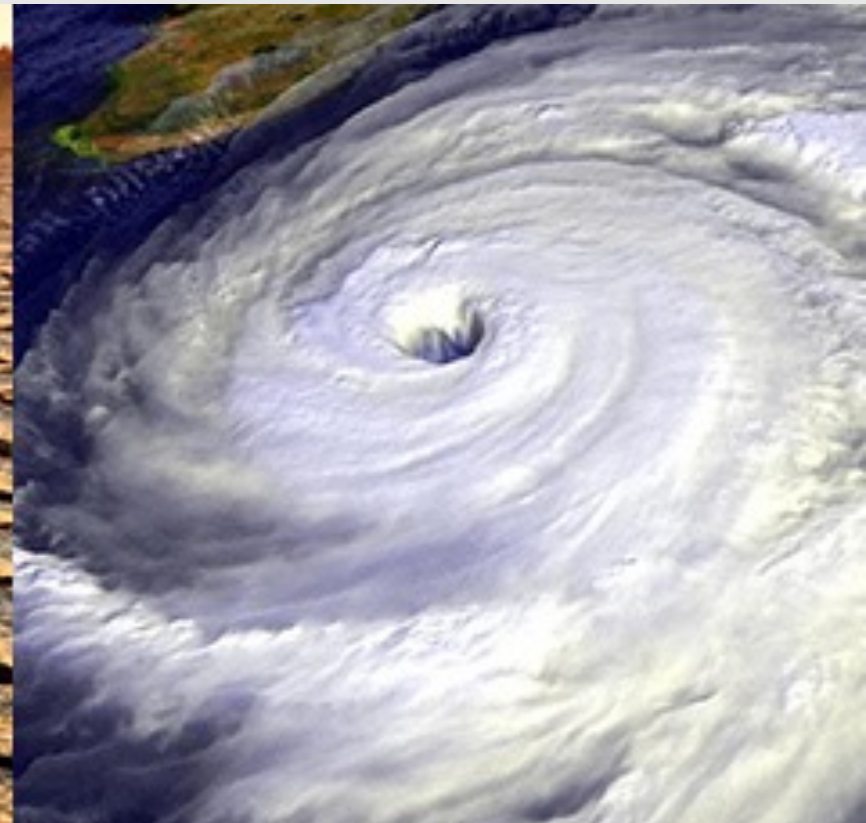
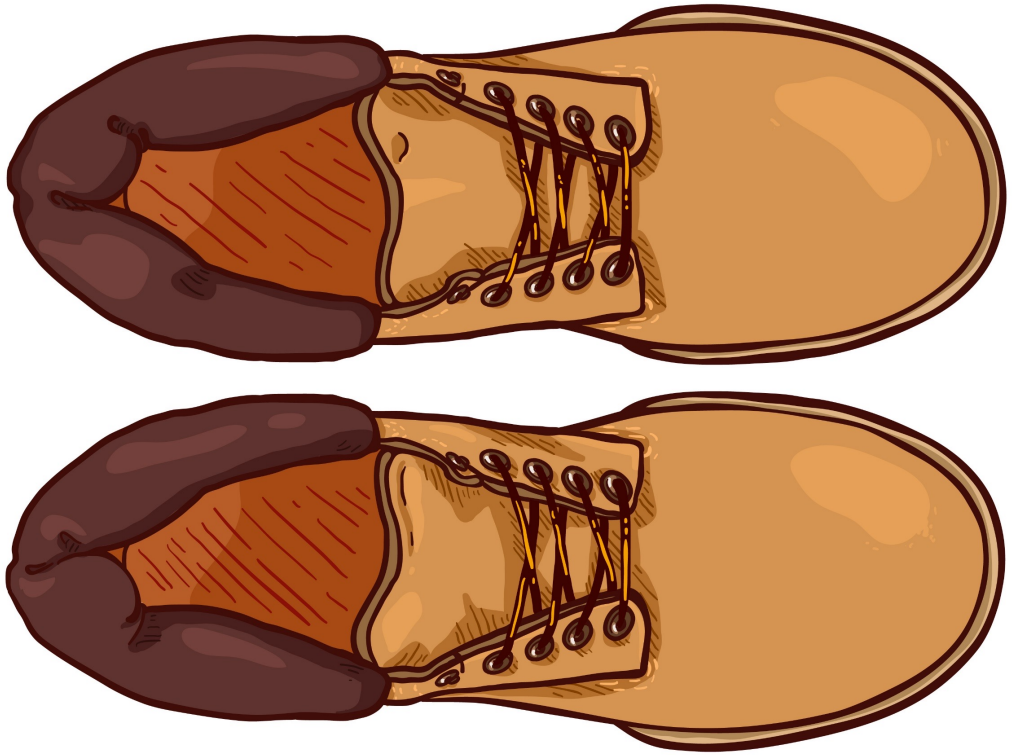
Insurer Capitalization and the Performance of State Guaranty Associations

Lars Powell, Kenny Wunder, and Boyi Zhuang

University of Alabama



Work in progress

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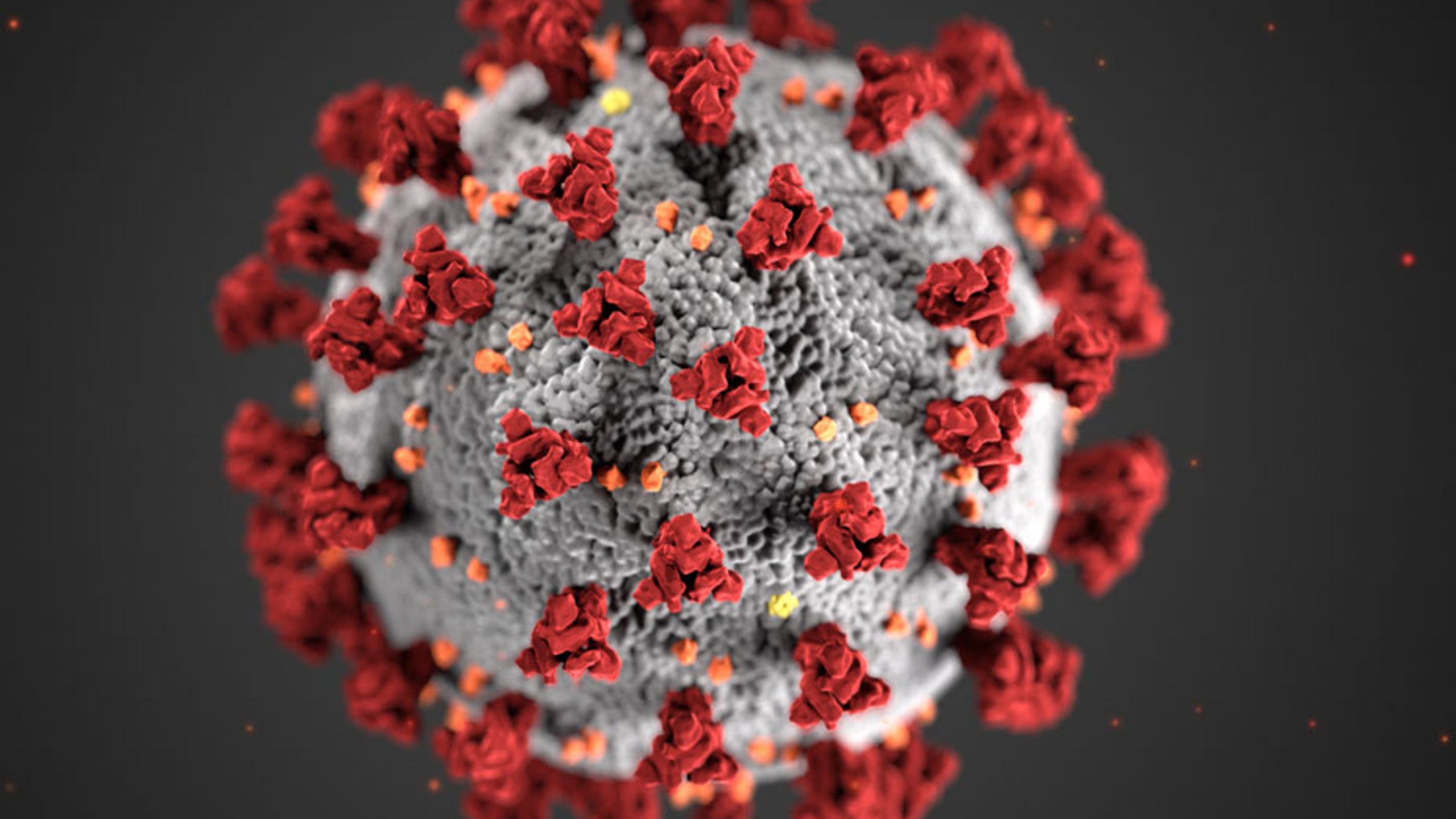


Climate Change?

A personal take on science and society

World view

By Gavin Schmidt

Why 2023's heat anomaly is worrying scientists

Climate models struggle to explain why planetary temperatures spiked suddenly. More and better data are urgently needed.

When I took over as the director of NASA's Goddard Institute for Space Studies, I inherited a project that tracks temperature changes since 1880. Using this trove of data, I've made climate predictions at the start of every year since 2016. It's humbling, and a bit worrying, to admit that no year has confounded climate scientists' predictive capabilities more than 2023 has.

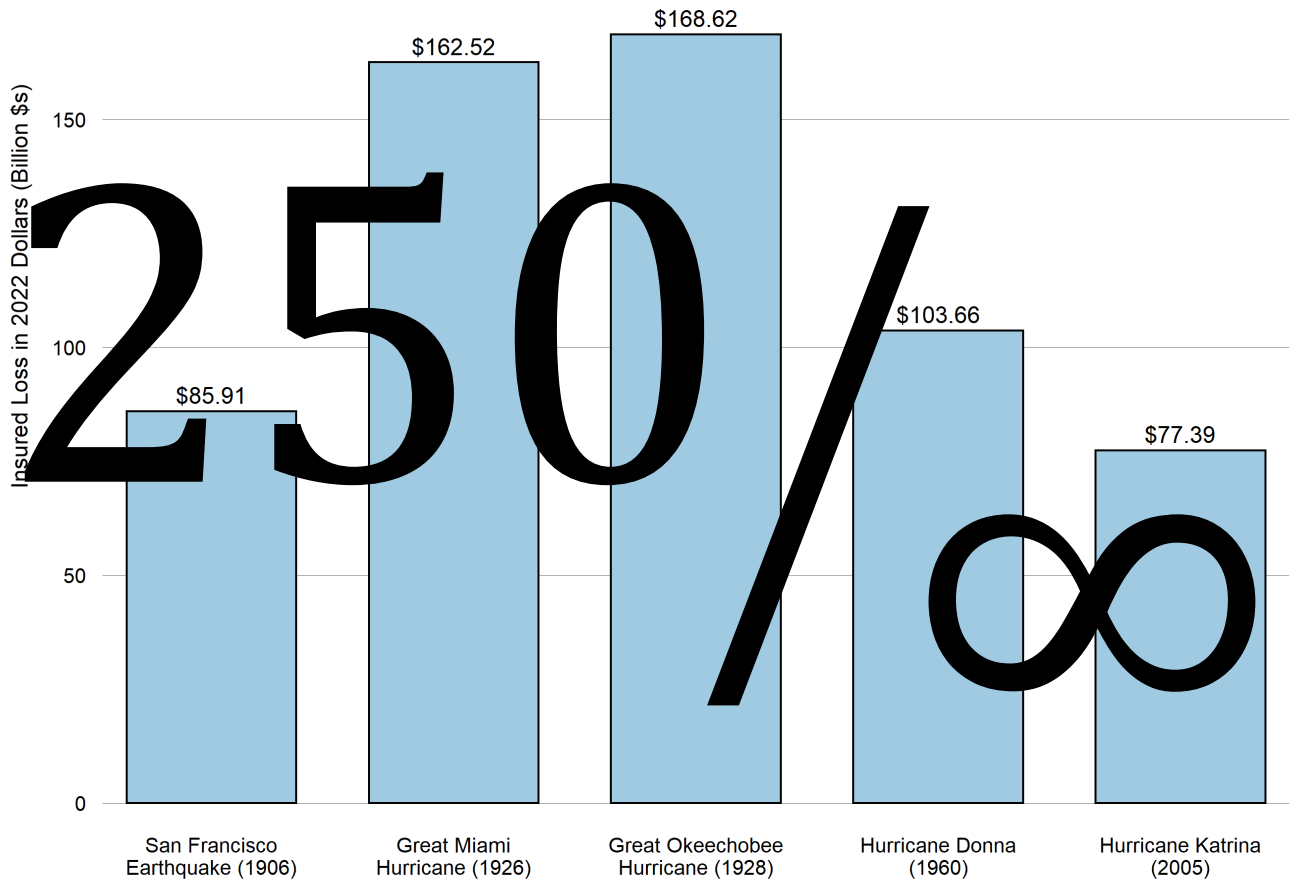
For the past nine months, mean land and sea surface temperatures have overshot previous records each month

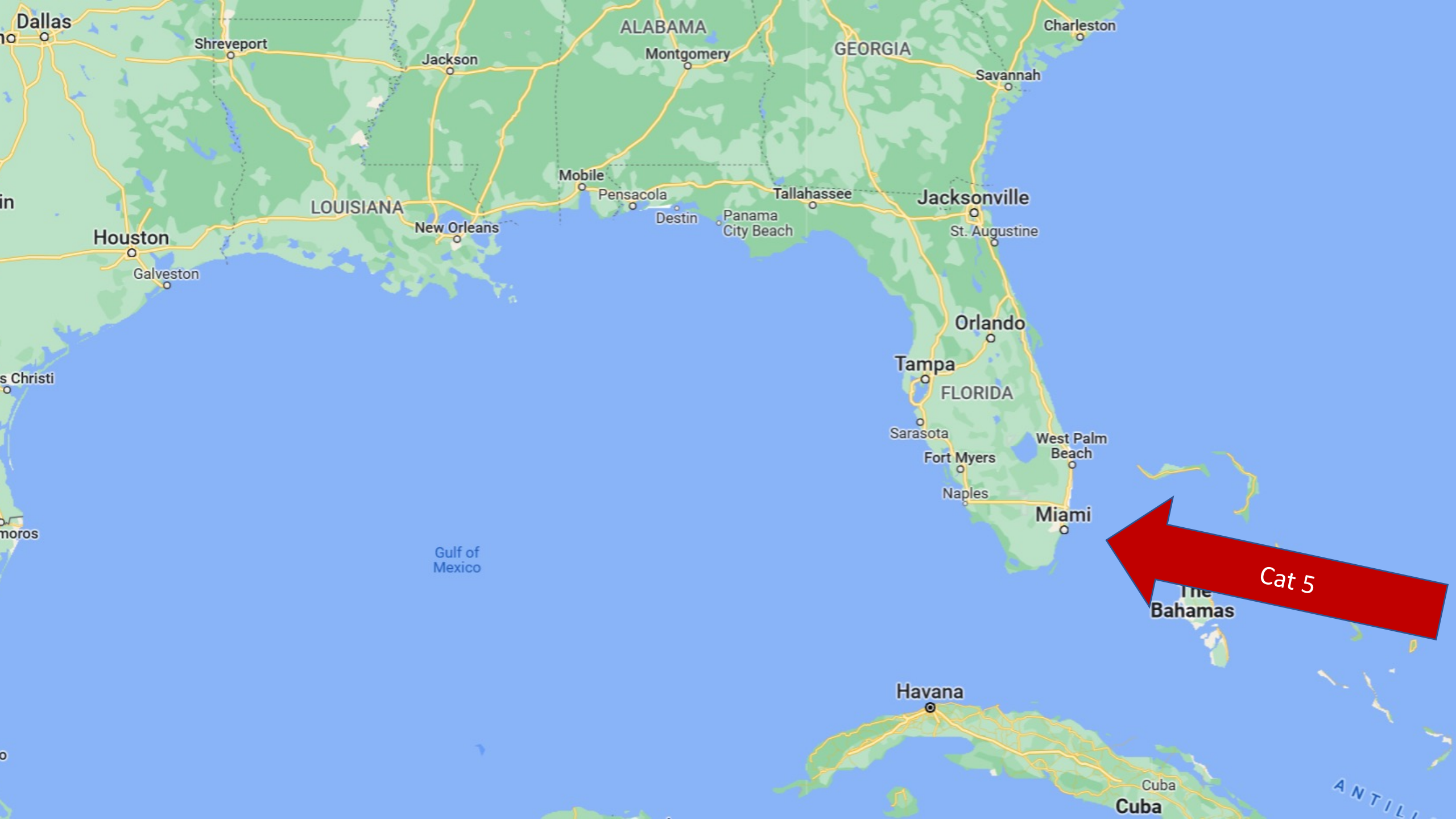
> "If the anomaly does not stabilize by August, then the world will be in uncharted territory."

from stratospheric water vapour, and the ramping up of solar activity in the run-up to a predicted solar maximum. But these factors explain, at most, a few hundredths of a degree in warming (Schoeberl, M. R. *et al. Geophys. Res. Lett.* **50**, e2023GL104634; 2023). Even after taking all plausible explanations into account, the divergence between expected and observed annual mean temperatures in 2023 remains about 0.2 °C — roughly the gap between the previous and current annual record.

There is one more factor that could be playing a part. In 2020, new regulations required the shipping industry to use cleaner fuels that reduce sulfur emissions. Sulfur compounds in the atmosphere are reflective and influence several properties of clouds, thereby having an overall cooling effect. Preliminary estimates of the

Large losses that have already happened

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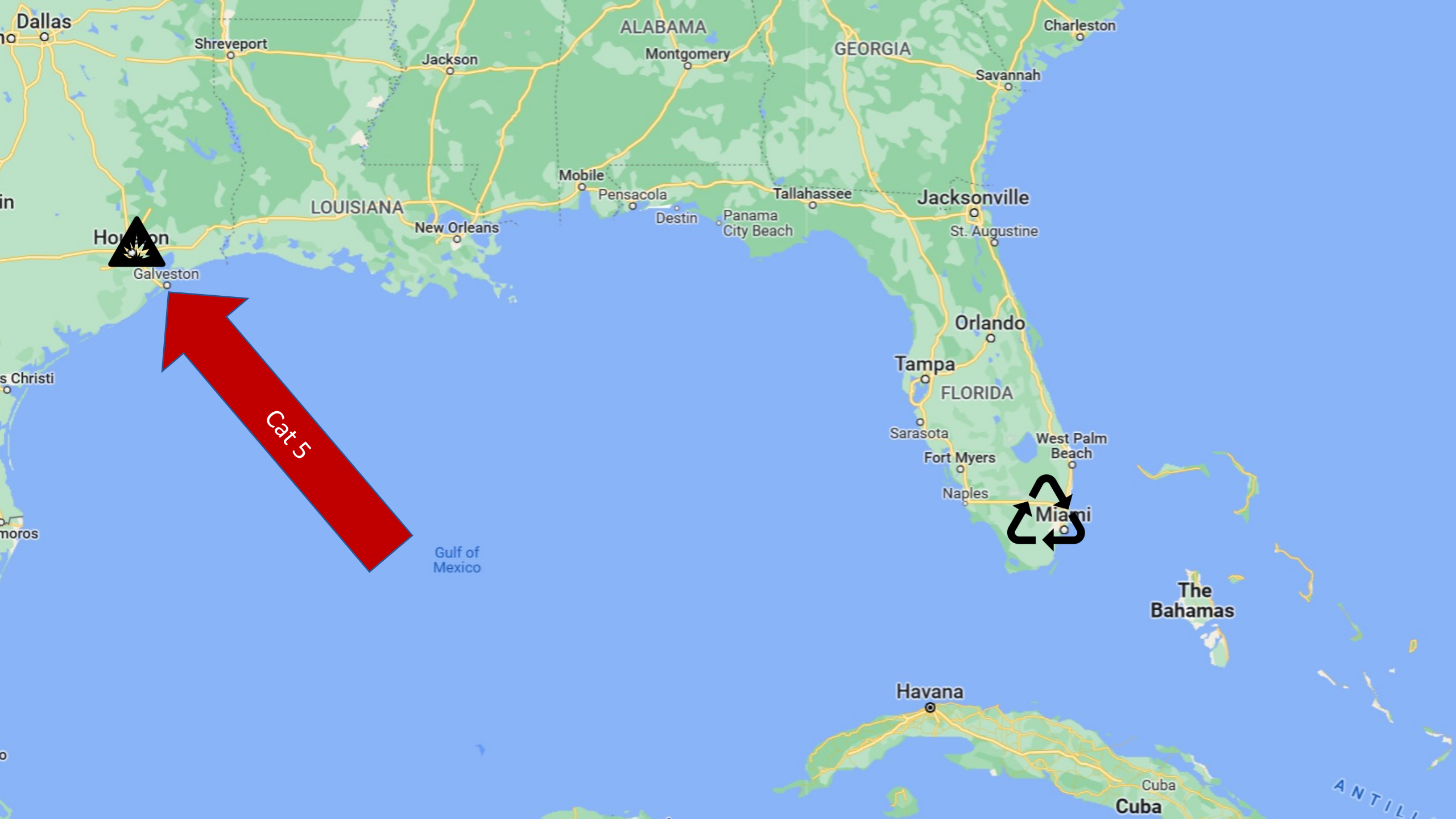
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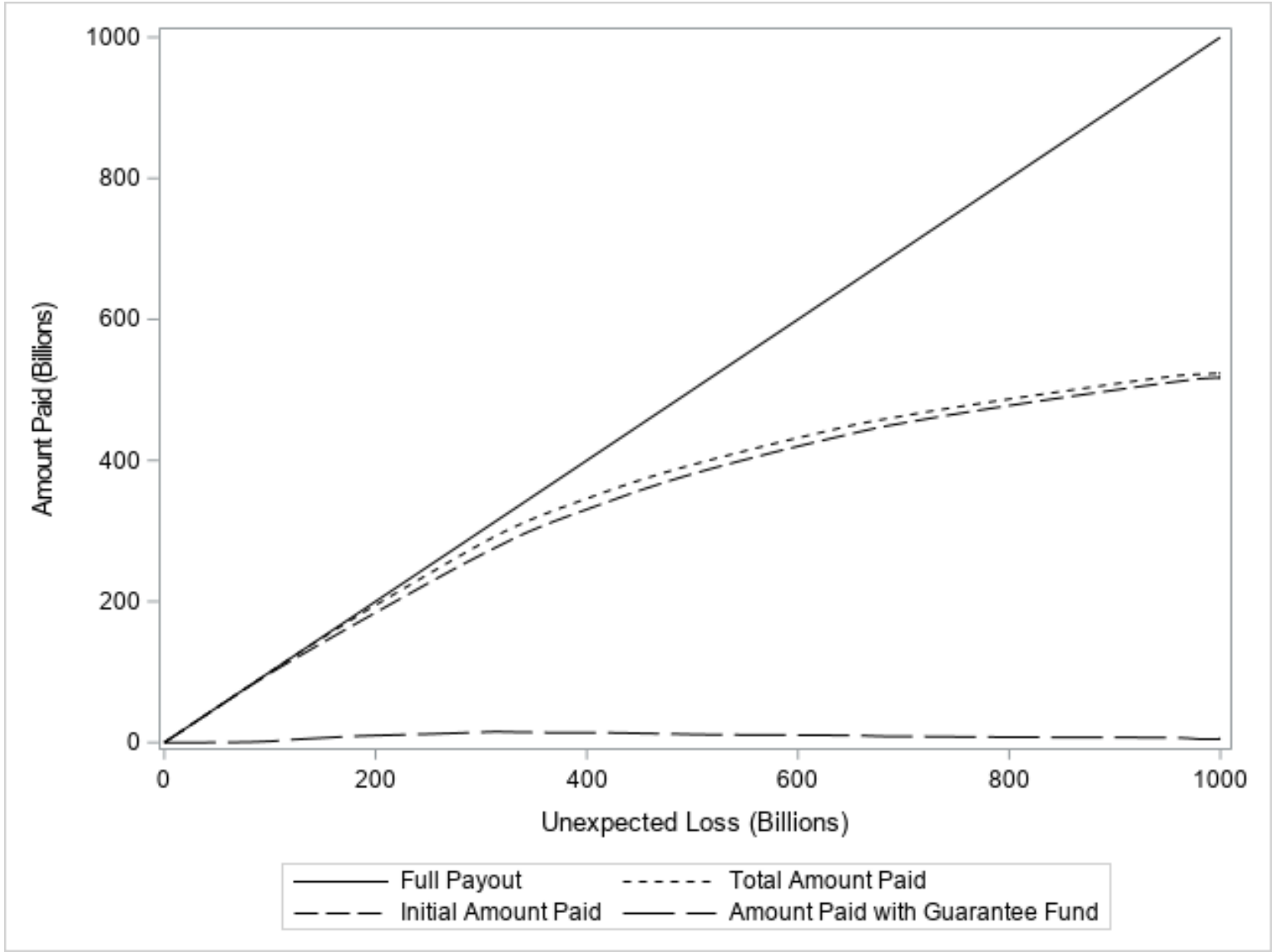
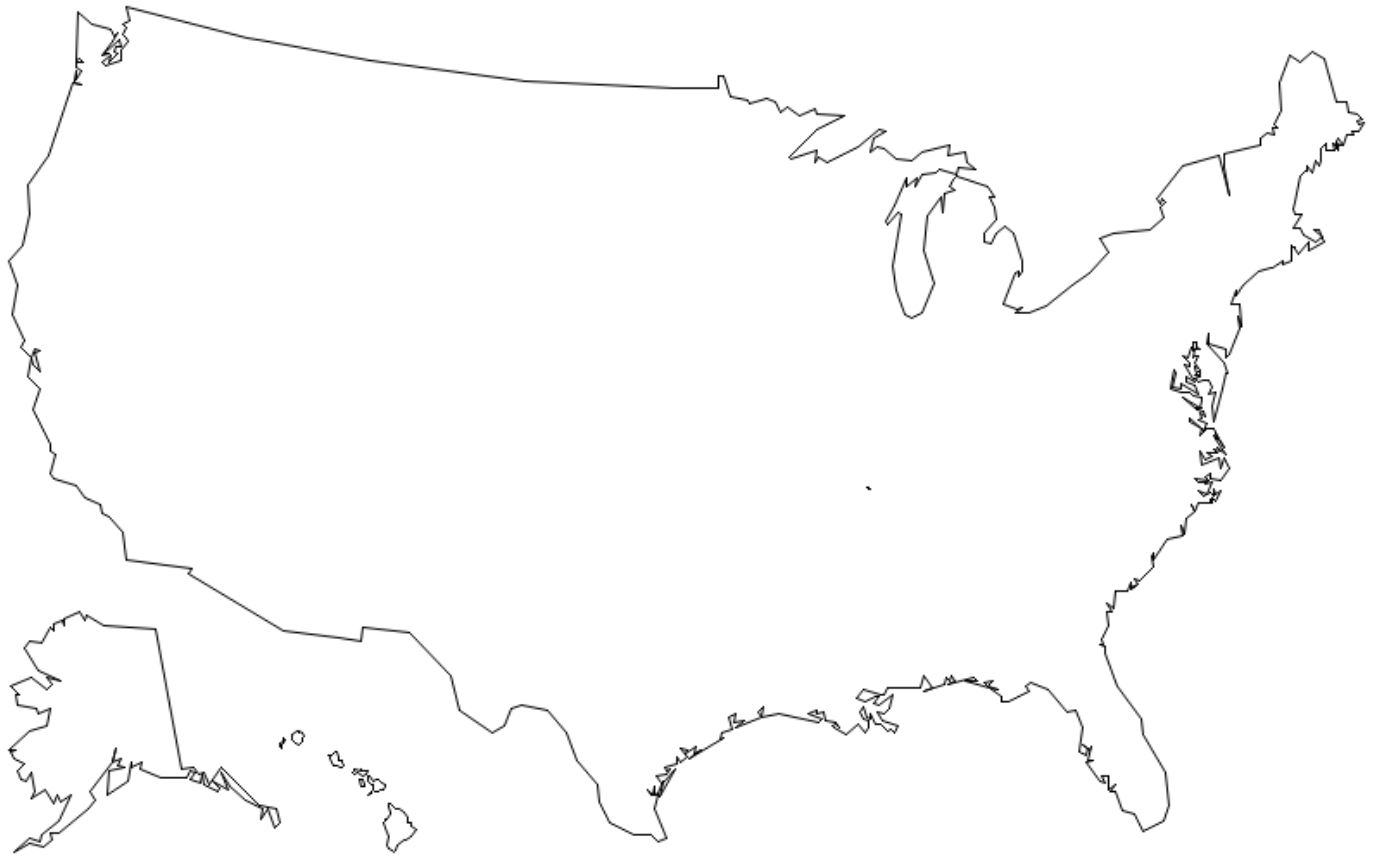
How much can insurance pay in 1st year?

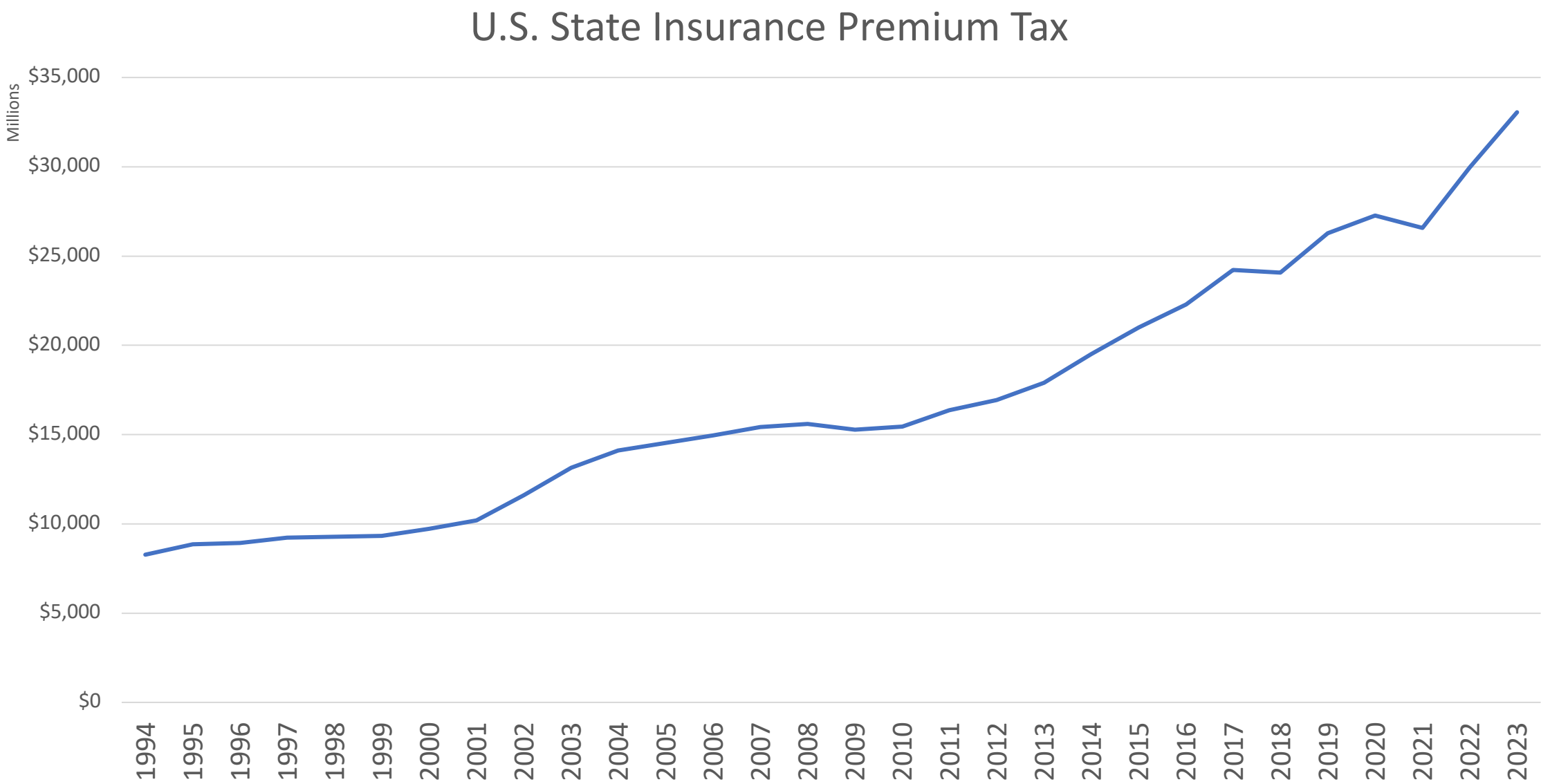


The federal solution

U.S. Insurance Regulatory Divisions

U.S. Insurance Regulatory Divisions




U.S. State Insurance Premium Tax
Millions
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
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2023

What we do

- Refine and build on the model developed by Cummins et al. (2002) to estimate each insurance company's exposure to industry-wide losses by state and line of business.
- Simulate loss events of increasing magnitude.
- Assess the capacity of the insurance industry and the efficiency of the state guaranty fund system in response to large scale loss events.
- Show how the guaranty assessments can threaten market competition and the quality of insurance products.
- Propose policy solutions.

Estimating insurer exposure

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Journal of Banking & Finance 26 (2002) 557–583

Journal of BANKING & FINANCE

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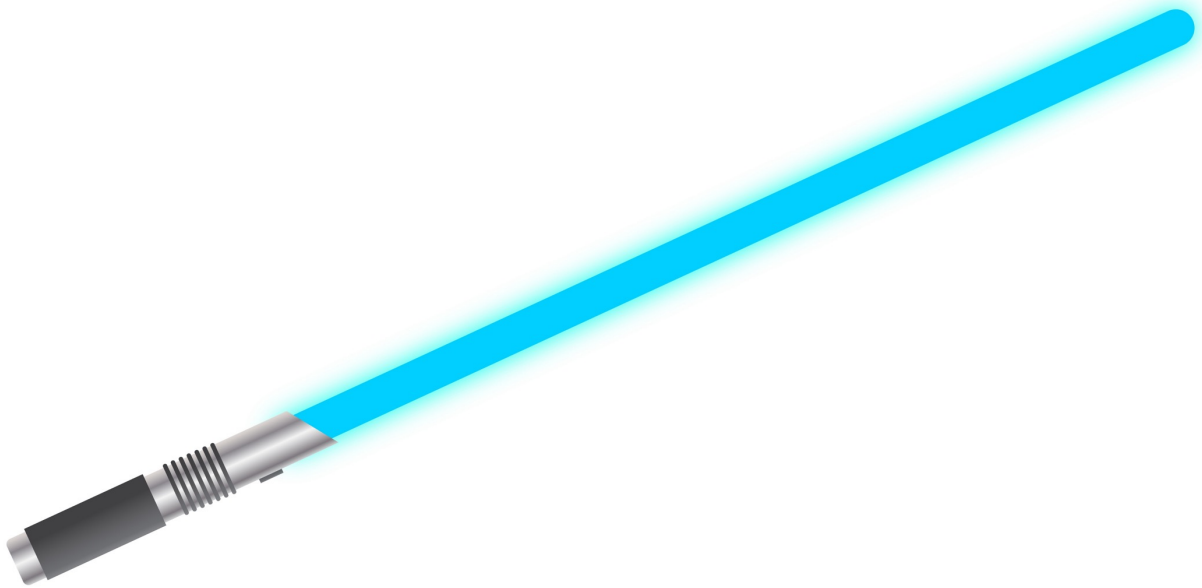
Can insurers pay for the "big one"? Measuring the capacity of the insurance market to respond to catastrophic losses

J. David Cummins *, Neil Doherty [1], Anita Lo [2]

Wharton School, University of Pennsylvania, 3641 Locust Walk, Philadelphia, PA 19104-6218, USA

Cummins, Doherty, & Lo 2002



Powell, Wunder, & Zhuang, 2024

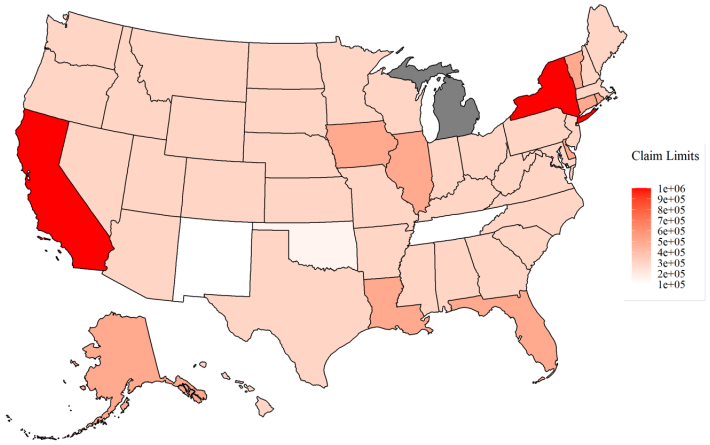
Guaranty Funds

Guaranty Fund Rules

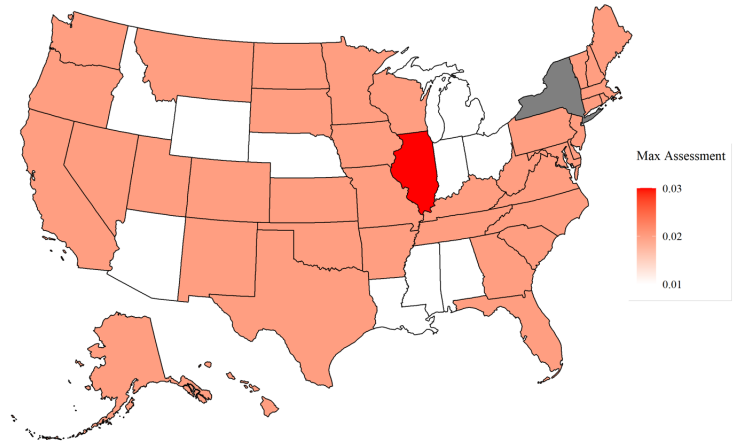
Guaranty Fund Rules

- Limit ≈ $300k per claim ($100K - $5MM)
- Assessments capped at ≈ 2% of DPW @ t-1 (1% - 3%)
- 1 to 5 accounts

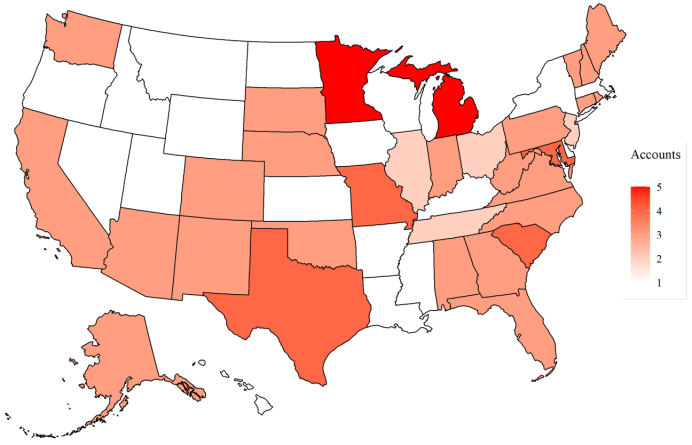
Claim Limits



Assessment Caps

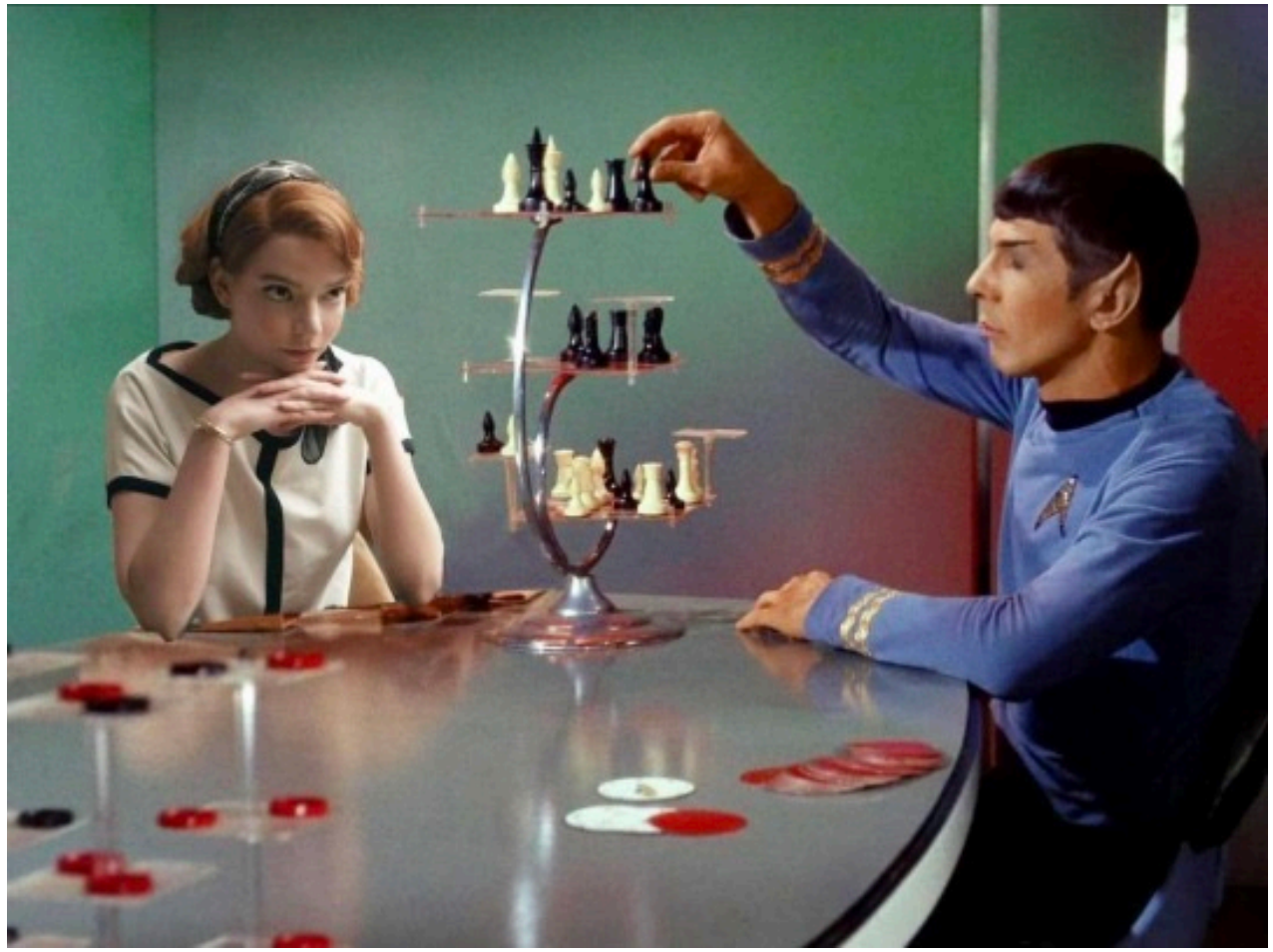


Accounts

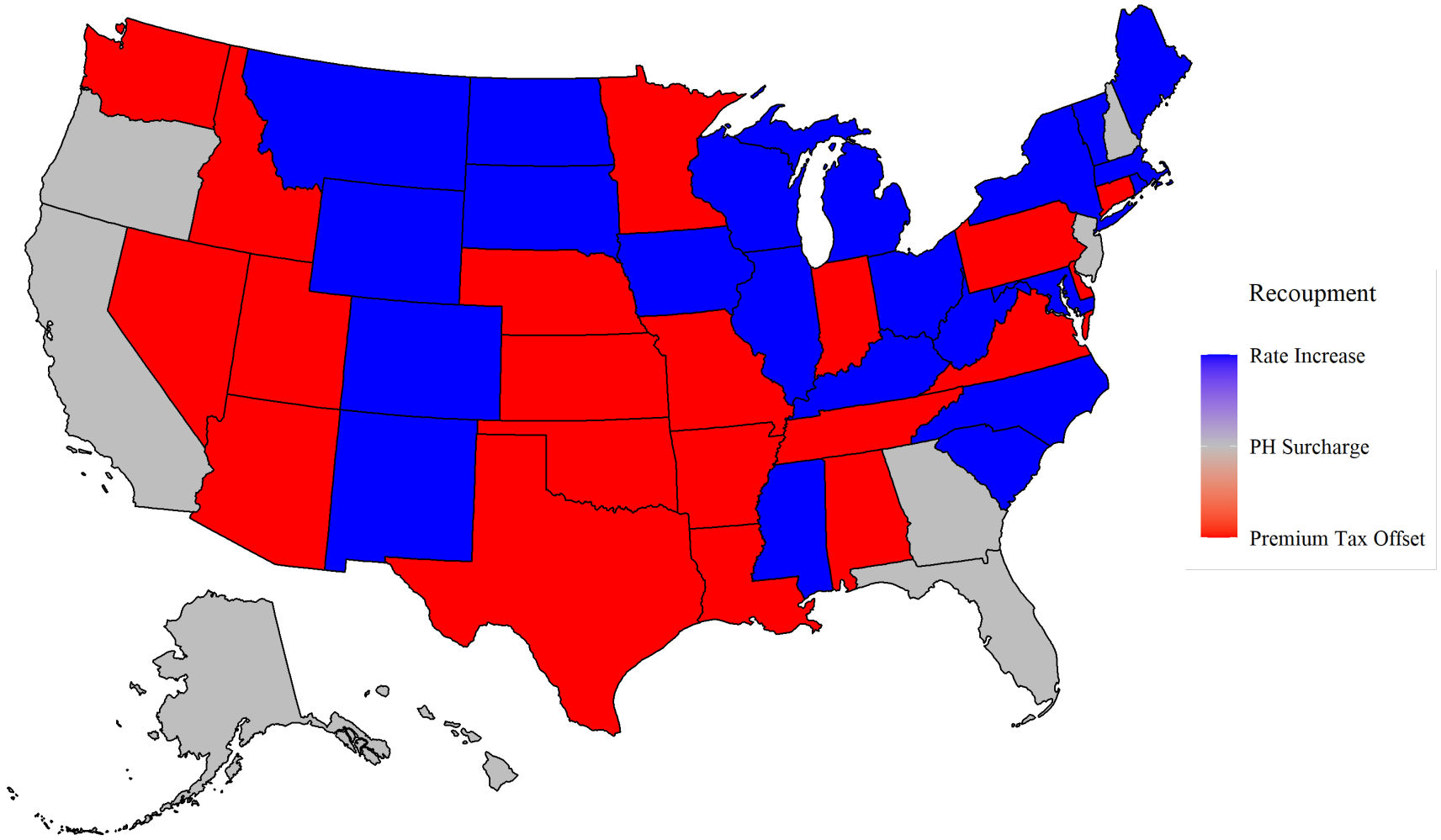


Assessment caps may apply to accounts

- One single account
- Workers compensation
- Auto
- All other
- Homeowners
- Title
- Fire & allied lines
- Domestic mutual companies



Recoupment

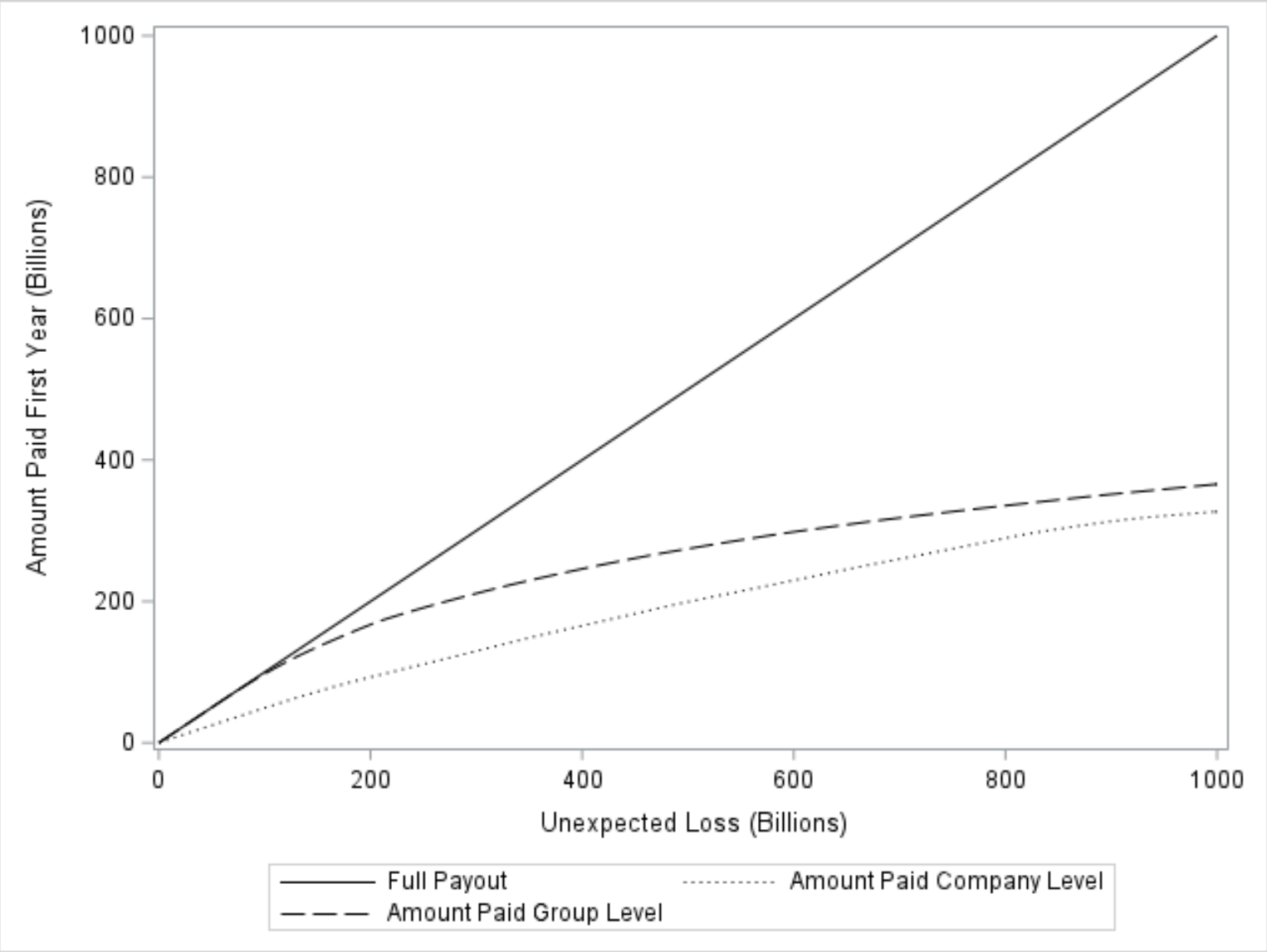


Insolvency Assumption

- Groups do not let affiliates fail?

- State Farm Florida
- Allstate Floridian
- Etc

Company vs group level payout



Estimating insurer exposure

Each dollar of loss is distributed to companies and states based on their exposure in two ways

Estimating insurer exposure: ρ_{is} & σ_{is}^2

$$\sum_{i=1}^{N} E(T_i|L) = \sum_{i=1}^{N} \int_0^{Z_i} [E(L_i) + Q_i - L_i] f(L_i|L) dL_i$$

$$(R|L) \equiv \sum_{i=1}^{N} R_i|L = E(L) + \sum_{i=1}^{N} Q_i - \sum_{i=1}^{N} E(T_i|L)$$

$$E(T_i|L) = E(L_i) + Q_i - \mu_{L_i|L} \mathrm{N}\left[\frac{E(L_i) + Q_i - \mu_{L_i|L}}{\sigma_{L_i|L}}\right] + \sigma_{L_i|L}\sqrt{\frac{1}{2\pi}} \cdot \exp\left[-\frac{1}{2}\left(\frac{E(L_i) + Q_i - \mu_{L_i|L}}{\sigma_{L_i|L}}\right)^2\right]$$

$$R_i|L = E(L_i) + Q_i - E(T_i|L)$$
$$= [E(L_i) + Q_i]\mathrm{N}(-C_i) + \mu_{L_i|L}\mathrm{N}(C_i) - \sigma_{L_i|L}\mathrm{f}(C_i),$$

$$\mu_{L_i|L} = \mu_i + \frac{\rho_i \sigma_i}{\sigma_L}(L - \mu_L),$$

$$\sigma^2_{L_i|L} = \sigma_i(1 - \rho_i^2).$$

$$\hat{\sigma}_{is}^2 = \frac{1}{T-1}\sum_{t-1}^{T}(L_{ist} - \bar{L}_{is})^2$$

$$\hat{\sigma}^2 = \frac{1}{T-1}\sum_{t=1}^{T}(L_t - \bar{L})^2$$

$$\hat{\rho}_{is} = \frac{\frac{1}{T-1}\sum_{t=1}^{T}(L_{ist} - \bar{L}_{is})(L_t - \bar{L})}{\hat{\sigma}_{is}\hat{\sigma}}$$

$$L_{ist} = \beta_{0is} + \beta_{1is}t + \varepsilon_{ist}$$

$$L_t = \beta_0 + \beta_1 t + \varepsilon_t$$

$$Pay_{is}|L = \min\left\{\hat{R}_{is}|L\ ,\ [E(L_i) + Q_i] \cdot \frac{\hat{R}_{is}|L}{\sum_s \hat{R}_{is}|L}\right\}$$

Premium method

- National and state exposure based on premium share
- Ignores potential underwriting heterogeneity
- Wind pools and FAIR Plans impose market-share exposure for the greatest risks.

How is PWZ(2024) ≠ CDL(2002)?

- Estimates at the firm/state level
- Cannot explicitly control for reinsurance
- Can study guaranty fund performance

Insolvency

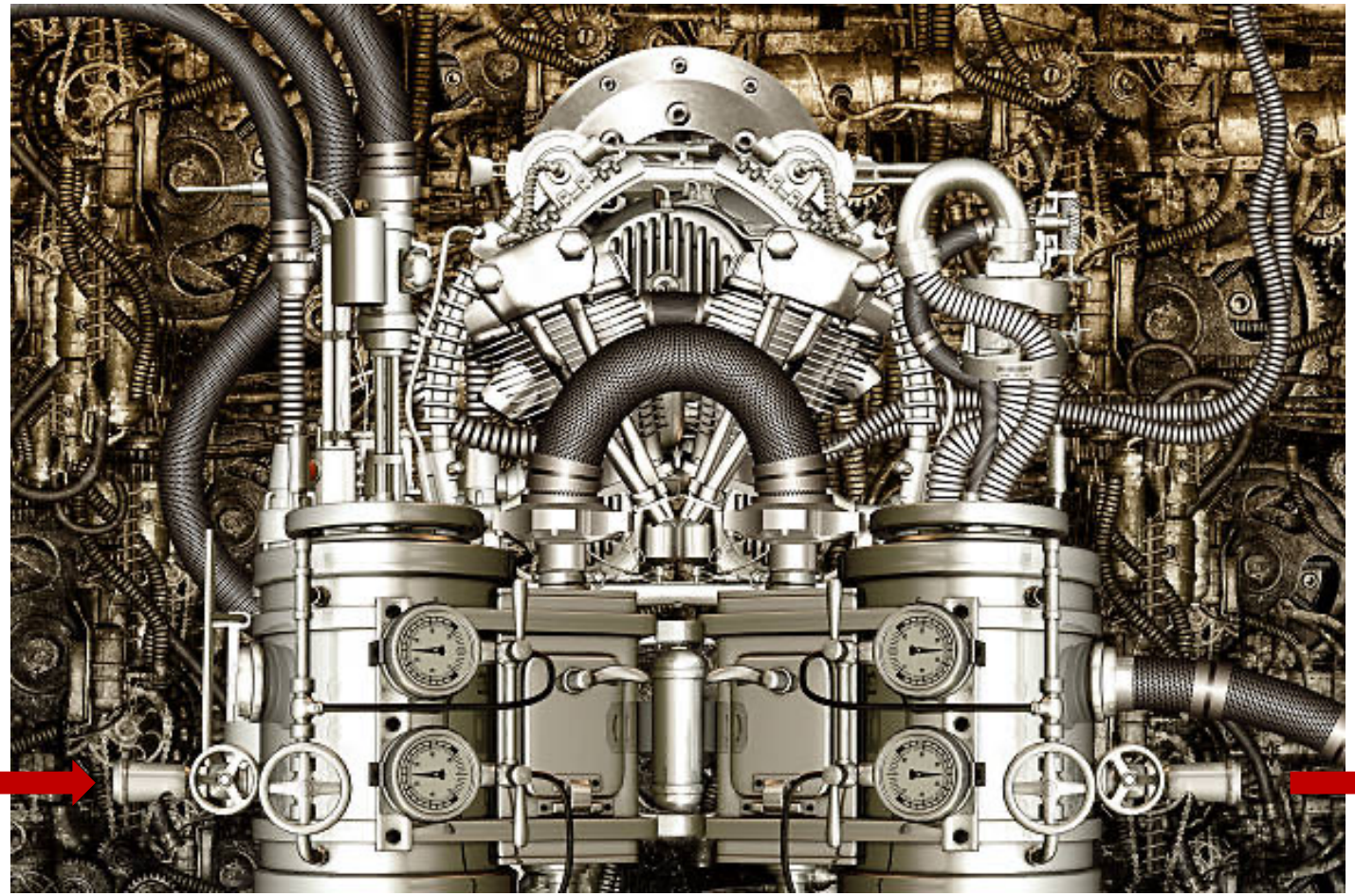
Insurers are insolvent when they run out of surplus

Remaining losses are owed by guaranty funds

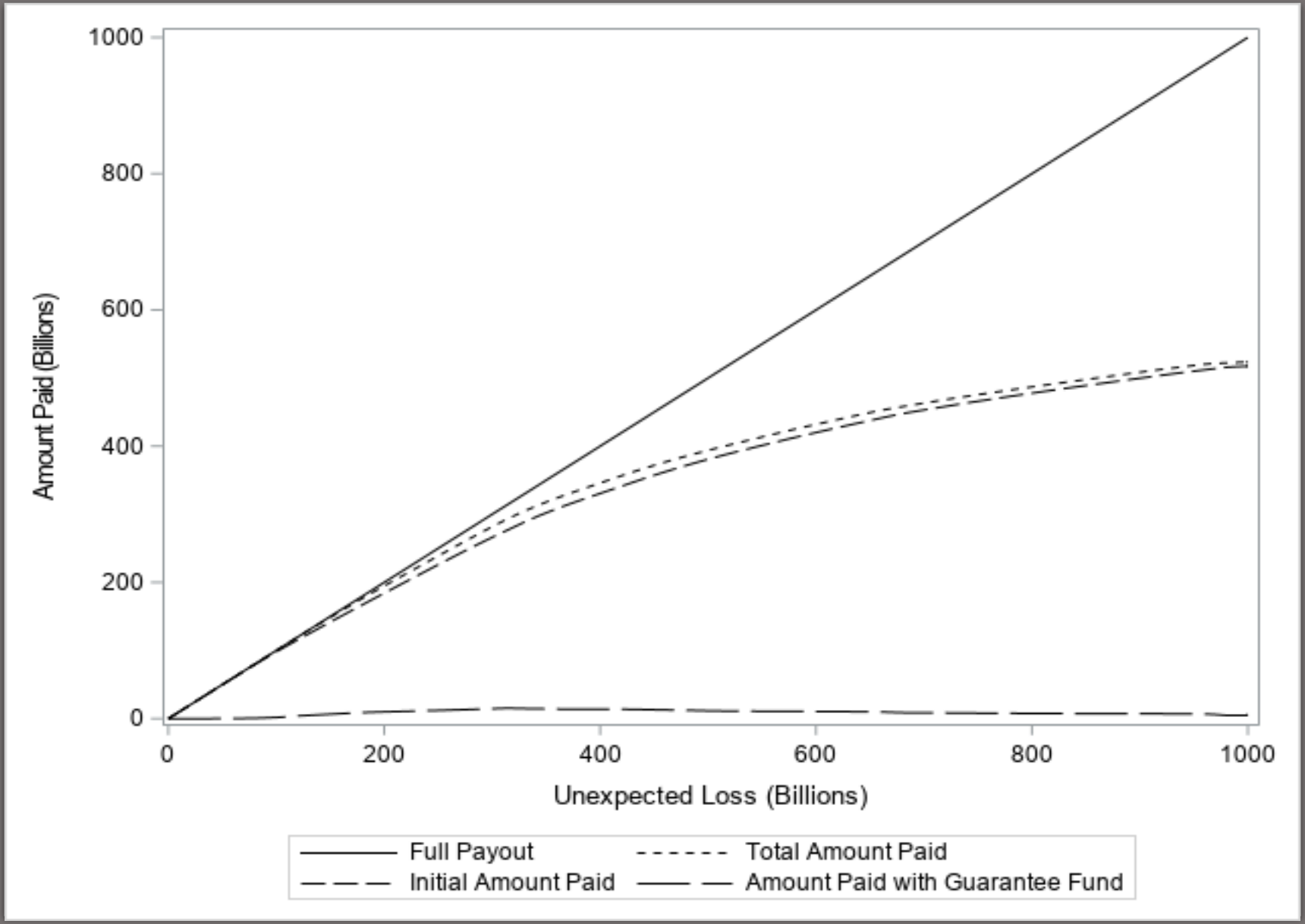
Guaranty fund assessments are limited by % of premium written and account rules

Guaranty fund payments and assessments

$Pay|L_{is}$

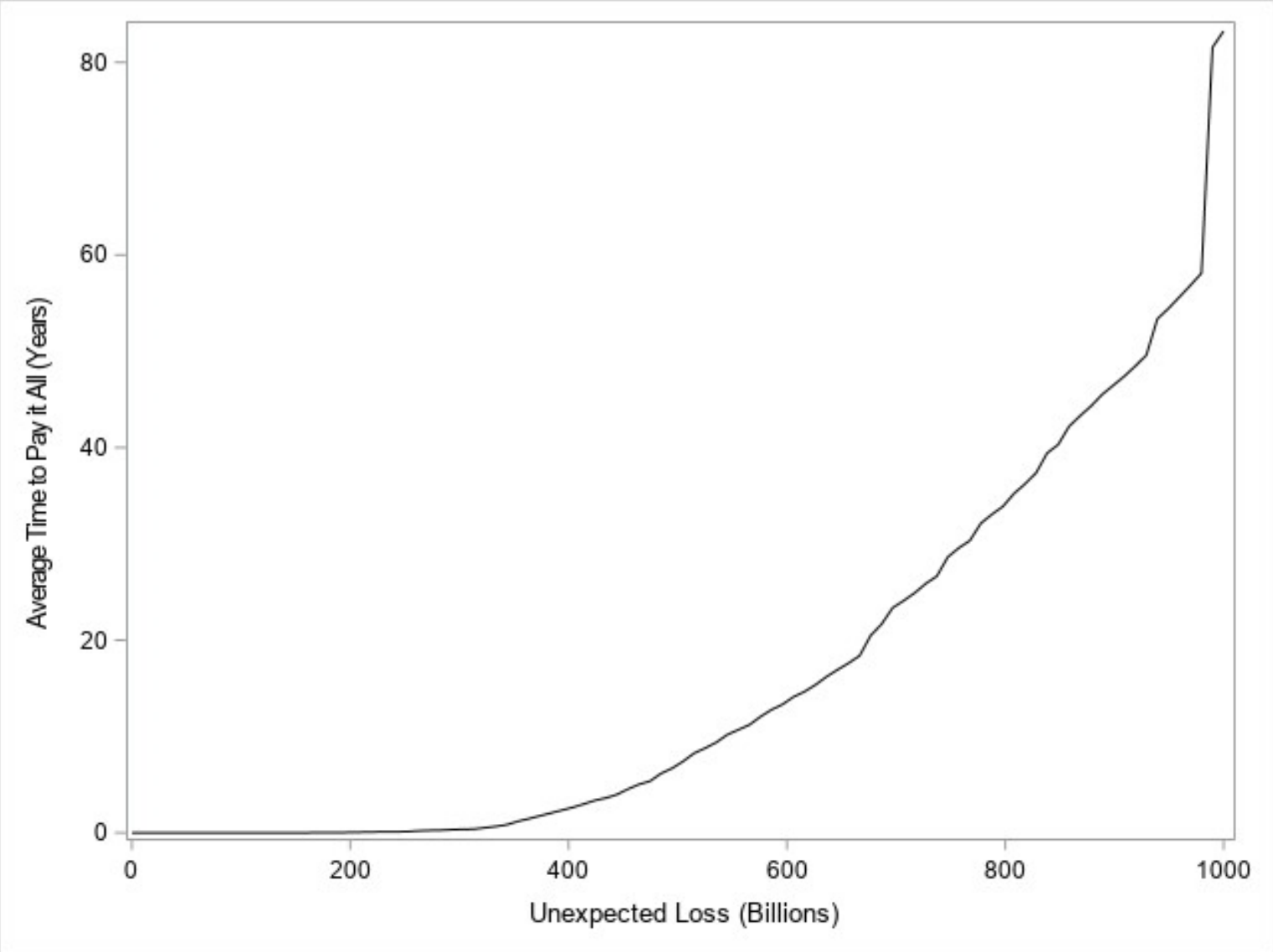


${}_1L^p_{is}$

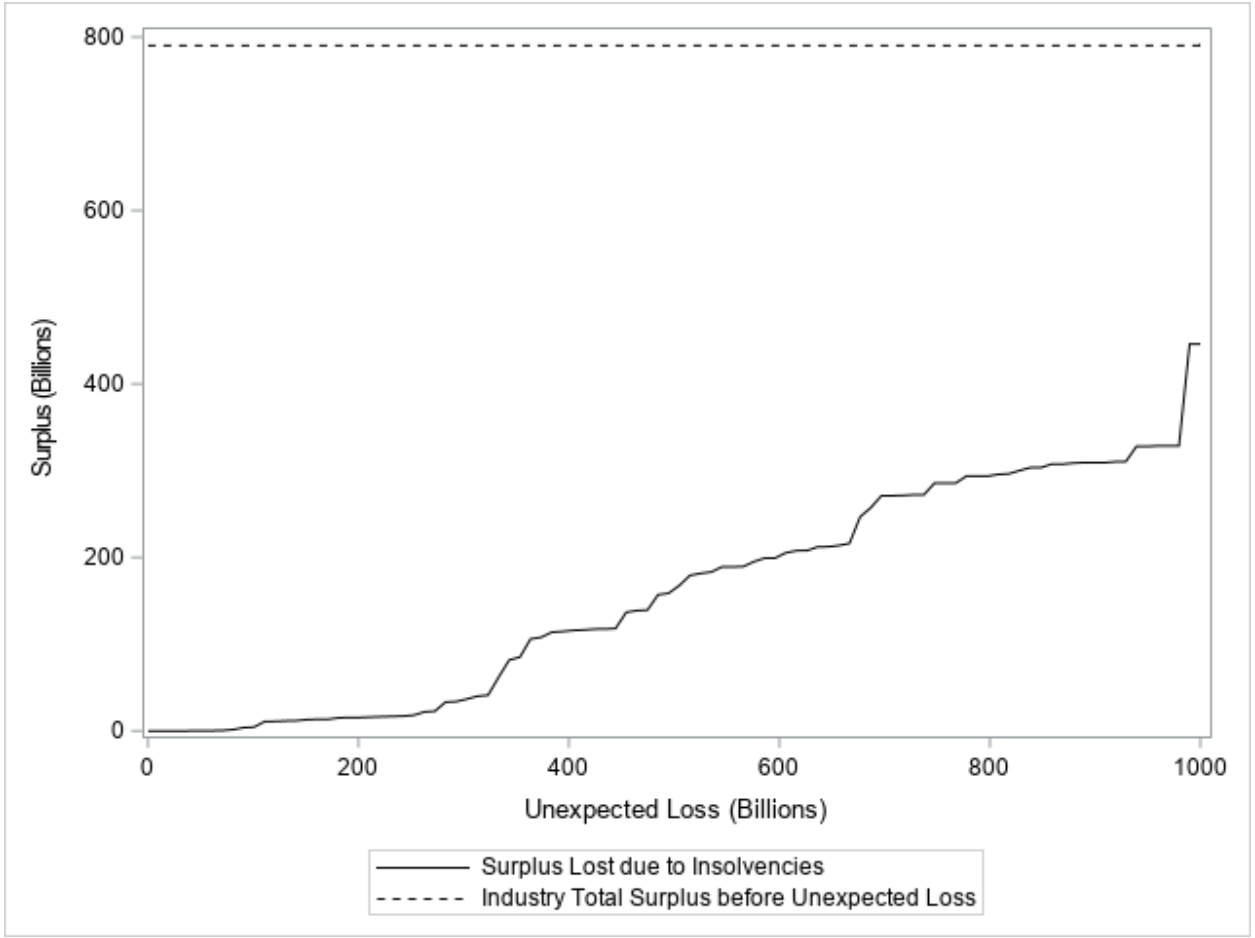


How much is paid 1st year?

Average time to full payment



Surplus paid out

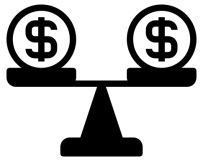


Potential consequences

- Unpaid losses
- G-fund death spiral
- Federal regulation

Public policy solutions

Prearranged debt capacity



Assessment parity with tax on new firms

Require group support

Thank you

Comments to:

Lars.Powell@ua.edu

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