

## ENERGY EFFICIENT RETROFITS IN GERMANY – TENANTS’ HEATING CONSUMPTION AND RESULTING COST BURDEN

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### 1. INTRODUCTION

Energy retrofits of residential buildings aim to increase the energy efficiency of buildings and reduce their carbon emissions. When it comes to the cost-effectiveness of energy retrofits, the reduction of heating costs is emphasized. The German rental law allows landlords to allocate up to 11 % of the costs for energy retrofits onto the annual cold rent in order to foster energy retrofits and to make sure that the tenants profiting from the retrofit contribute to the costs (i.e. minimization of the split incentive effect, a principal-agent problem which occurs when the person profiting from energy investment is not the one responsible for the investment costs). There is increasing awareness of the fact that the financial burden for tenants due to this levy is high and the expected energy savings are often not achieved. In this case study we therefore investigate the actual financial burden for tenants after an energy retrofit while taking into account the households’ individual heating consumptions.

### 2. THEORETICAL BACKGROUND

When analysing the influence of households’ heating behaviour on the financial burden they face after the retrofit, it is important to differentiate between the calculated *heating energy demand* of the flats and the actual *heating energy consumption* of the households. Only the latter is influenced by the tenants’ heating behaviour which is very heterogeneous, i.e. differing in temperature preferences and settings, ways of ventilating or attendance times [1,2].

### 3. DATA AND METHODS

Information on the heating energy costs and heating energy consumption has been gathered for 119 tenants of a municipal housing company by analysing their heating bills. The flat-specific energy performance rating (EPR) was generated using a flat-specific heating demand calculator [3]. The rent increase after the retrofit is assessed with information on the increase per m<sup>2</sup> provided by the housing association. In addition, semi-standardized interviews focusing on the households’ heating behaviour, such as ventilation and preferred indoor temperature have been conducted with 47 households [4]. Due to the small number of cases this information however delivered no added value for the analysis of tenants’ heating behaviour and resulting cost burden.

## 4. RESULTS

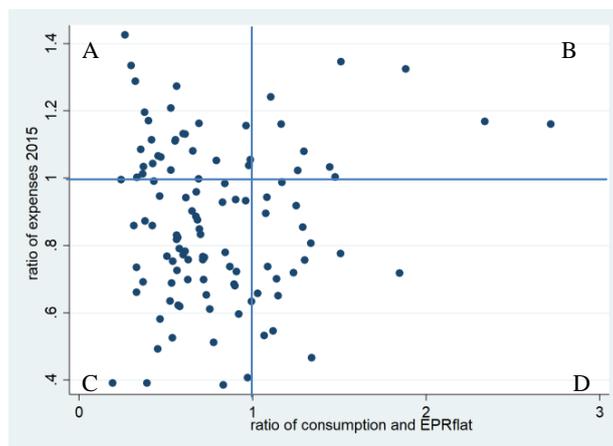


Figure 1: Comparison of the heating consumption relative to the flat-specific heating demand and the heating costs after the retrofit including a rent increase relative to the heating costs prior retrofit with base year 2015.

Figure 1 shows the financial burden for households after the retrofit, i.e. the ratio of expenses (y-axis) and the ratio of consumption (x-axis) determined by the households' heating behaviour. The horizontal baseline is a marker for heating expenses before retrofit equalling the expenses for both heating and cold rent increase after retrofit. A *ratio of expenses* below 1 therefore indicates that households are better off financially after the retrofit. The vertical baseline is a marker for household energy consumption equalling the predicted energy performance rating. A *ratio of consumption and EPRflat* below 1 hence indicates that households consume less energy than predicted by the EPR. Our findings show that one third of the households face increased costs post retrofit (fields A and B). Moreover, households in field A are not only worse off financially but also consume less energy than predicted by the EPR. This can be traced back to the fact that economizing households had already been saving on heating energy before the retrofit and therefore had had lower overall costs compared to households with higher consumptions – the stipulated rent increase due to the retrofit however is the same for everyone regardless of individual consumption.

## 5. CONCLUSION

In summary, our analysis shows that the lower the initial heating energy consumption, the lower also the financial benefit for households after a retrofit. Considering the goal of reducing primary energy consumption, a policy model that is structurally disadvantaging households with low consumption rates cannot be the best tool available. We thus propose a reconsideration of the current incentive model for energy efficient retrofits in Germany taking into account the results of this study.

## REFERENCES

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