

Housing market fundamentals, housing quality and energy consumption: evidence from German real estate markets

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Executive Summary

This study investigates the relationship between regional housing market fundamentals, housing quality and energy consumption. Residential housing plays a vital role in meeting climate change and CO₂ mitigation targets. According to OECD-data, residential energy demand accounts for 25-40% of final energy needs in developed countries. The lion share of residential energy demand stems from space-heating and cooling. Importantly, our understanding of the determinants of heating energy demand still appears inconsistent and incomplete (e.g. Eichholtz et al., 2010, 2013; Mills and Schleich, 2012; Nair et al., 2010).

In this study, we argue that dwellings, particularly rental properties, are not only consumer goods, but also constitute financial market assets. It is therefore reasonable to assume that rational investors choose a level of housing quality (e.g. thermal insulation, heating technology or windows) that yields an acceptable return on investment (ROI)—Importantly, rents and future sale prices of dwellings differ regionally (or even locally), and largely depend on housing market fundamentals such as income levels, vacancy rates

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and/or investors' expectations. Thus, real-estate markets directly influence regional levels of housing quality, and indirectly regional levels of energy consumption.

While this view is well established in real estate and urban economics, it has only recently found its way into the empirical literature around energy efficiency, which can partially be explained by a lack of adequate data (Eichholtz et al., 2010). This study provides a first attempt to address this paucity.

Utilizing aggregate data on regional space-heating energy consumption from over 300,000 apartment buildings in 97 German planning regions, the study applies structural equation modelling to estimate the influence of housing market fundamentals on the level of housing quality, and subsequently on regional energy consumption.

First, the empirical results suggest that housing market fundamentals explain regional differences in housing quality. In particular, findings show that the level of per capita income, investors' expectations about future housing market development as well as vacancy all explain regional differences in housing quality. Second, we find that housing quality in turn has a significant impact on energy consumption. In this way, we provide first empirical evidence that regional housing market fundamental have a substantial influence on regional levels of energy consumption.

The findings hold important implications for energy research and policy.

Housing market fundamentals have, as far the authors are aware, not been investigated as an important determinant of residential housing quality and energy demand and our findings provide an important starting point for more in-depth scenario analysis around regional energy consumption. In particular, the findings could play an important role in formulating assumptions about future levels of energy efficiency and consumption in regional contexts. Taking into consideration the heterogeneity of housing markets and the corresponding investment patterns would allow energy researchers to construct more accurate models of regional energy demand.

From a climate policy perspective, the underinvestment in energy efficiency constitutes

an ongoing problem. Importantly, the study shows that these under investments differ regionally. This has important implications for carbon abatement programs in houses, which are often implemented on a national level, taking a simple “one size fits all” approach. Our results imply that policies should take into consideration regional housing market conditions, and focus on markets regions with weak housing market fundamentals, because market conditions are unlikely to incentivize investors to provide adequate levels of energy efficiency.