The Role of Preferences for Pro-Environmental Behaviour among Urban Middle Class Households in Peru

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Abstract

Pro-environmental behaviour (PEB) is known to reflect people's social preferences, time preferences and risk preferences. Previous research has tended to consider these in isolation, which means they may proxy for omitted ones, leading to biased estimates. Moreover, it has not considered ambiguity preferences, which for some PEBs is conceptually more relevant than risk preferences. Using a survey module from the Global Preference Survey (GPS), we investigate the role of a large range of preferences for PEB in a sample of 900 middle class households in Lima, Peru. The PEBs we consider are habitually saving energy, avoiding the use of plastics, and limiting expenditures on electricity. We find that social preferences matter mainly for saving-energy behaviour; time, risk and ambiguity preferences matter mainly for the consumption of plastics; and time and ambiguity preferences matter for expenditures on electricity. The insight that particular preferences matter for particular PEBs has important policy implications.

Keywords: Risk Preferences; Ambiguity Preferences; Time Preferences; Social Preferences; Pro-Environmental Behaviour

1 Introduction

Individual consumers can help prevent disastrous climate change and environmental pollution by changing their behaviour. Pro-environmental behaviour (PEB) results both from large, occasional decisions such as having solar cells installed and from small, regular ones such as switching off the TV when nobody is actively watching it.

Economists think of behaviour as resulting from people's preferences. Research has shown that individual preferences can influence decision-making in many domains, including savings behaviour and educational attainment, health-related behaviours such as exercising and smoking, or pro-social behaviours such as donations to charity (Dohmen et al., 2011; Sutter et al., 2013; Falk et al., 2015; 2018).

Several studies have found individual preferences to be important for PEB. A group of these have found *social preferences* to matter for PEB (Gupta and Ogden, 2009; Volland, 2017; Ziegler, 2018). This is plausible since PEB requires caring about the wellbeing of other people, and a propensity to assume that others, when encouraged to engage in PEB, will do so (Gupta and Ogden, 2009). The social preferences of altruism, trust and reciprocity are therefore expected to be important for PEB.

Other studies looked at the role of *risk preferences*. The benefits of PEB are uncertain, meaning that deciding to engage in PEB carries the risk that the desired outcomes do not come about. In line with that, greater risk aversion has been found to be associated with the undervaluation of PEB (Farsi, 2010; Qiu et al., 2014; Fischbacher et al., 2015), although not universally so (Volland, 2017). Finally, *time preferences* are expected to matter. People who discount the future at a lower rate, i.e. people who are more patient, should value PEB more. This has been empirically confirmed by Qiu et al. (2014), Newell and Siikamäki (2015) and Fuerst and Singh (2018).

In this study, unlike in previous research, we consider the role of social preferences, risk preferences, and time preferences for PEB together, rather than one or some of these in isolation. To this we add ambiguity preferences. Ambiguity preferences relate to uncertain future outcomes that occur with unknowable probabilities. We explain below why ambiguity preferences are sometimes conceptually more appropriate than risk preferences for PEB. We collect survey data for a sample of middle-class households from Lima, the capital of Peru. The social preferences we include are altruism, trust and reciprocity (both positive and negative). With the exception of ambiguity preferences, all preferences are elicited using a survey module from the Global Preference Survey (GPS), introduced by Falk et al. (2016; 2018).

We make the following contributions to the literature on preferences and PEB. First, whereas previous studies consider one or a few preferences in isolation, we include a large range of relevant preferences. As Sutter et al. (2013) point out, omitting relevant preferences can lead to wrongly attributing behavioural effects to the preferences that have been included in the analysis. Whereas we do not claim to be able to identify causal effects of preferences on PEB, we avoid in this way potential omitted variable bias. For the same reason, we also control in the analysis for variables that are potentially correlated both with PEB and with preferences, such as environmental knowledge, environmental concern, wealth, age, gender and education.

Second, most research in this field has looked at the role of preferences in PEB that results from large, occasional decisions. However, as mentioned PEB consists of regular behaviour, too. To our knowledge, no previous evidence exists on preferences and their importance for regular PEB.[1] We contribute to the literature by considering two types: behaviours that save energy in the household and behaviours that reduce the amount of plastics consumption. We also consider a measure that results from both regular PEB and occasional PEB, the monthly electricity bill. Volland (2017) uses a similar measure for a sample of households in the UK.

Third, we include ambiguity aversion among the relevant preferences, which is a novel contribution as the studies on PEB that look at the role of attitudes towards uncertainty focus on risk aversion (Farsi, 2010; Qiu et al., 2014; Fischbacher et al., 2015; Volland, 2017). When probabilities of outcomes are known or can be estimated, risk preferences are relevant, when they are unknown, ambiguity preferences are (Elsberg, 1961). In the plausible situation that an individual decision-maker is unable to estimate the probabilities of outcomes of PEB, ambiguity aversion is therefore the relevant concept, which we are able to investigate in this study.[2]

Fourth, by eliciting data on preferences using questions from the Global Preference Survey (GPS) of Falk et al. (2016; 2018), we are employing a validated methodology that allows for simple comparison within and between countries and thereby provides a basis for replication in future research.

[1] A recent working paper by Lades et al. (2020) takes a similar approach while using online surveys and different techniques to measure regular PEB.

[2] Millner et al. (2013) and Weitzman (2009) theoretically discuss the relevance of ambiguity for climate policies. Yet, to our knowledge no previous study has ever quantified the effect of ambiguity aversion on PEB in a real world setting. Evidence on individual ambiguity preferences and behaviour outside the laboratory is rare in general (see Trautmann and Van de Kuilen, 2014, for a review).

Fifth and finally, with the exception of Fuerst and Singh (2018), who conducted their research in India, no evidence exists for the role of preferences in PEB outside a high-income country context. Peru, a middle income country, is a particularly interesting case because of the rapid rise of the middle class, as a result of sustained economic growth. According to the official news agency of the Peruvian state, Andina, the percentage of people living in middle class households grew from 14.1% of the population in 2004 to 44.7% in 2018, the year of our survey, which amounts to 14.4 million Peruvians (Andina 2019).[3] As their spending increases, so does their potential to do damage to the environment through their consumption behaviour.[4] Evidence on the preferences that correlate with PEB among a group with a large and rapidly growing environmental footprint may help policy makers understand how to encourage PEB more effectively and thereby prevent much damage.

Our findings may be summarised as follows. We find that social preferences matter mainly for saving-energy behaviour; time, risk and ambiguity preferences matter mainly for the consumption of plastics; and time and ambiguity preferences matter for expenditures on electricity. The insight that particular preferences matter for particular PEBs has important policy implications, which we spell out in the final section of the paper. The paper proceeds as follows: *Section 2* explains the research design, including the research hypotheses, data collection and measurement of variables. *Section 3* presents empirical findings based on regression analyses. *Section 4* ends with a discussion and conclusion.

2 Research design

2.1 Research hypotheses

As outlined in the introduction, previous literature has found social preferences to matter for PEB. PEB requires people to make the effort of engaging in activities that result mainly in collective benefits for the society, which again requires people to care about the wellbeing of others. In particular, it requires people to engage in sustainable activities without expecting any direct personal benefit from it (altruism). It also assumesthat they trust other people will engage in PEB as well when encouraged to do so (trust), and to be willing to reciprocate when other people's effort for collective benefit (reciprocity).

[3] Middle class households are defined by Lima's chamber of commerce as those earning between US$10 and US$50 per day, corrected for purchasing power parity (ibid.).

[4] See Never et al. (2020) for the carbon-intensity of consumption patterns of the growing middle class in Peru.

Volland (2017) finds that trust has a negative effect on residential energy use while Gupta and Ogden (2009) provide additional evidence that more trusting individuals are more likely to buy green products. Ziegler (2018) further finds that higher levels of trust and social preferences in general have a positive effect on switching to green electricity contracts. Moreover, at a macro level, Carattini et al. (2015) show that trust is negatively related with countries' greenhouse gas emissions and per capita energy consumption. Ostrom (2009) further summarizes the importance of trust and reciprocity for solving global collective action problems like climate change mitigation.

All these studies thus find positive correlations between social preferences and PEB. Notably, previous literature has focused mainly on trust, while evidence on the importance of other social preferences (altruism as well as positive and negative reciprocity) for PEB is sparse. Based on previous literature, we therefore hypothesise that higher levels of social preferences lead to more energy-saving behaviour and sustainable plastics consumption, and to lower expenditures on electricity. This will be our first hypothesis.

H1: Higher levels of social preferences predict more PEB (i.e. more energy-saving behaviour and sustainable plastics consumption, and less expenditures on electricity).

A link has also been found between risk preferences and PEB. PEB requires people to engage in activities of which the benefits are mostly uncertain. Qiu et al. (2014) show that more risk averse individuals are less likely to adopt energy-efficient technologies or have installed energy-efficient home improvements. Similar results are reported by Farsi (2010) for adopting energy-efficient systems in rental apartments. On the other hand, Volland (2017) finds that higher risk tolerance increases household energy use. While these findings might seem contradictory (more energy-efficient appliances should lead to lower energy use), Volland (2017) explains this effect with a higher willingness to purchase new appliances in general (energy-efficient or not) of people with higher levels of risk tolerance. Fischbacher et al. (2015) further find that more risk taking homeowners are more likely to have renovated their house for better insulation.

Evidence on the relation between risk preferences and PEB is therefore not as straightforward as for social preferences, even though the majority (with the exception of Volland, 2017) finds that higher levels of risk aversion are associated with less investment in PEB. However, Volland's measure of monthly energy expenditures in the UK comes closest to our dependent variable of the monthly electricity bill and might therefore be more relevant for this particular PEB. Moreover, we include ambiguity aversion in our analysis. When decision-makers are unable to associate probabilities with the

outcomes of PEB, ambiguity aversion, not risk aversion, is the relevant concept. Moreover, the strong correlation between the two measures indicates in any case the importance to consider both in the analysis.[5] In line with previous findings, we thus derive the following hypotheses for our analysis.

H2a: Higher levels of uncertainty tolerance (risk and ambiguity) predict more PEB with regards to energy-saving behaviour and sustainable plastics consumption.

H2b: Higher levels of uncertainty tolerance (risk and ambiguity) predict higher expenditures on electricity (i.e. less PEB in this regard).

Lastly, evidence exists on the importance of time preferences for PEB. PEB requires people to engage in activities in the present of which the benefits pay off mainly in the future. It is therefore plausible to assume that individual discount rates, used as a measure of impatience, are important for the decision to engage in PEB.

Newell and Siikamäki (2015) demonstrate that individual discount rates systematically influence households' willingness to pay for energy efficiency. Fischbacher et al. (2015) further find that future-oriented individuals live in homes with higher energy efficiency and have lower energy costs. Fuerst and Singh (2018) provide additional evidence that individuals who are more patient and less present-biased are more likely to invest in energy-efficient appliances. Ziegler (2018) further shows that more patient individuals are more likely to switch to alternative and green electricity contracts. The evidence therefore clearly suggests that higher levels of patience predict more PEB. This leads to our next hypothesis.

H3: Higher levels of patience predict more PEB (i.e. more energy-saving behaviour and sustainable plastics consumption, and less expenditures on electricity).

2.2 Data collection

To elicit information on the variables of interest for our analysis, a household survey was conducted among 900 middle class households in Lima, Peru, in November and December 2018. The data collection was conducted by a local survey firm. To identify middle class households, we first excluded the very poorest and very richest districts by making use of an existing poverty map for Lima (INEI, 2016) as well as the latest national household survey data for Peru (ENAHO, 2017). We next computed the number of households to sample by district through allocating the sample to districts in proportion to the number of middle-income households living in them, using the latest Census (2017) data and the INEI (2016) poverty

[5] A correlation matrix of all preferences and PEBs is attached in the appendix A1.

map. We decided to sample on average five households per block, so divided the number of households to be sampled per district by five in order to determine the number of blocks to sample by district. Blocks were randomly selected.[6]

Within each block, enumerators followed a random walk system and approached every fifth household, thereby sampling approximately five households per block. Enumerators asked eight screening questions before administering the actual questionnaire, in order to ensure that households did indeed belong to the middle class.[7] Enumerators were instructed to always interview the household head (preferably) or their spouse. The surveys were conducted with tablets using the software SurveyCTO. The monitoring function of the software made it possible to follow the data collection process continuously and to ensure direct quality control of the data.

2.3 Measurement of variables

2.3.1 Independent variables: preferences

Data on risk, time and social preferences was collected using questions from the Global Preference Survey (GPS) of Falk et al. (2016; 2018), which has been implemented worldwide, in at least 76 countries. A key advantage of the GPS is that it is experimentally validated, meaning that the survey items included in the GPS were the best predictors for preferences in incentivised choice experiments. By experimentally validating a survey module on preferences and testing it for cultural sensitivities, the authors provide a low-cost measurement tool for use in large and diverse samples, while still retaining key advantages of experimental approaches (Falk et al., 2016). Moreover, the use of a standardized tool for measuring preferences contributes to facilitating comparability across studies. By using questions from the GPS for our research, we thus take advantage of a tool that can easily be applied in almost any country, thereby facilitating international replication and comparison.

For our analysis, risk preferences are elicited using a so-called "staircase" procedure for the subjective valuation of a hypothetical gamble. In particular, respondents choose between this gamble and a certain payment. If they choose the gamble, then the certain payment is increased in the next choice; if they choose the certain

[6] To be precise, we numbered contiguous blocks consecutively on a map, divided the number of district blocks by the number of blocks to be sampled, which gave the number x, and sampled every xth block.

[7] Enumerators observed the appearance of the house, and asked some questions about certain indicative expenditure categories. On the basis of these questions, a score was computed, which if it was in the required range meant enumerators could proceed with the survey. If not, they approached the next house.

payment, then it is reduced. This continues until the certainty equivalent value of the gamble is approximated, i.e. until the decision-maker is almost indifferent between the gamble and the certain payment. Time preferences are measured using a similar staircase procedure for a hypothetical intertemporal choice (between a payment now and a payment in twelve months), and ambiguity preferences (which are not included in the GPS) by using the same staircase procedure as for risk, but replacing the gamble by an ambiguous outcome, i.e. one in which probabilities are not known by the decision-maker.[8]

We elicit social preferences using questions on altruism, trust, and positive and negative reciprocity, which are all measured through respondents rating their willingness to act in certain emblematic situations, or their self-image in terms of certain character traits, on an 11-point Likert-scale from 0 to 10. For example, preferences for negative reciprocity are captured through scores on the following two questions with equal weights.

*How willing are you to punish someone who treats **you** unfairly, even if there may be costs to do so?*

*How willing are you to punish someone who treats **others** unfairly, even if there may be costs to do so?*

All survey questions are shown in abbreviated form in table 1 below and can be found in their original longer version in appendix A2. For the analysis, we use the z-score of each preference measure.

Table 1: Preference measures used in the analysis (own illustration (short form) based on Falk et al., 2016).

[8] Our method for eliciting ambiguity preferences is inspired by Sutter et al. (2013).

Preference	Question in abbreviated form	Answer Scale
Risk	*(Sequence of five interdependent binary choice questions)* What would you prefer: 50 percent chance of receiving x and 50 percent chance of receiving nothing, or the amount of y as a sure payment?	Five choices between a risky and a certain payment
Ambiguity	*(Sequence of five interdependent binary choice questions)* This bag contains 20 balls, which are all either black or white, but you don't know how many of each there are. What would you prefer: a draw from the bag of 20 balls, where you would get amount x if you drew a white ball, and nothing if you drew a black ball, or the amount of y as a sure payment?	Five choices between an ambiguous and a certain payment
Time	*(Sequence of five interdependent binary choice questions)* Please consider the following: would you rather receive amount x today or amount y in 12 months?	Five choices between a payment now and one in twelve months
Altruism	*(Willingness to act)* How willing are you to give to good causes without expecting anything in return?	11-point Likert-scale from 0 to 10
Negative reciprocity	*(Willingness to act)* 0.5 x How willing are you to punish someone who treats **you** unfairly, even if there may be costs for you? 0.5 x How willing are you to punish someone who treats **others** unfairly, even if there may be costs for you?	11-point Likert-scale from 0 to 10
Positive reciprocity	*(Self-assessment)* When someone does me a favour, I am willing to return it.	11-point Likert-scale from 0 to 10
Trust	*(Self-assessment)* I assume that people have only the best intentions.	11-point Likert-scale from 0 to 10

2.3.2 Dependent variables: Pro-environmental behaviour (PEB)

We capture pro-environmental behaviour (PEB) in a number of different ways (for details see appendix A3). First, we measure the extent to which people engage in *energy-saving behaviour*. We do so through constructing an index based on three questions, one focussing on switching off the lights when leaving the room, another on turning off the TV when nobody is actively watching it, and a final one on pro-actively trying to save energy in general. The index constructed is the first component of a Principal Component Analysis (PCA). To verify our assumption that the first component captures

PEB rather than something else, we also use an index based on the simple mean of the three items, as a robustness check.[9]

Second, we capture whether respondents are aiming for *sustainable plastics consumption*. For this purpose, we construct an index based on two questions, one about reusing materials such as plastic bags and another about trying to avoid taking plastic bags in shops. Again, PCA is used to construct our preferred index while an index based on the mean of the items is used as a robustness check.

Third, we measure *monthly spending on electricity*, which relies mainly on self-reported data.[10] For the analysis of spending on electricity, we removed outliers: all households that claimed to have no spending on electricity at all (19 cases) and those that reported an electricity spending above 600 Soles per month (10 cases, top 1%), leaving 869 observations for the final variable. For the analysis, the logarithm of this variable was used.

2.3.3 Control variables

Environmental knowledge (EK) and environmental concern (EC) can be expected to matter for PEB and are therefore included as control variables in the analysis (see e.g. Lange et al., 2014, for a discussion on the relevance of environmental attitudes for residential heating expenditures). Moreover, EK and EC may correlate with both PEB and individual preferences, so that not including these variables would bias the estimated effect of preferences on PEB. The same applies to the other control variables, which include a wealth index (based on a PCA of all assets and characteristics of the house), age, gender and the level of education of the respondent as well as the number of household members (hh members) and household rooms (hh rooms). EK is captured using an additive index based on eight questions eliciting knowledge about the natural environment and humans' influence on it. Our EC index takes the value of the mean of scores on six questions eliciting concern for the environment and for sustainable consumption habits. The questions for EK and EC are based on Thogersen et al. (2010) and Thogersen et al. (2019), and can be found in appendix A4.

[9] All robustness checks and other supplementary analyses are available from the authors on request.

[10] Only a minority of people allowed us to take a picture of their electricity bill (n=33). In all other cases, people gave their best guess of how much they spent on electricity per month. Whether self-reported numbers are sufficiently accurate in this context has been discussed with key informants in Peru and was found to be the case. We only asked people about their guess on monthly electricity expenditures when they did not allow us to take a picture of their electricity bill. Therefore, we combine the two (actual number stated on electricity bill and best guess from respondent) for the final variable used in the analysis.

3 Empirical findings

3.1 Descriptive statistics

Table 2 shows descriptive statistics of the key variables used in the analysis. Respondents are 55% female, and aged between 18 and 75 years, with a mean age of 48 years. Confirming the middle-class nature of our sample, the most frequently occurring levels of education are having completed secondary school (41%) and technical higher education (39%).

For ease of interpreting the regression analyses below, we note here that higher indices of sustainable plastics consumption and saving-energy behaviour indicate a greater degree of PEB, higher monthly electricity spending a lower degree of PEB, and higher EK and EC indices greater environmental knowledge and concern, respectively. The time preference variable being higher indicates greater patience, and the risk preference variable being higher greater willingness to take risk (so lower risk aversion); ditto for ambiguity.

As to the social preferences, negative reciprocity being higher indicates a greater willingness to punish others for behaviour that is perceived to be unfair; altruism higher, a greater willingness to donate to good causes; positive reciprocity higher, a greater willingness to return a favour; and trust higher, a more generous assumption that other people only have the best intentions.

Table 2: Summary statistics of EK and EC, preferences and PEB.

Variable	Obs.	Mean	Std. dev.	Min	Max
Control variables					
Environmental knowledge	898	5.30	1.85	0	8
Environmental concern	898	3.78	0.58	1	5
Preferences					
Altruism	898	4.93	2.44	0	10
Trust	898	3.22	1.86	0	10
Pos. reciprocity	898	7.49	2.10	0	10
Neg. reciprocity	898	2.67	2.03	0	10
Risk	898	7.29	7.65	1	32
Ambiguity	898	6.72	7.26	1	32
Patience	898	1.96	3.76	1	32
PEB					
Each item individually					
Switching off lights	898	4.48	0.71	1	5
Turning off the TV	887	4.44	0.69	1	5
Trying to save energy	898	4.45	0.66	1	5
Reusing plastic materials	898	3.55	1.31	1	5
Avoiding plastic bags	898	2.08	1.09	1	5
Indices (mean)					
Energy-saving index	887	4.45	0.60	1	5
Plastics consumption index	898	2.81	0.94	1	5
Monthly spending on electricity					
Spending on electricity	869	127.93	80.34	12	556

3.2 Regressions

We analyse the relation of preferences and PEB in a multiple regression model

$$Y_i = ß_0 + ß_1 Altruism_i + ß_2 Trust_i + ß_3 Positive\ reciprocity_i + ß_4 Negative\ reciprocity_i + ß_5 Risk_i + ß_6 Ambiguity_i + ß_7 Time_i + ß_8 EK_i + ß_9 EC_i + ß_{10} X_i + u_i,$$

where Y_i is PEB (i.e. one of energy-saving behaviour, sustainable plastics consumption or the log of monthly spending on electricity), X_i indicates all other control variables and u_i is the error term.[11]

We specify five models for each of our three measures of pro-environmental behaviour (energy-saving, sustainable plastics consumption, electricity spending), gradually adding regressors to check sensitivity to model specification of coefficients on our key

[11] We have also run ordered logit and probit regressions on the individual questions of the indices as robustness checks and receive similar results.

independent variables. In model 1, only social preferences feature; model 2 adds risk and ambiguity preferences; model 3 time preferences; model 4 environmental knowledge and concern; and model 5 the full range of controls. [12]

3.2.1 Energy-saving behaviour

Table 3 shows the regression results for energy-saving behaviour. All social preferences are statistically significant predictors for energy-saving behaviour, also after adding all relevant control variables (model 5). The sign of the coefficients (positive for altruism, trust and positive reciprocity, negative for negative reciprocity) confirms the hypothesis that more pro-social individuals tend to display higher levels of energy-saving behaviour (H1). The size of the coefficients is not very sensitive to adding control variables. Because all variables have been z-standardised, the regression coefficients are directly comparable.

[12] *Given that pairwise correlations among our independent variables are low (see correlation matrix in the appendix A1), multicollinearity is unlikely to be a problem for our analysis.*

Table 3: OLS Regression analysis of energy-saving behaviour.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Altruism	0.197***	0.204***	0.201***	0.234***	0.220***
	(0.0563)	(0.0570)	(0.0574)	(0.0588)	(0.0585)
Trust	0.139***	0.131**	0.130**	0.119**	0.106**
	(0.0535)	(0.0544)	(0.0544)	(0.0545)	(0.0539)
Pos. reciprocity	0.223***	0.222***	0.221***	0.218***	0.215***
	(0.0553)	(0.0556)	(0.0557)	(0.0576)	(0.0580)
Neg. reciprocity	-0.229***	-0.238***	-0.238***	-0.223***	-0.173***
	(0.0545)	(0.0559)	(0.0559)	(0.0570)	(0.0576)
Risk		-0.00632	-0.00869	-0.0288	-0.0280
		(0.0876)	(0.0878)	(0.0881)	(0.0869)
Ambiguity		0.0482	0.0463	0.0624	0.0403
		(0.0877)	(0.0878)	(0.0879)	(0.0870)
Patience			0.0229	0.0309	0.0420
			(0.0513)	(0.0516)	(0.0509)
EK				-0.0823	-0.0565
				(0.0506)	(0.0543)
EC				-0.0883*	-0.0555
				(0.0520)	(0.0521)
Female					0.207**
					(0.0997)
Age					0.251***
					(0.0510)
Wealth index					-0.0318
					(0.0599)
Education					0.0563
					(0.0555)
Hh members					-0.0916*
					(0.0541)
Hh rooms					-0.0525
					(0.0593)
Constant	-0.00427	-0.00440	-0.00427	-0.00540	-0.118
	(0.0482)	(0.0482)	(0.0483)	(0.0481)	(0.0729)
Observations	887	887	887	887	887
R-squared	0.088	0.089	0.089	0.096	0.132

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

By contrast, we do not find significant results for risk, ambiguity and time preferences. Surprisingly, neither EK nor EC is a significant predictor for energy-saving behaviour in our analysis, which we briefly interpret in the discussion. We do find a positive coefficient for age, indicating that older people engage more in energy-saving behaviour. Finally, women are more likely than men to engage in such behaviour, and so are smaller households.

Table 4: OLS Regression analysis of sustainable plastics consumption.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Altruism	0.162***	0.113***	0.0977**	0.0343	0.0355
	(0.0413)	(0.0395)	(0.0396)	(0.0398)	(0.0400)
Trust	-0.151***	-0.0847**	-0.0864**	-0.0697*	-0.0568
	(0.0396)	(0.0379)	(0.0378)	(0.0370)	(0.0370)
Pos. reciprocity	0.132***	0.118***	0.113***	0.144***	0.126***
	(0.0405)	(0.0385)	(0.0383)	(0.0389)	(0.0395)
Neg. reciprocity	-0.0899**	0.00116	0.00140	-0.0407	-0.0217
	(0.0405)	(0.0392)	(0.0390)	(0.0389)	(0.0397)
Risk		-0.196***	-0.207***	-0.177***	-0.190***
		(0.0618)	(0.0616)	(0.0604)	(0.0602)
Ambiguity		-0.197***	-0.206***	-0.229***	-0.234***
		(0.0618)	(0.0616)	(0.0603)	(0.0603)
Patience			0.106***	0.0829**	0.0964***
			(0.0347)	(0.0341)	(0.0341)
EK				0.0804**	0.0685*
				(0.0346)	(0.0375)
EC				0.217***	0.206***
				(0.0355)	(0.0359)
Female					0.172**
					(0.0686)
Age					0.0454
					(0.0351)
Wealth index					0.0537
					(0.0409)
Education					0.0800**
					(0.0383)
Hh members					0.0924**
					(0.0374)
Hh rooms					-0.0663
					(0.0409)
Constant	-0.00313	-0.00265	-0.00273	-0.00186	-0.0975*
	(0.0358)	(0.0338)	(0.0337)	(0.0329)	(0.0501)
Observations	898	898	898	898	898
R-squared	0.055	0.161	0.169	0.210	0.228

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

3.2.2 Sustainable plastics consumption

Looking at the regression results for sustainable plastics consumption in table 4, we find that all social preferences are statistically significant predictors in model 1, but most of these effects are not robust, since they largely diminish after all other preferences measures and relevant control variables have been added. In model 5, the coefficients of altruism, trust and negative reciprocity are statistically insignificant, and the only social preferences variable that remains a statistically significant positive predictor is positive reciprocity (which enters with the expected sign, as specified in H1).

By contrast, risk and ambiguity tolerance are both significantly negatively related to sustainable plastics consumption, also after adding all relevant control variables. This means that more risk and

ambiguity tolerant people are less likely to engage in this particular PEB, which contradicts our hypothesis H2a and which we reflect upon in the discussion. The results for time preferences confirm the hypothesis that more patient individuals show higher levels of sustainable plastics consumption (H3).

Table 4 also illustrates the importance of considering all relevant preferences. For instance, when risk and ambiguity aversion are not controlled for, negative reciprocity is statistically significant, but it loses significance when these variables are added. This suggests that the significance of the coefficient of negative reciprocity in the incomplete models is spurious.

Finally, we find evidence that higher levels of EK and EC lead to more sustainable plastics consumption, as predicted, and that women, larger households and more educated people engage in this PEB more.

Table 5: OLS Regression analysis of monthly spending on electricity (log).

VARIABLES	(1)	(2)	(3)	(4)	(5)
Altruism	0.0154	0.0289	0.0394*	0.0265	0.0410*
	(0.0227)	(0.0228)	(0.0228)	(0.0233)	(0.0210)
Trust	0.0414*	0.0255	0.0271	0.0333	0.0260
	(0.0219)	(0.0220)	(0.0219)	(0.0219)	(0.0196)
Pos. reciprocity	0.0297	0.0276	0.0308	0.0222	-0.0166
	(0.0223)	(0.0222)	(0.0221)	(0.0229)	(0.0209)
Neg. reciprocity	0.0227	0.00560	0.00469	0.00507	0.0549***
	(0.0224)	(0.0228)	(0.0227)	(0.0232)	(0.0212)
Risk		-0.0343	-0.0276	-0.0172	-0.0197
		(0.0352)	(0.0350)	(0.0350)	(0.0313)
Ambiguity		0.111***	0.117***	0.108***	0.0991***
		(0.0351)	(0.0349)	(0.0349)	(0.0312)
Patience			-0.0691***	-0.0684***	-0.0374**
			(0.0194)	(0.0195)	(0.0175)
EK				0.0594***	-0.0130
				(0.0200)	(0.0194)
EC				0.0121	0.0133
				(0.0208)	(0.0188)
Female					-0.0213
					(0.0356)
Age					0.0811***
					(0.0183)
Wealth index					0.216***
					(0.0217)
Education					-0.00910
					(0.0202)
Hh members					0.0779***
					(0.0197)
Hh rooms					0.0509**
					(0.0216)
Constant	4.690***	4.689***	4.690***	4.690***	4.696***
	(0.0194)	(0.0192)	(0.0191)	(0.0190)	(0.0259)
Observations	869	869	869	869	869
R-squared	0.015	0.035	0.049	0.059	0.261

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

3.3.3 Monthly spending on electricity

Table 5 shows the regression results for the logarithm of monthly spending on electricity. No clear picture emerges for the relevance of social preferences. The only social preference that is statistically significant at better than marginal level in the complete model specification is negative reciprocity. Its coefficient is positive, which means that people who say they are more prepared to punish others for behaviour they think is unfair also spend more on electricity. It is not a robust result, since the coefficient on negative reciprocity is only significant in model 5. Altruism is marginally significant in model 3 and model 5, but nowhere else. No social preference is thus robustly statistically significant.

Ambiguity tolerance is positively related with spending on electricity, which confirms our hypothesis H2b and which we reflect on in the next section, and patience is negatively related with such spending, meaning that more patient individuals have lower spending on electricity per month, which is as expected (H3).

As for energy-saving behaviour, we find no evidence for a relationship between EK and EC and monthly electricity expenditures, which we briefly discuss in the next section. Age and wealth clearly matter, with richer and older people spending more on electricity. Moreover, spending increases with the number of household members and household rooms. There is a much larger jump in R-squared between models 4 and 5 in table 5 than there is in tables 3 and 4. This suggests that, relative to preferences, the socio-economic control variables are more important for electricity spending than for the other two PEBs.

Table 6 summarizes the results obtained from the regressions of preferences and PEB for all dependent variables that we consider in our analysis.

Table 6: Overview of OLS regression results of preferences and PEB (+ indicating a positive relationship, - a negative relationship, n.s. non-significant).

	Energy-saving behaviour	**Sustainable plastics consumption**	**Monthly spending on electricity**
Altruism	+	n.s.	+
Trust	+	n.s.	n.s.
Pos. reciprocity	+	+	n.s.
Neg. reciprocity	-	n.s.	+
Risk	n.s.	-	n.s.
Ambiguity	n.s.	-	+
Patience	n.s.	+	-

4 Discussion and conclusion

In this study, we contribute to the literature that relates PEB to individual preferences. We elicit a full range of individual preferences (risk, ambiguity, time and social) instead of focussing on just one preference in isolation, to make sure preferences do not proxy for omitted ones. We link data on individual preferences to two dependent variables that have not been considered before in this literature (habitual energy-saving behaviour and sustainable plastics consumption) and thereby expand the evidence base on the importance of preferences for PEB that takes place regularly (e.g. switching off lights), as opposed to occasional behaviour (e.g. buying an energy-efficient refrigerator). Unlike previous studies, we consider the role of ambiguity preferences in predicting PEB, which is arguably

561 conceptually more relevant than risk preferences. The reason for this
562 is that the probability of future benefits of PEB is not typically known
563 or easy to estimate.

564 For eliciting preferences, we make use of a state-of-the-art validated
565 survey measure that allows for international comparability and
566 replication (Falk et al., 2016; 2018). By focussing on households in
567 Peru, we shed light on preference heterogeneity and its importance
568 for PEB outside the context of high-income countries, which is rare in
569 the literature (Fuerst and Singh, 2018, for India is an exception). We
570 focus on middle class households, which is a group that is on the rise
571 in low and middle-income countries experiencing long-term
572 economic growth, and the determinants of whose PEB is important
573 to understand for helping ensure that the development of these
574 countries is sustainable. Due to having a rich data set, we are able to
575 control for individual characteristics such as environmental
576 knowledge and concern, wealth, and education that are potentially
577 correlated both with PEB and with preferences. This reduces the risk
578 of omitted variable bias.

579 We find that social preferences are strongly correlated with saving-
580 energy behaviour (switching off unnecessary lights etc.), which
581 confirms our initial hypothesis (H1). Yet, social preferences are hardly
582 correlated with sustainable plastics consumption and with the
583 monthly electricity bill. This demonstrates that preferences that
584 matter for one type of PEB do not necessarily matter for another. For
585 instance, our finding that a trusting propensity matters for saving-
586 energy behaviour confirms previous studies on the link between trust
587 and PEB (Gupta and Ogden, 2009; Volland, 2017; Ziegler, 2018), while
588 we don't find support for this link with our other two dependent
589 variables. Looking at the different types of PEB that we consider in
590 our analysis, a reason for this finding could lie in their different
591 nature. One the one hand, engaging in regular behaviours to save
592 energy in the household is something that one usually does for
593 oneself without being publically recognized for it. It is not observed
594 by others, except for perhaps roommates or family members, and
595 requires a strong sense of intrinsic motivation, which makes it
596 plausible that social preferences are important. Avoiding the use of
597 plastic bags in shops, on the other hand, is visible to other people and
598 might therefore depend less strongly on a pro-social motivation (even
599 though we do find a positive link for positive reciprocity and
600 sustainable plastics consumption, but not for social preferences in
601 general). Our analysis also shows that it is not just trust that can
602 explain PEB (as mostly focussed on in previous literature), but that
603 other social preferences are important to consider as well.

604 The willingness to take risk and experience ambiguity are both
605 negatively related with sustainable plastics consumption, which is the
606 same as saying that both risk and ambiguity aversion are positively

607 related with it. In other words, when people are less tolerant of risk
608 and ambiguity, they engage more in avoiding wasteful plastic use. As
609 stated earlier, this is at odds with most previous literature that relates
610 PEB and risk aversion (Farsi, 2010; Qiu et al., 2014; Fischbacher et al.,
611 2015) and contradicts our initial hypothesis (H2a). In that literature,
612 the rationale given for such a link is that the benefits of PEB are
613 uncertain, which more risk tolerant people mind less, as a result of
614 which they engage more in such PEB. However, it is worth pointing
615 out that it is not just the benefits of PEB that are uncertain: the costs
616 of not engaging in PEB are uncertain, too. A risk or ambiguity averse
617 person may thus avoid the use of plastics since the environmental
618 damage that may result from using plastics is uncertain. Given that
619 the smaller, regular PEBs to avoid plastics that we investigate in our
620 study require less uncertain investment than the PEBs in the studies
621 mentioned above (e.g. purchase of an energy-efficient appliance), the
622 uncertainties about potential damage from not engaging in the
623 behaviour seem to outweigh the uncertain benefits from engaging in
624 it in this case. Our findings might also hint towards the possibility that
625 with regards to the investment in energy-efficient technologies
626 (which has mostly been considered as the dependent PEB in relation
627 with risk preferences in previous research so far), the investment
628 decision itself might dominate the pro-environmental nature of the
629 behaviour. Future research that investigates these links more in
630 depth would be interesting.

631 Our findings for risk aversion and sustainable plastics consumption
632 are comparable to what Volland (2017) finds for spending on energy.
633 As illustrated before, he finds for a UK sample that higher risk
634 tolerance is associated with greater such spending (and therefore risk
635 aversion with less of such spending). In other words, both in his case
636 and in our case, uncertainty aversion and PEB are positively
637 associated, as we predicted (H2b). However, unlike Volland, we find
638 no link between risk tolerance and the monthly electricity bill.
639 Instead, we do find that the willingness to experience ambiguity is
640 positively related with such spending. Perhaps ambiguity averse
641 people mind the financial uncertainty more that results from
642 profligate spending. It shows in any case the importance of including
643 ambiguity aversion in the analysis of PEB, and not just risk aversion
644 alone.

645 We find no link between risk and ambiguity aversion and habitual
646 energy-saving behaviour. One possible interpretation is that, in the
647 case of this PEB, the uncertain benefits of engaging in this PEB and
648 the uncertain costs of not engaging in it are not considered to be
649 sufficiently sizeable to be much of a worry.

650 More patience is positively related with sustainable plastics
651 consumption, negatively related with the monthly electricity bill, and
652 not significantly related with habitual energy-saving behaviour. As

outlined before, previous studies have found patience to be positively related with PEB (Fischbacher et al., 2015; Newell and Siikamäki, 2015; Fuerst and Singh, 2018; Ziegler, 2018). Our findings on plastics avoidance and electricity expenditures are consistent with that and confirm our hypothesis on the link between time preferences and PEB (H3). The reason offered in these studies is that more patient people discount the future at a lower rate, and therefore value PEB, whose benefits are in the future, more highly. In line with that, we do not find a positive relationship between patience and PEB that also has immediate benefits (people saving money through energy-efficient behaviour) but only between patience and PEB with predominately future benefits (avoiding plastic waste).

Even though environmental knowledge and concern are not our key variables of interest in the analysis, it is worth noticing that both EK and EC positively predict sustainable plastics consumption (as one would expect), while we find no evidence for a relationship with energy-saving behaviour or the monthly electricity bill. While we can only speculate about these results, a reason could be that more environmental knowledge and concern is required to avoid the use of plastics, which is still a rather new topic in the Peruvian context, whereas regular measures to save energy in the household might already have become habits for people, regardless of their level of EK or EC. With regards to electricity expenditures, we have seen that especially socio-economic variables such as wealth or the household size are relevant predictors, which might simply outweigh any efforts resulting from higher levels of EK or EC.[13]

We see three main messages emerging from this study. First, it matters to control for all relevant preferences when explaining PEB. Examples abound, in the analyses above, of the statistical significance of coefficients on preferences disappearing as we gradually add more preferences as independent variables. This means that studies that do not control for all relevant preferences may draw the wrong conclusion about which ones matter for PEB.

Second, different preferences matter for different PEBs. For habitual energy-saving behaviour, which brings only tiny benefits to the individual actor and requires a strong sense of a shared responsibility for the well-being of future generations, we found social preferences mainly to matter. For sustainable plastics consumption, we found that patience and risk and ambiguity tolerance matter: people who discount the future at a lower rate and mind more the uncertain damage of not engaging in the behaviour are more likely to engage in this particular PEB. For spending on electricity, which unlike the other

[13] EK and EC are also positively correlated with education and wealth, which supports this hypothesis.

two PEBs brings large benefits to the actor, patience and ambiguity aversion matter.

Third, pro-environmental policy can make use of evidence that particular preferences matter for particular PEBs. There seems to be no "one size fits all" solution to encourage PEB by appealing on people's preferences, but policies should rather be targeted specifically to the type of behaviour that one wants to promote. Our results suggest that to promote daily energy-saving habits, policy messages could emphasise that this PEB is an opportunity to care for and take responsibility for future generations. Such a strategy might be especially powerful when the target behaviour is not observed by others and a strong sense of intrinsic motivation is required. To promote the sustainable use of plastics, our results imply that the consequences of not doing so could be vividly shown to people, so that the dreadful future that would result from excessive use feels real. In general, our findings have shown that it is not just the uncertain benefits of investing in PEB that are important, but that the uncertain costs of not engaging in PEB are relevant for people's decision-making as well, which can be used to design messages more effectively. Finally, to promote energy efficiency that results in a lower monthly electricity bill, our results suggest that simple worked examples on financial savings ("you could save X %") in addition to appeals on future benefits may work.

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References

Andina (2019). 'Peru's middle class grew 4.5% to 14.4 million in 2018,' Andina, 15 May [Online]. Available at https://andina.pe/ingles/noticia-perus-middle-class-grew-45-to-144-million-in-2018-751540.aspx [Accessed 12 March 2020].

Carattini, S., Baranzini, A. and Roca, J. (2015). Unconventional Determinants of Greenhouse Gas Emissions: The Role of Trust. Environmental Policy and Governance, 23 (4), 243-257.

Census (2017). Censos Nacionales 2017: XII de Población, VII de Vivienda y III de Comunidades Indígenas. Instituto Nacional de Estadística e Informática.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J. and Wagner, G. (2011). Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences. Journal of the European Economic Association, 9 (3), 522-550.

Ellsberg, D. (1961). Risk, Ambiguity, and the Savage Axioms. Quarterly Journal of Economics, 75 (4), 643-69.

ENAHO (2017). Perú – Encuesta Nacional de Hogares sobre Condiciones de Vida y Pobreza 2017. Instituto Nacional de Estadística e Informática.

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D. and Sunde, U. (2015). The Nature and Predictive Power of Preferences: Global Evidence. IZA Discussion Paper No. 9504.

Falk, A., Becker, A., Dohmen, T., Huffman, D. and Sunde, U. (2016). The Preference Survey Module: A Validated Instrument for Measuring. IZA Discussion Paper No. 9674.

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., and Sunde, U. (2018). Global evidence on economic preferences. Quarterly Journal of Economics, 133 (4), 1645-1692.

Farsi, M. (2010). Risk aversion and willingness to pay for energy efficient systems in rental apartments. Energy Policy, 38 (6), 3078-3088.

Fischbacher, U., Schudy, S. and Teyssier, S. (2015). Heterogeneous Preferences and Investments in Energy Saving Measures. Munich Discussion Paper No. 2015-11.

Fuerst, F. and Singh, R. (2018). How present bias forestalls energy efficiency upgrades: A study of household appliance purchases in India. Journal of Cleaner Production, 186, 558-569.

Gupta, S. and Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. Journal of Consumer Marketing, 26 (6), 376-391.

INEI (2016). Instituto Nacional de Estadística e Informática – Planos Estratificados de Lima Metropolitana a Nivel de Manzana 2016.

Lades, L. K., Laffan, K. and Weber, T. O. (2020). Do economic preferences predict pro-environmental behaviour? Working Paper 2020-03, Geary Institute, University College Dublin.

Millner, A., Dietz, S. and Heal, G. (2013). Scientific Ambiguity and Climate Policy. Environmental and Resource Economics, 55 (1), 21-46.

Never, B., Albert, J. R., Fuhrmann, H., Gsell, S., Jaramillo, M., Kuhn, S. and Senadza, B. (2020). Carbon-intensity of consumption patterns of the emerging middle classes. DIE Discussion Paper 10-2020, Bonn: Deutsches Institut für Entwicklungspolitik (DIE).

Newell, R. G. and Siikamäki, J. (2015). Individual Time Preferences and Energy Efficiency. American Economic Review: Papers & Proceedings, 105 (5), 196-200.

Ostrom, E. (2009). A Polycentric Approach for Coping With Climate Change. Policy Research Working Paper 5095, The World Bank.

Qiu, Y., Colson, G. and Grebitus, C. (2014). Risk preferences and purchase of energy-efficient technologies in the residential sector. Ecological Economics, 107, 216-229.

Sutter, M., Kocher, M. G., Glätzle-Rützler, D. and Trautmann, S. T. (2013). Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior. American Economic Review, 103 (1), 510-531.

Thogersen, J., Haugaard, P. and Olesen, A. (2010). Consumer responses to ecolabels. European Journal of Marketing, 44, 1787-1810.

Thogersen, J., Pedersen, S. and Aschemann-Witzel, J. (2019). The impact of organic certification and country of origin on consumer food choice in developed and emerging economies. Food Quality and Preference, 72, 10-30.

Trautmann, S. T. and Van de Kuilen, G. (2014). Ambiguity Attitudes. In: Keren, G. and Wu, G. (eds), The Wiley Blackwell Handbook of Judgment and Decision Making, First Edition, 89-116.

Volland, B. (2017). The role of risk and trust attitudes in explaining residential energy demand: Evidence from the United Kingdom. Ecological Economics, 132, 14-30.

809 **Ziegler (2018).** Heterogeneous preferences and the individual
810 change to alternative electricity contracts. MAGKS Papers on
811 Economics No. 27-2018, Philipps-University Marburg.

Appendix

A.1 Correlation matrix of preferences and PEB

Table 7: Pairwise correlations between preferences and PEB.

Var.	Alt-ruism	Trust	Pos. recip-rocity	Neg. recip-rocity	Risk	Ambi-guity	Pa-tience	Energy-saving beh.	Sust. plastics cons.	Elec-tricity exp.
Alt-ruism	1.000									
Trust	0.332***	1.000								
Pos. recip-rocity	0.407***	0.264***	1.000							
Neg. recip-rocity	0.191***	0.266***	-0.065*	1.000						
Risk	-0.022	0.171***	-0.076**	0.253***	1.000					
Ambi-guity	-0.059*	0.183***	-0.034	0.230***	0.833***	1.000				
Pa-tience	0.158***	0.107***	0.098***	0.072**	0.170***	0.165***	1.000			
Energy-saving beh.	0.196***	0.139***	0.237***	-0.104***	-0.014	-0.002	0.050	1.000		
Sust. plastics cons.	0.135***	-0.078**	0.148***	-0.093***	-0.350***	-0.351***	0.050	0.151***	1.000	
Elec-tricity exp.	0.077**	0.101***	0.076**	0.057*	0.108***	0.151***	-0.074**	-0.049	-0.088***	1.000

**** p<0.01, ** p<0.05, * p<0.1*

A.2 Measures for preferences

The questions for risk, time and social preferences are taken from the GPS of Falk et al. (2016; 2018). All questions are available for download online and can be found in various languages, which are also adjusted for local currencies: https://www.briq-institute.org/global-preferences/home. For the data collection, we used the Peruvian (Spanish) version of the GPS (using Peruvian Soles as currency). Here, we present the English wording as it is illustrated in Falk et al. (2016), listing only the questions that we use for our analysis.

Social preferences

We now ask for your willingness to act in a certain way in different areas. Please indicate your answer on a scale from 0 to 10, where 0 means you are "completely unwilling to do so" and a 10 means you are "very willing to do so". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Negative reciprocity

- *How willing are you to punish someone who treats **you** unfairly, even if there may be costs to do so?*
- *How willing are you to punish someone who treats **others** unfairly, even if there may be costs to do so?*

Completely unwilling to do so 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 very willing to do so

Altruism

- *How willing are you to give to good causes without expecting anything in return?*

Completely unwilling to do so 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 very willing to do so

How well do the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10. A 0 means "does not describe me at all" and a 10 means "describes me perfectly". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Positive reciprocity

- *When someone does me a favour, I am willing to return it.*

Does not describe me at all 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 describes me perfectly

Trust

- *I assume that people have only the best intentions.*

Does not describe me at all 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 describes me perfectly

Risk and ambiguity preferences

Risk

- *Please imagine the following situation: You can choose between a sure payment of a particular amount of money, or a draw, where you would have an equal chance of getting amount x or getting nothing. We will present to you five different situations. The draw with the 50/50 chance of receiving amount x or receiving nothing is the same in all situations. The sure payment is different in every situation.*

  What would you prefer: a draw with a 50 percent chance of receiving amount x, and the same 50 percent chance of receiving nothing, or the amount of y as a sure payment?

  [If the participant preferred the gamble, then the sure payment was increased, if they preferred the sure payment, then the sure payment was reduced; and they were asked the question again. This continued until the certainty equivalent value of the gamble was closely approximated (see figure A1 for the steps that were taken).]

Ambiguity

- *Please imagine the following situation: You can choose between a sure payment of a particular amount of money, or a draw from a bag of 20 balls, where some are white and some are black. You don't know how many balls are black and how many balls are white. If you draw a white ball, you get amount x, if you draw a black ball, you get nothing. We will present to you five different situations. The draw from the bag with black and white balls is the same in all situations. The sure payment is different in every situation.*

  What would you prefer: a draw from the bag of 20 balls, where you would get amount x if you drew a white ball, and nothing if you drew a black ball, or the amount of y as a sure payment?

  [The certainty equivalent value of the draw was approximated using the same staircase procedure as the one for risk (figure A1).]

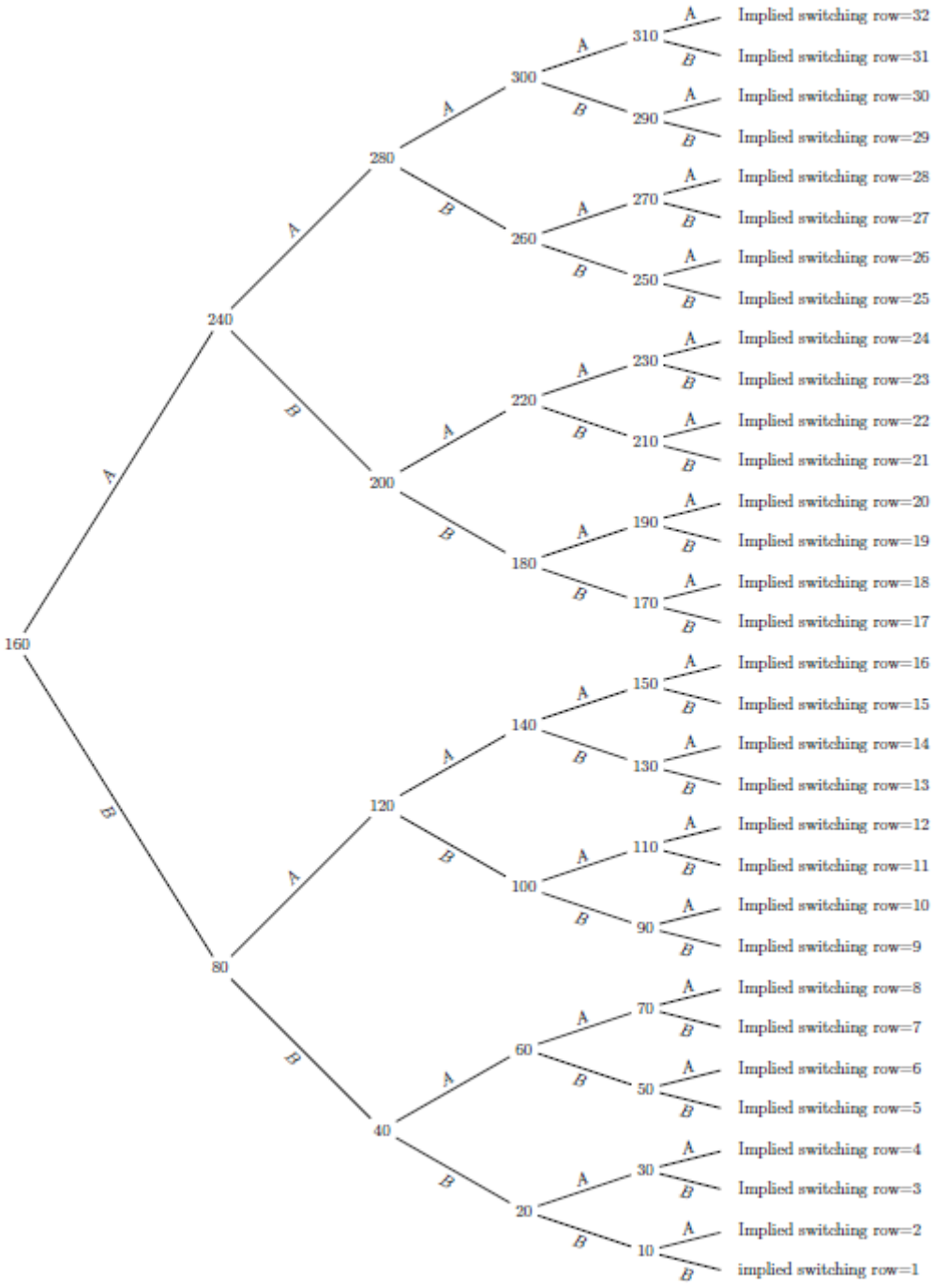

Figure A1: Tree for the staircase risk task (numbers = sure payment, A = choice of lottery, B = choice of sure payment); taken from Falk et al. (2016). The lottery considered here is a 50/50 chance of 300.

Time preferences

- *Suppose you were given the choice between receiving a payment today or a payment in 12 months. We will now present to you 5 situations. The payment today is the same in each of these situations. The payment in 12 months is different in every situation. For each of these situations we would like to know which you would choose. Please assume there is no inflation, i.e. future prices are the same as today's prices.*

  Please consider the following: would you rather receive amount x today or amount y in 12 months?

  [The participant then chose five times between amount x, which was kept constant, and a payment in twelve months, which was increased compared to the previous choice if the future payment had been chosen and reduced if the payment today had been chosen (see figure A2).]

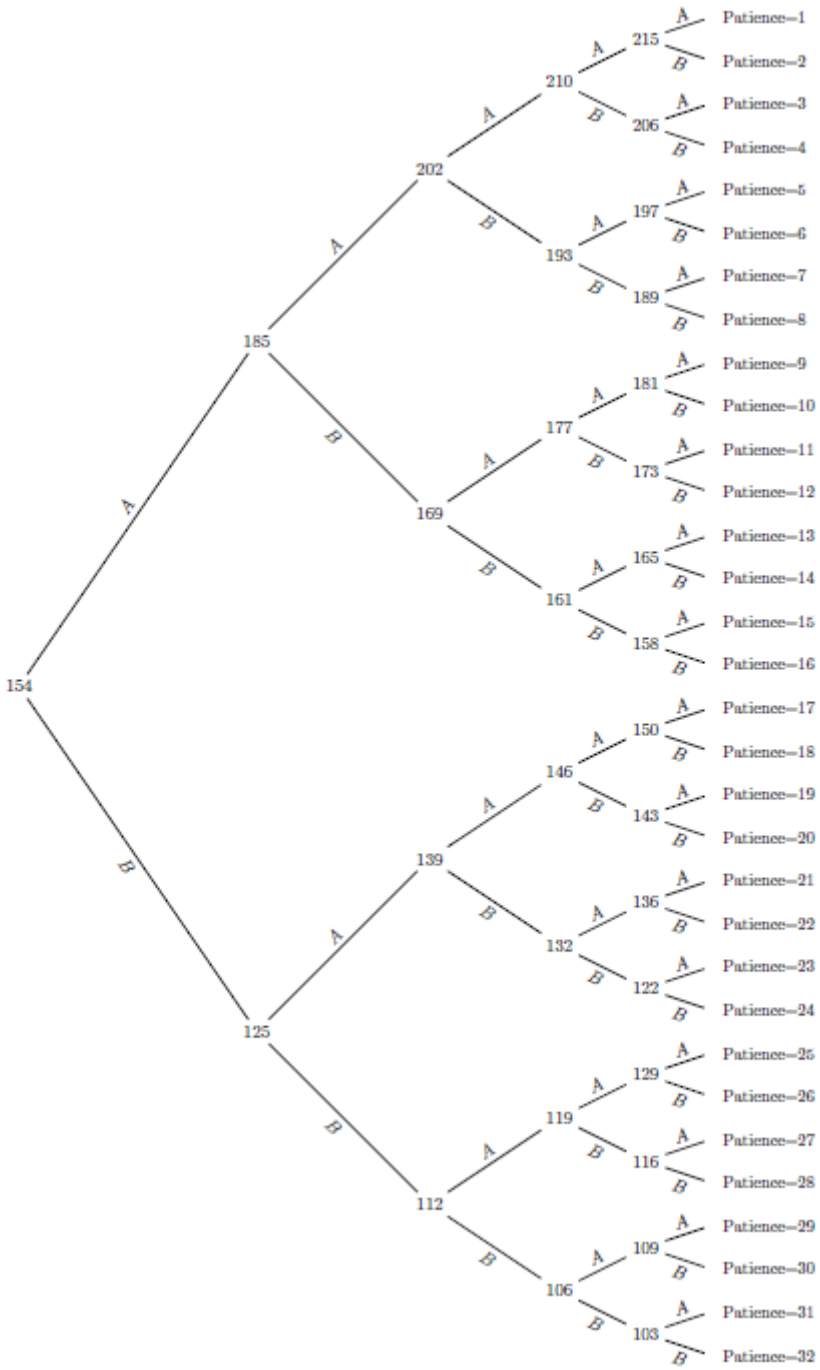

Figure A2: Tree for the staircase time task (numbers = payment in 12 months, A = choice of amount 100 today, B = choice of amount y in 12 months); taken from Falk et al. (2016). The first intertemporal choice considered is 100 today or 154 in 12 months.

A.3 Measures for Pro-Environmental Behaviour

The indices for energy-saving behaviour and sustainable plastics consumption are built based on different usage behaviour questions, which are all measured on a 5-point Likert-Scale.

Energy-saving behaviour

- *Do you usually switch off the lights when you leave the room?*
- *Do you usually turn off the TV if nobody is watching actively?*
- *Do you actively try to save energy in your household?*

no, nearly never (1) – yes, rarely (2) – yes, sometimes (3) – yes, often (4) – yes, nearly always (5)

Sustainable plastics consumption

- *Do you usually reuse materials such as plastic bags?*
- *Do you usually avoid taking plastic bags in shops (e.g. supermarkets)?*

no, nearly never (1) – yes, rarely (2) – yes, sometimes (3) – yes, often (4) – yes, nearly always (5)

Spending on electricity

For spending on electricity, enumerators either copied the number from the electricity bill (when participants allowed us to take a photo), or people were asked the following question.

- *Please give us your best guess how much you spent on electricity in the last month. (in Soles)*

A.4 Measures for control variables

The question for EK and EC are based on Thogersen et al. (2010) and Thogersen et al. (2019).

Environmental knowledge

The measure for EK is built using an additive index based on eight questions eliciting knowledge on different environmental dimensions. Each correct answer is counted as one, wrong answers or indifference are counted as 0.

Of the following statements, which one capture your understanding of energy saving and sustainable consumption? If you think a statement is correct, please say "yes"; if you think a statement is false, please say "no".

- *I know a lot about the topic of global climate change.*
- *I know quite a lot about the different possibilities how to save energy in my household.*
- *Compared with others, I have a good understanding of the impact of transport on air pollution.*
- *You can save energy when you set your air con 2 degrees warmer.*
- *Using a lot of energy has a negative impact on the environment.*
- *You can save energy and money in the long run when you buy a new fridge with an energy efficient technology.*
- *Whether I leave the light on the whole day or turn it off when I leave the room does matter for my energy consumption.*

- *Using public transport instead of a private car is better for the environment.*

  yes – no – don't know

Environmental concern

The measure for EC is built using a mean index based on six questions eliciting concern for the environment and for sustainable consumption habits, which are all measured on a 5-point Likert-Scale.

How much do you agree or disagree with the following statements?

- *It is important to me that the products that I use do not harm the environment.*
- *I consider the potential environmental impact of my actions when making many of my decisions.*
- *My purchase habits are affected by my concern for our environment.*
- *I am concerned about wasting the resources of our planet.*
- *I would describe myself as environmentally responsible.*
- *I am willing to restrict myself in order to take actions that are more environmentally friendly.*

strongly disagree (1) – disagree (2) – neither agree nor disagree (3) – agree (4) – strongly agree (5)

Wealth index

The wealth index is built based on the following items using PCA:

- Dummy variables for a number of household assets (0 or 1): fridge, freezer, radio, fan, rice cooker, microwave, washing machine, smartphone, laptop, desktop computer, stereo, water heater, car, motorbike, bicycle
- Characteristics of the house (low (-1), medium (0), high (1)): size, material, quality, water supply
- Highest level of education of the household head (low (-1), medium (0), high (1))

Level of education

The level of education of the respondent is measured based on the following question, with answer options coded from 1 to 7:

- *What is your highest certificate of education?*
  - *No education certificate or pre-school (1)*
  - *Primary school / Elementary school (2)*
  - *Secondary school / High school (3)*
  - *Technical higher education (4)*
  - *Bachelor's degree (5)*
  - *Master's degree (6)*
  - *PhD / Doctorate (7)*