Quantifying risks in a further warming world Implications for real assets

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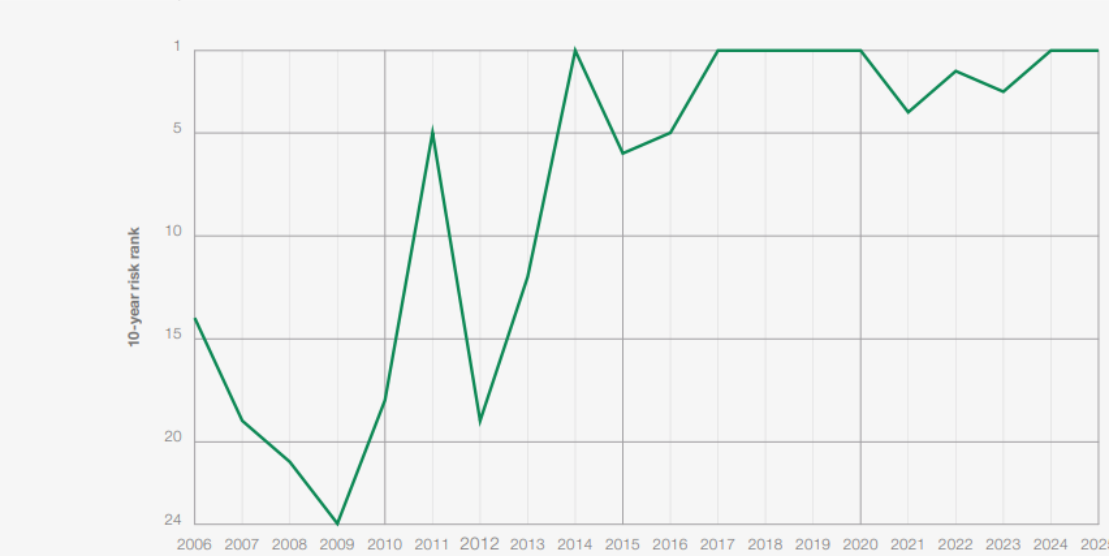
Why focus on climate?

Climate action failure and its consequences, including extreme weather, environmental damage, and biodiversity loss, are recognized as several of the top risks globally

FIGURE 2.18 | **Extreme weather events: Evolution in ranking, 2009-2025**



Global risks ranked by severity over the short and long term

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."

	2 years	10 years
1st	Misinformation and disinformation	Extreme weather events
2nd	Extreme weather events	Biodiversity loss and ecosystem collapse
3rd	State-based armed conflict	Critical change to Earth systems
4th	Societal polarization	Natural resource shortages
5th	Cyber espionage and warfare	Misinformation and disinformation
6th	Pollution	Adverse outcomes of AI technologies
7th	Inequality	Inequality
8th	Involuntary migration or displacement	Societal polarization
9th	Geoeconomic confrontation	Cyber espionage and warfare
10th	Erosion of human rights and/or civic freedoms	Pollution

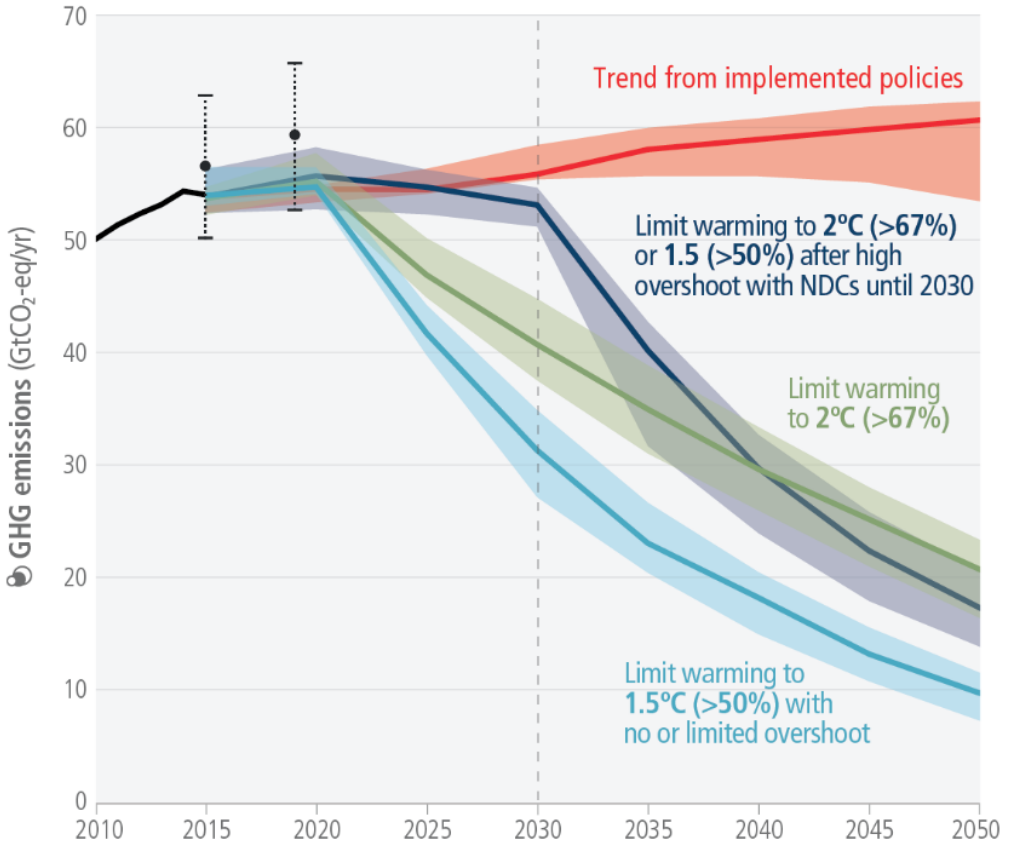
Source: World Economic Forum, Global Risks Report 2025

Why Climate Scenario Analysis?

"All scenarios are wrong, but some are useful"

- Climate change is an increasingly **important and complex** risk factor
- We cannot predict what the future will look like - **Climate change is exposed to fundamental uncertainty**
  - Lack of historical data and complex systems
- **Climate scenario analysis is a powerful tool**
  - High uncertainty and limited historical data
  - Narrative-based scenarios to evaluate a range of **plausible** outcomes

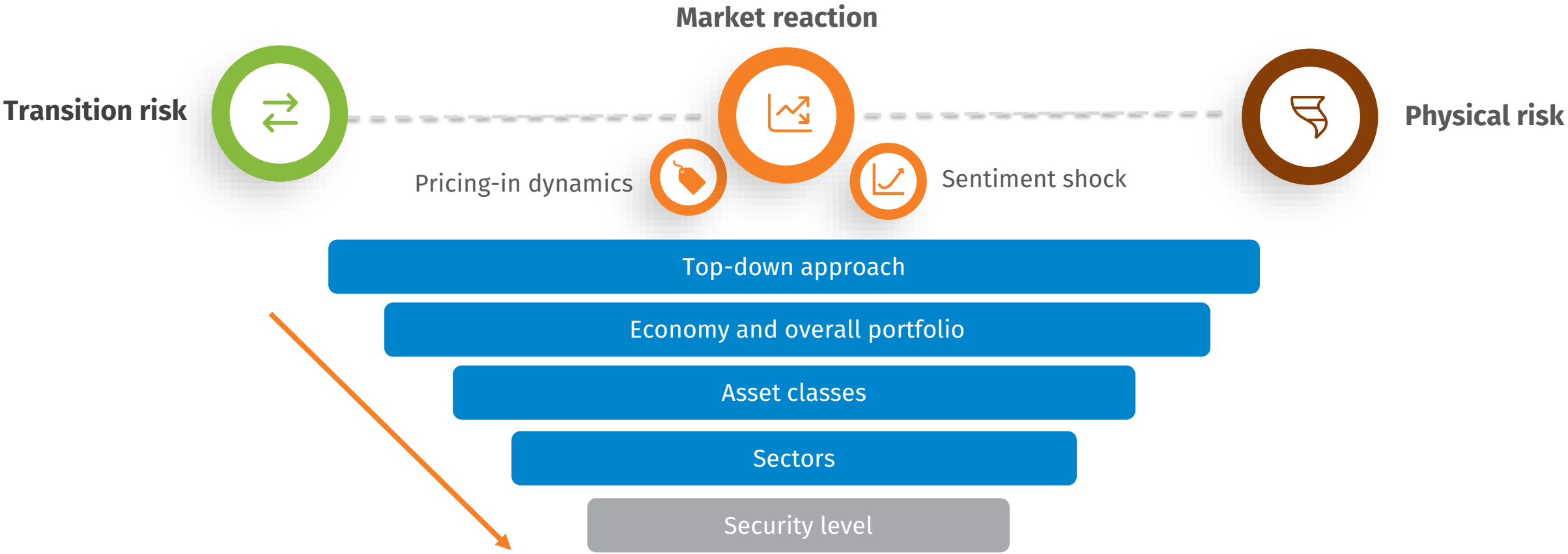
Greenhouse gas emissions under IPCC climate scenarios



IPCC (2023), AR6 Synthesis Report Climate Change 2023
https://www.ipcc.ch/report/ar6/syr/

Focus on systemic risk & top-down approach

Our approach focuses on capturing systemic climate risk and relies on a top-down approach, rather than aggregating holding-specific climate risk (bottom-up)



Purpose and interpretation of climate scenario analysis

- Climate Scenarios are plausible representations of a future successful or failed transition, based on a robust modelling framework and assumptions. The scenarios frame a quantitative and qualitative “story” which helps us to explain the relationships between inputs and outputs. However, the precise scenario story should **not be taken literally as a prediction**.

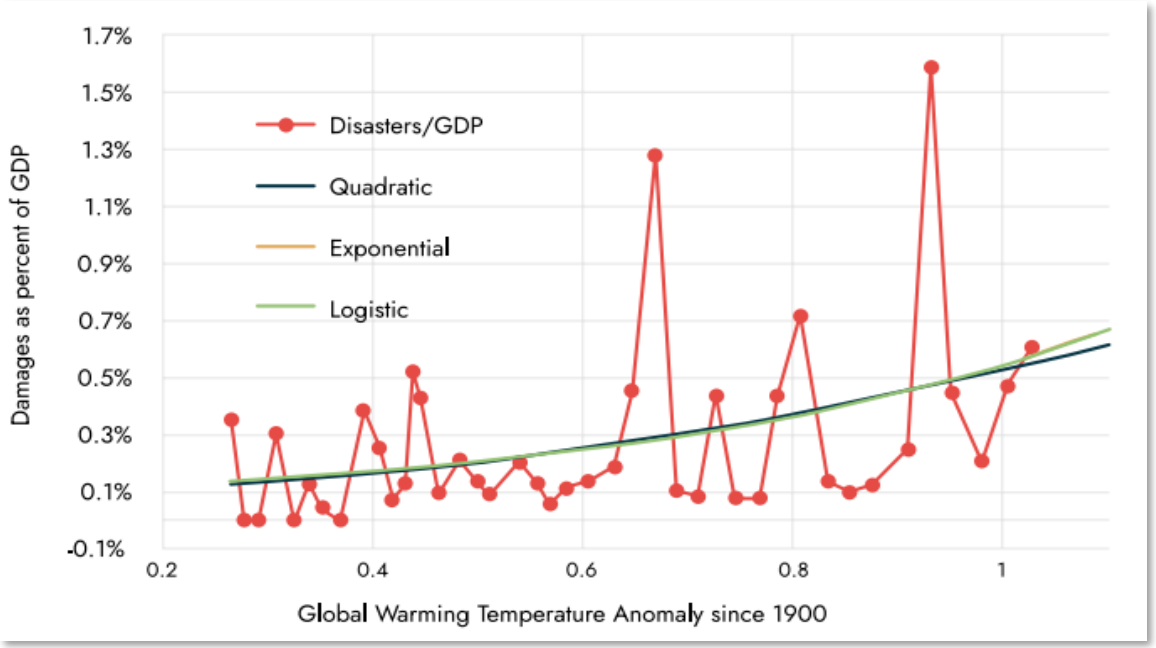
- Climate scenario analysis can help inform investment decisions by:
  - Identifying main **drivers and sources of climate risk**.
  - Evaluating and quantifying the **impact of systemic climate risk**.
  - Evaluating the resilience and consider or **prepare for options to mediate climate risk**.

- Focus on **direction and magnitude**, not exact numbers. Look for insights, not figures. Overlay these results on your views/knowledge of individual holdings/strategies and consider that the results are shown relative to the baseline.

- The climate scenarios are **not mutually exclusive**. With that, it is entirely plausible that the future holds a mixture of the scenarios that we model.

What difference a damage function makes

- Most climate scenario models (like NGFS) use quadratic damage functions for physical climate risk
- (Keen and Hanley 2023) fitted quadratic, exponential and logistic functions to NOAA data
- Functions were indistinguishable at current temperatures



What difference a damage function makes

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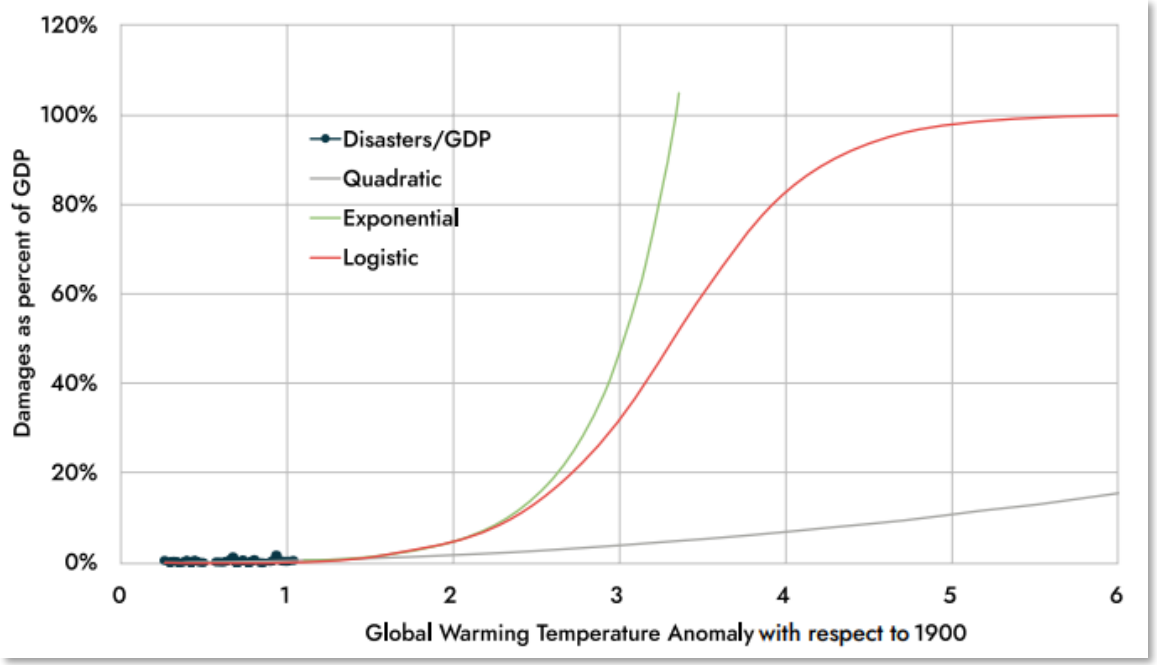
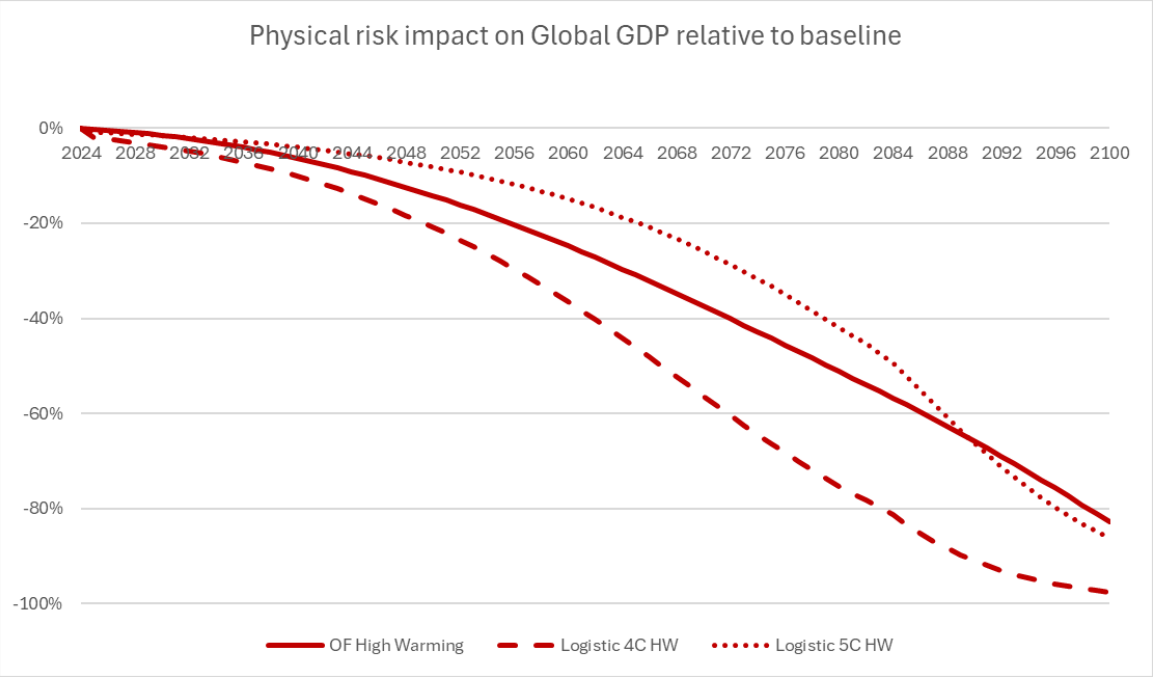
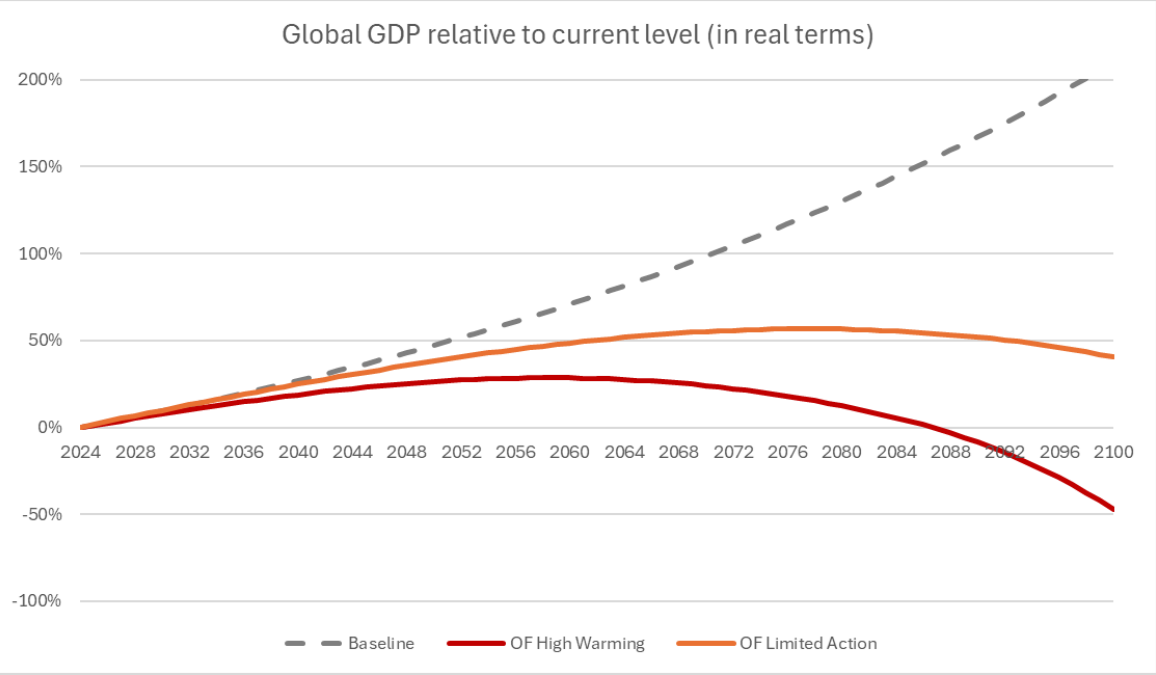
- At higher temperatures, **exponential & logistic imply 100% damages at 3-5°C**



- Quadratic is inconsistent with climate scientists
- Exponential & Logistic extrapolations are consistent :
  - “>3 °C as catastrophic;
  - >5 °C as unknown, implying beyond catastrophic, including existential threats.” (Xu and Ramanathan 2017)
- Ortec Finance climate scenarios are consistent with Logistic function

What about the Ortec Finance Climate Scenarios?





- OF High Warming scenario includes several tipping points
- Physical risk impacts similar to Logistic damage function
- Negative real GDP growth expected beyond 2060 (2080 for Limited Action)

Limited Action

Explores **falling short of meeting emissions targets** and high exposure to physical risks

2.9°C

High Warming

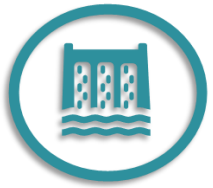
Explores **severe physical** risks under current policies

3.7°C

Deep-dive into physical risks: a top-down perspective

Acute Physical Risk Perils

Meteorological
Storms: Tropical cyclone, hurricanes, hailstorms, lightning etc.



Hydrological
Floods, mass movement (wet)

Climatological
Extreme temperatures, drought, wildfire (dry)

Geophysical
Earthquake, volcanic eruption, mass movement

Top-down vs. bottom-up put into context

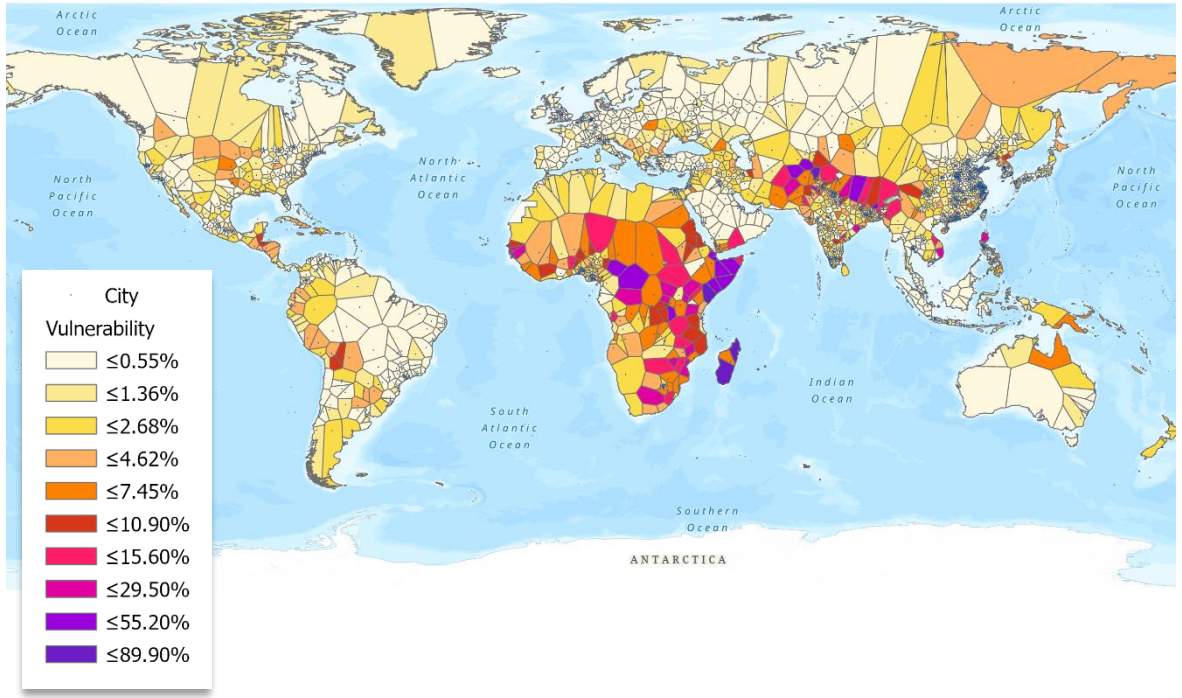
Beyond asset-level risk analysis

- In the simplified example on the right, one of the houses is not directly affected by the wildfire
- A bottom-up physical risk assessment would determine that no damage occurs due to the specific location of the house
- Top-down insights would suggest that the value of the house is impacted by the physical risk exposure of the surrounding area
- Both perspectives are important for your due diligence but often overlooked.

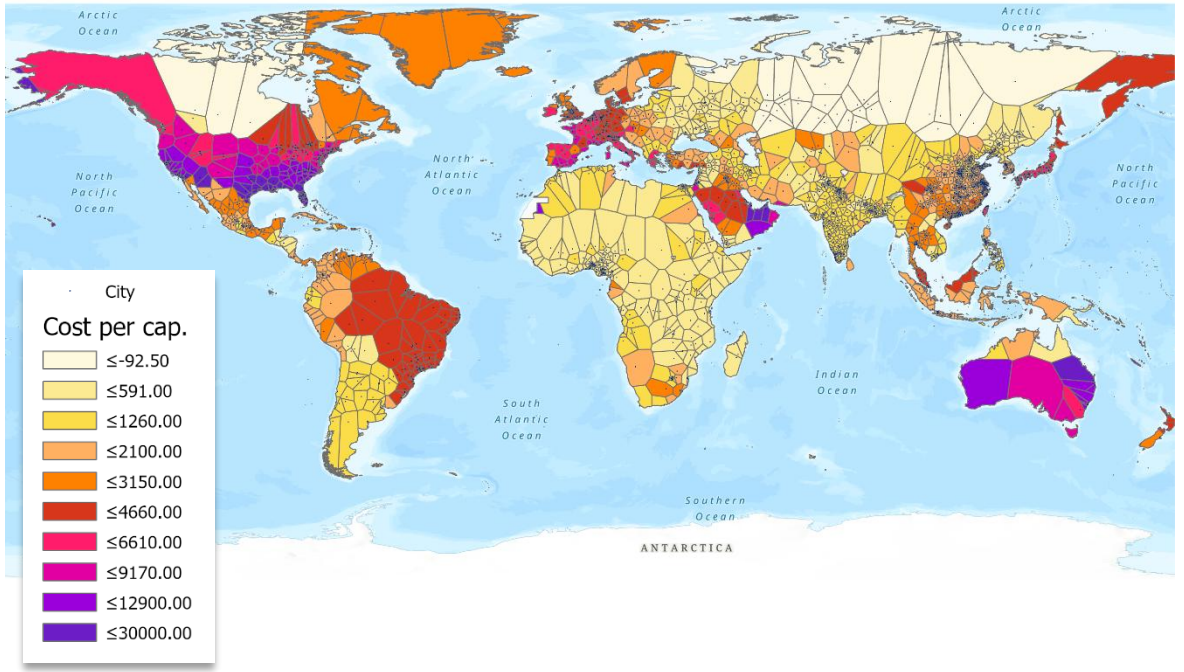
Acute Physical Risk

Visualizing Physical Risk Limited Action Scenario, 2050

Vulnerability (acute physical risk GDP impact/GDP)



GDP impact / capita (acute + chronic risk impacts)

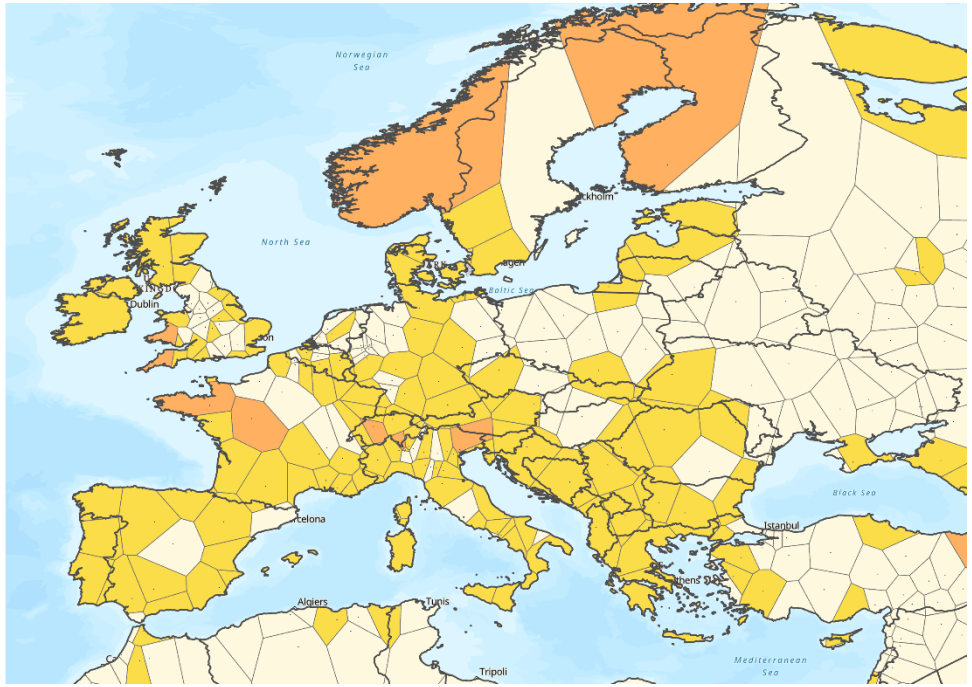


Acute Physical Risk

Europe, Limited Action Scenario, 2050

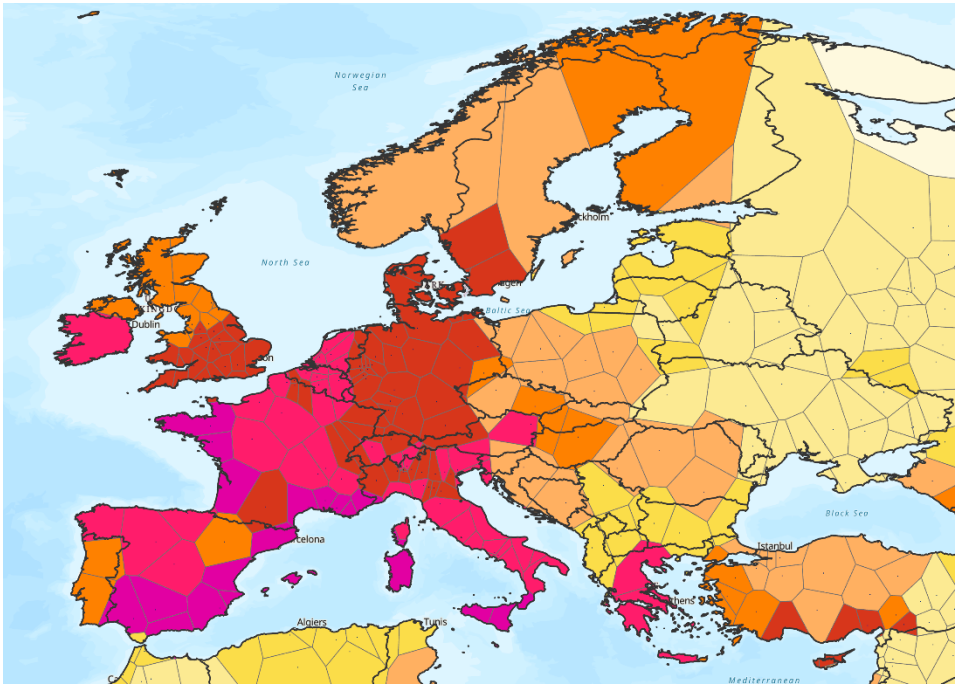
GDP impact/capita (acute)

France, Germany, Italy, Baltics, Norway, Finland



GDP impact / capita (acute + chronic)

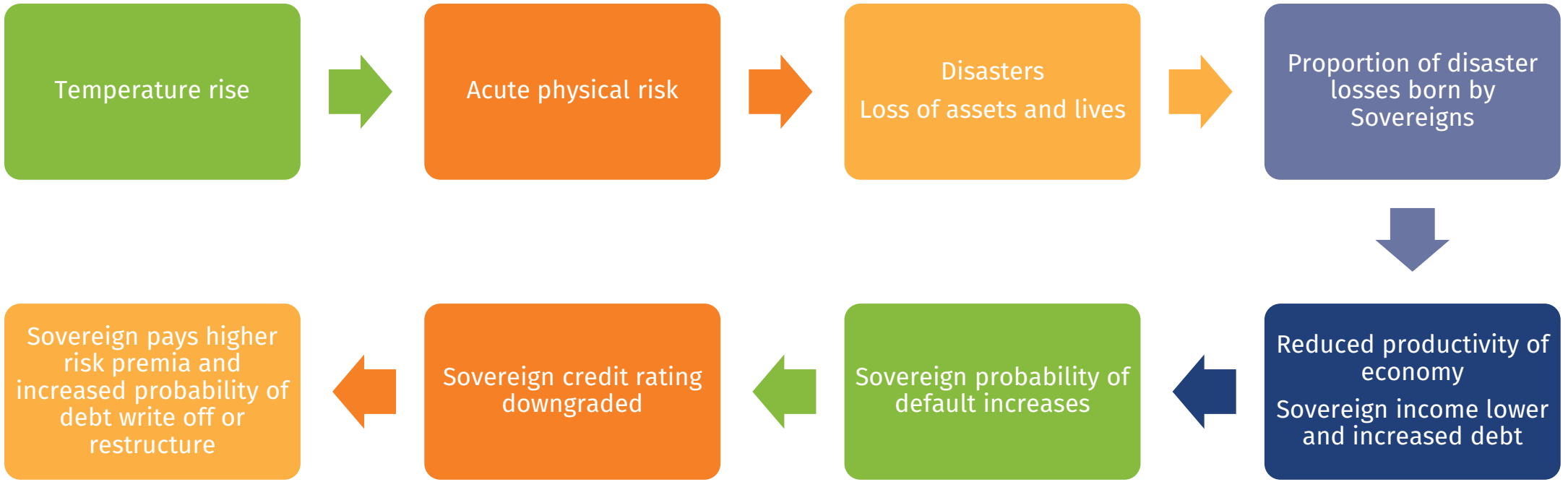
Central / Southern Europe (heat impacts)



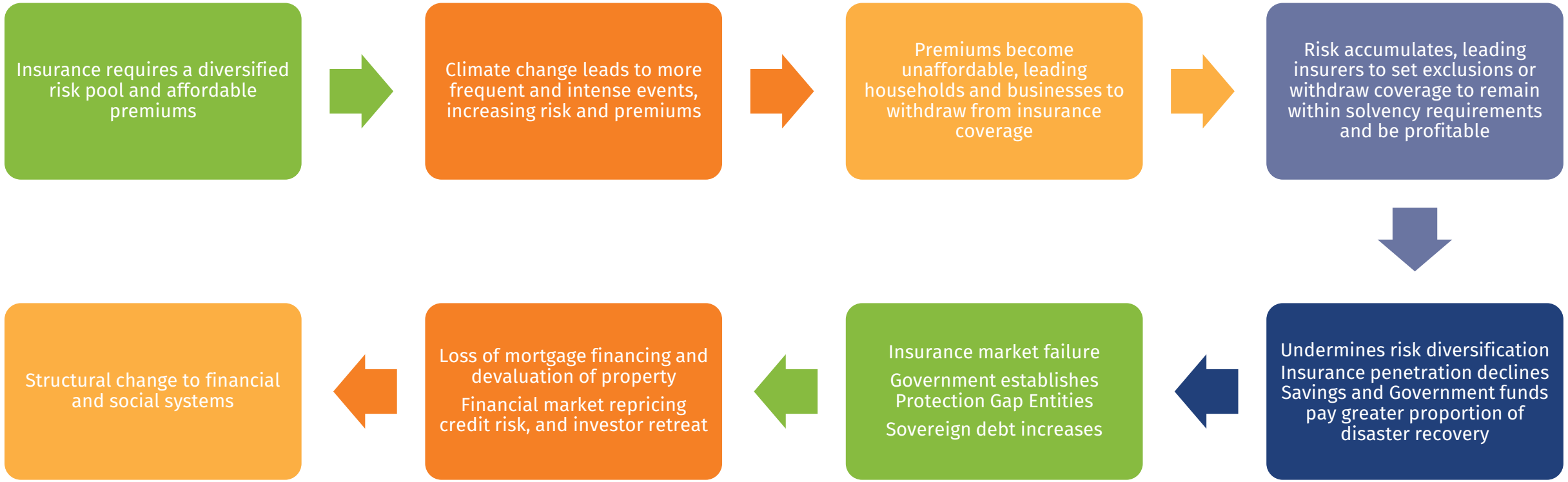
GDP Impact/capita

- ≤92
- ≤591
- ≤1260
- ≤2100
- ≤3150
- ≤4660
- ≤6610
- ≤9170
- ≤12900
- ≤30000
- City

Sovereign risk



Insurance spreads risk, until it can't



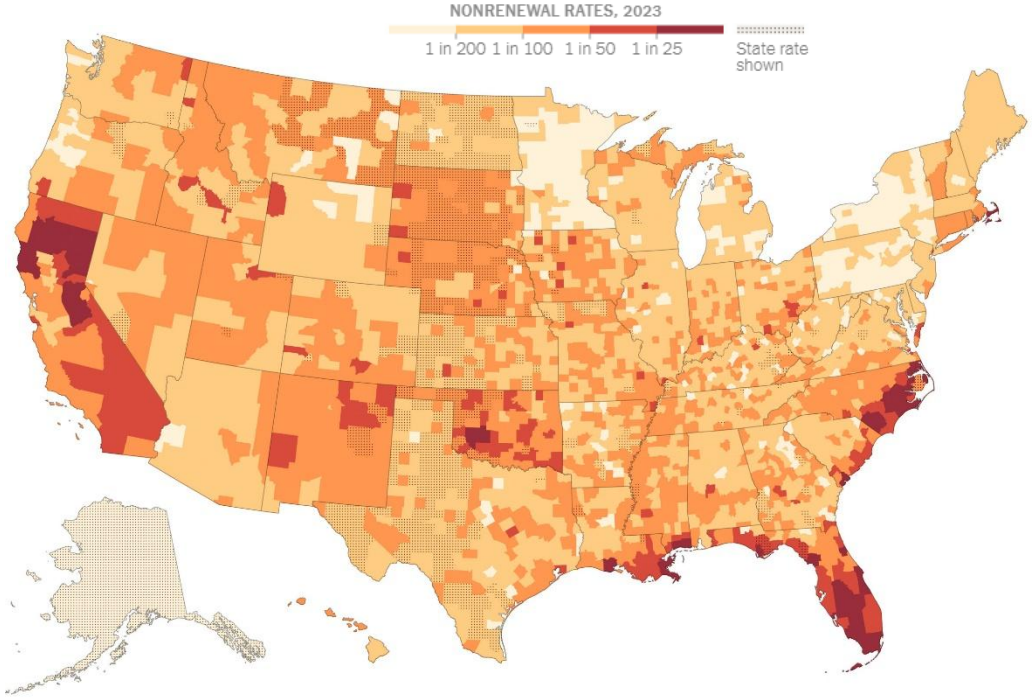
Insurer response

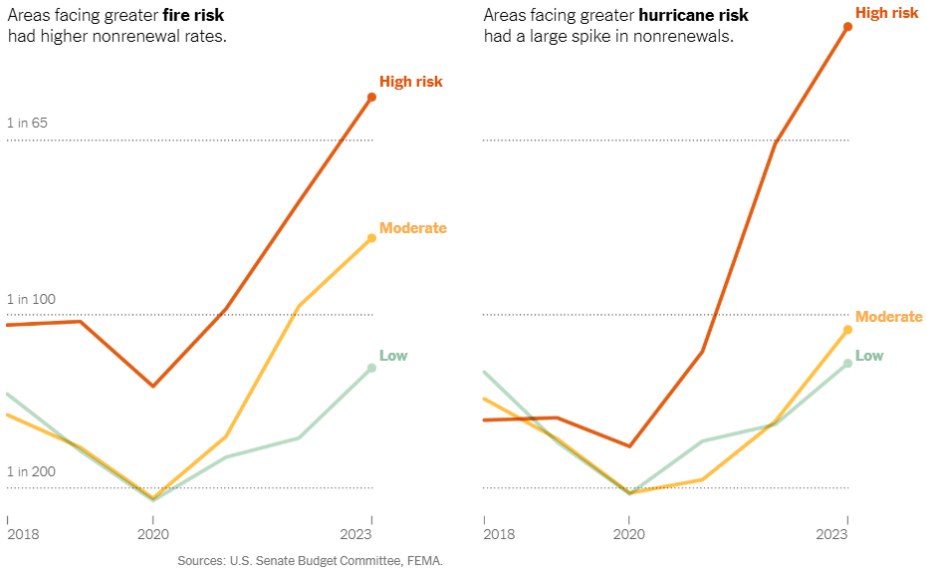
Withdrawing from cover

The New York Times Insurers Are Deserting Homeowners as Climate Shocks Worsen

Based on Senate Budget Committee enquiry

- Currently at maximum insurance penetration
- Insurers are offering and pricing policies with a conservative approach as actuarial models based on historical data are becoming obsolete
- Governments will pay a greater proportion of the economic losses from extreme weather events



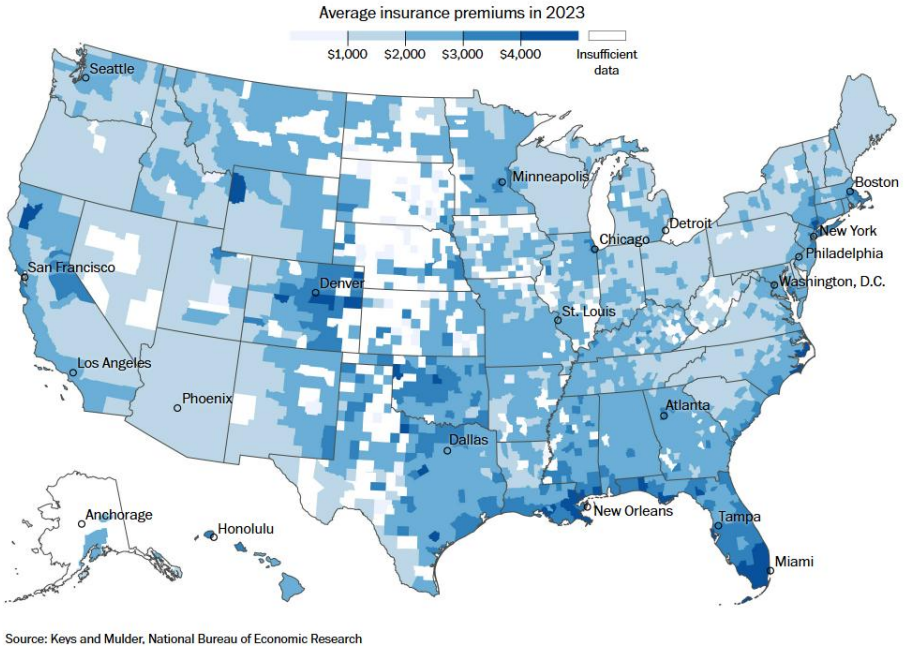


US Households

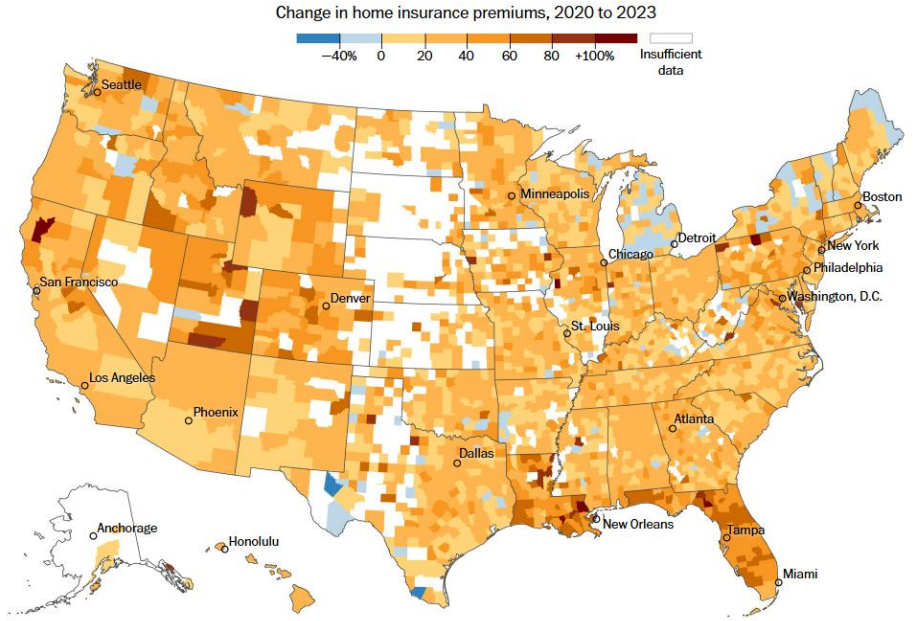
Raising premiums

- The Washington Post Insuring your home has never been harder. Here's how to do it.
- Jarzabkowski Insurance Options in a Climate Changed Future: The Way Forward for Urban Climate Policy and Practice

- Alternative insurance models to continue affordable insurance availability
  - Government-legislated risk pools
  - Parametric insurance



Source: Keys and Mulder, National Bureau of Economic Research



Source: Keys and Mulder, National Bureau of Economic Research

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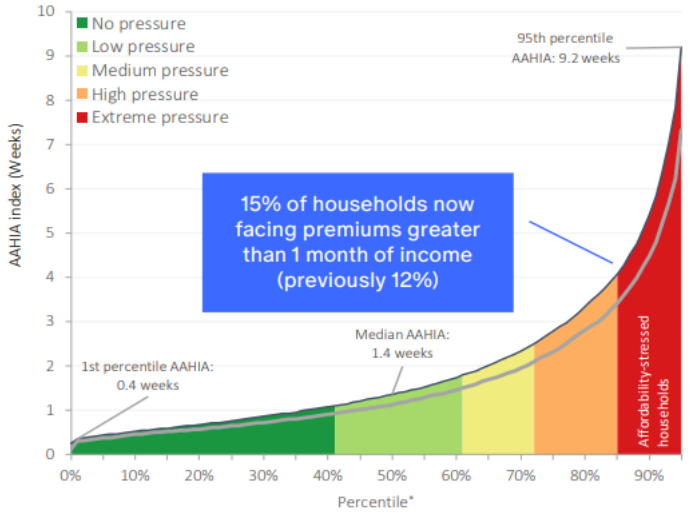
Australian Households

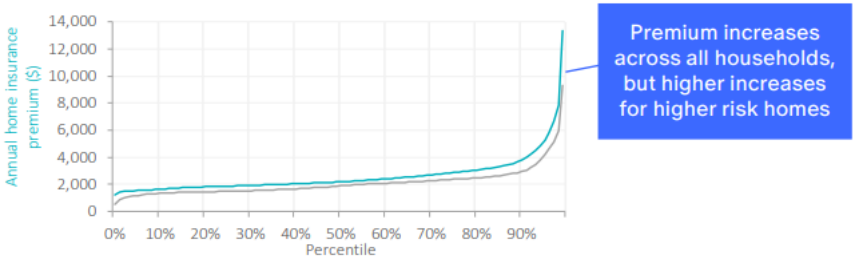
- The proportion of **"affordability-stressed"** households – those facing insurance premiums of more than four weeks of gross household income – **rose to 15% or 1.61 million households** in the year to March 2024. This is up from **12% in 2023 and 10% in 2022**.

- Home insurance premium increases are primarily a consequence of increased reinsurance costs during 2023, driven by rising costs of perils.

- An estimated 5% of Australian households with mortgages are experiencing insurance affordability stress, representing $57b of loan balances and 3% of all home loan assets.

https://www.actuaries.asn.au/research-analysis/thought-leadership/home-insurance-affordability-and-home-loans-at-risk





Pricing-in of physical risk

Kramer (2025) RERQ

- **Overall conclusion**: only the most obvious physical risks are priced, only for short-term exposure. Assets that are already significantly exposed and difficult to insure traded at a discount.
- ECB (2025): European mortgage rates are influenced by climate risk with a positive risk premium, which increased in recent years. But considerable heterogeneity in the extent that climate risk is priced and the average **risk premium is small in economic terms**, leading the authors to conclude that there is underpricing.
- Erten & Ongena (2024): loan environmental impact sensitivity only arises in areas where climate change denial is low. **Banks consider the personal beliefs in the local areas of their borrowers and especially whether the public may perceive global warming as a personal threat**. US banks reduced sensitivity of loan pricing to the environmental footprint in Republican states.
- Sirmans *et al* (2024): US commercial real estate **cap rates in locations with a higher belief in climate change are much more responsive to a change in disaster risk**. Political affiliation is the strongest demographic determinant of climate change belief by a wide margin.
- Gourevitch *et al* (2023): highly overvalued properties are concentrated in US counties along the coast with no flood risk disclosure laws and **where there is less concern about climate change**.

Conclusion and key take-aways

- Climate change and its potential economic/financial impact are subject to radical uncertainty
- Climate scenario analysis as key approach for exploring and understanding potential impact, supporting investment decisions and for regulatory reporting
- Climate change is drastically impacting the risk landscape, with sharply rising insurance premiums and increasing uninsurability in a growing number of regions.
- An insurability crisis, with insurers withdrawing from key markets, could trigger sudden repricing of real assets
- The lack of insurance coverage will also increase the risk and costs for governments, leading to higher debt levels and thus sovereign yields.
- Invest in adaptation, mitigation and resilience

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