

EFFECTIVE ENERGY POLICIES FOR INVESTMENTS IN EMISSION ABATEMENT IN THE BUILDING SECTOR

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Overview

The Building sector plays a crucial role in achieving German national CO₂ targets. In 2019, the building sector's share of total energy consumption amounted to 27%, with over 84.1% used for heating (both space and water heating). Therefore, a rigorous understanding of the building sector is crucial for effective climate policy. Unlike the electricity sector, where most of the abatement under the emission trading system EU ETS has taken place, the building sector has only a few options to abate emissions in the dispatch in the short term. The major potential of abatement lies in the investment into different heat generators, thus not in the static utilization of another energy carrier. Therefore, the investment decision in the building sector is crucial for a successful emission reduction. There are multiple obstacles special to the building sector, that may prevent policies to be effective. First, most of the investment decision is taken by single households which are prone to behavioural biases so that policies must address externalities and internalities. Second, the demand for heat is relative inelastic. There is only a small demand reaction to increasing prices, e.g., as consequence of higher emission prices. Therefore, high heating costs could come with considerable social costs. Third, households can invest in two basic options general energy efficiency or a fuel switch. Fourth, not all private households may have access to sufficient capital to undertake necessary investments. Without support, policies for investment stimulation may not be efficient.

This research project aims at providing a suitable framework for analysing the effectiveness of emission reduction policies in the building sector. Currently, the building and mobility sector raise increasingly attention in the efforts of emission reduction. An improved understanding of discussed policy measures may contribute to an informed transition of the building sector. This paper provides theoretical reasoning and numerical assessment to reveal which effects different policy measures have.

Methods

We build our model based on the externality-internality paper of Alcott (2014). We set up a theoretical model for a single consumer choice and for the respective social planner including market failures stemming from externalities and internalities. We extend this model by discussing the particularities of the building sector and deriving its impact on the effectiveness of considered policy measures. These particularities are (i) an inelastic demand, (ii) efficiency and fuel switch choices, and (iii) budget constraints. As policy measures, we discuss (i) emission pricing, (ii) efficiency and fuel standards, and (iii) subsidies for heating systems. We theoretically analyse, to which extent the findings of Alcott (2014) hold in the building sector.

We use the model to define a case study of the German building sector. Therefore, we implement an optimization model that represents the investment choices of households. We define two versions of the model, the first is congruent with the theoretical model in the first part of the paper, and the second relaxes the requirements of the theoretical model by allowing the implementation of discrete functions, e.g., for available investment options or fuel prices. The second version represents better the real investment choice consumers face. The results will be used to evaluate the effect of the policies and to discuss also the implicit biases of the linear problem formulation in the theoretical model.

Results

The analysis will deliver a theoretical understanding of the distortional effects of building sector peculiarities on the effectiveness of emission reduction policy measures. Beyond that it provides theoretically and numerically the welfare

gains of a first-best policy compared to the status quo as well as the welfare gap between feasible second best policies and the first-best policy.

Conclusions

Our paper provides a concise analysis of the abatement policy relevant peculiarities in the building sector. We reveal possible distortions and effects both theoretically and numerically. This may prove helpful for decision makers who currently lay out plans to further reduce emissions in the building sector. Additionally, the theoretical model framework sets the foundation for further research on abatement in the building sector.

References

Allcott, Hunt, Sendhil Mullainathan, and Dmitry Taubinsky. "Energy policy with externalities and internalities." *Journal of Public Economics* 112 (2014): 72-88.