DO RISK AVERSION AND TIME DISCOUNTING SLOW THE DIFFUSION OF LOW-ENERGY HOUSES? AN EMPIRICAL STUDY OF EU HOUSEHOLDS

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Overview

In this paper, we econometrically analyze determinants of adoption of low-energy houses. We rely on original data from a large survey conducted among households in eight EU countries. To our knowledge, this is the first study of low-energy building adoption that uses a representative sample. Our set of covariates includes parameters of risk and time preferences that were elicited via incentivized multiple price list experiments and via self-assessment scales.

Lowering energy use of buildings is a key strategy to achieve ambitious medium- and long-term energy and climate targets in the EU and elsewhere. The diffusion of low-energy houses in the residential sector in the EU seems to have been slow, yet information on the diffusion is scarce and limited to passive houses (e.g. Kozma et al., 2013). Additional construction costs hinder the adoption of low-energy houses : compared to new houses of equivalent layout and size that meet existing building standards, passive houses are estimated to cost an additional 5 to 15 percent to build (e.g. Galvin, 2014; Klingmair and Grussmann, 2015). Thus, payback times are long enough to suggest that individual time preferences may affect the diffusion of low-energy houses. Furthermore, payback times are uncertain. They depend on factors such as future fuel prices, household consumption levels, and performance of the implemented technologies. Conversely, occupants of low-energy houses are less exposed to energy price fluctuation. Thus, individual risk preferences may affect adoption of low-energy houses. The scarce literature empirically analyzing the take-up of low-energy houses based on large samples has so far focused on costs and benefits and socio-economic factors (Klingmair and Grussmann, 2015). The role of risk and time preferences, known to affect adoption of other, lower-cost energy efficient technologies, has yet to be explored empirically for low-energy houses.

Methods

The data used in the multivariate analysis were collected between July and August 2016 through an online survey distributed to members of the Ipsos GmbH online access panel. Roughly 15,000 respondents from France, Germany, Italy, Poland, Romania, Spain, Sweden, and the United Kingdom participated in the survey, using quota sampling to ensure representativeness in terms of gender, age (between 18 and 65 years), and regional population distribution for each country. For this research, only responses from homeowner participants whose primary residence was built after the year 2000 were retained, for a sample size of roughly 1,800 respondents.
Dependent variable: Respondents were asked whether their residence was constructed according to a particular energy efficiency standard. The ordinal dependent variable *EElevel* takes the value 3 if the house was a zero-energy or energy-plus building, 2 if the house was built according to the passive house standard, and 1 if no above-norm efficiency standard was indicated.
Explanatory variables: To measure risk and time preferences, we followed Falk et al. (2016) and used a combination of experiment- and scale-based measures.To elicit risk and time preference parameters (α and δ), the survey included incentivized non-contextualized multiple price list experiments. In addition, we used the scales employed by Dohmen et al. (2011) or Falk et al. (2016) to construct *WTRisk* and *WTWait*. Our aggregate measure of risk preferences, *Risk*, is calculated as the sum of the z-score of the scale-based measure *WTRisk* and the z-score of the experimental measure α. Analogously, *Patience* is calculated as the sum of the z-score of the scale-based measure *WTWait* and the z-score of the experimental measure δ. The survey further asked for dwelling characteristics, and socio-demographic information. Established scales were included to elicit environmental identiy and social norms. We econometrically analyze the relation of home energy efficiency and risk and time preferences while controlling for home and homeowner characteristics.

Results

Preliminary results are shown in Table 1. We find that risk aversion is negatively correlated with the energy efficiency level of the home. The result is strongest for the score-based risk measure and not significant for the experiment-based risk parameter. Time preferences are only significant for the aggregate measure, *Patience*, and exhibit the expected sign. Environmental and social preferences appear not to matter; neither do income and education.

Table 1 – Ordered logit regression estimates (Robust *p*-values in parentheses)

Variables	(1)		(2)		(3)	
z_*a*	0.109	(0.281)				
z_δ	0.172	(0.141)				
z_WTRisk			0.343 ***	(0.000)		
z_WTWait			-0.042	(0.608)		
Risk					0.135 **	(0.023)
Patience					0.145 **	(0.027)
z_Environmental_ID	0.054	(0.591)	-0.011	(0.895)	0.010	(0.921)
z_SocialNorm	0.055	(0.542)	-0.004	(0.966)	0.025	(0.777)
Size	-0.022	(0.689)	-0.005	(0.929)	-0.032	(0.560)
Detached	0.529 **	(0.011)	0.585 ***	(0.001)	0.537 ***	(0.009)
Urban	0.476 **	(0.016)	0.473 ***	(0.005)	0.450 **	(0.021)
Income	0.004	(0.362)	0.002	(0.673)	0.004	(0.451)
Educ	0.150	(0.479)	-0.095	(0.597)	0.108	(0.609)
Age	0.000	(0.975)	-0.006	(0.484)	0.001	(0.913)
Male	0.175	(0.331)	0.097	(0.543)	0.122	(0.498)
Country dummies	Yes		Yes		Yes	
cut_{1-2}	3.442 ***	(0.000)	3.067 ***	(0.000)	3.419 ***	(0.000)
cut_{2-3}	4.415 ***	(0.000)	4.008 ***	(0.000)	4.396 ***	(0.000)
Observations	1606		1799		1606	
$Chi^2(18)$	9097 ***		138.3 ***		10206 ***	
Log likelihood	-559.0		-714.9		-556.0	
Pseudo R^2	0.078		0.082		0.083	

*** $p < 0.01$, ** $p < 0.05$

Conclusions

Our results suggest that the choice of a low-energy house is perceived as risky and deters risk-averse buyers. The scale based risk measure turned out to be a better predictor than the experiment-based measure and may indicate that buyers' concerns are with other uncertainties than financial payback. Policies that lower perceived technical risk, such as information and demonstration measures, performance certificates/labels, or servicing guarantees, may be effective, also to capitalize energy performance into transaction prices (Aydin et al. 2016). The patience effect argues in favor of upfront subsidies over tax rebates. The finding that environmental and social preferences appear not to matter is consistent with the low-cost hypothesis, which claims that such factors become less relevant as the financial stakes increase. Hence, policies appealing to environmental benefits or social norms may not be effective for low-energy houses.

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