Distributional effects of climate change impacts and policies: Global and household perspectives

Franziska Piontek

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CHIPS
Climate Change Impacts and Policies in Heterogeneous Societies

The CHIPS project - background

CHIPS
Climate Change Impacts and Policies in Heterogeneous Societies

- www.chips-project.org
- Fall 2019 – February 2023
- 5 partners:

PIK

(Project Lead)
Franziska Piontek (PI), Björn Sörgel, Christian Otto, Inga Sauer, Thomas Vogt, Hazem Krichene, Dorothee Keppler

UNED

José Maria Labeaga Azcona

MCC
Mercator Research Institute on Global Commons and Climate Change

Ulrike Kornek, Stellio Del Campo, Simon Feindt

cnrs

Stéphane Zuber, Marie Young Brun, Marc Fleurbaey (assoc.)

UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Thomas Sterner, Jens Ewald

AXIS JPI Climate

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

ANR AGENCE NATIONALE DE LA RECHERCHE

FORMAS

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

CHIPS research questions & related contributions

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Climate Change Impacts and Policies in Heterogeneous Societies

Research question	Contributions from CHIPS
What are the impacts of climate change and how can they be better integrated in economic modeling?	Dasgupta et al. (2021), Piontek et al. (2021), Rising et al. (2022), Schultes et al. (2021), Yalew et al. (2021), Krichene et al. (under review)
What are the distributional consequences of climate impacts?	Literature review: Méjean et al. (in prep.) Between countries: Dasgupta et al. (2021) Within countries: USA - Haßel et al. (in prep.) global – Collins-Sowah & Piontek (in prep.)
What are the effects of inequality on the social cost of carbon?	Krichene et al. (under review), Young-Brun & Feindt (in prep.)
How can adverse effects of climate policy through carbon pricing be understood and avoided?	Conceptual: Del Campo et al. 2023), Fleurbaey & Kornek (2021) Europe - Feindt et al. (2021), Mexico - Labandeira et al. (2022), Global - Soergel et al. (2021), Méjean et al. (in prep.)
How do distributional aspects interact with transformation pathways to low carbon societies?	Piontek et al. (in prep.)
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Spotlight 1: Vulnerability to climate change depends on income (J. Haßel, T. Vogt, C. Otto)

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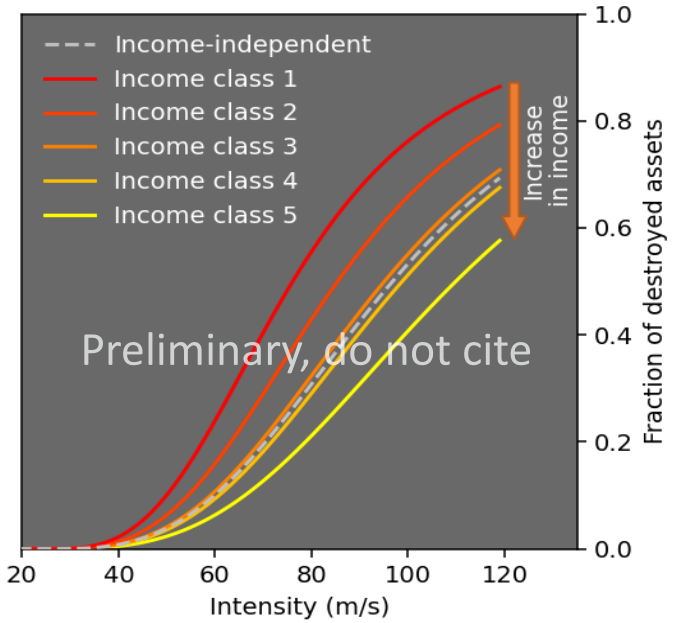
- We empirically derive the vulnerability of **five U.S. income groups** to hurricanes using:
  1. a **county-level database of damage reports** (97 events, 1996-2020),
  2. the distribution of **economic assets**, downscaled to a 10 km grid,
  3. modeled hurricane **wind fields** on that grid.
- We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



Haßel et al., in preparation

Spotlight 1: Vulnerability to climate change depends on income (J. Haßel, T. Vogt, C. Otto)

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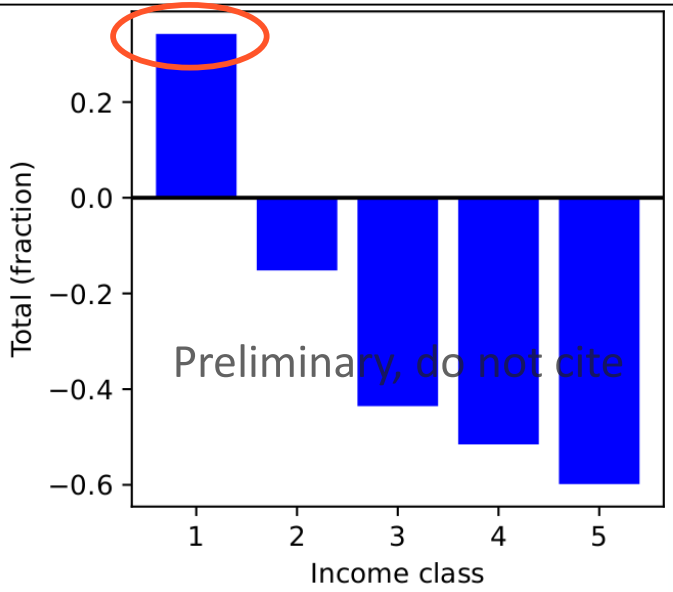
Compared to an approach with an **income-independent vulnerability**, the lowest income class's losses are 30% higher.



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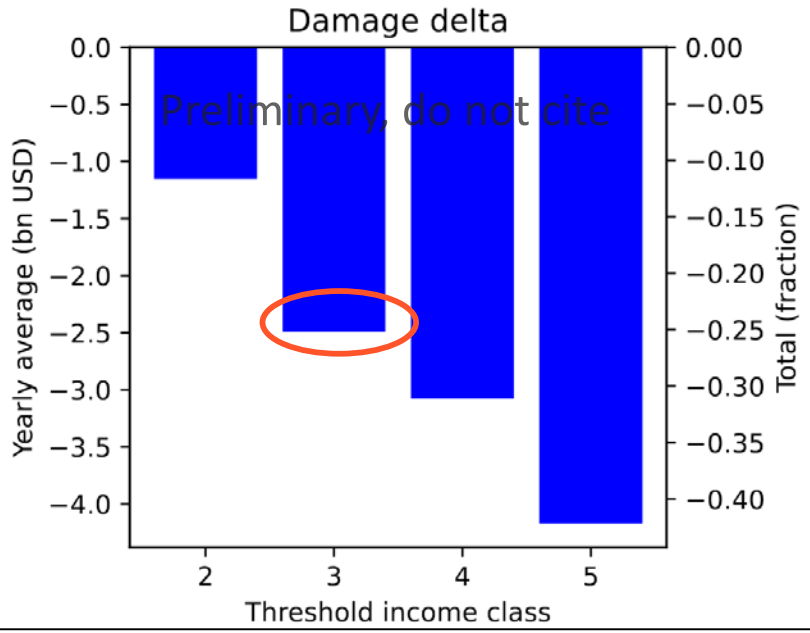

Appx. 25% of the total damages could be avoided by **increasing the resilience** of the lower two income classes to the level of the third income class.

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

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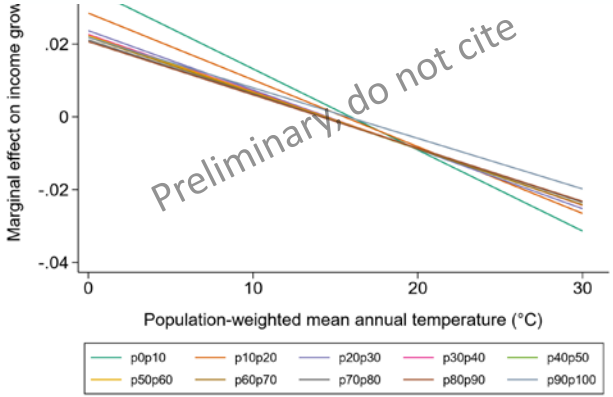
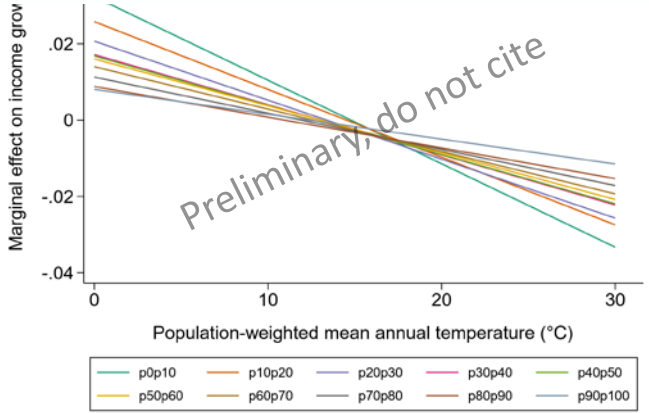
Econometric analysis of the effect of temperature (and precipitation) on income growth for different income groups (1980-2021)
→ non-linear effect, heterogeneous across income groups

Controlling for adaptive capacity dampens the effect especially for high income groups

Results crucial to improve quantification in integrated assessment modeling





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Spotlight 2: Distributional effects of carbon pricing in developed and developing countries

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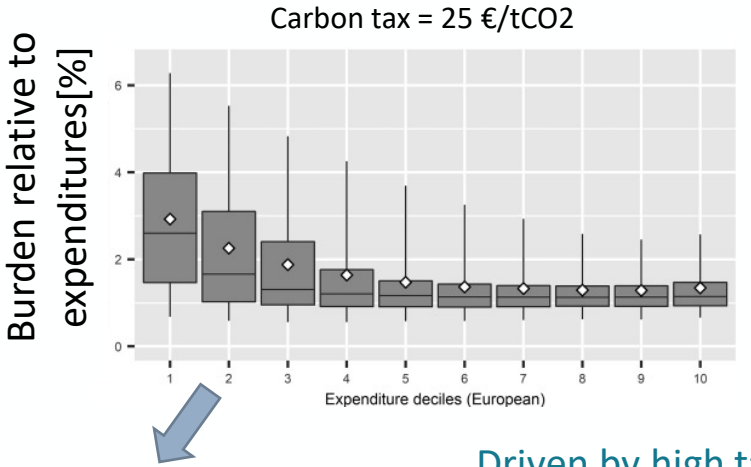
Feindt et al. (2021): European Union

→ Regressive across countries

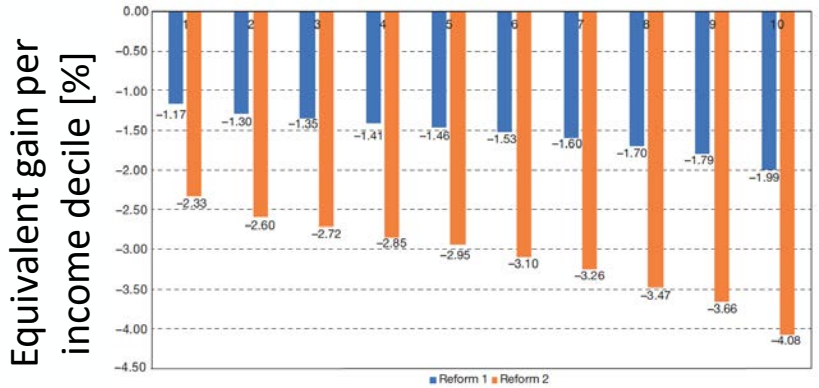


Driven by between-country inequality rather than within-country effects

→ Driven by high tax burden in low income member states (particularly Bulgaria, Poland, Romania)

Labandeira et al. (2021): Mexico

→ Progressive effects of higher gasoline prices offset regressive effects of higher electricity prices



tax = 25 €/tCO2 tax = 50 €/tCO2

→ Still increase in poverty rate, particularly in rural areas

Spotlight 2: Redistribution alleviates the burden

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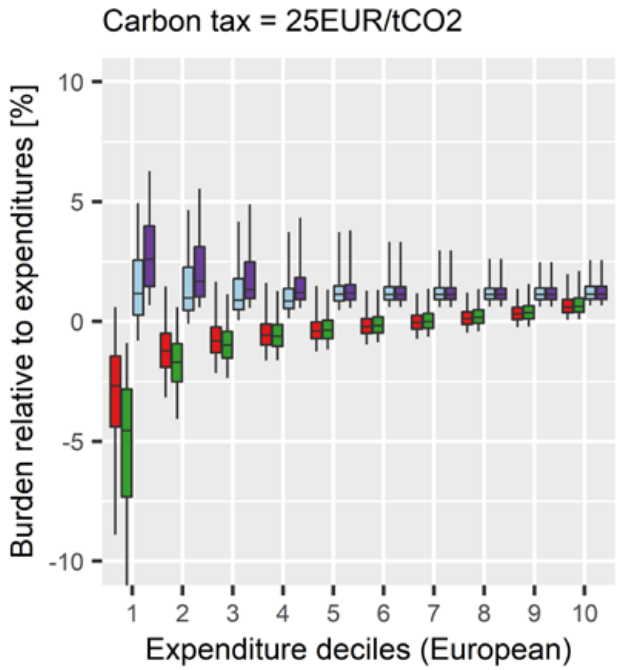
Feindt et al. (2021): European Union



Redistribution
- National e.p.c.
- European e.p.c.
- Targeted transfer
- No redistribution

Similar finding in Mexico study for targeted transfers to poor, rural households

More inflow to low-income countries

Deciles 1-4 receive transfer equalizing median burden of 1st and 5th decile → larger transfers to poor households in Poland, Bulgaria, Romania

Spotlight 2: Redistribution alleviates the burden – global picture

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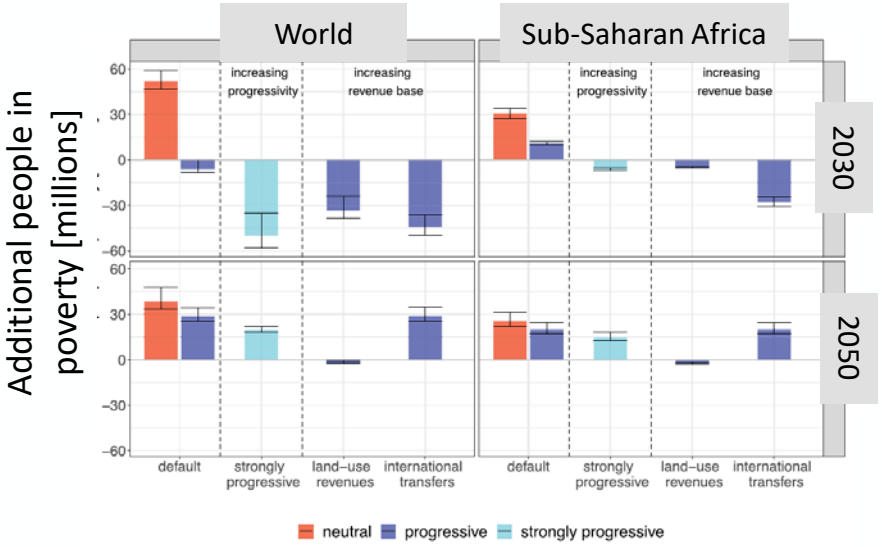
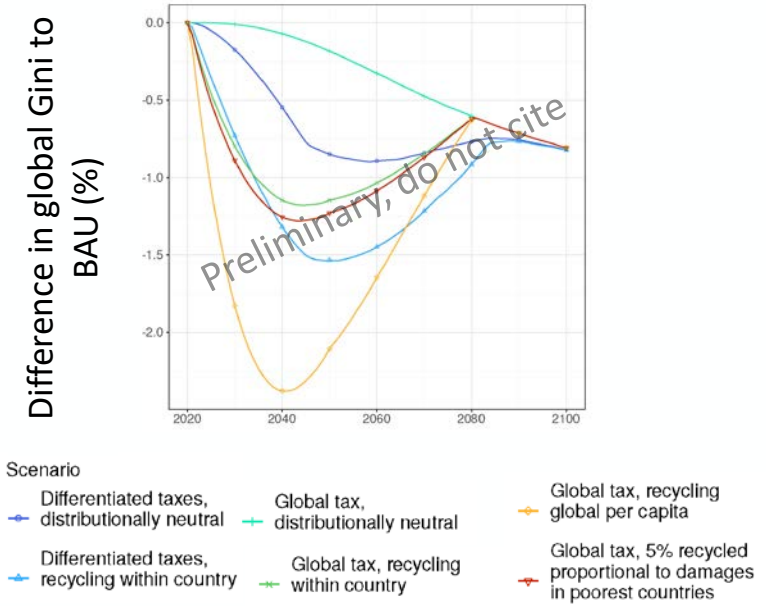
Soergel et al. (2021): progressive redistribution reduces near-term poverty increases from carbon pricing, but international transfers needed to achieve this for all regions



Méjean et al. (in prep.): international redistribution superior, loss & damage recycling better than national



Spotlight 3: Double benefits of climate policy

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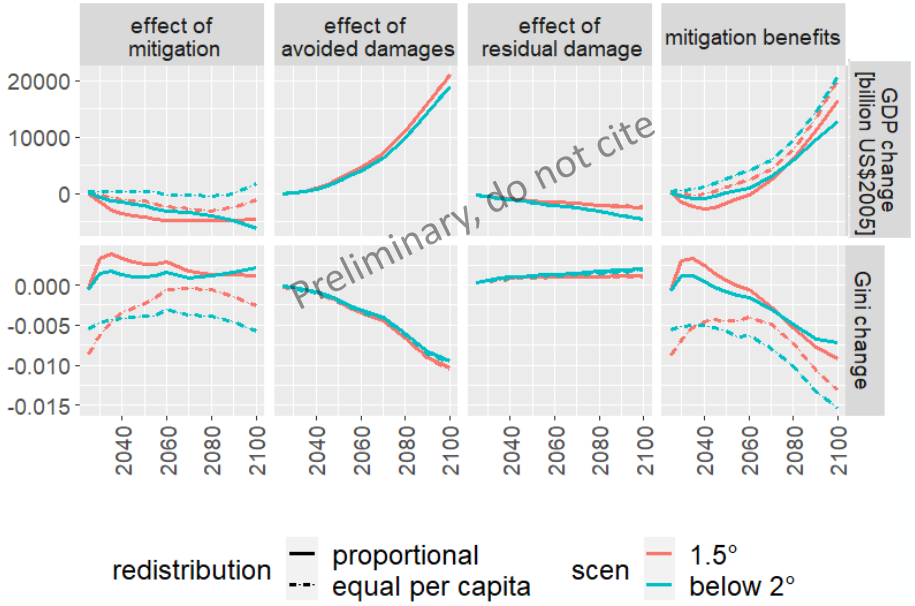
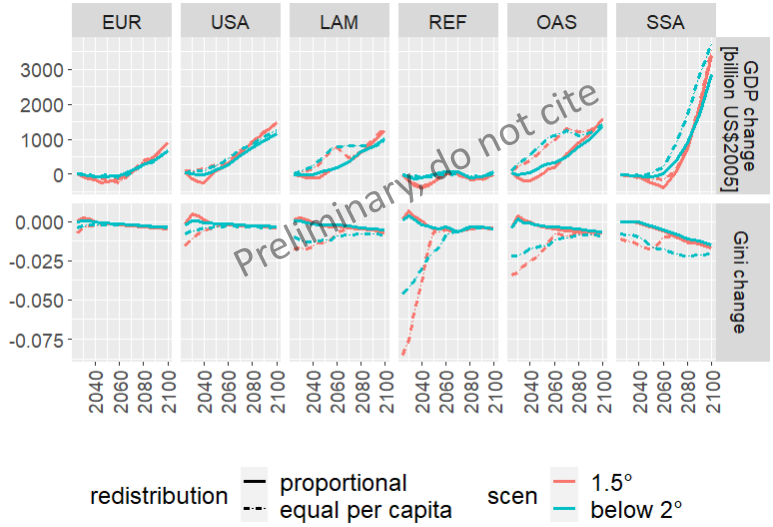
Piontek et al. (in prep.): global integrated assessment modeling including distributional effects of mitigation and impacts (REMIND model)



Mitigation benefits for selected regions



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Spotlight 4: Policies beyond carbon pricing can reduce inequality effects and increase acceptance

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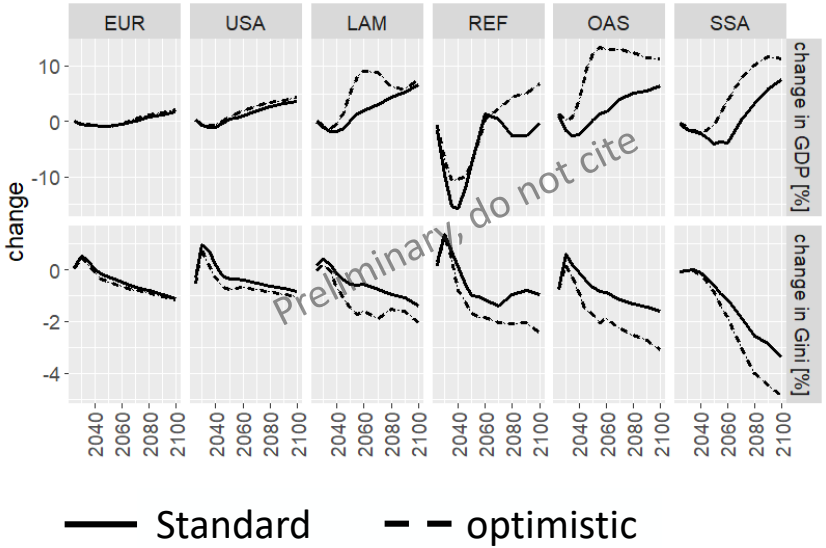
Piontek et al. (in prep.): optimistic assumptions about behavioral change in transport (use of public transport and electric mobility) reduce mitigation pressure and inequality



Ewald et al. (2021): survey study of Swedish households → protesters also concerned about climate change, but support for carbon taxation depends on trust in government + use of tax

Use of carbon tax revenues	Represen-tative group	Protest group
Earmark for clean energy to reduce emissions	60	51
Research on climate change	34	28
Traditional public goods, health, education, social	24	30
General budget use	11	10
Refunding to households (progressive)	8	15
Refunding to households (equal)	7	18

Spotlight 5: Individual inflation rates as indicators for distributional effects

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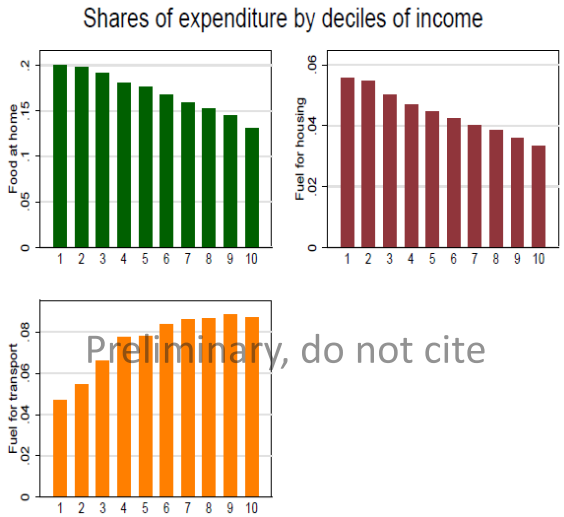
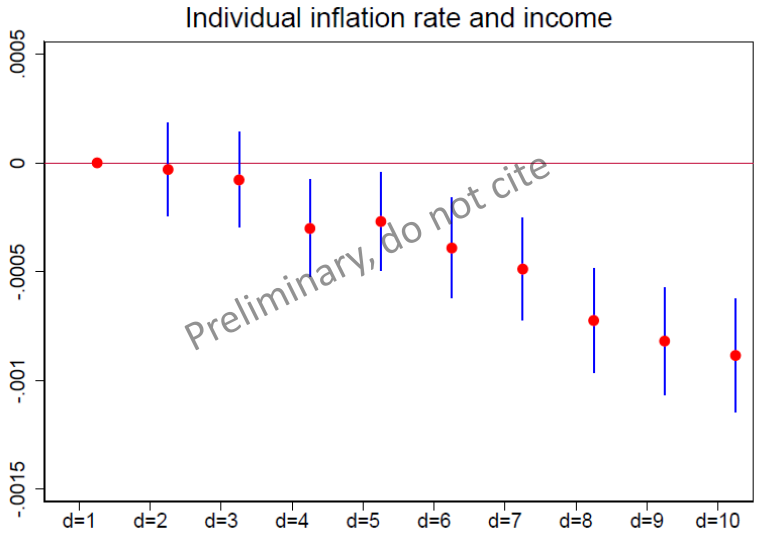
Ewald, Labeaga, Sterner (in prep.): households spend differently, depending on income → inequality effects directly through prices and indirectly through inflation → average national inflation after shocks (COVID, Ukraine war) far from real, individual inflation





Case study of Spain

Overall key messages

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- Climate change impacts increase inequality between and within countries and increases the social cost of carbon → additional incentive for climate policy and double benefits
- Carefully designed (targeted) redistribution mechanisms need to accompany climate policy measures to counteract disproportional effects on low income groups → turn trade-offs into synergies
- Further indirect channels through which inequality effects can arise need to be investigated (inflation)
- Other policies aside from carbon pricing can increase the acceptance and reduce inequalities → further research needed

- CHIPS benefited from collaboration between integrated assessment and micro-level economists, but linking across scales remains very challenging

Thank you!

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