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Analysis

Risk Perception of Climate Change: Empirical Evidence for Germany

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ABSTRACT

The perception of risks associated with climate change appears to be a key factor for the support of climate policy measures. Using a generalized ordered logit approach and drawing on a unique data set originating from two surveys conducted in 2012 and 2014, each among more than 6000 German households, we analyze the determinants of individual risk perception associated with three kinds of natural hazards: heat waves, storms, and floods. Our focus is on the role of objective risk measures and experience with these natural hazards, whose frequency is likely to be affected by climate change. In line with the received literature, the results suggest that personal experience with adverse events and personal damage therefrom are strong drivers of individual risk perception.

1. Introduction

Among the major threats of climate change is a substantial increase in the occurrence of natural hazards, including heat waves, storms, and floods. In its most recent report, the International Panel on Climate Change (Pachauri et al., 2014) predicts that in the northern hemisphere, heat waves will emerge more frequently and last longer than in previous decades. Moreover, heavy precipitation, as well as storms, are likely to occur more frequently and with a higher intensity, resulting in more floodings. Increasing the efforts to both mitigate climate change and adapt to its consequences therefore seems to be indispensable.

A key driver of adaptation and prevention at the household level – be this the purchase of insurance, investment in home insulation, or some other measure – is the perception of risks due to climate change (O'Connor et al., 1999; Peacock et al., 2005; Siegrist and Gutscher, 2006; Zaalberg et al., 2009). These risk perceptions vary substantially among countries (Eurobarometer, 2014) and individuals (e.g. Botzen et al., 2016). Yet, as climate change is widely perceived to be a temporally and spatially distant problem (e.g. Lorenzoni and Hulme, 2009), related risks may be underestimated. This bias in individual risk perception, while warranting public interventions to foster adaptation behavior, may undermine public support for climate protection policies. This is particularly critical for Germany, given its ambitious climate policy that aims at reducing greenhouse gas emissions by 40% by 2020 relative to 1990 levels and by at least 80% by 2050 (BMWi, 2010).[1]

Using a generalized ordered logit approach and drawing on a large data set originating from two surveys, each among more than 6000 German households, this study investigates the determinants of the personal risk perception of three adverse natural events: heat waves, storms, and floods, focusing on the role of experience, personal damage, and, most notably, the effects of objective risk measures. By including a suite of household characteristics as regressors, we account for findings from the literature

[1] An important prerequisite for the support of climate policies is that people believe in the existence of global warming and that it is mainly man-made. That people believe in the existence of global warming holds true for the overwhelming majority of 96% of the survey respondents. Out of these respondents, almost 93% believe that human beings are responsible for climate change, at least partly.

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on behavioral economics and psychology, which argues that the individual perception of environmental risks is a convolute of socio-demographic, cognitive, socio-cultural, and experiential factors (e.g. van der Linden, 2015).

Our empirical analysis contributes to the literature on the correlates of individual risk perceptions of natural hazards in several respects: First, in addition to individual hazard experience, we take account of personal damage as a determinant of the subjective risk perception. While assuming that the experience with any such adverse events may be associated with subjective perceptions of future risks, we recognize that this relationship is not necessarily causal: people with a high a-priori risk perception, as well as people with strong climate change beliefs, may be more likely to indicate personal experience with natural events (Myers et al., 2013). Yet, second, the severe flood event of 2013, which occurred in the year right between the two surveys, provided us with the opportunity to validate the impact of floods on risk perception by employing a difference-in-differences approach. Third, and most importantly, contrasting with the majority of previous studies, we account for the objective risks to suffer from natural hazards by constructing corresponding risk measures and adding them to our database.

The inclusion of a control for the objective risks allows us to examine an assertion of Siegrist and Gutscher (2006:977), who argue that the experience of adverse events may be confounded with the actual risk respondents face if objective risk measures are omitted from the analysis. Yet, we maintain that the objective risk does not affect subjective risk perceptions if individuals are unaware of the risk they actually face. In that case, any measure of the objective risk would be a superfluous variable in the analysis of subjective risk perceptions: only if people are aware of the objective risk can it influence their individual risk perception.

In line with a great deal of studies exploring the impact of personal experience with natural hazards on related risk perceptions and climate change beliefs (e.g. Dai et al., 2015; Zaalberg et al., 2009), we find that the experience of adverse natural events and, even more pronounced, suffering from damages has a strong bearing on individual risk perceptions. Similarly positive correlations between (damage) experience and individual risk perceptions of extreme weather events are identified for Germany by Menny et al. (2011), Thieken et al. (2007), and Weber (2006), as well as by Keller et al. (2006), and Siegrist and Gutscher (2006) for Switzerland. These results are challenged by Whitmarsh (2008), who does not find a higher individual risk perception among flood victims in the UK. In a similar vein, Botzen et al. (2016), Brody et al. (2008), van der Linden (2015), and Marquart-Pyatt et al. (2014) conclude that, once it is controlled for social, cognitive, and cultural factors, the explanatory power of personal experience is substantially reduced.

While simultaneously analyzing the effects of both flooding experience and objective risk measures in the form of flood risk zones on respondents' risk perception and preventive behavior, the analysis by Siegrist and Gutscher (2006) is among those rare studies that account for objective risks. Whereas these authors argue that both the objective risk and the experience of a flood have a positive impact on personal risk perception, Peacock et al. (2005) come to a different conclusion, studying the case of hurricane experience in Florida: once controlling for the objective risk, experience has no bearing on individual risk perception.

We contribute to this debate, benefitting from rich empirical evidence that originates from more than 13,000 questionnaires completed by German households in the years 2012 and 2014. The subsequent section describes this database, while the methodology employed is explained in Section 3. Presenting the estimation results in Section 4, the last section summarizes and concludes.

Table 1
Individual risk perception on the likelihood of an increase in future personal financial or physical damages due to heat waves, storms and floods.

Categories	j	Heat waves	Storms	Floods
Very likely	$(j=5)$	4.2%	6.6%	2.6%
Quite likely	$(j=4)$	17.1%	28.8%	9.3%
Moderately likely	$(j=3)$	31.3%	31.6%	19.1%
Quite unlikely	$(j=2)$	24.9%	14.0%	32.7%
Very unlikely	$(j=1)$	22.5%	19.0%	36.3%

2. Data

We draw on two surveys conducted in 2012 and 2014 that were part of a project funded by the German Federal Ministry of Education and Research (BMBF).[2] A major aim of this project was to elicit various preference indicators, such as environmental attitudes, as well as respondents' personal experience with natural hazards and related subjective risk perceptions. Data was collected by the German survey institute *forsa* via a state-of-the-art tool that allows respondents – in these surveys the household heads – to complete the questionnaire at home using either a television or the internet. A large set of socio-economic and demographic background information on all household members is available from *forsa*'s household selection procedure and updated regularly.[3]

Between October 4 and November 4, 2012, 6404 household heads completed the first survey, followed by a second survey in which 6602 household heads completed a very similar questionnaire between June 13 and July 30, 2014, yielding a total of 13,006 completed questionnaires. Of those respondents participating in the first survey, 4639 also participated in the second period, a survey design feature that is accounted for by clustering standard errors at the household level. Although *forsa*'s household panel is representative for the population of German speaking households, this may not hold true for our sample due to the self-selection of households in completing the questionnaire. For instance, the share of respondents with a college degree is higher in our sample than in the German population (see Table A1 in the Appendix). This fact may be due to their stronger interest in the questionnaire topics relative to less educated people. With respect to other aspects, however, such as regional distribution, we find that representativeness is maintained.

The dependent variable of our analysis, the respondents' subjective risk perceptions, is measured on a 5-point Likert (1932) scale (see Table 1) and is based on the following question: "With respect to the next decades, how likely is an increase in future personal financial or physical damages caused by ____ ", where the blank is filled in with one of the following events: heat waves, storms, or floods.

Not surprisingly, more than two thirds of the respondents indicate that personal damages owing to floods are either quite unlikely or very unlikely to increase in the future (Table 1). This large share is presumably due to the fact that only people living in flood-prone areas are faced with this risk. With respect to heat waves, about half of the respondents do not fear increasing damages, whereas increasing personal damages resulting from storms are perceived to have the highest likelihood among the three kinds of natural hazards.

[2] Information on the project, the underlying questionnaires and a summary of the descriptive results is available at the project homepage: www.rwi-essen.de/eval-map.
[3] The data set can be downloaded from the following site: fdz.rwi-essen.de/mikrodaten.html.