Consumer Choice and Willingness-To-Pay for Heating System Attributes

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Overview

Residential heating systems in the UK, which account for 60% of the nation's heat use, should be replaced with low-emission alternatives as part of the decarbonisation agenda. A heating system includes several features, including capital, installation and operating costs, energy efficiency, and supplier switching flexibility. The choice of a heating system depends on the attributes that homeowners prioritise when selecting a heating system for their homes. Therefore, it is crucial to investigate household preferences and willingness to pay (WTP) for heating system features (Scarpa & Willis, 2010).

In this work, we employ a discrete choice experiment to investigate households' WTP for a set of heating system characteristics for three different heating systems in Surrey County Council, UK. Our findings allow us to examine how people feel about heat pumps and heat networks, considered more cutting-edge, technologically based renewable technologies, vs traditional gas central heating.

Methods

We apply the Mixed Logit Model (MXL), a quite flexible specification that can approximate any random utility model (McFadden & Train, 2000). For the mixed logit model and panel data, the individual household's utility function is given as follows:

$$Uijt=Aijt'\beta i+Wijt'\delta+Zi'\gamma j+\varepsilon ijt,$$

where βi are random coefficients that vary among individual decision-makers in the population, whereas $Aijt'$ is a vector of alternative-specific variables. δ are fixed coefficients on $Wijt'$, another vector of alternative-specific variables. γj are fixed on Zi', a vector of case-specific variables. In this specification, each homeowner's utility function has some random taste parameters βi that follow an underlying probability distribution $f(\beta i|\theta)$. The parameters of this indirect utility function can be estimated by the maximum simulated likelihood.

After estimating the parameters using econometric methods, we calculate the willingness to pay for each attribute of the heating system. In simple linear models, the WTPs are calculated as follows:

$$WTP=-\beta_{attribute}/\beta_{price}$$

Where β_{price} and $\beta_{attribute}$ are the estimated coefficients of price and each attribute, respectively.

Study design and data

After making multiple changes following experts' opinions and web resources, we ultimately settled on seven attributes with varying levels. Next, we designed and created the online choice experiment in the SurveyEngine platform. We employed a D-efficiency design to identify the most efficient variety of choice sets while still allowing us to estimate the primary effects (Adams et al., 2015).

Following two pilots to test our survey, 79 final responses were collected from Surrey representative participants in the Summer of 2022 through an online questionnaire. Eight choice tasks were presented to each interviewee, and we ended up with 632 observations for our choice modelling. In addition to the experiment, we collected some socio-demographic and building characteristics data from the participants.

Results

Our preliminary results show that households' choices are influenced mainly by capital investment costs, energy efficiency levels, and energy supplier switching options. However, fixed costs, running costs, grants, and CO2 emissions have a limited impact on consumers' choice of heating systems. Moreover, socio-demographical variables are almost non-influential in selecting a home heating system.

Conclusion

Using a discrete choice experiment with homeowners in Surrey County, we offer new evidence of consumers' attitudes toward conventional and low-carbon residential heating systems. Our investigation of the three heating system alternatives shows that heat pumps are the most popular, and heat networks are the least popular choice for households. Furthermore, homeowners prioritise energy efficiency and provider switching over grants or CO2 emission levels. Finally, we recommend stepping up the process of information sharing so that more people are aware of climate change and the financial aid the government is providing through decarbonisation programmes.