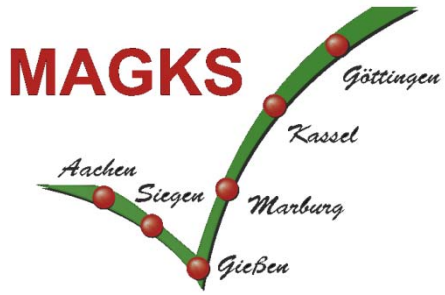

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Coordination: Bernd Hayo • Philipps-University Marburg
School of Business and Economics • Universitätsstraße 24, D-35032 Marburg
Tel: +49-6421-2823091, Fax: +49-6421-2823088, e-mail: hayo@wiwi.uni-marburg.de

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Claudia Schwirplies, Andreas Ziegler

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Claudia Schwirplies (corresponding author)
University of Kassel, Department of Economics
Nora-Platiel-Str. 5, 34109 Kassel, Germany
E-Mail: claudia.schwirplies@uni-kassel.de
Phone: +49/561/804-7573, Fax: +49/561/804-2501

Andreas Ziegler
University of Kassel, Department of Economics
Nora-Platiel-Str. 5, 34109 Kassel, Germany
E-Mail: andreas.ziegler@uni-kassel.de
Phone: +49/561/804-3038, Fax: +49/561/804-2501

Offset carbon emissions or pay a price premium for avoiding them? A cross-country analysis of motives for climate protection activities

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Abstract

This paper contributes to the economic literature on pure and impure public goods by considering two alternatives for contributing to the public good climate protection: compensating carbon emissions from conventional consumption or paying higher prices for climate-friendly products. We analytically and empirically examine a wide range of motives and their impact on individuals' choice in favor of these two alternatives. Relying on data from representative surveys among more than 2000 participants from Germany and the USA, our results indicate that environmental awareness, warm glow motives, and the desire to set a good example significantly motivate the choice of both climate protection activities in both countries. However, some motives differ considerably between both alternatives and countries. A green identity enhances the willingness to pay a price premium for climate-friendly goods or services in Germany, while social norms seem to be of much higher relevance in the USA. Our results further suggest that the choice of climate protection activities, especially of carbon offsetting, entails a high degree of uncertainty.

Keywords: Public good; climate change; climate protection; carbon offsetting; price premium

JEL: H41, Q54, Q58

1. Introduction

In recent years, pro-environmental activities and associated markets have expanded rapidly worldwide. Prominent examples include carbon neutral, Rainforest Alliance certified, and certified organic consumption goods or plant-based alternatives for meat and dairy products, as well as energy from renewable sources and related products, vehicles with alternative propulsion technologies, and energy efficient appliances. Since 2007, the worldwide global sales of organic food, for example, nearly doubled and reached almost 64 billion U.S.-Dollar in 2012 (e.g., Soil Association, 2009, 2014). In 2013, Rainforest Alliance certified farms produced more than 450,000 tons of coffee representing an increase of 20% compared to the previous year (even when the market share of the global coffee production is rather low with 5.2%).[1] Understanding the motivation for pro-environmental activities is of particular importance in order to enhance environmentally responsible consumption and to reduce the negative impacts of human behavior on the natural environment.

In this paper, we analytically and empirically examine motives for activities that reduce greenhouse gas emissions and help combating global warming. Individuals face two possible options for making a contribution to the public good climate protection. On the one hand, they have the possibility to consume conventional goods and engage in carbon offsetting to compensate carbon emissions from this consumption by directly donating money to a public good, i.e. climate protection projects. On the other hand, they might pay higher prices for everyday products or services that are better for the climate than competing products. This alternative can be regarded as the consumption of an impure public good.

By now we have substantial evidence suggesting that extrinsic and intrinsic motives like altruism, feelings of warm glow and moral obligation, social norms, and image motivation influence contributions to charities and other public goods (e.g., Andreoni, 1995; Glazer and Konrad, 1996; Harbaugh, 1998; Crumpler and Grossman, 2008; Ariely et al., 2009; Shang and Croson, 2009). These factors have also been found to potentially motivate pro-environmental and in particular climate protection activities.

Akter et al. (2009) and Lange and Ziegler (2012), for instance, show that feelings of responsibility have positive effects on the probability to pay a carbon travel tax or to purchase carbon offsets and less emitting vehicles. Further studies also support the hypothesis that a perceived moral obligation leads to a higher willingness to engage in carbon offsetting (e.g., Brouwer et

[1] Source: http://www.rainforest-alliance.org/publications/sustainable-coffee-farming-report.

al., 2008; Blasch and Farsi, 2014). Araghi et al. (2014) demonstrate that travelers are more likely to offset their carbon emissions from air-traveling if the collective participation rate is high. Welsch and Kühling (2009) show that the social environment influences the use of green energy, the use of solar thermal systems, and the consumption of organic food. Further evidence for the impact of the contribution of others is provided by Blasch and Farsi (2014) who find carbon offsetting to be strongly driven by the adherence to social norms and the expectations about the cooperation of others. Kotchen and Moore (2008) show that members of an environmental organization consume almost 10% less conventional electricity and are more likely to participate in green-electricity programs. Videras et al. (2012) find behaviors like the consumption of fair trade products or recycling activities to be positively correlated with an environmentalist identity. Evidence on the effects of warm glow in the context of climate protection activities is ambiguous. In the study by Clark et al. (2003), for example, participants of a green electricity program in the USA rank warm glow as their least important motive, whereas Menges et al. (2005) find evidence for impure altruistic behavior in their experiment on the willingness to pay for green electricity.

We contribute to this literature by identifying several motives for climate protection activities of citizens in Germany and the USA. In contrast to former studies (e.g., Lange et al., 2014; Schleich et al., 2014), we regard two alternatives for making contributions to the public good climate protection which provide no additional co-benefits like financial advantages or positive health effects for the individual. We account for several psychological motives like feelings of warm glow or moral obligation, social norms, green identity, and signaling. To the best of our knowledge, our study is the first to investigate such a wide range of motivational factors in a cross-country comparison. In contrast, the previous literature usually considers one single motive for contributions to public goods by capturing (lump-sum) utility gains or losses (e.g., Kotchen and Moore, 2008; Lange and Ziegler, 2012).

The paper is structured as follows. In Section 2, we analytically investigate motives from the psychological and economic literature using the characteristics approach of the impure public goods model and derive hypotheses on their impact for our econometric analyses. Relying on data from representative surveys among more than 2000 citizens from Germany and the USA, in Sections 3 and 4 we econometrically analyze the determinants of the willingness to demand carbon offsets and to pay higher prices for everyday products or services that are more climate-friendly. Section 5 summarizes our results and draws some important conclusions.

2. Discussion of motives and hypotheses

To illustrate how different motives may affect the demand for climate-friendly goods or services and carbon offsets we adopt the characteristics approach of the impure public goods model (e.g., Cornes and Sandler, 1984; Kotchen, 2005). In our setting the typical individual's utility function is defined over three characteristics: $U(X, Y, Z)$. X and Z are both private characteristics and Y is the public characteristic. Characteristic Z is interpreted as psychological benefits or losses (e.g., a good feeling from contributing to a public good or a bad feeling from not complying with a social norm). $U(\cdot)$ is strictly increasing in the three characteristics and strictly quasiconcave. The demand for the three characteristics is assumed to satisfy normality.

Assume that the individual faces two alternatives for contributing to the public good climate protection. Alternative d is consuming a conventional good that generates X and compensating carbon emissions from this consumption by carbon offsetting[2] which generates Y. Alternative g is paying a price premium for the consumption of a good or service which is better for the climate and thus commonly generates X and Y. For simplicity, we assume that the alternatives d and g are perfect substitutes in all respects other than their generation of the private characteristic Z. Therefore, the utility maximization problem is equivalent to the maximization of the utility derived from characteristic Z, i.e.

$$\max_{d,g} \{U(Z)|Z = (\alpha + \beta)d + \gamma g, (1 + p^o)d + p^g g \leq w\}$$

with exogenously given income w and p^o and p^g denoting prices for carbon offsetting and the climate-friendly product. The price of the conventional good is normalized to unity such that $(1 + p^o)$ is the price for alternative d. The conventional good, carbon offsetting, and the climate-friendly product are assumed to be normal. The parameters $\alpha, \beta,$ and γ $(\alpha, \beta, \gamma \geq 0)$, i.e. the effectiveness of the conventional good, carbon offsetting, and the climate-friendly product in generating Z, are determined by the mix of motives discussed below and capture the meaning that the individual attaches to the alternatives for contributing to climate protection (e.g., Bénabou and Tirole, 2006).[3] These psychological gains or losses may be affected by various factors like education and information, culture and religion, personal experiences, or the social environment of an individual.

[2] Carbon offsetting is equivalent to making a money donation to climate protection projects.

[3] The focus on the psychological utility distinguishes our study from other papers that investigate how changes in the effectiveness of money donations and climate-friendly products affect the consumption patterns of private vs. impure goods when direct donations to the public good are possible (e.g., Lange et al., 2014).

In the optimum, the individual is indifferent between the alternatives d and g if

$$\frac{\gamma}{(\alpha+\beta)} = \frac{p^g}{(1+p^o)}.$$

Denote the optimal solutions to the utility maximization problem $d^*(\alpha,\beta,\gamma,p^o,p^g)$ and $g^*(\alpha,\beta,\gamma,p^o,p^g)$. Totally differentiating the first order conditions for the solution to the individual's maximization problem and assuming the second order condition $|J|>0$ to hold whenever the first order conditions hold yields

$$\frac{\partial d^*}{\partial(1+p^o)} = \frac{-p^g\gamma U_z}{|J|} < 0 \text{ and } \frac{\partial g^*}{\partial(1+p^o)} = \frac{\gamma U_z(1+p^o)}{|J|} > 0 \text{ if } \gamma > 0,$$

as well as

$$\frac{\partial d^*}{\partial p^g} = \frac{p^g(\alpha+\beta)U_z}{|J|} > 0 \text{ and } \frac{\partial g^*}{\partial p^g} = \frac{-(\alpha+\beta)U_z(1+p^o)}{|J|} < 0 \text{ if } (\alpha+\beta) > 0.$$

It is straightforward to see that an increase in the price of alternative d (g) has a negative effect on the choice of this alternative and a positive effect on the choice of alternative g (d) if alternative g (d) is associated with psychological gains. Not surprisingly, the two alternatives are substitutes and the individual will only choose alternative d (g) if $(\alpha+\beta)/(1+p^o)$ is greater (smaller) than γ/p^g.

The comparative statics further reveal that an increased effectiveness of one alternative in providing characteristic Z leads to an increase in the choice of this alternative: [4]

$$\frac{\partial d}{\partial(\alpha+\beta)} = \frac{(p^g)^{2U_z}}{|J|} > 0 \text{ and } \frac{\partial g}{\partial\gamma} = \frac{(1+p^o)^2U_z}{|J|} > 0.$$

With $\beta=\gamma=0$, the individual would derive no psychological benefits from her contribution to the public good which can be regarded as purely altruistic (e.g., Andreoni, 1988). Generally, the contribution to a public good produces additional psychological gains or losses. A prominent example for potential losses refers to the free-rider phenomenon reflecting the belief that others benefit from the contribution of an individual without making a contribution themselves. This phenomenon intensifies as the number of people who benefit from the public good increases, while the effect of the own contribution remains relatively or even negligibly low (e.g., Stiglitz, 2000). Individuals who believe that their contribution alone cannot make any difference may suffer a utility loss from choosing d and g since they derive no psycho-

[4] U_Z denotes the partial derivative $\partial U/\partial Z$.

logical benefits or even suffer psychological losses from their demand for carbon offsets and the more expensive climate-friendly good or service. Thus, the free-rider rationale potentially decreases β and γ and the individual may reach a higher utility level by solely consuming the conventional good.

> *Hypothesis 1: The free-rider rationale decreases both the willingness to engage in carbon offsetting and the willingness to pay a price premium for the climate-friendly good or service.*

The concept of impure altruism or "warm glow" (e.g., Andreoni, 1989, 1990) has been found to be an important approach for explaining contributions to public goods. Warm glow can be described as a good feeling, which is experienced through the sole act of giving and can be regarded as a private benefit from contributing to a public good. Similarly, individuals may also be motivated by avoiding negative consequences. According to Schwartz (1973), behaviors are activated by an underlying system of values and norms. If individuals are aware of the consequences of their activities and ascribe responsibility for these consequences to themselves they perceive a moral obligation to engage in climate protection activities. Warm glow motives potentially increase β and γ and individuals derive (higher) psychological benefits from carbon offsetting and the more expensive climate-friendly product, while Z remains unchanged with the consumption of the conventional good.

> *Hypothesis 2: Warm glow motives increase both the willingness to engage in carbon offsetting and the willingness to pay a price premium for the climate-friendly good or service.*

Recent theoretical, empirical, and experimental work shows that self-image and moral balance are important factors explaining individual decision making (e.g., Stringham, 2011; Ploner and Regner, 2013). Akerlof and Kranton (2000) describe the identity of a person as the internalization of the behavioral rules belonging to a certain social category. Choosing activities which are not compliant with these rules lead to a loss in identity accompanied by a loss in utility for the individual and other members of this social category. Hence, individuals who identify with a "green" social category may suffer a psychological loss when consuming the conventional good (i.e. α decreases) which can be compensated by the purchase of carbon offsets, while consuming the more expensive climate-friendly good or service is associated with psychological gains (β and γ increase). In this case, γ increases more than $(\alpha + \beta)$ and

individuals derive (higher) psychological benefits from consuming the more expensive climate-friendly product.

> *Hypothesis 3: A green identity only increases the willingness to pay a price premium for the climate-friendly good or service.*

Similarly, Holländer (1990) defines social norms as being the object of others' positive emotions. By complying with social norms individuals seek to get social approval and avoid disapproval (e.g., Nyborg and Rege, 2003). According to sociological theory, a behavioral norm or code of conduct reflects the normative expectations of the group members regarding the behavior of others. As the group rewards or punishes positive as well as negative deviations, individuals adjust their behavior. In addition, social approval based on norm compliant behavior seems to be positively correlated with the share of the population that acts according to these norms (e.g., Rege, 2004), while behaviors based on different social norms may crowd out each other (e.g., Greenberg, 2014). On the one hand, the behavior of individuals can be highly dependent on the social behavior of their peers. If individuals observe that their social environment does not contribute to climate protection, they may suffer a psychological loss from contributing themselves. This case is similar to the case of the free-rider rationale. On the other hand, individuals may believe that society expects them to contribute to climate protection and derive psychological gains from carbon offsetting and the more expensive climate-friendly product. This case is similar to the case of warm glow motives.

> *Hypothesis 4: The perception that the social environment does not contribute to climate protection decreases both the willingness to engage in carbon offsetting and the willingness to pay a price premium for the climate-friendly good or service.*

> *Hypothesis 5: Social pressure in terms of expectations of the society increases both the willingness to engage in carbon offsetting and the willingness to pay a price premium for the climate-friendly good or service.*

The contributions to a public good may also depend substantially on their visibility (e.g., Bénabou and Tirole, 2006; Ariely et al., 2009). The concept of signaling was primarily applied in contract theory (e.g., Spence, 1973), but is also transferable to the impacts of image and acting as an example in consumption behavior (e.g., Frank, 1985; Ariely et al., 2009). The contribution to a public good may also be seen as a positive signal to others belonging to the same social category (e.g., Glazer and Konrad, 1996), if this contribution can be easily observed by others. If the contribution to the public good depends on its visibility, the consump-

tion of the conventional good may be interpreted as a bad signal (i.e. α decreases), while carbon offsetting provides no signal due to its lacking visibility (i.e. β remains unchanged) and the consumption of the more expensive climate-friendly good or service provides a positive signal (i.e. γ increases). In this case, γ increases more than $(\alpha + \beta)$ and individuals derive (higher) psychological benefits from consuming the more expensive climate-friendly product.

> *Hypothesis 6: Signaling motives increase only the willingness to pay a price premium for the climate-friendly good or service.*

Decisions in favor of certain alternatives for contributing to the public good climate protection may also be influenced by individual preferences for the public and private characteristics. Individuals with a greater environmental awareness draw a higher marginal utility from Y (i.e. $\partial U/\partial Y$) compared to individuals who are less environmentally aware. Since the two alternatives for contributing to climate protection are assumed to be substitutes in providing Y, individuals who are more environmentally aware should be indifferent between these two alternatives.

> *Hypothesis 7: A greater environmental awareness increases both the willingness to engage in carbon offsetting and the willingness to pay a price premium for the climate-friendly good or service.*

In addition, choices in favor of the two alternatives for contributing to climate protection and the mix of motives may vary substantially across individuals (e.g. with socio-economic characteristics and regional factors) and situations. Therefore, we test the seven hypotheses in a microeconometric analysis for Germany and the USA that include such additional factors.

3. Data and variables

The data for our microeconometric analyses stem from representative web-based surveys among citizens aged 18 or older. Overall, 1005 respondents in Germany and 1010 respondents in the USA participated in the surveys which collected information on general personal assessments of climate change, specific attitudes towards international climate policy and negotiations, as well as climate protection activities. Survey questions were thoroughly pretested by the market research company GfK SE (Gesellschaft für Konsumforschung) before carrying out the surveys in May and June 2013. The sample was drawn from the GfK Online Panel based on the official population statistics of the two countries and the completion of the survey required about 30 minutes on average in both countries.

In order to test our hypotheses derived in Sections 2, we construct two binary dependent variables *carbon offsetting* and *price premium*. The underlying questions are whether respondents would be prepared to engage in carbon offsetting in the future to compensate the carbon emissions they caused and if they are willing to pay higher prices for everyday products or services that are better for the climate than competing products. Based on the binary structure of our dependent variables, we apply bivariate binary probit models to estimate the determinants of *carbon offsetting* and *price premium* and thereby allow for potential interdependencies between the decisions in favor of the two climate protection activities. The parameters are estimated by the maximum likelihood method.[5] The estimation of bivariate probit models incorporates the estimation of correlation coefficients between the dependent dummy variables in the error terms of the underlying latent variables. These correlation coefficients are estimated to be 0.41 for Germany and 0.55 for the USA and are both different from zero at the 1% significance level in the bivariate binary probit models that are discussed in the following.

The base categories of the binary dependent variables are very heterogeneous[6] such that the binary probit analysis is not suitable to identify specific patterns of demanding carbon offsets and simultaneously paying a price premium for climate-friendly goods and services. Therefore, we additionally apply multinomial logit models by constructing the mutually exclusive alternatives *neither carbon offsetting nor price premium* (base category), *price premium but not carbon offsetting*, *carbon offsetting but not price premium*, as well as *carbon offsetting and price premium*. These models are also estimated by the maximum likelihood method.

Our main explanatory variables capture the motives discussed in Section 2: *free-rider rationale* (hypothesis 1), *warm glow motives* (hypothesis 2), *green identity* (hypothesis 3), *no contribution of social environment* (hypothesis 4), *expectation of society* (hypothesis 5), as well as *act as an example* as a potential indicator for an environmentally conscious identity according to hypothesis 3 or for signaling according to hypothesis 6. Regarding hypothesis 7, environmental preferences are measured through the index variable *NEP scale* which is constructed using six items from the New Environmental Paradigm (Dunlap et al., 2000). All motivational factors are measured by asking respondents to specify their level of agreement with particular statements (which are reported in Table 1) on a symmetric scale with five or-

[5] We consider heteroskedasticity robust z-statistics. As a robustness check for our results, we also use common univariate binary probit models. The estimation results are very similar to those from the bivariate binary probit models and are thus not reported but are available upon request.

[6] For example, the base category of *carbon offsetting* comprises both respondents who are willing to pay a price premium for the climate-friendly products and respondents who are not.

dered response levels (i.e. “very weakly”, “rather weakly”, “neither weakly nor strongly”, “rather strongly”, and “very strongly”).[7]

We also include the dummy variable *high contribution of carbon offsetting* reflecting respondents’ beliefs that carbon offsetting is rather or very effective in providing climate protection suggesting that carbon offsetting is perceived to be less costly than alternative climate protection activities. We additionally control for socio-demographic characteristics of the respondents, namely the variable *age* (in years), the gender dummy variable *female*, the variable *number of own children*, the dummy variable *highly educated* indicating that the respondent’s highest level of education is at least secondary (Abitur in Germany and high school degree in the USA), as well as the regional dummies W*estern Germany* for Germany and *midwest*, *northeast*, *west*, and *south* for the USA.[8] Table 1 provides a full list of explanatory variables and their definitions.

4. Results

Table 2 reports the descriptive statistics of the dependent and explanatory variables for our samples of 1005 German and 1010 U.S. respondents. While the average readiness to engage in carbon offsetting is quite similar in both countries (55% in Germany and 57% in the USA of those respondents who answered the question), the willingness to pay higher prices for climate-friendly goods or services is much lower in the USA (54% in Germany and 37% in the USA). The number of respondents in this table also reveals that a large proportion of respondents did not answer to these two questions in both countries: 43% of German and 46% of U.S. respondents are unsure about their willingness to offset carbon emissions and about one quarter of respondents in each country refused to answer the question about their willingness to pay higher prices for climate-friendly products. The free-rider rationale is nearly equal in both countries (34% in Germany and 35% in the USA), but the mean values for all other motives differ considerably. In Germany, respondents show on average higher mean values for the NEP scale, warm glow motives, and green identity, while U.S. respondents more often wish to act as an example, believe that their social environment makes no contribution and

[7] Among others, Schleich et al. (2014) discuss potential problems associated with this kind of scale.
[8] Since in both countries a high number of income data is missing, we omit the control variable for the income of the respondent. If we use single imputation methods for the income variable to reduce the number of missing observations, the estimation results are qualitatively equal to the estimation results without controlling for income. These results are not reported due to brevity but are available upon request.

that the society expects them to make a contribution to climate protection, and are more often highly educated.

Table 3 reports the maximum likelihood estimates (including robust z-statistics) from the bivariate binary probit models. In both countries, a perceived high contribution of carbon offsetting to climate protection has a significantly positive effect on *carbon offsetting*.[9] Being female is associated with a significantly higher willingness to offset carbon emissions in Germany and a significantly lower willingness to pay higher prices for climate-friendly products in the USA. German respondents with a higher educational level are significantly more willing to pay a *price premium* for climate-friendly goods or services, but this variable has no significant effect in the USA.

The free-rider rationale significantly decreases the willingness to offset carbon emissions in Germany and for both climate protection activities in the USA which is, especially for U.S. respondents, in line with hypothesis 1. In Germany and the USA, our estimation results suggest a strong significantly positive relationship between *warm glow motives* and both *carbon offsetting* and *price premium* confirming hypothesis 2. *Green identity*, as predicted in hypothesis 3, significantly increases the willingness to pay a price premium for climate-friendly goods or services, but has no significant effect on the willingness to engage in carbon offsetting.

The impacts of social norms differ substantially in the two countries. While *no contribution of social environment* has a weak significantly negative effect on the readiness of German respondents to pay higher prices for climate-friendly goods or services and no significant effect on *carbon offsetting*, in the USA the reverse is true. These findings only partly confirm hypothesis 4, since *no contribution of social environment* was expected to have a negative effect on both climate protection activities. *Expectation of society* has no significant effect on any of the two activities in Germany, but significantly increases the willingness to offset carbon emissions and (more weakly) to pay a price premium for climate-friendly products in the USA. Thus, hypothesis 5 can only be confirmed for U.S. respondents. In hypothesis 6, *act as an example* was predicted to only have a positive effect on *price premium* due to the better visibility of this activity. This hypothesis can be confirmed in Germany, but not in the USA, where the variable has a significantly positive effect on *carbon offsetting*. In both countries,

[9] We also include this variable in the model explaining the willingness to pay a price premium for climate-friendly goods or services and find a significantly positive relationship in the USA.

environmental awareness measured by the variable *NEP scale* is a significant driver for both *carbon offsetting* and *price premium*, which is in line with the final hypothesis 7.

Tables 4 and 5 report the maximum likelihood estimates (including robust z-statistics) from the multinomial logit models. These estimation results mostly support and strengthen the results from the bivariate binary probit analysis. The NEP scale has a significantly positive effect on *carbon offsetting and price premium, carbon offsetting but not price premium,* and *price premium but not carbon offsetting* in both countries, which strengthens the confirmation of hypothesis 7. In line with hypotheses 1 and 2, the free-rider rationale has a significantly negative effect and *warm glow motives* a significantly positive effect on *carbon offsetting and price premium* in both countries. We additionally find a significantly negative relationship between *free-rider rationale* and *carbon offsetting but not price premium* and a significantly positive relationship between *warm glow motives* and *carbon offsetting but not price premium* in Germany. *Act as an example* is significantly associated with a higher willingness of German respondents to only pay higher prices for climate-friendly products (which strengthen the confirmation of hypothesis 6 in this country) and to carry out both climate protection activities, but only significantly increases the probability for the latter alternative in the USA. *Green identity* has a significantly positive effect on *price premium but not carbon offsetting* (in line with hypothesis 3) as well as on *carbon offsetting and price premium* in Germany, but even a weakly significantly negative effect on *carbon offsetting but not price premium* for U.S. respondents.

The findings for the different role of social norms in both countries are very similar to the results from the bivariate binary probit analysis. In Germany, we find no significant effects of the two variables reflecting the social norms. In the USA, the belief that the social environment does not contribute to climate protection is associated with a significantly lower willingness to engage in both climate protection activities. We also find a significantly positive relationship between *expectation of society* and *carbon offsetting and price premium* as well as a weak significantly positive relationship between *expectation of society* and *carbon offsetting but not price premium* for U.S. respondents. Therefore, the hypotheses 4 and 5 can only be confirmed for the USA.

In addition, *high contribution of carbon offsetting* is a significant driver for the readiness to engage in carbon offsetting in both countries. German respondents with a high educational level are significantly more willing to only pay higher prices for climate-friendly goods or services and to carry out both measures, but the variable *highly educated* has no significant

effects in the USA. This result is in line with former studies that reveal insignificant effects of education on climate change beliefs and concerns in the USA (which is obviously due to the underlying political and ideological orientation, (e.g., McCright, 2011; Hamilton and Stampone, 2013). Interestingly, age has no significant effect in the USA, but significantly positive effects on *carbon offsetting and price premium* and *price premium but not carbon offsetting* in Germany. In addition, female respondents in Germany show a weak significantly higher propensity to only demand carbon offsets and to engage in both climate protection activities, whereas in the USA, being female is significantly associated with a lower willingness to engage in both activities and weakly significantly associated with a lower willingness to only pay higher prices for climate-friendly goods or services. This suggests that not only the impacts of social norms differ substantially in the two countries, but that also different population groups contribute to the public good climate protection. In contrast, neither the number of own children nor regional dummies have any significant effect.

5. Summary and discussion

Voluntary climate protection activities play an important role for implementing new climate policy objectives and reducing the negative impacts of human behavior on the climate. Understanding the determinants and motivation for climate protection activities is crucial since international climate policy has failed to make significant progress over the past years. This paper is the first to investigate a wide range of motives for climate protection activities. The analysis considers two alternatives for making contributions to the public good climate protection which provide no additional co-benefits (like financial advantages or health benefits): consuming conventional products and offsetting carbon emissions (i.e. directly donating to a public good) or paying higher prices for climate-friendly goods or services (i.e. consuming an environmental impure public good). Our discussion of motivational factors focusses on feelings of warm glow, moral obligation, social norms, green identity, and signaling. We demonstrate analytically that impacts of these factors may vary across the two alternatives.

Using data from representative surveys among more than 2000 participants from Germany and the USA, our empirical results mostly support our seven hypotheses in the two countries and in particular do not reject any of these hypotheses. Not surprisingly, environmental awareness, warm glow motives, and the desire to set a good example have the most robust significantly positive effects on the two alternatives in both countries. The latter result might

be attributed to the development that more and more suppliers of carbon offsets issue personalized certificates for supporters who offset a certain amount of carbon emissions and thereby enhance the visibility of this measure. In addition, our estimation results suggest psychological losses due to the free-rider phenomenon in both countries since the belief that one person on their own will not change anything regarding climate protection significantly reduces the willingness to offset carbon emissions and to pay higher prices for climate-friendly goods.

In contrast, some motives differ considerably between both climate protection activities and countries. A green identity only enhances the willingness to pay higher prices for climate-friendly products in Germany, but weakly decreases the willingness to demand carbon offsets in the USA. These findings reflect the profound historical skepticism towards carbon offsetting among environmental groups and parties. While this skepticism seems to have weakened in Germany (e.g. the German Federal Environmental Agency, which is highly respected by environmental groups and the Green party in Germany, now supports carbon offsetting as an important climate policy instrument after a long time of critics), it obviously continues to dominate decisions for climate protection activities especially in the USA. Furthermore, social norms seem to be of much higher relevance in the USA, since the perceived expectation of the society to contribute to climate protection significantly increases the propensity to demand carbon offsets and to pay higher prices for climate-friendly products of U.S. respondents, but has no significant effect in Germany. One possible explanation for this result is that the population is more separated in ideologically similar groups in the USA. Individuals identify far more closely with peers who have common concerns and interest or share similar world views and beliefs. Consequently, the behavior of individuals is strongly influenced by values and norms of their peers and “their” society.

Our descriptive results further suggest that decisions about climate protection activities involve substantial uncertainties. Individuals in both countries seem to be poorly informed about carbon offsetting, but also about environmental impure public goods, since a large proportion of respondents refused to answer the questions about their willingness to take these climate protection activities. The provision of fundamental knowledge may reduce these uncertainties and eliminate existing reservations particularly towards carbon offsetting (e.g., UBA, 2010). Our findings regarding the determinants and motivations for climate protection activities might serve as basis for successful and targeted information campaigns.

Future research may investigate whether our estimation results hold for other countries and apply such a wide range of motives to non-environmental contributions to public goods such

as fair-trade, Child-Labor-Free certified, or products combined with charitable purposes (see also Kotchen, 2006).

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Appendix

Table 1: Description of explanatory variables

Variables	Description
Free-rider rationale	1 if the respondent agreed rather strongly or very strongly to the statement "regarding climate protection one person on their own will not change anything anyway", 0 otherwise.
Warm glow motives	1 if the respondent agreed rather strongly or very strongly to the statement "it makes me feel good to contribute to climate protection" or to the statement "I feel responsible for making a contribution to climate protection", 0 otherwise.
Green identity	1 if the respondent agreed rather strongly or very strongly to the statement "I identify myself closest with green politics", 0 otherwise.
No contribution of social environment	1 if the respondent agreed rather strongly or very strongly to the statement "my family, friends or colleagues do not contribute to climate protection", 0 otherwise.
Expectation of society	1 if the respondent agreed rather strongly or very strongly to the statement "society expects me to contribute to climate protection", 0 otherwise.
Act as an example	1 if the respondent agreed rather strongly or very strongly to the statement "I want to set an example for others by making a contribution to climate protection", 0 otherwise.
NEP scale	Additive indicator using the following six items from the NEP scale: – "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", – "the balance of nature is very delicate and easily upset". The underlying question is "how strongly do you agree to the following statement" with the five ordered response categories "very weakly", "rather weakly", "neither weakly nor strongly", "rather strongly", and "very strongly". The variable is designed by constructing dummy variables that take the value one if the respondent agreed to the respective statement rather or very strongly (in case of positively keying items) or rather or very weakly (in case of negatively keying items), and adding up the six dummy variables. Accordingly, the variable takes values from 0 to 6.
High contribution of carbon offsetting	1 if the respondent believes that carbon offsetting is rather effective or very effective for climate protection, 0 otherwise. The underlying question is "how effective is CO2 offsetting in protecting the climate?" with the five ordered response categories: "Very ineffective", "rather ineffective", "neither effective nor ineffective", "rather effective", and "very effective".
Age	Age of the respondent in years.
Female	1 if the respondent is a woman, 0 otherwise.
Number of own children	Number of own children of the respondent.
Highly educated	1 if the respondent's highest level of education is at least secondary (Abitur in Germany,high school degree in the USA), 0 otherwise.
Western Germany	1 if the respondent lives in Western Germany, 0 otherwise.
Northeast (midwest, west, south)	1 if the respondent lives in the Northeast (Midwest, West, South) of the USA, 0 otherwise.

Table 2: Descriptive statistics of dependent and explanatory variables for overall 1,005 respondents in Germany and 1,010 respondents in the USA

Variables	Germany			USA		
	Number of observations	Mean	Standard deviation	Number of observations	Mean	Standard deviation
Carbon offsetting	572	0.55	0.50	549	0.57	0.50
Price premium	762	0.54	0.50	760	0.37	0.48
Free-rider rationale	959	0.34	0.47	931	0.35	0.48
Warm glow motives	957	0.66	0.47	934	0.60	0.49
Green identity	938	0.30	0.46	907	0.21	0.41
No contribution of social environment	912	0.19	0.39	872	0.29	0.45
Expectation of society	944	0.32	0.47	916	0.44	0.50
Act as an example	961	0.40	0.49	931	0.47	0.50
NEP scale	928	4.08	1.82	905	3.07	1.91
High contribution of carbon offsetting	892	0.54	0.50	778	0.49	0.50
Highly educated	1,000	0.55	0.50	1,006	0.68	0.47
Age	1,005	41.13	12.52	1,010	48.51	14.46
Female	1,005	0.49	0.50	1,010	0.53	0.50
Number of own children	1,005	0.95	1.12	1,010	1.32	1.39
Western Germany	1,005	0.79	0.41			
West				1,010	0.22	0.41
Northeast				1,010	0.20	0.40
Midwest				1,010	0.23	0.42

Table 3: Maximum likelihood estimates (robust z-statistics) of parameters in the bivariate binary probit models in Germany and the USA

Explanatory variables	Germany		USA	
	Carbon offsetting	Price premium	Carbon offsetting	Price premium
Free-rider rationale	-0.44***	-0.06	-0.37**	-0.56***
	(-2.83)	(-0.42)	(-2.11)	(-3.32)
Warm glow motives	0.69***	0.56***	0.45**	0.54**
	(3.85)	(3.16)	(2.17)	(2.31)
Green identity	0.13	0.60***	-0.05	0.40**
	(0.82)	(4.03)	(-0.23)	(2.27)
No contribution of social environment	0.04	-0.34*	-0.36**	-0.16
	(0.24)	(-1.94)	(-1.99)	(-0.91)
Expectation of society	0.16	-0.11	0.57***	0.31*
	(1.08)	(-0.74)	(3.31)	(1.76)
Act as an example	0.21	0.48***	0.53***	0.32
	(1.34)	(3.11)	(2.64)	(1.46)
NEP scale	0.10**	0.16***	0.11**	0.11**
	(2.41)	(3.84)	(2.42)	(2.30)
High contribution of carbon offsetting	0.91***	0.13	0.57***	0.52***
	(6.52)	(0.90)	(3.35)	(3.16)
Highly educated	-0.01	0.53***	0.17	0.22
	(-0.09)	(3.57)	(0.91)	(1.30)
Age	0.01	0.01	-0.01	-0.01
	(1.10)	(1.37)	(-1.32)	(-1.06)
Female	0.39***	-0.01	-0.05	-0.44***
	(2.66)	(-0.07)	(-0.29)	(-2.73)
Number of own children	-0.02	-0.08	0.02	0.01
	(-0.30)	(-1.19)	(0.38)	(0.13)
Western Germany	0.08	0.03		
	(0.54)	(0.22)		
West			0.21	0.22
			(0.99)	(1.05)
Northeast			0.14	0.10
			(0.61)	(0.47)
Midwest			-0.11	-0.06
			(-0.54)	(-0.31)
Constant	-1.74***	-1.87***	-0.79**	-1.02***
	(-4.69)	(-4.93)	(-2.06)	(-2.93)
Number of respondents	427		372	

* (**, ***) means that the appropriate parameter or effect is different from zero at the 10% (5%, 1%) significance level.

Table 4: Maximum likelihood estimates (robust z-statistics) of parameters in the multinomial logit model in Germany, base category: neither carbon offsetting nor price premium

Explanatory variables	Price premium but not carbon offsetting	Carbon offsetting but not price premium	Carbon offsetting and price premium
Free-rider rationale	-0.20	-1.16***	-0.77**
	(-0.55)	(-2.65)	(-2.28)
Warm glow motives	0.63	0.92**	1.67***
	(1.56)	(2.06)	(4.08)
Green identity	1.26***	0.20	1.11***
	(3.06)	(0.42)	(2.98)
No contribution of social environment	-0.70	0.22	-0.35
	(-1.57)	(0.49)	(-0.96)
Expectation of society	-0.37	0.25	0.06
	(-0.93)	(0.63)	(0.18)
Act as an example	0.80**	0.27	0.97***
	(2.06)	(0.62)	(2.67)
NEP scale	0.40***	0.25**	0.37***
	(3.88)	(2.38)	(3.69)
High contribution of carbon offsetting	0.05	1.84***	1.51***
	(0.15)	(4.83)	(4.90)
Highly educated	1.57***	0.21	0.88***
	(3.70)	(0.52)	(2.62)
Age	0.03*	0.02	0.03**
	(1.78)	(1.37)	(1.98)
Female	-0.19	0.74*	0.59*
	(-0.44)	(1.87)	(1.65)
Number of own children	-0.19	-0.07	-0.19
	(-1.06)	(-0.37)	(-1.16)
Western Germany	-0.26	-0.07	0.12
	(-0.69)	(-0.18)	(0.37)
Constant	-4.72***	-4.25***	-5.27***
	(-4.89)	(-3.89)	(-5.57)
Number of respondents		427	

* (**, ***) means that the appropriate parameter or effect is different from zero at the 10% (5%, 1%) significance level.

Table 5: Maximum likelihood estimates (robust z-statistics) of parameters in the multinomial logit model in the USA, base category: neither carbon offsetting nor price premium

Explanatory variables	Price premium but not carbon offsetting	Carbon offsetting but not price premium	Carbon offsetting and price premium
Free-rider rationale	-0.90*	-0.38	-1.27***
	(-1.81)	(-0.94)	(-3.43)
Warm glow motives	1.30*	0.87*	1.18***
	(1.87)	(1.70)	(2.67)
Green identity	-0.04	-0.98*	0.18
	(-0.06)	(-1.72)	(0.41)
No contribution of social environment	0.12	-0.50	-0.83**
	(0.21)	(-1.13)	(-2.16)
Expectation of society	0.11	0.85*	1.21***
	(0.20)	(1.92)	(3.38)
Act as an example	-0.45	0.34	1.09**
	(-0.75)	(0.63)	(2.38)
NEP scale	0.44***	0.35***	0.32***
	(3.21)	(3.39)	(3.38)
High contribution of carbon offsetting	0.80	0.84**	1.50***
	(1.56)	(1.97)	(4.07)
Highly educated	0.61	0.42	0.55
	(1.13)	(1.00)	(1.50)
Age	-0.02	-0.02	-0.02
	(-1.04)	(-1.50)	(-1.51)
Female	-0.98*	0.04	-0.73**
	(-1.70)	(0.09)	(-2.07)
Number of own children	-0.07	0.01	0.07
	(-0.33)	(0.10)	(0.59)
West	0.17	0.07	0.42
	(0.28)	(0.15)	(0.87)
Northeast	0.45	0.36	0.28
	(0.72)	(0.65)	(0.51)
Midwest	-1.01	-0.75	-0.29
	(-1.50)	(-1.56)	(-0.65)
Constant	-2.29**	-1.61**	-2.09**
	(-2.04)	(-1.97)	(-2.51)
Number of respondents		372	

* (**, ***) means that the appropriate parameter or effect is different from zero at the 10% (5%, 1%) significance level.