Distributional consequences of climate change impacts and policies – a global perspective

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Highlights on two research questions

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Can we improve the quantification of differential climate change impacts on different income groups?

→ For specific types of climate change impacts → tropical cyclones

→ Globally

How does global climate policy interact with inequality and how can negative effects for inequality be alleviated from a global point of view?

Spotlight 1: Income-specific vulnerability to tropical cyclones in the U.S. (J. Haßel, T. Vogt, C. Otto)

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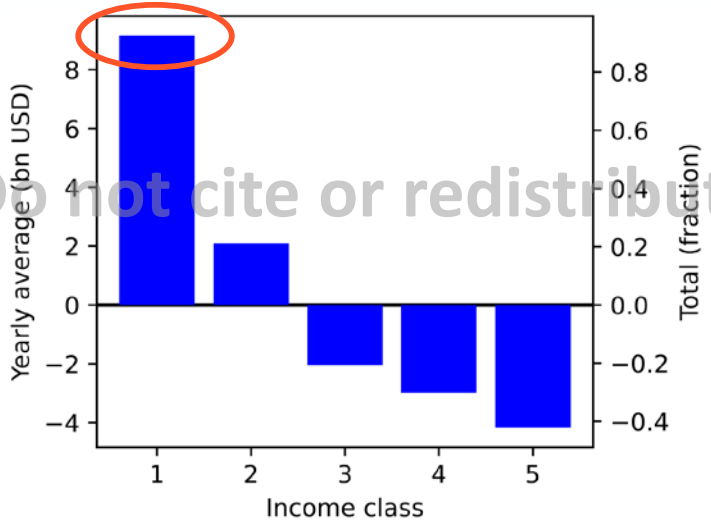
- We empirically derive the vulnerability of **five U.S. income groups** to hurricanes using:
  1. a **county-level database of damage reports** (97 events, 1996-2020),
  2. the distribution of **economic assets**, downscaled to a 10 km grid,
  3. modeled hurricane **wind fields** on that grid.
- We define vulnerability as the relationship between **wind speed** and the **share of destroyed assets** in a grid cell.

If everyone in the USA was as vulnerable as the poorest 20%, the **hurricane losses would be more than 90% higher**.



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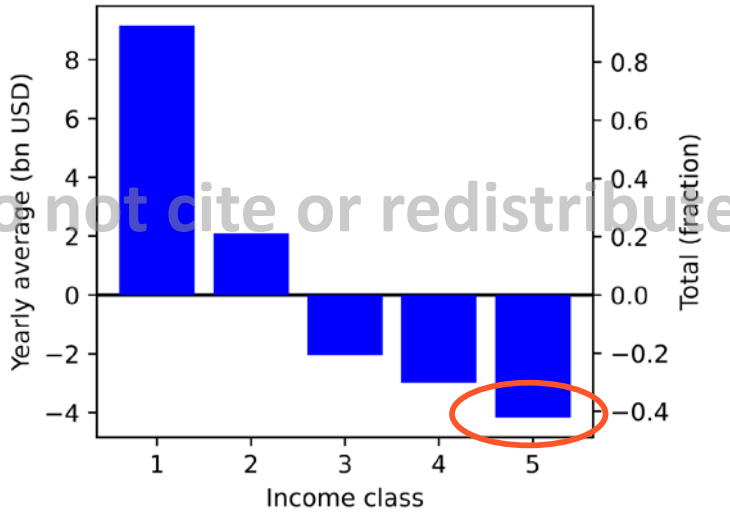
- We define vulnerability as the relationship between **wind speed** and the **share of destroyed assets** in a grid cell.

If everyone in the USA was as vulnerable as the richest 20%, the **hurricane losses would be more than 40% lower**.



Spotlight 1: Income-specific vulnerability to tropical cyclones in the U.S. (J. Haßel, T. Vogt, C. Otto)

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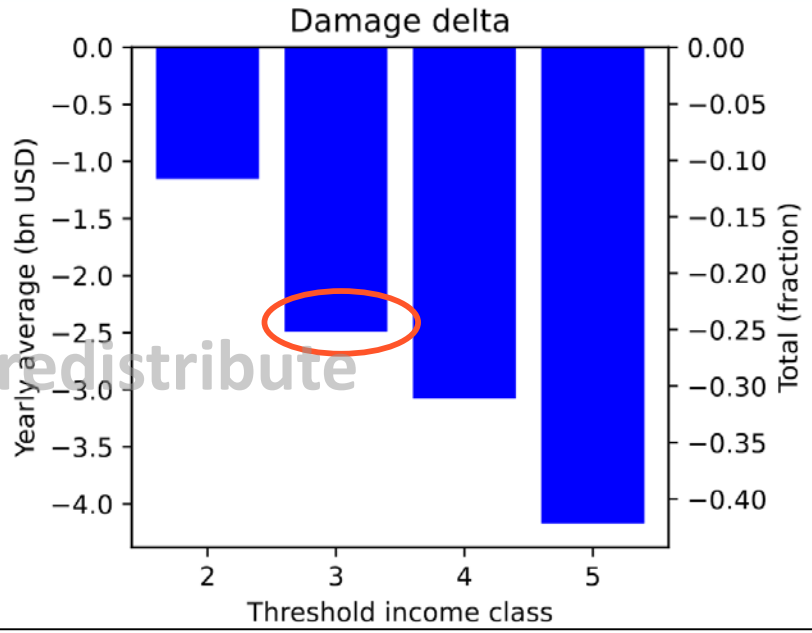
Compared to an approach with an **income-independent vulnerability**, the lowest income class's losses are 30% higher.



Appx. 25% of the total damages could be avoided by **increasing the resilience** of the lower two income classes to the level of the third income class.

Spotlight 2: Temperature change has differential effect on income groups (P. Collins-Sowah, F. Piontek)

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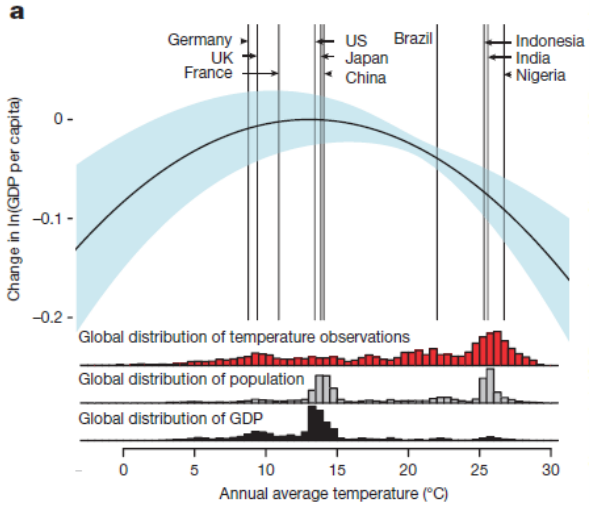
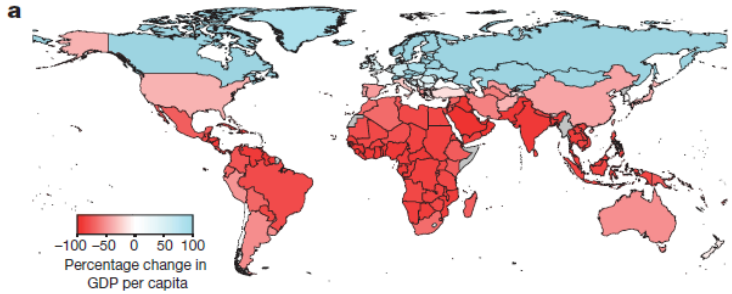
Well known: non-linear impacts of temperature change on country-level economic growth
→ increases between-country inequality



GDP change in 2100 under high climate change



Burke et al. (2015)

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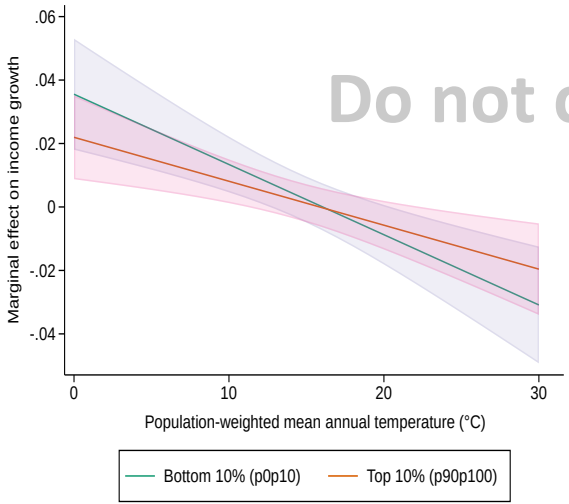
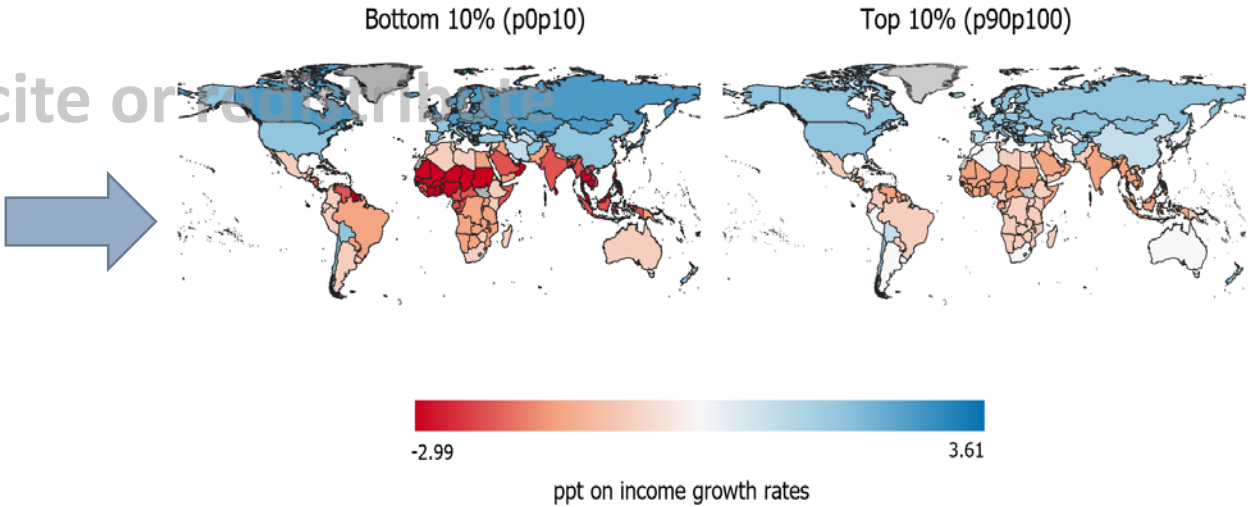
What about within country inequality → effects for different income groups





Change in income growth rates per 1°C increase in temperature (percentage points)

Spotlight 3: Global integrated assessment of climate policy pathways and impacts under inequality considerations

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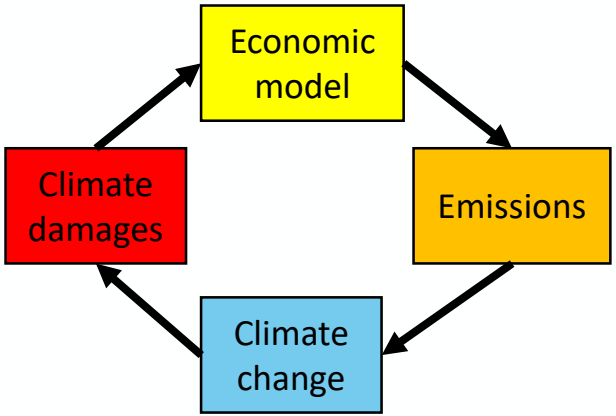
NICE:

- 12 regions
- Aggregate damage function
- Simplified link between GDP, emissions and mitigation costs
- 10 subregional income groups affected by damages and mitigation costs



REMIND:

- 12 regions
- Aggregate damage function
- Detailed energy system & technology-based mitigation
- Subregional distribution affected by damages and mitigation costs

Application:

- 1 socioeconomic scenario
- Different climate policy targets (1.5, 2°)
- Redistribution of carbon price revenues

Double benefits of climate policy

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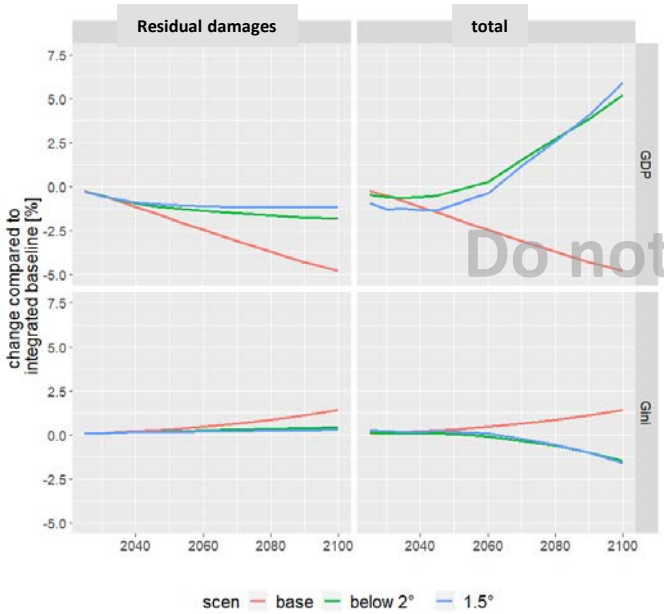

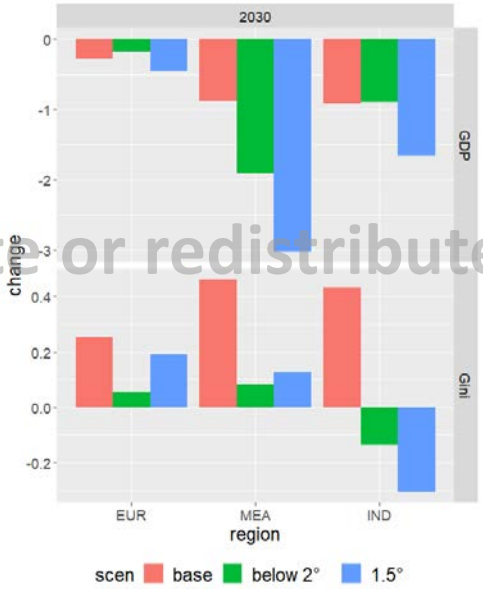

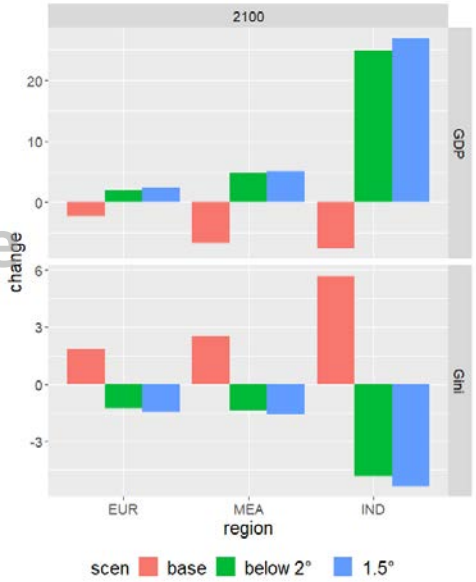

REMIND model, Piontek et al. (in prep.)

Effect of inequality on optimal policy pathways: more ambitious near-term mitigation

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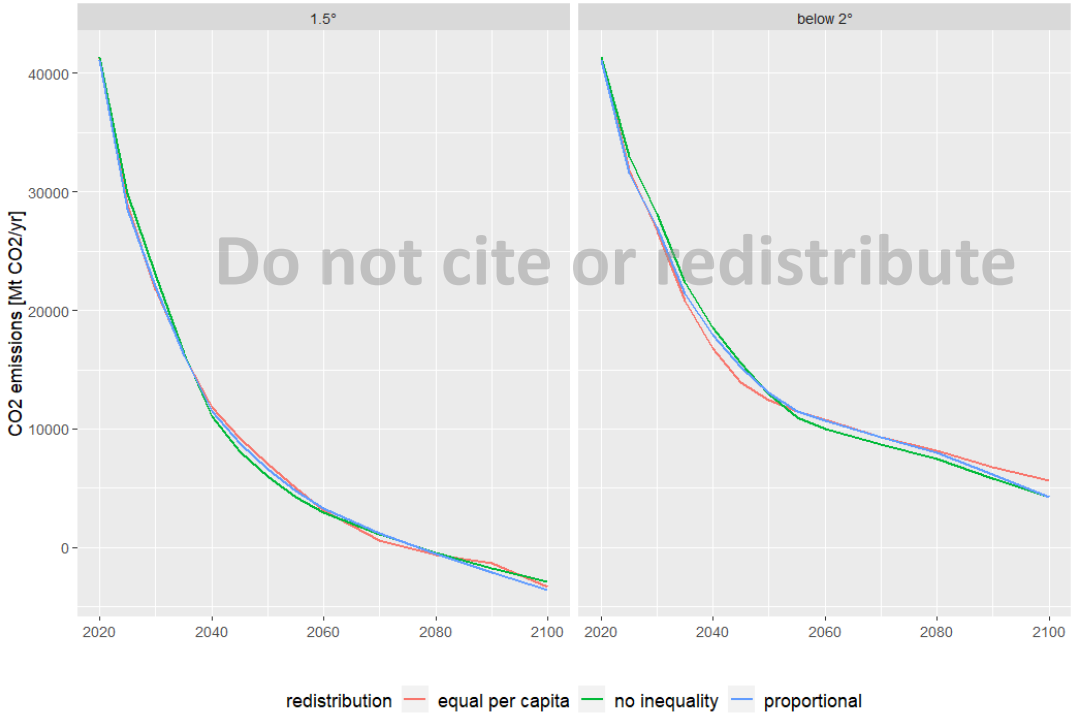

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Redistributing carbon tax revenues can alleviate inequality issues

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Global carbon tax often as a tool for mitigation, but raises issues of justice (IPCC WG3, AR5, chap 3)

Redistributing the carbon tax can alleviate inequality (Sterner, 2012; Metcalf, 2018; Budolfson et al. 2022)

Policy discussion on loss and damages (COP27, Prime Minister of Antigua proposed a "global carbon tax" on their profits as a source of funding for loss and damage).

We use the NICE integrated assessment model to assess how different ways of redistributing the carbon tax (e.g. creating a global climate fund) may affect inequality and poverty

> Regional, global redistribution; or redistributing as a function of climate damages (loss and damages)

Global redistribution can reduce inequality, especially in developing countries

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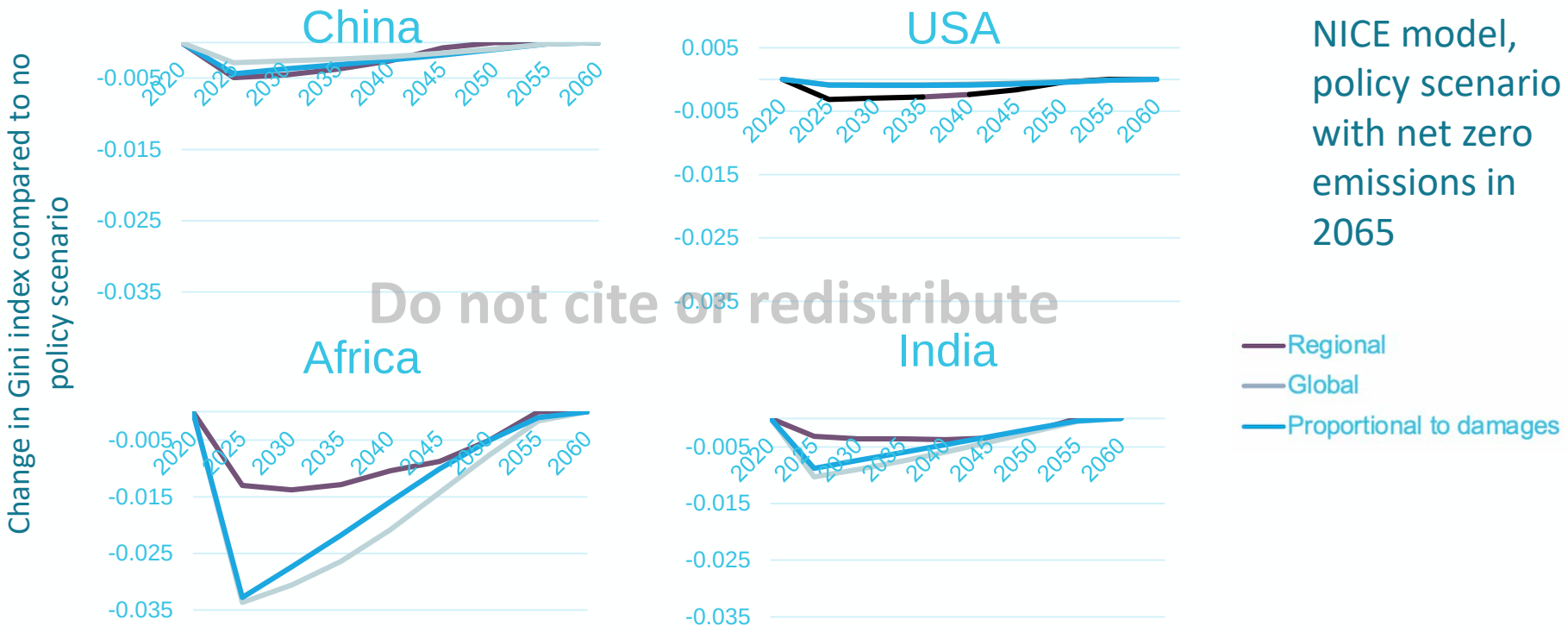

NICE model, policy scenario with net zero emissions in 2065

Global redistribution can reduce poverty in the medium run (but must be supplemented afterwards)

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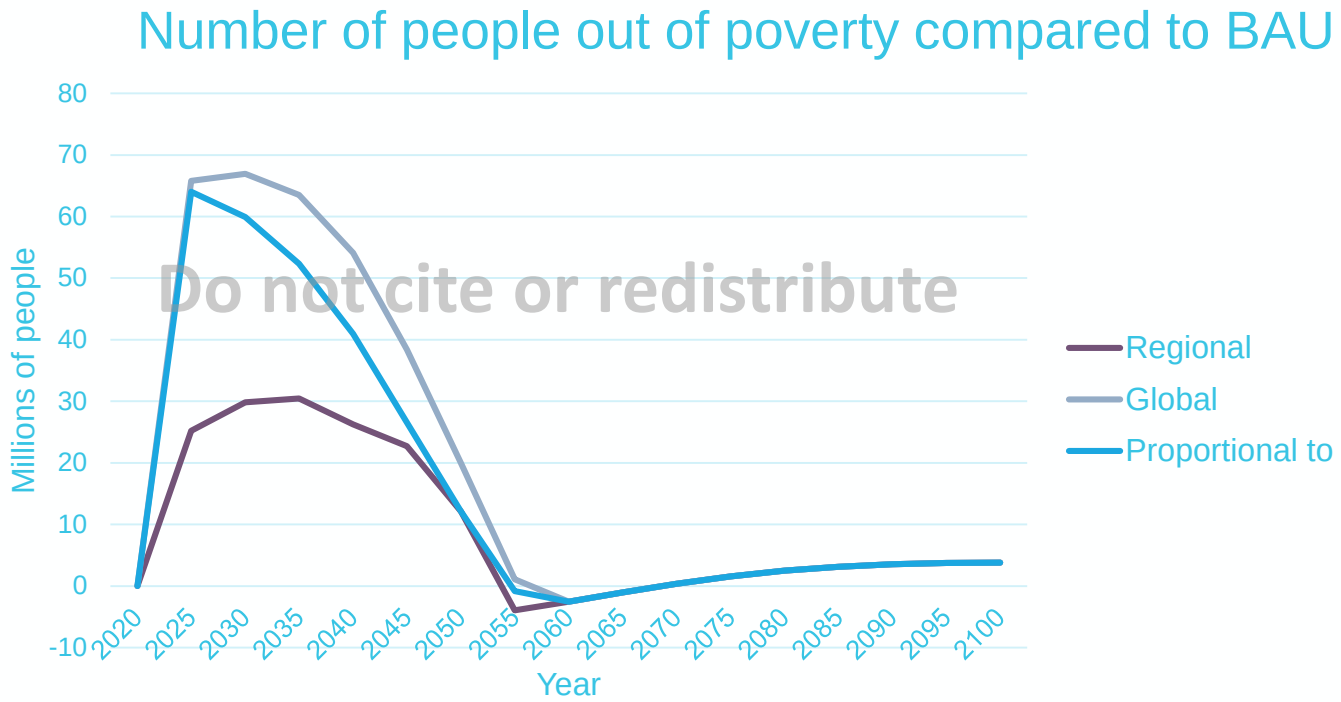

NICE model, policy scenario with net zero emissions in 2065

Spotlight 4: Disaggregate damage, inequality and the social cost of carbon (Young-Brun & Feindt, in prep.)

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- Distribution of climate impacts depends on pre-existing inequalities:
  - heat stress hits outdoor workers more
  - poorer households tend to live in more flood-prone areas
- Most climate policy models neglect heterogeneity in income channels and inequality in damages

How does inequality in income and damage channels affect future inequality and climate policy ?

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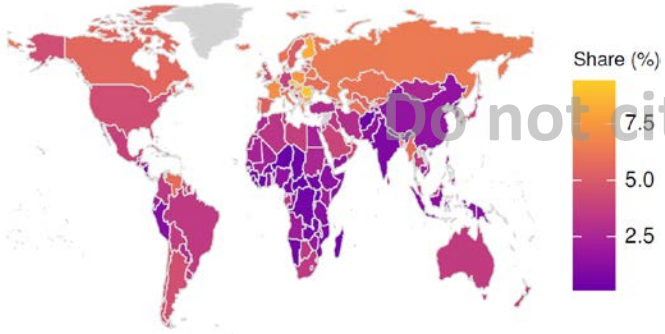
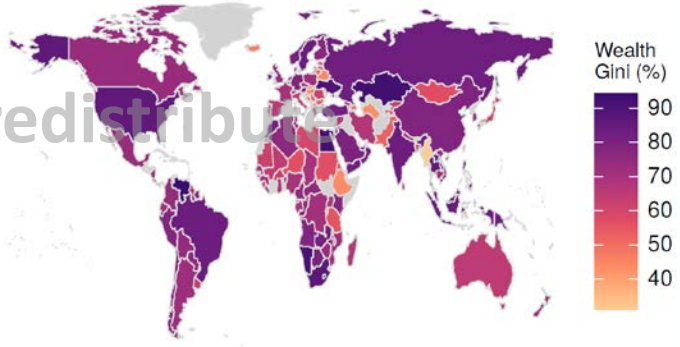
- Decomposition of income inequality in capital and labor income
- Disproportionality of damages

Raw data used for aggregation to 12 regions

Labor income share of the first quintile, 2017, ILOSTAT



Wealth Gini index, 2017, Credit Suisse (based on Davies et al., 2017)



Young-Brun & Feindt (2023), in preparation

Key take-aways

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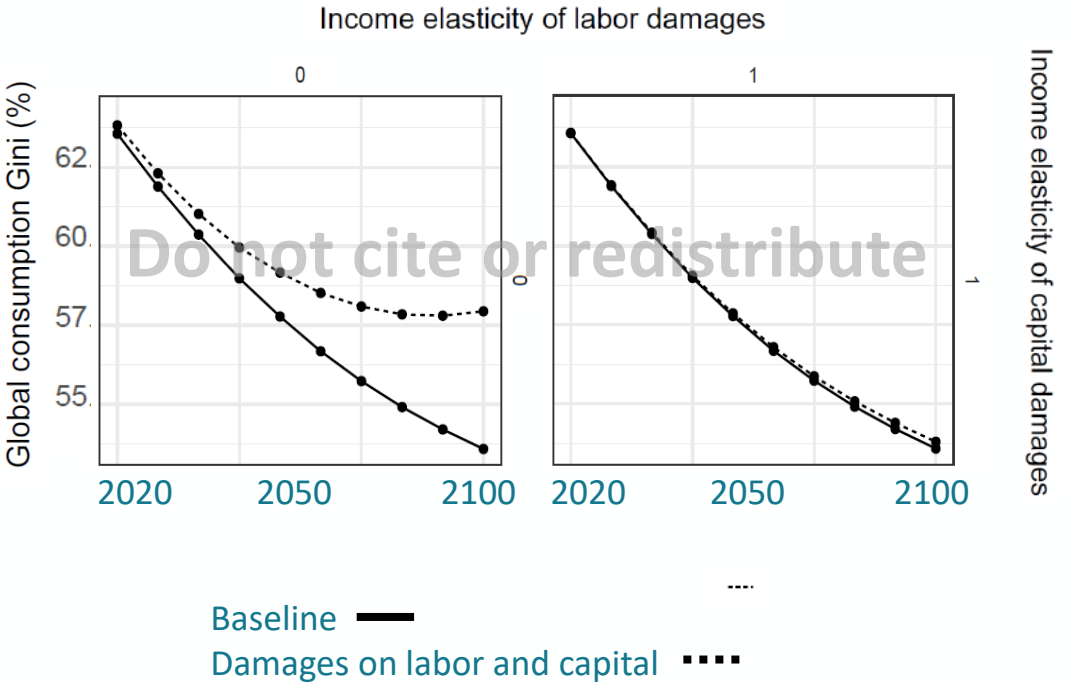
- Channel-specific damages and disproportionality of damages:
  - Less reduction in global inequality
  - Mainly caused by increases of within-region inequality
  - Lead to higher social cost of carbon
- Stronger mitigation can avoid increases in future inequality



Young-Brun & Feindt (2023), in preparation

What is this good for?

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- Quantitative evidence of differential impacts of climate change for different income groups:
  - Increases the social cost of carbon → motivates climate policy
  - Support policy design for adaptation and loss and damage
  - Improves robustness of integrated assessment of transformation scenarios
- Evaluation of integrated transformation scenarios with distributional considerations
  - Including inequality increases near-term mitigation ambition
  - Climate policy benefits can be expressed in different dimensions
  - Design of global policies to alleviate negative distributional effects of mitigation
  - Future: global policies for adaptation

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