

Residential CO₂ Emissions in Europe and Carbon Taxation: A Country-Level Assessment

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CO₂ emissions from the residential sector represent an important concern for climate policy design. The residential sector accounts for around 20% of European CO₂ emissions, with energy demand mainly driven by heating. Because emissions from the residential sector are difficult to displace to other countries, implementing climate policies could be effective but a clear understanding of their consequences is required. Issues like energy taxation and prices as well as carbon mitigation and redistribution are often connected to this sector.

The first objective of this paper is to study the determinants of CO₂ emissions from the residential sector in 19 European countries over the 2000-2017 period. We first estimate a static model that assumes an instantaneous adjustment of CO₂ emissions per capita to variations in energy prices, income or heating needs. We then relax this assumption and extend the static model to account for dynamic adjustments. We distinguish short-term from long-term elasticities of per capita CO₂ emissions relative to each driver. Our results show strong relationships between CO₂ emissions per capita, GDP per capita, energy prices and heating needs. We found that the income elasticity of CO₂ emissions per capita is not constant and depends on the level of GDP per capita. When instantaneous adjustment is assumed, the elasticities of per capita CO₂ emissions relative to natural gas and heating-oil prices are found to be -0.23 and -0.14 respectively. The corresponding short-term elasticities from dynamic models are -0.12 and -0.11, and the long-term elasticities estimated to be -0.47 and -0.38. We also confirm that CO₂ emissions per capita increase with heating needs, the short-run elasticities fall between 0.77 and 0.85, and the corresponding long-run elasticities are three times higher.

The second objective of this paper is to examine whether a carbon tax can be an effective complement to the EU ETS for emissions that remain unregulated, like those from the residential sector. We measured the consequences of the tax on CO₂ emissions and how the burden of this tax is distributed among countries. Imposing a European carbon tax could increase the regressive properties of carbon taxation, which could result in a popular rejection of the policy. Our econometric estimates were used to predict which countries would bear the largest increase in energy prices from a European carbon tax. We assumed a 100% pass-through rate of the tax into energy prices and assessed the short-term impacts of the tax policy. We confirmed that this tax leads to inequalities in the tax burden, as measured by the ratio of tax revenues to GDP by country. Our simulations show for example that a carbon tax of €20 per tonne represents 0.02% of the Danish GDP but 0.17% of that of Poland in terms of tax revenue. Finally, we propose a policy that may correct for these inequalities. It consists of the redistribution of carbon tax revenues in order to obtain, ex-post, an equal tax-to-GDP ratio among all countries. We show that the main beneficiaries would be Poland, the Czech Republic and Belgium, while Denmark, Spain and Luxembourg would have to pay a surtax.

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