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On the relevance of ideology and environmental values for climate change beliefs, climate policy support, and climate protection activities: An empirical cross country analysis

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Abstract

Based on unique data from representative computer-based surveys among more than 3400 citizens, this paper empirically examines the determinants of climate change beliefs, climate policy support, and climate protection activities in three countries which are key players in international climate policy, namely the USA, Germany (as largest country in the European Union), and China. Our econometric analysis focuses on the effect of ideological and political identification and especially considers the interrelationship between a right-wing or a left-wing orientation and environmental values. Our estimation results imply that environmental awareness is in all three countries the major factor for attitudes and activities towards climate change. In Germany, citizens with a conservative, but not social or green orientation significantly less often support climate policy and particularly have a significantly lower willingness to pay a price premium for climate-friendly products, whereas ideological differences are negligible for climate change beliefs. In contrast, a right-wing orientation has significantly negative effects on all attitudes and activities towards climate change in the USA. Furthermore, an increasing environmental awareness decreases ideological differences in the support of climate policy in Germany and the USA and especially in general climate change beliefs and beliefs in anthropogenic climate change in the USA. Our estimation results suggest alternative strategies such as specific communication campaigns in order to reduce the climate change skepticism in conservative and right-wing circles in the USA and to increase the support of climate policy among such population groups.

JEL classification: Q54, Q58, A13

Keywords: Climate change beliefs, climate policy support, climate protection activities, ideological and political identification, environmental values, econometric analysis

1. Introduction

According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2013, summary for policymakers of the Working Group I), global warming is unequivocal and human activities are very likely to have contributed to the increase of global temperatures. Climate change is therefore widely considered as a multi-faceted challenge worldwide. In order to limit it, drastic reductions of greenhouse gas emissions (e.g. IPCC, 2014, summary for policymakers of the Working Group III contribution to the IPCC Fifth Assessment Report), but also efforts to adapt to consequences of unavoidable global warming are needed. However, international climate policy was very ineffective so far. Former international climate negotiations have shown that their success involves several challenges such as the cooperation between very heterogeneous countries or the translation of agreements into national regulations. But even national climate policies (such as the German energy transition) including efforts to stimulate voluntary individual climate protection activities have not led to strong decreases in greenhouse gas emissions until now.

One major success factor of international or national climate policy is its acceptance in the population. Therefore, insights into the support of climate policies, but also into the willingness for climate protection activities are certainly valuable for decision makers to implement specific policies. This paper empirically examines the determinants of individual climate policy support and climate protection activities. It focuses on the relevance of ideology as well as environmental values. Another main determinant of the aforementioned attitudes and activities is obviously the general concern about climate change (e.g. Dienes, 2015). It is even plausible to think that the belief in anthropogenic climate change is a necessary condition for the support of policies for (possibly costly) mitigation activities and for voluntary individual climate protection activities (at least if no additional co-benefits occur). Similarly, the necessary condition for voluntary individual adaptation activities and for the support of policies for (possibly costly) adaptation efforts is that citizens believe in the existence of climate change.

The contribution of our empirical analysis is threefold: First, this paper compares the three aforementioned directions of attitudes and activities towards climate change, namely climate change beliefs, climate policy support, and climate protection activities in three countries, which are key players in international climate policy, namely the USA, Germany (as largest country in the European Union), and China. In contrast, former empiri-

cal studies often focus only on climate change beliefs and concerns (e.g. Marquart-Pyatt et al., 2014), only on the acceptance or support of climate policies (e.g. Hammar and Jagars, 2006), or only on voluntary climate protection activities (e.g. Kotchen and Moore, 2007). Furthermore, previous studies mostly use data from only one country. The basis for our cross country analysis are data from simultaneous surveys with widely identical questions across the three countries (with some exceptions in China, as discussed below). With respect to climate change beliefs, we additionally distinguish between general global warming beliefs and beliefs in anthropogenic global warming.

Second, our categorization of ideological and political identification and orientation is much more sophisticated (see also the discussion in Unsworth and Fielding, 2014). Former empirical studies, especially for the USA, mostly consider one-dimensional indicators for a right-wing or a left-wing identification, for example, by including variables for liberal versus conservative orientation (e.g. McCright and Dunlop, 2011, Dastrup et al., 2012) and/or variables for the identification with the Democratic versus the Republican Party (e.g. Hamilton, 2011, Egan and Mullin, 2012, Shao et al., 2014). However, it is possible that different ideological orientations are interrelated, which cannot be captured by the simple comparison of a right-wing and a left-wing identification, especially in Europe. In Germany, for example, a conservative identification can be correlated with a green and particularly with a liberal identification, in contrast to the often very sharp differences between liberals and conservatives in the USA. In order to better understand the different drivers of ideological identification across countries for attitudes and activities towards climate change as basis for reliable conclusions for climate policy, we therefore consider four variables for a conservative, liberal, social, and green orientation, respectively, which are not mutually exclusive.

Third, and perhaps most important, we consider the interrelationship between ideology and environmental values. In his analysis of voluntary climate protection activities, Kahn (2007) claims that environmental awareness and a Green Party membership are alternative indicators for environmentalism. Similarly, many empirical analyses only consider ideological and political orientation (e.g. Dastrup et al., 2012, Costa and Kahn, 2013, Marquart-Pyatt et al., 2014) or only environmental values (e.g. Kotchen and Moore, 2007, Brody et al., 2011, Delmas and Lessem, 2014) as explanatory variables. However, it is the question whether environmental values and ideological and political identification are really exchangeable or whether they are mutually interrelated. For example, dif-

ferences between a conservative and a liberal-social-green identification can be influenced by environmental values. In fact, many former studies show that both factors positively influence attitudes and activities towards climate change (e.g. Dietz et al., 2007, Attari et al., 2009, Joireman et al., 2010, Whitmarsh, 2011), even when their interrelationship is mostly not discussed. In particular, to the best of our knowledge, no former empirical study has examined interaction effects of environmental values and ideological orientation so far. However, for the discussion of appropriate climate policies it seems to be very valuable to know whether, for example, a negative effect of a conservative identification on climate change beliefs, climate policy support, or climate protection activities decreases, increases, or remains stable for increasing environmental awareness.

The remainder of the paper is organized as follows: Section 2 reviews the related literature. Section 3 presents the data and the variables in our econometric analysis as well as some descriptive statistics. Section 4 discusses the estimation results and the final Section 5 draws some conclusions.

2. Literature review

In former studies it is shown that the USA is one of the countries with the highest frequency of (anthropogenic) climate change skeptics. For example, Survey AXA/IPSOS (2012) reports that almost 90% of the respondents in an online survey among over 13000 adults from 13 countries in Europe (Belgium, France, Germany, Italy, Spain, Switzerland, Turkey, UK), North America (USA, Mexico), and Asia (Hong Kong, Indonesia, Japan) believe that the climate has changed significantly in the past 20 years. However, while more than 95% of the respondents in Mexico, Hong Kong, Indonesia, and Turkey state that the climate has changed, only about 72% of the US respondents share this view. This result is in line with the study of Carlsson et al. (2012), which compares attitudes towards climate change in the USA, Sweden, and China. Although the existence of global warming is believed by a strong majority of respondents in all three countries, the share of climate change skeptics is by far the highest in the USA, where more than 24% of the 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 US respondents do not believe in anthropogenic climate change, whereas the corresponding share is only 4% in China.

Due to the high extent of climate change skeptics and its major role in international cli-

mate policy, former empirical analyses of the determinants of climate change beliefs and concerns often focus on the USA with only a few exceptions, which, however, mostly refer to other Anglo-Saxon countries such as the UK (e.g. Whitmarsh, 2011, Spence et al., 2011) or Australia (e.g. Li et al., 2011, Unsworth and Fielding, 2014). Dai et al. (2014) is one of the very few analyses for China in this field. In addition, Tjernström and Tietenberg (2008) consider individual data from the International Social Survey program (2000 module on the Environment), which include topics surrounding environmental concern. The data refer to overall 26 world-wide countries from America (i.e. the USA, Canada, Mexico, Chile), Asia/Oceania (i.e. Israel, Japan, Philippines, New Zealand, but not China), and especially Europe including the UK, Russia, and Germany.

Even when ideological and political identification is not always focused in empirical analyses (e.g. Joireman et al., 2010, Li et al., 2011, Egan and Mullin, 2012, Hamilton and Stampone, 2013, Hamilton and Lemcke-Stampone, 2014, Shao et al., 2014, Marquart-Pyatt et al., 2014)[1], all these studies reveal the importance of ideology (see also e.g. Tjernström and Tietenberg, 2008, Dunlap and McCright, 2008, McCright and Dunlop, 2011, Hamilton, 2011, Whitmarsh, 2011, Unsworth and Fielding, 2014). The studies show that conservatives and citizens with a high identification with the right-wing of politics (especially with the Republican Party in the USA) have strongly lower climate change beliefs and concerns than liberals and citizens with a high identification with the left-wing of politics (especially with the Democratic Party in the USA) (see also the discussion in Pidgeon, 2012). According to McCright and Dunlap (2011), one possible explanation for this result is that conservatives have stronger system justification tendencies, which lead them to defend the status quo and to deny problems such as climate change that threaten system functioning.

These views of conservatives and Republican voters seem to significantly contribute to the internationally very high level of climate change skepticism in the USA. This result also strengthens the extremely strong polarization between the ideological groups on different issues in this country. The differences between conservatives and Republicans on the one hand and liberals and Democrats on the other hand are so sharp that some studies identify that ideological and political identification even influences the relationship between education and climate change beliefs and concerns. For example, Hamilton (2011),

[1] These studies especially consider weather patterns or perceived weather experiences and are in line with, for example, Spence et al. (2011), Zaval et al. (2014), Dai et al. (2014), or Herrnstadt and Muehlegger (2014).

Hamilton and Stampone (2013), Shao et al. (2014), and Hamilton and Lemcke-Stampone (2014) show that education or perceived knowledge of climate change only have positive effects among liberals and Democratic voters, but are insignificant or even have negative effects among conservatives or Republican voters (see also the theoretical analysis of McCright, 2011). This pattern often leads to overall insignificant impacts of education.

Besides ideological and political orientation, some former studies additionally identify the relevance of environmental values. For example, Joireman et al. (2010) shows on the basis of data from marketing undergraduate students from a US university that the strength of agreement to four items (protecting environment and preserving nature, unity with nature and fitting into nature, respecting the earth and harmony with other species, preventing pollution and protecting natural resources) strongly affects the belief that global warming is occurring now. Based on representative data among US citizens, McCright and Dunlap (2011) show that environmental orientation (i.e. the identification with environmental movement) has a negative impact on climate change skepticism and the belief that human activities are not the primary cause of increasing temperatures. On the basis of data from Australian citizens, Unsworth and Fielding (2014) show that the perceived importance of protecting the environment is positively correlated with the belief in anthropogenic climate change. In contrast, Whitmarsh (2011) considers the New Environmental Paradigm (NEP) scale to measure environmental values and shows on the basis of data from citizens in two small regions in the UK that this scale has strong negative effects on climate change skepticism.

While it can be argued that the belief in anthropogenic climate change is a necessary condition for the support of mitigation policies and for voluntary individual climate protection activities (at least if no additional co-benefits occur), it can be hypothesized that climate change concerns are at least an important factor. On the basis of individual data from the Life in Transition Survey in 35 countries from Europe (including 16 countries from the European Union) as well as from the former Soviet Union (e.g. Armenia, Georgia, Kazakhstan, Uzbekistan) and in addition Mongolia, Dienes (2015) confirms this hypothesis. According to his econometric analysis, a high concern level with respect to climate change has strong positive impacts on the willingness to pay more taxes (and thus on the support of corresponding climate policies), on the willingness to give part of the income to mitigate the effects of climate change, as well as on (stated) voluntary climate protection activities (i.e. actions aimed at helping to fight climate change). However, he

neither controls for ideological and political identification nor for environmental values, which could influence the relationship between climate change concerns and climate protection activities.

In contrast, based on representative data among Swedish citizens, Hammar and Jagars (2006) and Jagars et al. (2010) reveal that the sympathy with the Green Party is positively correlated with the support of a CO_2 tax and a personal carbon allowances scheme. Furthermore, Unsworth and Fielding (2014) show that a left-wing orientation and environmental awareness (i.e. the perceived importance of protecting the environment) have not only positive effects on the belief in anthropogenic climate change, but also on the support for climate policies (i.e. on general government activities to address climate change and on the support for carbon pricing policy). Dietz et al. (2007) reveal for residents in Michigan and Virginia, USA, that a liberal identification is positively correlated with the support of several climate policies such as energy taxes or federal tax subsidies. Interestingly, the effect of a liberal orientation becomes insignificant if environmental values according to the NEP scale are included as explanatory variable and the positive effect of the NEP scale becomes insignificant if pro-environmental personal normative beliefs are included. However, the empirical analysis does not identify whether the estimated effects are interrelated or influenced by multicollinearity problems. On the basis of (unrepresentative) data from citizens in Pittsburgh, USA, Attari et al. (2009) show that a higher NEP scale leads to a higher support of climate policies that restrict the purchase of SUV and trucks as well as policies that increase green energy use. In contrast, the support of policies restricting the purchase of SUV and trucks is weaker among Republicans.

Attari et al. (2009) additionally examine voluntary climate protection activities, i.e. the (stated) purchase of low emission vehicles and the (stated) purchase of green energy from the energy supplier. While environmental awareness according to the NEP scale has again a strong positive effect, ideological identification does not significantly affect these climate protection activities. These findings are in line with the results of Brody et al. (2011), who show that the NEP scale and another indicator for environmental values are strongly positively correlated with climate protection activities, which are measured by two questions on the (stated) willingness to alter behavior to mitigate climate change. However, ideological and political identification is not included as explanatory variable in this empirical analysis on the basis of representative data among US citizens. In contrast, on the basis of household data from California, USA, Kahn (2007) reveals a posi-

tive relationship with the Green Party membership by considering (low) self-reported consumption of gasoline, the (waiver of the) possession of a SUV, and the use of public transit. However, the study only examines shares of Green Party registered voters in the community and not individual indicators for ideological and political orientation.[2] Furthermore, he does not control for environmental values. His empirical analysis considers both a voluntary restraint of consumption (in the case of gasoline consumption) and a climate-friendly conspicuous consumption (and thus the consumption of an impure public good in the case of owning a sustainable vehicle such as a hybrid car) as indicators for climate protection activities.

On the basis of data from home owners in a Western Region electric utility area of the USA, a voluntary restraint is also analyzed in the empirical analysis of Costa and Kahn (2013) by examining electricity consumption. They show that Democratic and Green Party registered voters consume strongly less electricity than Republican registered households. However, environmental values are not included in this empirical analysis, either. In contrast, based on data from a field experiment in the residence halls at the University of California - Los Angeles, USA, Delmas and Lessem (2014) consider the NEP scale and reveal some negative effects on electricity use including heating/cooling, overhead lights, and plug load, and especially on electricity use for heating. However, they do not include ideological and political identification. This is in line with the study of Kotchen and Moore (2008), which also analyzes a voluntary restraint in the electricity consumption. Their empirical analysis is based on household data from Traverse City, Michigan, USA. While environmental values are not directly considered, they show (among others) that conservationists, i.e. households who report a membership in an environmental organization, consume less electricity than nonconservationists. In addition, conservationists are more likely to participate in the Green Rate program of Traverse City Light & Power (TCL&P), which requires that the participating households pay a price premium for their electricity to finance a wind turbine.

Kotchen and Moore (2007) also examine the participation in green-electricity programs in Michigan, USA. However, they do not only consider the aforementioned Green Rate program, which is based on an impure public good, but also the SolarCurrents program of Detroit Edison, which is based on contributions to finance the creation of new photovol-

[2] The study additionally examines the effect of the shares of Green Party registered voters on transportation mode choice and vehicle choice on the basis of aggregated tract level data.

taic facilities and thus on a pure public good. Based on data from TCL&P and Detroit Edison customers, they show that environmental awareness according to the NEP scale strongly increases the participation in these green-electricity programs. However, they do not control for ideological and political identification, either. Finally, by analyzing the use of solar panels at home, Dastrup et al. (2012) consider a climate-friendly conspicuous consumption since solar panels are observable so that solar home owners know that other citizens know that they have solar panels. Based on data from registered voters in San Diego, USA, they show that voters of the Democratic, Peace and Freedom, and Green Parties live much more often in a solar home. While environmental values are not directly included in the empirical analysis, the study additionally reveals that contributions to environmental organizations are also positively correlated with the probability to live in solar homes.[3]

In total, former empirical analyses of attitudes and activities towards climate change, i.e. climate change beliefs, climate policy support, and climate protection activities hardly try to detect the interrelationship between multi-dimensional indicators of ideological and political identification and environmental values, as discussed above. In particular, to the best of our knowledge, no previous study examines corresponding interaction effects.

3. Data and variables

The data for our empirical analysis were collected from computer-based surveys among a total of more than 3400 citizens aged 18 and older in the USA (1010 respondents), Germany (1005 respondents), and China (1430 respondents). The surveys were carried out simultaneously in May and June 2013 by the market research company GfK SE (Gesellschaft für Konsumforschung). In the USA and Germany, the samples were drawn from representative GfK Online Panels. The respondents were invited via email to attend a self-administered interview in a web-based online environment. In contrast, online surveys in China would be likely to lead to systematic bias because internet access is typically lacking in rural areas and market research is less common. Therefore, the respondents were recruited by employees of GfK China in eleven core regions, invited to centrally located test studios, and interviewed face-to-face. About one half of the respondents in China come from rural areas and the other half lives in metropolitan areas. The question-

[3] However, the study mainly focuses on the effect of the existence of a solar panel on the observed sales prices of homes in the San Diego and Sacramento areas in the USA.

naires comprised five main groups of questions in all three countries: Assessment of climate change, voluntary climate protection activities, assessment of climate policy and negotiations, fundamental values, as well as socio-demographic and socio-economic variables. The completion of the survey required about 30 minutes on average in all three countries.

In order to examine general global warming beliefs, the participants were asked which of the following statements about global climate change they are most likely to agree with: "Global climate change is already occurring", "global climate change is not happening now, but it will occur in the future", or "global climate change is not going to occur at all". For the econometric analysis, we therefore construct a dummy variable that takes the value one if a respondent agrees with one of the two first statements and the value zero if she believes that climate change is not going to occur at all. In order to examine the beliefs in anthropogenic global warming, those participants who agreed with climate change now or in the future were additionally asked for their perception of the cause of global warming: "Natural processes", "human activities", or both "natural processes and human activities". For the econometric analysis, we therefore construct a dummy variable that takes the value one if a respondent believes that human activities alone or together with natural processes are the causes of climate change and the value zero if he believes that only natural processes are responsible or that climate change is not going to occur at all.

Table 1 reports the frequencies of general climate change beliefs across the three countries.[4] While the upper part of the table shows detailed frequencies, the lower part refers to the frequencies for the two categories of the dependent variable in the econometric analysis.[5] The upper part reveals that in all three countries the majority believes that climate change is already occurring. In addition, about one tenth believes that climate change will occur in the future. However, the minorities of climate change skeptics and respondents who did not answer to the underlying question differ considerably. While in China less than 0.5% of the respondents are climate change skeptics, about one tenth in Germany and even more than 21% in the USA either believe that climate change is not going to occur at all or did not answer to the underlying question. This relatively high number in the USA is particularly influenced by the more than 12% who refused to answer to the question. The lower part of Table 1 shows that the frequencies for climate

[4] All calculations and estimations were conducted with the statistical software package STATA.
[5] The respondents who did not answer to the underlying question are excluded.

change believers in the econometric analysis would vary between about 90% in the USA and more than 99.5% in China. However, such an econometric analysis is certainly not useful in China since only six respondents would take the value zero in the dependent variable. Furthermore, it should be mentioned that the about 90% in the USA are probably an overestimated value due to the high number of respondents who did not answer to the underlying question.

Table 2 reports the frequencies of beliefs in anthropogenic climate change in addition to general climate change beliefs across the three countries. While the upper part of the table again shows detailed frequencies, the lower part refers to the frequencies for the two categories of the dependent variable in the econometric analysis (again excluding participants who did not answer to the underlying questions about general climate change beliefs and beliefs in anthropogenic climate change). The main result is that not only the frequencies of climate change skeptics and participants who refused to answer are highest in the USA, but also the frequency of climate change believers who think that this global warming is not anthropogenic. As a consequence, almost 81% of the respondents in the USA are believers in anthropogenic climate change in the econometric analysis, whereas the frequencies are more than 90% in Germany and especially in China. Again, it should be mentioned that these almost 81% in the USA are probably an overestimated value due to the high number of participants who did not answer to the underlying questions.

In order to examine climate policy support, we consider mitigation policies which are connected with additional costs. The participants were asked whether they would agree to additional climate protection measures being financed by the national budget. Unfortunately, however, it was only possible to ask this question in the USA and Germany, but not allowed in China. For the econometric analysis, we construct a dummy variable that takes the value one if a respondent agrees to these measures. In order to examine voluntary climate protection activities, the participants were asked whether they have already taken several measures such as the purchase of energy-efficient appliances, the purchase of a car with lower fuel consumption, or the reduction of car use or the number of flights. However, all these measures can be connected with co-benefits, especially with financial advantages. However, in line with Kotchen and Moore (2007, 2008) and Dustrup et al. (2012), we want to analyze price premiums for climate-friendly goods (see also Schwirplies and Ziegler, 2015) since we speculate that especially such climate protection activities are influenced by ideological and political identification as well as environmental

values.[6] The participants were asked they would be willing to pay higher prices for everyday products or services that offer a comparable quality or performance but are better for the climate than competing products. For the econometric analysis, we construct a dummy variable that takes the value one if a respondent states to be willing.

Table 3 reports in the upper part the frequencies of the support of climate policy and in the lower part the willingness to pay a price premium for climate-friendly products. The upper part of the table reveals that nearly three quarters of the German respondents state that they support additional climate protection measures being financed by the national budget, whereas the corresponding frequency is less than 44% in the USA. This relatively low number in the USA is influenced by the more than a quarter of respondents who refused to answer to the underlying question. The corresponding frequencies of refusals to answer are similar in both the USA and Germany for the question about the climate protection activity. The stated willingness to pay a price premium is again higher in Germany, even when the difference of the frequencies (about 41% compared with about 28%) is not as high as in the case of the support of climate policy. However, the willingness to pay a price premium for climate-friendly products is by far the highest in China, where nearly 80% of the respondents agree to the underlying question.

The main explanatory variables in the econometric analyses refer to ideological identification as well as to environmental values. With respect to ideological identification, we consider the following statements: "I am conservative", "I am liberal", "I would describe myself as socially", and "I identify myself closest with green politics". The respondents were asked how strongly they agree with these statements on a symmetric scale with five ordered response categories, i.e. "very weakly", "rather weakly", "neither weakly nor strongly", "rather strongly", and "very strongly".[7] This larger set of items allows a clearly more differentiated pattern of ideological and political identification compared to former studies. Based on these questions for ideological identification, the econometric analyses include the four dummy variables "conservative", "liberal", "social", and "green" that take the value one if the respondent agrees very or rather strongly to the four statements, respectively. It was again only possible to ask these questions in the USA and Germany, but not allowed in China. In the latter country, we therefore only asked whether the participant belongs to the Communist Party, to the Democratic Party, or to none of these

[6] Complementary empirical analyses of the other voluntary climate protection activities can be found in Schleich et al. (2014) and Lange et al. (2014).
[7] Among others, Schleich et al. (2015) discuss potential problems associated with this kind of scale.

parties. The econometric analysis includes the dummy variable "communist" that takes the value one if she belongs to the Communist Party.

Table 4 reports the detailed frequencies of ideological identification in the USA and Germany. It reveals a strongly higher conservative identification in the USA since about 38% of the respondents agree very or rather strongly to the statement "I am conservative", whereas the corresponding frequency is only a bit more than 22% in Germany. In contrast, the German respondents have a higher green identity and particularly a strongly higher social identity since more than 70% agree very or rather strongly to the statement "I would describe myself as socially", whereas the corresponding frequency is less than 30% in USA. This supports the well-known higher conservative-right orientation in the USA and the higher green-left orientation in Germany. The higher frequency of nearly 26% for a very weak agreement to the statement "I am liberal" in the USA and the higher frequency of more than 31% for a rather strong agreement in Germany underline this result, particularly since a liberal identity rather belongs to the green-left orientation in the USA, whereas a liberal identity can also belong to a conservative-right orientation in Germany.

In line with Whitmarsh (2011), we consider the NEP scale as indicator for environmental values. The NEP scale (e.g. Dunlap et al., 2000) is a standard instrument in the social and behavioral sciences and is also increasingly common in the economic literature (see also Kotchen and Reiling, 2000, in addition to the studies as discussed above). It is based on the following six statements: "Humans have the right to modify the natural environment to suit their needs", "humans are severely abusing the planet", "plants and animals have the same right to exist as humans", "nature is strong enough to cope with the impacts of modern industrial nations", "humans were meant to rule over the rest of nature", and "the balance of nature is very delicate and easily upset". The respondents were asked how strongly they agree with these statements including five ordered response categories, i.e. "very weakly", "rather weakly", "neither weakly nor strongly", "rather strongly", and "very strongly". The variable "NEP" is designed by constructing dummy variables that take the value one if the respondent agrees very or rather strongly (in the case of the three positively keying statements) or very or rather weakly (in the case of the three negatively keying statements) and by adding up the values of the six dummy variables. As a consequence, "NEP" varies between zero and six.

Finally, we include several control variables in our econometric analyses. The dummy

variable "high education" takes the value one if the highest level of education is at least secondary. The dummy variable "female" takes the value one if the respondent is a woman, while "age" is the age of the respondent in years. We additionally control for regional heterogeneities. We include the corresponding dummy variables "northeast", "midwest", and "south" (considering "west" as base category) for the USA, the dummy variable "Western Germany" for Germany, and the dummy variables "Shenyang", "Wuhan", "Chengdu", "Shijazhuang", and "Lanzhou" (considering "Beijing", "Shanghai", "Guangzhou", "Hefei", "Yinchuan", and "Quanzhou" as joint base category) for China. Table 5 reports the descriptive statistics for these explanatory variables. It particularly shows that the environmental awareness, measured by the NEP scale, in Germany is on average higher than in China and especially strongly higher than in the USA.

4. Econometric analysis

4.1. Climate change beliefs

General climate change beliefs

Table 6 reports the results of Maximum Likelihood (ML) estimations of binary probit models for the determinants of general climate change beliefs.[8] In line with former studies, the first two models include only "conservative" (model 1) or "conservative" and "liberal" (model 2) as variables for ideological identification. Model 3 additionally includes the variables for the social and green orientation and model 4 finally includes "NEP" as indicator for environmental values as additional explanatory variable. The estimation results in model 1 and model 2 for the USA in the upper part of the table confirm former findings that a conservative orientation has a significantly negative and a liberal orientation has a significantly positive effect on general climate change beliefs. Gender is the only additional variable that has a significant effect, whereas the parameters of "high education" and "age" are not significantly different from zero.[9] The positive estimate of the parameter of "female" is in line with several former studies (e.g. McCright and Dunlop, 2011, Hamilton, 2011, Egan and Mullin, 2012, Marquart-Pyatt et al., 2014). With respect to the insignificant effect of education, we have also analyzed whether this result is influenced by conflicting effects for conservative and liberal re-

[8] We consider heteroscedasticity-robust estimates of the standard deviations of the estimated parameters according to White (1982) and thus heteroscedasticity-robust z statistics.
[9] Also the parameters of the regional dummies are not significantly different from zero with one exception ("Western Germany" in model 3).

spondents as shown and discussed in several studies (e.g. Hamilton, 2011, McCright, 2011, Hamilton and Stampone, 2013, Shao et al., 2014, and Hamilton and Lemcke-Stampone, 2014). However, we cannot find any significant interaction effect for "high education" and "conservative" or for "high education" and "liberal".[10]

However, the main result in the upper part of Table 6 for the USA is that the significantly positive correlation between a liberal orientation and general climate change beliefs becomes insignificant if the variables for the social and green identification are additionally included. Instead, the green orientation has a significantly positive effect in this model 3. This suggests that the positive correlation between a liberal identification and general climate change beliefs is only indirect and instead influenced by an underlying green identification. However, even this significantly positive effect of "green" becomes weaker if the NEP scale is included as additional explanatory variable. The strong significantly positive effect of "NEP" in model 4 implies that environmental values are a dominant factor in explaining general climate change beliefs in the USA. Nevertheless, an important result in the upper part of Table 5 is that a conservative identification has a significantly negative effect across all four models and thus also in model 4 that includes environmental values as explanatory variable.

The estimation results in the lower part of Table 6 show that a conservative identification in Germany is only weakly significantly negatively correlated with general climate change beliefs in model 1, but that the correlation becomes insignificant in the three other models. Furthermore, a liberal identification and surprisingly also a green identification never have any significant effect. In contrast, a social identification has a significantly positive effect on general climate change beliefs in model 3, which, however, becomes insignificant if the NEP scale is included as additional explanatory variable. The corresponding estimation results in model 4 reveal that environmental awareness has a significantly positive effect and thus is the only factor in explaining general climate change beliefs. Furthermore, none of the parameters of the other explanatory variables is significantly different from zero across all three models. These estimation results suggest that ideological and political orientation is not very relevant for differences in climate change

[10] The corresponding estimation results are not reported due to brevity, but are available upon request. It should be noted that the consistent estimation of the interaction effect is not in line with the parameter of the underlying interaction term. Therefore, we use for this estimation and the calculation of the corresponding z statistics the approach of Ai and Norton (2003) and Norton et al. (2004), which was commonly not considered in former studies that include interaction effects with possible distorted conclusions if only the parameter of the interaction term is interpreted (an exception is e.g. Dienes, 2015).

beliefs in Germany, which could be influenced by the overall very high levels of beliefs compared with the values in the USA.

In order to examine the size of the effects of ideological identification, Table 7 reports estimated average probabilities for general climate change beliefs, which are based on the estimation results in Table 6. While the first lines for both countries refer to the estimated average probabilities across all respondents, the next two lines compare the values between conservative and non-conservative respondents. On the basis of the significant effects of "conservative" and "green" in the USA in model 4 according to Table 6, we additionally compare the estimated average probabilities for the two groups with the strongest differences in ideological orientation, namely conservative, but not green respondents and green, but not conservative respondents. In total, the table reveals relatively small differences in the estimated average probabilities for general climate change beliefs in Germany, but strong differences between a conservative and a green identification in the USA. The maximum difference is 19.5 percentage points in model 3, but also the differences between conservative and non-conservative respondents are up to 12.9 percentage points in model 3. These two values decrease to 14.2 and 9.4 percentage points in model 4 if "NEP" is included as explanatory variable. This result suggests that environmental awareness has not only an own strong positive effect on general climate change beliefs, but that it also weakens the differences between a conservative and green identification in the USA.

In order to examine this hypothesis for the USA, we consider the interaction effect between "conservative" and "NEP". The additional inclusion of an interaction term in model 4 reveals a positive interaction effect at the 5% significance level[11] so that the significantly negative effect of a conservative orientation becomes in fact weaker with increasing environmental awareness. This result is strengthened in Table 8, which reports estimated average probabilities for the two groups with the strongest ideological differences as discussed above (i.e. conservative-non-green and non-conservative-green respondents) at the seven different values of the NEP scale. The basis for these estimates is model 4 (without the inclusion of an interaction term). The table reveals that the estimated negative average discrete probability effect is highest (32.0 percentage points) for the lowest environmental awareness and then decreases with higher values of "NEP". If the NEP

[11] In contrast, the parameter of the interaction term is only different from zero at the 10% significance level. The correct estimation of the interaction effect is explained in the previous footnote.

scale takes the maximum value six, the estimated negative average discrete probability effect of a conservative-non-green identification becomes very small (3.0 percentage points). This illustrates the strong influence of environmental values on the effects of ideological and political orientation.

Beliefs in anthropogenic climate change

The upper and middle parts of Table 9 are constructed like Table 6, but now report the estimation results for beliefs in anthropogenic climate change. The upper part for the USA shows that (in contrast to former studies) a liberal identification has never a significant impact, whereas a conservative identification has still a significantly negative impact across all four models and a green orientation has a significantly positive impact in model 3. This latter effect becomes insignificant in model 4, where "NEP" has a strong significantly positive effect, which implies that environmental awareness is also a dominant factor in explaining beliefs in anthropogenic global warming in the USA. "Female" has again a significantly positive effect in the first three models which now remains weakly significant in model 4. Age has now a weak significantly negative effect in model 1 and model 2 and a strong significantly negative effect in model 4. This result is in line with several former studies (e.g. Hamilton, 2011, Whitmarsh, 2011, Hamilton and Stampone, 2013, Shao et al., 2014). The middle part of Table 9 shows again that ideological orientation is not very relevant in Germany, even when the negative effect of "conservative" is now slightly more significant in the first three models. In model 4 "NEP" is still the only variable with a significantly positive effect. Furthermore, females now have significantly higher beliefs in anthropogenic climate change, however, only in model 1 and (to a weaker extent) in model 2.

The lower part of the table reports the corresponding estimation results for China. As discussed above, it is not possible to include the four dummy variables for ideological identification since it was not allowed to ask the underlying questions in this country. We therefore consider "communist" as the only indicator for ideological and political orientation in China. The additional explanatory variables ("NEP", "high education", "female", "age") are in line with the analysis in the USA and Germany.[12] While model 1 does not consider environmental values, model 2 includes the NEP scale as additional explanatory variable. The corresponding estimation results reveal that the NEP scale in model 2 is the

[12] We also include five regional dummies, but cannot consider additional dummies due to perfect predictions in the values of the dependent variables.

only variable that is significantly positively correlated with beliefs in anthropogenic climate change across both models. This underlines the relevance of environmental awareness, but also suggests that the identification of population groups with different beliefs in anthropogenic climate change is difficult due to the extremely low skepticism and thus low variation in beliefs in China.

Table 10 and Table 11 are constructed like Table 7 and Table 8, but now report the estimation results for beliefs in anthropogenic climate change in the USA and Germany. Table 10 shows lower estimated average probabilities for a conservative identification in both countries. However, the differences in the estimates for a different ideological orientation are again stronger in the USA than in Germany. The maximum difference between a conservative and a non-conservative orientation in model 3 is now 18.2 percentage points in the USA. However, the value again strongly decreases to 9.0 percentage points in model 4 if "NEP" is included as explanatory variable, which strengthens the suggestion that environmental values weaken the differences in the estimated average probabilities. As in the case of general climate change beliefs, the additional inclusion of an interaction term for "conservative" and "NEP" in model 4 leads to a positive interaction effect at the 5% significance level.[13] This result is strengthened in Table 11, which reports estimated average probabilities for conservative and non-conservative respondents at the seven different values of "NEP". In line with the results in Table 8, the table reveals that the estimated negative average discrete probability effects have a maximum value of 17.7 percentage points for the lowest environmental awareness and then decrease with increasing "NEP" to 3.8 percentage points for the strongest environmental awareness. This points to the strong influence of environmental values on the negative effect of a conservative identification on beliefs in anthropogenic climate change in the USA.

4.2. Support of climate policy and climate protection activities

Table 12 for the USA and Table 13 for Germany report the results of ML estimations of bivariate binary probit models for the determinants of the support of climate policy and the willingness a pay a price premium for climate-friendly products. We again compare

[13] Interestingly, the parameter of the interaction term is now not different from zero at the 10% significance level (the p value is even 0.469), which would often be incorrectly interpreted as an insignificant interaction effect, as discussed above.

four different models as in the analysis of climate change beliefs.[14] In all models in both countries the estimated correlation coefficients between the dependent dummy variables in the error terms of the underlying latent variables are positive and highly significantly different from zero. Table 12 reveals for the first three models a significantly negative effect of a conservative orientation and a significantly positive effect of liberal, social, and green orientation on both the support of climate policy and the willingness to pay a price premium for climate-friendly products in the USA. However, the effect of ”social” in the case of the support of climate policy and the effect of “conservative” in the case of the willingness to pay a price premium become insignificant if the NEP scale is included in model 4, which has again a significantly positive impact. In addition, age has a significantly negative effect on the support of climate policy, while females and older citizens have a (weakly) significantly lower willingness to pay a price premium for climate-friendly products in model 4, respectively.

According to Table 13, a conservative orientation is significantly negatively correlated and a green orientation and “NEP” are significantly positively correlated with the support of climate policy in Germany. Furthermore, “social”, “green”, and “NEP” are significantly positively correlated with the willingness to pay a price premium for climate-friendly products. Interestingly, the significant effects in model 3 remain qualitatively relatively similar if the NEP scale is included in model 4, especially in the case of the support of climate policy. In addition, females and citizens from Eastern Germany support significantly more often the considered climate policy on the basis of model 4. The latter result can be explained by the historically higher support of general public regulations in this part of Germany. Furthermore, “high education” is the only additional variable that has a significantly positive effect on the willingness to pay a price premium for climate-friendly products in model 4. One possible explanation for this finding is the high positive relationship between education and income, even when Kotchen and Moore (2007) show that household income has no significant effect on paying a price premium for green electricity, which suggests that education is more relevant. While for (household) income was asked in the underlying survey, we omit this control variable since in both countries a high number of respondents did not answer the question, which would lead to unreliable estimation results, especially since it is possible that the refusal to answer to this question is not random.

[14] The additional notation “a” for the four models refers to the first dependent variable, and the notation “b” to the second dependent variable, respectively.

As discussed above, it was neither allowed to ask for the climate policy support nor to ask the underlying questions for the four dummy variables for ideological identification in China. Table 14 therefore only reports the results of ML estimations of binary probit models for the willingness to pay a price premium for climate-friendly products in this country. "Communist" is again the only indicator for ideological and political orientation. While model 1 does not consider environmental values, model 2 includes "NEP" as explanatory variable. As in the USA and Germany, the table reveals a significantly positive effect of the NEP scale, which underlines the relevance of environmental values. In contrast to the estimation results in the lower part of Table 9 for beliefs in anthropogenic global warming, the belonging to the Communist Party has a significantly positive impact on the willingness to pay a price premium for climate-friendly products. This impact is significant without the inclusion of "NEP" in model 1 as well as with the inclusion of "NEP" in model 2. In line with the estimation results in Germany, citizens with a higher education additionally have a significantly higher willingness to pay a price premium.

Based on the underlying estimation results, Table 15 for the USA, Table 16 for Germany, and Table 17 for China report estimated average probabilities for the support of climate policy and the willingness to pay a price premium for climate-friendly products. On the basis of the significant effects of the variables for ideological and political identification in model 4 according to Table 12, 13, and 14, we compare in each case and for each country the values for the two groups with the strongest differences in ideological orientation besides the estimated average probabilities across all respondents. Table 15 reveals extremely high differences in the estimated average probabilities in the USA for the support of climate policy between a conservative-non-liberal-non-green and a non-conservative-liberal-green identification in model 3a (57.9 percentage points) as well as for the willingness to pay a price premium between a non-liberal-non-social-non-green and a liberal-social-green identification in model 3b (53.1 percentage points). The two values only decrease moderately to 46.3 and 44.5 percentage points if "NEP" is included as explanatory variable in model 4a and model 4b.

In contrast to the corresponding findings for climate change beliefs, Table 16 also shows strong differences in the estimated average probabilities in Germany, even when the value for the support of climate policy between citizens with a conservative-non-green and a non-conservative-green orientation in model 3a is lower with 23.1 percentage points than in the USA. The corresponding value for the willingness to pay a price premium for cli-

mate-friendly products between a non-social-non-green and a social-green orientation in model 3b is even 46.4 percentage points. Again, the two values only decrease moderately to 18.6 and 35.0 percentage points if "NEP" is included as explanatory variable in model 4a and model 4b. In contrast, Table 17 reveals very low differences in the estimated average probabilities in China for the willingness to pay a price premium for climate-friendly products between a non-communist and a communist identification, either without the inclusion of the NEP scale as explanatory variable in model 1 (4.7 percentage points) or with the inclusion of the NEP scale in model 2 (4.8 percentage points). These results are certainly strongly influenced by the high (stated) willingness to pay a price premium for climate-friendly products in China according to Table 3.

Finally, Table 18 for the USA, Table 19 for Germany, and Table 20 for China report estimated average probabilities for the two groups with the strongest ideological differences as discussed above at the seven different values of the NEP scale. The basis for these estimates is model 4a or 4b for the USA and Germany as well as model 2 for China. The tables reveal for all three countries that increasing values of the NEP scale have no clear impacts on the estimated average discrete probability effects in the case of the willingness to pay a price premium for climate-friendly products. Furthermore, the upper part of Table 18 shows only a slight weakening impact for the two highest values of "NEP" in the case of the support of climate policy. In contrast, according to the upper part of Table 19, the estimated negative average discrete probability effect of a conservative-non-green identification is highest (30.0 percentage points) for the lowest environmental awareness and then decreases with increasing values of the NEP scale to 11.3 percentage points if the NEP scale takes the maximum value six.

5. Conclusions for climate policy

Based on unique data from representative computer-based surveys among a total of more than 3400 citizens, this paper compares three directions of attitudes and activities towards climate change, namely climate change beliefs, climate policy support, and climate protection activities in the USA, Germany, and China. It is shown that in the USA the frequencies of these attitudes and activities are lower than in Germany and particularly in China. Our econometric analysis reveals that both environmental awareness and the belonging to the Communist Party significantly affect the willingness to pay a price premium for climate-friendly products in China, whereas environmental awareness is the only

significant determinant for beliefs in anthropogenic climate change. The latter result is obviously due to the extremely low skepticism in China. Environmental values also play a major role in explaining climate change beliefs and beliefs in anthropogenic climate change in Germany, whereas ideology is less relevant. In contrast, citizens with a conservative, but not green orientation significantly less often support climate policy and citizens with a social-green identification have a significantly higher willingness to pay a price premium for climate-friendly products. The analysis of the interrelationship between ideological identification and environmental values reveals that an increasing environmental awareness decreases ideological differences in the support of climate policy.

In the USA, conservatives have significantly lower climate change beliefs. Furthermore, citizens with a conservative, but not liberal and green identification significantly less often support climate policy and citizens with a liberal-social-green identification have a significantly higher willingness to pay a price premium for climate-friendly products. While liberals seem to have significantly higher general climate change beliefs, this effect is strongly influenced by a green identity and particularly by environmental awareness. Furthermore, the significantly positive effect of a social orientation on the support of climate policy and the significantly negative effect of a conservative orientation are also only indirect and influenced by environmental values. The analysis of the interrelationship between ideology and environmental values reveals that the significantly negative effect of a conservative identification on climate change beliefs is strongly weakened and the significantly negative effect of a conservative-non-liberal-non-green identification on the support of climate policy is slightly weakened by a high environmental awareness. We conclude that environmental values influence ideological differences in attitudes and activities towards climate change and particularly in general climate change beliefs and beliefs in anthropogenic climate change in the USA.

Which conclusions for climate policy can be drawn from these results? According to McCright and Dunlap (2011), citizens with a right-wing identification in the USA have much stronger system justification tendencies than citizens with a left-wing identification, i.e. they support the maintenance of the societal status quo and resist attempts to change. System justification is associated with the denial of problems that threaten system functioning such as climate change. Furthermore, through conservative talk radio, television news, newspapers, and websites, conservative elites in the right-wing movement and the fossil fuels industry send consistent messages to the US public that climate

change is not existent and thus that climate policies and climate protection activities are not necessary. Against this background, it is very difficult to develop strategies to convince conservative citizens already about the existence of (anthropogenic) climate change since more information or even a higher education do obviously not lead to higher climate change beliefs and beliefs in anthropogenic climate change. However, our results suggest that the reinforcement of environmental values in conservative or right-wing circles might be a more successful direction for climate policy. For example, one could think about communication campaigns that appeal to the general conservation of creation and the environment, which might especially capture the large group of very religious people among the conservatives. Such campaigns could also be used to increase the support of climate policy by citizens with a conservative, but not green identity in the USA, but also in Germany.

In contrast, our results suggest that specific campaigns to support (anthropogenic) climate change beliefs are of limited relevance in Germany (and probably also in other European countries) and particularly in China due to the already high beliefs. However, even when people believe in anthropogenic climate change, they do not automatically support policies for adaptation or mitigation activities or voluntarily conduct climate protection activities. A good example for this is the German energy transition ("Energiewende"), which is indeed supported by the majority of the German population, but which is also highly criticized due to their high costs. Therefore, climate policy should certainly search for cost-efficient solutions in order to reduce greenhouse gas emissions, but also inform the population about the necessity and especially the complex content of several policy measures. Furthermore, environmental values are obviously not relevant for the large ideological differences in the willingness to pay a price premium for climate-friendly products in the USA and Germany. Therefore, climate policy can go a step further and try to find general support for individual climate protection activities. Complementary studies (e.g. Schleich et al., 2014, Lange et al., 2014) show that financial advantages through such activities are extremely relevant so that these advantages (e.g. in the case of energy-efficient appliances or the reduction of the use of the car) could be emphasized in corresponding communication campaigns.

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Tables

Table 1: Frequencies of general climate change beliefs

Detailed frequencies						
Statements	USA		Germany		China	
Global climate change is already occurring	699	69.21%	788	78.41%	1275	89.16%
Global climate change is not happening now, but it will occur in the future	97	9.60%	117	11.64%	128	8.95%
Global climate change is not going to occur at all	88	8.71%	57	5.67%	6	0.42%
Don't know / no answer	126	12.48%	43	4.28%	21	1.47%
Total	1010	100%	1005	100%	1430	100%
Frequencies for the dependent variables in the econometric analysis						
General climate change beliefs	USA		Germany		China	
Yes	796	90.05%	905	94.07%	--	--
No	88	9.95%	57	5.93%	--	--
Total	884	100%	962	100%	--	--

Table 2: Frequencies of beliefs in anthropogenic climate change

Detailed frequencies						
Statements	USA		Germany		China	
Human activities as main cause of climate change	214	21.19%	230	22.89%	591	41.33%
Natural processes and human activities as main cause of climate change	485	48.02%	649	64.58%	761	53.22%
Natural processes as main cause of climate change	78	7.72%	18	1.79%	45	3.15%
Global climate change is not going to occur at all	88	8.71%	57	5.67%	6	0.42%
Don't know / no answer	145	14.36%	51	5.07%	27	1.89%
Total	1010	100%	1005	100%	1430	100%
Frequencies for the dependent variable in the econometric analysis						
Beliefs in anthropogenic climate change	USA		Germany		China	
Yes	699	80.81%	879	92.14%	1352	96.36%
No	166	19.19%	75	7.86%	51	3.64%
Total	865	100%	954	100%	1403	100%

Table 3: Frequencies of the support of climate policy and the willingness to pay a price premium

Support of climate policy						
	USA		Germany		China	
Yes	442	43.76% (58.85%)	738	73.43% (82.83%)	--	--
No	309	30.59% (41.15%)	153	15.22% (17.17%)	--	--
Don't know / no answer	259	25.64%	114	11.34%	--	--
Total	1010	100%	1005	100%	--	--
Willingness to pay a price premium						
	USA		Germany		China	
Yes	279	27.62% (36.71%)	411	40.90% (53.94%)	1140	79.72% (88.30%)
No	481	47.62% (63.29%)	351	34.93% (46.06%)	151	10.56% (11.70%)
Don't know / no answer	250	24.75%	243	24.18%	139	9.72%
Total	1010	100%	1005	100%	1430	100%

Note: The percentages in the parentheses refer to the frequencies for the dependent variables in the econometric analysis

Table 4: Frequencies of ideological and political identification

USA				
	Conservative identification	Liberal identification	Social identification	Green identification
Very weak	179 (17.72%)	261 (25.84%)	123 (12.18%)	216 (21.39%)
Rather weak	109 (10.79%)	114 (11.29%)	87 (8.61%)	137 (13.56%)
Neither weak nor strong	268 (26.53%)	289 (28.61%)	383 (37.92%)	366 (36.24%)
Rather strong	168 (16.63%)	148 (14.65%)	204 (20.20%)	130 (12.87%)
Very strong	216 (21.39%)	127 (12.57%)	97 (9.60%)	58 (5.74%)
Don't know / no answer	70 (6.93%)	71 (7.03%)	116 (11.49%)	103 (10.20%)
Total	1010 (100%)			
Germany				
	Conservative identification	Liberal identification	Social identification	Green identification
Very weak	145 (14.43%)	45 (4.48%)	11 (1.09%)	168 (16.72%)
Rather weak	236 (23.48%)	105 (10.45%)	41 (4.08%)	170 (16.92%)
Neither weak nor strong	347 (34.53%)	387 (38.51%)	205 (20.40%)	314 (31.24%)
Rather strong	185 (18.41%)	315 (31.34%)	472 (46.97%)	185 (18.41%)
Very strong	41 (4.08%)	85 (8.46%)	234 (23.28%)	101 (10.05%)
Don't know / no answer	51 (5.07%)	68 (6.77%)	42 (4.18%)	67 (6.67%)
Total	1005 (100%)			

Table 5: Descriptive statistics of explanatory variables

USA			
Variables	Number of observations	Mean	Standard deviation
Conservative	940	0.409	0.49
Liberal	939	0.293	0.46
Social	894	0.337	0.47
Green	907	0.207	0.41
NEP	905	3.072	1.91
High education	1006	0.681	0.47
Female	1010	0.529	0.50
Age	1010	48.506	14.46
Northeast	1010	0.202	0.40
Midwest	1010	0.228	0.42
South	1010	0.350	0.48
West	1010	0.220	0.41
Germany			
Variables	Number of observations	Mean	Standard deviation
Conservative	954	0.237	0.43
Liberal	937	0.427	0.49
Social	963	0.733	0.44
Green	938	0.305	0.46
NEP	928	4.079	1.82
High education	1000	0.548	0.50
Female	1005	0.492	0.50
Age	1005	41.129	12.52
Western Germany	1005	0.786	0.41
China			
Variables	Number of observations	Mean	Standard deviation
Communist	1430	0.304	0.46
NEP	1376	3.602	1.42
High education	1411	0.764	0.42
Female	1430	0.499	0.50
Age	1430	39.263	12.47
Shenyang	1430	0.078	0.27
Wuhan	1430	0.076	0.27
Chengdu	1430	0.062	0.24
Shijiazhuang	1430	0.062	0.24
Lanzhou	1430	0.099	0.30
Beijing	1430	0.154	0.36
Shanghai	1430	0.164	0.37
Guangzhou	1430	0.127	0.33
Hefei	1430	0.061	0.24
Yinchuan	1430	0.060	0.24
Quanzhou	1430	0.057	0.23

Table 6 Maximum Likelihood estimates in binary probit models in the USA and Germany, dependent variable: general climate change beliefs

USA				
Explanatory variables	Model 1	Model 2	Model 3	Model 4
Conservative	-0.70***	-0.65***	-0.75***	-0.61***
Liberal	--	0.38**	0.07	-0.03
Social	--	--	0.20	0.08
Green	--	--	0.67***	0.47*
NEP	--	--	--	0.28***
High education	0.07	0.07	0.04	0.06
Female	0.27**	0.29**	0.27**	0.19
Age	-0.00	-0.00	0.00	-0.01
Regional dummies	Yes	Yes	Yes	Yes
Constant	1.50***	1.31***	1.25***	0.91***
Number of observations	835	830	769	722
Germany				
Explanatory variables	Model 1	Model 2	Model 3	Model 4
Conservative	-0.25*	-0.20	-0.19	-0.19
Liberal	--	0.03	-0.08	-0.06
Social	--	--	0.32**	0.16
Green	--	--	0.05	0.01
NEP	--	--	--	0.12***
High education	0.06	-0.03	-0.03	0.04
Female	0.18	0.15	0.14	0.09
Age	-0.00	-0.00	-0.00	-0.00
Regional dummy	Yes	Yes	Yes	Yes
Constant	1.52***	1.47***	1.27***	0.91***
Number of observations	915	899	887	846

Note: * (**, ***) means that the appropriate parameter is different from zero at the 10% (5%, 1%) significance level, respectively

Table 7: Estimated average probabilities in binary probit models in the USA and Germany, dependent variable: general climate change beliefs

USA				
	Model 1	Model 2	Model 3	Model 4
Across all respondents	0.897	0.896	0.899	0.895
Conservative=1	0.822	0.831	0.819	0.843
Conservative=0	0.948	0.944	0.948	0.937
Conservative=1, green=0	--	--	0.791	0.829
Conservative=0, green=1	--	--	0.986	0.971
Number of observations	835	830	769	722
Germany				
	Model 1	Model 2	Model 3	Model 4
Across all respondents	0.939	0.940	0.940	0.940
Conservative=1	0.915	0.921	0.923	0.923
Conservative=0	0.947	0.946	0.946	0.946
Number of observations	915	899	887	846

Table 8: Estimated average probabilities and discrete probability effects of ideological and political identification at different values of "NEP" in the fourth binary probit models in the USA, dependent variable: general climate change beliefs, number of observations: 722

	Estimated average probability for conservative=1, green=0	Estimated average probability for conservative=0, green=1	Estimated average discrete probability effect
Average	0.829	0.971	-0.142
NEP=0	0.576	0.896	-0.320
NEP=1	0.680	0.938	-0.258
NEP=2	0.771	0.965	-0.195
NEP=3	0.846	0.982	-0.136
NEP=4	0.902	0.991	-0.089
NEP=5	0.942	0.995	-0.053
NEP=6	0.968	0.998	-0.030

Table 9: Maximum Likelihood estimates in binary probit models in the USA, Germany, and China, dependent variable: beliefs in anthropogenic global warming

USA				
Explanatory variables	Model 1	Model 2	Model 3	Model 4
Conservative	-0.61***	-0.60***	-0.66***	-0.46***
Liberal	--	0.12	-0.11	-0.21
Social	--	--	0.14	-0.00
Green	--	--	0.46***	0.23
NEP	--	--	--	0.31***
High education	0.07	0.08	0.04	0.16
Female	0.33***	0.33***	0.30***	0.20*
Age	-0.01*	-0.01*	-0.01	-0.01***
Regional dummies	Yes	Yes	Yes	Yes
Constant	1.22***	1.18***	1.07***	0.63**
Number of observations	818	813	752	709
Germany				
Explanatory variables	Model 1	Model 2	Model 3	Model 4
Conservative	-0.29**	-0.27*	-0.24*	-0.23
Liberal	--	0.06	-0.08	-0.06
Social	--	--	0.42***	0.24
Green	--	--	0.08	0.02
NEP	--	--	--	0.16***
High education	-0.16	-0.14	-0.14	-0.08
Female	0.26**	0.23*	0.20	0.14
Age	-0.01	-0.01	-0.01	-0.01
Regional dummy	Yes	Yes	Yes	Yes
Constant	1.58***	1.54***	1.28***	0.83***
Number of observations	912	897	885	846
China				
Explanatory variables	Model 1		Model 2	
Communist	0.01		-0.01	
NEP	--		0.29***	
High education	-0.05		-0.10	
Female	0.16		0.14	
Age	0.00		-0.00	
Regional dummies	Yes		Yes	
Constant	1.81***		1.12***	
Number of observations	1390		1349	

Note: * (**, ***) means that the appropriate parameter is different from zero at the 10% (5%, 1%) significance level, respectively

Table 10: Estimated average probabilities in binary probit models in the USA and Germany, dependent variable: beliefs in anthropogenic global warming

USA				
	Model 1	Model 2	Model 3	Model 4
Across all respondents	0.802	0.801	0.799	0.801
Conservative=1	0.703	0.704	0.689	0.740
Conservative=0	0.872	0.870	0.871	0.850
Number of observations	818	813	752	709
Germany				
	Model 1	Model 2	Model 3	Model 4
Across all respondents	0.920	0.921	0.921	0.920
Conservative=1	0.885	0.889	0.893	0.894
Conservative=0	0.932	0.931	0.930	0.929
Number of observations	912	897	885	846

Table 11: Estimated average probabilities and discrete probability effects of ideological and political identification at different values of "NEP" in the fourth binary probit model in the USA, dependent variable: beliefs in anthropogenic global warming, number of observations: 709

	Estimated average probability for conservative=1	Estimated average probability for conservative=0	Estimated average discrete probability effect
Average	0.740	0.850	-0.110
NEP=0	0.412	0.589	-0.177
NEP=1	0.529	0.699	-0.170
NEP=2	0.645	0.794	-0.149
NEP=3	0.748	0.868	-0.120
NEP=4	0.833	0.921	-0.088
NEP=5	0.896	0.956	-0.060
NEP=6	0.940	0.978	-0.038

Table 12: Maximum Likelihood estimates in bivariate binary probit models in the USA, dependent variables: support of climate policy and willingness to pay a price premium

Dependent variable: Support of climate policy				
Explanatory variables	Model 1a	Model 2a	Model 3a	Model 4a
Conservative	-0.57***	-0.48***	-0.58***	-0.48***
Liberal	--	0.74**	0.37***	0.35**
Social	--	--	0.27**	0.17
Green	--	--	0.84***	0.67***
NEP	--	--	--	0.25***
High education	0.01	-0.02	0.03	0.07
Female	-0.01	0.00	-0.04	-0.20
Age	-0.01***	-0.01**	-0.01*	-0.01***
Northeast	0.24	0.22	0.33*	0.27
Midwest	0.11	0.07	0.18	0.22
South	0.14	0.10	0.18	0.26
Constant	0.77***	0.51**	0.20	-0.16
Number of observations	595	593	544	517
Dependent variable: Willingness to pay a price premium				
Explanatory variables	Model 1b	Model 2b	Model 3b	Model 4b
Conservative	-0.33***	-0.22**	-0.26**	-0.16
Liberal	--	0.73***	0.33**	0.26*
Social	--	--	0.42***	0.31**
Green	--	--	0.74***	0.68***
NEP	--	--	--	0.18***
High education	0.15	0.12	0.18	0.21
Female	-0.14	-0.15	-0.21*	-0.30**
Age	-0.01**	-0.01*	-0.00	-0.01*
Northeast	0.03	0.01	0.08	0.00
Midwest	-0.22	-0.26*	-0.21	-0.28
South	-0.04	-0.07	-0.05	-0.04
Constant	0.35	0.03	-0.31	-0.59**
Number of observations	595	593	544	517

Note: * (**, ***) means that the appropriate parameter is different from zero at the 10% (5%, 1%) significance level, respectively

Table 13: Maximum Likelihood estimates in bivariate binary probit models in Germany, dependent variables: support of climate policy and willingness to pay a price premium

Dependent variable: Support of climate policy				
Explanatory variables	Model 1a	Model 2a	Model 3a	Model 4a
Conservative	-0.38***	-0.40***	-0.36***	-0.37***
Liberal	--	0.13	0.04	0.03
Social	--	--	0.16	-0.05
Green	--	--	0.57***	0.42***
NEP	--	--	--	0.24***
High education	0.13	0.11	0.08	0.09
Female	0.41***	0.40***	0.39***	0.38***
Age	0.01	0.01	0.01	0.01
Western Germany	-0.23	-0.26*	-0.30**	-0.33**
Constant	0.68***	0.66**	0.44	-0.14
Number of observations	690	677	668	644
Dependent variable: Willingness to pay a price premium				
Explanatory variables	Model 1b	Model 2b	Model 3b	Model 4b
Conservative	-0.05	-0.09	0.05	0.06
Liberal	--	0.12	-0.02	-0.03
Social	--	--	0.43***	0.31**
Green	--	--	0.80***	0.69***
NEP	--	--	--	0.17***
High education	0.48***	0.47***	0.41***	0.43***
Female	0.07	0.07	0.02	-0.02
Age	0.00	0.00	0.00	0.00
Western Germany	0.30***	0.29**	0.27**	0.25
Constant	-0.54**	-0.55**	-1.00***	-1.49***
Number of observations	690	677	668	644

Note: * (**, ***) means that the appropriate parameter is different from zero at the 10% (5%, 1%) significance level, respectively

Table 14: Maximum Likelihood estimates in binary probit models in China, dependent variable: willingness to pay a price premium

Explanatory variables	Model 1	Model 2
Communist	0.27**	0.29**
NEP	--	0.13***
High education	0.41***	0.38***
Female	-0.06	-0.04
Age	0.00	-0.00
Regional dummies	Yes	Yes
Constant	0.75***	0.41***
Number of observations	1281	1257

Note: * (**, ***) means that the appropriate parameter is different from zero at the 10% (5%, 1%) significance level, respectively

Table 15: Estimated average probabilities in bivariate binary probit models in the USA, dependent variables: support of climate policy and willingness to pay a price premium

Dependent variable: Support of climate policy				
	Model 1a	Model 2a	Model 3a	Model 4a
Across all respondents	0.541	0.539	0.545	0.556
Conservative=1, liberal=green=0	--	--	0.321	0.385
Conservative=0, liberal=green=1	--	--	0.900	0.848
Number of observations	595	593	544	517
Dependent variable: Willingness to pay a price premium				
	Model 1b	Model 2b	Model 3b	Model 4b
Across all respondents	0.407	0.407	0.413	0.421
Liberal=social=green=0	--	--	0.258	0.295
Liberal=social=green=1	--	--	0.789	0.730
Number of observations	595	593	544	517

Table 16: Estimated average probabilities in bivariate binary probit models in Germany, dependent variables: support of climate policy and willingness to pay a price premium

Dependent variable: Support of climate policy				
	Model 1a	Model 2a	Model 3a	Model 4a
Across all respondents	0.813	0.811	0.810	0.807
Conservative=1, green=0	--	--	0.684	0.705
Conservative=0, green=1	--	--	0.915	0.891
Number of observations	690	677	668	644
Dependent variable: Willingness to pay a price premium				
	Model 1b	Model 2b	Model 3b	Model 4b
Across all respondents	0.558	0.559	0.562	0.561
Social=green=0	--	--	0.346	0.398
Social=green=1	--	--	0.790	0.748
Number of observations	690	677	668	644

Table 17: Estimated average probabilities in bivariate binary probit models in China, dependent variable: willingness to pay a price premium

	Model 1	Model 2
Across all respondents	0.885	0.889
Communist=0	0.871	0.875
Communist=1	0.918	0.923
Number of observations	1281	1257

Table 18: Estimated average probabilities and discrete probability effects of ideological and political identification at different values of "NEP" in the fourth bivariate binary probit model in the USA, dependent variables: support of climate policy and willingness to pay a price premium, number of observations: 517

Dependent variable: Support of climate policy			
	Estimated average probability for conservative=1, liberal=green=0	Estimated average probability for conservative=0, liberal=green=1	Estimated average discrete probability effect
Average	0.385	0.848	-0.463
NEP=0	0.151	0.657	-0.506
NEP=1	0.213	0.739	-0.526
NEP=2	0.288	0.810	-0.522
NEP=3	0.373	0.868	-0.495
NEP=4	0.465	0.911	-0.446
NEP=5	0.560	0.944	-0.384
NEP=6	0.650	0.966	-0.316
Dependent variable: Willingness to pay a price premium			
	Estimated average probability for liberal=social= green=0	Estimated average probability for liberal=social= green=1	Estimated average discrete probability effect
Average	0.295	0.730	-0.435
NEP=0	0.138	0.545	-0.407
NEP=1	0.180	0.614	-0.434
NEP=2	0.230	0.678	-0.448
NEP=3	0.286	0.738	-0.452
NEP=4	0.349	0.792	-0.433
NEP=5	0.415	0.838	-0.423
NEP=6	0.484	0.877	-0.393

Table 19: Estimated average probabilities and discrete probability effects of ideological and political identification at different values of "NEP" in the fourth bivariate binary probit model in Germany, dependent variables: support of climate policy and willingness to pay a price premium, number of observations: 644

Dependent variable: Support of climate policy			
	Estimated average probability for conservative=1, green=0	Estimated average probability for conservative=0, green=1	Estimated average discrete probability effect
Average	0.705	0.891	-0.186
NEP=0	0.361	0.661	-0.300
NEP=1	0.452	0.742	-0.290
NEP=2	0.545	0.812	-0.267
NEP=3	0.635	0.868	-0.233
NEP=4	0.719	0.912	-0.193
NEP=5	0.792	0.944	-0.152
NEP=6	0.853	0.966	-0.113
Dependent variable: Willingness to pay a price premium			
	Estimated average probability for social=green=0	Estimated average probability for social=green=1	Estimated average discrete probability effect
Average	0.398	0.748	-0.350
NEP=0	0.171	0.507	-0.336
NEP=1	0.217	0.574	-0.357
NEP=2	0.270	0.639	-0.369
NEP=3	0.328	0.700	-0.372
NEP=4	0.391	0.756	-0.365
NEP=5	0.457	0.805	-0.348
NEP=6	0.524	0.848	-0.324

Table 20: Estimated average probabilities and discrete probability effects of ideological and political identification at different values of "NEP" in the second binary probit model in China, dependent variables: willingness to pay a price premium, number of observations: 1257

	Estimated average probability for communist=0	Estimated average probability for communist=1	Estimated average discrete probability effect
Average	0.875	0.923	-0.048
NEP=0	0.759	0.838	-0.079
NEP=1	0.798	0.868	-0.070
NEP=2	0.833	0.893	-0.060
NEP=3	0.863	0.915	-0.052
NEP=4	0.900	0.934	-0.034
NEP=5	0.912	0.949	-0.037
NEP=6	0.931	0.961	-0.030