



LUND UNIVERSITY
School of Economics and Management

Economic growth or the environment

A cross-country study on the foundations of pro-environmental preferences

Meera Saskia Damaraju
me1464da-s@student.lu.se

Supervisor: Erik Wengström
Department of Economics
Lund University
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Abstract

Cross-national surveys have pointed out that environmental concern has been decreasing across the globe over time due to a focus on economic growth. While cultural and socio-demographic factors determine the degree of a lack of environmental concern, preference measures namely risk, patience, positive reciprocity, negative reciprocity, altruism and trust have found to be determinants as well. This thesis explores which of these core economic preferences drive environmental concern at a regional level by using variables from the Global Preferences Survey and the Joint 2017 wave of the European Value Survey and World Values Survey. Negative reciprocity is found to be significant. This paper contributes three elements to the literature: how preference measures have an impact on pro-environmental concern at the regional level, negative reciprocity being a significant measure for environmental concern and a regional key that connects two different cross-country surveys.

Keywords: Behavioural Economics, Global Preferences Survey, Environmental concern, Preference variation.

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1. Introduction

The largest concern over the last few years has been environmental change due to issues such as climate warming, pollution and biodiversity loss (Bloom 1995). Cross-national surveys across both developing and developed countries have indicated that more concern over economic growth than the multitude of environmental issues that exist is the leading cause of a nation's environmental problems (Bloom 1995). This debate has existed since the 1970s when in the UN World Conference in 1972, developing countries made it clear that while prioritising the environment was a worthy cause, slowing economic growth in its favour was not on the agenda (Beckerman 1992). Among developed countries too, between affluent and less-affluent members, the vast majority appreciate the improvements in living standards over the environmental agenda of more affluent members of society (Beckerman 1992). Concurrently, as economic growth slows down (Beckerman 1992) recent surveys such as the 2010 International Social Survey Programme (ISPP) have seen a decrease in this environmental concern as well (Franzen and Vogl 2013).

Environmental concern is defined as the degree to which people are aware of problems regarding the environment and support efforts to solve them (Tam and Chan 2018). This varies from pro-environmental behaviour which is defined as the environmental action that seeks to minimise the negative impact of one's actions on the natural and built world (Pothitou et al. 2016). Classically in the literature, environmental problems have been analysed as market failures where private actions generate negative environmental externalities (Baddeley 2011). While most individuals don't act on their concern resulting in the phenomenon titled as the concern-behaviour gap (Tam and Chan 2018) the drivers for both concern and behaviour are remarkably similar. At the individual level, behaviours are influenced by internal factors such as environmental awareness, values and attitudes and external factors such as social norms (Pothitou et al. 2016). As human activity itself is a key driver in these environmental challenges, identifying determinants and drivers of pro-environmental concern through a behavioural lens are essential to policy makers who construct strategies to nudge the public in a pro-environmental dimension (Lades et al. 2021).

Decision making for individuals are largely driven by preferences. These include risk, when rewards are received (patience), and pro-social traits such as reciprocity, altruism and trust (Falk et al. 2018). Measures such as risk and patience have been linked to not just investment in clean technologies but also when to invest in such technologies (Lades et al. 2021). Negative reciprocity has been linked to labor markets and life outcomes previously (Lades et al. 2021). Altruism and positive reciprocity have been connected to the adoption of green programs (Lades et al. 2021). Preference measures are also driven by economic, geographical and cultural patterns (Falk et al. 2015). Thus, this thesis

explores what core economic preferences drive environmental concern. This is done by using two-cross country surveys namely the Global Preferences Survey (GPS) and the Joint 2017 wave of the European Value Survey (EVS) and World Values Survey (WVS) at the regional level.

This is the first paper of sorts that aims to look at how preference measures have an impact on a particular pro-environmental concern at the regional level. In addition to finding that negative reciprocity across regions results in lower environmental concern, a key that maps the regions between the two surveys has been done.

The rest of this paper is organized as follows. Section 2 highlights the literature on attitudes and pro-environmental concern. Section 3 highlights the data set that is used for examination. Section 4 builds on the variables and models used for analysis. Section 5 consists of results from the analysis. Section 6 discusses the analysis along with key challenges and limitations before concluding. This paper also consists of an Appendix (Appendix I) consisting of the cross regional mapping between the two surveys.

2. Theoretical background

Preference measures are often driven by variation in age, gender, education, socio-economic status and political views (Baddeley 2011), (Franzen and Vogl 2013), (Sarigöllü 2009), (Falk et al. 2018). Individual level variation is largely due to within country heterogeneity (Falk et al. 2015). While certain relationships between preferences and socio-demographics may be common across all cultures, others are more culturally or institutionally specific thus affecting developed and developing countries differently (Falk et al. 2015). Largely, with respect to environmental concern, single country studies have demonstrated that the younger, the more educated and the more affluent an individual is, higher the concern for the environment (Sarigöllü 2009).

Altruism is defined as the behaviour that sacrifices the altruist's utility for the utility of another (Simon 1993). As per the Schwartz model drawn from the social science literature, altruist behaviour can be extended to the participation in a range of environmentally relevant behaviours such as energy conservation, recycling etc. (Stern and Dietz 1994). The application of such an attitude demonstrates an overarching concern between and across communities, regions and countries (Stern and Dietz 1994). It is expected that this is positively correlated with environmental concern.

Patience is measured as rate of time preference i.e. a function that reflects the amount of present consumption one would be willing to forego in order to increase future consumption by a certain amount (Bradford et al. 2017). Patience has been linked positively to comparative development (Franzen and Vogl 2013). Thus, the more affluent a country, the more patient its individuals will be and higher the environmental concern.

Reciprocity is understood as being as the response to an action (Fehr and Gächter 2000). If an individual reacts in a cooperative manner towards a friendly action, then it is termed as positive reciprocity. (Fehr and Gächter 2000). Conversely, if an individual reacts in a hostile or retaliatory manner then it is termed as negative reciprocity (Fehr and Gächter 2000). Reciprocity can be viewed as an "egoistic value", where individuals only participate in protecting the environment when it affects an individual personally (Stern and Dietz 1994). It is expected that positive reciprocity influences a higher environmental concern and vice-versa for negative reciprocity.

Trust, while having multiple connotations, is defined in the institutional context as the mutual confidence that no party to an exchange will exploit the other's vulnerability (Wilson 2000). Trust is significantly correlated with economic development (Falk et al. 2018). However, trusting others results in more concern for public goods. Generally trusting others enhances the belief that in a cooperative setting, others are also maintaining public goods (Baddeley 2011). Thus, the greater the trust, the greater the willingness to contribute to environmental protection. Cooperation, trust and reciprocity on a larger

scale are required in cooperative frameworks as this establishes credibility and goodwill (Baddeley 2011). General trust in other people is also associated with environmental concern (Franzen and Vogl 2013).

Risk or uncertainty regarding decisions about the environment are reflected in scenarios such as investments in more environmentally friendly products. Often, the riskier a scenario, the more the tendency to drift towards inaction and apathy due to self-interest and underestimating the impact of an action (Baddeley 2011). It is expected that this negatively impacts environmental concern.

Certain preference pairs are often correlated with each other giving rise to different sets of preference profiles (Falk et al. 2018). Exploring these buckets can demonstrate how environmental concern may be affected by a combination of these preferences. They can be categorised into two buckets namely:

Time traits: These consist of risk tolerance, patience and negative reciprocity. Risk tolerance and patience are positively correlated at the country level (Falk et al. 2018). Negative reciprocity is positively correlated only with patience. Time traits are prevalent in the creation of goals and feedback (Baddeley 2011).

Pro-Social Traits: These consist of positive reciprocity, altruism and trust. The correlation between altruism and positive reciprocity is particularly high with trust being greater when people are more positively reciprocal (Falk et al. 2018).

Among socio-economic traits, income has the greatest impact on environmental concern. Wealthier individuals have lesser economic concerns and thus have more time to devote towards examining environmental concerns (Franzen and Vogl 2013). An individual income effect exists i.e. those with higher incomes not only consume more private goods but also have a higher willingness to pay for better public goods.

Based on the above literature, the following is hypothesized:

Environmental concern is positively impacted by preference measures of altruism, patience, positive reciprocity and trust. Environmental concern is also negatively impacted by measures of risk and negative reciprocity.

In terms of correlated preferences, it is hypothesized that time preferences inclusive negative reciprocity will lead to a decrease in environmental concern as two of these preference measures are correlated. Further, higher the degree of pro-social traits in a region, higher the environmental concern.

3. Data

3.1 Overview

The sample is primarily drawn from two data sources: The Global Preferences Survey and the World Value Survey, along with other sources. The GPS covers questions across various levels of aggregation to identify heterogeneity by cataloguing preference variation across countries. The survey covers 80,000 respondents representing samples from over 76 countries (Falk et al. 2018). The samples collected from each country are representative, thus it is a uniform geographic and economic representative for countries that have been covered. Further, the survey data has undergone a rigorous experimental validation and selection procedure resulting in a robust set of preference measures (Falk et al. 2018).

The other survey used is the Joint Wave of the European Value Survey and the World Value Survey published in 2017. The European Values Survey committee was responsible in carrying out the survey in the European countries, while the World Value Survey committee was responsible in carrying out and planning the surveys in countries outside Europe. However, the surveys did overlap in a few countries. Each survey committee developed their own draft questionnaires independently as per their organisation guidelines respectively. Each survey consisted of both common questions and questions unique to the survey. Common questions are marked in yellow for both surveys.

The variable of interest for environmental concern taken from this survey is the following:

Here are two statements people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view?

1- Protecting the environment should be given a priority, even if it causes slower economic growth and some loss of jobs.

2- Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent.

3- Other.

As option 3) Other is unclear, it is dropped. This only consists of 0.03% of our sample prior to merging and does not cause a significant difference.

Macroeconomic controls are obtained from the following sources:

- Adjusted GDP per capita is derived from the World Bank.
- The EPI Index is obtained from the Environmental Performance Index published by the Yale Center for Environmental Law & Policy.

3.2 Data Selection

In order to merge data at the regional level and explore regional level variation, connecting the regions across surveys was required. The GPS survey consisted of region names that were directly provided in the data set - these consisted of either local names or larger regions itself. The Joint survey, due to the nature of its spread consisted of two regional identifiers. The EVS component of the survey was identified by the NUTS-1 region and NUTS-2 region. These are regional classifications of territories done by the Eurostat (Önnerfors et al. 2018). The NUTS-1 region identifies a larger general region while NUTS-2 identifies a specific state or a province. The classification uses uniform conventions to define regions in comparable manners based on diverse physical, demographic and administrative situations (Önnerfors et al. 2018). The WVS component of the survey used the ISO-3166-2 classification i.e. the regional classification defined by the International Organisation for Standardisation. Due to the nature of variation in region names across the data, manually identifying and cross-checking regions for both sets of surveys was done.

Countries that were not covered by both sets of surveys were dropped. Regions that were not covered by either the EVS (example: the NUTS-2 level coding missing for Germany), the WVS (due to non-inclusion in code-book for mapping) were dropped. For regions that were coded for both NUTS-2 and EVS in the joint survey, priority was assigned to the NUTS-2 level of classification. Mapping was done if more than 80 percent of the name was similar. The data was coordinated primarily with the NUTS-2 regional sub-coding due to there being less missing variables. As the GPS survey data set already consisted of regions which fell into the NUTS-2 category, often two or more regions were merged with the same NUTS-2 coding. This increased the sample size for certain regions. For regions which were larger but consisted of multiple observations that could potentially affect the final data set (example: London having multiple specified regions in the GPS data set while the Joint Survey only had the NUTS-2 regional mapping), the regions were mapped to the largest urban population region as it has been found that city controls do have an effect on environmental concern (Franzen and Vogl 2013). Once mapping was done, unique identities that tied the region with the country was created as certain countries shared common regional names (example: two countries both sharing the name “East region”).

Before merging, all individual regional statistics had to be averaged at the regional level as unequal data frames cannot be merged. However, the usage of a categorical dependent variable at the individual level called for the transformation of the variable prior to taking the average at the regional level. Item Response Theory models can be used to transform categorical data into continuous, measurable data. However, Item Response Theory models such as the Rasch Model function which build on the Likert

scale, function on the primary assumption that higher the value, higher the better trait. Further, while these models may be applicable at the individual level, on taking the mean of these variables, the transformation effect is lost and interpreting it could be erroneous. Thus, a proportionate system is adopted and then calculate the average per region before merging the two data sets to obtain out completed data frame.

The final cross-merged sample consists of 606 regions across 50 countries (Table 3.1).

As the variables have already been previously standardised at the individual level, they continue to be normally distributed at the regional level as well. Preference variation for risk and negative reciprocity across countries demonstrate downwards trends (Figure 3.1). Measures such as patience, altruism, positive reciprocity and trust demonstrate slight upward trends.

At the regional level (Figure 3.2), the preferences are distributed differently in addition to clearer trends. Patience, risk, negative reciprocity, altruism and trust tend to be more clustered around the mean. Altruism and trust are more tightly clustered than the aforementioned preferences. However the clustering for positive reciprocity demonstrates that most regions do have a higher tendency to be positively reciprocal than not in spite of age, gender and socio-economic differences.

COUNTRY	Environmental Concern.	Patience	Risk Tolerance	Positive Reciprocity	Negative Reciprocity	Altruism	Trust
Argentina	0.502	-0.290	-0.263	0.139	-0.153	-0.076	-0.077
Australia	0.555	0.055	0.053	0.043	0.086	0.093	0.088
Austria	0.544	0.242	-0.091	0.170	-0.018	0.002	0.079
Bangladesh	0.479	0.009	-0.102	0.203	0.073	0.770	-0.024
Bolivia	0.585	-0.006	0.028	0.127	-0.021	0.034	0.000
Bosnia and Herzegovina	0.430	-0.161	-0.038	0.078	0.000	0.024	-0.025
Brazil	0.558	-0.215	-0.257	0.392	-0.052	0.488	0.009
Chile	0.532	-0.210	0.080	0.226	-0.211	-0.018	-0.065
China	0.578	0.149	0.007	0.307	0.032	0.274	0.172
Colombia	0.570	-0.358	-0.120	0.135	-0.283	0.061	0.055
Czechia	0.543	0.162	-0.025	-0.244	0.036	-0.500	-0.086
Egypt	0.454	-0.425	-0.374	0.522	0.067	0.521	0.438
Estonia	0.570	0.000	0.000	0.000	0.000	0.000	0.000
Finland	0.576	0.223	-0.233	0.099	-0.045	-0.124	0.000
France	0.528	0.300	-0.033	-0.149	0.098	-0.096	-0.136
Georgia	0.570	0.000	0.000	0.332	0.000	0.000	0.000
Germany	0.570	0.432	-0.079	-0.061	-0.094	-0.066	-0.083
Greece	0.530	-0.302	-0.241	-0.005	0.294	-0.066	-0.309
Guatemala	0.580	-0.274	-0.250	-0.058	-0.301	-0.186	-0.141
Hungary	0.561	-0.491	-0.600	-0.009	-0.069	-0.257	0.515
Indonesia	0.593	-0.235	-0.134	0.373	0.094	0.147	0.125
Islamic Republic of Iran	0.557	-0.179	0.149	0.495	0.101	0.432	0.020
Iraq	0.481	-0.275	0.001	-0.298	0.093	-0.276	0.068
Italy	0.566	0.203	-0.043	0.249	0.167	0.426	-0.072
Japan	0.459	0.081	-0.217	-0.211	0.031	-0.139	-0.254
Jordan	0.526	0.000	0.000	0.124	0.000	0.245	0.000
Kazakistan	0.502	-0.070	0.127	0.182	-0.009	0.039	-0.025
Korea, Republic of	0.516	0.095	-0.042	-0.064	0.321	0.251	-0.049
Lithuania	0.457	0.000	0.000	0.000	0.000	0.000	0.000
Mexico	0.520	-0.003	-0.005	-1.065	0.083	-0.710	-0.181
Netherlands	0.547	0.842	0.140	-0.060	0.139	-0.066	0.349
Nicaragua	0.553	-0.494	-0.515	-0.651	-0.302	-0.304	-0.045
Nigeria	0.485	-0.208	0.375	-0.216	-0.004	-0.185	-0.082
Pakistan	0.477	0.093	0.053	0.065	0.266	-0.262	0.000
Peru	0.528	0.000	0.000	0.098	0.000	0.000	0.000
Philippines	0.595	0.129	0.337	0.228	-0.054	0.403	0.170
Poland	0.484	0.081	-0.078	-0.097	0.098	-0.208	-0.127
Portugal	0.575	-0.087	-0.477	0.082	0.000	0.000	0.000
Republic of Serbia	0.487	-0.060	0.000	0.378	0.000	-0.120	0.000
Romania	0.484	-0.050	-0.019	-0.015	0.000	0.018	0.000
Russia Federation	0.512	-0.041	-0.091	-0.044	0.000	0.011	0.000
Spain	0.547	0.301	-0.231	0.341	0.076	-0.155	0.244
Sweden	0.631	0.386	0.031	-0.005	-0.083	-0.098	0.114
Switzerland	0.587	0.131	-0.084	0.097	0.001	0.136	0.030
Thailand	0.521	-0.260	-0.106	0.363	0.262	-0.192	0.349
Ukraine	0.506	-0.120	-0.089	0.128	-0.092	-0.094	-0.048
United Kingdom	0.530	0.110	-0.002	-0.022	-0.002	0.041	0.111
United States	0.527	0.702	0.079	0.150	-0.028	0.349	0.242
Vietnam	0.589	0.107	-0.226	-0.389	-0.275	-0.127	0.036
Zimbabwe	0.513	-0.162	0.645	-0.065	-0.029	0.044	-0.311

Table 3.1 Average preference variation across countries.

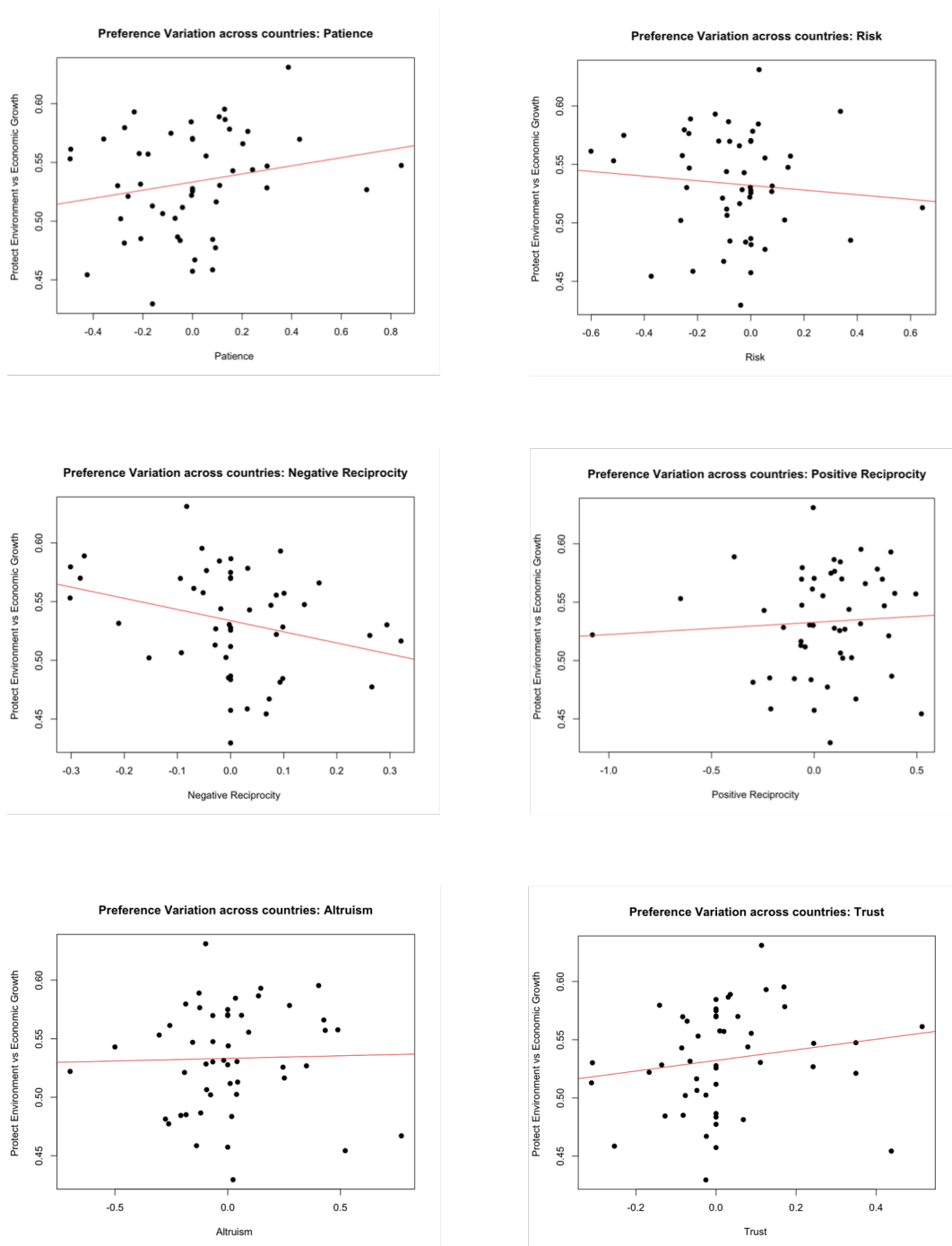


Figure 3.1 Preference variation across countries

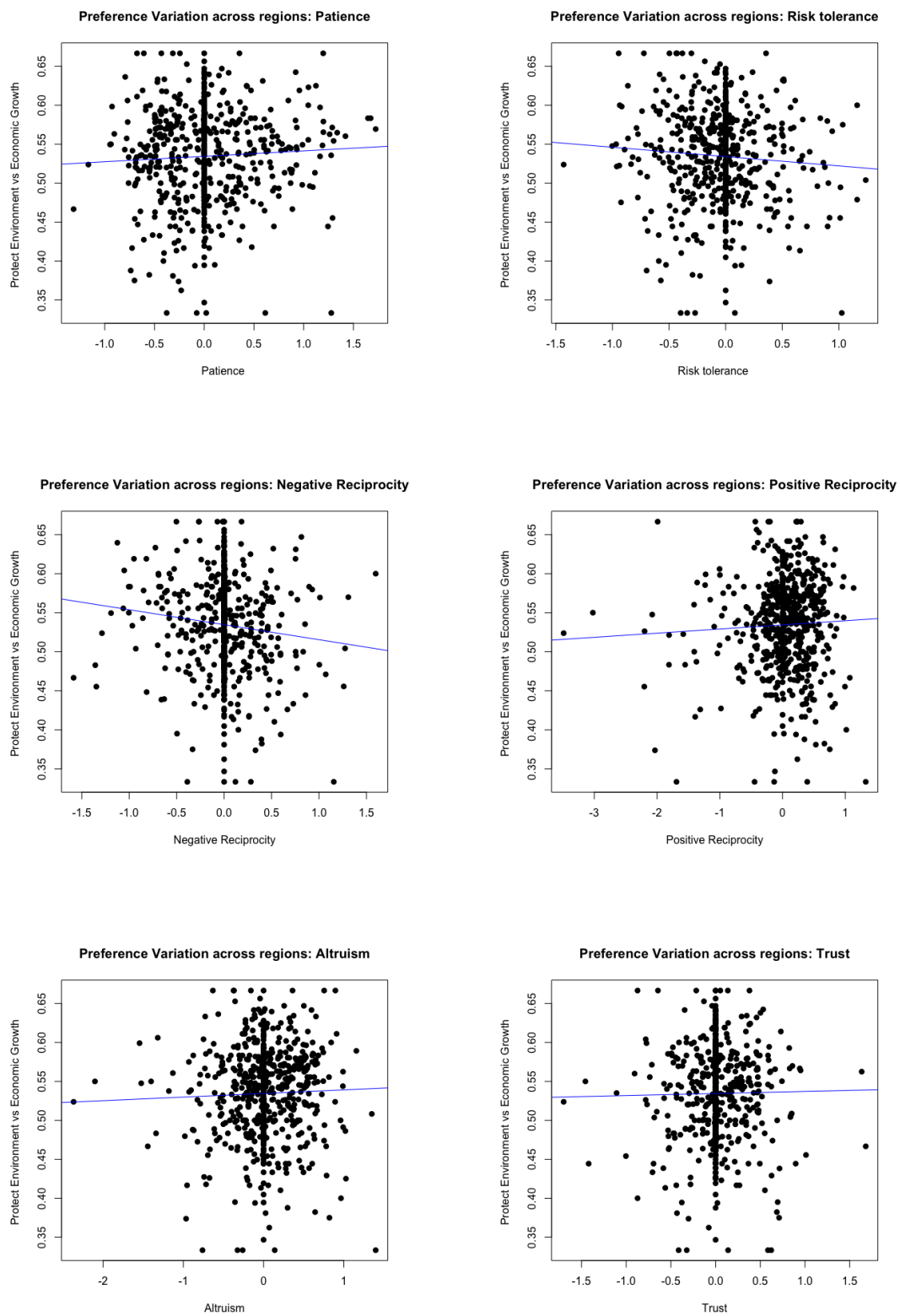


Figure 3.2 Preference variation across regions

4. Empirical strategy

4.1 Variable selection

A correlation plot for cross-regional preferences demonstrate that environmental concern is primarily negatively correlated with negative reciprocity. With respect to the time traits, patience and risk also demonstrate significant positive correlation as mentioned in (Falk et al. 2018). Negative reciprocity is associated with all 3 i.e. environmental concern, patience and risk.

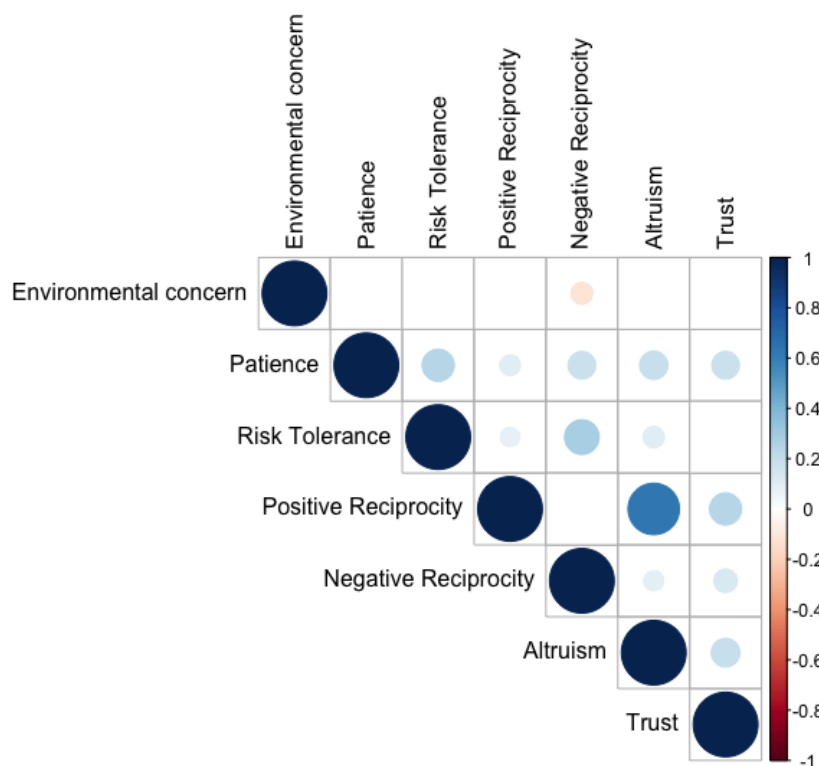


Figure 4.1 Correlation Matrix for Preferences (Significant variables only).

Thus, based on the above we utilise the following variables in the model. For the preference measures, there were both quantitative and qualitative components (Falk et al. 2018). The quantitative component consisted of a “willingness to act” and the qualitative assessment consisted of self-assessments. The variables are thus an endogenously weighted measure of the following components which are condensed into one. Further, for ease of use, all variables had already been standardised at the individual level (Falk et al. 2018).

Patience: A sequence of five interdependent quantitative questions related to when the participant would choose to receive a payment. The qualitative component measured

a willingness to act, the question being : “how willing are you to give up something that is beneficial today in order to benefit more from that in the future” (Falk et al. 2018).

Risk Taking: A sequence of five interdependent questions that had the respondent either draw an amount x or receive nothing versus an amount y as a sure payment, presented in a tree logic. The qualitative component consisted of self-assessing how willing or unwilling the respondent would be to taking risks, on a scale from 0 to 10 (Falk et al. 2018).

Positive reciprocity: The quantitative component consisted of how much the respondent would award a stranger who helped them at an expense. The qualitative component consisted of a self -assessment measuring the respondent’s willingness to return a favour (Falk et al. 2018).

Negative reciprocity: Consisted of three components. A self-assessment that asking if the respondent was treated unjustly, would they take revenge at the first occasion in spite of a (theoretical) cost involved. The Willingness to act component included two questions. The first one asked how much the respondent would be willing to punish someone who treated them unfairly even if it cost the respondent. The second one questioned how willing would the respondent be at punishing someone who treats others unfairly, even if it cost the respondent (Falk et al. 2018).

Altruism: Consisted of two components. Firstly, a hypothetical situation that asked the respondent how much they would donate to a good cause if they happened to unexpectedly receive a large specified sum of money. The second component involved measuring their willingness to act by asking the respondent how much would they would be willing to give to a good cause without expecting anything in return (Falk et al. 2018).

Trust: A self-assessment question that asked the respondent if they assumed that people only have the best intentions (Falk et al. 2018).

The main variable of concern is drawn from the Joint survey. Environmental Concern is defined as a choice variable between the options of economic growth or protecting the environmental that takes the value of 1 when the respondent answers economic growth and 2, when the respondent answers protecting the environment. At the regional level, higher the proportion, higher the environmental concern.

The socio-demographic variables of age, gender, cognitive ability and income are included. Cognitive ability is a variable for education where the respondent was asked how good they were at math on a Likert scale from 1 to 10 (Falk et al. 2018). Income has been extracted as the average per region.

The following macroeconomic controls were included as well:

Purchasing power adjusted GDP per capita: This is defined as the per capita values for GDP expressed in current international dollars converted by purchasing power parity (PPP) conversion factor (2021). This is an average value across ten years.

EPI index: The 2020 Environmental Performance Index provides a summary of the state of sustainability based on 32 performance indicators across 11 issue categories ([epi2020](#)). Data sources for the construction of the 2020 EPI Index date back to the most recent published data which between 2017 and 18.

4.2 Model Selection

Prior studies have implemented multi-level models to examine both individual and country level effect ([Franzen and Vogl 2013](#)). Running a varying intercept model with cross-regional variation only attests to the presence of such variation. However, extending this model to consider cross-level interaction effects so that regional slopes may depend on particular cultural contexts requires well-defined theoretical hypotheses ([Franzen and Vogl 2013](#)). As preference measures prior to this have been studied only in terms of country level contexts, an OLS model and a country fixed effects model have been constructed instead.

The generalised preference measure regression is written as:

$$y_{ij} = \alpha + \beta_1 \text{preference}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{gender}_{ij} + \beta_4 \text{Education}_{ij} + \beta_5 \text{Income}_{ij} + \beta_6 \text{AdjustedGDP}_j + \beta_7 \text{EPIIndex}_j + \varepsilon_{ij} \quad (4.1)$$

Where y is the proportion of environmental concern, preference consists of patience, risk tolerance, positive reciprocity, negative reciprocity, altruism and trust; age, gender, cognitive ability and income are the average regional socio-demographic variables; adjusted GDP and the EPI Index have been included as country level controls; i denotes region and j denotes country.

Building on this, two sets of measures are analysed as well. These are time-related preference measures and pro-social preferences.

Time preference measures are written as:

$$y_{ij} = \beta_1 \text{Patience}_{ij} + \beta_2 \text{RiskTolerance}_{ij} + \beta_3 \text{age}_{ij} + \beta_4 \text{gender}_{ij} + \beta_5 \text{CognitiveAbility}_{ij} + \beta_6 \text{Income}_{ij} + \beta_7 \text{AdjustedGDP}_j + \beta_8 \text{EPIIndex}_j + \varepsilon_{ij} \quad (4.2)$$

$$y_{ij} = \beta_1 \text{Patience}_{ij} + \beta_2 \text{RiskTolerance}_{ij} + \beta_3 \text{NegativeReciprocity}_{ij} + \beta_4 \text{age}_{ij} + \beta_5 \text{gender}_{ij} + \beta_6 \text{CognitiveAbility}_{ij} + \beta_7 \text{Income}_{ij} + \beta_8 \text{AdjustedGDP}_j + \beta_9 \text{EPIIndex}_j + \varepsilon_{ij} \quad (4.3)$$

The pro-social measure is written as:

$$y_{ij} = \beta_1 \text{PositiveReciprocity}_{ij} + \beta_2 \text{Altruism}_{ij} + \beta_3 \text{Trust}_{ij} + \beta_4 \text{age}_{ij} + \beta_5 \text{gender}_{ij} + \beta_6 \text{CognitiveAbility}_{ij} + \beta_7 \text{Income}_{ij} + \beta_8 \text{AdjustedGDP}_j + \beta_9 \text{EPIIndex}_j + \varepsilon_{ij} \quad (4.4)$$

Where the variables are defined and indexed as above.

5. Results

In order to explore regional variation each individual preference is analysed first, with and without country fixed effects. As aforementioned in the data portion, we include socio-demographic variables for both models along with the EPI Index and Adjusted GDP at the regional level. Two models are run: An OLS model with standard errors pooled at the country level and an OLS model with country fixed-effects. Clustering has been done at the country level due to the underlying unobserved correlation of some correlations existing within regions between countries (Abadie et al. 2017). The second model consists of a fixed effects model.

5.1 Individual measures

In table 5.1 and table 5.2, age is the only variable that is significant (model 1) implying that an increase in age results in a decrease in environmental concern. However, the fixed effects model demonstrates a decrease in environmental concern when more women are present in a region. However, this could be an endogenous output as the data is overfit to the present model (as demonstrated by the high R^2 measures. The similarities between patience and positive reciprocity thus, might be due to their high correlation.

Risk tolerance is significant (albeit at the 10% level) (Table 5.3, model 1). However, the decrease in concern is almost negligible, as an increase in the ability to take risks results in a decrease in environmental concern. This may be due to risk worthiness being associated with investment opportunities and consequently a focus on economic growth at the expense of the environment.

An increase in average negative reciprocity of a region results in a significant decrease in environmental concern by 0.022 points (Table 5.4, model 1). This is surprising given that negative reciprocity has never been directly pinpointed to concern in the environmental literature. Gender acts in the same manner as it has for other preference models (Table 5.4, model 2).

Altruism and trust (Table 5.5 and 5.6 respectively) are insignificant, contradicting parts of the literature that have identified altruism as being responsible for environmental concern.

Table 5.1 Regression Results for individual time preference measures: Patience

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS test</i>	<i>OLS</i>
	(1)	(2)
Patience	0.003 (0.007)	0.001 (0.006)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.031 (0.076)	-0.127** (0.064)
Cognitive Ability	0.050 (0.049)	-0.019 (0.050)
Income	-0.027 (0.191)	0.039 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0001 (0.0004)	0.005*** (0.001)
Intercept	0.517*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.010	0.993
Adjusted R ²	-0.001	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.2 Regression Results for individual time preference measures: Positive Reciprocity

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS test</i>	<i>OLS</i>
	(1)	(2)
Positive Reciprocity	0.005 (0.006)	-0.003 (0.005)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.022 (0.076)	-0.125* (0.064)
Cognitive Ability	0.053 (0.049)	-0.018 (0.050)
Income	-0.018 (0.193)	0.038 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0001 (0.0004)	0.005*** (0.001)
Intercept	0.519*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.012	0.993
Adjusted R ²	0.000	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.3 Regression Results for individual time preference measures: Risk

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS</i> <i>test</i>	<i>OLS</i>
	(1)	(2)
Risk Tolerance	−0.0002* (0.0001)	0.0001 (0.0001)
Age	0.012 (0.076)	−0.126** (0.064)
Gender	0.057 (0.049)	−0.020 (0.050)
Cognitive Ability	−0.028 (0.190)	0.037 (0.169)
Income	0.00000 (0.00000)	0.00000*** (0.00000)
Adjusted GDP	−0.00003 (0.0004)	0.005*** (0.001)
EPI Index	−0.013* (0.008)	0.002 (0.007)
Intercept	0.530*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.016	0.993
Adjusted R ²	0.004	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.4 Regression Results for individual time preference measures: Negative Reciprocity

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS test</i>	<i>OLS</i>
	(1)	(2)
Negative Reciprocity	-0.022*** (0.008)	-0.008 (0.006)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.021 (0.078)	-0.126** (0.064)
Cognitive Ability	0.065 (0.049)	-0.010 (0.050)
Income	-0.039 (0.189)	0.052 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0002 (0.0004)	0.005*** (0.001)
Intercept	0.519*** (0.043)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.026	0.993
Adjusted R ²	0.015	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.5 Regression Results for individual time preference measures: Altruism

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS test</i>	<i>OLS</i>
	(1)	(2)
Altruism	0.003 (0.006)	-0.006 (0.006)
Age	-0.0002 (0.0001)	0.0001 (0.0001)
Gender	0.026 (0.076)	-0.120* (0.065)
Cognitive Ability	0.050 (0.049)	-0.017 (0.050)
Income	-0.027 (0.192)	0.052 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0001 (0.0004)	0.005*** (0.001)
Intercept	0.518*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.010	0.993
Adjusted R ²	-0.001	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.6 Regression Results for individual time preference measures: Trust

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS</i> <i>test</i>	<i>OLS</i>
	(1)	(2)
Trust	0.001 (0.009)	-0.007 (0.007)
Age	-0.0002 (0.0001)	0.0001 (0.0001)
Gender	0.030 (0.076)	-0.123* (0.064)
Cognitive Ability	0.051 (0.049)	-0.017 (0.050)
Income	-0.029 (0.190)	0.040 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0001 (0.0004)	0.005*** (0.001)
Intercept	0.517*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.010	0.993
Adjusted R ²	-0.002	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

5.2 Joint preferences

Time traits have been analysed and divided into two categories: exclusive and inclusive off negative reciprocity.

Table 5.7 consists of regression results for time traits. An increase in risk tolerance of a region results in a 0.015 decrease in average proportion of environmental concern (model 1). With the inclusion of negative reciprocity however, the original results change and the significance of negative reciprocity increases (Table 5.8, model 1). An increase in average negative reciprocity of a region results in an environmental concern decreasing by an average proportion of 0.02 points. When contrast with the earlier results of just negative reciprocity, the inclusion of other time traits results in a just a 0.002 point difference. This difference could be driven due to the nature of correlation between the time traits.

Pro-social traits are insignificant. Creating interaction terms results in endogeneity, hence they are not included in the regressions.

Our analysis can be summarised as follows:

- 1) Negative Reciprocity is significant across regions while none of the other preference measures are.
- 2) Individual socio-demographic variables capture more variation and have a higher impact on environmental concern at the regional level.

Table 5.7 Regression Results for Time traits

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS test</i>	<i>OLS</i>
	(1)	(2)
Patience	0.007 (0.007)	0.00000 (0.006)
Risk Tolerance	-0.015* (0.008)	0.002 (0.007)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.010 (0.075)	-0.126* (0.064)
Cognitive Ability	0.054 (0.049)	-0.020 (0.050)
Income	-0.023 (0.191)	0.037 (0.169)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.00003 (0.0004)	0.005*** (0.001)
Intercept	0.531*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.017	0.993
Adjusted R ²	0.004	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.8 Regression Results for Time traits inclusive negative reciprocity

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS</i> <i>test</i>	<i>OLS</i>
	(1)	(2)
Patience	0.008 (0.007)	0.001 (0.006)
Risk Tolerance	-0.010 (0.008)	0.006 (0.008)
Negative Reciprocity	-0.020** (0.008)	-0.010 (0.007)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.010 (0.077)	-0.124* (0.064)
Cognitive Ability	0.064 (0.049)	-0.012 (0.050)
Income	-0.031 (0.189)	0.050 (0.169)
Adjusted GDP	-0.000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0002 (0.0004)	0.005*** (0.001)
Intercept	0.527*** (0.043)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.030	0.993
Adjusted R ²	0.015	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5.9 Regression Results for Pro-Social Traits

	<i>Dependent variable:</i>	
	Protect Environment or Economic Growth	
	<i>Pooled OLS</i> <i>test</i>	<i>OLS</i>
	(1)	(2)
Positive Reciprocity	0.006 (0.008)	-0.001 (0.006)
Altruism	-0.001 (0.008)	-0.005 (0.008)
Trust	-0.001 (0.009)	-0.006 (0.007)
Age	-0.0002* (0.0001)	0.0001 (0.0001)
Gender	0.023 (0.077)	-0.117* (0.065)
Cognitive Ability	0.055 (0.050)	-0.016 (0.050)
Income	-0.017 (0.193)	0.051 (0.170)
Adjusted GDP	0.00000 (0.00000)	0.00000*** (0.00000)
EPI Index	0.0001 (0.0004)	0.005*** (0.001)
Intercept	0.519*** (0.042)	
Country Fixed Effects	No	Yes
Observations	607	607
R ²	0.012	0.993
Adjusted R ²	-0.002	0.992

Note:

*p<0.1; **p<0.05; ***p<0.01

6. Discussion

Negative reciprocity across regions being highly significant demonstrates how egoistic values take predominance over cross-country and cultural identities (Stern and Dietz 1994). If protecting the environment is considered a public good then the existence of free-riders at the expense of effort of others (Fehr and Gächter 2000) occurs at the regional level as well. At the individual level, this comes down to two sets of individuals and their actions: self-interested types and reciprocal types. Self-interested types choose to free-ride due to self-interest while reciprocal types free-ride because they observe others free-riding (Fehr and Gächter 2000). As social norms play a big role in the promotion of public goods, addressing and correcting for this social norm is important (Fehr and Gächter 2000).

The analysis faces a few limitations. Primarily, the literature on cross-regional environmental concern is limited. Further, inferring the direction of causality might be an issue (Tanaka et al. 2010) as the prioritisation of one over the other may drive preferences or vice-versa. In fact, the high degree of negative reciprocity across regions highlights that value orientations across regions may not be mutually exclusive (Stern and Dietz 1994). The data has a tendency to either underfit or overfit the model as demonstrated by the polarising R^2 values. In addition to the above, merging the data at the regional level is subject to issues of endogeneity as the preference measures are subjective to age, gender and cognitive ability (Falk et al. 2018). The study is also limited as only one measure of environmental concern has been used - this is mainly due to this being the only variable available to measure environmental concern from the joint survey. Finally, this study has not utilised political variables due to their high correlations with preference measures which limits the scope of the analysis.

7. Conclusion

This study analyses cross-regional variation of preferences with respect to environmental concern by exploring preference measures individually and in two other combinations, namely time traits and pro-social traits. It is found that negativity reciprocity is significant across regions and results in a decrease in environmental concern.

This study acts mainly as a stepping stone in understanding how key economic preferences could drive one measure of environmental concern. Further analysis in this domain is required and could build on other more nuanced measures of public opinion in order to intrinsically understand how negative reciprocity affects environmental concern. Alternatively, understanding drivers of negative reciprocity could allow for more focused policy design. As an example, the implementation of costly individual punishment measures could identify which regions consist of more self-interested types and more reciprocal types (Fehr and Gächter 2000). Of course, the cultural and religious factors at play that affect environmental concern will be required as well. Ultimately, examining how and why certain preference measures affect this cross-border concern is the key to creating policies that decrease the behaviour-concern gap.

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I Appendix 1: Mapped Regions

The following list are the final list of regions that are mapped between the GPS survey and the Joint WVS/EVS Survey.

Continent	Country	Region		
Africa	Egypt	Alexandria		
		Aswan		
		Cairo		
		Dakahlia		
		Faiyum		
		Gharbia		
		Giza		
		Ismailia		
		Minya		
		Sohag		
		Africa	Nigeria	Abia
				Abuja Federal Capital Territory
				Adamawa
				Akwa Ibom
Anambra				
Bauchi				
Benue				
Borno				
Cross River				
Delta				
Edo				
Ekiti				
Enugu				
Gombe				
Imo				
Kaduna				
Kano				
Katsina				
Kebbi				
Kogi				
Kwara				
Lagos				
Nasarawa				
Niger				

Table A1 continued from previous page

Continent	Country	Region
		Ogun
		Ondo
		Oyo
		Plateau
		Rivers
		Sokoto
		Taraba
		Zamfara
Africa	Zimbabwe	Bulawayo
		Harare
		Manicaland Province
		Mashonaland Central Province
		Mashonaland East Province
		Mashonaland West Province
		Masvingo
		Matabeleland North Province
		Matabeleland South Province
		Midlands
Asia	Bangladesh	Barisal
		Chittagong
		Dhaka
		Mymensingh
		Rajshahi
		Sylhet
Asia	China	Anhui Sheng
		Beijing Shi
		Chongqing Shi
		FujianSheng
		Gansu Sheng
		Guangdong Sheng
		Guangxi Zhuangzu Zizhiqu
		Guizhou Sheng
		Hainan Sheng
		Hebei Sheng
		Heilongjiang Sheng
		Henan Sheng

Table A1 continued from previous page

Continent	Country	Region
		Hubei Sheng
		Hunan Sheng
		Jiangsu Sheng
		Jiangxi Sheng
		Liaoning Sheng
		Nei Mongol Zizhiqu
		Shaanxi Sheng
		Shandong Sheng
		Shanghai Shi
		Shanxi Sheng
		Sichuan Sheng
		Yunnan Sheng
		Zhejiang Sheng
Asia	Georgia	Capital Georgia
		Eastern Georgia
		Western Georgia
Asia	Indonesia	Jawa
		Kalimantan
		Nusa Tenggara
		Papua
		Sulawesi
		Sumatra
Asia	Islamic Republic of Iran	Azarbayjan-e Sharqi
		Alborz
		Ardabil
		Azarbayjan-e Gharbi
		Bushehr
		Chaharmahal and Bakhtiari Province
		Isfahan
		Fars
		Gilan
		Golestan Province
		Hamadan
		Hormozgan Province
		Ilam Province
		Kerman
		Kermanshah

Table A1 continued from previous page

Continent	Country	Region
		Khorasan-e Jonubi
		Khorasan-e Razavi
		Khorasan-e Shomali
		Khuzestan Province
		Kordestan Province
		Lorestan Province
		Markazi Province
		Mazandaran Province
		Qazvin Province
		Qom Province
		Semnan Province
		Sistan and Baluchestan Province
		Tehran Province
		Yazd Province
		Zanjan Province
Asia	Iraq	Al Anbar
		Al Basrah
		Arbil
		As Sulaymaniyah
		Babil
		Baghdad
		Dhi Qar
		Ninawa
Asia	Japan	Aichi
		Akita
		Fukuoka
		Hiroshima
		Hokkaido
		Ishikawa
		Osaka
		Tokyo
		Yamanashi
Asia	Jordan	Amman
Asia	Kazakstan	Akmolinskaya oblast
		Aktyubinskaya oblast
		Almaty
		Astana

Table A1 continued from previous page

Continent	Country	Region
		Atyrauskaya oblast
		Karagandinskaya oblast
		Kostanayskaya oblast
		Kyzylordinskaya oblast
		Mangistauskaya oblast
		Pavlodarskaya oblast
		Severo-Kazakhstanskaya oblast
		Turkestanakaya oblast
		Vostochno-Kazakhstanskaya oblast
		Zapadno-Kazakhstanskaya oblast
		Zhambylskaya oblast
Asia	Korea, Republic of	Busan
		Daegu
		Daejeon
		Gangwon
		Gwangju
		Gyeonggi
		Incheon
		North Chungcheong
		North Jeolla
		Seoul
		South Chungcheong
		Ulsan
Asia	Pakistan	Balochistan
		Khaibar Pakhtunkhwa
		Sindh
Asia	Philippines	National Capital Region
		Quezon
Asia	Russia Federation	Central Federal District
		Far East Federal District
		North Caucasian Federal District
		North West Federal District
		Privolzhsky Federal District
		Siberian Federal District
		South Federal District
		Urals Federal District
Asia	Thailand	Bangkok

Table A1 continued from previous page

Continent	Country	Region
		Chiang Rai
		Chon Buri
		Khon Kaen
		Loei
		Nakhon Ratchasima
		Nong Khai
		Phangnga
		Phetchabun
		Phichit
		Phra Nakhon Si Ayutthaya
		Roi Et
		Sakon Nakhon
		Samut Prakan
		Songkhla
		Surin
		Ubon Ratchathani
		Udon Thani
Asia	Vietnam	Dak Lak
		Dong Nai
		Ha Noi
		Hai Durong
		Ho Chi Minh
		Hoa Binh
		Nghe An
		Quang Nam
		Thanh Hoa
		Tien Giang
Australia	Australia	New South Wales and ACT
		Northern Territory(NT)
		Queensland
		South Australia
		Victoria
		Western Australia
Europe	Czechia	Jihovychod
		Jihozapad
		Moravskoslezsko
		Prague

Table A1 continued from previous page

Continent	Country	Region
		Severovychod
		Severozapad
		Stredni Cechy
		Stredni Morava
Europe	Estonia	Estonia
Europe	Finland	North and East Finland
		South Finland
		West Finland
Europe	France	Alsace
		Aquitaine
		Auvergne
		Bourgogne
		Brittany
		Centre-Val de Loire
		Champagne-Ardenne
		Franche-Comte
		Ile de France
		Languedoc-Roussillon
		Limousin
		Lorraine
		Lower Normandy
		Midi-Pyrenees
		Nord-Pas-de-Calais
		Pays de la Loire
		Picardy
		Poitou-Charentes
		Provence-Alpes-Côte d'Azur
		Rhone-Alpes
		Upper Normandy
Europe	Germany	Baden-Wurttemberg
		Bayern
		Berlin
		Brandenburg
		Bremen
		Hamburg
		Hesse
		Mecklenburg-Western Pomerania

Table A1 continued from previous page

Continent	Country	Region
Europe	Greece	North Rhine-Westphalia
		Rhineland-Palatinate
		Saarland
		Saxony
		Saxony-Anhalt
		Schleswig-Holstein
		Thuringia
		Attica
		Central Greece
		Central Macedonia
		Crete
		Eastern Macedonia and Thrace
		Epirus
Europe	Hungary	Ionian Islands
		North Aegean
		Peloponnese
		South Aegean
		Thessaly
		Western Greece
		Western Macedonia
		Budapest
		Central Transdanubia
		Northern Great Plain
		Northern Hungary
		Southern Great Plain
		Southern Transdanubia
Europe	Italy	Western Transdanubia
		Abruzzo
		Basilicata
		Calabria
		Campania
		Emilia-Romagna
		Friuli-Venezia Giulia
		Lazio
		Liguria
		Lombardia
		Marche

Table A1 continued from previous page

Continent	Country	Region
		Molise
		Piemonte
		Puglia
		Sardegna
		Sicilia
		Toscana
		Trentino-Alto Adige/ Südtirol
		Umbria
		Veneto
Europe	Austria	Burgenland
		Carinthia
		Lower Austria
		Salzburg
		Styria
		Tyrol
		Upper Austria
		Vienna
		Vorarlberg
Europe	Lithuania	Sostinės regionas
		Vidurio ir vakaru Lietuvos regionas
Europe	Netherlands	Drenthe
		Flevoland
		Friesland
		Gelderland
		Groningen
		Limburg
		North Brabant
		North Holland
		Overijssel
		South Holland
		Utrecht
		Zeeland
Europe	Poland	Dolnoslaskie
		Kujawsko-Pomorskie
		Lubelskie
		Lubuskie
		Malopolskie

Table A1 continued from previous page

Continent	Country	Region
		Mazowiecki regional
		Opolskie
		Podkarpackie
		Podlaskie
		Pomorskie
		Slaskie
		Swietokrzyskie
		Warminsko-Mazurskie
		Wielkopolskie
		Zachodniopomorskie
Europe	Portugal	Alentejo
		Algarve
		Area Metropolitana de Lisboa
		Centro
		Norte
Europe	Romania	Bucuresti-Ilfov
		Centru
		Nord-Est
		Nord-Vest
		Sud-Est
		Sud-Muntenia
		Sud-Vest Oltenia
		Vest
Europe	Republic of Serbia	Beogradski region
		Region Juzne I Istocne Srbije
		Region Sumadije I Zapadne Srbije
		Region Vojvodine
Europe	Bosnia and Herzegovina	Brcko District
		Federation of Bosnia and Herzegovina
		Republica Srpska
Europe	Spain	Andalusia
		Aragon
		Balearic Islands
		Basque Community
		Canary Islands
		Cantabria
		Castile-La Mancha

Table A1 continued from previous page

Continent	Country	Region
Europe	Sweden	Castile-Leon
		Catalonia
		Extremadura
		Galicia
		La Rioja
		Madrid
		Navarre
		Principality of Asturias
		Region of Murcia
		Valencian Community
		Mellersta Norrland
		Norra Mellansverige
		Ostra Mellansverige
		Ovre Norrland
Smaland med oarna		
Stockholm		
Sydsverige		
Vastsverige		
Europe	Switzerland	Central Switzerland
		Eastern Switzerland
		Espace Mittelland
		Lake Geneva region
		Northern Switzerland
		Ticino
		Zurich
Europe	Ukraine	Cherkaska oblast
		Chernihivska oblast
		Chernivetska oblast
		Dnipropetrovska oblast
		Donetska oblast
		Ivano-Frankivska oblast
		Kharkivska oblast
		Khersonska oblast
		Khmelnytska oblast
		Kirovohradska oblast
		Kyiv
		Kyivska oblast

Table A1 continued from previous page

Continent	Country	Region
Europe	Ukraine	Luhanska oblast
		Lvivska oblast
		Mykolaivska oblast
		Odeska oblast
		Poltavska oblast
		Rivnenska oblast
		Sumska oblast
		Ternopilska oblast
		Vinnytska oblast
		Volynska oblast
		Zakarpatska oblast
		Zaporizka oblast
		Zhytomyrska oblast
		Europe
Derbyshire and Nottinghamshire		
Essex		
Gloucestershire Wiltshire and Bristol or Bath area		
Inner London-West		
Northumberland and Tyne and Wear		
West Central Scotland		
West Midlands		
West Yorkshire		
North America	Guatemala	
		Baja Verapaz
		Chimaltenango
		Chiquimula
		El Progreso
		Escuintla
		Guatemala
		Huehuetenango
		Izabal
		Jalapa
		Jutiapa
		Quetzaltenango
		Quiche
		Retalhuleu
		Sacatepequez

Table A1 continued from previous page

Continent	Country	Region
		San Marcos
		Santa Rosa
		Solola
		Suchitepequez
		Totonicapan
		Zacapa
North America	Mexico	Baja California
		Campeche
		Chiapas
		Chihuahua
		Coahuila de Zaragoza
		Colima
		Guanajuato
		Guerrero
		Hidalgo
		Jalisco
		Mexico
		Michoacan de Ocampo
		Morelos
		Nayarit
		Nuevo Leon
		Oaxaca
		Puebla
		Queretaro
		Sinaloa
		Sonora
		Tabasco
		Tamaulipas
		Tlaxcala
		Veracruz de Ignacio de la Llave
		Yucatan
North America	Nicaragua	Boaco
		Carazo
		Chinandega
		Chontales
		Esteli
		Granada

Table A1 continued from previous page

Continent	Country	Region
		Jinotega
		Leon
		Madriz
		Managua
		Masaya
		Matagalpa
		Nueva Segovia
		Rio San Juan
		Rivas
North America	United States	Alabama
		Arizona
		Arkansas
		California
		Colorado
		Connecticut
		Delaware
		District of Columbia
		Florida
		Georgia
		Hawaii
		Idaho
		Illinois
		Indiana
		Iowa
		Kansas
		Kentucky
		Louisiana
		Maine
		Maryland
		Massachusetts
		Michigan
		Minnesota
		Mississippi
		Missouri
		Montana
		Nebraska
		Nevada

Table A1 continued from previous page

Continent	Country	Region
		New Hampshire
		New Jersey
		New Mexico
		New York
		North Carolina
		Ohio
		Oklahoma
		Oregon
		Pennsylvania
		Rhode Island
		South Carolina
		South Dakota
		Tennessee
		Texas
		Utah
		Vermont
		Virginia
		Washington
		West Virginia
		Wisconsin
		Wyoming
South America	Chile	Antofagasta
		Arica y Parinacota
		Atacama
		Biobio
		Coquimbo
		La Araucania
		Libertador General Bernardo Ohiggins
		Los Lagos
		Los Rios
		Maule
		Region Metropolitana de Santiago
		Tarapaca
		Valparaiso
South America	Colombia	Antioquia
		Atlantico
		Boyaca

Table A1 continued from previous page

Continent	Country	Region
		Caldas
		Cauca
		Cesar
		Cundinamarca
		Distrito Capital de Bogota
		Huila
		La Guajira
		Magdalena
		Meta
		Narino
		Norte de Santander
		Quindio
		Risaralda
		Santander
		Sucre
		Tolima
		Valle del Cauca
South America	Argentina	Capital Federal
		Cordoba
		Corrientes
		Gran Buenos Aires
		Mendoza
		Salta
		San Luis
		Santa Fe
		Tucuman
South America	Peru	Municipalidad Metropolitana de Lima
South America	Bolivia	Beni
		Chuquisaca
		Cochabamba
		La Paz
		Oruro
		Potosi
		Santa Cruz
		Tarija
South America	Brazil	Acre
		Alagoas

Table A1 continued from previous page

Continent	Country	Region
		Bahia
		Ceara
		Espirito Santo
		Goiias
		Maranhao
		Mato Grosso
		Mato Grosso do Sul
		Minas Gerais
		Para
		Paraiba
		Parana
		Pernambuco
		Piaui
		Rio de Janeiro
		Rio Grande do Norte
		Rio Grande do Sul
		Rondonia
		Santa Catarina
		Sao Paulo
		Sergipe

Table A1 List of mapped regions.