Title: PES for the poor? The preferences of buyers

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Abstract

Whether to consider distributive goals when designing payments for ecosystem services is controversial. Opponents argue this undermines the efficiency of ecosystem service provision and poverty reduction should be addressed with separate policies. However, many developing country governments are weak and unable to implement such policies. In such cases, the preferences of buyers of ecosystem services should count. We conduct a choice experiment to elicit the preferences of such potential buyers (donors from a developed country) to include distributive goals in payments to conserve the Malagasy dry spiny forest, and find respondents have a positive willingness-to-pay for including distributive goals.

I. Introduction

The environmental policy instrument of payments for ecosystem services (PES) has received considerable attention in recent years (Ferraro and Kiss 2002; Corbera and Pascual 2012; Kinzig et al. 2011; TEEB 2010). A contentious issue has been whether to consider distributive impacts when designing PES schemes. Some scholars argue that the consideration of equity issues, along with efficiency, should be an integral part of PES design (Corbera and Pascual 2012). A key argument for this view is that the support of local communities to implement a PES scheme can often only be achieved if their consideration of fairness is taken into account in PES design. Otherwise, local communities may ignore or even oppose the scheme, which is likely to make its implementation more costly and undermine its long-term success (Narloch et al. 2012; Pascual et al. 2010). Another argument is that considering equity issues increases the political attractiveness of PES, and hence a PES scheme that contributes to poverty alleviation is easier to implement (Turpie et al. 2008).

In contrast, other scholars argue that distributive impacts should not be considered because this may undermine the main goal of PES, which is to improve the efficiency of natural resources management (Engel et al. 2008; TEEB 2010; Kinzig et al. 2011). While not disputing the relevance of distributive goals, those authors hold that it is more efficient overall to address distribution objectives with other, more suitable, policy instruments. As succinctly pointed out by Kinzig et al. (2011, p.604): "Poverty reduction is a laudable goal, but it should not prevent PES schemes from signaling the scarcity of ecosystem services. Every payment system has implications for equity; although these effects may be extremely important they should be addressed separately, not through payments made under the scheme".

The argument put forward by Kinzig et al. (2011) and others relates to the "Tinbergen rule" of the classical theory of economic policy. This rule dates from the work of the Nobel Prize

winner Jan Tinbergen (Tinbergen 1952) and states, in summary, that in order to achieve a certain number of policy targets, an equal number of policy instruments should be applied. The implicit assumption behind the Tinbergen rule is that a functioning government exists which is able to formulate policy goals, design policies to achieve these goals, and successfully implement the policies – an assumption which, however, does not hold in many developing countries (Rice and Patrick 2008). In practice, governments in developing countries tend to be weak, and substantial policy implementation deficits exist (Engel and Palmer 2008). This is particularly true for remote rural areas, where often targets of PES schemes are located (Kaczan et al. 2013).

Establishing a PES scheme in such an area often proves very difficult and may only be possible with the support of an international organization or donor (Sommerville et al. 2010). It is therefore unrealistic to expect that a second policy which focuses on distributive goals can or will be implemented in the same area by the government or another organization. In such situations there are only two realistic alternatives: 1) to implement a PES scheme which focuses solely on efficiency, or 2) to implement a PES scheme which also includes distributive goals.

From an economic perspective the decision between these two alternatives has to be based on the preferences of the "buyers" of the ecosystem service. It is therefore important to understand to what extent distributive goals are relevant for these buyers. In the case of payments for ecosystem services directed at the protection of global public goods in developing countries, "buyers" are often citizens in developed countries. Their donations and taxes – typically channeled through international NGOs and other international organizations – are used to finance or co-finance PES schemes aiming to conserve endangered biodiversity of global value or to preserve forests as carbon sinks (TEEB 2010; Wunder et al. 2008).

The aim of this paper is to investigate by means of a case study whether citizens in developed countries, as potential buyers of ecosystem services, have a preference for including distributive goals in the design of PES. For this purpose we carried out a choice experiment to elicit potential buyers' willingness-to-pay for an ecosystem service and for different distributive impacts of payments to preserve this ecosystem service. Our case study is the conservation of the dry spiny forest in the Mahafaly Plateau region in Madagascar, which is inhabited by many endangered endemic species and is of high conservation value (Olson and Dinerstein 2002). The forest is threatened by slash-and-burn agriculture from local inhabitants who are very poor (SULAMA 2011). In Madagascar the government is weak and policies are poorly developed and implemented (Rice and Patrick 2008). In our choice experiment we asked inhabitants of the city of Cottbus, Germany, as potential "buyers", about their willingness to donate money to fund alternative PES schemes characterized by different levels of conservation and different distributive impacts.

Overall we find that respondents have a substantial willingness-to-pay for the conservation of the dry spiny forest and that their willingness to donate to conservation is significantly affected by the distributive impacts of the payment to the inhabitants of the Mahafaly region. Respondents do have preferences for achieving distributive goals with their donations and prefer to be informed about the way payments are distributed among the local beneficiaries.

Our results are also relevant to the debate about the design of possible future policies to implement payments to prevent deforestation and forest degradation in the context of the REDD+ framework (e.g. Parker 2009). These payments will most likely be financed by tax payers in developed countries, and in many developing countries with a high level of deforestation the government is weak. Our results indicate that citizens in developed countries do care about the distributive impact of their payments to protect ecosystem services in poor

countries. This suggests that distributive aspects should also receive attention in the debate about the design of REDD+ policies (Kaczan et al. 2013; Lederer 2011).

II. Conservation problem

The dry spiny forest ecoregion, which extends across southern and southwestern Madagascar, is listed as one of the 200 most important ecological regions in the world (Olson and Dinerstein 2002). It provides a habitat for numerous endemic species, such as the radiated tortoise and the giant-striped mongoose, and has the highest level of plant endemism in Madagascar (95% at the species level) (Ferguson et al. 2013; Koechlin 1972). Deforestation has led to a decline in the area covered by spiny forest from about 30.000 km² in 1970 to about 21.000 km² in 2000, which corresponds to an annual deforestation rate of -1.2% (Harper et al. 2007).

The Mahafaly Plateau, a rural area in the southwest of Madagascar about 30 km south of Tulear, covers an area of approximately 8,000 km². The climate is semi-arid with an annual rainfall of between 300-600 mm, mainly occurring between November and April (SULAMA 2011). There is no supply of electricity or tap water. Water for humans and livestock comes from wells and small ponds which, however, partly dry out during the dry season. There are only few roads which are not covered with concrete. Goods are transported almost exclusively by ox cart. Education covers only primary school (SULAMA 2011).

In the Mahafaly region, 87.7 % of households are considered poor with an annual per capita income below 468,800 Ariary (around 200 US$) (INSTAT 2010; Neudert et al. submitted). Agriculture provides the main source of income for most inhabitants but many households also have other sources of income to complement their income from farming (Neudert et al.

submitted). Cassava and maize are the main food crop and small-scale farming prevails with the median field size per household being 1.2 ha (INSTAT 2010; SULAMA 2011). Many households also keep livestock such as goats, sheep and chickens. Zebu, however, are kept only by the wealthy households (Neudert et al. submitted). One way to gain more land for agriculture is slash-and-burn agriculture, a key driver of deforestation in the Mahafaly region (SULAMA 2011).

In order to halt slash-and-burn agriculture, local communities could receive payments from international organizations for maintaining the dry spiny forest. Local communities could use these payments to buy food or increase the productivity of already cultivated agricultural land by, for example, applying manure (SULAMA 2011). PES schemes in Madagascar are typically financed by international donors (Sommerville et al. 2010; Wendland et al. 2010), and it is widely recognized that financial support from international organizations is essential for the conservation of endangered biodiversity in Madagascar (Richard and Ratsirarson 2013).

In Madagascar, governmental structures are generally weak (Freudenberger 2010; Rice and Patrick 2008) and almost non-existent in the rural areas of the south and west (Bertelsmann Stiftung BTI 2012). The government is therefore unlikely to be able to successfully implement measures to alleviate poverty in the Mahafaly Plateau. This argument is supported by the fact that transfer payments from the central government to the communities in Madagascar are usually paid with delay, and sometimes not at all (The World Bank 2004). It is therefore unrealistic to assume that the government is able to design and implement poverty alleviation policies to complement possible payments to local communities to conserve the dry spiny forest in the Mahafaly region.

III. Methods

Choice Experiment - Survey

To study the preferences of potential buyers of ecosystem services for achieving specific distributive goals we used the stated-preference method of choice experiments. Based on Lancaster's (1966) characteristics theory of value, choice experiments are well-suited for analyzing trade-offs among different characteristics (attributes) of a good or a policy. The choice models employed in choice experiments help analyze the relative importance of attributes and/or different attribute levels. In our case the most important choices for the analysis are between achieving and not achieving distributive goals by a donation for nature conservation through PES, and between different distributive goals. Thus we designed a choice experiment with one of the attributes being the way payments are distributed among the providers of ecosystem services. We are especially interested in the relative importance of the levels of this attribute which reflect different distributive aspects.

The hypothetical scenario of our simple choice experiment is that a conservation NGO intends to conserve the dry spiny forest in the Mahafaly Plateau region through the distribution of payments among the local population. For this purpose the NGO is to establish a conservation fund, to be funded by donations. The local communities are then to receive the donations and distribute them among the households. When conducting the survey we referred to the payments as "compensation payments" and did not use the term PES to make it easier for respondents to understand the concept.

In this generic choice experiment the respondents faced alternatives with three attributes: (I) different levels of conservation as expressed by the area of forest conserved, (II) different (ways of) distribution of payments, and (III) different one-time payments in the form of a donation, which they would have to pay.

On each choice card the respondents had to choose only one among three alternatives: two alternatives for donation and one so-called "status-quo" alternative, where they would not have to donate anything, no forest would be conserved and no payments would be distributed.

--- Table 1 somewhere here ---

The different levels of conservation, as expressed by the area of forest conserved (attribute I), were defined based on literature research about the Mahafaly region and in such a way that respondents could easily grasp the different levels. The different areas – 25 km², 50 km² and 75 km² – were presented to the respondents also in comparison to the area of the city of Cottbus, for better understanding.

We decided to keep the number of alternative ways of distributing payments low to make the choice experiment easier and more understandable for the respondents. Thus the focus of the analysis was narrowed down to the relative importance of including either equality aspects, or pro-poor aspects or not including any distributive aspects in the payments distribution.

In the hypothetical scenario of the experiment respondents were informed that the way payments were distributed depended on which communities would be chosen to participate in the conservation project. We stated that different local communities have different traditions in terms of the distribution of common goods, and that there were three options for the distribution of the payments (i.e. three levels of the distributive attribute):

(1) *Everyone gets the same* – if only those communities are involved where according to tradition all households get equal amounts of common goods or of payments to the community. This corresponds to an equal distribution, i.e. to the egalitarian principle

(Leventhal 1980; Konow 2003), where everyone gets the same amount. This is the traditional and most straightforward view on equity which Pascual et al. (2010) have also identified as one of the fairness criteria for PES programs.

(2) *Low-income households get more* – if only those communities are involved where according to tradition poorer households get higher amounts of common goods (we stated that approximately half of the payments go to the poorest one-third of the households). Following Pascual et al. (2010) for PES this corresponds to a pro-poor distribution or "maximin" distribution, in accordance with Rawls (1971). Rawls' difference principle was translated to the respondents as "larger payments to low-income households". This seemed the best and most direct way of conveying the idea that the payments can contribute to poverty alleviation.

(3) *Unknown distribution* – the way payments are distributed is not predictable when the communities involved have no prevailing traditions due to intensified migration and resettlement from other regions. Thus it might be that all households get the same payments, or that the low-income households get more, or that wealthier households get more. This distribution level was included in order to be able to better assess whether distributive issues matter at all to respondents.

Voluntary donation (attribute III) was chosen as a payment vehicle, because this is the usual way of financing the kind of project in question. We decided to use a one-off donation, since the effect on a respondent's budget is easier to understand than in the case of an annual payment over several years. To allow respondents to choose between different low, middle and high amounts of payment the donation attribute was set at nine levels between €2 and €100.

For the purpose of the experiment we consider the estimation of main effects as sufficient and ignore interaction effects. A fractional factorial design with 27 profiles was generated for the

estimation of main effects. The profiles were blocked and each respondent was presented with nine choice sets (choice cards), constructed based on experimental design. A sample choice card is presented in Figure 1. Each choice card consisted of A and B alternatives as combinations of different attribute levels and a C alternative that corresponded to a status quo, where no fund is established, no forest is conserved, and no donation is made by the respondent.

Due to the theoretical nature of the survey scenario, the participants' responses are subject to hypothetical bias. So-called "cheap talk" (an explanation of the bias problem to respondents and a request not to overstate their WTP) has been successfully used in contingent valuation studies (e.g. Cummings and Taylor 1999; Murphy et al. 2005) and some choice experiments (Carlsson et al. 2005) to reduce the effects of hypothetical bias. During the survey we therefore tried to convey to the respondents how important it is that they answer according to their own preferences and budget/financial situation, as they would in a real-life situation. We also informed them that similar studies have shown that respondents tend to exaggerate their stated willingness to pay.

--- Figure 1 somewhere here ---

Choice Modeling

We tested three different choice models for predicting the choice probabilities of respondents, namely the conditional logit model (CLM), the random parameters logit (RPL) model, and the latent class model (LCM). In general, choice models employ the random utility theory, according to which the choice of an alternative depends on some observable and unobservable

characteristics. Different choice models rely on different assumptions about the distribution of the error term that captures the unobservable characteristics.

In the simplest and most widely used conditional logit model, as formulated by McFadden (1974), the error term is an independently and identically distributed (IID) extreme value Type I. The parameters estimated are fixed for all the respondents, i.e. no heterogeneity of preferences is assumed. Further, the ratios of choice probabilities of the alternatives are considered to be independent of including new alternatives into the choice set or of excluding alternatives (independence from irrelevant alternatives – IIA assumption). This assumption is strong and should always be tested, usually using the Hausman test (Hausman and McFadden 1984).

A more sophisticated model, which relaxes the strong assumptions of the CLM, is the mixed logit model or random parameters logit model (McFadden and Train 2000), where parameter coefficients are assumed to vary across respondents. The probability distributions of the random parameters in an RPL model have to be predefined/ specified by the analyst, which might lead to some trial and error process in the model estimation. The normal distribution, which is often preferred, has the disadvantages of being unbounded and symmetrical. Thus it is not well suited for estimating coefficients which are presumed to be either only negative (e.g. cost coefficients) or only positive. A triangular distribution, which can be asymmetric, is better for deriving behaviorally meaningful individual-level outputs (Hensher et al. 2005). Therefore in our analysis in the RPL model, we specify a triangular distribution for the donation attribute and for the forest area conserved, whereas for the distributive attribute levels (effects-coded variable in our experiment) we use a normal distribution.

Another way to relax the assumptions of the CLM is by using an LCM (Greene and Hensher 2003), which can potentially give some interesting insights into the preferences of

respondents according to their socio-demographic characteristics. In an LCM preferences are assumed to vary between classes of respondents. The sample is implicitly divided into a small number of classes based on different individual characteristics or attitudes. Membership of a class is probabilistic and not known a priori to the analyst. The parameters are estimated based on a logit model for each class of respondents. The number of classes has to be defined by the analyst, which might pose a difficulty, but the disadvantage of an RPL model of having to make assumptions about the distribution of parameters is obviated.

All three model types were applied and the results are presented below.

Data collection

A pretest with 18 individuals was conducted which resulted in some suggestions for improving the presentation and the questionnaire. It was also beneficial to test what kind of questions respondents have on the scenario and the experiment to be prepared for the actual survey.

The survey respondents were recruited via announcements in the local newspaper and by word of mouth in the city of Cottbus. Quota sampling based on age and gender was used. Only individuals aged 18 years and older were included in the sample. The exact topic of the survey was not revealed to the respondents in order to counter sample selection bias. Each respondent received €15 compensation for participating in the survey. The interviews were conducted by one of the authors.

Since the scenario was hypothetical and the topic not well known in the general public, the choice experiment survey was conducted in a group setting and at the beginning of each survey session there was a presentation by the interviewer on the conservation problem and

the Mahafaly region and on the proposed hypothetical solution through payments. Guidelines on filling out the choice cards were also given. The goal was to ensure that the respondents have a good understanding of the topic and the problem, and to help in filling out the questionnaire. Several stated-preference studies show that the amount and kind of information provided to respondents has a significant effect on their preferences and WTP (Czajkowski and Hanley 2012), especially if respondents are not familiar with the good (MacMillan et al. 2006; Wätzold et al. 2008).

The presentation included information about an ongoing research project in the Mahafaly Plateau region, which deals with the land-use conflicts in the area and how to discourage slash-and-burn agriculture and conserve the dry spiny forest. The respondents were given a brief introduction to the Mahafaly region, the dry spiny forest, and on the livelihoods of the local population. Pictures of the region and the locals, the dry spiny forest and some of the endangered species living there were shown too. It was important to explain the income situation of the households in the region, since their situation is very different from that of households in developed countries. It was pointed out that the income and asset situation of a household in this remote rural area depends mainly on the number and type of livestock they own. A household with cattle is considered wealthy. A household which does not own cattle but possesses goats and/or sheep is considered an average or middle income household. A household which possesses only poultry is considered a low-income household. During the presentation the interviewer also explained how the choice cards were to be filled out.

After the presentation the respondents had the opportunity to ask questions concerning the experiment and the project and then everyone completed the questionnaire on their own. The questionnaire itself consisted of some “warm-up” questions, the choice cards plus instructions for filling them out, and some debriefing and socio-economic questions. Some of the debriefing questions were included to help identify protest responses. Some attitudinal

questions and questions on the perceived complexity of the experiment for respondents were included too. The questionnaire ended with an appendix with the information on the project and the problem as presented in the oral presentation which respondents could refer to, if needed.

Altogether 298 respondents took part in the 16 survey sessions. Table 2 compares summary statistics for the survey sample to available statistics for the population of Cottbus (Statistical Office for Berlin-Brandenburg 2012). Overall the sample is fairly representative of the population, especially in terms of income and gender. However it is less representative in terms of age. The age class 20-44 years is slightly underrepresented in the sample whereas the age class 45-64 years is slightly overrepresented.

--- Table 2 somewhere here ---

Out of the 298 respondents the data from only 245 respondents was used in the choice model estimation. Sixteen respondents were dropped because of missing values for the choice variable. In addition the answers of 37 respondents were identified as protest responses and excluded from the model estimation. The issue of protest responses has received much attention in the literature on contingent valuation (CV) but so far less in choice experiments. Choice experiments are alleged to lead to lower protest response rates than CV. However, e.g., Meyerhoff and Liebe (2008) found no significant differences in protest responses between CE and CV. Barrio and Loureiro (2013) showed that protest responses are usually encountered in choice experiments and that their incorporation into the analysis influences the model performance, model estimates, and valuation results.

The protest respondents in this study were defined as respondents who object to or reject some parts of the hypothetical scenario of the stated-preferences survey and allocate non-true zero values to the program valued. Thus the protest responses were identified among the respondents with no WTP, i.e. among those who chose not to donate on each choice card. To distinguish between protest responses and real zeros we asked respondents to give their reasons in case they chose not to donate on each choice card. For this purpose a closed-ended question with an option for stating "reasons for not donating" was included in the questionnaire, in the debriefing part after the choice cards. After analyzing the answers to this question the protest responses were identified based on protest beliefs ( ) used by Jakobsson and Dragun (2001), Strazzera et al. (2003), Meyerhoff and Liebe (2008) and Loomis et al. (1996). Three respondents (out of the 37 identified as protests) gave no reason for not donating and left many questions unanswered. They were classified as protest responses too.

--- Table 3 somewhere here ---

IV. Results

Main Results

In the choice model estimations we used effects coding for the levels of the distribution attribute to be able to analyze trade-offs between different alternative ways of distributing payments. Continuous variables were defined for the forest area conserved and the donation amount.

Table 4 shows the results of the CLM and RPL model estimated only using the attributes. The RPL model was estimated once with an unconstrained triangular (t-)distribution for the

donation attribute and then with a constrained t-distribution. The standard deviation parameter estimate was constrained to that of the mean of the random parameter, as suggested by Hensher et al. (2005). This ensures no change of sign in the parameter estimates for donation and is therefore useful for WTP calculations.

Both the CLM and RPL model result in statistically significant coefficients for all attributes used. Respondents apparently faced trade-offs between the different ways of distributing payments, the donation amount and the level of conservation. The coefficient for forest area conserved is significant at the 1% level and with a positive sign. As expected, the larger the forest area conserved, the higher the utility of an alternative. The coefficient for donation is negative and significant at the 1% level, showing that utility decreases with higher donations. The positive and statistically significant coefficients for "equal distribution" and "pro-poor distribution" suggest that respondents have preferences for achieving distributive goals with their donations. This is also confirmed by the negative and significant coefficient for "unknown distribution". Respondents seem to prefer to donate to a program involving some distributive goals and prefer to have information on the way the donations are distributed.

As discussed above, the estimation of a CLM is always accompanied by a test of the validity of the IIA assumption. The widely used Hausman test (Hausman and McFadden 1984) compares the parameter estimates of the CLM with a restricted model where one of the alternatives in the choice set is dropped. If IIA holds (null hypothesis in the test) the two sets of parameter estimates should not differ significantly. The test is conducted for each of the alternatives separately. The Hausman test for the CLM used here resulted in the rejection of the null hypothesis for the A alternative at the 1% level and for the B alternative at the 5% level. The test resulted in a negative χ^2 value for the C alternative. Hausman and McFadden (1984) acknowledge that getting a negative result may occur and suggest that this can be interpreted as supporting the null hypothesis (i.e. IIA). However, there has been some

criticism in the literature on the direct interpretation of a negative Hausman test result (e.g. Vijverberg 2011).

To ensure straightforward conclusions on the validity of the IIA assumption we conducted a generalized Hausman test suggested by Weesie (1999), which should yield non-negative results. We used the statistical package Stata for the Weesie test and found that it leads to rejection of the IIA assumption for each of the three alternatives at the 1% level. Morrison et al. (1998) suggest the presence of close substitutes in a choice set or the existence of preference heterogeneity among respondents as possible reasons for violation of the IIA assumption. In our experiment the A and B alternatives as defined can be regarded as close substitutes, which might explain the violation of the IIA assumption. It seems, however, that there is also preference heterogeneity in the sample, which we analyze with an RPL model and an LCM.

Following the procedure suggested by Hensher et al. 2005 we use the common-choice-specific conditional parameter estimates of the constrained RPL model shown in Table 4 to calculate the implicit prices (marginal WTP) for the different attributes and levels. The comparison of implicit prices gives us a better insight into respondents' preferences, especially into the preferences for different ways of distribution. The implicit price or marginal WTP for any attribute is equal to the ratio between the coefficient for that attribute and the coefficient for cost or price.

--- Table 4 and Table 5 somewhere here ---

Table 5 shows that respondents are willing to pay on average €0.74 for one km^2 forest area conserved. A conservation program involving higher payments to lower income households ("pro-poor" distribution) is valued higher than a program with equal distribution of payments. The WTP to have a "pro-poor" distribution equals €24.45, whereas "equal" distribution is valued at €10.73. The negative WTP value of -22.58 for unknown distribution can be interpreted as the willingness to pay not to have unknown distribution, implying that it is undesirable for respondents not to have information on the distribution of the payments. Apparently, not knowing how payments are distributed decreases the utility of a conservation program for respondents. A useful comparison of the preferences for different ways of distribution can be based on the part-worths of changes in the distribution (calculated as the difference in marginal WTP). Changing the distribution from "unknown" to "equal" is worth €33.31; changing the distribution from "unknown" to "pro-poor" is worth €47.03; a change from "equal" to "pro-poor" distribution is worth €13.72.

Sources of preference heterogeneity

The estimated simple RPL models show the existence of preference heterogeneity, but do not give information on the sources of heterogeneity. To analyze the influence of socio-demographic characteristics and attitudes on preferences we employ an RPL model (including interactions) and an LCM, and test the following hypotheses for the determinants of preferences:

1) Respondents who have already donated to an environmental or nature protection cause are more likely to choose programs with higher conservation levels, i.e. alternatives with greater forest area conserved.

2) It is also likely that respondents who have already donated to environmental causes have higher utility of the donation payment. A question on previous donations to an environmental or nature protection organization (in the previous two years) was included in the questionnaire and coded as "Donation for Environment". We let this variable interact with the area and the donation attributes.
3) Respondents who think it is important that low income households get higher payments for implementing nature conservation measures in developing countries might be more likely to choose to donate to a program involving a "pro-poor" distribution. To test this hypothesis we include a respective debriefing question in the choice experiment questionnaire. We then create a dummy variable "Poor Important", which is equal to 1 if respondents stated that low income households getting more is important or very important and 0 otherwise, and let it interact with the "pro-poor" attribute. This is to some extent a consistency check, too.
4) "Low-Income" respondents are represented in the data by a dummy variable equal to 1 if the net monthly household income is below €900 and 0 otherwise. Respondents with low income are expected to prefer to donate to a program where low income households get higher payments, out of compassion. We check this by including an interaction between the "Low-Income" variable and the "pro-poor" distribution attribute in the model.
5) It is also likely that low-income respondents have higher disutility of donation payments, due to their higher marginal utility of income (money) compared to wealthier households. We therefore let the donation attribute interact with the "Low-Income" variable.
6) Respondents who have already donated to poverty alleviation causes will tend to choose programs which help the poor.
7) They might also have lower disutility from a donation payment, if it goes for such a program. To test these two statements (6 and 7) we include interactions between the "pro-poor" and the donation attributes with the variable "Donation for Poverty". The latter

accounts for respondents' donations to development aid or poverty alleviation causes in the previous 2 years.

8) Available donation statistics show that the proportion of donations/"donors" in the population increases with age. The donation rate (as a percentage of money donors) is especially high in the age class of 65 and above (TNS Infratest 2011). To account for the higher willingness to donate of the elderly, we create a dummy variable "Age 65 and above", which is equal to 1 if a respondent is 65 or above and 0 otherwise.
9) Apart from analyzing the interaction of age and the donation attribute, we test the influence of age on the choice of a program which supports the poor. There is some evidence in the literature that altruistic behavior becomes more likely with age (e.g. List 2004). Thus, it might be that elderly respondents are more likely to choose a program involving "pro-poor" distribution.

To test the above hypotheses we run an RPL model including the estimation of fixed interactions between the attributes and the dummy variables "Poor Important", "Low-Income", "Donation for Environment", "Donation for Poverty", "Age 65 and above". Thereby we set the distribution attribute levels "equal distribution" and "unknown distribution" as non-random parameters, as suggested by the results of the simple constrained RPL model (see Table 4), where the standard deviation estimates of these variables are insignificant.

The results of the RPL model including sources of preference heterogeneity are presented in Table 6. The coefficients for all attributes, displayed in the first section of the table, are significant and of the expected sign. The coefficients for the interaction effects are shown in the second section of the table. The insignificant coefficient for the interaction effect between the forest area conserved and the "Donation for Environment" implies that previous donations to environmental and nature protection causes do not increase the likelihood of choosing an

alternative with higher forest area conserved in the experiment. The reason for this might be that in this special case of donations for the poor Mahafaly region respondents focus more on the distributive aspects than on the level of forest conservation.

--- Table 6 somewhere here ---

Elderly respondents and respondents who have already donated for poverty alleviation do tend to choose the "pro-poor" distribution of payments, where the low-income households get more. Here the coefficients for the interaction effects are positive and significant at the 5% level. The interaction effect between "pro-poor" and "Poor Important" is also positive and significant (at the 1% level) – in line with expectations. Surprisingly, there is no significant link between low-income respondents and a "pro-poor" distribution. It seems that low-income respondents are not more likely to choose a "pro-poor" distribution (hypothesis 4 is not supported). This might be due to the relatively high number of university students in our sample. Students usually have low income, but also prospects of having high income in the future. Therefore they might not be inclined to choose a pro-poor distribution. For the donation attribute only the interaction effects with low-income and elderly respondents are significant (at the 1% level).

As expected, low-income respondents have higher disutility of donation due to higher marginal utility of income. The hypothesis that elderly respondents have higher willingness to donate and thus higher utility of donation is also supported. However the expectations that previous donations to environmental or poverty alleviation causes might have an effect on the willingness to donate and thus on the likelihood of choosing higher payments are not confirmed. The coefficients for the interactions between the donation amount and "Donation

for Environment" and "Donation for Poverty" are insignificant. A possible explanation for this result is that a donation for the Mahafaly region is specific in a sense that the biodiversity is unique and exotic and the poverty very severe. For these reasons the donation might equally appeal to respondents who have already donated for the environment or for poverty alleviation as well as to those who have not donated for such causes yet.

We also tested the hypotheses listed above using an LCM. Although it has some limitations compared to an RPL model, an LCM can give interesting insights into the heterogeneity of preferences in the sample. As already mentioned, it divides the sample into classes of respondents with different preferences based on some individual characteristics. We use a model with two classes. For the division into classes, i.e. for the class-membership function, we use the determinants of preferences already used in the RPL model above ("Poor Important", "Low-Income", "Donation for Environment", "Donation for Poverty", "Age 65 and above"). The first section of Table 7 presents the estimates for the attributes and the second section displays the coefficients for the class-membership function. The coefficients of the class-membership function are set to zero for Class 2 and the coefficients for Class 1 show the probability of membership of Class 1 relative to Class 2 for each variable.

--- Table 7 somewhere here ---

As Table 7 shows, the coefficients for all variables used for the class-membership function are significant, however at different significance levels. Among these variables "Age 65 and above" and "Poor Important" are the strongest determinants of class membership. Elderly respondents, respondents who support higher payments for low-income households and respondents who have already donated to poverty alleviation causes belong to Class 1. They

show much higher preferences for a "pro-poor" distribution than Class 2 and seem not to be influenced in their choices by an "equal" distribution. The coefficient for "equal distribution" is positive but insignificant for Class 1. Class 1 respondents also show somewhat weaker rejection of the "unknown" distribution compared to Class 2, since the coefficient for this attribute is lower (in absolute terms) and less significant for Class 1. The low-income respondents and those who have already donated to environmental causes belong to Class 2. In contrast to Class 1 they show a preference for the "equal" distribution and no significant preferences for the "pro-poor" distribution. Class 2 respondents' disutility of donation is higher (the absolute value of the coefficient is higher) than that of Class 1, which is in line with expectations for low-income households. The preferences for the level of conservation of the two classes do not differ (the coefficients for area conserved are identical). What does differ are the preferences for the two distributive justice principles – "pro-poor" and "equal" distribution. Lower income respondents tend to choose an "equal" distribution, whereas elderly, higher income individuals prefer a "pro-poor" distribution.

V. Discussion and conclusions

Many scholars argue against incorporating distributive goals in PES schemes so that the efficiency goal of natural resources management is not violated (Engel et al. 2008; TEEB 2010; Kinzig et al. 2011). Their arguments are in line with the Tinbergen rule which states that in order to achieve different goals the same number of different policy instruments should be implemented. Such an approach, however, requires the existence of a functioning government. In many developing countries governments are weak, and a successful implementation of separate policies for separate goals is unlikely. From an economic

perspective in such a setting the preferences of buyers of ecosystem services – who are often donors from developed countries – should count.

In a case study, we investigate the preferences of inhabitants of the German city of Cottbus – as an example of potential donors from a developed country – to conserve the endangered dry spiny forest in a very poor rural area in Madagascar and find that respondents have a positive willingness-to-pay for forest conservation but also for a pro-poor or equal distribution of payments among local beneficiaries compared to an unknown distribution. Our results suggest that citizens in developed countries have preferences for achieving distributive goals with their donations and prefer to be informed about the way payments are distributed among local beneficiaries. They dislike alternatives where the distributive effects are unclear and there is the possibility that wealthier locals would benefit more from the payments. In the estimated choice models the coefficients for forest area conserved and for the way payments are distributed are highly significant. All estimated models suggest strong preferences for equal distribution and pro-poor distribution. As suggested by the LCM, the latter seems to be more important to elderly respondents and respondents with higher incomes.

The aim of our study is not to reject the notion that efficiency and equity issues should be treated separately in environmental policy design. We merely argue that the institutional preconditions needed for a separate treatment of efficiency and equity frequently do not exist in developing countries, and that in such cases the preferences of buyers should count. If, on the other hand, the institutional preconditions do exist we agree that the goals of poverty alleviation and environmental improvement can be better achieved if they are dealt with separately. Buyers of ecosystem services in developing countries are not necessarily citizens of developed countries but may also be local beneficiaries of an ecosystem service. To what extent such local beneficiaries have preferences for including distributive goals in PES schemes is a matter for future research.

Our findings show that buyers have a positive willingness to donate when there is an equal or pro-poor distribution of payments. Since an equal distribution also corresponds to a widespread view of fairness among local beneficiaries (Narloch et al. 2011 and GrossCamp et al. 2012), payments that lead to an equal distribution of benefits to providers of ecosystem services might be a good option for incorporating equity concerns in a PES program In the context of PES schemes an equal distribution can also be combined with pro-poor elements, such as provision of livestock to the poorest, as suggested by GrossCamp et al. (2012).

On a general level, our work contributes to the debate on the relationship between equity and efficiency in environmental and resource policy (Armstrong and Clarke 1997) and evaluation (Baumgärtner et al. 2013). In this context, our work is close to Dietz and Atkinson (2010) who investigate citizens' preferences for considering equity alongside efficiency in the context of local traffic-emissions control and national climate change mitigation policies. Similar to us, they find that including distributive goals in the design of these policies also matters to citizens. In addition to PES design, our research is particularly relevant for REDD+ policies. Like PES, they are also implemented in developing countries, where governments may not be able to successfully implement separate policies for achieving efficiency and distributive goals. Therefore, our results support the notion that distributive aspects should be taken into account early in the design of REDD+ programs (Lederer 2011).

Here we have focused on distributive aspects, which represent just one dimension of equity. McDermott et al. (2013) suggest that other aspects, such as procedural equity and local beneficiaries' cultural understanding of fairness have to be taken into consideration as well when implementing PES schemes. Therefore further research on the preferences of potential buyers of ecosystem services for such equity considerations can provide interesting insights, and contribute to the design of "tailor-made" PES and REDD+ programs, which correspond to the preferences and expectations of providers and buyers of ecosystem services. This might

positively influence the acceptance of PES and REDD+ schemes and their implementation both in developed and developing countries.

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TABLES

TABLE 1

ATTRIBUTES AND ATTRIBUTE LEVELS USED

Attributes	**Levels**
Forest area conserved	25 km^2, 50 km^2, 75 km^2
Distribution of payments (who gets the payments/ depends on the communities where the project will be implemented)	**(1)** According to the communities' traditions → **everyone gets the same** *Corresponds to the equality/ egalitarian principle*
	(2) According to the communities' traditions → **low-income households get more** *Corresponds to the Rawlsian maximin principle*
	(3) No information available on the traditions in the communities → **distribution unknown** *Implies no consideration of distributive issues*
Donation (one-time payment in Euro)	2, 4, 10, 15, 20, 35, 55, 75, 100

TABLE 2

SAMPLE STATISTICS COMPARED TO THE POPULATION OF COTTBUS

	Sample in % (count)	**Population of Cottbus in % (31.12.11)**
Gender		
female	52.7 (156)	50.7
male	47.3 (140)	49.3
Age (years)		
15-19	4.8 (14)	3.1
20-44	29.2 (85)	37.1
45-64	42.3 (123)	34.5
>=65	23.7 (69)	25.2
Income		
< 900 €	21.9 (61)	22.4
900 € to under 1300 €	17.3 (48)	19.1
1300 € to under 2600 €	41.4 (115)	38.5
>=2600 €	19.4 (41)	20.0
Size (count)	298	102,129

TABLE 3

STATEMENTS USED TO DISTINGUISH BETWEEN PROTEST RESPONSES AND REAL ZEROS

Protest beliefs:
I have no trust in the success of the program.
It is unfair that I have to pay for such a program.
I do not have enough information on the problem.
Others should pay for such a program.
I object to the question as asked. Not enough information is given.
The method of payment is considered inappropriate.
In general, I am opposed to such programs/to donations.
No reason given for not donating.
No Protest - real zeros:
Cannot afford to pay.
Society has more important problems to solve than this one.

TABLE 4 CLM AND RPL MODEL ESTIMATES OF PREFERENCES (STANDARD ERRORS IN PARENTHESES)

Variable	**CLM**	**RPL (unconstrained)**		**RPL (constrained)**	
		Mean	Std. Dev./ Spread	Mean	Std. Dev./ Spread
Forest area conserved	0.221*** (0.002)	0.048*** (0.015)	0.085** (0.039)	0.027*** (0.003)	0.052*** (0.013)
Equal distribution	0.215*** (0.049)	0.879** (0.358)	1.671* (0.885)	0.390*** (0.075)	0.270 (0.493)
Pro-poor distribution	0.628*** (0.048)	1.780*** (0.654)	2.084** (0.839)	0.880*** (0.106)	0.732*** (0.242)
Unknown distribution	-0.810*** (0.062)	-0.976*** (0.283)	1.305* (0.745)	-0.825*** (0.082)	0.027 (0.277)
Donation	-0.025*** (0.001)	-0.085*** (0.031)	0.165** (0.066)	-0.037*** (0.004)	0.037*** (0.004)
Number of respondents	245	245		245	
Number of observations	2,205	2,205		2,205	
Log-likelihood	-1,990.315	-1,961.811		-1,973.158	
AIC (normalized)	1.810	1.788		1.798	
Pseudo-R2	16.7%	19.0%		18.5%	

*** significant at 1%, ** significant at 5%, * significant at 10%

TABLE 5

IMPLICIT PRICES (MARGINAL WTP) USING CONDITIONAL CONSTRAINED PARAMETER ESTIMATES FROM RPL

	Marginal WTP (in Euro)			
Attributes	**Forest area conserved (per km^2)**	**Equal distribution**	**Pro-poor distribution**	**Unknown distribution**
Mean	0.74	10.73	24.45	-22.58
St. Dev.	0.28	1.97	8.66	2.63
MAX	1.59	26.11	56.53	-18.81
MIN	0.13	7.20	6.25	-43.92

TABLE 6

RPL PREFERENCE ESTMATES INCLUDING THE INFLUENCE OF RESPONDENTS' CHARACTERISTICS AND ATTITUDE (STANDARD ERRORS IN PARENTHESES)

Variable	Mean/ Parameter	St. Dev./ Spread
Forest area conserved	0.029*** (0.003)	0.069*** (0.014)
Equal distribution	0.483*** (0.094)	-- (non-random parameter)
Pro-poor distribution	0.290** (0.137)	0.710** (0.334)
Unknown distribution	-0.806*** (0.087)	-- (non-random parameter)
Donation	-0.052*** (0.007)	0.081*** (0.014)
Heterogeneity in mean – interactions		
Forest Area: Donation for Environment	-0.000 (0.004)	
Pro-poor: Poor Important	0.688*** (0.141)	
Pro-poor: Low-Income	0.123 (0.148)	
Pro-poor: Donation for Poverty	0.309** (0.133)	
Pro-poor: Age 65 and above	0.359** (0.155)	
Donation: Low-Income	-0.018*** (0.006)	
Donation: Donation for Environment	0.007 (0.005)	
Donation: Donation for Poverty	0.004 (0.005)	
Donation: Age 65 and above	0.026*** (0.006)	
Number of respondents	242	
Number of observations	2,178	
Log-likelihood	-1,882.415	
AIC(normalized)	1.744	
Pseudo-R2	21.3%	

*** significant at 1%, ** significant at 5%, * significant at 10%

TABLE 7

PREFERENCE ESTIMATES USING A LATENT CLASS MODEL (STANDARD ERRORS IN PARENTHESES)

Variable	Class 1		Class 2	
Forest area conserved	0.024***	(0.004)	0.026***	(0.003)
Equal distribution	0.421	(0.267)	0.373***	(0.108)
Pro-poor distribution	1.627***	(0.295)	0.094	(0.131)
Unknown distribution	-0.644**	(0.255)	-0.720***	(0.120)
Donation	-0.013***	(0.004)	-0.049***	(0.007)
Class membership				
Constant	-1.361***	(0.442)	--	
Poor Important	1.127***	(0.292)	--	
Low Income	-0.653**	(0.256)	--	
Donation for Environment	-0.317*	(0.164)	--	
Donation for Poverty	0.315*	(0.164)		
Age 65 and above	1.495***	(0.285)		
Number of respondents	245			
Number of observations	2,205			
Log-likelihood	-1,911.657			
AIC(normalized)	1.748			
Pseudo-R2	21.1%			

*** significant at 1%, ** significant at 5%, * significant at 10%

FIGURES

FIGURE 1. SAMPLE CHOICE CARD

Which alternative would you choose, if you were asked to donate to the establishment of a conservation fund for the spiny forest?			
	Alternative A	***Alternative B***	***Alternative C: no donation***
Spiny forest area conserved	**75 km^2**	**25 km^2**	**0 km^2**
Distribution of payments. Who gets the payments?	**"distribution unknown"**	**"low income households get more"**	**X**
One-time donation	**15 €**	**20 €**	**No donation**
I choose: **Please, check only one box!**	☐	☐	☐

X means no distribution of payments, no conservation fund established.