Children willigness to pay for environmental protection

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Abstract

Young generations will bear the cost of present natural capital degradation and, as youth strikes for climate change proved, do not want their voices to be ignored. Discrete Choice Experiments are increasignly being used for the valuation of environmental goods, nevertheless, they have never been conducted with children. We design and conduct a discrete choice experiment to elicit children aged 8-19 years, willigness to pay (WTP) for environmental protection projects. We find that 97.5 percent of respondents are willing to pay their own money for protecting environment. Our results suggest that children WTP is higher for projects targeting natural protection in children's own country (Italy) and that WTP is increases significanlty with age. Given recent findings on transfer of knowledge, attitudes and behaviours towards environmental protection from children to parents, these results are important to support policy makers decisions on how to deal with the issues of natural capital degradation.

JEL classification:

C93,Q51,D83

Keywords:

Discrete Choice Experiment; Children; Natural Capital; Environmental Protection;Willigness to Pay

1 Background

"Since our leaders are behaving like children, we will take the responsability they should have taken long ago" Gretha Tunberg 2019

Given the emerging recognition of the importance of natural capital and its fragility, there has been an increasing number of studies valuing ecosystem services. The economic valuation of the ecosystem services is crucial to quantify the contribution of biosystems and biodiversity to human well-being and it is

an essential input to carry out cost-benefit analysis of environmental-related interventions (Botzen and Beukering 2018).

Stated preference techniques are commonly used to assign a monetary value to non-marketed goods and services. Examples in the literature include valuation of inland European wetlands (Brander et al., 2011); grasslands, global wetlands, mangroves and coral reefs (Hussain et al., 2011); recreational and passive forests services (Chiabai et al., 2009), ecological and health risks from wastewater flooding in urban centers and the environments(Veronesi et al. 2014).

All these studies have elicited WTP from an adult perspective excluding youth from deicision making process. As suggested by Currie (2016) and the EC Parma Declaration (2014) to plan evidence based incentives to protect a public good such as natural environment it is important to include the viewpoint of the present young generations. As demonstrated by the youth climate strikes, very little has been done so far by policy makers. Preliminary scientific evidence suggests that children do play a role in their families when it come to environmental related behaviours. In 2004 Dupont showed that the presence of children influences households WTP for environmental goods improvements. A more recent article provides evidence that child to parent intergenerational learning - transfer of knowledge, attitudes or behaviours from children to parents- may be a powerful pathway through which children forster climate change concerns among their parents. To the best of our knowledge, no study investigates whether young generations can assign a monetary value natural capital. Two are the most common methods used to value environmental projects: Discrete Choice Experiments (DCE) and Contingent Valuation studies (CV). Unlike CV studies, which directly ask respondents how much they are willing to pay for a specific change (e.g. in health risk), DCEs present respondents with achoice sets, in which alternatives, described as a set of attributes, are mutually exclusive (Louviere et al. 2010). Compared with CV technique, DCE have the capacity to describe a choice situation with a range of attributes that reflect the different characteristics of the good being valued (Louviere et al.2010). When a cost attribute is included, marginal utility estimates for changes in the level of each, attribute can be converted into WTP estimates (Ryan 2009;Boxall et al.1996). Given these several advantages, DCEs have become popular in transportation, environmental and health economics (Hensher 2001;Bateman et al. 2009).

Despite the assumption that children are not able to speak for themselves when it comes to assessing the value of health risk reduction no stated preference study have been conducted to test this assumption and verify whether children have defined preferences for environemntal protection, or develop them from a certain age (OECD 2006). The aim of this study is to investigate using a DCE, children willigness to pay for environmental protection. We find that 97.5 percent of respondents are willing to pay their own money for protecting environment. Our results suggest that children WTP is higher for projects targeting natural protection in children's own country (Italy) and that WTP is increases significanlty with age.

The remaining part of this paper is structured as follows: the next sec-

tion provides details about the DCE and the questionnaire employed for data collection. Section 3 outlines the econometric approach we use for modeling preferences. Section 4 describes the relevant results from the analysis. The last section, discusses the findings and concludes the paper.

2 Data and Methods

This study is part of a large research project investigating children's use and understanding of money, health risk comprehension and their ability to answer to stated choice preferences (Guerriero and Cairns 2017). Ethical approval for this study was received by the Italian CNR Ethical Commitee and the London School of Hygiene Ethical Commitee. Informed written consent and informed assent were obtained from parents and children. The study was carried out by an interdisciplinary team involving psychologits, policy specialists and economists. This study was designed according to the state-of-the-art recommendations for DCE. Given that this is the first DCE experiment with children, the desing of the DCE began with a qualitative interviews using focus groups with the children to investigate their awareness of policy relevant attributes. Further qualitative research was carried out to refine the attributes description and the wording to use in the cheap talk (Johnson et al. 2013). Before conducting the DCE a study investigating respondents' use and understading of money was also carried out (results for younger children are reported in Guerriero and Cairns 2017). The questionnaire used in the final study asked about respondents' socio-demographic characteristics. It also included warm-up questions about the respondents' attitudes toward environmental protection (Krupnick and Adamowicz 2006). The second part of this study employed a discrete choice experiment to elicit respondents willigness to pay for environmental protection.

All images and accompanying wording were tested in the focus group discussions and pilot study to ensure a satisfactory understanding and scenario acceptance by respondents (Johnston, Swallow, and Bauer 2002, 2016; Bateman et al. 2005, 2006a; Horne, Boxall, and Adamowicz 2005; Boyle et al. 2010; Meyer 2013).

2.1 Discrete Choice Experiment Design

DCE are a widely-used technique in economics, marketing, and transportation research to understand preferences and predict demand for a very wide range of goods, services, and policies (Hanley and Barbier, 2009; Hanley and Czajkowski, 2017).

Our DCE begins with a cheap talk during which we made sure that the scenario and the projects being valued were clearly understood (Jerrod Penn, Wuyang Hu 2019). During the talk, we also paid attention that children perceive their responses as influencing the provision of the item being valued (i.e. consequentiality applies) and we encourage truthful preference revelation.

After the cheap talk, the children are asked to complete the DCE considering their own budget constraint. A budget reminder was made at the beginning of each choice set. The scenario presented makes clear that the voluntary payment was due only once every year and that they were deciding whether and if so how much to contribute in the present year to observe the described outcome in the following year. To facilitate money comprehesion, during the cheap talk and in the legend we report the annual values also in terms of monthly contributions. The environmental program consisted in a voluntary contribution with annual payment and annual improvement of the natural capital. The attributes and levels are shown in Table 1 while Figure 1 shows an example of a choice card. The DCE used generic attributes common to both alternatives (unlabeled design) and includes a status quo option. Each of the choice set (see an example in Figure 1) consists of three alternatives characterized by three attributes: the annual donation paid for the environmental good; two types of environmental projects the first one targeting Italy the second one targeting environmental conservation in a foreign country different from Italy.

The two envirnmental projects in the DCE are designed on the basis of two projects currenlty managed by the World Wildlife Fundation (see WWF for Italy https://sostieni.wwf.it/wwf-for-italy.html). One choice option was always a zero-additional-cost opt-out, which was associated with environmental degradation in both Italy and in the other part of the world. Given that the experiment was designed to estimate the tradeoffs children were willing to make between environmental protection and their income (pocket money), the policy questions comprised only three attributes: (i) the size of the environmental quality in Italy; (ii) the size of the environmental quality in countries different from Italy and (iii) the voluntary annual contribution for the environmental project. As in previous research with adults, we found that visual aids (horizontal bar) facilitate the understading of change in environmental quality (Adamovicz et al.2007;Jones-Lee et al. 1985;Corso et al.2001). Four possible action levels were used to depict the effect of the project on natural capital. Each bar has three squares and a red line. The red vertical line indicates the present environmental quality, on the left of the red line there is environmental degradation (black square) on the right (two green squares) environmental improvements from the current status. A legenda was given to each child during the DCE. In the experiment the attributes have four possible levels (see Table 1) generating a full factorial desing of 64 combinations of attributes and levels. Based on our pilot studies we found that seven choice sets with three alternatives were a reasonable number of choices for the respondents. Using Ngene, we construct a Bayesian D-efficient experimental design based on priors obtained from the pilot study data (Scarpa and Rose, 2008). Overall our final DCE includes six choice sets plus a dominated choice set.

Table 1. Attribute names and levels.

Attributes	Description	Levels
Italy	Annual improvement of the natural capital in Italy	-1,0,1,2
World	Annual improvement of the natural capital in part of the World different from Italy	-1,0,1,2
Price	Price of the annual voluntary contribution	16,32,60,200

Figure 1. Example of choice set.

1.1

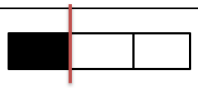
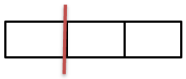
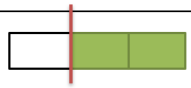
Where?	A	B	C
 ITALY			
 REST OF THE WORLD			
Annual Payment	€0	€16	€60
Questions			
Which among the three alternatives would you choose?			
Between B e C, which alternative would you choose?			

Table 2. Descriptive Statistics of the Sample.

	Share/Median
Females	44%
Age	14
Education	
Primary/Elementary	68
Secondary	71
High School	227
Monthly pocket allowance	30(S.D.96.4)

2.2 Discrete Choice Model estimation

The results of the DCE are used to assess individual preferences within the random utility maximization (RUM) framework proposed by Thurstone in 1927 and further developed by McFadden in 1974. According to RUM individuals' choice is determined by some construct of indirect utilities for choice alternatives. Given that the researchers cannot directly observe all the individual factors affecting their utility, individual i choice behavior is broken-down into two additive and separable parts: one a systematic (observable) component determined by the characteristics of the alternatives j, and a second random (unexplained) component representing the variation in respondent choices influenced by individual characteristics, such as heterogeneity in tastes, measurement errors and functional specification[23]. The utility associated with each alternative can be formalized a follow:

$U_{ij} = \beta' x_{ij} + \epsilon_{ij}$

where β is the vector parameter of marigal utilites of the attributes, x_{ij} is the vector of the attributes of the alternatives and ϵ_{ij} is an error term assumed to be indipendent identically distributed (IDD) type I extreme value. The Conditional Logit (CL) model is the starting point for most analyses of DCEs. The popularity of CL is associated with a number of properties which make it easily computable (e.g. the independent and identical distribution of the error component). Despite its popularity, the CL is not the best model to analize our data as it assumes decisions to be independent across choice sets. Our data are "panel" data as each respondent answers seven choice questions. Another limitation of the CL is that it fails to account for random taste variation between respondents ignoring that individuals may attach different levels of importance to alternatives within the choice set based on their attitudes and tastes[20]. A common solution to account for the potential heterogeneity between respondents' tastes is to use a mixed logit (MIX) model with random coefficients. In the MIX model, the observed variables are no longer assumed fixed; but considered to vary according to a predefined distribution (usually normal and lognormal), which offers a representation of the heterogeneity between respondents' tastes. The standard approach to estimate WTP from a mixed logit model is to assume a distribution for the coefficients and estimate the WTP as the ratio of the two randomly distributed terms. Depending on the choice of distributions for the coefficients this can lead to WTP distributions which are heavily skewed and that may not even have defined moments. One common solution to adress this issue is to assume a constant cost coefficient which unrealistically implies that all the respondents have a constant marginal utility of money (Meijer and Rouwendal,2006). An alternative approach which allows the preferences for price to be heterogeneous is to specify that the price coefficient is log-normally distributed. This approach constrains the price coefficien to be positive and with defined moments. However, WTP distribution can be highly skewed which may produce unrealistic estimates of the means and standard deviations of WTP.

Train and Weeks (2005) suggest that a way to circumvent this problem is to

estimate the mixed logit model in WTP space rather than in preference space. This involves estimating the distribution of willingness to pay directly by reformulating the model in such a way that the coefficients represent the WTP measures. When using WTP space models, the researcher then makes a priori assumptions direclty about the distributions of th welfare estimates rather than on the attribute coefficients parameters (Scarpa et al. 2008).

The WTP space model assumes that the utility of subject i in the choice set t is a function of price p_{ijt} and non-price attributes β_{ijt} so that utility can be written:

$$U_{njt} = -(1/\sigma_n p_{njt}) + (\beta_n/\sigma_n)x_{njt} + e_{jt}$$

where: β_n is the welfare estimate for a unit change in the level of the attribute which is assumed to vary randomly over decision makers; σ_n is an individual specific inverse of the scale parameter.e_{jt} is the identically distributed error term with contant variance (Train and Week 2005). In 2010 Hensher and Greene show that the GMNL model nests the preference Space and the WTP space. According to Train and Week 2005, WTP estimates obtained from WTP space have a smaller variance than those estimated from MIX models.

All the models of our analysis investigate the role of socio-demographic variables as gender, age and monthly pocket allowance. All these variables were included in the models as interactions with the attributes. In principle, being our study unlabeled, apart from attributes and their levels no other elements should influence respondents' utility. However, reserachers generally include an alternative specific constant for the SQ to allow for unobserved effects (e.g. loss aversion, inertia)beyond the attributes in the choice sets (Adamowicz et al. 1998; Meyernoff Liebe 2009; Ferrini and Willis 2005, Kanheman, Knetsch and Thanler 1991). In our study the status quo (SQ) option comes with a zero cost but not in terms of environmental quality which in absence of any intervention would deteriorate in both Italy and in the rest of the world (Scott, 2001). As result, we always include a SQ constant term (ASQ_{SQ}) taking value of 1 for the alternative describing the SQ and zero otherwise in all the models considered.

3 Results

The survey was conducted between January and April 2013, and 370 respondents took part in it. The basic socio-demographic characteristics of the sample are provided in Table 2. The mean age of the children interviewed was 14 years old (range, 8–19 years old) with 56 percent of males. The median monthly pocket allowance is 30 euro. All but 10 respondents completed the choice tasks giving a total of 2,520 observations. 9 (2.5 percent of respondents) children always decided to choose the status quo. In the remaining of this section we present the results of five different models: (1) CL model, (2) MIX model without correlations, (3) MIX Model with correlated coefficients, (4) WTP space Model with indipendent coefficients, (5) WTP space model with correlated coefficients. We use 2500 Halton draws for the estimation of Models 3 to 6. To explore the effects of socio-demographic variables on children models are run

with and without interactions terms. Attribute levels of choice were coded in the way described in Table 1 with the exception of price that is divided by 100. Gender is coded 0 for girls and 1 for boys while age is mean-centered. Table 3 shows the results of the preference space models. The CL Model includes the three attributes plus the SQ constant. The coefficients World and Italy capture the extra utility associated with an increase in environmental quality.

Table 3. Results of preference space models

	Model 1a Conditional Logit	**Model 1b Conditional Logit with Interactions**	**Model 2a MIX with independent coefficients**	**Model 2b MIX with Interactions**	**Model 3 MIX with correlated coefficients**
Mean(SE)					
ASC_{SQ}	-.50(.18) ***	-.55(.17) ***	-4.69(.79)***	-4.71(.80)***	-4.85(.74)***
World	.42(.04) ***	.51(.06) ***	.54(.07)***	.61(.10)***	.43(.07)***
Italy	.83(.05) ***	1.04(.08) ***	1.37(.11)***	1.67(.15)***	1.58(.14)***
Price	-1.33(.08) ***	-1.61(.12) ***	-.82(.09)***	-1.05(.09)***	-.81(.10)***
SD					
World			.79(.08)***	.76(.09)***	.66(.10)***
Italy			.66(.11)***	.80(.12)***	.85(.14)***
Price			.97(.07)***	.73(.07)***	.65(.07)***
Interactions					
Age*World		-.07(.04)		.11(.07)	
Gender *World		-.18(.09)		-.11(.14)	
Age*Italy		-.01(.05)		.22(.09)**	
Gender *Italy		-.41(.11) ***		-.50(.18)***.	
Age*Price		-.30(.08)***		-.67(.13)***	
Gender *Price		.69(.17)***		1.31(.28)***	
Pocket allowance*Price		-.001(.001)**		-.002(.001)*	
Model characteristcs					
LL	-1647.77	-1603.19	-1322.41	-1291.18	-1303.49
AIC	3303	3228	2660	2612	2682
BIC n=307(n=2149)	3318(3326)	3269(3290)	2690(2706)	2669(2697)	2719(2738)

SE: Standard Error; SD: Standard Deviation; Statistical Significance denoted by: *p<0.10, **p<0.05, ***p<0.01.

All else equal, children interviewed have an increased marginal utility for environmental protection in Italy and in other part of the World but the size of the coefficient is higher if the project is targeting the environment in Italy. The price coefficient is also negative and highly significant. In our analysis the constant term for the status quo (ASQ_{SQ}) takes value of 1 for the alternative describing the SQ and zero otherwise. As seen in Table 3 the SQ option is found to be consistently negative and significant, indicating that leaving the current situation would result in increasing utility.

The potential impact of respondents' characteristics on children's WTP was explored by including interaction terms of the attribute and individuals' characteristics. Attributes of the DCE are interacted with demographic varibales (age and gender) while the price attribute is also interacted with subject-specific monthly pocket allowance. As in previous studies the two CL models were included as benchmark specification. MIX model with indipendent random coefficents with and without correlations are reported in Model 2 and 3. As for previous studies, price was entered as negative since a log-normal distribution implies a positive coefficient. Being the price coefficient assumed to be log-normally distributed the mean and the variance of the coeffients reported are

difficult to interpret. The mean and the standard deviation of the price coefficient derived from the parameters reported in Table 3 are:-3.64(SE:.40) and -3.76(SE:.38) for Model 3a and 3b respectively.

Table 4.Correlation between coefficients in preference space

	World	Italy	Price
World	1	.1062	.9825***
Italy		1	-.0129
Price			1

Statistical Significance denoted by: *p<0.10, **p<0.05, ***p<0.01.

As in the CL models all the attributes are significant with the expected signs, however, results from MIX models show that relaxing the assumption of a constant coefficents improves significalty the model results. To compare models we reported three goodness of fit measures: the simulated Log-likelihoods (LL), the Aikaike information criteria and the Bayesian Information criteria. Consistently with previous studies, we find that all three measures decrease as the flexibility of the model increases suggesting that MIX models fit the data better than traditional CL models not accounting for preference heterogeneity.

The SDs for the random coefficents in Model 2 and 3 indicate there is significant evidence of unobserved preference heterogeneity for environmental protection and price. All interaction coefficients remain significant in the MIX Model (with and without correlations). Compared to CL model MIX results show that the *AgeXItaly* interaction coefficient is significant at conventional levels suggesting that as children get older their WTP for environmental protection targeting Italy increases. Model 3 allows for correlation between price, Italy and World coefficients. As for Model 2, Model 3 results show that there is substantial heterogeneity in preferences for the attributes considered. Table 3 shows the results of the correlations between the attribute coefficients with and without interactions. As expected, coefficients Italy and World is posistive indicating that a person valuing environmental protection is Italy also value enviromental protection in the rest of the World, this result however is not significant at coventional level. The price coefficent is also positively correlated with Italy and highly statistically significant. This result suggests that those children that whose utility is positively affected by environmental quality in Italy are also less concerned about the price.

Table 5 reports the mean, CIs and the standard deviation of the willigness to pay measures obtained from the models reported in Table 3.

Table 5.WTP in preference space models

Model 1	Mean	SE	95%CI
World	.31		.24-.38
Italy	.63		.56-.70
Model 2			
World	.31		.24-.39
Italy	.65		.55-.74
Model 2b			
World	.66	.10	.45-.86
Italy	1.66	.16	1.34-1.98
Model 3a			
World	.58	.10	.38-.77
Italy	1.58	.14	1.29-1.85
World	.53	.11	.31-.75
Italy	1.94	.21	1.51-2.36

Note: price coefficient in the MIX model is assumed to be lognormally distributed

Confidence intervals for the WTP values are obtined using the Delta method. The mean WTP estimates derived from CL models are substantially lower compared with those estimated using a MIX model with random (log-normally distributed) price coefficent. The mean willigness to pay for environmental protection in countries other than Italy is 31 euro, while for projects targeting Italy is 63 euros. These values more than double if a MIX model is adopted.

Table 6 presents the results of WTP space models with indipendent and correlated coefficients.

Table 6.WTP space models.

	Model 4a with independent coefficients	Model 4b with independent coefficients and Interactions	Model 5 with correlated coefficients
Mean			
ASC_{SQ}	-3.61(.53)***	-2.47(.43)***	-.32(.07)***
World	.26(.04)***	.26(.03)***	.38(.04)***
Italy	.64(.04)***	.66(.04)***	.73(.04)***
Price	.89(.13)***	1.00(.11)***	1.09(.10)***
SD			
World	.27(.03)***	.28(.02)***	.43(.39)***
Italy	.28(.04)***	.25(.03)***	.33(.02)***
Price	1.10(.28)***	-.85(.16)***	.69(.11)***
Interactions			
Age*world		.05(.02)*	
Gender *world		-.04(.05)	
Age*Italy		.10(.03)***	
Gender *Italy		-.18(.06)***	
Age*price		-.23(.04)***	
Gender *price		.32(.08)***	
Pocket allowance*price		-.0001(.001)	
Model characteristics			
LL	-1337.13	-1320.91	-1348
AIC	2694	2671	2716
BIC n=307(n=2149)	2731(2750)	2727(2756)	2754(2773)

SE: Standard Error; SD: Standard Deviation; Statistical Significance denoted by: *p<0.10, **p<0.05, ***p<0.01.

A normal distribution was assumed for the WTP of non price attributes. The interpretation of WTP space coefficients is straightforward as they represent respondents' marginal WTP for each attribute. As in the MIX models the price coefficient is assigned a log-normal distribution. Consistenlty with previous models all coefficients are have the expected signs and are highly statistically signiifcant. The positive signs of the parameters for Italy and World indicate that higher levels of these attributes affect utility positively. In con-

strast, increasing the price of the voluntary contribution decrease the likelyhood of selecting the alternative. Compared with previous models the interaction coefficient between price and pocket allowance is no more significant while as for Italy increasing age is associated with higher WTP for the World environmental protection.

The mean WTP for environmental protection in Italy and in the rest of the World are 64 and 89 euros respectively. As noted in previous studies conducted with adults by Sonnier (2007) Train and Weeks (2005) and Hole and Kolstad (2012) these estimates are much lower if compared with those of MIX models and more similar to those obtained from the traditional CL models. Consistenlty with previous findings, also the distributions of WTP estimates are lower compared with those of preference space models. However, the MIX models fit the data better indipendenlty from the cirteria adopted (LL, Bic and Aic) considered (Train and Weeks Hole Kolstad). Table 7 shows the correlation between WTP space coefficients. As seen, using this approach all the correlations are statistically significant.

Table 7. Correlations between WTP space models coefficients

	World	Italy	Price
World	1	.0822***	-.3735***
Italy		1	-.2745***
Price			1

Statistical Significance denoted by: *p<0.10, **p<0.05, ***p<0.01.

4 Discussion and conclusions

This study investigates children willigness to pay for environmental protection. We designed and administered a DCE to 370 children aged 8-19 years in Naples (Italy).Our results suggest that children are concerned about environmental protection and willing to sacrifice part of their own money to contribute to environmental improvement. Indipendenlty from the model used for the analysis, we find that proximity to the public good affects economic decision making: children are willing to pay more for environmental projects targeting Italy vs. projects targeting other parts of the World (LaRiviere et al. 2014; Schotter 2003, Grossman and Owens 2012; Botzen and Beukering 2018)

Results of the analysis show that females compared to males are willing to pay more for environmental protection in Italy. The marginal disutility of price is also influenced by socio-demographic characteristics: older respondents, females and "wealthier" children caring more for money. Results on gender differences in the evaluation of environmental improvements are in line with previous studies conducted with adults to value public good. Previous studies

consistenlty suggest that gender is not predictive in the probability to state a positive WTP but does influece the amount paid with men generally willing to pay more than women. Previous studies suggest that women are more sensible than men to see "environmental quality to have consequences for personal well-being" which would explain why they care more than men for Italy(Stern et al. 1993;Bord and O'Connor 1997). On the other hand men are found with a higher WTP. This results is cosnistent with a previous CV study conducted with children and suggests that instead of being a a problem of leisure time constraint women have an innate higher mariginal utility from men with respect to price.

The literature demonstrates that for public goods, ideal designs include choices where the item being valued is clearly understood, payment is binding if the proposed change is put into practice, respondents perceive their responses as influencing the provision of the item being valued (i.e., consequentiality applies), and other aspects of the elicitation format (e.g., number of questions and alternatives per question) encourage truthful preference revelation. In the experiment respodents were asked to pay with their own money however they did not have to make the payment for real. Ideally to assess the external validity of the experiment future studies may consider to pay with their own money or to provide respondents with a lump sum at the beginning of the experiement and then ask respodents to make a payment out of the lump sum. Both approaches raise many ethical concerns if applied with children. Novetheless this is an important area for further research (quote paper on external validity).

Three are the channels through which human well-being is affected by natural capital: first through the services that are used as inputs to economic production (e.g. soil fertility); second ecosystem services can be used as joint inputs to household consumption. In this channel market goods and ecosystem services are complementary inputs that are used to product nature recreational experiences e.g. nature services in combination with travel expenditures. Thirdly, ecosystem services can directly affect household well being even if they do not serve as input for household consumption or industrial production. For example the nature as an abstract (existence value or passive use) (OECD 2006;Freeman et al.2013;Brown et al. 2007). Another important are for further reserach is to investigate collective decision making within the household when children are present. A previous study conducted with couples with and without children showed that parents have a higher WTP compared with childless couples. Investigating wehther children influence their parents WTP for environmental protection is an important are for future studies.

The topic environmental degradation has been the subject of a growing economic literature. Compared to geological times, species are estimated to be going extinct at rates 1000 times faster because of the progressive reduction of their habitats (Pimm et al. 1995, Chivian and Bernstein 2008). As suggested by the Blueprint for a Green Economy, one of the key theme of environmental economics and central to sustainable development thinking is the need to place a proper value on the services provided by natural environments.

Studies using adults' perspective to value natural capital assume that future people (generations that do not exist yet) will have the same preferences as

those living today (present values are usually uplifted to take into account the change in per capita income). However, as many authors suggest, it is likely that present adult preferences will be different from those of the future generations. In the future, some natural resources may not exist anymore. If the resources will still exist, changes in their quantity/quality will affect their intrisic value. Even for present aboundant resources the continue loss in natural asset cannot be compensated forever as there will be a cirtical point of degradation (see for instance the issue of plastic in the oceans). The increasing elasticity of substitution due to scarcity effects is discussed in two different papers: Hoel and Sterner (2007) and Sterner and Persson (2008) both these papers show that the shadow price of environmental amenity is likley to increase over time. Another main reason to include the viepoint of children is that, given the rate of environmental degradation, present children will spend a significant part of their lives in a different world with fewer natural resources and more frequent extreme events compared to their adult parents.

References

1. EPA Handbook on Valuing Children's Health 2003.

2. OECD, Economic evaluation of environmental health risks to children. OECD Publishing 2006. OECD Paris, 2006.

3. Dickie M. and Messman V.L., Parental altruism and the value of avoiding acute illness: are kids worth more than parents? Journal of Environmental Economic Menagment, 2004. 48: p. 1146-74.

4. Gerking S. and Dickie M., Valuing Reductions in Environmental Risks to Children's Health Ann. Rev. Resour. Econ., 2013 5: p. 245-260

5. OECD The valuation of environmental health risks to children: methodological and policy issues. 2005.

6. Harbaugh J. Valuing children's health and life: what does economic theroy say about including parental and societal willigness to pay. University of Oregon Economics Working Paper 1999.

7. Dockins C., et al., Valuation of childhood risk reduction: the importance of age, risk preferences, and perspectives. . Risk Anal, 2002. 22(2): p. 335-346.

8. Van Der Pol, M., et al., Convergent validity between a discrete choice experiment and a direct, open-ended method: comparison of preferred attribute levels and willingness to pay estimates. Soc Sci Med, 2008. 12: p. 2043-50.

9. Ryan M., A comparison of stated preference methods for estimating monetary values. Health Economics 2009. 13(3): p. 291-296.

10. Louvriere J., Flynn T., and Carson N., Discrete Choice Experiments Are Not Conjoint Analysis. Journal of Choice Modelling, , 2010. 3(3): p. 57-72.

11. Boxall et al., A comparison of stated preference methods for environmental valuation. Ecological Economics 1996. 18: p. 243-253.

12. Hensher DA., The valuation of commuter travel time savings for car drivers: evaluating alternative model specifications. Transportation 2001. 28(2): p. 101-118.

13. Bateman I., e.a., Economic Evaluation with Stated Preference Techniques.A Manual ed. D.f. Transport. 2002.

14. Alberini A. and Scansy M., Context and the VSL: Evidence from a Stated Preference Study in Italy and the Czech Republic. Environmental and Resource Economics and Menagment, 2011. 48(4): p. 511-38.

15. Espelid, I., et al., Preferences over dental restorative materials among young patients and dental professionals. Eur J Oral Sci, 2006. 114(1): p. 15-21.

16. Guerriero C., et al., Can children value their own health? A contingent valuation study conducted with children and their parents. CSEF Working Paper, 2016.

17. Guerriero C. and Cairns J., Use and Understanding of Money among Italian Children. Working paper 2016.

18. Arrow KJ., e.a., Report of the NOAA Panel on Contingent Valuation," Federal Register, 58(10), January 15, 1993, 4602-4614. 1993.

19. Thurstone, L.L., A law of comparative judgment. Psychological Review, 34 273-286. 1927.

20. McFadden, D. and Train K., Mixed MNL Models For Discrete Response. Journal of Applied Econometrics, 15 (15) 447-470. 2000.

21. McFadden D., Conditional logit analysis of qualitative choice behavior. In P. Zarembka (ed.) Frontiers in Econometrics. New York: Academic Press, 105-142. 1974.

22. McFadden D., The choice theory approach to market research. Marketing Science, 5 275-279. 1986.

23. Batman I., e.a., Economic Evaluation with Stated preference techniques: a manual, ed. Department for Transport. 2002: Edward Elgar Publishing

24. Diabetes in South Africa. S Afr Med J, 1969. 43(49): p. 1485.

25. Ryan M. and Watson V., Comparing welfare estimates from payment card contingent valuation and discrete choice experiments. Health Economics, 2009. 18: p. 389-401.

26. Hole AR., A comparison of approaches to estimating confidence intervals for willingness to pay measures. CHE Research Paper 8, 2006.

27. Daly, A., Hess S., and Train K., Assuring finite moments for willingness to pay in random coefficient models. Transportation, 39(1), 19-31. 2012.

28. Bliemer M. and Rose J., Confidence intervals of willingness-to–pay for random coefficient logit models. Working Paper 2013.

29. Thiene M. and Scarpa R., Deriving and testing efficient estimates of WTP distributions in destination choice models. Environmental and Resource Economics, 2009. 44(3): p. 379-395.

30. Carson RT., etal., Contingent Valuation: Controversies and Evidence. Environmental and Resourc Economics, 2001. 19(2): p. 173-210.

31. Ryan M., A comparison of stated preference methods for estimating monetary values. Health Economics, 2004. 13: p. 291-296.

32. Ready R. and Buzby JC., Differences between countinous and discrete contingent valuation estimates Land Economics 1996. 72: p. 397-441.

33. Mark TL. and Swait j., Using stated preference modeling to forecast the effect of medication attributes on prescriptions of alcoholism medications. Value in Health, 2004. 6(4): p. 474-82.

34. Hole AR. and Kolstad JR., Mixed Logit estimaiton of willignes to pay distributions: a comparison of models in preference and WTP in space using data from a health-related choice experiment. Empirical Economics, 2012. 42(2): p. 445-469.

35. Meijer1 E. and Rouwendal J., Measuring welfare effects in models with random coefficients. Applied Econometrics 2006. 21(2): p. 227-244.

36. Belcombe K., Bailey A., and Fraser I., Modifying WTP estimates where respondents mis-report their preferences. Applied Economics Letters, 2008. 15(327-330).

37. Ben-Akiva ME., et al. ,, Integration of choice and latent variable models, in: Hani S. Mahmassani (ed.): In perpetual motion: Travel behaviour research opportunities and application challenges, Elsevier, Amsterdam, 431–470. 2002b.

38. Walker J. and Ben-Akiva M., Generalized random utility model Mathematical Social Science, 2002. 43(2): p. 303-343.

39. al., B.A.e., Hybrid choice models: Progress and challenges. Marketing Letters, 13(3), 163–175. 2002.

40. Boyle et al., An investigation of part-whole biases in contingent valuation studies J Env Econ Mange 1994. 1994(27): p. 64-83.

41. Hanley N., Ryan M., and Wright R., Estimating the monetary value of health care: Lessons from environmental economics Health Economics 2003. 12(3-16).