

The Distribution of Energy Efficiency and Regional Inequality

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Energy efficiency in the building sector remains an important cornerstone of energy and climate policy in Germany. In order to maximize the economic benefits of energy efficiency, policies should prioritize investments that lead to cost-effective energy savings. At the same time, if the allocation of savings from energy efficiency contributes to increasing socioeconomic inequality, then overlooking the overall distribution of policy outcomes may make it more difficult to achieve long-run policy targets (e.g., climate neutrality by 2045). In order to target cost-effective, yet socially optimal investments, policy makers need a reliable indicator that measures improvements in the energy performance of the existing building stock, along with information on its socioeconomic and regional distribution. We contribute to this goal.

This paper uses unique billing data (3 million yearly heating bills from 2008 to 2018) on actual energy consumption to understand the heat energy requirements of the existing multi-apartment building stock in Germany. We estimate the response of heat energy demand to changes in the total annual sum of heating degree days as an approximate measure of building-level energy efficiency, and describe its distribution – giving particular attention to regional disparities.

We employ both fixed effects regressions and causal forests to study heterogeneity in the energy efficiency standards of buildings. Both methodologies lead us to the same qualitative conclusions. The distribution of energy efficient buildings is particularly inequitable in the West of Germany: higher efficiency buildings are concentrated in richer areas. The distribution of energy efficiency is more egalitarian in the East of Germany: zip codes associated with the highest unemployment rates, benefit from both the use of less carbon-intensive heating fuel type and an energy-efficient building stock, owing to renovation efforts that took place post-reunification in East Germany between 1990 and 2001. We confirm this in the data observed on Energy Performance Certificates (EPC) issued from 2014 to 2019: compared to the West, a significantly higher share of old buildings in the East, built before 1995 (“Altbau”), were certified to meet the energy standards set out in the national thermal insulation ordinance from 1995 (“Wärmeschutzverordnung” or WSV0). Finally, our results show that the current geographic distribution of energy efficiency outcomes in Germany is well-explained by regional differences in the intensity of the winter heating season.

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