

# ***PREFERENCES FOR ENVIRONMENTALLY FRIENDLY AND UNFRIENDLY MEASURES TO CONTROL THE CLIMATE AT HOME: A STATED CHOICE ANALYSIS FOR GERMANY***

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## **Overview**

Even in the stringent CO<sub>2</sub> mitigation scenario of the Intergovernmental Panel on Climate Change, it is likely that the increase of the global average temperature will exceed 1.0 °C until the end of the 21<sup>st</sup> century compared to the period from 1986 to 2005 (e.g. IPCC, 2015). In this respect, it becomes necessary to investigate how households adapt to rising temperatures. Beside the mostly adverse effects (e.g. a higher frequency and greater intensity of extreme weather events), rising temperatures are also expected to decrease the demand for heating due to warmer winters and to increase the demand for cooling due to hotter summers (e.g. IPCC, 2014). Therefore, climate change provides an opportunity to decrease the energy demand and the corresponding CO<sub>2</sub> emissions on the residential sector in Germany. The extent to which this opportunity is exploited depends on the climate change adaptation behavior of German households. If the additional demand for cooling is covered by energy-saving climate control measures (e.g. insulation and solar control windows), these potential savings can be exploited.<sup>1</sup> However, if German households (mal)adapt with energy-intensive climate control measures (e.g. air conditioning systems or ceiling fans), the reduced energy demand for heating will be partly, completely, or even over-compensated by an increase in the energy demand for cooling (e.g. Auffhammer and Mansur, 2014). Consequently, to design an efficient German climate policy, which makes use of these savings, it is of high interest to examine the preferences of German households for measures to control the indoor climate at home and for a specific direction to adapt to climate change. We focus our research on tenants since the majority of flats in Germany are rented (e.g. Destatis, 2016).

The empirical studies on mitigation of climate change give a first idea of the preferences for measures to control the indoor climate at home. These studies reveal that German households have a strong preference for energy cost savings from climate mitigation measures (e.g. Achtnicht, 2011; Alberini et al., 2013; Achtnicht and Madlener, 2014). However, the preferences for CO<sub>2</sub> emission savings from climate mitigation measures are quite ambiguous. While most of the studies do not distinguish between energy cost and CO<sub>2</sub> emission savings, Achtnicht (2011) and Achtnicht and Madlener (2014) find evidence of a willingness to pay for CO<sub>2</sub> emission savings from changing the heating system. However, they do not find evidence of a willingness to pay for CO<sub>2</sub> emission savings from improving the insulation. The existing empirical studies on adaptation to climate change mainly focus on the general propensity to adapt and thus do not distinguish between environmentally friendly adaptation and maladaptation. For example, general health risk (e.g. Schwirplies and Ziegler, 2017) and risk aversion (Osberghaus, 2015) are identified as important factors for the general propensity to adapt. However, they cannot identify the preferences for a specific direction to adapt to climate change.

Against this background, our study contributes to the scientific literature of mitigation of and adaptation to climate change by analyzing the preferences for measures to control the indoor climate at home and for a specific direction to adapt to climate change. The data for this analysis stem from a large-scale online survey among German citizens, which includes a stated choice experiment that refers to four different climate control measures, namely solar control windows, insulation, ceiling fans, and air conditioning systems. The survey was conducted by the market research institute Forsa between June and July 2014. Overall, 6,054 households completed the survey and 972 households participated in the stated choice experiment. These were all participants which were tenants and had either already implemented a climate control measure or were planning to do it. We restrict our sample to these subjects to reduce the hypothetical bias and therefore increase the validity of our estimation results.

## **Methods**

Our microeconomic analysis is based on flexible mixed logit models. We use 1,000 Halton draws for the simulation of the choice probabilities and a robust estimation of the variance-covariance matrix.

## **Results**

Our preliminary empirical analysis reveals that German tenants not only have a high preference for energy cost savings but also for CO<sub>2</sub> emission savings from adaptation measures to climate change. They are on average willing to pay an

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<sup>1</sup> A special window which is radiating and reflecting away a large degree of the sun's heat.

approximately €0.14 higher monthly gross cold rent to reduce the annual energy cost by €1 and a €0.03 higher monthly gross cold rent to reduce the annual CO<sub>2</sub> emissions by 1 kg.<sup>2</sup> The estimated willingness to pay for the reduction of the annual energy cost by €1 is surprisingly high, since a reduction of the annual energy cost is only profitable if the monthly gross cold rent increases by not more than (€1/12 ≈) €0.08. The estimated willingness to pay for the reduction of the annual CO<sub>2</sub> emission by 1 kg is approximately four times higher than the actual average price for CO<sub>2</sub> emissions in the EU Emission Trading Scheme in the same year. We additionally find that German tenants who have a left-wing political affinity, who believe in anthropogenic climate change, and who have high environmental awareness (measured by the New Ecological Paradigm) have a higher willingness to pay for CO<sub>2</sub> emission savings. Surprisingly, we find the opposite for German tenants with high income. In addition, our analysis reveals low stated preferences for the environmentally unfriendly or maladaptation measures ceiling fan and air conditioning system. Furthermore, female, left-wing political orientation as well as environmental awareness are significantly negatively correlated with the stated preferences for air conditioning systems, which are the most environmentally unfriendly measure among the four climate control measures. In line with previous studies, our results suggest strong similarities between the determinants of climate mitigation and environmentally friendly climate adaptation activities. In contrast, risk aversion and general health risk associated with climate are not significantly correlated with the stated choice of one of the four climate control measures. This suggests that these factors are rather relevant for the general propensity to adapt to climate change, but not to specific adaptation measures.

## Conclusions

Our preliminary findings have several useful practical implications. Our empirical analysis provides useful information for the design of an efficient German climate policy, which exploits the potential energy and CO<sub>2</sub> emission savings on the residential sector, which go hand in hand with climate change. We can identify specific target groups on which such policy measures should focus, namely males, environmentally unaware, and non-left-wing oriented individuals. Our findings additionally suggest that subsidies should be considered with caution. Subsidies for environmentally friendly climate control measures could fail to increase their share significantly due to free-ridership through the high intrinsic willingness to pay for energy and CO<sub>2</sub> emission savings from climate adaptation measures. Furthermore, our results might be of interest for real estate companies and landlords to retrofit their flats in line with the demand of their tenants.

## References

- Achtnicht, M. (2011), Do environmental benefits matter? Evidence from a choice experiment among house owners in Germany, *Ecological Economics* 70(11), 2191–2200.
- Achtnicht, M. and R. Madlener (2014), Factors influencing German house owners' preferences on energy retrofits, *Energy Policy* 68, 254–263.
- Alberini, A., S. Banfi, and C. Ramseier (2013), Energy efficiency investments in the home: Swiss homeowners and expectations about future energy prices, *The Energy Journal* 34(1), 49–86.
- Auffhammer, M. and E. T. Mansur (2014), Measuring climatic impacts on energy consumption: A review of the empirical literature, *Energy Economics* 46, 522–530.
- Destatis (German Federal Statistic Office) (2016), *Bauen und Wohnen, Mikrozensus – Zusatzerhebung 2014, Bestand und Struktur der Wohneinheiten, Wohnsituation der Haushalte*, last access: January 31, 2018, URL: [https://www.destatis.de/DE/Publikationen/Thematisch/EinkommenKonsumLebensbedingungen/Wohnen/WohnsituationHaushalte2055001149004.pdf?\\_\\_blob=publicationFile](https://www.destatis.de/DE/Publikationen/Thematisch/EinkommenKonsumLebensbedingungen/Wohnen/WohnsituationHaushalte2055001149004.pdf?__blob=publicationFile).
- IPCC (Intergovernmental Panel on Climate Change) (Hg.) (2015), *Climate Change 2014: Synthesis Report, Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC*. Geneva, Switzerland.
- IPCC (Intergovernmental Panel on Climate Change) (Hg.) (2014), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the IPCC*. Cambridge University Press, Cambridge.
- Osberghaus, D. (2015), The determinants of private flood mitigation measures in Germany—Evidence from a nationwide survey, *Ecological Economics* 110, 36–50.
- Schwirplies, C. and A. Ziegler (2017), Adaptation of future travel habits to climate change: A microeconomic analysis of tourists from Germany, *Tourism Economics* 23(6), 1275–1295.

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<sup>2</sup> The gross cold rent includes maintenance but excludes heating.