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CARBON PRICING AND THE AFFORDABILITY OF RESIDENTIAL HEATING

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Overview

Carbon pricing is a key instrument of climate policy. Germany has recently introduced a carbon price for heating and transport fuels, and the European Union plans to introduce an emissions trading scheme for these sectors in 2027. Carbon pricing further increases the price of fossil fuel-based residential heating to incentivize lower consumption, improved energy efficiency and the use of low-carbon heating technologies. With this intended effect, however, there may also be undesirable social burdens such as the impairment of affordability due to higher prices (Flues and Van Dender 2017). Affordability refers to the ability of households to meet their basic needs for heating and other goods (Florence School of Regulation 2008). This requirement should also be met in the context of carbon pricing and the decarbonization of the building sector. The concept of affordability has not yet been applied to the analysis of carbon pricing. The existing literature on the carbon price cost burden for private households focuses on the distributional impacts and how it can be designed progressively (Levinson 2019; Zhao and Mattauch 2022; Hänsel et al. 2022; Preuß, Reuter, and Schmidt 2019; Edenhofer et al. 2019; Klenert and Mattauch 2016). While a fair distribution of the cost burden is considered important for public acceptability and political feasibility (Drews and van den Bergh 2016; Maestre-Andrés, Drews, and van den Bergh 2019), it does not sufficiently address the issue of affordability (Gawel, Sigel, and Bretschneider 2013). For affordability, it is not the distribution of costs that is decisive, but whether a household's ability to meet basic needs for heating and other goods is impaired by the carbon price cost burden and the costs of reducing emissions. This paper aims to fill this gap by bringing together theoretical approaches to the carbon price cost burden on households with research on affordability. We ask how carbon pricing affects the affordability of residential heating. In this context, we also explore affordability implications if households may respond to carbon pricing by investments in energy efficiency and low-carbon heating technologies. On the one hand, such investments may reduce the burden imposed by carbon pricing. On the other hand, the costs of these investments impose additional burdens. We also ask which conditions favor the occurrence of affordability problems and which policy instruments are suitable to alleviate affordability problems.

Method

We develop a microeconomic model in which a household consumes heating and other goods and can reduce its carbon price cost burden by consuming less heating or by investing in energy efficiency and a low-carbon heating technology. We apply four different affordability indicators to the case of residential heating (conventional affordability ratio, potential affordability ratio, low-income high-cost indicator, residual income approach). Using a comparative static analysis, we examine the impact of carbon pricing on these four different affordability indicators. In addition, we analyze the affordability impacts of a carbon price in a policy mix with targeted transfer payments and subsidies.

Results

Our model shows, that apart from consuming less heating households can reduce their carbon price cost burden and thus prevent affordability problems by improving energy efficiency or adopting a low-carbon heating technology. However, the costs associated with implementing these measures may pose affordability problems for low-income households. They are forced to either reduce their consumption of heat services or other goods below subsistence levels. Affordability problems are exacerbated if low-income households are endowed with low initial levels of energy efficiency and a high-carbon heating technology. We also find that the monetary burden and affordability impact of carbon pricing depend not only on the carbon price level but also on the cost for improving energy efficiency and adopting a low-carbon heating technology. Finally, we show that targeted income transfers and subsidies for improving energy efficiency and adopting low-carbon heating technologies are effective in

alleviating affordability problems. While the potential magnitude of affordability problems and the cases that are identified as problematic depend on the used affordability indicator, our main findings are robust across all four indicators.

Conclusions

Carbon pricing is an important pillar of climate policy but it can affect the affordability of energy services such as residential heating. Affordability goes beyond conventional distributional analysis and is concerned with the ability of households to meet basic needs for heating and other goods. We use a theoretical microeconomic framework to examine the impact of carbon pricing on four different indicators of heating affordability. While we find that carbon pricing can significantly impair the affordability of heating, especially for low-income households, we also demonstrate that these adverse effects can be offset by targeted transfers and subsidies. We conclude that ambitious carbon pricing policies should include well targeted compensatory measures to ensure the affordability of residential heating.

References

Drews, Stefan, and Jeroen C.J.M. van den Bergh. 2016. "What Explains Public Support for Climate Policies? A Review of Empirical and Experimental Studies." *Climate Policy* 16 (7): 855–76. https://doi.org/10.1080/14693062.2015.1058240.

Edenhofer, Ottmar, Christian Flachsland, Matthias Kalkuhl, Brigitte Knopf, and Michael Pahle. 2019. "Optionen Für Eine CO2-Preisreform." Mercator Research Institute on Global Commons and Climate Change (MCC).

Florence School of Regulation. 2008. "Affordability of Basic Public Utilities: Regulation and Poverty Policies." Robert Schuman Centre for Advanced Studies, European University Institute.

Flues, Florens, and Kurt Van Dender. 2017. "The Impact of Energy Taxes on the Affordability of Domestic Energy." OECD Taxation Working Papers No. 30. OECD.

Gawel, Erik, Katja Sigel, and Wolfgang Bretschneider. 2013. "Affordability of Water Supply in Mongolia: Empirical Lessons for Measuring Affordability." *Water Policy* 15 (1): 19–42.

Hänsel, Martin C., Max Franks, Matthias Kalkuhl, and Ottmar Edenhofer. 2022. "Optimal Carbon Taxation and Horizontal Equity: A Welfare-Theoretic Approach with Application to German Household Data." *Journal of Environmental Economics and Management* 116 (October): 102730. https://doi.org/10.1016/j.jeem.2022.102730.

Klenert, David, and Linus Mattauch. 2016. "How to Make a Carbon Tax Reform Progressive: The Role of Subsistence Consumption." *Economics Letters* 138 (January): 100–103. https://doi.org/10.1016/j.econlet.2015.11.019.

Levinson, Arik. 2019. "Energy Efficiency Standards Are More Regressive Than Energy Taxes: Theory and Evidence." *Journal of the Association of Environmental and Resource Economists* 6 (S1): S7–36. https://doi.org/10.1086/701186.

Maestre-Andrés, Sara, Stefan Drews, and Jeroen van den Bergh. 2019. "Perceived Fairness and Public Acceptability of Carbon Pricing: A Review of the Literature." *Climate Policy* 19 (9): 1186–1204. https://doi.org/10.1080/14693062.2019.1639490.

Preuß, Malte, Wolf Heinrich Reuter, and Christoph M. Schmidt. 2019. "Verteilungswirkung Einer CO2-Bepreisung in Deutschland." Arbeitspapier 08/2019. Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung.

Zhao, Jiaxin, and Linus Mattauch. 2022. "When Standards Have Better Distributional Consequences than Carbon Taxes." *Journal of Environmental Economics and Management* 116 (October): 102747. https://doi.org/10.1016/j.jeem.2022.102747.