The impact of green policies on carbon inequalities in Italy: A macrosimulation approach

Topic: Special Session - Assessing Industrial, Trade and Green Transition Policies Through SFC-IO Models
Author: David Cano Ortiz
Co-Authors: Guilherme Spinato Morlin, Simone DAlessandro, Till Heydenreich

Climate change does not affect everyone in the same way, neither do the green transition policies envisaged to avert it. Consumption-based measures of greenhouse gas (GHG) emissions have allowed to deepen the understanding of carbon inequality, by tracing emissions along global supply chains (Davis & Caldeira, 2010) and identifying carbon footprints across income groups (Gore, 2021). For Europe, the integration of consumption and input-output data allows to estimate carbon inequality across countries, income groups, and categories of consumption goods (Ivanova & Wood, 2020), while carbon inequalities across sub-national regions is also of interest (Kilian et al., 2023). In this study, we follow the approach of integrating input-output matrices with household consumption patterns into a macrosimulation model, to analyze disparities in emissions from household consumption across subnational regions in Italy.

Italy exhibits some of the highest regional disparities among OECD countries in household income and unemployment (International Energy Agency, 2023). Regional differences are also prevalent for carbon emissions and energy consumption (Italy for Climate, 2022), with consumption-based emissions concentrated in Northern regions (Algieri et al., 2022), and big disparities in terms of energy poverty risk, renewable energy generation, and exposure to extreme climate events (International Energy Agency, 2023). Thus, climate change will deepen regional inequalities and affect disproportionally certain population groups in Italy, through its differentiated effects across regions, productive sectors, and income groups (Spano & Mereu, 2020). It is crucial to consider the distributional impact of green policies too, which can also deepen these inequalities (Vandeplas et al., 2022).

In this context, we assess how regional inequalities in Italyâ€”in income and consumption-based emissionsâ€”will respond to different policies for the green transition: the elimination of carbon subsidies and a transition from fossil fuels to electricity. We use macrosimulations with a new version of the Eurogreen model for Italy (Cieplinski et al., 2021). Eurogreen is a data-driven ecological macroeconomic model based on a detailed input-output structure with demand-led growth, that allows to analyze simultaneously macroeconomic and environmental variables in a system dynamics framework. It includes a stochastic endogenous process of technical change, by which technical input-output coefficients and labor productivity change dynamically.

The new version of the model includes two novelties that allow for an analysis of householdsâ€™ income and carbon inequalities across regions. On the one hand, the model features 100 representative households, differentiated by region and income quintiles, which exhibit different income source compositions and consumption patterns. On the other hand, the model includes an integration between monetary and physical-energy input-output matrices, which provides a link between energy sources, productive structure, and emissions. Moreover, the new version expands the sectoral classification, providing a more detailed structure with regards to the energy sectors. The model is calibrated for 2010 as the base year, using data from Bank of Italyâ€™s Survey of Household Income and Wealth (SHIW), Istatâ€™s Survey on Household Budgets (SHB), and Italian National Accounts for the household module, and from the World Input Output Database (WIOD) and EXIOBASE for the technology and energy modules.

In this framework, we simulate, on the one hand, the elimination of subsidies to fossil fuel industries, and on the other hand, a gradual transformation of the energy mix from fossil fuels towards electricity, first assuming only changes in the productive structure, and then allowing also changes in transport consumption patternsâ€”from private vehicles to public transport. We find that the elimination of brown subsidies has a small effect on both income and carbon inequalityâ€”since it impacts sectors with different wage structures like agriculture, petroleum, and manufacturing. Regarding electrification, changes in consumption patterns make a difference. Without them, electrification reduces carbon inequality across income groups, as the impact on richer householdsâ€™ is stronger. On the other hand, changing consumption patterns increases regional householdsâ€™ carbon inequality, since the substitution towards low-emissions public transport is stronger in poorer regions, assuming considerable infrastructure improvements. In summary, our results highlight the strong connection between carbon and income inequalities, and how current inequalities condition the distributional impacts of green policies.