PRIVATE HEATING CHOICES AND WELFARE IMPACTS OF DIFFERENT CO_2 ABATEMENT POLICIES

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Overview

Buildings account for 40 percent of European energy consumption and an important proportion of overall CO_2 emissions. The building sector thus offers a potential to further decrease CO_2 emissions in the EU. Investments into heating systems and insulation are major drivers to reduce CO_2 emissions. In this paper, we develop a simulation model for the private sector which accounts for the behaviour of households. The model is based on a discrete choice estimation of private heating choices and allows for analyses of investments into different types of heating systems and insulation and the comparison of different policies, their effectiveness and impact on welfare. Energy consumption, CO_2 emissions, investment in different energy based heating systems as well as the welfare costs of different policy measures in terms of the compensating variation and excess burden are evaluated in the paper. The model is based on micro data for the German private heating sector.

Methods

Based on detailed micro data for the German private heating sector, we develop a simulation model of household investments into heating systems and insulation. Thereby, the diffusion process of heating technologies accounts for the decision and utility of households. Analyzing the diffusion of heating technologies in the past, we assume that household decision which heating system to install, does not only depend on the plain costs for the heating system or simultaneous potential insulation measures to reduce future energy costs. Additional non-observable switching costs thus have an impact on households' utilities. To identify the impact of the heating system costs and energy carrier specific impacts on the current households' choice of heating systems we conduct an empirical estimation with a discrete choice model (alternative-specific conditional logit model, McFadden (1973 and 1977)). The results of this estimation are implemented in the simulation model to account for these additional non-observable costs for the installation of heating systems.

In a second step we compute the compensating variation and excess burden of different policy scenarios with the similar CO_2 reduction targets until 2030: a carbon tax on fossile fuels, subsidies on the investment of non-fossile fuel based heating systems and a combination of both.

Results

In the first part of our results we compare three scenarios, to identify the impact and importance of non-observable household costs:

- Scenario 0 (Sc.0): We ignore non-observable household costs. The households then invest into heating systems according to plain heating cost minimization.
- Scenario 1 (Sc.1): We model the behaviour of households accounting also for non-observable costs for investments in insulation and other non-observable impacts on the private heating choice and the replacement of heating technologies. Thereby, we do not include any policy measures.
- Scenario 2 (Sc.2): We model actual policies implemented in Germany for private heating. These are mainly subsidies, interest rate reductions and standards for new buildings.

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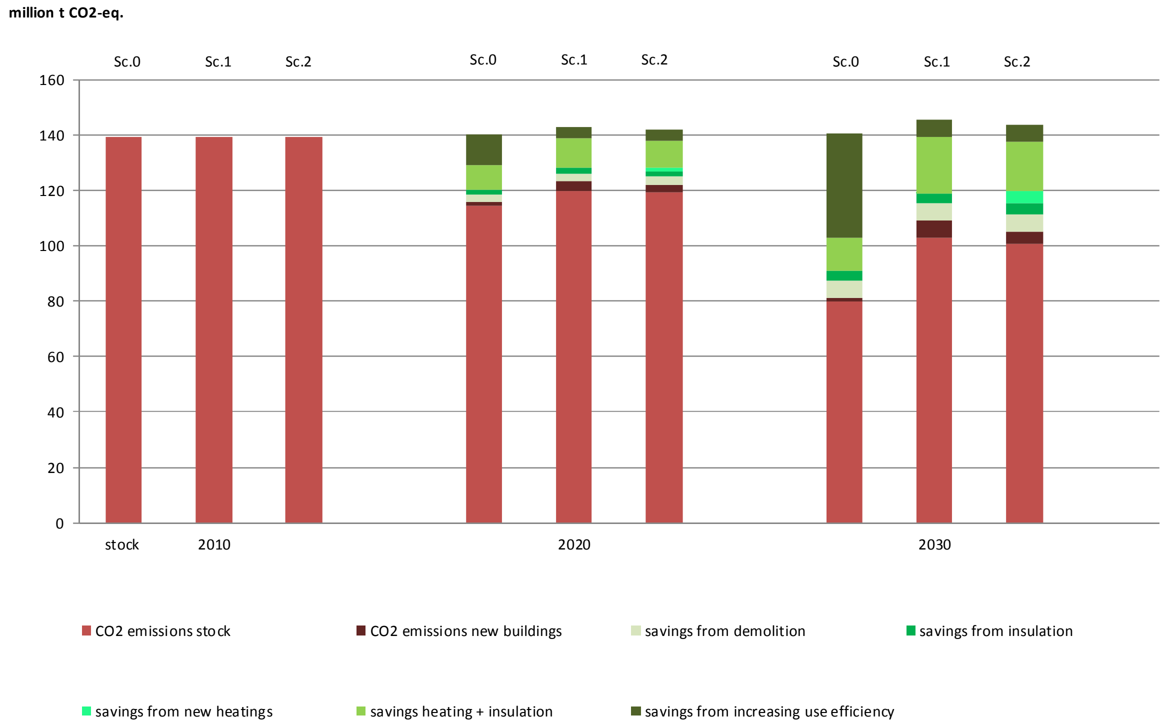

Figure 1: CO2 emissions and aggregated emission savings until 2030

Figure 1 indicates how the emission abatement potential is overestimated when non-observable household costs are neglected. Without accounting for non-observable costs CO2 emissions in 2030 are much lower (Sc.0) than with these costs. Accounting for non- observable costs, the actual political measures do not even reach these significant CO2 emissions savings until 2030 (compare Sc.2 with Sc.0). In addition, the different structure of the different causes of savings is distorted.

In a second part, we compare different policies to reduce CO2 emissions in private buildings, i.e. carbon taxes, subsidies for non-fossile based heating systems and combinations of both, and analyze the welfare costs and effectiveness of these measures. We thereby compute the compensating variation and excess burden as presented by Small and Rosen (1981).

Conclusions

Ignoring other impacts than the plain heating system and insulation costs such as non-observable costs of the heating choice or other impacts on the heating choice of households and on the development of the dwelling stock leads to an overestimation of the CO2 reduction potential. Thus, analysing costs and options of CO2 abatement in the private building sector, the household behaviour needs to be accounted for. Implementing certain policies to give incentives for CO2 reduction need to account for this behaviour and moreover for the reaction of households to total annual heating system cost changes. These elasticities determine the welfare costs and thus the costs society would have to carry for achieving certain CO2 objectives. Thereby,introducing a carbon tax appears to establish significantly less welfare losses than the provision of subsidies on investment into heating systems. If not all costs and impacts are observable that have an impact on the heating choice of households, the determination of a subsidy that is equivalent to a carbon tax is impossible and thus always leads to larger distortions on the household choice. Therefore, a subsidy on the heating investment causes a higher excess burden than a carbon tax, which affects the price of the "bad" CO2 directly.

References

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