UBS Center
for Economics in Society

at the University of Zurich

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Economics of Global Challenges

Financial risks of climate change

in association with CEPR

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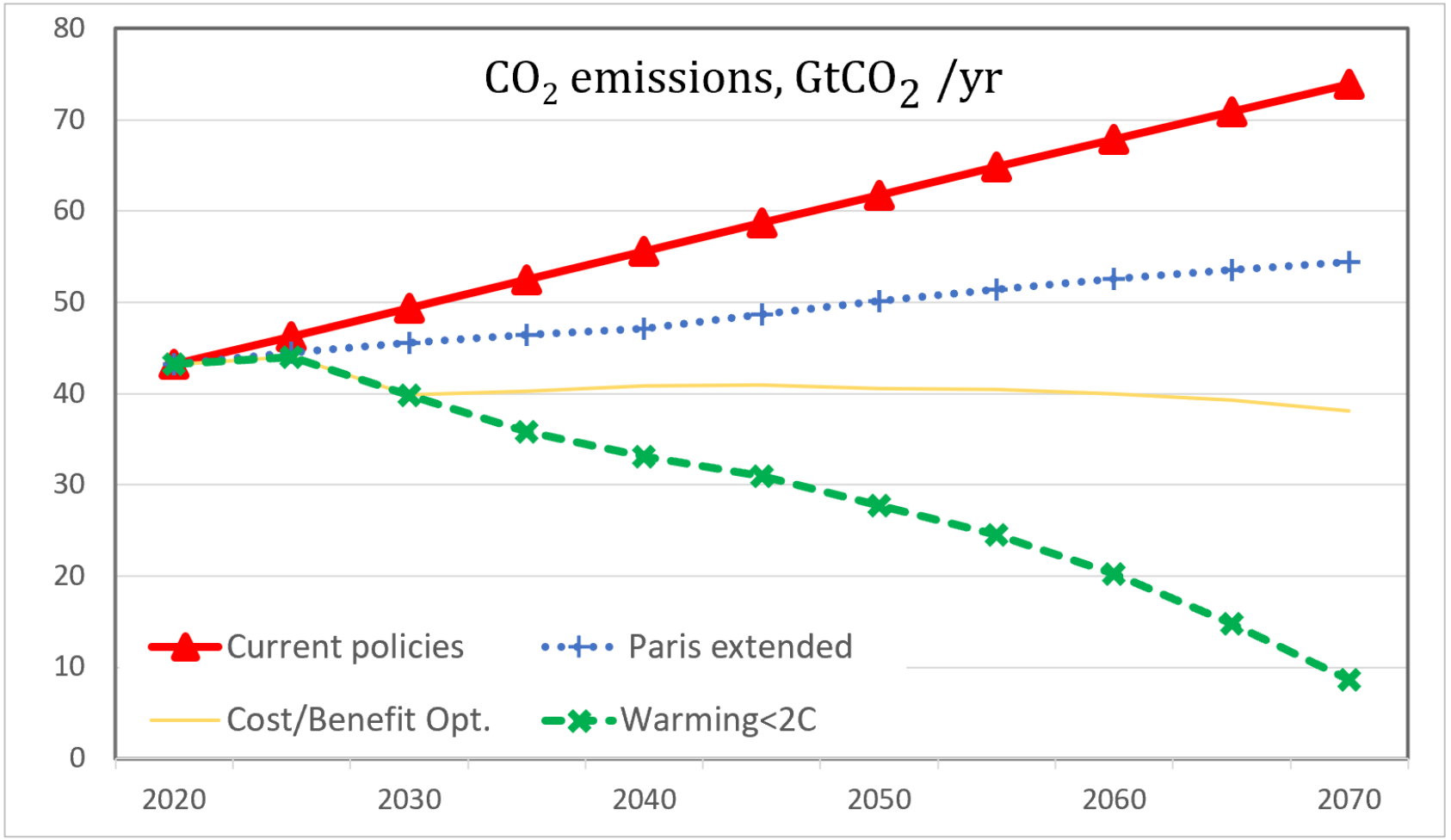
Financial Risks from Climate Change

Prof. Dr. Lint Barrage, Chair of Energy and Climate Economics, D-MTEC

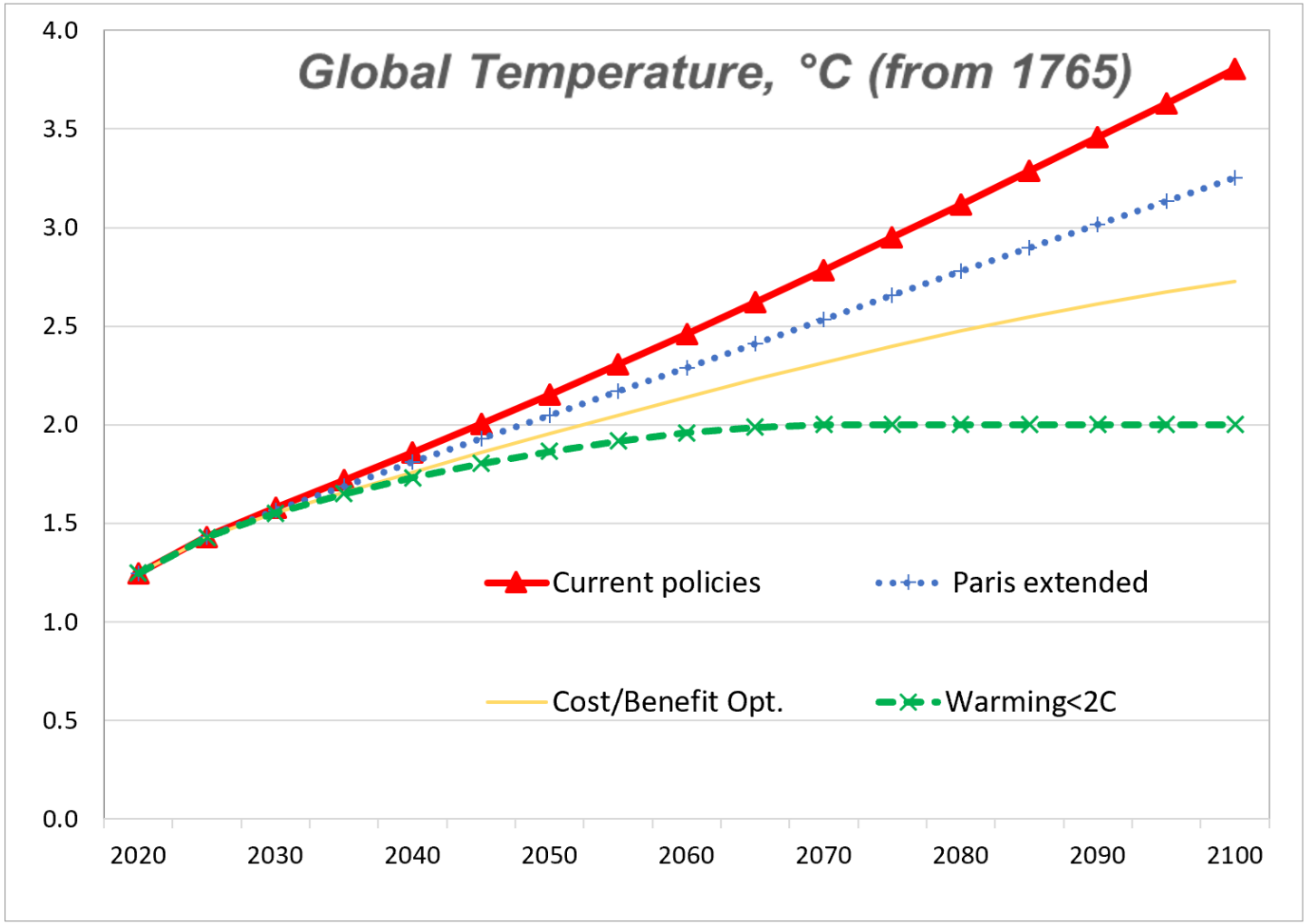
Despite increasing attention towards climate change in recent years...

...current policies remain grossly insufficient for global policy objectives



Source: Barrage and Nordhaus (2023)

...current policies remain grossly insufficient for global policy objectives



Source: Barrage and Nordhaus (2023)

Climate outlook

- Current policies estimated to lead to **~3.8°C warming by 2100**

- Current global avg. effective price on carbon emissions $3/ton CO2 (IMF, 2019)
  - Far below $60-190/tCO2 required to meet climate policy goals

- In fact, fossil fuels still subsidized around the world
  - Consumption subsidies estimated at >$1 trillion in 2022 (IEA, 2022)

How big do you think the economic costs of 3.8°C warming will be in 2100?

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How big do you think the fall in global GDP was during COVID in 2020?

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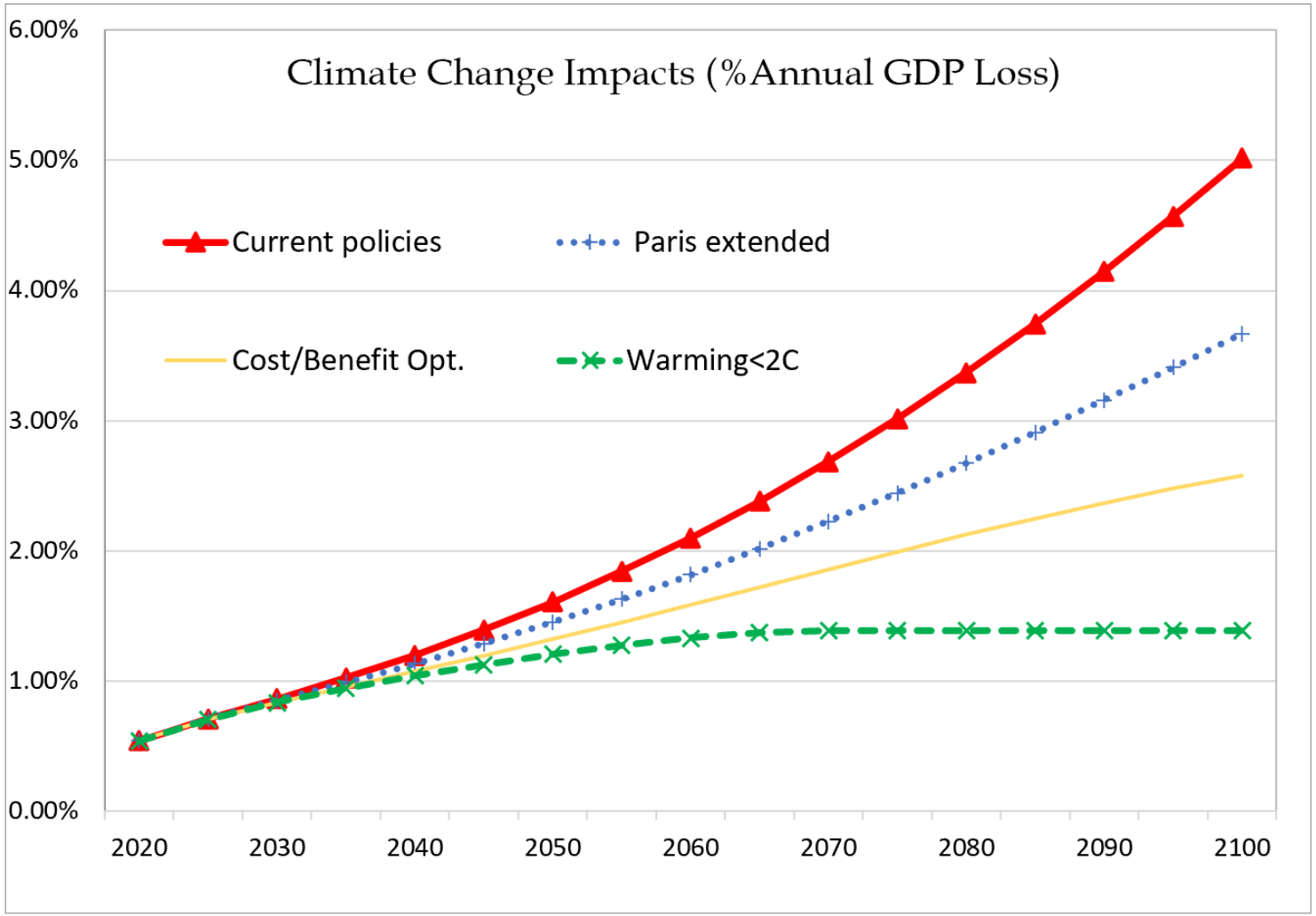
Climate change economic impact estimates

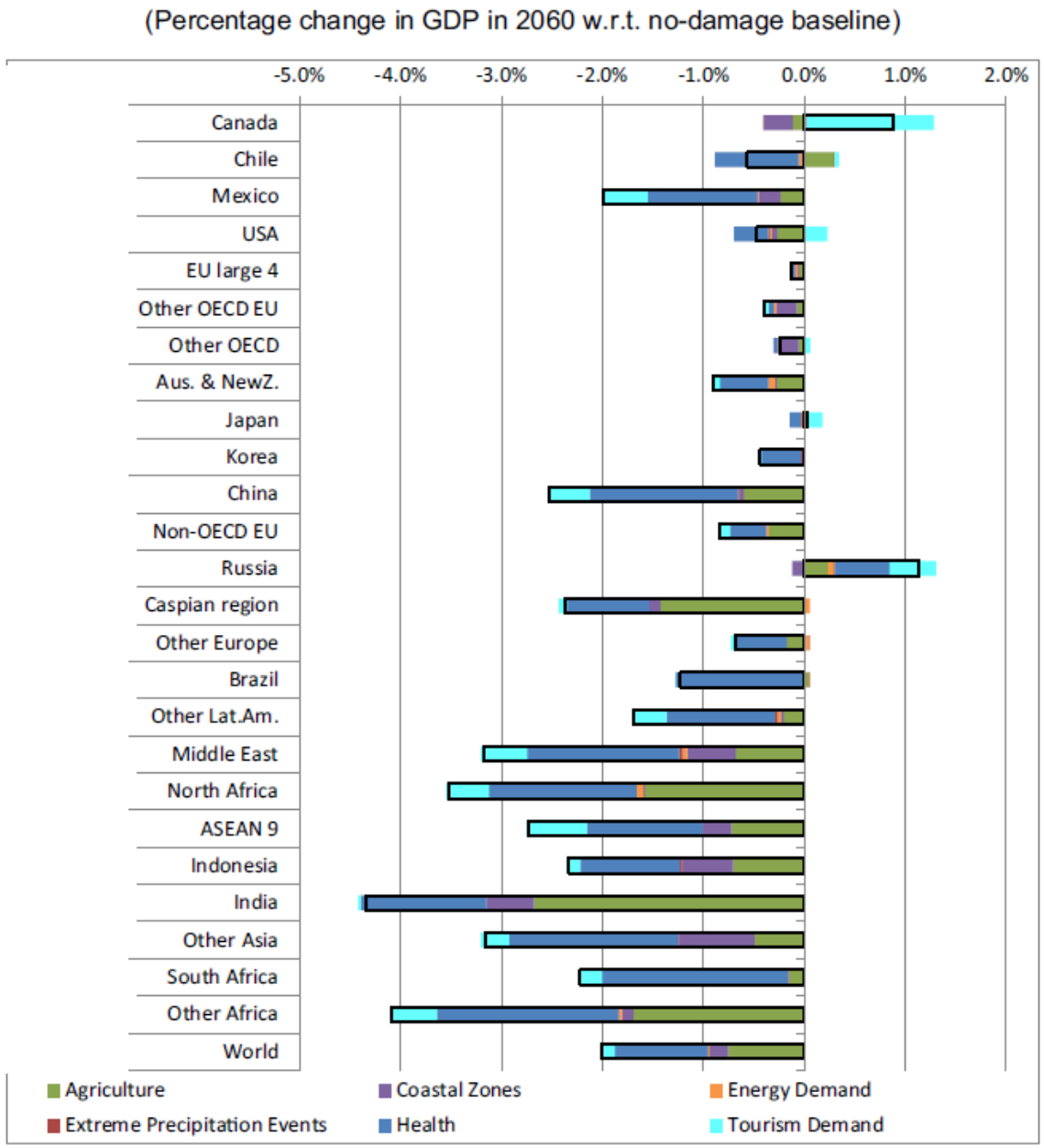


Source: Barrage and Nordhaus (2023)

- Synthesis of 57 global impact estimates → **5% GDP-equiv. loss per year** from 3.8°C warming
- COVID 2020 global GDP change: -3%

Climate change impact estimates

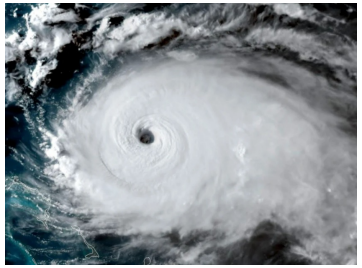
- What **is** included in current impact estimates?
- «Bottom-up» estimates typically account for impacts via:
  - Agricultural productivity
  - Energy consumption
  - Mortality
  - Sea level rise
  - Labor productivity
  - Various other channels (tourism, crime, etc.)
- «Top-down» estimates capture effects of past temperature variation (typically short- and medium-run changes) on GDP



Dellink et al. (2019)

Climate change economic impact estimates

- What **isn't** included in current impact estimates?
- Value of many climate impacts notoriously difficult to quantify (e.g., biodiversity loss, ocean acidification, etc.)
- Benchmark models also have very limited coverage of changes in **natural disaster risks** (e.g., wildfires, tropical cyclones, inland flooding, etc.) and their macroeconomic consequences



(Macro)Economic Costs of Natural Disasters

- Direct Costs:
  - Destruction of valuable assets (e.g., homes, cars, infrastructure, livestock, etc.)
  - Loss of life-years (value of statistical life, loss of human capital)

- Indirect Costs:
  - Loss of economic productivity
  - Supply chain disruptions
  - Fiscal costs (disaster assistance, public healthcare, etc.) necessitating tax increases or spending cuts
  - Losses in welfare from *uncertainty*
  - Changes in investment/savings decisions based on disaster risks

- Most damages uninsured, especially in emerging markets

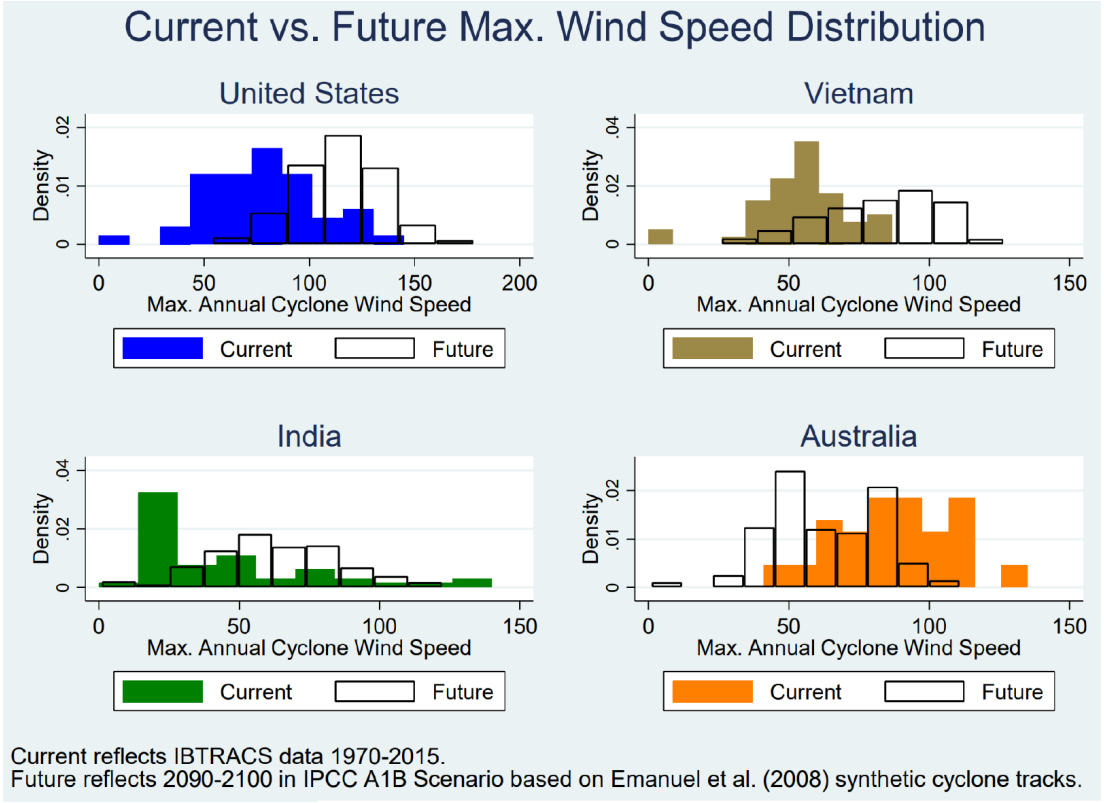
Cyclones, Climate, and the Macroeconomy

- Climate change projected to alter global distribution of tropical cyclone (hurricane, typhoon) risks

- We use historical economic and satellite-based storm data to quantify cyclone impacts on:
  - Physical capital
  - Human capital
  - Productivity

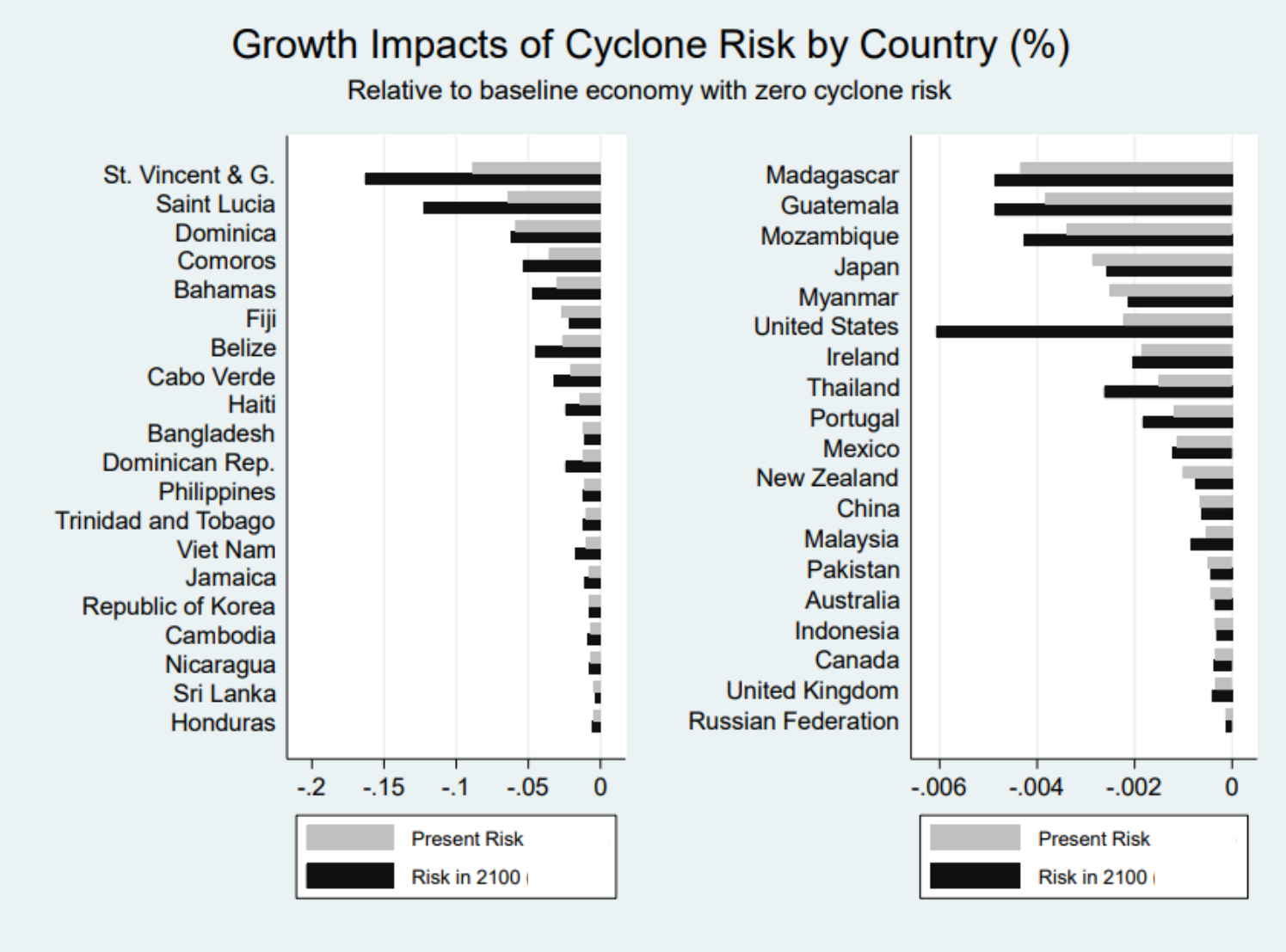
- Impacts vary with country, storm characteristics
  - Damages rise rapidly with high wind speed
  - Economic, financial development lower impacts

- Develop economic growth model with cyclones to simulate impacts of climate-induced risk changes



Source: Bakkensen and Barrage (2021)

Cyclones, Climate, and the Macroeconomy



Source: Bakkensen and Barrage (2021)

(Macro)Economic Costs of Natural Disasters

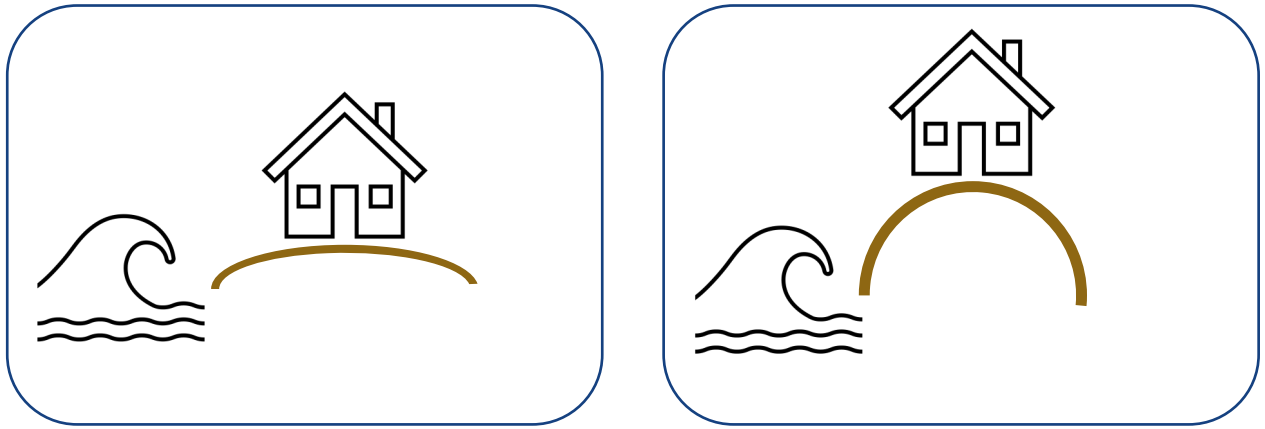
- **Cyclones risk increases may decrease longer-run growth prospects in vulnerable countries**
  - Impacts can be mitigated through economic & financial market development

- Estimates do not (yet) account for some potentially important impact channels, e.g.:
  - Interactions of cyclone risk with sea level rise; Supply chain disruptions
  - Fiscal effects: Evidence of importance from elsewhere, e.g., United States (Barrage, 2021)
    - Every +1% increase in government consumption requirements per 1°C warming increases overall economic burdens of climate change by ~20%

- Rapidly growing literature and understanding of potential economic impacts of climate change through channels ranging from workplace injuries (Park et al., 2021) to airline network disruptions (Lee et al., 2020)
  - Micro estimates not (yet) fully reflected in macro models & climate impact estimates

Capitalization of Climate Risks in Asset Prices

- (How) are financial markets responding to climate risks? Are climate forecasts reflected in asset prices?
- Important question for market efficiency, risk of future devaluations, adaptation incentives, etc.
- Housing: Compare statistically identical homes except for difference in climate risk

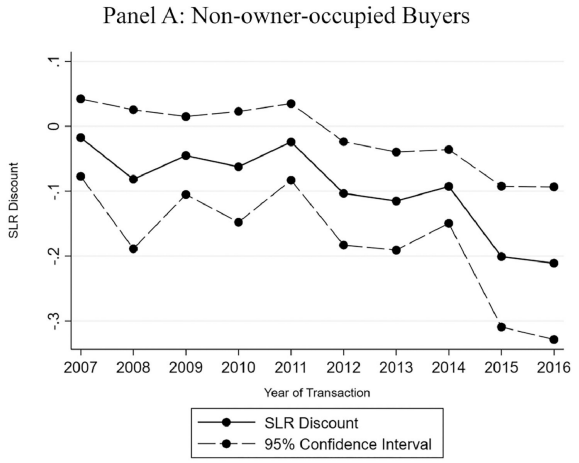


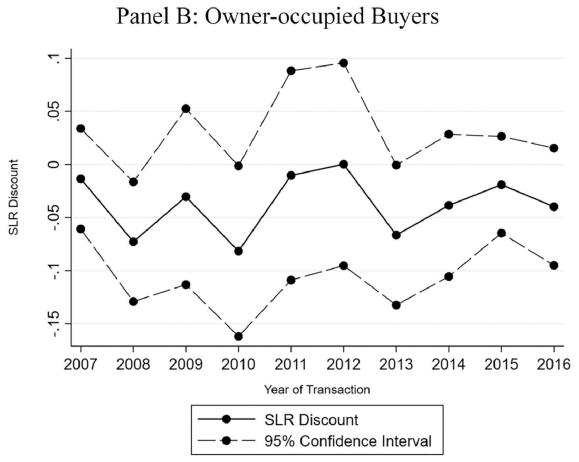
Capitalization of Climate Risks in Asset Prices

- Risk of inundation from sea level rise associated with significant discount in U.S. homes
  - E.g., being under water from 30 cm sea level rise associated with 15% lower price (Bernstein et al., 2019)

- However, two important caveats:
  1. Climate risk capitalization generally still appears **incomplete**
  2. Climate risk capitalization is a **recent** phenomenon

- For housing and sea level rise, capitalization only evident...
  - for non-owner occupied buyers (Bernstein et al., 2019)
  - in areas with high climate change beliefs (Baldauf et al., 2020)
  - since 2012 (Bernstein et al., 2019)





Source: Bernstein et al. (2019)

Capitalization of Climate Risks in Asset Prices

- Similar story for (some) other assets: Climate risk capitalization **evident** but only **recently** and **incompletely**

- Equity prices not yet fully reflective of country drought trend impacts on food industry profitability (Hong et al., 2019)

- Municipal bond credit spreads increasing in sea level rise exposure since ~ 2013 (Goldsmith-Pinkham et al. 2021)

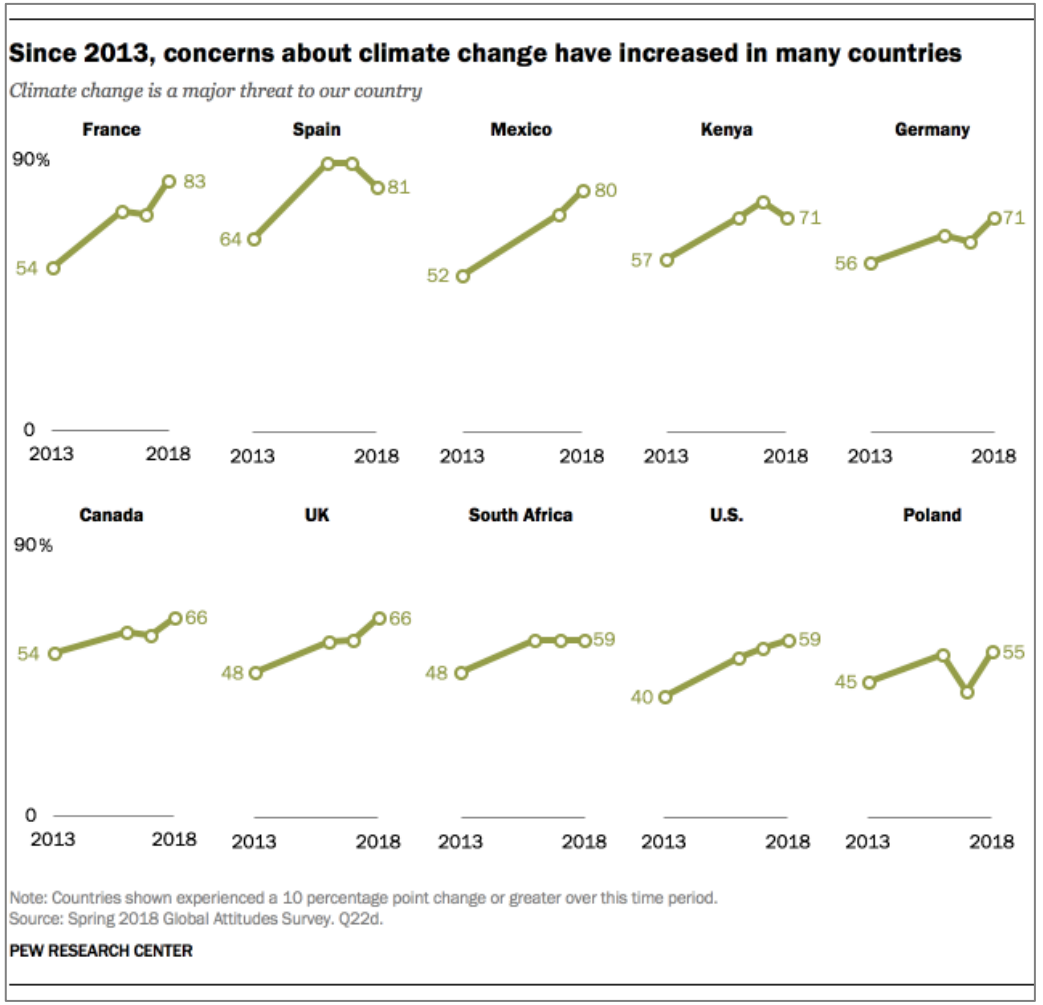
- Agricultural land prices increasingly responsive to climate change forecast, but only in areas with sufficiently high belief that climate change is happening (Severen et al. 2018)

Capitalization of Climate Risks in Asset Prices

- Why this pattern, and what are the implications?
- On the one hand:

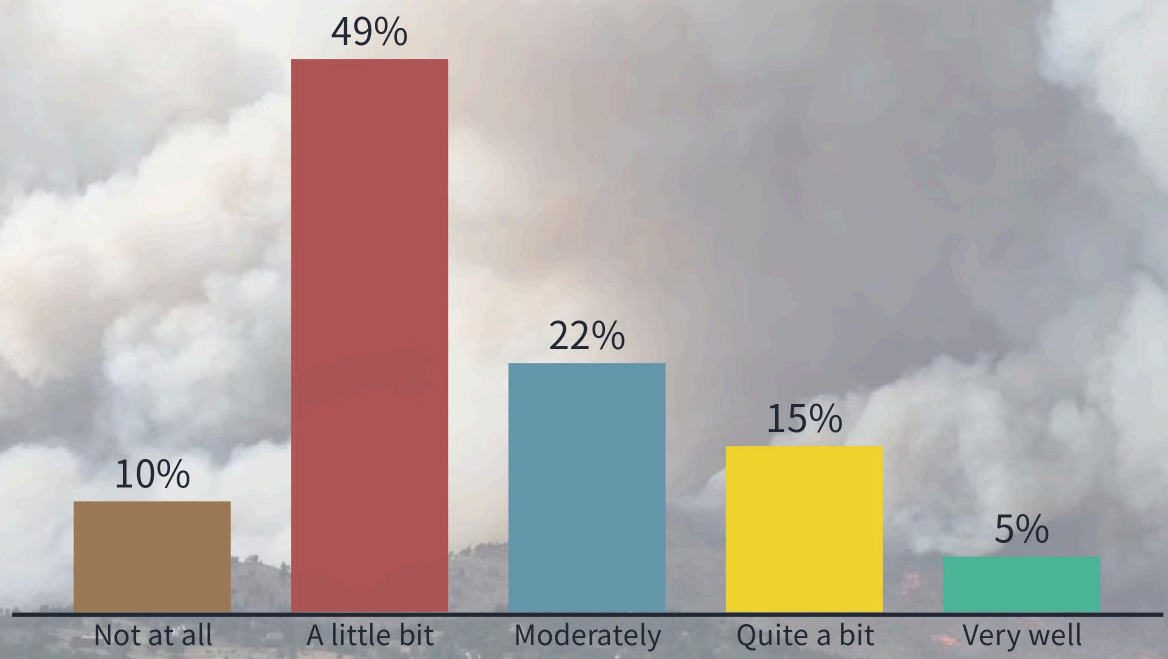
  Increasing concern about climate change over time
- On the other hand:

  Risk information, beliefs therein often still limited



Source: Pew Research Center (2019)

How well do you know the projected impacts of climate change on weather risks?



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Capitalization of Climate Risks in Asset Prices

- Importance of risk information already evident for current weather risk capitalization
  - Flood risk leads to home price discount only in states with strong disclosure requirements (Hino and Burke, 2021)

- Disagreement about climatic risks may also lead those with (excessively) optimistic views to buy risky assets
  - 40% of homewoners in high risk flood zone «not at all» worried about flooding vs. plurality of inland neighbors would be «very worried» about flooding in those homes (Bakkensen and Barrage, 2021)
  - At-risk home prices may be significantly overvalued as a result (6-13% in RI, USA) (Bakkensen and Barrage, 2021)

- Research, understanding of climate risks still growing

➔ Should likely expect increasing asset price impacts of climate risks going forward

Summary

Source: BBC / Beacon Rock Golf Course / Facebook

1. Current policies insufficient for global climate policy objectives
   - Estimate 3.8°C warming by 2100

2. Research to date suggests large potential economic impacts
   - Estimate 5% GDP-equiv. loss per year by 2100

3. Benchmark estimates still missing many potentially important warming impacts
   - E.g., changes in natural disaster risks which may decrease economic prosperity/security in vulnerable areas

4. Asset prices are beginning to reflect climate risk projections
   - However, capitalization appears incomplete & evidence base still small

5. Lack of information, climate skepticism appear to inhibit (some) capitalization
   - Risk of future price corrections, asset devaluations («climate bubble»), mal-adaptation

Thank you.


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