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On the valuation of the causes and consequences of environmental damages: Evidence from a Field Experiment

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Abstract

Standard economic theory assumes that agents' valuation of economic outcomes is independent of the process via which these outcomes are produced. Yet Bulte, Gerking, List, and de Zeeuw (2005) found that causes in addition to outcomes matter in valuation. Using a field experiment I test whether drawing people's attention to the role they play in the process of environmental degradation affects their willingness to pay for mitigation, and how this compares the activities undertaken by others. I do so by eliciting contributions to a reforestation program in an environmentally valuable area in Ethiopia. I implement three different conditions which allow me to measure the impact on contributions of emphasizing (i) the contributions of others to forest conservation, and (ii) the role of the respondents themselves in the forest degradation process. I find that learning about the efforts of others does not affect contributions while emphasizing the respondents' negative role in the process actually increases contributions. Extant literature notes that including information on human-caused environmental damage in contingent valuation surveys does indeed increases the WTP values. This was, however, attributed to 'outrage effect' – that is, because respondents are upset, they contribute more to environmental goods. In a somewhat different setting this study finds evidence that people's contributions also increase significantly and substantially if attention is drawn to their own responsibility in the deforestation and desertification process, suggesting, the 'responsibility effect' is also important in valuation.

Key words: Valuation of the environment, incentive compatible valuation techniques, conservation, Field Experiment, Forestry, Public goods.
JEL codes: C93, D04, H41, O13, Q51**,** Q23.

1. Introduction

One of the key assumptions of standard economic theory is that agents attach value to (economic) outcomes, and not to the process by which the outcomes are generated (Sen, 1995). If this were the case, people's willingness to financially contribute to the development of a cure for brain damage would be the same independent of whether accidents or excessive drinking are the main cause of the brain damage. Similar considerations would apply to the appreciation and/or provision of public goods as well – for example, whether the demise of a seal population is due to a natural disease or the consequence of fossil fuel extraction at sea, people's willingness to pay for a seal regeneration project should be the same. In fact, Bulte et al. (2005) find that people's willingness to pay (WTP) for a seal population recovery program is indeed higher when the demise of the species is due to human activity. They attribute this difference to a mechanism labeled as "outrage effect", a term first coined by Kahneman, Ritov, Jacowitz, and Grant (1993) — people are more upset if they think the damage to the environment is caused by human activities they are not directly engaged in themselves.

In this paper, I extend the work by Bulte et al. (2005) by addressing the question of whether people's willingness to pay for protecting the environment is also higher if not other humans but they themselves are at least partly responsible for the current (degraded) state of the environment. More specifically, I analyze whether people are more willing to contribute to an environmental good if their own role in the environmental degradation process is emphasized. I do so by eliciting contributions to a reforestation program among farmers in an environmentally valuable area, the Bale Eco-region in Ethiopia, by emphasizing that one of the activities that they engage in, logging, is one of the main causes of local forest loss.

Research on people's preferences and environmental valuations is often difficult because there is no direct relationship between people's preferences and their environmental behavior – people may have a strong preference for the environment but still decide not to undertake environmentally friendly actions. The difference between preferences and behavior may be the result of the environment being a public good. An individual engaging in environmentally friendly behavior incurs costs while her private benefits of the improved environmental outcome are typically small. Revealed preference techniques may thus not always be applicable, but unfortunately, survey methods to elicit valuation, the so-called stated preferences techniques, are

not without problems either. Hypothetical bias is one of the most important problems with stated preferences valuation techniques. If asked to value an item, people tend to overstate their true willingness to pay if they think that they will not actually be forced to financially contribute.

To mitigate this issue, I decided to financially incentivize farmers' decision by (i) endowing them with a budget that is, in principle, theirs to keep, and (ii) subsequently asking them how much of their budget they are willing to invest in a local reforestation project. Asking farmers for their financial contribution implies that farmers will think carefully about their decision of how much to contribute. Step (ii) is implemented under three different conditions (using a between-subjects design). The first condition is one in which respondents receive a full account regarding forest-related activities. The scenario in this condition provides information on the efforts of other countries in the region to protect the forest, and it also emphasizes the fact that small-scale logging is one of the main causes of local forest degradation. Information on the effort other countries undertake to protect the forest is left out in the scenario of the second condition. The difference in contributions between the first and the second condition allows me to infer whether efforts by others tend to result in a higher propensity to contribute (as the good example by others crowds in contributions) or whether this tends to invite more free-riding (as the perceived necessity to contribute oneself too may be lower if others already engage in forest conservation activities). Compared to that of the first condition, the scenario in the third condition leaves omits the emphasis of the role of logging by farmers as an important cause of forest loss which, in turn, causes desertification in the region. Comparing the outcomes of the first and the third condition allows me to infer whether an increased emphasis on one's own personal role in the environmental degradation process tends to result in higher contributions, or not. I find that emphasizing the role of others does not affect contributions, while explicitly pointing out the (negative) role the respondents play actually increases contributions.

Asking respondents to make actual contributions in a public good setting induces respondents to think more carefully about the problem they are confronted with, but it does so at the expense of underestimating the farmers' true valuation of the forest. After all, the costs of contributing are private while the benefits accrue to all, and hence true willingness to pay (for example elicited in a binding referendum format) will likely be higher than observed willingness to pay. However, under the plausible assumption that the extent to which hypothetical versus factual payments affect

farmers' WTP levels is the same in all three conditions, my study provides a careful test of the "responsibility effect" on willingness to pay – the fact that I find differences in farmers' contributions between the various treatment arms indicates that also the farmers' true valuation will vary between the three treatment arms.

The setup of my paper is as follows. In section 2, I discuss the issue of hypothetical bias in stated preference valuation techniques, and how I dealt with this issue in this study. In section 3, I present the study's hypotheses and experimental design. Section 4 includes the results of the experiment and further analysis using different tools. Finally, section 5 presents the conclusions.

2. Valuation of Environmental Goods and Services

Environmental valuation is an important issue as the quantity and quality of nature and the environment directly affect people's welfare – and especially the welfare of those people who are directly dependent on these natural resources (Dean & Hoeller, 1991). Nevertheless, environmental valuation is not straightforward owing to the typical nature of the public goods. Pure public goods have two characteristics. First, they are non-excludable – people cannot be excluded from the benefits these goods provide, not even if they themselves did not contribute to their provision. And second, their consumption is non-rival – one person's consumption of the public good does not affect the extent to which others can benefit from it. Markets can provide information on people's valuation of private goods, but the characteristics of non-excludability and non-rivalry in consumption implies that there are no naturally occurring markets for public goods (Richard T Carson, Flores, & Meade, 2001). Artificial markets for public goods, however, can be developed by using different valuation methods.

One such valuation method is the contingent valuation method (CVM), which was developed by Ciriacy-Wantrup (1947). CVM is, in essence, a survey method in which the respondent is provided with a description of a hypothetical public good provision program, like a bird protection project or an oil spill prevention program. The respondents are given detailed information on the benefits that the program will provide – the type of birds targeted, how they look like, their importance for maintaining the integrity of the ecosystem, etc. The scenario also specifies the increase in population size (or prevention of their decline) the program is expected to realize. After having provided this information, the respondent's valuation of the project is elicited

– either by simply asking what the maximum amount of money is that she is willing to pay for the project to be implemented (so-called "open-ended bid elicitation"), or by asking the respondent whether she would be willing to pay a specific amount of money for the project's implementation yes or no. The second type of question is often framed as a referendum ("if the project would require the imposition of a tax of $x, would you vote in favor of the project, yes or no?") and is typically referred to as the dichotomous choice valuation approach (Adamowicz, Boxall, Williams, & Louviere, 1998; Mitchell & Carson, 1989). The demand function for the public good is then obtained by varying the amount to be paid – the higher the amount stated the lower the share of respondents who indicate that they would be willing to pay that amount.

Since its first application (Robert, 1963), the dichotomous choice valuation technique has become increasingly more popular (compared to the open-ended valuation approach); see (Freeman III, Herriges, & Kling, 2014; Haab, Interis, Petrolia, & Whitehead, 2013; Oerlemans, Chan, & Volschenk, 2016). The reason is that theoretically, the dichotomous choice approach is incentive compatible, in the sense that there is little reason to strategically misrepresent one's preferences (by saying "yes" to a price offer that is above one's true value or "no" to an offer that is below one's true value). This is not necessarily the case in the open-ended versions, where respondents may strategically (grossly) under- or overstate their willingness to pay depending on whether they think that they will actually be forced to contribute the stated amount, or not implementation (Cummings, Elliott, Harrison, & Murphy, 1997; Taylor, 1998).

However, despite the mentioned advantage of dichotomous choice mechanism, experimental studies have found some unresolved issues with the mechanism. One issue is a disparity in valuation results between the hypothetical referendum and the real referendum (Cummings & Taylor, 1999; Hausman, 2012). It is often the case that in CV, the WTP elicited tend to be higher than in situations where the yes/no question has real consequences (with all respondents being forced to pay and the project being implemented if the majority votes in favor). Two of the main causes for this upward bias is that the hypothetical nature of the method invites socially desirable answers, while respondents may also fail to pay enough attention to the budget consequences of their answer (if the project had not been hypothetical).

To address this issue, I decided to financially incentivize farmers' decision to contribute to the public good – a reforestation project in their local forest. Whereas this decreases the farmers'

propensity to provide socially desirable answers, it does so at the cost of underestimating their true willingness to pay. This can be seen as follows.

Let q_i denote community member's contribution to the reforestation project – the number of trees she decides to have planted on her behalf. If there are *n* community members, the number of trees planted is $Q = \sum_{i=1}^{n} q_i$. From the community's perspective there are local benefits to having more trees. Let us denote the local benefits accruing to community member *i* (improved soil protection, improved retaining of groundwater, etc.) with $B_i\ (Q)$. Denoting community member *i*'s budget for tree planting with E_i and the (constant) costs of financing planting a tree with c_i, community member *i*'s welfare associated with planting *Q* trees is equal to

$$w_i = E_i - c_i q_i + B_i\ (\sum_{i=1}^{n} q_i), \quad (1)$$

and the social welfare consequence of the community planting $Q(= \sum_{i=1}^{n} q_i)$ trees is

$$W = \sum_{i=1}^{n} w_i = \sum_{i=1}^{n} (E_i - c_i q_i) + \sum_{i=1}^{n} B_i\ \ (\sum_{i=1}^{n} q_i). \quad (2)$$

Maximizing (2), the socially optimal number of trees planted by each community member is implicitly defined by

$$\frac{\partial W}{\partial q_i} = -c_i + \sum_{i=1}^{n} B_i' = 0. \quad (3)$$

But if a community member does not attach any value to the benefits of planting trees accruing to his/her fellow community members, he/she maximizes (1), and hence his/her privately optimal number of trees planted is

$$\frac{\partial w_i}{\partial q_i} = -c_i + B_i' = 0. \quad (4)$$

Comparing (3) and (4) and noting that $\sum_{i=1}^{n} B_i' = B_i' + \sum_{j \neq i} B_i' > B_i'$, it is clear that the privately optimal number of trees planted is smaller than the socially optimal number.

For this study, we financially incentivize community members to choose how many trees should be planted on their behalf. Unless all community members are pure altruists, our estimates of the marginal social value of trees are anywhere between B_i' and $\sum_{i=1}^{n} B_i'$, and hence may be a gross /underestimate of the (true) social value. With this approach, we trade off the benefits of a well thought-through financially incentivized decision at the cost of underestimating the true value. However, as we are interested in the treatment differences rather than in the levels themselves, we choose to financially incentivize private decision-making. Therefore, we do not estimate the true social value of trees. But we argue that if the framing affects the private decisions in a specific way, the social values are likely to vary similarly.

3. Context and Hypotheses

I hypothesize that the information about the efforts taken by others to promote forest conservation and reduce desertification will not affect respondents' valuation of conservation activities (and also not their contributions), but that reminding them of their own role in the deforestation process will result in increased contributions. Previous studies have found that including the human-caused environmental damage information will increase WTP (Bulte et al., 2005; R.T Carson et al., 2003). More specifically, Bulte et al. (2005) studied how different causes of environmental degradation (human vs. natural) affect WTP values. They found that people state a higher WTP when the cause of environmental damage is human activity. They attributed this difference to an "outrage effect" –people contribute more if they think the damage to the environment is caused by human activity because this makes them feel upset. Alternatively, the results may be due to a "responsibility effect." People are willing to pay more if they think they themselves are (partly) responsible for the observed degradation (Brown, Peterson, Marc Brodersen, Ford, & Bell, 2005; Walker, Morera, Vining, & Orland, 1999).

In this study, I test whether such a "responsibility effect" also exists among farmers in Ethiopia's Bale Eco-region (see below for more information). I do so using a financially-incentivized experiment that elicited WTP for a public good, afforestation. Decisions thus have real financial contributions. Respondents receive an endowment of 50 ETB (which is only slightly less than a full day's wage for unskilled labor). Respondents can pocket the money, but they can also spend it purchasing trees. Any tree purchased will be planted on their behalf. Having a tree planted on one's behalf costs10 ETB. The contribution decision is about the number of trees planted on one's behalf – any integer number between 0 and 5 trees. WTP thus takes six discrete values (0, 10, 20, 30, 40, and 50). I use a between-subjects design, and hence participants make a decision of how much to contribute in one of the three scenarios.

All scenarios (treatments) present the same information on the background about the importance of environmental good provision (deforestation and desertification), the good provided (afforestation), the mode of payment and budget constraint, and finally, the question of WTP elicitation. Hence, all the surveys have the same background, good, and payment mechanism but differ in the information used as treatments in the experiment. The three treatments are the

following. The baseline treatment offers a scenario that, in addition to the information above, describes the efforts that neighboring countries are undertaking to prevent the problem, and it also explicitly draws attention to the role logging plays in the process of desertification and forest loss. Our respondents are small-scale farmers who engage in logging activities, and hence this scenario reminds them of their own responsibility in the process as well as of the activities of others to mitigate the problem. I call this the *combined* treatment. Compared to this first scenario, the second treatment condition omits the information about the respondents' own responsibility, and hence only provides information on the conservation efforts by others. I call this treatment the *effort elsewhere only* treatment. Compared to the scenario in the first treatment, the third condition omits the effort elsewhere content and hence provides only the information on the role of logging in the deforestation and desertification process. I call this scenario the *human-caused* treatment. Comparing contributions in the first and the second treatment provides insights about whether information about efforts of other countries crowds in or crowds out contributions by our respondents. And comparing contributions in the first and the third treatment isolates the "responsibility effect".

The scripts are as follows. The general information on the deforestation was as follows:

> *"Desertification is the advance of deserts because the tree and plant cover that bind the soil is removed. It occurs when trees and bushes are stripped away for fuelwood and timber, or to clear land for cultivation. Desertification is a global issue, with serious implications worldwide for nature, wildlife, and agriculture. Some 50 million people in Ethiopia may be displaced within the next 10 years as a result of desertification."*

And the willingness to pay question was framed as follows:

> *"One effective mitigating measure is planting trees to change the non-forest land to forest and prevent deserts from expanding.*
> *Consider the benefits of planting trees in this region. Of the 50Birr you just received, how much do you wish to contribute to planting trees? For every 10Birr, we can plant 1 tree.*
> *I am willing to contribute _____ birr."*

The script regarding the role of small-scale logging activities was as follows:

> *"There are different factors that are increasing deforestation. One important factor is illegal logging by different parties. The uncontrolled cutting of trees will eventually change the forest land to non-forest land. This will aid the gradual changing of the land to desert and to an unfavorable climate. The trees that are cut down by illegal loggers are used as fuel for cooking as well as being sold in the market to be used for furniture and construction purposes."*

This script was included in the *human-caused only* and in the *combined* treatments, but not in the *effort elsewhere only* treatment.

The script regarding the efforts of other countries to prevent deforestation and desertification was as follows:

> *"Tanzania, Kenya, and Uganda have united their efforts to combat illegal timber trade in East Africa to decrease deforestation. These countries recognize that illegal logging must be mitigated and forests managed sustainably, in order to reduce emissions from forest loss. As such, a key goal of the initiative is to curb illegal logging and trade in East Africa as a way to address deforestation and subsequently reduce emissions from forests.*
>
> *Even though there are many international initiatives to curb deforestation, recent reports show that global efforts to curb deforestation are insufficient, as forests are cleared faster than ever for agribusiness, timber, and other land development schemes. However, there was an important call made for a change in policy to deal with the problem."*

This script was included in the *effort-elsewhere* and in the *combined* treatments, but not in the *human-caused only* treatment.

I now explicitly state the hypotheses that will be tested in this study:

Hypothesis 1: Drawing respondents' attention to the role of illegal logging in the process of deforestation and desertification increases their contributions to the reforestation project offered. Average contributions are higher in the *combined* treatment than in the *effort elsewhere only* treatment.

Hypothesis 2: Informing respondents that other countries recognize the role of illegal logging and actively try to discourage it induces respondents to raise their contributions to the reforestation project. Average contributions are higher in the *combined* treatment than in the *human-caused only* treatment.

4. Field, Randomization, Recruitment, and Experimental Procedure

The context of the study is the Bale Mountains Eco-region in Ethiopia. The Bale Mountains Eco-region is the second largest standing moist tropical forest in Ethiopia (Defries et al., 2002). The Afro-alpine region provides habitat for numerous endemic species, marking the region as one of the 34 globally recognized biodiversity hotspots (Williams et al., 2005). More than 12 million people depend on the water that originates from the mountains. The dry lowlands of the east and southeast of Ethiopia (including neighboring Somalia and parts of Northern Kenya) get their perennial water only from water that springs from the mountains in the Eco-region. This region was selected as a study area for three reasons. First, it is of considerable economic importance for Ethiopia –its direct consumptive use value alone was estimated to be in billions of dollars per year (Watson, 2007). Second, it is a priority forest area selected for conservation, in light of its importance for neighboring countries and the surrounding communities. Finally, it covers the largest area of Afro-alpine forests in the African continent (100,000ha) and is registered as a world heritage area by UNESCO.

The sample in this study is taken from Dodola "Woreda" (the lower administration level next to regional administration), out of which three villages were selected: Bura-Adelle, Kechema, and Geneta (see Figure 1). These villages were selected because they were among the first to implement forest management in the Bale Eco-region, and they are more accessible in terms of infrastructure (see also Chapter 4).

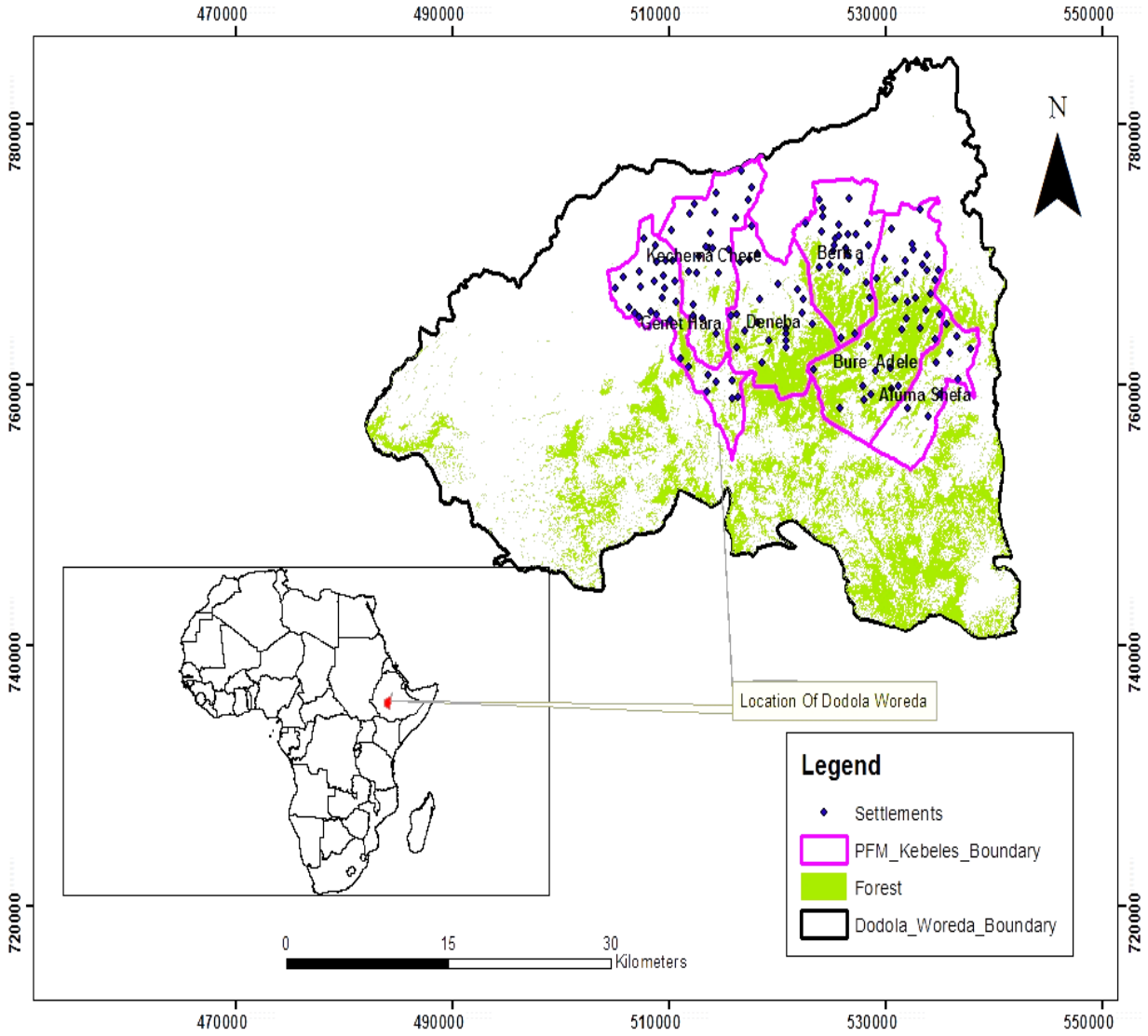


Figure 1: Map of the study area.

The experiment was implemented in January 2016 in the three villages. Every treatment was implemented in each of the three villages, and respondents participated in just one treatment. In total 96 individuals participated in this study. The subjects were invited via the village-level administration agents to come to the meeting places. Inviting subjects to the meeting via village administration agents is not unusual in the study area. Village-level meetings are a common occurrence in which various issues are discussed on a regular basis. Hence, it is unlikely that the

village administration's assigned person would disseminate systematically biased information to recruit certain types of individuals only.[1] Hence, the subjects in this study are likely to be a fairly representative sample of the people living in the three villages.

Upon arrival of the subjects to the meeting place, the experimenters gave a brief explanation of the research project and the researcher's background. Next, subjects undertook two tasks in the field. The first task was filling out a general survey which was administered to collect the background information on the subjects. Experimenters collected this information individually from the subjects in the form of an interview.

The second task was the implementation of the WTP elicitation experiment. Subjects were assigned to one of three treatment groups. Note that the within-village treatment allocation helps mitigate concerns of unobserved heterogeneity affecting treatment outcomes. Next, research assistants read out the script aloud to each treatment group. Reading of scripts to each treatment group was done such that participants in the one group were not able to overhear what was being said in another group. Furthermore, the subjects made the decision individually after being approached by the experimenters in the form of an interview. Finally, based on their decision the money was immediately collected, and the trees were planted seven months later, i.e. July 2016).

5. Results

5.1. Sample and Descriptive Statistics

Table 1 shows the summary statistics of responder characteristics in the three treatments, as well as the outcomes of the relevant balance tests. The subject pools are found to differ in some respects. In the combined treatment the share of male participants is lower than in the other two treatments. However, it should be noted that differences in female participants across treatments are small in magnitude. For example, the third treatment group contains only 3 women more compared to the other two treatments. Similarly, the membership in local collaborative forest management (CFM) groups differ somewhat across the treatments. The subjects of this experiment are also people who

[1] This is also because, given that the government already initiated a "5 households in one group" culture of working together, information disseminates very fast. Thus, it is less probable that certain households would be systematically sent to attend a meeting and others excluded, as this might damage the future relationships in the villages.

care about the environment and take the seriousness of environmental degradation into consideration. This opinion does not differ across treatments, as can be seen from the variable Opinion on climate change.

Table 1. Participants' characteristics by treatment group

	Human-caused only	**Effort elsewhere only**	**Combination**	**p-value**
Income	3506.284 (423.767)	3504.650 (529.497)	3807.793 (547.556)	0.899
Land Size	2.268 (0.293)	2.581 (0.252)	2.544 (0.273)	0.674
Age (>25)	1.000 (0.000)	0.947 (0.037)	1.000 (0.000)	0.215
Education (1-5)	0.677 (0.085)	0.447 (0.082)	0.519 (0.098)	0.159
Family size (>5)	0.742 (0.080)	0.658 (0.078)	0.667 (0.092)	0.734
Male	0.935 (0.045)	0.974 (0.026)	0.778 (0.082)	0.022
CFM member	0.774 (0.076)	0.526 (0.082)	0.667 (0.092)	0.099
Opinion on climate change	2.871 (0.077)	2.895 (0.063)	2.889 (0.082)	0.971
N	31	38	27	

Standard errors in parentheses. Orthogonality outcomes are based on F-tests on the variable distributions across the three treatment arms.

5.2. Experimental Results

Table 2 presents the mean contribution (or WTP) as well as results of pairwise comparison tests of the mean contributions across the three treatment groups. Subjects in the *human-caused only* treatment have the highest mean WTP value (19.03ETB), while those in *effort-elsewhere* treatment have the lowest mean WTP value of 10.78ETB. The mean WTP value of *combination* treatment is 18.14ETB.

Table 2. WTP by treatment group

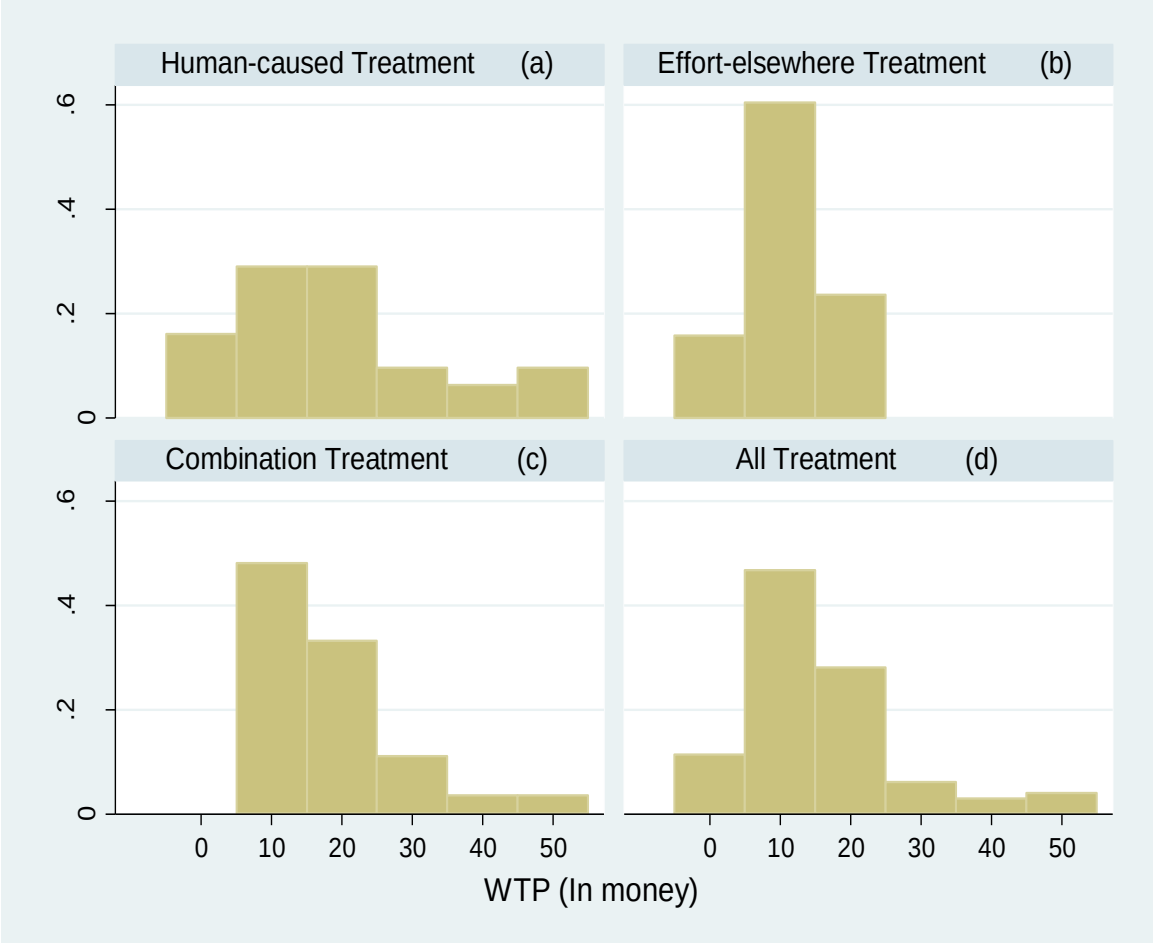
Summary of WTP by treatment		Difference test	
Treatments	Mean WTP	Comparison between treatments	p-values
Combined	18.14 (11.38)		
Human-caused only	19.03 (14.78)	Human-caused only vs. Combined	0.457
Effort-elsewhere	10.78 (6.27)	Effort-elsewhere vs. Combination	0.0041

Standard deviation in parentheses.

The Kruskal-Wallis overall difference test indicates a statistically significant difference between the three treatment groups ($p = 0.0097$). The difference in means across treatments is tested using Mann-Whitney U tests. I find that mean contributions are significantly lower in the *effort elsewhere only* treatment than in the *combined* treatment ($p = 0.0041$). I thus find support for Hypothesis 1: compared to just being informed of efforts undertaken in other countries, additional information on the role of illegal logging in the region results in a significant and substantial increase in contributions. Next, contributions are not significantly affected by information on the efforts of neighboring countries to combat the problem. Average contributions are slightly higher in the *human-caused only* than in the *combined* treatment (albeit not significantly so, as the p-value is 0.457). This suggests that, if anything, information on efforts elsewhere tend to crowd out (rather than crowd in) contributions, which is not in line with Hypothesis 2.

The distribution of WTP across the treatment groups can be seen from Figure 1, which presents the histograms of WTP by treatment and for all treatments together (Figure 1d). As noted before, the WTP is a discrete variable taking values within the range of 0 to 50 ETB, with step size 10. The overall distribution of subjects' WTP shows a right-skewed distribution (Figure 1d) similar to other WTP studies (Green, Jacowitz, Kahneman, & McFadden, 1998; Gunatilake & Tachiri, 2014; Kanninen, 2007; Martín-Fernández et al., 2014). Some participants have WTPs below 10 ETB (including zero). The majority of subjects' WTP values lie within the interval between 10 and 20 ETB. The distribution of WTP values, however, differs across the treatment groups.

Figure 1. Histograms of WTPs by Treatment.



In *human-caused only* treatment (panel a), the WTP shows more variation across the discrete values. The shape of WTP distribution for this treatment group is also rather less skewed. On the

other hand, the distribution of WTP values in the *effort-elsewhere only* treatment is less varied. The shape of the WTP distribution in this treatment is quite unimodal. Hence, the WTP of most participants in this treatment is very close to the others (about 60 percent have a WTP value of 10ETB). Finally, the distribution in the *combination* treatment indicates some variation. About 50 percent of subjects have WTP within the range of 10 to 20 ETB, with a positive distribution.

In general, the histograms suggest that the WTP values vary more in the *human-caused only* treatment and the *combination* treatment compared to the treatment of *effort-elsewhere only*.

5.3. Econometric Analysis

The observed treatment differences are also explored using regression analysis, which allows for conditioning on covariates, in order to control for concerns about the impact of possible differences in the subject pools. Utilizing regression will furthermore help us test the construct validity of our CV surveys. To take into consideration the discrete nature of the dependent variable, the model is estimated using interval as well as ordered probit regression techniques. The ordered probit regression in this study serves as a robustness check given the weak normality of the dependent variable (revealed by the Shapiro-Wilk test), which is assumed by interval regression. The regression equation is specified by equation (5):

$$WTP_{ij} = \beta_0 + \beta_1 \, TrHumanCauseOnly_{ij} + \beta_2 \, EffortElsewhereOnly_{ij} + \beta_3 \, X_{ij} + \varepsilon_{ij.} \qquad (5)$$

WTP values are regressed on treatment variables to extract treatment effects on individual *i* in village *j*, which are (β_1, β_2). β_0 captures the average contribution in the *combined* treatment – the omitted category. The baseline treatment in our case is the *effort-elsewhere only* treatment. Finally, β_3 captures the subject-specific characteristics, such as the subjects' age, educational status, gender, income, land size, family size, and membership of environmental conservation groups.

Table 3 shows the factors that influence contributions to the reforestation project. All specifications include village fixed effects. The omitted category of the treatment indicators is the *combined* treatment; the coefficients on *human-caused only and effort elsewhere only* treatment dummies thus indicate the impact of omitting "effort elsewhere" and "own responsibility" information, respectively. Columns 1 and 2 of the table indicate the treatment effects without

including other explanatory variables using OLS and interval regression, respectively. Consistent with the non-parametric tests presented in Table 2, I find that omitting information on effort elsewhere does not affect outcomes (as the coefficient on *human-caused only* is not significantly different from zero), but that the responsibility effect is substantial (as the coefficient on the *effort elsewhere only* treatment dummy is negative and significantly different from zero).

Controlling for participants' characteristics (columns 3 and 4), under both interval and ordered probit regressions, does not really affect the above estimated coefficients. However, the explanatory variables can be utilized as a test of construct validity. Construct validity is typically tested to examine whether or not the CVM captures preferences of people in the valuation (by looking at whether the correlation of economic variables such as cost and income with WTP value is as expected in standard economic principles). In Table 3, the economic variable, income of participants, seems to predict WTP values consistent with the standard expectation – that is, the higher the income, the higher the WTP values, and this relationship is significantly different from zero.

Table 3: Factors affecting contributions to the reforestation project.

	(1) WTP (OLS)	(2) WTP (Interval regression)	(3) WTP (Interval regression)	(4) WTP (Ordered probit)
Human-cause only treatment	1.028	0.829	0.454	-0.107
	(2.712)	(2.729)	(2.511)	(0.310)
Effort-elsewhere only treatment	-7.044***	-7.646***	-7.081***	-1.086***
	(1.932)	(2.053)	(2.071)	(0.287)
Gender			-0.886	-0.355
			(2.260)	(0.348)
Education (1-5 yrs)			0.977	0.294
			(1.935)	(0.256)
Age (>25 yrs)			-10.92***	-2.374***
			(3.067)	(0.713)
Income			0.000847**	0.000114**

			(0.000373)	(0.0000509)
Land Size			-0.495	-0.0793
			(0.904)	(0.123)
CFM member			4.418**	0.591**
			(2.081)	(0.287)
Village FE	YES	YES	YES	YES
Constant	9.921***	4.315**	10.75**	
	(1.599)	(1.677)	(4.331)	
Lnsigma				
Constant		2.166***	2.090***	
		(0.112)	(0.116)	
Observations	96	96	96	96
Adjusted/Pseudo R^2 /Log pseudolikelihood	0.379	-120.523	-114.417	0.3090

*Robust standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01.*

Note: Column 1 presents OLS with the dependent variable WTP. Columns 2 and column 3present the interval regressions. The additional variables were included in column 4, which presents ordered probit regression of WTP on treatments with the additional explanatory variables.

The regressions also indicate other participant-specific predictors of the WTP values. For instance, the older participants are more likely to have lower WTP values compared to the younger ones (less than 25 years of age), and the same holds for below-average educated participants (although not significantly so).

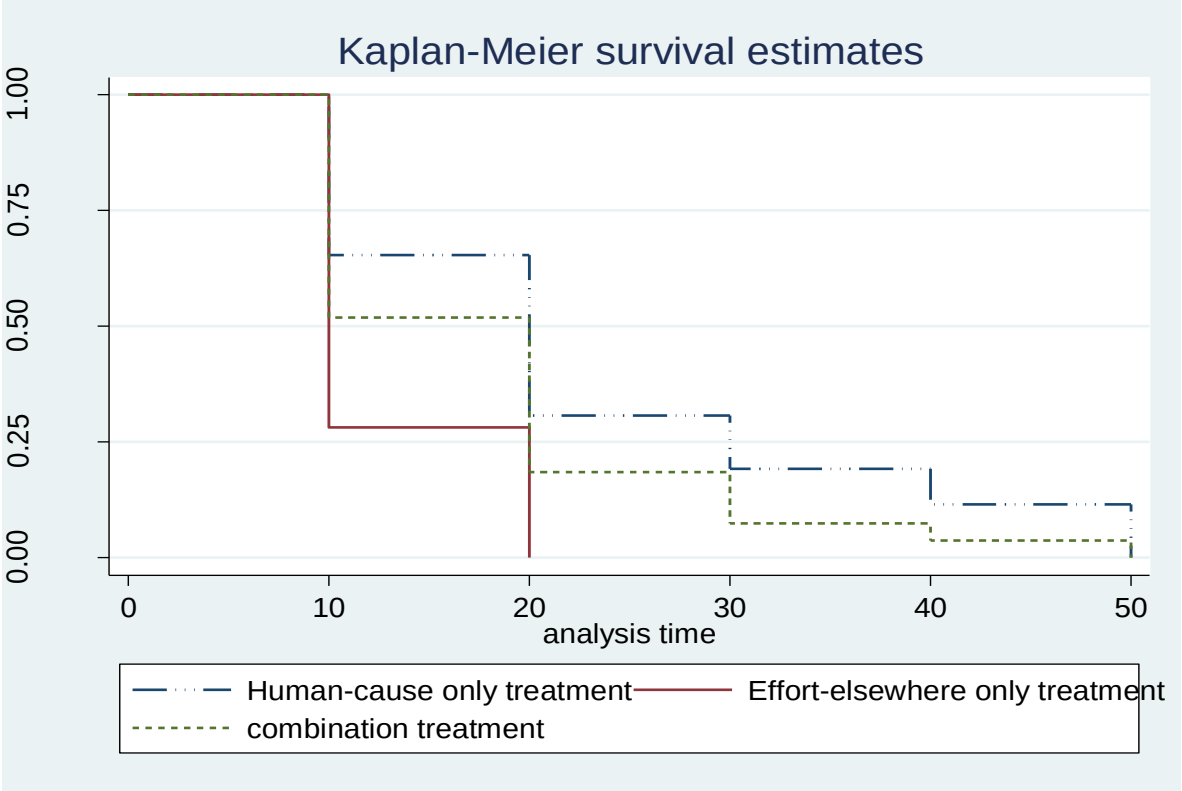
Another interesting point is that being engaged in local collaborative forest conservation shows a positive correlation with WTP. In the study area, it is possible to engage in forest conservation with a group called a collaborative forest management group (CFM). This is a local conservation group that looks after the surrounding forest. Hence, the positive correlation sign of CFM membership and WTP in the regression is expected since the members are contributors to the public good. I also ran regressions testing whether the treatment effects differ between CFM members and non-CFM members. None of these interaction effects are found to be different from zero, and hence they are not included in this table.

6. Aggregate WTPs and Robustness Checks

Reforestation provides a public good, and hence total willingness to pay is the sum of individual willingness to pays. I estimate the implications of the treatments for total willingness to pay using survival functions. Setting WTP responses as a survival function means that, instead of the original notion of "time," survival is defined by all the possible amounts (payments) that the respondents can contribute to the project. A respondent with positive willingness to pay "survives" that amount and a respondent with no willingness to pay "fails" that amount. Here, the log likelihood function is calculated by the difference in WTP densities evaluated at contributions of 0, 10, 20, 30, 40 and 50 ETB. The likelihood function can then be maximized based on the selected parametric distribution (shape) such as in a standard Kaplan-Meier and Weibull estimator. Setting data into a survival function format mitigate the discrete nature of the WTP values (predicts the probability that *true values* are within the discrete values). A further advantage of utilizing this function is that the survival analysis is in line with the assumption of the key economic theory that the cost for the fraction of participants with positive WTP decreases monotonically (R.T Carson et al., 2003).

Hence, in this study, the Kaplan-Meier survival curve is used to present the summary measure of people's WTP under the three treatments (Figure 2). Given the right-skewed nature of WTP – that is, there seem to be individuals who are not willing to contribute – mean summary for welfare analysis might not be the correct representation. Hence, the demand for the environmental good under the three treatments is compared with the 50^{th} quintile of the graph. As can be seen from Figure 2, the human-caused only treatment appears to have a higher survival rate than the other two treatments. Looking at the median survival time, which is the probability of survival at 0.5, the effort elsewhere only treatment appears to give 10 ETB versus about 20 ETB in the other two treatments.

Figure 2. Survival function estimate of WTP across the treatments



6.1. Robustness Check: Estimators of WTP

I assess the role of covariates in the survival analysis using Weibull regression. In this model, the hazard measures risks faced by respondents in terms of failure (not paying). Accordingly, a higher hazard rate was associated with lower WTP values. In Weibull regression, since the reported coefficients of covariates are in the form of exp (β_i), interpretation of the hazard rate requires transforming the coefficient to exp (β_i) -1. Weibull regression results are reported in Table 4 below, which shows hazard increasing over the cost values (a positive sign of Weibull parameter ρ=2.90). That is, an increase in value by 10 ETB increases the likelihood of not leaving the lower WTP interval. As the values of WTP increase, the participants are less likely to pay more.

Table 4.

	WTP (Hazard ratio reported)
Education (1-5yrs)	0.790

	(0.194)
Age (>25yrs)	4.806**
	(3.744)
Income	1.000**
	(0.0000441)
Human-cause only treatment	0.627
	(0.191)
Efforts-elsewhere only treatment	3.094***
	(0.946)
CFM member	0.639*
	(0.169)
Village FE	YES
N	85
Weibull parameter (ρ)	2.90
	(0.235)

*Exponentiated coefficients; Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01*

Table 4 shows and confirms that several explanatory variables are significant predictors of WTP decisions. For instance, being an older participant increases the hazard rate by more than 4 times over being a younger participant. That is, older participants are 4 times more likely not to leave the lower interval of WTP values. Being a CFM member decreases hazard by 36% (0.627-1). Thus, a member is 36% less likely to stay in the lower interval, which indicates that CFM members have higher WTP than non-CFM members. Table 4 also shows that one ETB increase in income results in a zero hazard rate (1-1). This is to say, for one ETB increase, the hazard rate will stay constant. Hence, the economic variable seems to predict the WTP decision.

Furthermore, the role of treatments as shown by the Weibull regression similar to the results in the main finding mentioned before. In Table 4, the treatment coefficients show that being in the treatment group of *effort-elsewhere only* increases the hazard rate by more than 3 times compared to the baseline treatment (i.e., *combination*). That is, being offered the *effort-elsewhere only*

scenario decreases WTP. In general, despite the assumption of a specific shape parameter in the Weibull regression, the results in this regression are consistent with the main findings (Table 3).

7. Conclusions

The contingent valuation method was designed to elicit preferences for environmental goods for which conventional markets are unavailable (R.T Carson et al., 2003; Hanemann, 1994). I By allowing the attachment of monetary values to environmental goods, CV creates conventional market-like decision-making. In this study, we see evidence for this claim – that is, the creation of market-like behavior by CV – from the preferences of the subjects. Specifically, the relationship between the predictors and WTP values shows evidence of the subjects' preference for environmental goods. First, the economic variables seem to be in line with the standard economic theory that the higher the income the higher the WTP of participants. Second, other predictors such as being a cooperative member of a local forest conservation seem to be correlated with higher WTP values.

This study tests the hypothesis of whether drawing attention to owns involvement of human-caused environmental damages increase the WTP estimates. I do so by offering respondents in Ethiopia's Bale Eco-region the opportunity to contribute to a reforestation project, using three different scenarios. All scenarios describe the issue of deforestation and desertification that is affecting the region. In one scenario additional information is provided that illegal logging plays a major role in this process, in another additional information is provided about the efforts other countries are undertaking to mitigate this problem of illegal logging; the third scenario offers both these types of information. Next I analyze how the contributions to the reforestation projects differ between the three different scenarios. This approach is akin to the contingent valuation method, which was designed to elicit preferences for environmental goods (R.T Carson et al., 2003; Hanemann, 1994). My approach differs from this method by asking respondents to make real financial contributions. Asking for real contributions makes decisions consequential and makes sure that respondents will think hard about how much they are willing to provide, and hence mitigates the effect of providing socially desired answers. Indeed, economic variables seem to predict contributions in a way that is in line with the standard economic theory; the higher the income the higher contributions made by the participants. Also, other predictors such as being a cooperative member of a local forest conservation seem to be correlated with higher contributions.

Extant literature notes that including information on human-caused environmental damage in contingent valuation surveys increases the WTP values. This was, however, attributed to outrage effect – that is, because respondents are upset, they contribute more to environmental goods. In a somewhat different setting this study finds evidence that contributions to a reforestation project by respondents who are implicated in the process of environmental degradation are not affected by information on efforts of others to mitigate the problem, but also that their contributions increase significantly and substantially if attention is drawn to their own responsibility in the deforestation and desertification process.

The responsibility effect increases contributions for two reasons. First, the sample pool of this study consists of participants who potentially engage in human-caused damage. In this case, the responsibility effect can be reinforced by including information on human-caused damage. Second, the majority of participants have a strong belief that the current environmental damage is a serious problem in terms of the near future consequence (as measured in the survey question).

References

Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. *American journal of agricultural economics, 80*(1), 64-75.

Brown, T. C., Peterson, G. L., Marc Brodersen, R., Ford, V., & Bell, P. A. (2005). The judged seriousness of an environmental loss is a matter of what caused it. *Journal of Environmental Psychology, 25*(1), 13-21.

Bulte, E., Gerking, S., List, J. A., & de Zeeuw, A. (2005). The effect of varying the causes of environmental problems on stated WTP values: Evidence from a field study. *Journal of Environmental Economics and Management, 49*(2), 330-342.

Carson, R. T., Flores, N. E., & Meade, N. F. (2001). Contingent valuation: Controversies and evidence. *Environmental and resource economics, 19*(2), 173-210.

Carson, R. T., Mitchell, R. C., Hanemann, M., Kopp, R. J., Presser, S., & Ruud, P. A. (2003). Contingent valuation and lost passive use: Damages from the Exxon Valdez oil spill. *Environmental and resource economics, 25*(3), 257-286.

Ciriacy-Wantrup, S. V. (1947). Capital returns from soil-conservation practices. *Journal of Farm Economics, 29*(4), 1181-1196. doi: 10.2307/1232747

Cummings, R. G., Elliott, S., Harrison, G. W., & Murphy, J. (1997). Are hypothetical referenda incentive compatible? *Journal of political Economy, 105*(3), 609-621.

Cummings, R. G., & Taylor, L. O. (1999). Unbiased value estimates for environmental goods: A cheap talk design for the contingent valuation method. *The American Economic Review, 89*(3), 649-665.

Dean, J. N. A., & Hoeller, P. (1991). Economics and the environment: A survey of issues and policy options. *OECD Economic Studies, 16*(Spring).

Defries, R. S., Houghton, R. A., Hansem, M. C., Field, C. B., Skole, D., & Townshend, J. (2002). Carbon emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 90s. *Proceeding of National Academy of Science, 99*, 14256–14261.

Freeman III, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: theory and methods*. New York: Routledge.

Green, D., Jacowitz, K. E., Kahneman, D., & McFadden, D. (1998). Referendum contingent valuation, anchoring, and willingness to pay for public goods. *Resource and energy economics, 20*(2), 85-116.

Gunatilake, H., & Tachiri, M. (2014). Willingness to pay and inclusive tariff designs for improved water supply services in urban Bangladesh. *Journal of Sustainable Development, 7*(5), 212.

Haab, T. C., Interis, M. G., Petrolia, D. R., & Whitehead, J. C. (2013). From hopeless to curious? Thoughts on Hausman's "dubious to hopeless" critique of contingent valuation. *Applied Economic Perspectives and Policy, 35*(4), 593-612.

Hanemann, W. M. (1994). Valuing the environment through contingent valuation. *The Journal of Economic Perspectives, 8*(4), 19-43.

Hausman, J. A. (2012). *Contingent valuation: A critical assessment* (Vol. 220). Amsterdam, Netherlands: Elsevier.

Kahneman, D., Ritov, I., Jacowitz, K. E., & Grant, P. (1993). Stated willingness to pay for public goods: A psychological perspective. *Psychological science, 4*(5), 310-315.

Kanninen, B. J. (2007). *Valuing environmental amenities using stated choice studies*. Dordrecht, Netherlands: Springer.

Martín-Fernández, J., Polentinos-Castro, E., del Cura-González, M. I., Ariza-Cardiel, G., Abraira, V., Gil-LaCruz, A. I., & García-Pérez, S. (2014). Willingness to pay for a quality-adjusted life year: An evaluation of attitudes towards risk and preferences. *BMC health services research, 14*(1), 287.

Mitchell, R. C., & Carson, R. T. (1989). *Using surveys to value public goods: The contingent valuation method*. Washington, DC: Resources for the Future.

Oerlemans, L. A., Chan, K.-Y., & Volschenk, J. (2016). Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error. *Renewable and Sustainable Energy Reviews, 66*, 875-885.

Robert, K. (1963). *The value of outdoor recreation: An economic study of the Maine woods*. Cambridge, MA: Harvard University.

Sen, A. K. (1995). Rationality and social choice. *American economic review, 85*(1), 1-24.

Taylor, L. O. (1998). Incentive compatible referenda and the valuation of environmental goods. *Agricultural and Resource Economics Review, 27*, 132-139.

Walker, M. E., Morera, O. F., Vining, J., & Orland, B. (1999). Disparate WTA-WTP disparities: The influence of human versus natural causes. *Journal of Behavioral Decision Making, 12*(3), 219.

Watson, C. (2007). *Direct consumptive use valuation of ecosystem goods and services in the Bale Mountains Eco-Region, Ethiopia.* (Msc Thesis), Imperial College London, London.