Financial Stability and Climate Change

A race against time

Patrick Bolton
Imperial College

Banque de France
May 22-23, 2024

Outline

- Progress in grappling with the financial stability risks from climate change

- But climate change risks are worsening

- Complexities in linking climate change and financial stability risks

- Conclusion

Progress in grappling with climate change risk

- Mark Carney speech (September 2015) **"Breaking the tragedy of the horizon"**
  "*once climate change becomes a defining issue for financial stability, it may already be too late*"

- April 2018: First Climate Risk Conference for Supervisors in Amsterdam (supervisors from over 30 countries)

NGFS
Central Banks and Supervisors
Network for Greening the Financial System

October 2018 NGFS report *"climate-related risks are a source of financial risk. It is therefore within the mandates of central banks and supervisors to ensure the financial system is resilient to these risks."*

- November 2020: Fed applied for membership of the NGFS

- March 2024: NGFS consists of 138 members and 21 observers

https://www.ngfs.net/en/about-us/membership

Progress in grappling with climate change risk

1. **Forward-looking Scenarios**:

- NGFS reference scenarios (https://www.ngfs.net/ngfs-scenarios-portal/)

  - **Macroeconomic variables** (GDP, GHG emissions, Damages, Carbon tax): a. Orderly; b. Disorderly; c. Hothouse World; d. Too little too late

  - NGFS publishes a first set of climate scenarios in June 2020 "*They will allow the 66 members of the Network and the myriad financial institutions they supervise to better identify, quantify and mitigate climate risks in the financial systems*" Frank Elderson, then Chair of NGFS

- Bank of England's 2021 Biennial Exploratory Scenario (**CBES**)

  - Exploratory exercise: Asked major U.K. banks and insurers to estimate the size of climate change risks under 3 NGFS-based scenarios (decarbonization pathways) over a 30-year time horizon

  - Say how they would adjust their business models under each scenario

Progress in grappling with climate change risk

CBES Takeaways:

- UK banks and insurers are making good progress in some aspects of their climate risk management, but they need to do more

- The lack of available data on corporates' current emissions and future transition plans is a collective issue affecting all participating firms

Chart 4.1: Climate-related losses are larger in the late action and no additional action scenarios

Additional cumulative climate losses over scenario [a] [b]

Chart 4.2: Projected bank losses were highest in the late action scenario

Banks' total losses in the transition scenarios versus expected losses in hypothetical counterfactual scenario [a] [b]

Progress in grappling with climate change risk

CBES Takeaways

	Early Action	Late Action	No Additional Action
Transition risks	**Medium**	**High**	**Limited**
Transition begins in	2021	2031	n.a.
Nature of transition	Early and orderly	Late and disorderly	Only policies that were in place before 2021
Peak UK shadow carbon price (carbon tax and other policies) (2010 US$/tonne carbon dioxide equivalent)	900	1,100	30
Physical risks	**Limited**	**Limited**	**High**
Mean global warming relative to pre-industrial times by the end of scenario (°C)	1.8	1.8	3.3
Mean sea level rise in the UK (m)	0.16	0.16	0.39
Impact on output	**Temporarily lower growth**	**Sudden contraction (recession)**	**Permanently lower growth and higher uncertainty**
Average annual output growth in the UK (per cent)	1.4, 1.5, 1.6 (Year 6–10, Year 11–15, Year 26–30)	1.5, 0.1, 1.6 (Year 6–10, Year 11–15, Year 26–30)	1.4, 1.4, 1.2 (Year 6–10, Year 11–15, Year 26–30)

Progress in grappling with climate change risk

- Banque de France & ACPR (French Prudential Supervision and Resolution Authority) climate stress test pilot exercise (2021)
  - Exploratory exercise: Three NZ scenarios & one physical risk scenario (RCP8.5) over a 30-year horizon
  - **Takeaways:** French banks' & insurers' exposure to transition risks is "moderate" but a significant rise in physical risks with a widening of the *insurance protection gap*

- General takeaway from all such climate exploratory scenarios: bank losses estimated to be lowest in early (orderly) decarbonization scenario

- Fed Board pilot climate scenario analysis (**CSA**) 2023:
  - Six BHCs participate
  - Ongoing

Progress in grappling with climate change risk

- Survey article (2023) *ARFE* *"Climate Stress Testing"* by Acharya, Berner, Engle, Jung, Stroebel, Zeng, and Zhao

➢ Scenario design, **open questions**:

1. Complement transition pathways with "*policies and private responses*" in a sub-game perfect equilibrium
2. Explicitly specify feedback loops from CC to the economy
3. Tail risk and climate tipping points

➢ Market-based climate stress testing methodology (**CRISK**):

— Climate risk factor
— Bank exposure to factor (stock return sensitivity)
— CRISK: expected capital shortfall conditional on climate stress

— **Main difficulty:** "*no past climate episode that can serve as a stress event to test the validity of CRISK*"

Recent Contributions: more granular tests

- **The Road to Paris: stress testing the transition towards a net-zero economy** (2023) ECB occasional paper 328

➢ Three **short-term** transition scenarios
➢ Granular sectoral dynamics
➢ impact on the euro area corporate sector and on the financial system

➢ **Some key findings.** Consistent with the three scenarios:
— detailed projections of change in energy mix & investment (with sectoral breakdown) + expected energy prices until 2030
— Impact on corporations → energy price shock and profitability (based on firm-level scope 1 and 2 emissions)
— Impact on credit risk: "*corporate PDs would increase the most under the late-push transition scenario*"
— Large sectoral heterogeneity
— Around 40% of banks' corporate loan portfolios are in (high risk) energy-intensive sectors

Recent Contributions: more granular tests 2

- **U.S. Banks' Exposures to Climate Transition Risks** (2024) Jung, Santos, and Seltzer

➢ A quantitative general equilibrium approach

➢ Sectoral breakdown of energy transition (based on Jorgenson, Goettle, Ho, and Wilcoxen, 2018, Goulder and Hafstead, 2018, and G-Cubed NGFS, 2022)

➢ Loan-level data on US banks' sectoral exposures

➢ Key difference with ECB study is GE (strength: includes feedback effects – weakness: potential model misspecification)

➢ **Main finding**: US banks' exposures to transition risk are modest

Recent Contributions: more granular tests 3

- **Transition risk and imperfect competition: evidence from a structural model of the Italian credit market,** Paolo Farroni (BOI) (2024)

➢ A structural model of the Italian credit market

➢ Uses EU Taxonomy to determine transition risk exposure of firms

➢ Counterfactually increases the cost of lending to firms that are more exposed to transition risk

➢ **Main finding**: interest rates for exposed firms would increase by 0.7 to 1.34 percentage points on average for a one standard deviation increase in marginal transition costs

Complexities in linking climate change and financial stability risks

Grappling with climate change risk: Some theoretical issues

I] Filling the gaps between Macro NZ Targets and Micro (sectoral and firm-level) transition pathways

→ NZ targets are for the most part target year 2050 goals, with some interim targets 2030

→ No commitment to carbon-budget constraints

→ NGFS is filling in the blanks by specifying year-by-year pathways (these are indicative)

→ How to decentralize the aggregate pathway to the sectoral level and the firm level?

→ Ideally, there should be a (shrinking) carbon allowance per firm (as in the ETS) with a comprehensive emission allowance trading system

Grappling with climate change risk: Some theoretical issues

II] What if climate change is faster than predicted?

→ Physical damages will be significantly higher & the insurance protection gap will widen

- ➢ greater negative productivity shocks
- ➢ greater contingent fiscal liabilities

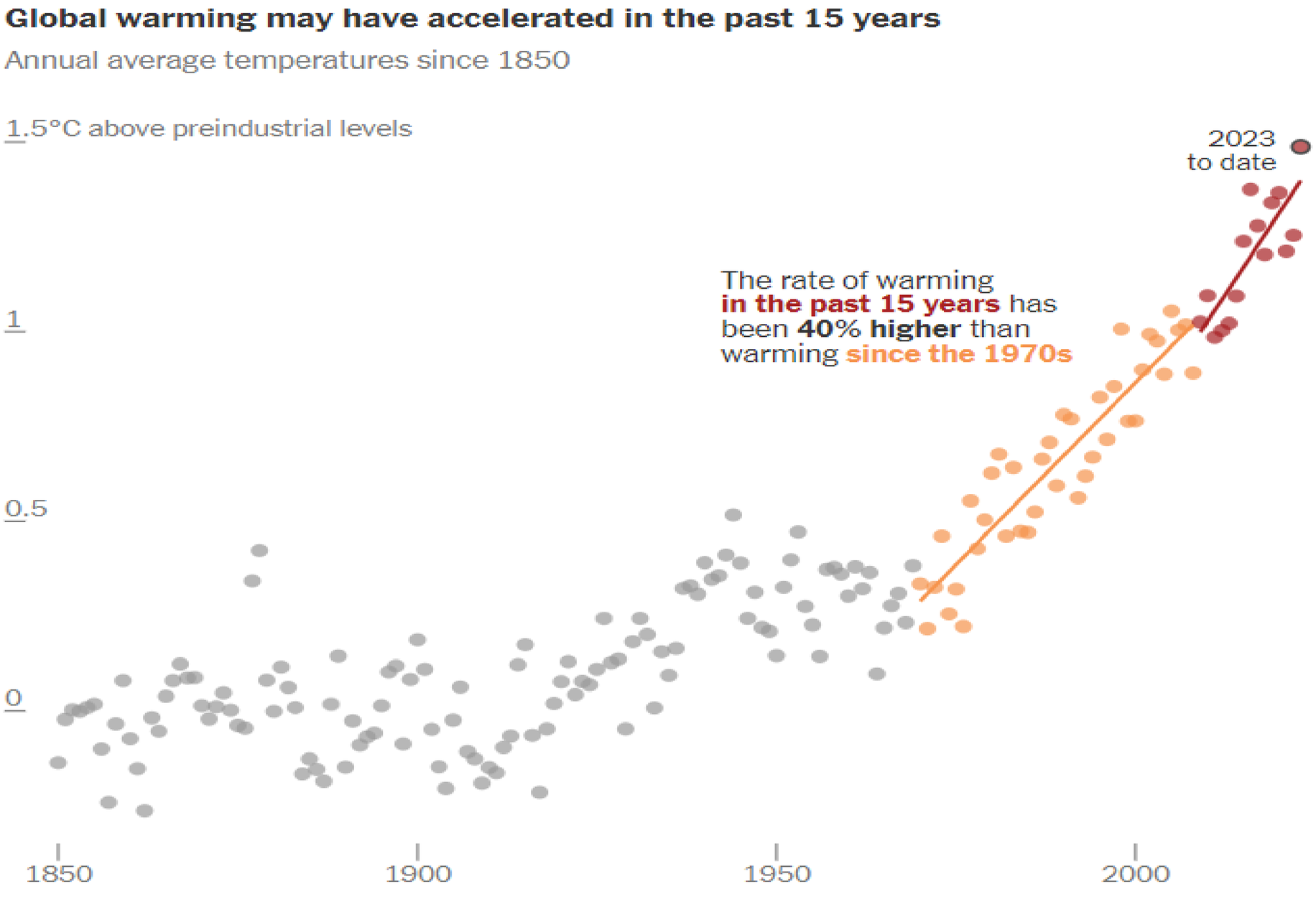
→ Risk of crossing a hothouse tipping point (*Ice–albedo feedback*)

→ NZ commitments are built around notional temperature rise limits (1.5^0C or 2^0C)

- ➢ accelerating climate change may induce drastic revisions towards much tighter NZ commitments (switch to disorderly and hothouse world scenarios?)

What if climate change is faster than predicted?

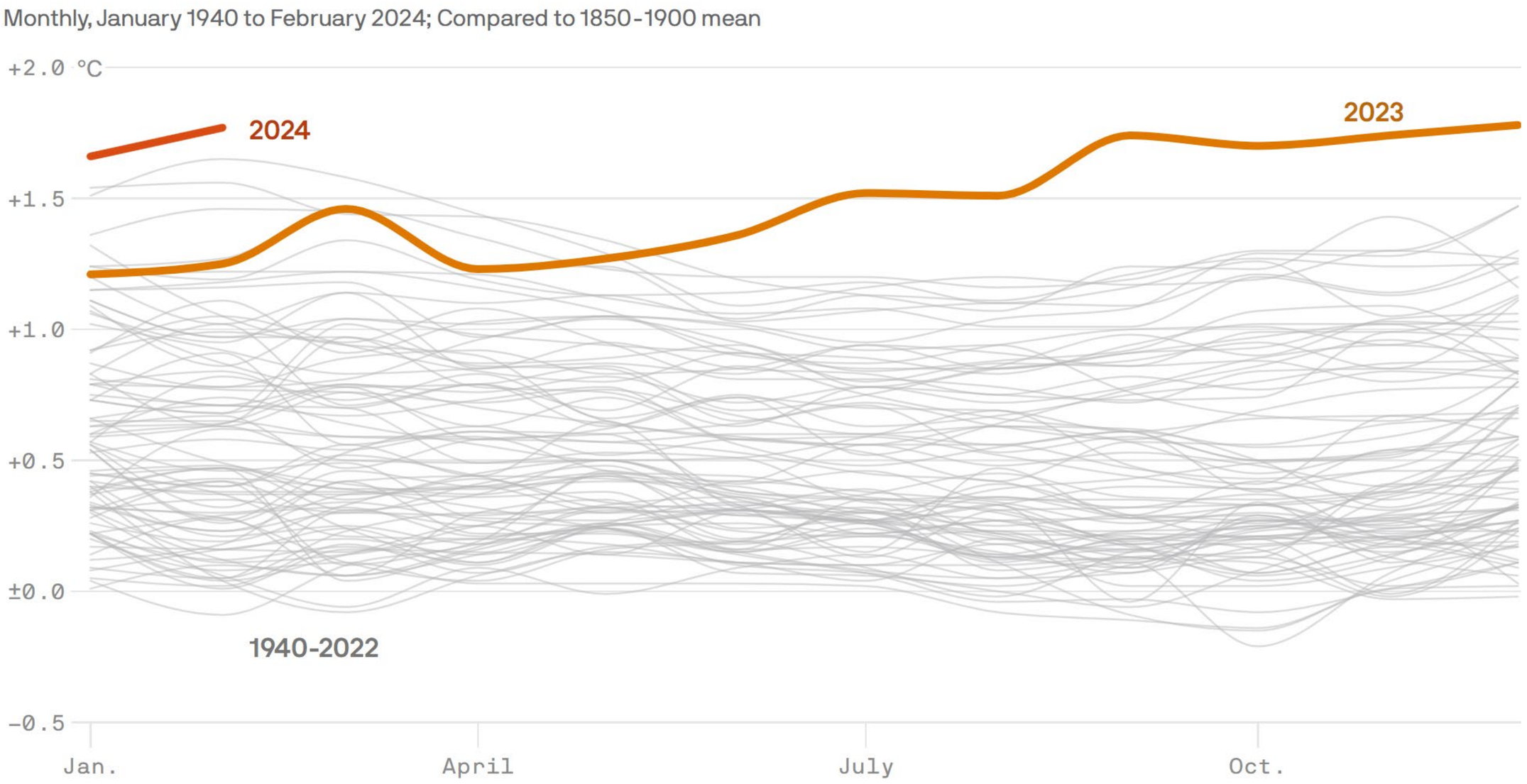
→ A selection of the latest evidence



Source: Berkeley Earth Land/Ocean Temperature Record

What if climate change is faster than predicted?

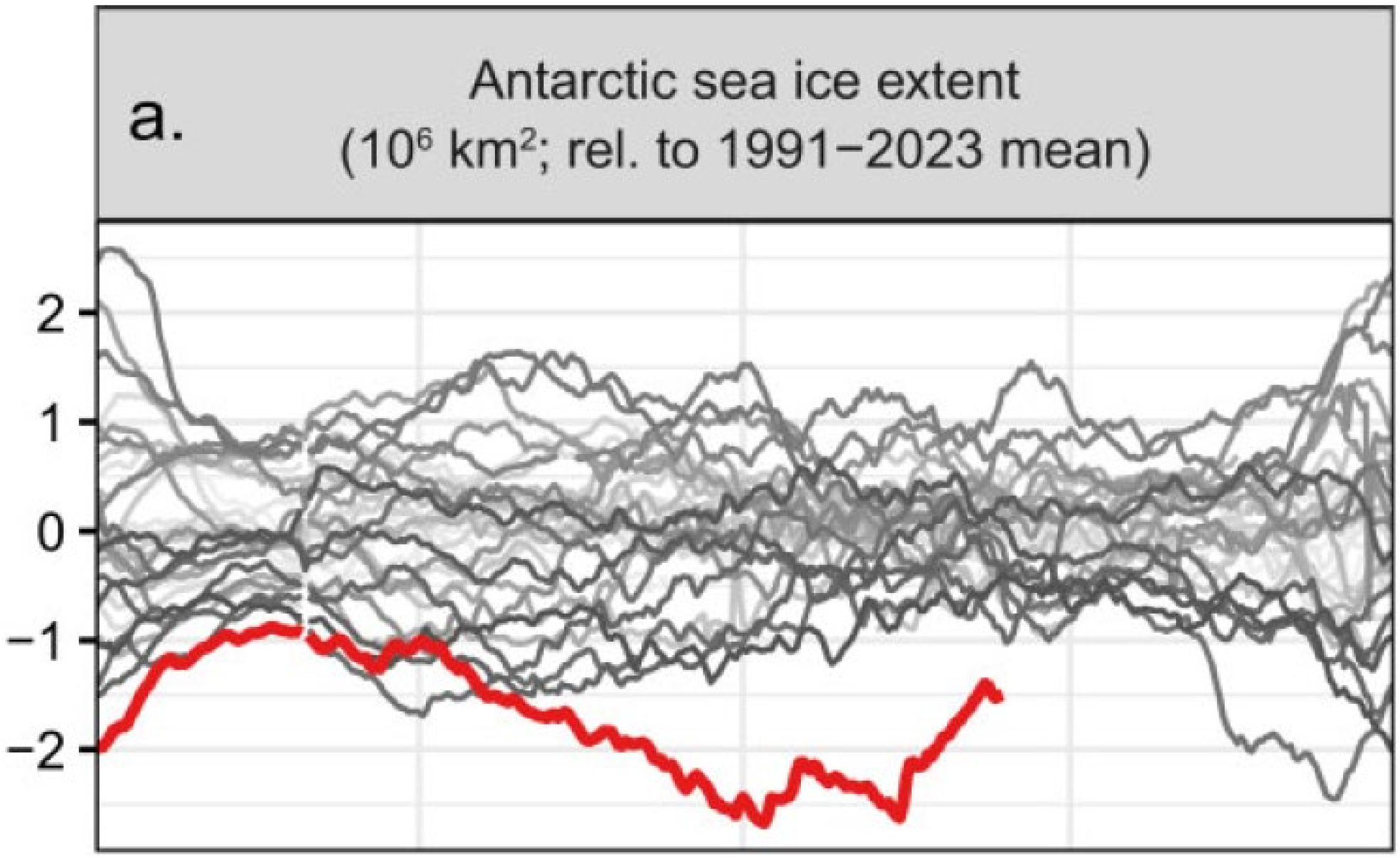
→ Latest evidence



Data: ERA5, Copernicus Climate Change Service; Chart: Axios Visuals

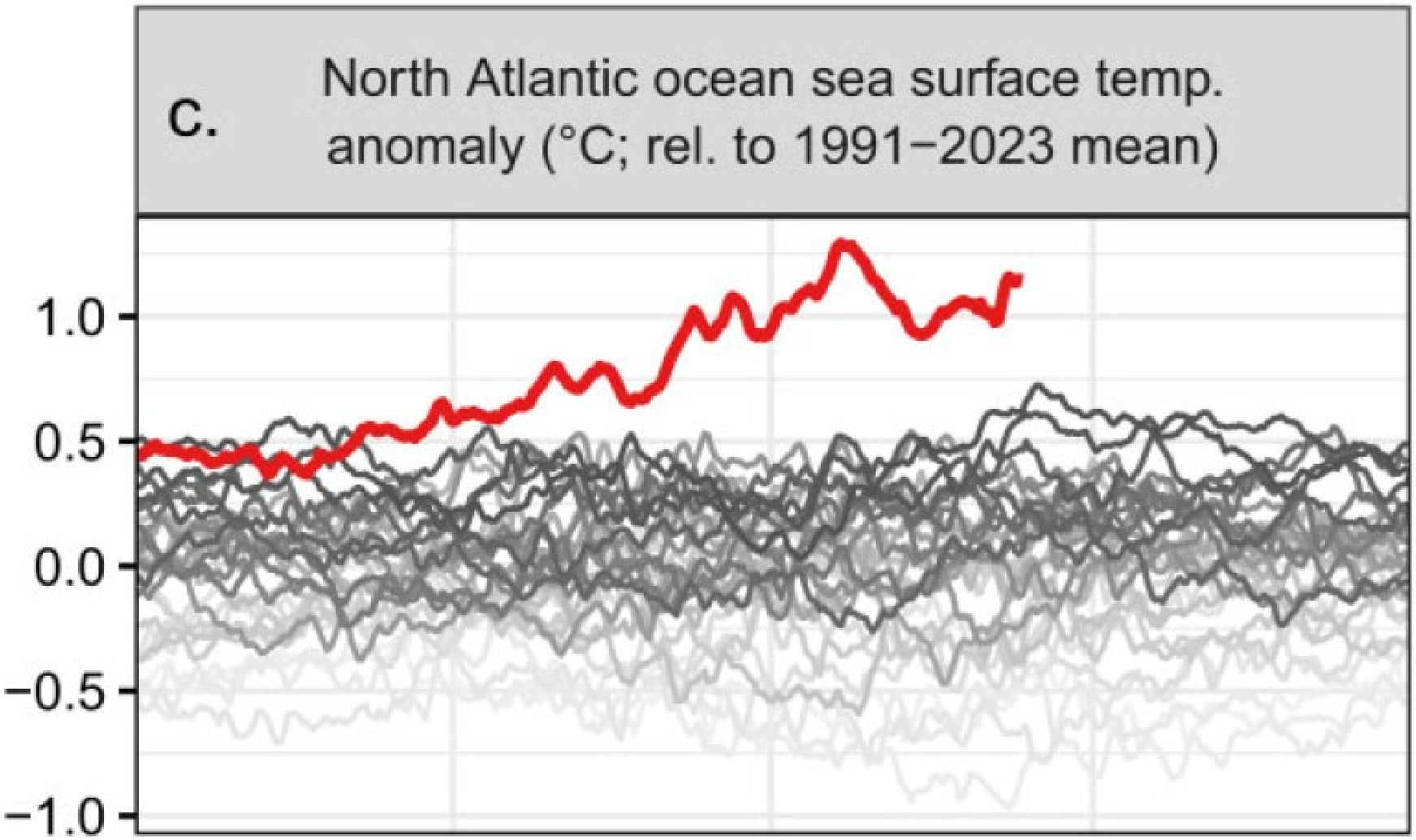
What if climate change is faster than predicted?

From the 2023 state of the climate report, *Bioscience*:
https://academic.oup.com/bioscience/article/73/12/841/7319571



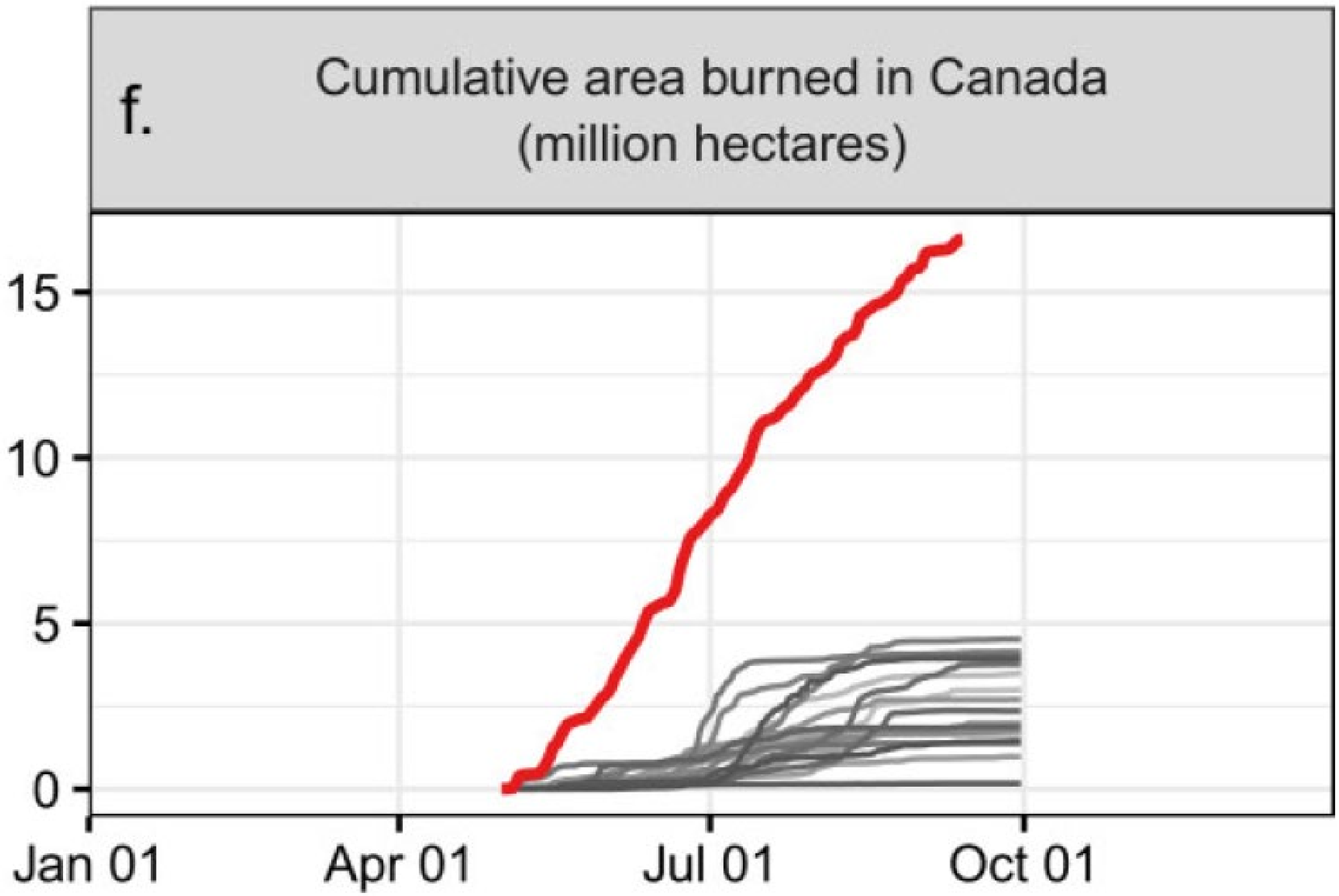
What if climate change is faster than predicted?

From the 2023 state of the climate report, *Bioscience*:
https://academic.oup.com/bioscience/article/73/12/841/7319571



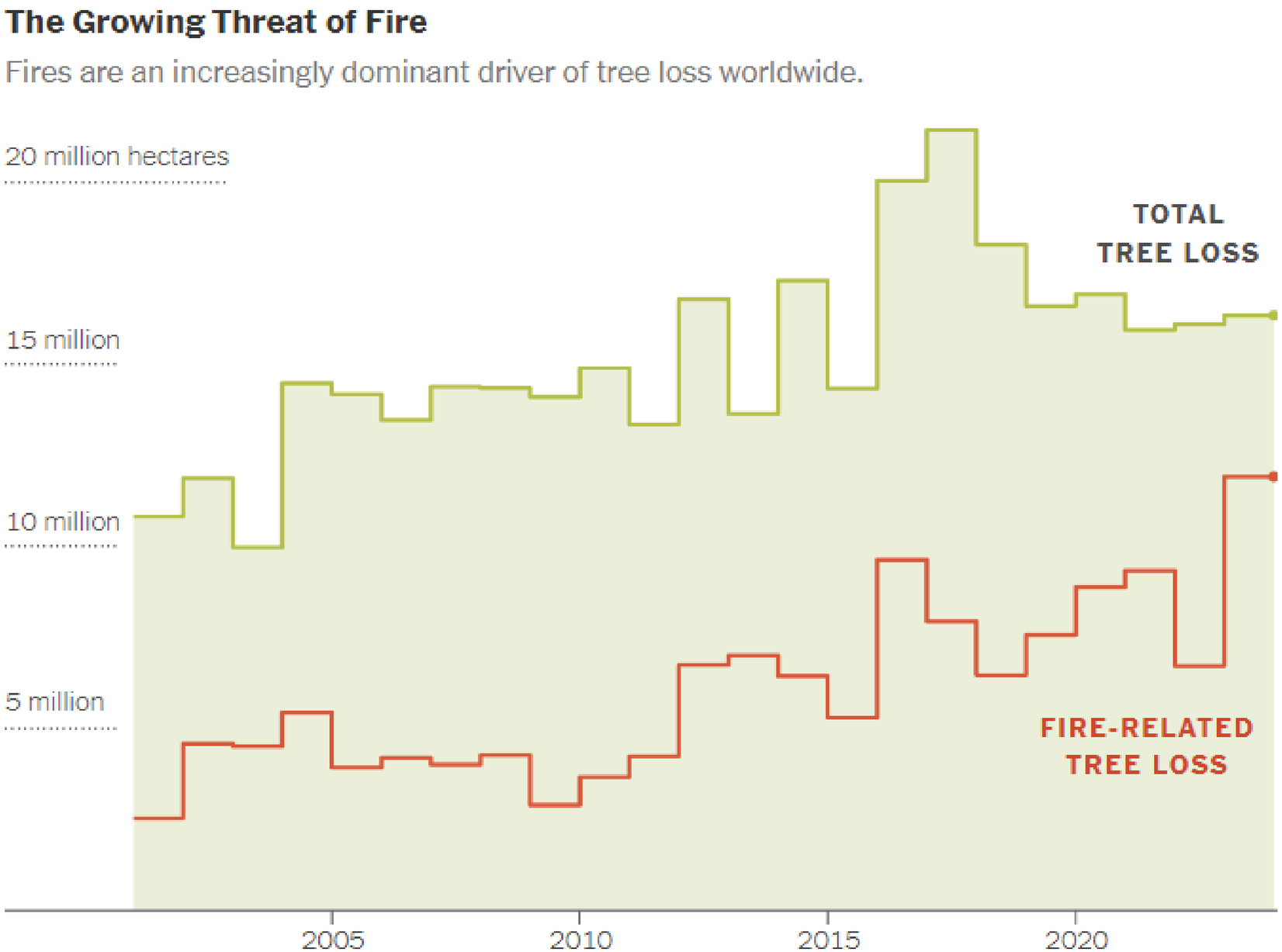
What if climate change is faster than predicted?

From the 2023 state of the climate report, *Bioscience*:
https://academic.oup.com/bioscience/article/73/12/841/7319571



What if climate change is faster than predicted?

→ Latest evidence



Grappling with climate change risk: Some theoretical challenges

III] Climate Change and likely societal responses:

→ Greater **awareness** & rising **frequency and intensity** of climate events is likely to bolster **political action** to accelerate the decarbonization of the economy

→ **Backlash** to rising mitigation and adaptation costs **=>** either a **U-turn** on transition policy **or bailouts and subsidies** (with monetary and fiscal implications)

- **Recent examples**:

1) Fossil fuel subsidies during the energy price shock of 2022-2023;

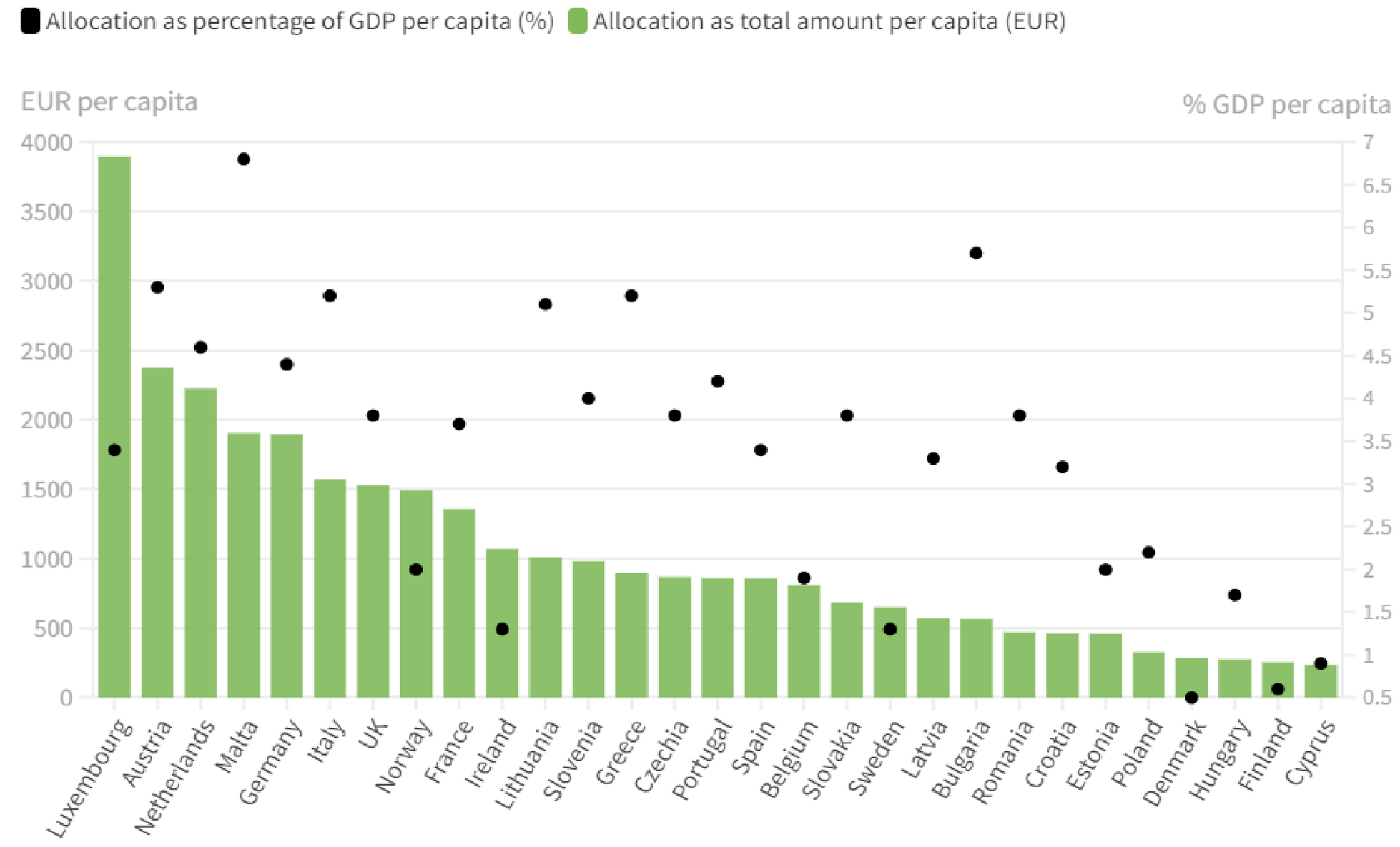
2) EU backtracks on proposal to halve pesticide use across the EU in the face of farmer protests

3) US introduces 100% tariff on EVs from China + tariff increases on solar panels from 25% to 50%

Subsidies during the energy price shock

2 of 3

Governments earmarked and allocated funding to shield households and firms from the energy crisis (Sep 2021 - Jan 2023), % GDP per capita.
Last update: 26.0.2023



Source: https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices

Grappling with climate change risk: Some theoretical challenges

Climate Change and likely societal responses:

→ How to determine the endogenous financial stability implications of climate change?

- First recommendation in "*Climate Stress Testing*" survey is to complement transition pathways with policies and private responses in a *sub-game perfect equilibrium*

- **Dynamic game**:
  1. CC induces more mitigation and adaptation pressure
  2. Introduction of tighter regulations & higher carbon pricing
  3. Backlash from voters facing higher costs
  4. To appease rising opposition, governments intervene by providing subsidies (or by backtracking)
  5. Fiscal impact and/or delay

- What will be the fiscal impact of CC mitigation & adaptation actions?

Concluding Thoughts

- Forward-looking scenarios, climate stress tests have multiple purposes:

  - Information discovery (what are the risks?) → carbon disclosure
  - Indicative planning (decarbonization pathways) → short-term stress tests
  - Coordination of (with?) private sector expectations and planning (SBTi)
  - Risk supervision → implementation of supervisory expectations
  - Regulation

- Climate Change and the 'tragedy of the horizon'. GHG emissions continue to rise inexorably
  → **By the time risks materialize it will be too late**

- **Mark Carney, 2015:**
  - "*you should not assume your ability to manage risks today means the future is secure*"
  - "*An abrupt resolution of the tragedy of horizons is in itself a financial stability risk*"