

Distributional impacts of climate policy and effective compensation: Evidence from 88 countries

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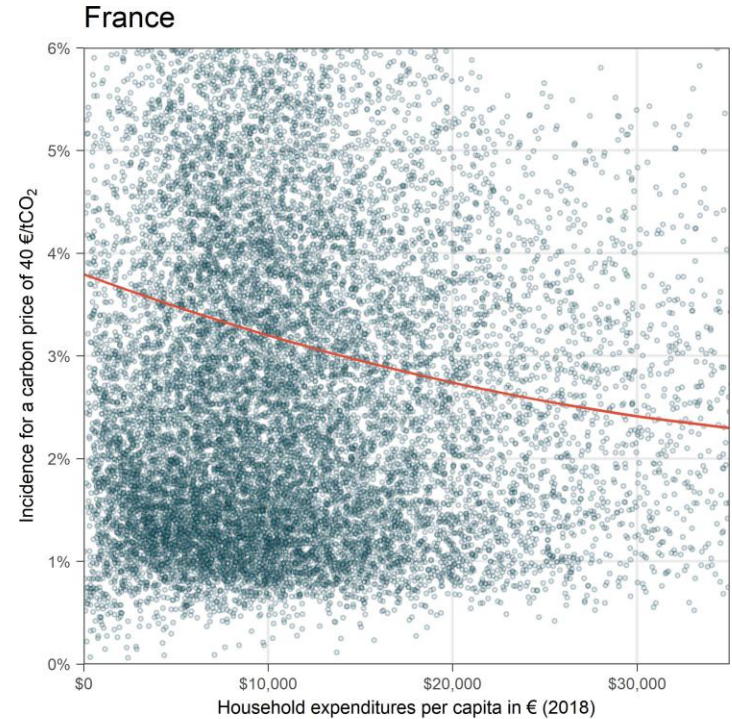
Which households bear the highest costs of climate policy?

- **Unequal distribution** of costs is a key barrier for climate policy.
- **Compensation policies** can help addressing distributional effects.
- Which households bear the highest costs of climate policy? Why?
- Important for design of compensation policies.

- A novel cross-country dataset.
- Understanding country-level drivers of heterogeneity with machine learning.
- Country- and policy specific drivers. Six country clusters.

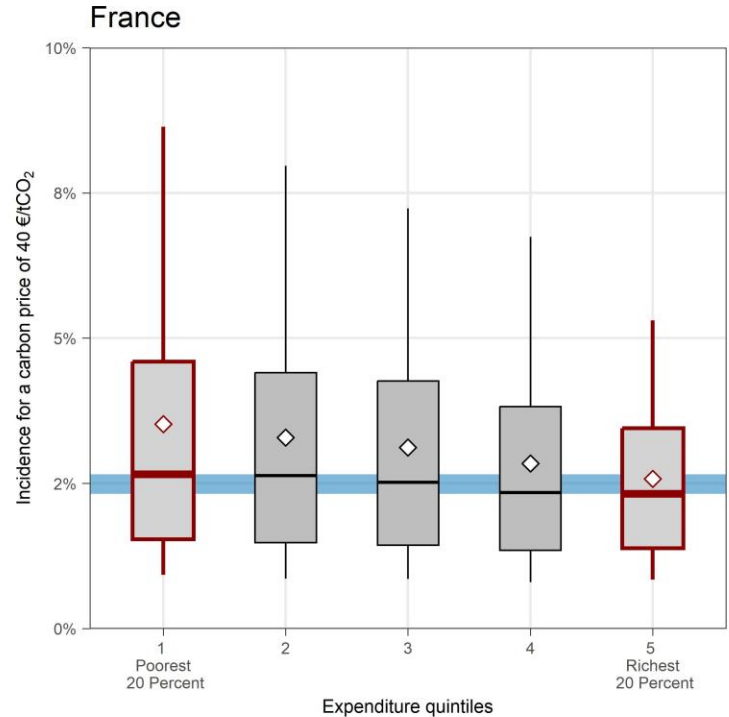
Climate policy affects different households differently

- Poorer households would bear higher additional costs than richer households.



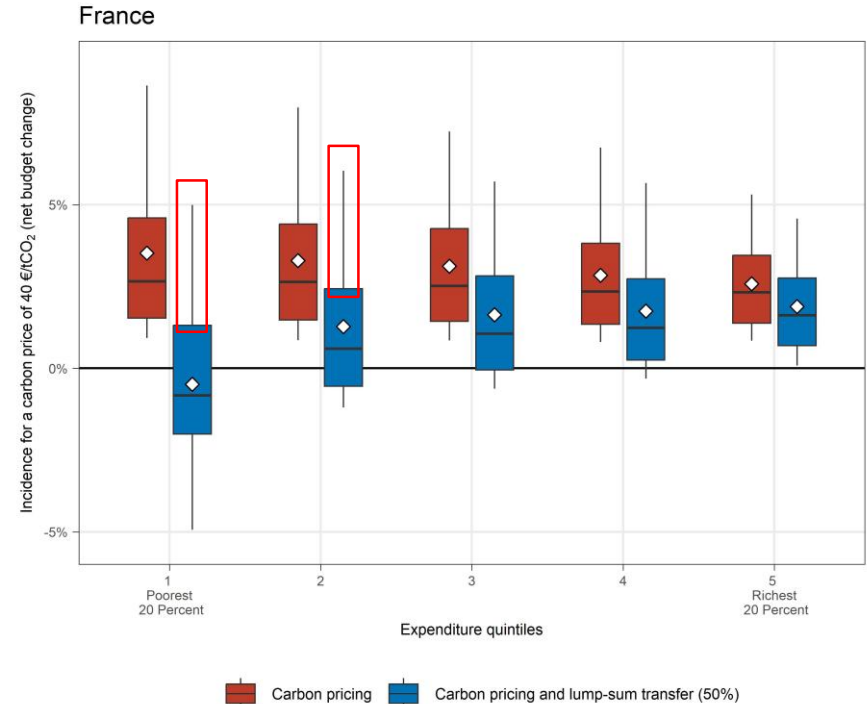
Horizontal differences exceed vertical differences

- Poorer households would bear higher additional costs than richer households.
 - Vertical heterogeneity
- Differences within expenditure quintiles are large.
 - Horizontal heterogeneity



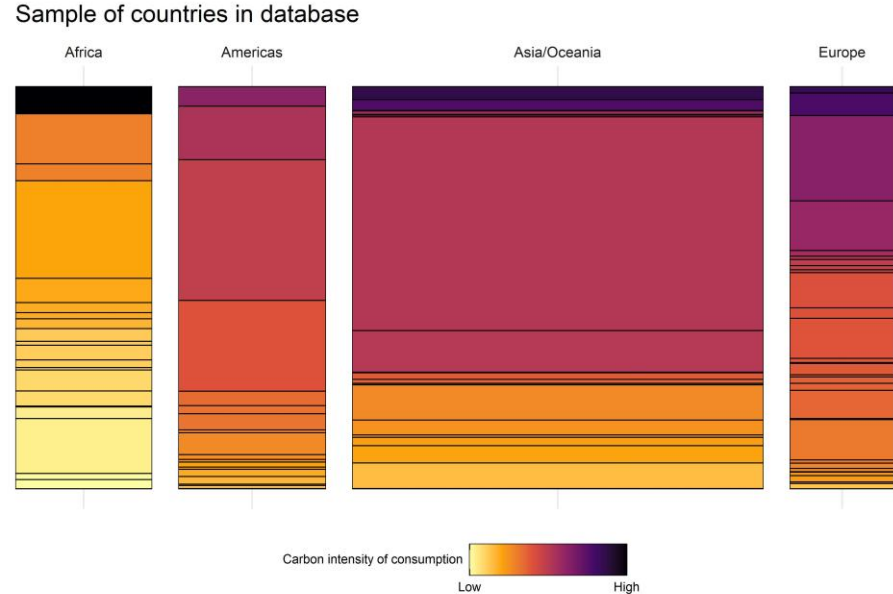
Horizontal differences exceed vertical differences

- Poorer households would bear higher additional costs than richer households.
 - Vertical heterogeneity
- Differences within expenditure quintiles are large.
 - Horizontal heterogeneity
- Implications for design of compensation
- Lump-sum transfers lead to a more **progressive distribution** of costs
- Yet, some households would be left highly affected.



Contribution and method

- What helps to explain heterogeneity in additional costs of climate policy?
- We construct a novel dataset.

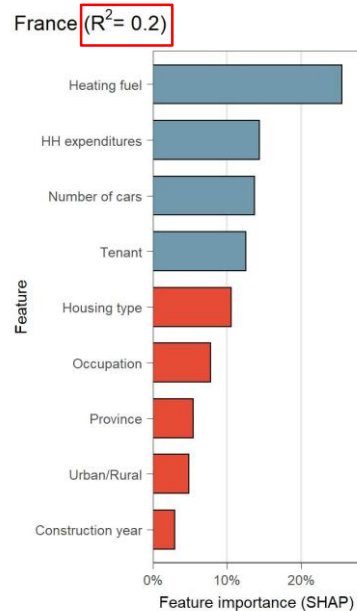


Contribution and method

- What helps to explain heterogeneity in additional costs of climate policy?
- We construct a novel dataset
- More than 1.5 million households from 88 countries
- What do households consume?
 - Household-level expenditure data
- What are CO₂-emissions embedded in consumption?
 - Multi-regional input-output data
- We use supervised machine learning to detect the relationship between **household characteristics** and the **carbon intensity** of consumption.

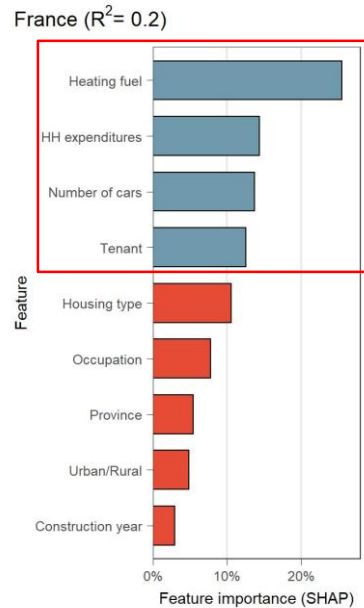
What explains differences in costs of climate policy in France?

- The model can predict **20%** of variation in households' carbon intensity.



What explains differences in costs of climate policy in France?

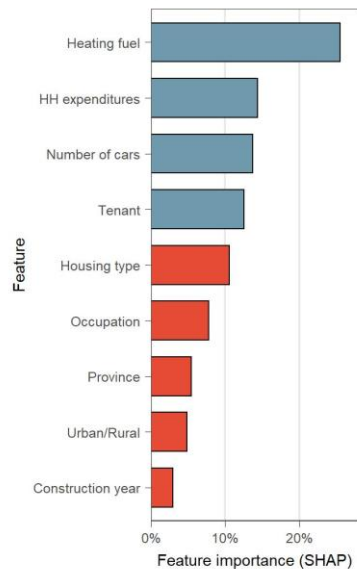
- Variation in some household characteristics is more important than in others.



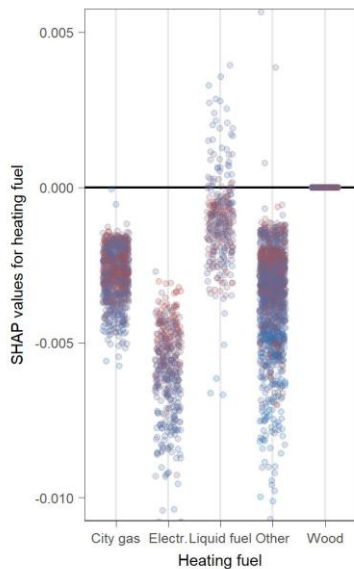
What explains differences in costs of climate policy in France?

- Households heating with **liquid fuels** or **wood** bear higher costs.

France ($R^2=0.2$)



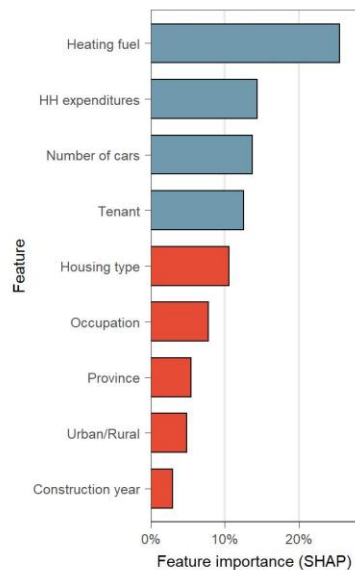
Heating fuel (Importance: 26%)



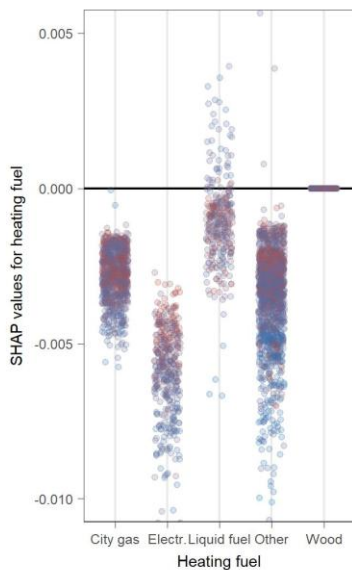
What explains differences in costs of climate policy in France?

- Controlling for other factors, **poorer households** bear higher costs.

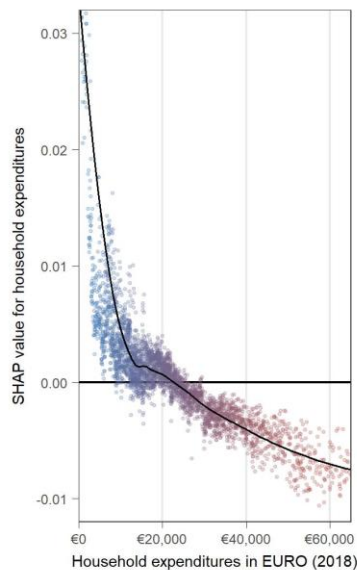
France ($R^2 = 0.2$)



Heating fuel (Importance: 26%)



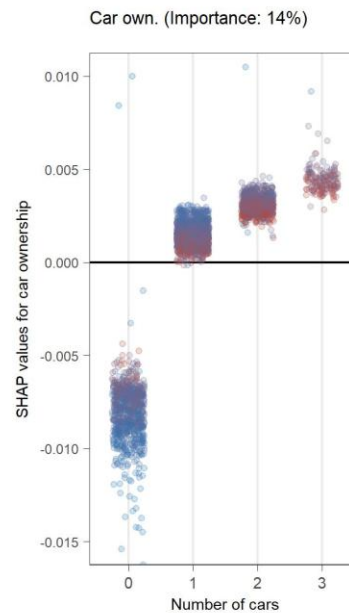
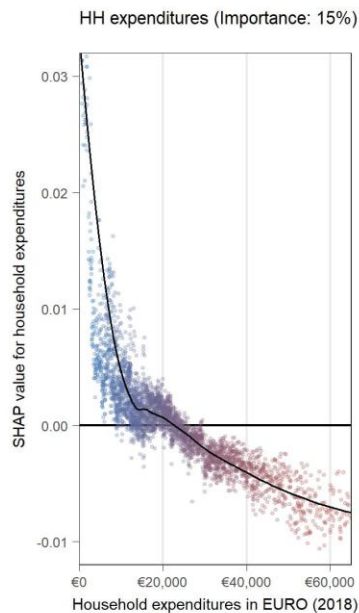
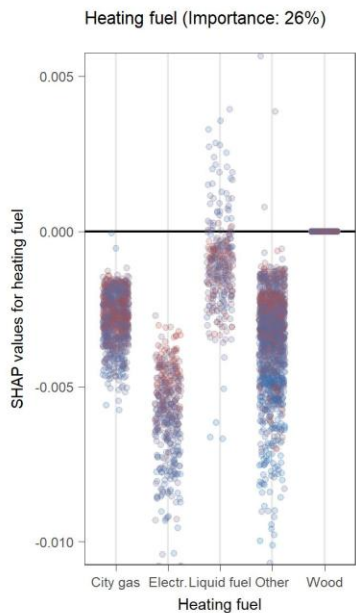
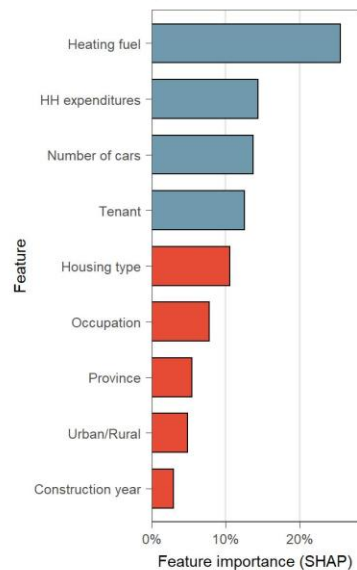
HH expenditures (Importance: 15%)



What explains differences in costs of climate policy in France?

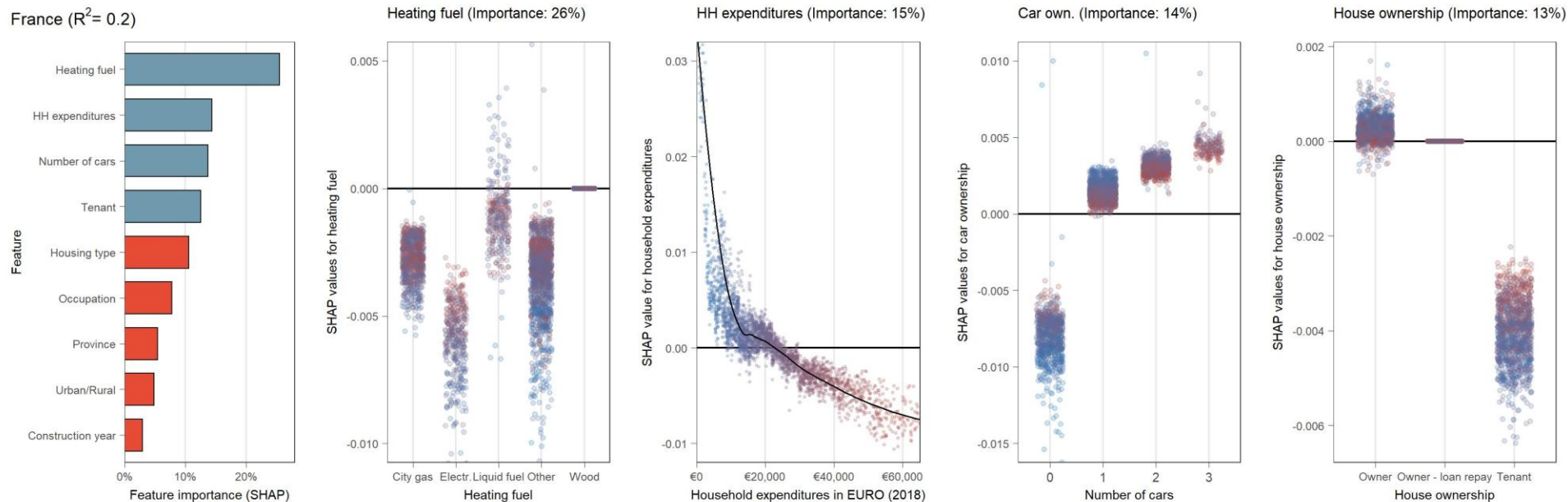
- Households that own and use **cars** bear higher costs.

France ($R^2 = 0.2$)



What explains differences in costs of climate policy in France?

- Tenants bear lower costs.

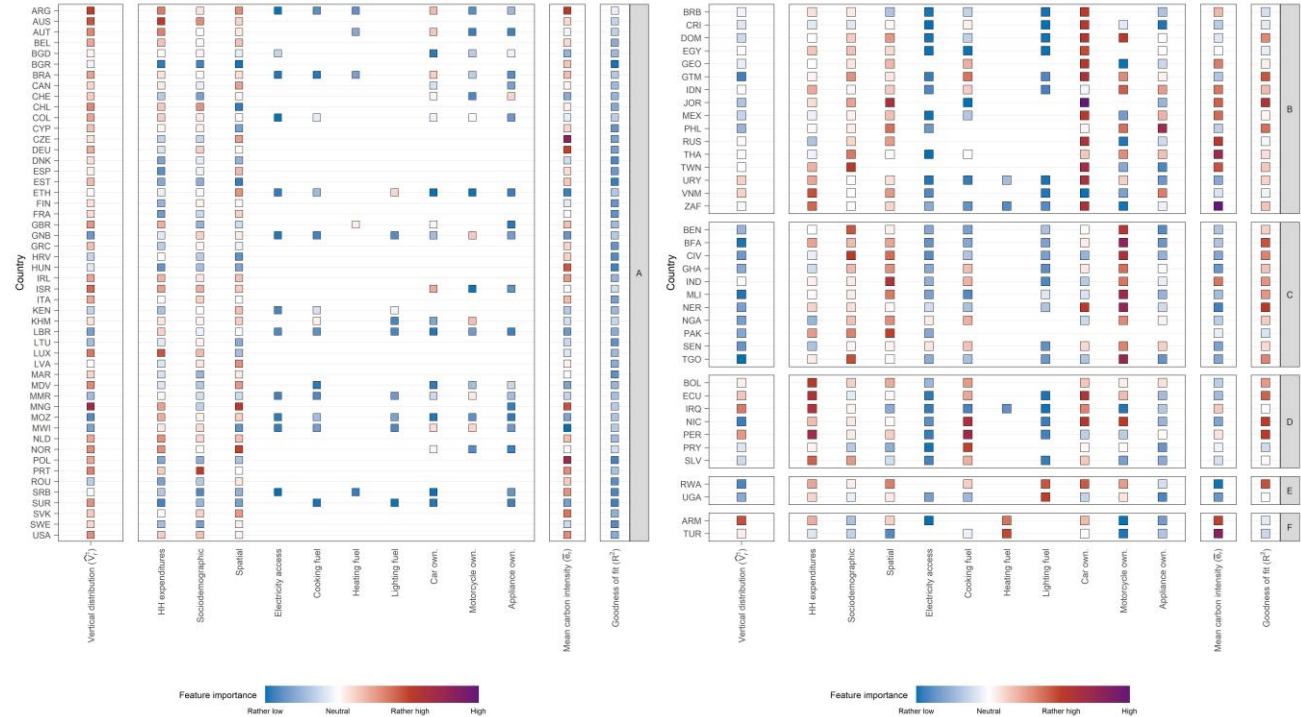


What can we learn about effective compensation?

- In France, it is difficult to predict additional costs.
- Progressive transfers can help alleviate such costs.
- In addition:
 - Transfers conditional on demand for heating fuels?
 - Transfers conditional on demand for transport fuels?
 - Transfers targeted to home owners?

Driver of heterogeneity differ across clusters

- We identify six clusters of countries.
- Some forms of compensation may be more effective in some clusters.



Conclusion

- Distributional effects of climate policy are **country-** and **policy-specific**.
- **Horizontal** differences exceed **vertical** differences.
- Heterogeneity in households' **income** can not explain heterogeneity in households' carbon intensity.
- Instead, include information on energy use, location, assets and socio-demographics.
- Distributional effects do not need to be a barrier for climate policy.
- But: Design of **effective compensation policy** matters.

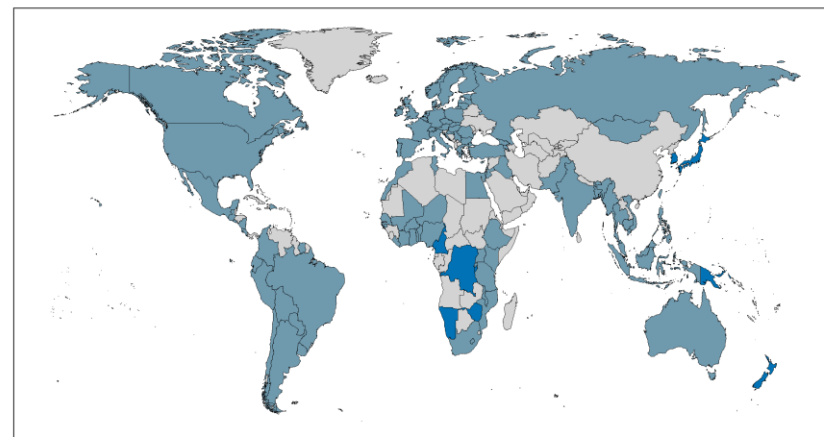
Carbon pricing incidence calculator: cpic-global.net

- Analyze the country-level distributional impacts of climate policies
- Customize analyses to your needs
- Investigate different compensation measures
- Broad coverage

The screenshot displays the user interface of the Carbon Pricing Incidence Calculator, organized into three main columns under the headings 'Population', 'Carbon Price', and 'Compensation'.

- Population:** Users are asked to 'Select up to two characteristics (order matters!)'. The 'Five income groups' option is highlighted in yellow. Other options include 'Ten income groups', 'Household size', 'Urban or rural area', 'Gender of household head', 'Education of household head', 'Car ownership', 'Province (sub-national division)', 'Main cooking fuel', 'Main lighting fuel', and 'Electricity access'.
- Carbon Price:** The 'Set a carbon price' section shows a slider set to '40\$/tonne'. Below, 'Select a policy instrument' offers 'Global carbon price', 'National carbon price' (highlighted in yellow), 'National carbon price in the electricity sector', and 'National carbon price in the transport sector'.
- Compensation:** The 'Set how much of the revenues raised is distributed back to the population' section has a slider set to '50%'. 'Select a compensation measure' includes 'Equal per capita transfer (lump sum)' (highlighted in yellow), 'Equal per household transfer (lump sum)', 'Electricity price subsidy', 'Exempting electricity from carbon pricing', and 'Reducing consumption taxes (e.g. VAT)'.

Coverage of carbon pricing incidence calculator



■ Data collected ■ Data available ■ Data not available

Thank you.

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Visit <https://lmissbach.github.io> for more information and working paper.

Preprint available: <https://tinyurl.com/Missbach2024>

Thank you