 2017)

Percent change in county suicide rate



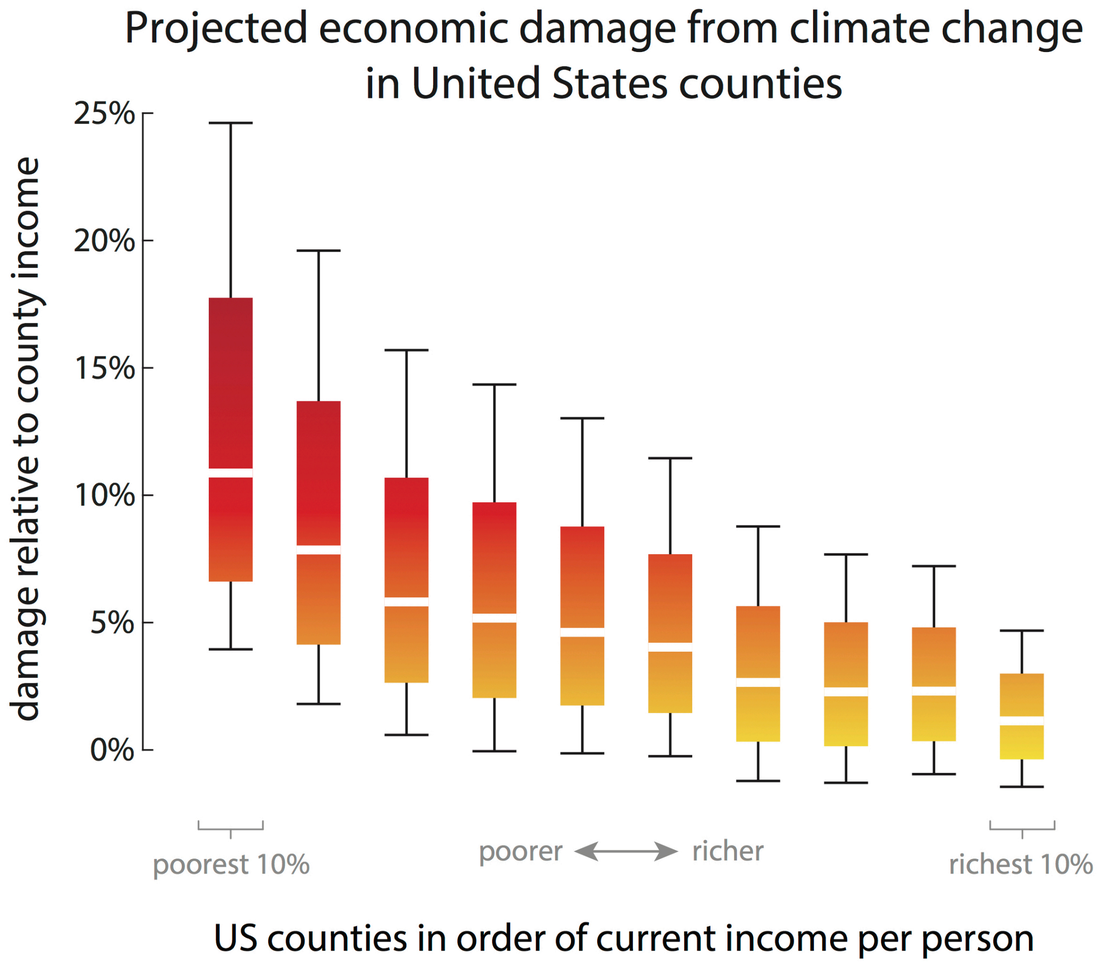
Burke et al (Nature Climate Change, 2018)

Climate affecting violence & social stability



Baysan et al. (JEBO, 2019)

Impacts can increase pre-existing inequality



Hsiang et al. (Science, 2017)

Institutions for supervising adaptation technology & data

- There are / will be massive efforts to minimize economic damages from climate change.
- There are no institutions to ensure data / policies / technologies are “safe and effective”
- Ineffective technologies defraud consumers and disclosure of inaccurate climate risk data may harm unaware citizens.

Recommendation:

- Develop systems for third-party supervision / verification of technologies and data (e.g. RCTs, audits) to protect consumers (e.g. cities, homeowners).

World Health Organization

CDC
Centers for Disease Control and Prevention

FDA
Department of Health & Human Services · USA

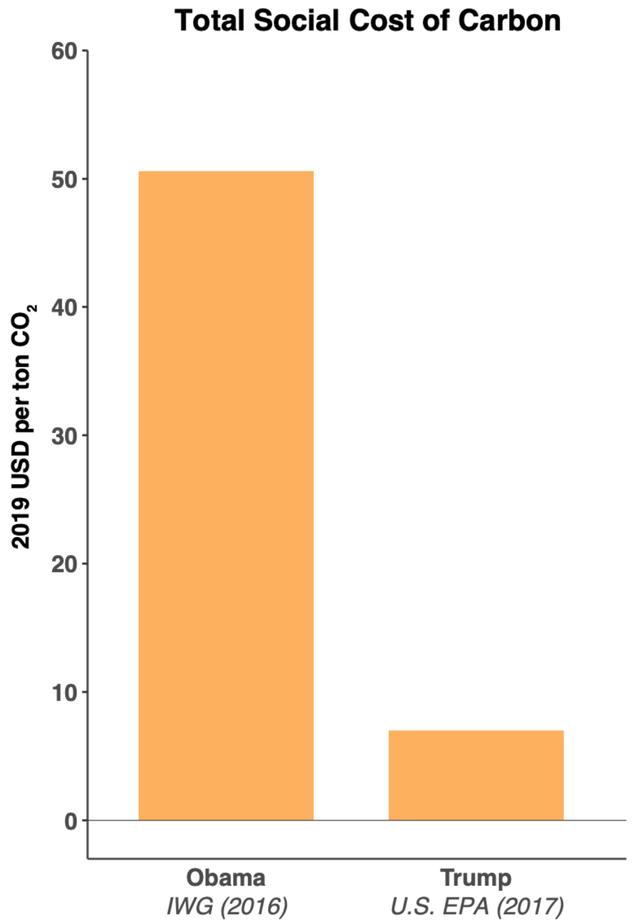
We do not have comparable institutions for climate-related policies or technologies

Social Cost of GHGs

- SC-GHG is an estimate of the net present value of mitigation one unit of emissions today. Used to “price carbon”.
- Global CO2 emissions = 40 billion tons
- Suppose SC-GHG = $60 / ton CO2
- Annual emissions valued at $2.4T (Global GDP = $96T)
- Repricing (e.g. altering discount rate) could introduce enormous volatility into markets if US SC-GHG is widely adopted.

Recommendations:

- Systematize and codify scientific process to regularly update SC-GHG based on best available science.
- Set “speed limits” on how rapidly parameter values (e.g. discount rates) may change to limit volatility.



Fiscal Planning

- Many legacy systems were designed prior to climate change but “bear the weight” of climate-related costs (e.g. public unemployment insurance, private healthcare)
- Either existing systems / programs must expand to manage costs or we must design / deploy new ones
- Moral hazard is pervasive across adaptation planning contexts

Recommendations:

- Index budgets and financial systems against climate change to improve fiscal sustainability (analogous to indexing to inflation)
- Incentivize measurable risk reduction across all planning levels
- Phase out *ad hoc* discretionary relief programs (presidential disaster declarations), replace with financially sustainable risk-sharing systems (e.g. unsubsidized crop insurance / NFIP)

Coordinating /supporting adaptation investment

- Adaptation to climate change will be decentralized and executed at multiple levels of government
- Coordination failures may be extremely costly (e.g. electrical grid planning, interstate surface water allocations)
- State & local governments may lack resources / expertise to evaluate cost-effectiveness of adaptation technologies / strategies

Recommendations:

- Review existing adaptation coordinating mechanisms, establish cross-level / cross-regional / cross-sectoral systems to coordinate actions.
    - Signal priorities centrally (e.g. WH) to facilitate coordination.
    - Incentivize transfer of savings across programatic areas (e.g. FEMA buyback program)
- Create / disseminate systems to support technical aspects of local / state adaptation planning.
- Expand education programs to develop the interdisciplinary labor force needed for national adaptation.