



Analysis

Extreme weather experiences and climate change beliefs in China: An econometric analysis



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ABSTRACT

This paper examines the extent and the determinants of global climate change beliefs. In contrast to former studies for the U.S. and other western countries, we focus on China due to its crucial role in international climate policy in conjunction with its vulnerability to global warming. The empirical analysis is based on unique data from a survey among more than 1000 adults in five Chinese cities. In line with former studies, our results reveal that the vast majority of almost 90% of the Chinese respondents believes in the existence of global warming. This seems to be a convenient and necessary basis for the support of costly public adaptation activities in China. Our econometric analysis reveals that already perceived experiences with extreme weather events (and particularly heatwaves) alone are strongly correlated with climate change beliefs and that physical or financial damages due to these events lead to even stronger relationships. Our estimation results additionally suggest females as well as people with a lower education, in medium ages, with higher household incomes, and from Chengdu or Shenyang to be more skeptical toward the existence of climate change.

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1. Introduction

The recently published Assessment Report of the Intergovernmental Panel on Global Climate Change (IPCC) (see IPCC, 2013, i.e. the summary for policymakers of the Working Group I contribution to the IPCC Fifth Assessment Report) considers interferences within the climate system as unequivocal. Many of the predicted changes are without precedent and human activities are very likely to have contributed to climate change. Global warming is therefore considered as one of the crucial environmental and societal challenges in most parts of the world due to its strong impacts on the natural environment and human lives. In order to limit the increase in global temperatures below 2 °C as recognized, for instance, in the Copenhagen Accord 2009 (see UNFCCC, 2010), significant reductions of greenhouse gas and particularly CO₂ emissions are necessary (see also IPCC, 2014, i.e. the summary for policymakers of the Working Group III contribution to the IPCC Fifth Assessment

Report). Furthermore, increasing efforts to adapt to the consequences of unavoidable climate change are needed, particularly in the most vulnerable regions.

China plays a dominant role in international climate policy since it is not only the most populous country in the world with more than 1.3 billion inhabitants, but has also overtaken the U.S. as the worldwide biggest producer of CO₂ emissions and even has surpassed the EU in per-capita emissions (e.g. Le Quéré et al., 2014). As many other countries, China has taken a series of specific adaptation and mitigation measures to address global warming. In its highest priority national plan, namely the 12th Five-Year Plan (2011–2015), the Chinese government has included reduction targets for both energy consumption and CO₂ emissions. According to this, it is intended to reduce energy consumption and CO₂ emissions per unit of GDP by 16% and 17% by 2015, both compared to 2010 levels. Against this background, China has implemented emission trading schemes in seven cities and provinces and is planning a national cap-and-trade scheme (e.g. Jotzo and Löschel, 2014). Furthermore, China has recently outlined a national adaptation plan to enhance its capabilities to adapt to climate change. According to the National Development and Reform Commission, The People's Republic of China (2013), the 2013 national adaptation plan includes measures on

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disaster prevention and mitigation, monitoring and early warning, and also policies in the areas of agriculture, water resources, coastal areas and ecosystem, and public health.

While adaptation activities by individuals might be characterized as a private good, which provides private benefit, public adaptation and mitigation activities can be viewed as a national or an international public good, respectively. Therefore, policies to respond to climate change in China and other countries can certainly only be successfully implemented if citizens are willing to support these policies and to accept individual costs for public mitigation or adaptation activities. The necessary condition for the willingness to support different climate policies is that people believe in the existence of global warming and its potential impacts on themselves and/or on other members of the society. General beliefs in the existence of global warming are thus crucial for the acceptability of costly public adaptation and mitigation activities to reduce the negative impacts of climate change (even when the acceptability of mitigation activities additionally requires the specific belief in anthropogenic climate change). Therefore, knowledge about the extent and particularly the determinants of global climate change beliefs is certainly important. Former studies have shown that weather patterns (e.g. Egan and Mullin, 2012; Hamilton and Stampone, 2013) and perceived experiences with extreme weather events such as heatwaves, floods, or droughts (e.g. Spence et al., 2011; Leiserowitz et al., 2012) seem to be important (besides socio-economic variables) since they are positively correlated with climate change beliefs or concerns.

While the direct attribution of an extreme weather event to climate change is not possible and there are still important gaps in knowledge about the impacts of global warming, particularly on a regional scale, it is generally accepted that changes in the mean average surface temperature may lead to a long-run increase of extreme weather events (e.g. Rosenzweig et al., 2001; World Bank, 2010; Howe and Leiserowitz, 2013). While the deaths from extreme weather events have decreased in the last decades, the number of people requiring humanitarian assistance after disasters has strongly increased, especially in lower-middle income countries (e.g. World Bank, 2010). Furthermore, the economic damages due to storms, floods, and droughts have strongly risen from the 1980s to the early 2000s. While the increasing economic damages might rather be affected by a higher exposure of economic value instead by climate change, this development points to the necessity of appropriate adaptation activities to reduce the negative impacts of climate change.

In China the frequency and intensity of short duration heatwaves, droughts, and floods due to intensive daily rainfalls have risen in recent decades. This led, for instance, to an increasing frequency of extreme rains in western and southern parts including the region of the Changjiang river, more frequent floods from the Changjiang river in the past decade and in the North-East since the 1990s, more intensive summer rains in the East, a severe flood in 1999, and a seven-fold increase in the frequency of floods since the 1950s (e.g. Zhai et al., 1999, 2004; Ding and Pan, 2002; Zhai and Pan, 2003; Zhai, 2004; Parry et al., 2007). These changing weather patterns and extreme weather events are widely discussed in the Chinese and also international media and academia, particularly dealing with the role of global warming for this development and the consequential physical and financial damages for people being affected by these events.

The aim of this paper is to analyze the relationship between perceived extreme weather experiences and climate change beliefs in China. The contribution of our empirical analysis to former studies of the determinants of climate change beliefs and concerns is three-fold: First, we do not focus on single extreme weather events such as floods (e.g. Whitmarsh, 2008; Spence et al., 2011), but consider six different events, which may be related to global climate change. Second, we do not only examine the general perception of extreme weather experiences, but additionally consider perceived personal physical or financial damages. Third, our econometric analysis refers to China due to its crucial role in global climate policy and its likely vulnerability to climate change. This adds important insights to former empirical studies that

are particularly referred to the U.S. (e.g. Joireman et al., 2010; McCright and Dunlap, 2011; Hamilton, 2011) and only sporadically to other high-income western countries such as the UK (e.g. Whitmarsh, 2008; Spence et al., 2011) or Australia (e.g. Li et al., 2011).

Our econometric analysis is based on unique survey data among more than 1000 Chinese citizens in five economically important cities, namely Beijing, Guangzhou, Chengdu, Wuhan, and Shenyang. According to these data, the vast majority of respondents believe in global climate change. It should be noted that our analysis of climate change beliefs refers to general beliefs in global warming and not exclusively to beliefs in anthropogenic global warming. We analyze the perceptions of experiences with different extreme weather events with and without physical or financial damages including heatwaves, heavy rainfalls or floods, droughts, sandstorms, windstorms, and avalanches. This analysis of several extreme weather experiences is in line with Leiserowitz et al. (2012), who also consider the relationship between climate change beliefs and experiences with different extreme weather events. However, it should be noted that their study is purely descriptive for U.S. citizens. In addition to the analysis of extreme weather experiences, we control for the relevance of socio-demographic and socio-economic factors (i.e. education, gender, age, income, children in the household) in our econometric analysis.

The remainder of the paper is organized as follows: The next section reviews the relevant literature and develops several hypotheses for our econometric analysis. In the third section our new dataset is presented. The fourth section discusses some descriptive statistics and the results of the econometric analysis and the final section concludes.

2. Literature review and hypotheses

Several surveys and empirical studies reveal that most people in the world believe in the general existence of global warming and in the specific existence of anthropogenic global warming. For instance, based on an online survey among over 13,000 adults from 13 countries in Europe (Belgium, France, Germany, Italy, Spain, Switzerland, Turkey, UK), North America (U.S., Mexico), and Asia (Hong Kong, Indonesia, Japan), Survey AXA/IPROS (2012) reports that almost 90% of the respondents believe that the climate has (not necessarily due to human activities) changed significantly in the past 20 years. However, the corresponding shares differ across the countries. While more than 95% of the respondents in Mexico, Hong Kong, Indonesia, and Turkey feel that the climate has changed, only about 72% of the U.S. respondents share this view. This rather low frequency for the U.S. is in line with the results of several polls as discussed in Nisbet and Myers (2007). The result is also confirmed by the study of Carlsson et al. (2012), which compares attitudes toward climate change in the U.S., Sweden, and also China. Although the general existence of global warming is believed by a strong majority in all three countries, the share of climate change skeptics is by far the highest in the U.S. More than 24% of the U.S. respondents state that the temperature has not increased globally. In contrast, these shares are only about 6% in Sweden and even less than 5% in China. Furthermore, almost 27% of the U.S. respondents do not believe in anthropogenic climate change (i.e. state that humans have not affected the temperature increase), whereas the corresponding share is only 4% in China.

With respect to the determinants of climate change beliefs and concerns, a series of empirical studies reveals the high relevance of weather patterns or experiences.¹ Recent studies often use objectively measured weather data at the day of the survey or for different periods before the

¹ Most of the empirical studies that are discussed in the following consider general beliefs, concerns, and views about climate change, which is thus not necessarily affected by human activities. Some of these studies additionally include some aspects of the human contribution in their analyses, while not explicitly focusing on anthropogenic climate change (e.g. Whitmarsh, 2008, 2011, Malka et al., 2009, McCright, 2010, Joireman et al., 2010; McCright and Dunlap, 2011; Spence et al., 2011). In contrast, Hamilton and Stampone (2013) explicitly focus on the determinants of anthropogenic climate change.

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