THE TRAGEDY OF THE COMMON HEATING BILL

In buildings where heating energy consumption is not individually metered, tenants split a common heating bill. How large are the distortions this creates?

Harald Mayr and Mateus Souza

The building's sector can potentially take a prominent role for carbon abatement strategies, since it contributes to almost 40% of global energy and process-related greenhouse gas emissions. Only part of these emissions is covered by carbon pricing policies, such as the EU Emissions Trading System (ETS). Further, even if carbon pricing for buildings becomes widespread, there are other market distortions that may hinder the effectiveness of price signals in this sector. Mateus Souza and co-author Harald Mayr share preliminary results from a study of one of these distortions.

The focus is on buildings where heating energy consumption is not individually metered and, hence, not individually billed. Tenants split a common heating bill, usually according to the area or volume of their apartments. The authors propose a theoretical framework for this setting that incorporates two key externalities. The first is the environmental externality, due to carbon emissions from heating energy consumption. The second is the direct externality that arises from the fact that each household's consumption choice impacts all neighbors' heating expenses. The authors pose that individual metering can eliminate the direct externality while simultaneously reducing the environmental externality.

They then conduct an empirical analysis in the context of Switzerland. They have access to heating expense data from almost 300 apartment buildings in which

individual billing was introduced between 2007 and 2021 (Figure 1). Also, they have data from a "control group" of over 3 thousand buildings which remained in the common heating bill regime during this period. The authors implement an event study design to evaluate how individual metering (or sub-metering) affects heating expenses.

Their main results are summarized in Figure 2. Results are presented for an event study regression with "no controls" (in blue), other than apartment and year fixed effects. The red triangles are results for a "saturated" model that also controls for weather variations, apartment vacancies, and tenant changes. **One key takeaway is that individual metering lowered heating expenses by about 10% for each**

Figure 1: Rollout of Individual Metering

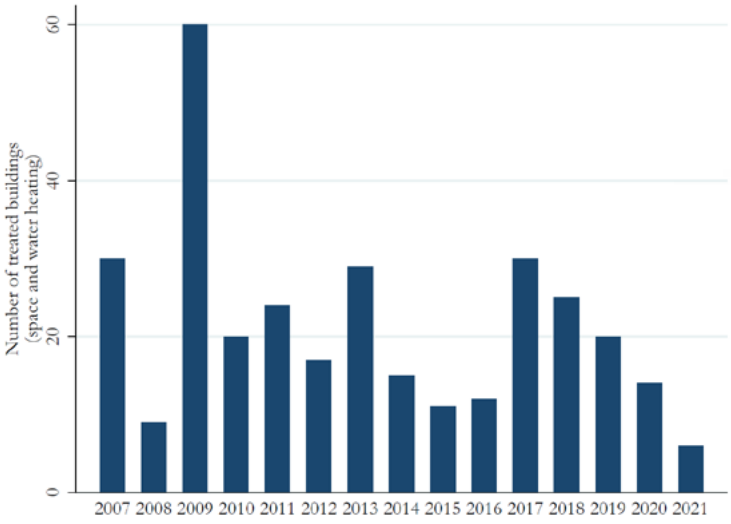


Figure 2: Effects of Individual Metering on Heating Expenses

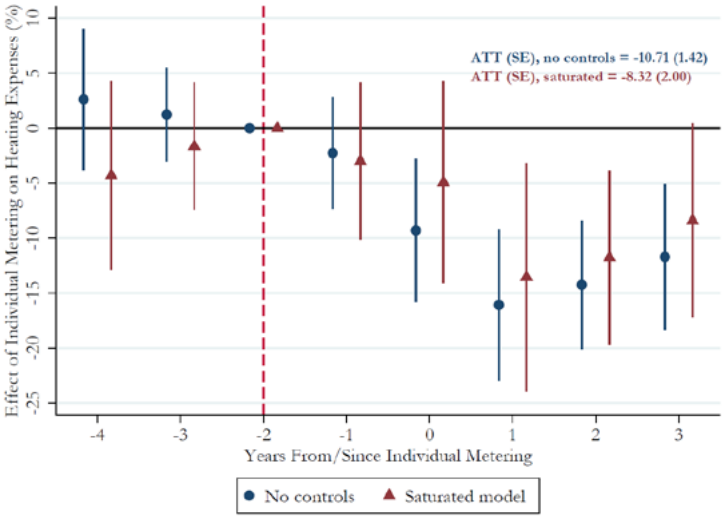
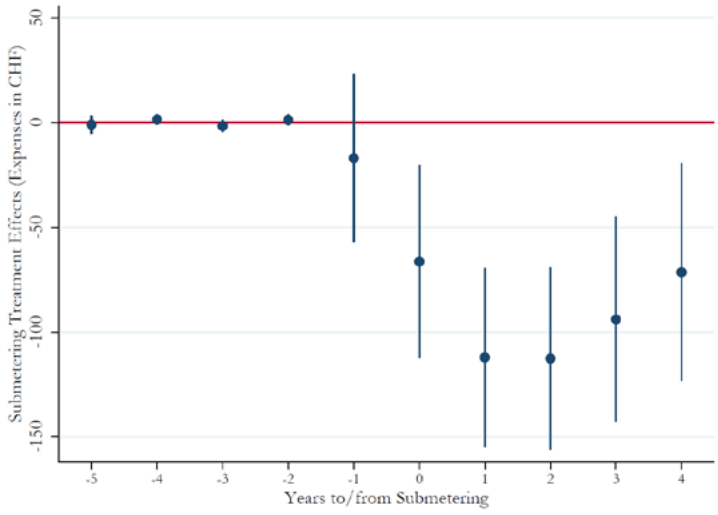


Figure 3: Machine Learning Treatment Effects



apartment, which translates to almost 100 CHF (close to 100 Euros) annually. These effects persist for at least three years after individual billing was introduced.

These findings are also validated with a machine learning (ML) approach, which is based on predicting counterfactual energy expenses in case individual metering had not been implemented. In Figure 3, it is shown that the ML algorithm results in prediction errors that are virtually zero during the pre-treatment period (before sub-metering). However, after sub-metering, the ML algorithm reveals a sharp decline in heating expenses compared to the counterfactual.

The results from this study are a striking example of a strong market distortion, other than the environmental externality, that exists in the building's sector

The machine learning approach is also useful for investigating the heterogeneity of treatment effects. Preliminary results (not shown) suggest that the effects are stronger in larger buildings (with more neighbors). This is consistent with the author's theoretical framework that shows that the energy price distortion increases with the number of bill-sharing neighbors.

Overall, the results from this study are a striking example of a strong market distortion, other than the environmental externality, that exists in the building's sector. The authors still plan to assess the welfare consequences of individual metering, by comparing the reduction in heating expenses to the sub-metering costs. **Future analyses will also investigate if sub-metering affects rents or tenant turnover**, for example ·