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Prices and standards for vertical and horizontal equity in climate policy

A quantitative exploration of fairness considerations in climate policy design

INTRODUCTION

Charting a just transition to climate neutrality

Climate change and economic **inequality** are two key societal challenges. While delivering on the ambitious targets of the Paris Agreement requires strong climate action, the question arises how the transition can decrease greenhouse gas emissions and reduce economic inequality at the same time. Moreover, the perception of fairness may provide an important barrier to societal support and the acceptability of climate policy measures. **Distributional issues are at the forefront of the debate, and require thoughtful consideration when designing climate policy packages.**

Here, we aim to inform this debate on fairness of climate policy by studying the equity issues for different climate policy packages, all aimed at reaching the renewed 2030 target of reducing greenhouse gas emissions by net 55% compared to 1990 in the EU (EC, 2020). In particular, we study **three policy packages that differ in terms of the instrument mix:**

- The ***Regulation*** scenarios relies on regulatory measures other than price signals to strengthen climate policy beyond what is currently implemented. The scope of the EU ETS remains unchanged, but targets (share of renewables, RED; energy efficiency, EED) and standards (vehicles, buildings) are strengthened. There is no additional tax revenue compared to the baseline.
- The second scenario reflects a policy design based on a strong ***Carbon Price*** signal through the scope extension of the EU ETS to cover residential and commercial buildings and transport-related emissions. Revenue is recycled within countries as uniform lump-sum transfers to households.
- The ***Mix*** scenario combines features of the above two scenarios. Revenue recycling is mixed: subsidies for residential energy efficiency investment (up to 50%) & uniform lump-sum transfers.

Previous work has illustrated the importance of **(1)** vertical (between income groups) and horizontal (here: within income groups) equity (Rausch et al., 2011); **(2)** expenditure- and income-side impacts (Goulder et al., 2019; Vandyck et al., 2021); **(3)** instrument choice (Fischer and Pizer, 2019). We combine these three key elements in a methodological framework that combines economy-wide, computable general equilibrium modelling (the CGE model JRC-GEM-E3) with household-level micro-data (matched dataset with HBS and EU-SILC). Generalizing Fischer and Pizer (2019), we construct a novel welfare metric W to assess policy-induced income changes ($\Delta y_i = y_i - y_{0i}$):

- $W = \Delta y_{EDE} - \gamma \left(N^{-1} \sum_i (\bar{y}/y_{0i})^{\varepsilon\rho} |\Delta y_i - \overline{\Delta y}_{d(i)}|^{1+\rho} \right)^{1/(1+\rho)}$
- with $y^0_{EDE} = \left(N^{-1} \sum_i y_{0i}^{1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}}$ and $u_i' = 1/y_i^\tau$

In these expressions, horizontal equity weight γ and vertical inequality aversion ε conveniently characterise the social planner's equity preferences. Horizontal equity is defined in terms of deviations from the decile-average impact ($\overline{\Delta y}_{d(i)}$), with higher values of ρ representing a stronger aversion to extreme within-decile impact variation. Curvature of the utility function is expressed by τ.

RESULTS

Climate policy impacts are heterogeneous between and within income groups. As low-income households spend a larger part of their income on energy-related expenditures, increases in energy-related spending tend to show a regressive pattern across income deciles (before revenue recycling). Impact variation within income deciles tends to be larger than the heterogeneity across decile averages.

Both expenditure- and income-side channels contribute to between- and within-group impact heterogeneity. While differences in expenditure patterns are the main driver behind impact heterogeneity between and within income groups, income- or sources-side impacts further exacerbate both vertical and horizontal equity concerns.

Carbon pricing generates revenue to compensate losses, while regulation limits horizontal inequities. Carbon pricing is regressive before revenue recycling, but progressive after revenue recycling via uniform lump-sum transfers to households (see Fig. 1). Regulation-based policies are mildly regressive, generate no additional revenue, but somewhat limit within-decile impact variation relative to carbon pricing policies as price changes are less pronounced and households only face the mitigation cost, not the price paid on remaining emissions.

The optimal instrument choice depends on vertical and horizontal equity preferences. For high vertical inequality aversion ε, the price-based scenario with uniform lump-sum transfers dominates the other policy designs on welfare grounds as low-income households benefit from a cash transfer that is relatively large to their incomes. However, once horizontal equity considerations γ reach a threshold, the carbon price dominance breaks down and a mixed policy design is preferred (coloured frame in Fig. 2), in which income support (transfers) addresses vertical equity and non-price regulation and targeted subsidies limit horizontal equity concerns. **A mixed policy design, combing price and non-price measures with subsidies is preferred when horizontal equity gets sufficient weight relative to vertical equity.**

Figure 1. Distributional impacts of climate policy packages across EU income groups

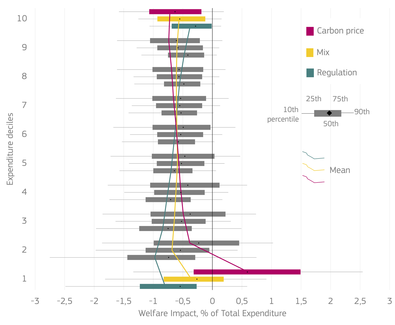
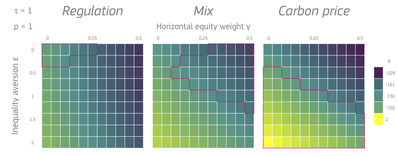


Figure 2. Optimal policy mix depending on vertical and horizontal equity preferences



CONCLUSIONS

Climate policy impact heterogeneity warrants attention in policy design and compensation schemes to ensure feasibility of implementation.

A fair climate policy package has a higher probability when it comes to societal acceptability. The impacts of climate change – not addressed in this paper – may also affect society's most vulnerable groups disproportionately. Careful policy choices must govern that the policies to address climate change protect rather than harm vulnerable households, reducing emissions and energy poverty while improving the resilience and well-being for all.

Broadening the perspective on fairness – combining horizontal and vertical equity – may lead to a shift in recommendations on policy design towards comprehensive, multi-instrument policy packages.

The once-held economic view of a carbon price as the only instrument needed to achieve a fair transition towards climate neutrality may be overly simplistic. While carbon pricing deserves a central role in policy packages, its use can be complemented by (1) orienting revenue recycling towards the compensation of low-income households to offset potential 'vertically' regressive effects, (2) standards and targeted subsidies that limit impact heterogeneity in the horizontal sense.

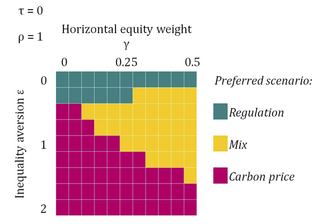


Figure 3. Preferred policy mix for different parameter settings

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The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

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This poster is derived from the following working paper (scan QR code for direct access):

Vandyck, T., Temursho, U., Landis, F., Klenert, D., & Weitzel, M. (2022). Prices and Standards for Vertical and Horizontal Equity in Climate Policy. *Working Paper*, Available at SSRN 4144282.

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