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## New Ecological Paradigm meets behavioral economics: On the relationship between environmental values and economic preferences

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# **New Ecological Paradigm meets behavioral economics: On the relationship between environmental values and economic preferences**

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Preliminary version

## **Abstract**

Many studies examine the effect of environmental values on environmental behavior. In such empirical analyses it is typically at least implicitly assumed that environmental values are independent of economic preferences from behavioral economics like risk and time preferences, trust, or reciprocity, which play an important role for the explanation of individual behavior. This paper tests whether environmental values are related to economic preferences and examines possible consequences when independence is assumed. The data for this test stem from a large-scale computer-based survey among more than 3700 German citizens. Our indicators for environmental values are based on the New Ecological Paradigm (NEP), which is a standard instrument in the social and behavioral sciences and increasingly common in the economic literature. The econometric analysis with Generalized Poisson regression models reveals strong correlations between the NEP scales and economic preferences, which are based on established experimental measures: While social preferences (measured in an incentivized dictator game) and positive reciprocity are significantly positively correlated, trust and (less robust) negative reciprocity are significantly negatively correlated with environmental values, respectively. Only risk and time preferences (also measured in an incentivized experiment) are not robustly significantly correlated with the NEP scales. These estimation results strongly recommend the additional inclusion of economic preferences and especially of social preferences, trust, and positive and negative reciprocity in econometric analyses that use a NEP scale as explanatory factor for individual behavior since their non-consideration can lead to strong distortions due to omitted variable biases. This conclusion is illustrated in an empirical example that reveals biased estimation results for the effect of a NEP scale on donation activities if not all relevant economic preferences are included as control variables.

JEL classification: Q50, A13, C93, D91, Q57

Keywords: Environmental values, New Ecological Paradigm (NEP), economic preferences, artefactual field experiments, Generalized Poisson regression models

## 1. Introduction

In order to explain economic and especially environmental behavior, empirical studies often consider the relevance of social norms and individual values including environmental values and awareness. For example, Kotchen and Moore (2008) analyze the effect of the membership in an environmental organization on electricity consumption and Dastrup et al. (2012) examine the effect of contributions to environmental organizations on the probability to live in solar homes. Recently, the use of indicators on the basis of the New Ecological Paradigm (NEP), which is a standard approach in the social and behavioral sciences, is increasingly common in the economic literature. For example, NEP indicators are considered to explain the participation in green electricity programs (e.g. Kotchen and Moore, 2007) or electricity conservation (e.g. Delmas and Lessem, 2014). A first version of the NEP was introduced by Dunlap and Van Liere (1978) and describes an ecological worldview. It incorporates ideas like limits to growth and the significance of the balance of nature. The NEP scales measure general beliefs about the relationship between humankind and the natural environment and are currently the most widely used indicator for environmental values and awareness (e.g. Dunlap, 2008).

This paper examines the relationship between NEP indicators and several economic preferences from behavioral economics like risk and time preferences, trust, or reciprocity. In addition to social norms and individual values, economic studies reveal that such preferences also play an important role for the explanation of individual behavior (e.g. Dohmen et al., 2011, Sutter et al., 2013). With respect to environmentally relevant behavior, Fischbacher et al. (2015) specifically identify correlations between risk and time preferences and investments in energy saving measures. However, Albanese et al. (2017) show that risk and time preferences, trust, and reciprocity are correlated with each other. On this basis, they argue that neglecting one of these indicators in explaining individual behavior can lead to strong distortions due to omitted variable biases. Similarly, Dohmen et al. (2008) reveal correlations between trust and reciprocity and Dohmen et al. (2010) reveal correlations between cognitive ability and risk and time preferences. The latter study thus argues that significant effects of cognitive ability on individual behavior can be due to its relationship with these two economic preferences.

Against this background, it can also be speculated that the estimated effects of environmental values and specifically of NEP scales on individual behavior are biased if relevant economic preferences are correlated with environmental values and not additionally

included in econometric analyses, i.e. possible effects of environmental values might in fact represent underlying effects of economic preferences. So far, only few studies focusing on the effects of environmental values include such preferences. One exception is the study of Fischbacher et al. (2015) who show significant effects of risk and time preferences on energy efficiency measures. However, similar to other studies, that study does not examine possible distortions for the estimated effect of the NEP indicator if some economic preferences would not be considered in the econometric analysis. Previous empirical analyses instead typically assume at least implicitly that environmental values are independent of economic preferences. However, this assumption has received no attention in the empirical literature so far. The main contribution of our systematic analysis of the relationship between environmental values and common economic preferences is therefore to identify possible biased estimation results in this respect.

In addition to risk and time preferences, trust, and positive and negative reciprocity, our econometric analysis considers social preferences, which also have significant effects on environmentally relevant behavior (e.g. Kotchen and Moore, 2007, Fischbacher et al., 2015). Since our identification of time and social preferences is based on artefactual field experiments (e.g. Levitt and List, 2009, List, 2011), our empirical analysis also contributes to previous studies (e.g. Dohmen et al., 2011, Fischbacher et al., 2015) that mimic laboratory experiments in the field by considering incentivized measures in a large-scale computer-based survey among more than 3700 German citizens. Our econometric analysis with Generalized Poisson regression models reveals that social preferences and positive reciprocity are significantly positively correlated, whereas trust and (less robust) negative reciprocity are significantly negatively correlated with environmental values, respectively. Only risk and time preferences are not robustly significantly correlated with the NEP scales. In addition, our econometric analysis also reveals distortedly estimated effects of the NEP indicators on individual behavior (i.e. donation activities) if economic preferences are insufficiently included in the econometric analysis. As a consequence, these estimation results strongly recommend the additional integration of economic preferences and especially of social preferences, trust, and positive and negative reciprocity in order to avoid omitted variable biases.

The remainder of the paper is organized as follows: Section 2 discusses the concept of the NEP and the relevance of economic preferences for individual behavior. Section 3 presents the data and the variables in our econometric analysis as well as some descrip-

tive statistics. Section 4 discusses the main estimation results, several robustness checks, and an application to the explanation of donation activities.

## **2. New Ecological Paradigm and economic preferences**

### ***2.1. New Ecological Paradigm***

The precursor of the NEP, i.e. the New Environmental Paradigm, was first introduced by Dunlap and Van Liere (1978) and incorporates ideas like limits to growth, achieving a steady-state economy, and the significance of the balance of nature. It represents an ecological worldview and thus challenges the previously dominating worldview of the Dominant Social Paradigm (e.g. Pirages and Ehrlich, 1974, Dunlap, 2008), which can serve as a guideline for social and individual behavior as well as for social expectations. In most industrialized societies, the Dominant Social Paradigm incorporates ideas like the belief in progress, growth, and wealth, in technology and science, as well as in the superiority of humankind towards nature (e.g. Pirages and Ehrlich, 1974). However, the commitment to this paradigm leads to serious ecological issues, which question its contemporary validity (e.g. Dunlap and Van Liere, 1978, Dunlap, 2008). As a consequence, the Dominant Social Paradigm was often criticized and a change towards another main paradigm was often deemed necessary in order to manage ecological problems.

Therefore, the New Environmental Paradigm and its successor, i.e. the NEP, as discussed below are commonly considered to be more realistic. While Dunlap and Van Liere (1978) introduced this new paradigm as an ecological worldview, they also consider it as a measure of beliefs about the relationship between humankind and the natural environment or even a measure of environmental concern (see also Dunlap, 2008). While some studies interpret and understand the New Environmental Paradigm in this direction (e.g. Kotchen and Moore, 2007, Hawcroft and Milfont, 2010), other studies consider it as a measure of different constructs (e.g. Dunlap et al., 2000), i.e. the New Environmental Paradigm is also applied as a measure of environmental attitudes (e.g. Attari, et al. 2009, Delmas and Lessem, 2014), environmental values (e.g. Whitmarsh, 2008, 2011, Ziegler, 2017), or environmental awareness (e.g. Schwirplies and Ziegler, 2016), which leads to an ambiguity of the measure (e.g. Dunlap et al., 2000). Nevertheless, compared to previous approaches like the Ecology Scale (e.g. Maloney and Ward, 1973, Maloney et al., 1975) or the Environmental Concern Scale (e.g. Weigel and Weigel, 1978), scales from the New Environmental Paradigm and the NEP have become the most common

measures of environmental values and attitudes in social and behavioral science (e.g. Stern et al., 1995, Fransson and Gärling, 1999, Dunlap et al., 2000, Dunlap, 2008).

The original scale from the New Environmental Paradigm according to Dunlap and Van Liere (1978) refers to 12 items that can be summarized by three facets of environmental attitudes, i.e. beliefs in the ability of humans to affect the balance of nature, beliefs in existing limits to growth, and anti-anthropocentrism, which implies that humans do not have the right to rule over nature. In order to improve this scale, Dunlap et al. (2000) developed a modified 15-item scale on the basis of a revised paradigm, which they termed New Ecological Paradigm (NEP). This revised paradigm is based on social-psychological theory so that it refers to primitive beliefs about the relationship between humans and the natural environment (e.g. Rokeach, 1969, Dunlap, 2008). The NEP scale includes a wider range of an ecocentric or ecological worldview, whereby two further facets, i.e. the rejection of exemptionalism and the possibility of an eco-crisis, are additionally considered. Furthermore, the underlying 15 statements avoid outdated terminology and are more balanced with respect to positively and negatively defined items. They are based on five ordered response categories (i.e. on five-point Likert scales). However, Dunlap et al. (2000) do not further specify the specific construction of the scale and the range of their values.

As a consequence, the empirical application of NEP scales is very different in the literature. While some studies refer to all 15 items (e.g. Kotchen and Reiling, 2000), other studies refer to ten items (e.g. Clark et al., 2003), six items (e.g. Whitmarsh, 2011), five items (e.g. Kotchen and Moore, 2007), or even only three items (e.g. Fischbacher et al., 2015). According to Hawcroft and Milfont (2010), most of the analyzed studies use all 15 items, but also six items are often considered. Furthermore, the number of ordered response categories in the underlying statements differs in the literature. In contrast, the ordered response format is more consistent since the strong majority, i.e. over 80% of the examined studies, consider a five-point scale (e.g. Kotchen and Moore, 2007, Lange et al., 2017), whereas less studies consider a four-point scale (e.g. Brody et al., 2012) or a seven-point scale (e.g. Attari et al., 2009). In addition, other studies modify the wording of the single items for a better fit (e.g. Fischbacher et al., 2015). For example, the wording of all NEP items is changed negatively to measure ecological disregard instead of ecological values or beliefs (e.g. Brody et al., 2012). Further studies even report interpretation and understanding issues of various NEP items. In this paper, our NEP scales are

based on six items (see Table 1) according to Dunlap et al. (2000). The consideration of only six items is in line with Whitmarsh (2008, 2011) who shows that many respondents have difficulties to interpret the remaining nine NEP items

## ***2.2. Economic preferences***

Economic preferences play an important role for individual behavior. In particular, risk and time preferences, trust, social preferences, as well as positive and negative reciprocity are commonly considered in behavioral economics (e.g. Falk et al., 2016, 2018). For example, it is shown that risk preferences are relevant for behaviors such as occupational choice, housing ownership, or stock purchases (see e.g. the overview in Dohmen et al., 2012). Other studies reveal the importance of risk and time preferences for cognitive ability (e.g. Dohmen et al., 2010). It is also shown that time preferences are relevant for long-term outcomes such as income or employment (e.g. Golsteyn et al., 2014). Furthermore, previous studies identify the relevance of aggregate trust measures for several macroeconomic variables like GDP growth, inflation, or the volume of trade between countries (see e.g. the overview in Fehr, 2009). At the individual level, it is, for example, shown that trust plays an important role for buying stocks (e.g. Guiso et al., 2008). With respect to reciprocal preferences, for example, their importance for employee concerns such as employee representations are analyzed (e.g. Jirhahn and Lange, 2015). In addition, previous studies examine the relationship between several economic preferences such as risk and time preferences, trust, and reciprocity (e.g. Albanese et al., 2017).

Furthermore, economic preferences are also specifically examined in the field of environmentally relevant behavior. For example, Sirin and Gonul (2016) consider the relationship between several economic preferences and the choice of an electricity tariff. Fischbacher et al. (2015) show that risk taking preferences are positively correlated with renovation decisions, while patience is positively correlated with the probability to live in energy efficient homes. Other studies examine the importance of risk and time preferences for energy-efficiency or energy-saving measures (e.g. Epper et al., 2011, Newell and Siikamäki, 2015) or for the willingness to participate in time-of-use electricity tariffs (e.g. Qiu et al., 2017). Furthermore, Kotchen and Moore (2007) show a strong relevance of social preferences for the individual participation in a green electricity tariff. On the basis of these studies, it is plausible to think that economic preferences are not only correlated with environmentally relevant behavior, but also with environmental values or

attitudes. One indication in this respect is that, for example, trust is relevant for communicated information on climate change (e.g. Whitmarsh, 2011) and for the support of climate change policy actions (e.g. Dietz et al., 2007). However, to the best of our knowledge, the relationship between several economic preferences and a NEP scale has not been examined so far.

### **3. Data and variables**

Our empirical analysis is based on data collected from a large-scale computer-based survey among 3705 citizens in Germany, which was carried out in June and July 2016 in cooperation with the German market research business Psyma. Due to the focus of the survey on energy-specific questions, only adults who are alone or together with a partner responsible for the choice of electricity tariffs and providers are included. In order to consider relevant population groups after this filtering, the sample (which was drawn from a Psyma Panel) was stratified in terms of age, gender, place of residence, and religious affiliation so that it is representative for these criteria.<sup>1</sup> The first part of the questionnaire consisted of screening questions to identify the previously described target group. The second part of the questionnaire referred to personal values and attitudes including our main interesting economic preferences including two artefactual field experiments to identify time and social preferences. Furthermore, the second part especially comprised the six statements as reported in Table 1 for the construction of our NEP scales. The next three parts, which are, however, not considered in this paper, referred to energy-specific details including a stated choice experiment with respect to different electricity tariffs. The final part of the survey comprised further socio-economic and socio-demographic variables. Among all participants, the median time to complete the questionnaire was about 28 minutes.

#### ***3.1. Dependent variables***

As discussed above, our NEP scales are not based on all 15 items, but only on six items. This procedure is in line with Whitmarsh (2008, 2011), who showed by means of pilot studies that many respondents had difficulties to interpret the remaining nine NEP items. As a consequence, the following six statements are considered (see also Table 1): “Humans have the right to modify the natural environment to suit their needs”, “humans are

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<sup>1</sup> However, this sampling strategy can lead to deviations for other criteria, for example, due to an overrepresentation of high education.



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. “totally disagree”, “rather disagree”, “undecided”, “rather agree”, and “totally agree”. On the basis of these six items, we construct two different NEP scales.

In line with, for example, Schwirplies and Ziegler (2016), the first NEP scale is constructed on the basis of six dummy variables. For a positively worded statement, the corresponding dummy variables take the value one if a respondent rather or totally agrees with the statement and the value zero otherwise. In the case of negatively worded statement, the dummy variables take the value one if a respondent rather or strongly disagrees and the value zero otherwise. The variable “NEP based on dummy variables” is designed by adding up the single values of the six dummy variables and thus can vary between zero and six. In line with, for example, Kotchen and More (2007), the second NEP scale includes for each statement all categories of the ordered response categories. Specifically, we assign increasing integers from zero to four for the three environmentally positively worded statements and decreasing integers from four to zero for the three environmentally negatively worded statements. The variable “NEP based on ordinal variables” is then constructed by adding up the six values so that it can vary between zero and 24. For both NEP scales, higher values imply a higher environmental awareness. Table 1 reports the frequencies of the agreement with the six statements, respectively, which reveal relatively strong environmental values and attitudes for all six items.

### ***3.2. Economic preferences***

Our main explanatory variables refer to economic preferences, i.e. risk and time preferences, trust, social preferences, as well as positive and negative reciprocity. Our variable for risk preferences is based on a survey question from the German Socio-Economic Panel (SOEP). The respondents were therefore asked how willing they are generally to take risks with the five ordered response categories “not at all willing to take risks”, “rather not willing to take risks”, “undecided”, “rather willing to take risks”, and “very willing to take risks”. The reliability of this general risk preferences measure was validated by Dohmen et al. (2011) in a field experiment which confirms that this general risk as-

assessment is an appropriate measure. Furthermore, several previous empirical studies apply such measures of risk preferences (e.g. Jaeger et al., 2010, Dohmen et al., 2012, Fischbacher et al., 2015). On the basis of this ordinal variable, we construct the dummy variable “risk taking preferences” that takes the value one if the respondent indicated one of the latter two categories and zero otherwise. Table 2 reports the frequencies of the willingness to take risks across all respondents and reveals that 28.5% of the participants self-assess as rather or very willing to take risks.

The identification of time preferences is based on an incentivized artefactual field experiment. The respondents had to decide to receive 80 Euro in one month after the survey or to receive higher amounts in seven months after the survey. The choice table for the experiment can be found in Table 3 and reveals that the respondents had to make 12 different decisions. Furthermore, the participants were informed that 36 individuals of the sample are randomly selected at the end of the survey, for each selected participant one of the 12 decisions is randomly chosen, and the indicated payment is realized in one or seven months. Furthermore, we informed the respondents that the winners are immediately notified after the survey and that the Euro amount is credited in bonus points on their account as member of the Psyma panel. In line with, for example, Dohmen et al. (2010) or Fischbacher et al. (2015), the variable “patience” represents the minimum discount factor and is constructed as ratio between 80 Euro and the value at which the participant chooses the amount in seven months for the first time. Therefore, “patience” varies between 0.74 and one. Table 4 reports the distribution of the discount rates across all 3705 respondents and reveals similar results as in Fischbacher et al. (2015), although our sample comprises more strongly impatient respondents (i.e. more than 28%) who always prefer 80 Euro in one month.

In line with, for example, Dohmen et al. (2012) and similar to common trust measures in surveys such as the General Social Survey (GSS) or the World Value Survey (WVS) (e.g. Fehr, 2009), our variable for trust is also based on experimentally validated survey questions from the SOEP, which refer to the following three statements: “In general, one can trust people”, “these days you cannot rely on anybody else”, and “when dealing with strangers, it is better to be careful before you trust them”. The respondents were asked how strongly they agree with these statements on a symmetric scale with five ordered response categories, i.e. “totally disagree”, “rather disagree”, “undecided”, “rather agree”, and “totally agree”. Our trust variable is designed on the basis of three dummy

variables. With respect to the first positively worded statements, the dummy variable takes the value one if a respondent rather or totally agrees and zero otherwise, whereas for the latter two negatively worded statements the dummy variable takes the value one if a respondent rather or totally disagrees and zero otherwise. The variable “trust” is then constructed by adding up the single values of the three dummy variables and thus can vary between zero and three, whereby higher values indicate a higher trust. Table 5 reports the frequencies of the agreement with the three statements of trust attitudes across all 3705 respondents.

In line with Fischbacher et al. (2015), the identification of social preferences is also based on an incentivized artefactual field experiment. The experiment is specifically based on a standard dictator game, where generosity is costly, i.e. each participant was presented a table and asked to divide the amount of 100 Euro with another randomly selected respondent in the case that he belongs to the winner in the lottery. The corresponding choice table in the survey can be found in Table 6. The participants were informed that 36 individuals of the sample are randomly selected at the end of the survey and have the opportunity to receive 100 Euro. Furthermore, we again informed the respondents that the winners are immediately notified after the survey and that the Euro amount is credited in bonus points on their account as member of the Psyma panel. Table 7 reports the distribution of the payment amounts for other participants across the 3705 respondents. In accordance with Fischbacher et al. (2015), it shows that the majority chooses an equal distribution of the 100 Euro. In the econometric analysis, we consider the variable “social preferences” that is the amount that is allocated to another participant, divided by 100. Therefore, this variable can take values between zero and one, whereby higher values imply stronger social preferences.

Our variable for positive and negative reciprocity is in line with several previous studies (e.g. Dohmen et al., 2009, Caliendo et al., 2012) and thus in line with survey questions from the SOEP. The variable for positive reciprocity is based on the following three statements: “If someone does me a favor I am ready to return it”, “I am particularly trying to help someone who has helped me before”, and “I am willing to pay costs to help someone who has helped me before”. The variable for negative reciprocity is based on the following three statements: “If I am faced with a great injustice, I will avenge myself at the next opportunity”, “if someone puts me in a difficult position, I’ll do the same with him”, and “if someone insults me, I will also be offensive to him”. The respondents were

again asked how strongly they agree with these statements on a symmetric scale with five ordered response categories, i.e. “totally disagree”, “rather disagree”, “undecided”, “rather agree”, and “totally agree”. Again, we consider dummy variables, which take the value one if a respondent rather or totally agrees to statement and zero otherwise. The variables “positive reciprocity” and “negative reciprocity” are then constructed by adding up the single values of the three dummy variables, respectively, so that both variables can vary between zero and three, whereby higher values indicate higher positive or negative reciprocal preferences. Table 8 reports the frequencies of the agreement with the corresponding statements and reveals a relatively high positive reciprocity and a relatively low negative reciprocity on average.

### ***3.3. Further explanatory variables***

According to Stern (2000), individual values and social norms are additionally relevant for the explanation of environmental values or attitudes. Important values and norms refer to political identification. We do not only consider simple one-dimensional indicator for a right-wing or a left-wing political identification, but asked the participants how strongly they agree with the statements “I identify myself with conservatively oriented politics”, “I identify myself with liberally oriented politics”, “I identify myself with socially oriented politics”, and “I identify myself with ecologically oriented politics” again on a symmetric scale with the five ordered response categories “totally disagree”, “rather disagree”, “undecided”, “rather agree”, and “totally agree”. On the basis of these ordinal variables, we construct the four dummy variables “conservative identification”, “liberal identification”, “social identification”, and “ecological identification” that take the value one if the respondent indicated one of the latter two categories, respectively. Another direction of important values and norms refers to religiosity or religious affiliation. Therefore, the respondents were asked whether they belong to the Roman Catholic Church, to Protestant Churches, to Islam, to other religious communities, or whether they have no religious affiliation. On this basis, we construct the dummy variables “Catholic affiliation” for Catholics, “Protestant affiliation” for Protestants, “other religious affiliation” for the membership to other religious communities including Islam, and “no religious affiliation” for respondents who do not belong to any religious group.

Finally, some additional socio-demographic factors are included as control variables. The variable “age” is the age of a respondent in years. The dummy variable “female”

takes the value one for a female participant. The dummy variable “higher educational degree” takes the value one if a respondent has at least a college or university degree and the dummy variable “Eastern Germany” controls for geographical differences and takes the value one if a respondent lives in one of the new Eastern federal states of Germany including Berlin. Table 9 reports some descriptive statistics for our dependent and explanatory variables.

#### **4. Preliminary econometric analysis**

Our two dependent variables “NEP based on dummy variables” and “NEP based on ordinal variables” are quantitative discrete variables and restricted to non-negative integers. Due to the quantitative character of the dependent variables, the analysis of linear regression models would generally be possible. However, if the data generation process does not follow the assumptions of linear regression models, but, for example, a Poisson regression model, the OLS estimations would be inconsistent. As a consequence, we focus on the application of count data models for the econometric analysis, although we check the robustness of the estimation results by additionally applying linear regression models. While the Poisson regression model is the most commonly used count data model, its implicit assumption of equidispersion is often very restrictive in empirical practice. As a consequence, it is not very surprising that our underlying data do not support equidispersion and thus the use of Poisson regression models. Instead, we can identify a strong underdispersion. Against this background, we focus on the application of Generalized Poisson regression models, which can be used for the analysis of both over- and underdispersion (e.g. Winkelmann, 2008).

##### **4.1. Main estimation results**

Table 10 reports Maximum Likelihood (ML) estimations of two different Generalized Poisson model specifications.<sup>2</sup> While the first column refers to the first NEP scale, i.e. the dependent variable “NEP based on dummy variables”, the second column refers to the second NEP scale, i.e. the dependent variable “NEP based on ordinal variables”. In both models, all six economic preferences, i.e. “risk taking preferences”, “patience”, “trust”, “social preferences”, “positive reciprocity”, and “negative reciprocity” are included as explanatory variables. Furthermore, our variables for political identification

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<sup>2</sup> All estimations (and also all descriptive statistics as discussed above) were conducted with the statistical software package Stata.

and religious affiliation as well as the four socio-demographic control variables are incorporated. The estimation results in both models reveal the strong relevance of political identification and religious affiliation. As expected, a liberal-conservative political identification is significantly negatively correlated, whereas an ecological and (less robustly) a social policy identification is significantly positively correlated with the average values of both NEP scales. Furthermore, religious affiliations and especially Catholic and other religious affiliations are significantly negatively correlated with the average NEP scales. Finally, older respondents, females, respondents with a lower education, and respondents from Western Germany indicate significantly higher average NEP scales.

However, the main estimation results refer to the relationships with the six economic preferences. While the willingness to take risks and time preferences are not significantly correlated with any NEP scale, Table 10 reveals a significantly positive correlation between social preferences and positive reciprocity and the average values of both NEP scales. In contrast, trust is significantly negatively correlated with the average values of both NEP scales and negative reciprocity is significantly negatively correlated with “NEP based on dummy variables”. These estimation results clearly suggest the strong relationships between several economic preferences and especially trust, social preferences, positive reciprocity, and (less robust) negative reciprocity and the NEP scales and thus environmental values and attitudes. In particular, these estimation results clearly suggest the integration of economic preferences in econometric analyses that use specific NEP scales as explanatory factor for individual behavior since their non-consideration can lead to strong distortions due to omitted variable biases.

In order to test the robustness of our estimation results, we examine alternative model specifications in several directions. As discussed above, we first consider the OLS estimation of linear regression models by including the same dependent and explanatory variables. Furthermore, we still consider the ML estimation of two Generalized Poisson regression models, but include alternative indicators for risk and time preferences, trust, and reciprocal preferences. Instead of constructing a dummy variable for risk taking preferences, the underlying ordinal variable is included as explanatory variable, which is in line with, for example, Dohmen et al. (2012) and Fischbacher et al. (2015). In accordance with the construction of the second NEP scale “NEP based on ordinal variables”, the alternative variables of trust, positive reciprocity, and negative reciprocity are not based on the sum of values of dummy variables, but on the sum of the underlying values

of the ordinal variables. Finally, with respect to time preferences, the number of patient choices is included instead of the minimum discount factor, which is, for example, in line with Fischbacher et al. (2015). Table 11 reports the corresponding estimation results and reveals qualitatively extremely similar estimation results so that the main conclusions from the estimation results in Table 10 are validated.

#### ***4.2. Analysis of possible omitted variable biases***

In order to examine possible distorted estimation results if economic preferences are not included as control variables for an analysis of the effects of NEP scales on individual behavior, we econometrically consider the determinants of donation activities. The corresponding dummy variable takes the value one if the respondent has donated in 2015 for social, clerical, cultural, or charitable purposes. Table 12 reports the ML estimations of three binary probit models that include the same indicators for political identification and religious affiliations as explanatory variables as in the econometric analyses before. Furthermore, also the identical age and education variables are included. Due to the explanation of donations, we now additionally include the control variables “household size”, i.e. number of persons in the household of the respondent and “higher household income”, i.e. a dummy variable that takes the value if the household income of the respondent is higher than the median. However, the main interesting explanatory variables refer to the (first) NEP scale and the economic preferences as considered in the previous econometric analysis. While the first model specification includes all six economic preferences, the second model specification excludes “patience”, “social preferences”, “positive reciprocity”, and “negative reciprocity” and the third model specification even ignores all six economic preferences.

The preferred estimation results in the first column reveal an insignificant effect of the NEP scale on donation activities. In contrast, this positive effect becomes significant in the second model specification. Therefore, a typical econometric analysis that only controls for the effect of a restricted number of economic preferences (here risk taking preferences and trust) would incorrectly imply that environmental values and attitudes, measured by a NEP scale, positively affects donation activities. This result would not be surprising since many donations refer to the environmental sector, for which environmental values can be expected to be relevant. However, this estimated effect is obviously distorted due to the insignificant effect of the NEP scale if all economic preferences are

included as control variables. The significant effect in the restricted model is thus obviously caused by the underlying correlations between the NEP scale and the excluded economic preferences. This argumentation is strengthened by considering the estimation results in the third column that are based on the most restrictive model specification without any economic preferences as explanatory variables. The effect of the NEP scale is now again insignificant. This result can be explained by the strong significantly positive effect of trust on donation activities and the strong significantly negative correlation between trust and the NEP scales (see Table 10 and Table 11), which obviously destroys the significant positive effect of the NEP scale on donation activities in the second column of Table 12 if trust is incorrectly excluded as explanatory variable.

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## Tables

Table 1: Frequencies of the agreement with the six statements of the NEP scales, 3705 observations

	Totally agree	Rather agree	Undecided	Rather disagree	Totally disagree
“Humans have the right to modify the natural environment to suit their needs”	64 (1.73%)	379 (10.23%)	769 (20.76%)	1440 (38.87%)	1053 (28.42%)
“Humans are severely abusing the planet”	1519 (41.00%)	1605 (43.32%)	369 (9.96%)	136 (3.67%)	76 (2.05%)
“Plants and animals have the same right to exist as humans”	1738 (46.91%)	1295 (34.95%)	398 (10.74%)	212 (5.72%)	62 (1.67%)
“Nature is strong enough to cope with the impacts of modern industrial nations”	82 (2.21%)	357 (9.64%)	647 (17.46%)	1662 (70.69%)	957 (25.83%)
“Humans were meant to rule over the rest of nature”	70 (1.89%)	297 (8.02%)	581 (15.68%)	1248 (33.68%)	1509 (40.73%)
“The balance of nature is very delicate and easily upset”	1389 (37.49%)	1683 (45.43%)	401 (10.82%)	193 (5.21%)	39 (1.05%)

Table 2: Frequencies of the willingness to take risks, 3705 observations

Very willing to take risks	Rather willing to take risks	Undecided	Rather not willing to take risks	Not at all willing to take risks
67 (1.81%)	989 (26.69%)	965 (26.05%)	1406 (37.95%)	278 (7.50%)

Table 3: Choice table in the time preferences experiment

Choice situation	Option A (payment amount in one month)	Option B (payment amount in seven months)
1	80 Euro <input type="checkbox"/>	80 Euro <input type="checkbox"/>
2	80 Euro <input type="checkbox"/>	80,50 Euro <input type="checkbox"/>
3	80 Euro <input type="checkbox"/>	81 Euro <input type="checkbox"/>
4	80 Euro <input type="checkbox"/>	82 Euro <input type="checkbox"/>
5	80 Euro <input type="checkbox"/>	83,50 Euro <input type="checkbox"/>
6	80 Euro <input type="checkbox"/>	85,50 Euro <input type="checkbox"/>
7	80 Euro <input type="checkbox"/>	88 Euro <input type="checkbox"/>
8	80 Euro <input type="checkbox"/>	91 Euro <input type="checkbox"/>
9	80 Euro <input type="checkbox"/>	94,50 Euro <input type="checkbox"/>
10	80 Euro <input type="checkbox"/>	98,50 Euro <input type="checkbox"/>
11	80 Euro <input type="checkbox"/>	103 Euro <input type="checkbox"/>
12	80 Euro <input type="checkbox"/>	108 Euro <input type="checkbox"/>

Table 4: Frequencies of minimum discount factors, 3705 observations

Discount factors	0.741	0.777	0.812	0.847	0.879	0.909
Frequencies	1046 (28.23%)	209 (5.64%)	177 (4.78%)	203 (5.48%)	412 (11.12%)	436 (11.77%)
Discount factors	0.936	0.958	0.976	0.988	0.994	1
Frequencies	296 (7.99%)	164 (4.43%)	102 (2.75%)	80 (2.16%)	275 (7.42%)	305 (8.23%)

Table 5: Frequencies of the agreement with the three statements of the trust variable, 3705 observations

	Totally agree	Rather agree	Undecided	Rather disagree	Totally disagree
“In general, one can trust people”	65 (1.75%)	1096 (29.58%)	1477 (39.87%)	854 (23.05%)	213 (5.75%)
“Nowadays one cannot rely on anyone”	233 (6.29%)	973 (26.26%)	1191 (32.15%)	1051 (28.37%)	257 (6.94%)
“When dealing with strangers, it is better to be careful before you trust them”	953 (25.72%)	1698 (45.83%)	690 (18.62%)	313 (8.45%)	51 (1.38%)

Table 6: Choice table in the social preferences experiment (i.e. dictator game)

Amount for you	0 Euro	10 Euro	20 Euro	30 Euro	40 Euro	50 Euro	60 Euro	70 Euro	80 Euro	90 Euro	100 Euro
Amount for another randomly selected person	100 Euro	90 Euro	80 Euro	70 Euro	60 Euro	50 Euro	40 Euro	30 Euro	20 Euro	10 Euro	0 Euro
Decision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 7: Frequencies of payment amounts (in Euro) for other participants in the social preferences experiment (i.e. dictator game), 3705 observations

Payments	0	10	20	30	40	50
Frequencies	626 (16.90%)	208 (5.61%)	336 (9.07%)	396 (10.69%)	378 (10.20%)	1670 (45.07%)
Payments	60	70	80	90	100	
Frequencies	24 (0.65%)	16 (0.43%)	21 (0.57%)	15 (0.40%)	15 (0.40%)	

Table 8: Frequencies of the agreement with the three statements of positive reciprocity and with the three statements of negative reciprocity, 3705 observations

	Totally agree	Rather agree	Undecided	Rather disagree	Totally disagree
“When someone does me a favor I am willing to return it”	1882 (50.80%)	1672 (45.13%)	123 (3.32%)	15 (0.40%)	13 (0.35%)
“I make a special effort to help someone who has helped me before”	1285 (34.68%)	2021 (54.44%)	330 (8.91%)	54 (1.46%)	15 (0.40%)
“I am willing to pay costs to help someone who has helped me before”	973 (26.26%)	2062 (55.65%)	690 (18.62%)	313 (8.45%)	51 (1.38%)
“If I am treated very unjustly, I will take revenge at the first occasion, no matter what the cost”	141 (3.81%)	499 (13.47%)	1108 (29.91%)	1270 (34.28%)	687 (18.54%)
If someone puts me in a difficult position, I will do the same to him/her”	94 (2.54%)	368 (9.93%)	1042 (28.12%)	1529 (41.27%)	672 (18.14%)
If someone offends me, I will also offend him/her	143 (3.86%)	634 (17.11%)	1099 (29.66%)	1334 (36.01%)	495 (13.36%)



Table 9: Descriptive statistics of dependent and explanatory variables, 3705 observations

Variables	Mean	Standard deviation	Minimum	Maximum
NEP based on dummy variables	4.615	1.50	0	6
NEP based on ordinal variables	18.182	3.77	0	24
Risk taking preferences	0.285	0.45	0	1
Patience	0.864	0.10	0.741	1
Trust	0.765	0.91	0	3
Social preferences	0.341	0.20	0	1
Positive reciprocity	2.671	0.67	0	3
Negative reciprocity	0.507	0.89	0	3
Conservative identification	0.224	0.42	0	1
Liberal identification	0.338	0.47	0	1
Social identification	0.637	0.48	0	1
Ecological identification	0.489	0.50	0	1
Catholic affiliation	0.288	0.45	0	1
Protestant affiliation	0.320	0.47	0	1
Other religious affiliation	0.043	0.20	0	1
No religious affiliation	0.349	0.48	0	1
Age	48.720	15.10	18	87
Female	0.505	0.50	0	1
Higher educational degree	0.282	0.45	0	1
Eastern Germany	0.209	0.41	0	1

Table 10: Maximum Likelihood estimates (robust z-statistics) in Generalized Poisson regression models, 3705 observations

Explanatory variables	Dependent variable: NEP based on dummy variables	Dependent variable: NEP based on ordinal variables
Risk taking preferences	-0.008 (-0.88)	0.000 (0.03)
Patience	0.031 (0.73)	0.016 (0.49)
Trust	-0.027*** (-5.83)	-0.024*** (-6.57)
Social preferences	0.045** (2.10)	0.044*** (2.68)
Positive reciprocity	0.049*** (6.38)	0.035*** (6.51)
Negative reciprocity	-0.012** (-2.33)	-0.006 (-1.37)
Conservative identification	-0.056*** (-4.97)	-0.057*** (-6.61)
Liberal identification	-0.040*** (-4.40)	-0.034*** (-4.81)
Social identification	0.029*** (2.91)	0.016** (2.17)
Ecological identification	0.111*** (11.47)	0.100*** (14.07)
Catholic affiliation	-0.047*** (-4.27)	-0.043*** (-5.09)
Protestant affiliation	-0.018* (-1.76)	-0.025*** (-3.16)
Other religious affiliation	-0.087*** (-3.95)	-0.058*** (-3.71)
Age	0.001*** (2.72)	0.001*** (3.38)
Female	0.078*** (9.06)	0.066*** (10.49)
Higher education	-0.038*** (-3.92)	-0.038*** (-5.29)
Eastern Germany	-0.033*** (-3.00)	-0.022*** (-2.69)
Constant	1.297*** (26.32)	2.731*** (77.33)

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

Table 11: OLS estimates (robust z-statistics) in linear regression and Maximum Likelihood estimates (robust z-statistics) in Generalized Poisson regression models, robustness checks, 3705 observations

	OLS estimation in linear regression models		ML estimation in Generalized Poisson regression models with alternative indicators for the economic preferences	
Explanatory variables	Dependent variable: NEP based on dummy variables	Dependent variable: NEP based on ordinal variables	Dependent variable: NEP based on dummy variables	Dependent variable: NEP based on ordinal variables
Risk taking preferences	-0.032 (-0.63)	-0.024 (-0.18)	-0.009** (-2.19)	-0.004 (-1.38)
Patience	0.317 (1.32)	0.365 (0.60)	0.000 (0.45)	0.000 (0.02)
Trust	-0.150*** (-5.66)	-0.434*** (-6.49)	-0.014*** (-7.46)	-0.014*** (-9.82)
Social preferences	0.295** (2.44)	0.850*** (2.80)	0.043** (2.03)	0.038** (2.40)
Positive reciprocity	0.299*** (7.35)	0.638*** (6.76)	0.024*** (8.91)	0.025*** (11.89)
Negative reciprocity	-0.067** (-2.36)	-0.119 (-1.57)	-0.009*** (-5.32)	-0.008*** (-5.75)
Conservative identification	-0.342*** (-5.58)	-1.062*** (-6.87)	-0.057*** (5.13)	-0.060*** (-7.16)
Liberal identification	-0.243*** (-4.75)	-0.637*** (-4.87)	-0.039*** (-4.35)	-0.032*** (-4.73)
Social identification	0.173*** (3.09)	0.309** (2.24)	0.027*** (2.71)	0.013* (1.74)
Ecological identification	0.666*** (12.83)	1.882*** (14.37)	0.106*** (10.99)	0.095*** (13.62)
Catholic affiliation	-0.259*** (-4.09)	-0.777*** (-4.94)	-0.046*** (-4.24)	-0.041*** (-5.05)
Protestant affiliation	-0.085 (-1.45)	-0.451*** (-3.04)	-0.015 (-1.53)	-0.022*** (-2.89)
Other religious affiliation	-0.440*** (-3.72)	-1.050*** (-3.69)	-0.093*** (-4.24)	-0.065*** (-4.27)
Age	0.004*** (2.62)	0.012*** (3.22)	0.001*** (2.62)	0.001*** (3.39)
Female	0.454*** (9.53)	1.245*** (10.61)	0.067*** (7.76)	0.055*** (8.88)
Higher education	-0.220*** (-4.09)	-0.703*** (-5.29)	-0.032*** (-3.39)	-0.032*** (-4.60)
Eastern Germany	-0.210*** (-3.30)	-0.430*** (-2.75)	-0.032*** (-2.93)	-0.021*** (-2.59)
Constant	3.121*** (11.42)	15.075*** (23.21)	1.330*** (28.95)	2.701*** (75.86)

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

Table 12: Maximum Likelihood estimates (robust z-statistics) in binary probit models, dependent variable: donation activities, 3705 observations

Explanatory variables			
NEP based on dummy variables	0.010 (0.63)	0.029** (1.96)	0.020 (1.32)
Risk taking preferences	0.189*** (3.85)	0.194*** (4.00)	--
Patience	0.319 (1.39)	--	--
Trust	0.144*** (5.72)	0.183*** (7.39)	--
Social preferences	0.626*** (5.75)	--	--
Positive reciprocity	0.173*** (5.04)	--	--
Negative reciprocity	-0.146*** (-5.68)	--	--
Conservative identification	0.090* (1.65)	0.073 (1.37)	0.054 (1.01)
Liberal identification	0.072 (1.48)	0.081* (1.67)	0.122** (2.56)
Social identification	0.225*** (4.43)	0.263*** (5.23)	0.297*** (5.95)
Ecological identification	0.254*** (5.08)	0.265*** (5.35)	0.300*** (6.11)
Catholic affiliation	0.436*** (7.84)	0.447*** (8.14)	0.454*** (8.32)
Protestant affiliation	0.392*** (7.34)	0.411*** (7.76)	0.430*** (8.20)
Other religious affiliation	0.797*** (6.53)	0.844*** (6.94)	0.846*** (7.03)
Age	0.009*** (6.31)	0.010*** (6.85)	0.010*** (6.72)
Higher education	0.231*** (4.53)	0.231*** (4.56)	0.275*** (5.51)
Household size	0.095*** (4.36)	0.102*** (4.70)	0.096*** (4.45)
Higher household income	0.218*** (3.78)	0.197*** (3.46)	0.229*** (4.05)
Constant	-2.355*** (-9.37)	-1.682*** (-13.27)	-1.495*** (-12.08)

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