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Carbon offsets out of the woods? Acceptability of domestic vs. international reforestation programmes in the lab☆

Andrea Baranzini[a], Nicolas Borzykowski[a,b,*], Stefano Carattini[c,d]

[a] Haute école de gestion de Genève, HES-SO University of Applied Sciences and Arts Western Switzerland, Switzerland
[b] Institute of Economic Research, University of Neuchatel, Switzerland
[c] Yale School of Forestry & Environmental Studies, United States
[d] Grantham Research Institute on Climate Change and the Environment and ESRC Centre for Climate Change Economics and Policy, London School of Economics and Political Science, United Kingdom

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ABSTRACT

Following the entry into force of the Paris Agreement in November 2016, governments around the world are now expected to turn their nationally determined contributions into concrete climate policies. Given the global public good nature of climate change mitigation and the important cross-country differences in marginal abatement costs, distributing mitigation efforts across countries could substantially lower the overall cost of implementing climate policy. However, abating emissions abroad instead of domestically may face important political and popular resistance. We ran a lab experiment with more than 300 participants and asked them to choose between a domestic and an international reforestation project. We tested the effect of three informational treatments on the allocation of participants' endowment between the domestic and the international project. The treatments consisted in: (1) making more salient the cost-effectiveness gains associated with offsetting carbon abroad; (2) providing guarantees on the reliability of reforestation programmes; (3) stressing local ancillary benefits associated with domestic offset projects. We found that stressing the cost-effectiveness of the reforestation programme abroad did increase its support, the economic argument in favour of offsetting abroad being otherwise overlooked by participants. We relate this finding to the recent literature on the drivers of public support for climate policies, generally pointing to a gap between people's preferences and economists' prescriptions.

Introduction

Following the 2016 entry into force of the Paris Agreement, governments are now expected to turn their greenhouse gas emissions pledges into concrete climate policies. These policies need not only to be sufficiently effective to reach the emissions abatement objectives, but also to be as inexpensive as possible to leave some economic and political room for further policy tightening, in particular when it will come to set new ambitions in 2023. Only in this way, the long-term objectives of the Paris Agreement can be met. Since greenhouse gases mix uniformly in the atmosphere, and given the important differences in cross-country marginal abatement costs, distributing abatement efforts across countries could substantially lower the overall cost of implementing a global climate policy (Morris et al., 2012; Kriegler et al., 2014).

The choice of the policy instrument is crucial to ensure that the abatement objectives can be reached at a reasonable cost. Economists contend that carbon pricing represents the central pillar of the policy package necessary to transform emissions targets into effective abatements (Goulder and Parry, 2008; Aldy and Stavins, 2012). However, important political resistance opposes the use of carbon pricing, which explains the limited diffusion of carbon taxes and cap-and-trade programmes around the world (Baranzini and Carattini, 2014; World Bank, 2017). The same resistance also applies to the use of carbon offsets resulting from activities or projects implemented abroad, but used to compensate domestic

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* Corresponding author at: Haute école de gestion de Genève, rue de la Tambourine 17, GE-1227 Carouge, Switzerland.
E-mail address: nicolas.borzykowski@hesge.ch (N. Borzykowski).

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emissions, as well as, more generally, to the mechanisms permitting the compensation of emissions among countries (Monbiot, 2007; Schneider, 2009). For instance, the European Union (EU) Emissions Trading Scheme capped until 2013 the amount of carbon credits that firms could buy from emissions abatement projects taking place outside the EU. Since 2013, international credits are no longer accepted. Similarly, the use of international offsets is currently capped in the California cap-and-trade scheme, and international offsets may disappear altogether from this scheme as it enters the third compliance period in 2018. In the case of California, strong resistance to the use of offsets comes in particular from local environmental justice groups, which claim that firms should reduce their emissions locally, and provide co-benefits to local communities (Schatzki and Stavins, 2009; Pastor et al., 2013). The 2009 Waxman–Markey bill also included a cap for the use of carbon offsets, related to the location of abatement efforts. Domestic and international offset programmes were each capped at 1 billion metric tons, with the possibility for the US Environmental Protection Agency to shift part of the domestic cap to international offsets only if it could be determined that the domestic supply was insufficient. The room for abating greenhouse gas emissions abroad is also limited by law in other contexts. In Switzerland, for instance, a minimum of 30% of the total emissions reduction must be achieved domestically. Stronger requirements may apply for some industries. For instance, fossil-thermal power plants are required to offset all of their emissions, 50% of which must be compensated domestically.

At the same time, some countries, such as Norway, Finland, Sweden or Costa Rica, plan to become carbon neutral over the next decades, an objective that potentially implies a large use of offsetting practices. While Costa Rica plans to undertake local measures to offset emissions through reforestation, reaching this objective in Scandinavian countries would very likely require the purchase of a substantial amount of carbon offsets from foreign countries. Sweden, for instance, plans to cut its domestic emissions by 85%, while offsetting the remaining amount. This paper is motivated by the conflict between the large potential cost savings associated with abating emissions through projects implemented abroad and the possible political resistance to such practice.

Some evidence already suggests that the public may not always favour the most efficiency-enhancing solution in climate policy, even when pay-offs are transparent (Cherry et al., 2012). People may not even pay attention to the provided quantity of public good, if their motivation is impurely altruistic and driven by the moral satisfaction of contributing (cf. Andreoni, 1990). For instance, using stated preferences methods, Kahneman and Knetsch (1992) find that the willingness to pay for a public good may not be influenced by the quantity provided: individuals may not necessarily understand that different quantities of public good can be provided with the same contribution. This difference can, however, be very large, especially for environmental goods such as carbon offsets, whose costs can vary greatly depending on location.

In addition, practical reservations have been raised to the purchase of international carbon offsets. Evidence of abuses in the additionality condition have clearly contributed to reduce the credibility of the UNFCCC's mechanisms to facilitate international emissions trading, such as the Clean Development Mechanism and Joint Implementation (see Schneider and Kollmuss, 2015; Tirole, 2012). In the light of these critiques, the preference that the general public seems to give to local projects, and to standards certifying projects generating emissions offsets abroad, should not surprise (see Blasch and Farsi, 2014). However, beyond this, little is known on how to overcome these obstacles and increase the popularity of international carbon offsets.

A new literature analysing this question empirically is thus needed. Torres et al. (2015) use a choice experiment to test the effect of distance to the mitigation site on the propensity to support mitigation activities. This stated preference study finds a preference for local mitigation, which provides local co-benefits. All potential mitigation sites are, however, located in Mexico, where the survey takes place. The international dimension, and the related heterogeneity in abatement costs, is thus left for future research. Two additional studies shed more light on the question of domestic vs. international abatements. Anderson and Bernauer (2016) recruit participants on an online labour market and analyse the effect of different informational treatments on stated support for domestic vs. international offsets. People seem to express higher support for international abatements when the argument of efficiency (vs., e.g. ethicality) is raised, even though no real carbon offsets are proposed and no real monetary consequences are present. Diederich and Goeschl (2017) recruit German participants on an online survey platform to participate in an experiment in which, depending on the treatment, they may be offered the purchase of local (EU-based) or developing country offsets. Inference is this time based on revealed preferences. In the local treatment, participants are reminded that it is in Germany, where they live, that they are generating emissions. In the developing country treatment, participants are informed that the offset projects are certified Gold Standard and will be realised in an environmentally-friendly way while providing benefits to the local population (such as jobs). The demand for these two offset options is compared to a neutrally-framed treatment (the control group), where the location of the abatement is also explicit (the EU), but no attempts to stimulate guilt or affect decisions are made. Diederich and Goeschl (2017) analyse the demand for carbon offsets across treatments and find that location does not matter. If anything, their informational treatments increase overall contributions with respect to the neutral framing. Note, however, that in all treatments, including the neutral framing, participants are informed that the climate is indifferent about where mitigation is carried out (that is, location does not matter).

Our paper also uses experimental methods, inferring from revealed preferences. We contribute to this nascent literature by focusing specifically on the allocation decision that determines how demand for domestic vs. international offsets changes depending on the information provided. Our approach thus exploits a real situation, in which there is a real difference in location and abatement costs between two otherwise similar offsetting projects. In this setting, we analysed the role of informational treatments in conjunction with the real difference in the offset price tag. In short, our experiment went as follows. We gathered about 300 students in the lab and observed how they allocated their endowment between two reforestation projects, one taking place domestically and one abroad. We provided three randomised informational treatments. The treatments mimicked the role of a political campaign trying to foster (or hamper) the political support for generating carbon offsets from reforestation projects implemented in a foreign country, instead of domestically. Two treatments played in favour of carbon offsets generated abroad by (1) emphasising the cost-effectiveness related to international projects and (2) giving guarantees on the reliability of the reforestation programmes. The third treatment stressed the local ancillary benefits from domestic carbon offset projects in terms of biodiversity, recreational activities, protection from natural disasters and local employment. We compared these three treatment groups with a control group, subject to a neutrally-framed treatment.

We found that stressing the cost-effectiveness of the international reforestation programme led to a significant increase in contributions to the latter. That is, some participants seemed to overlook the price differential, absent any specific treatment leveraging it. We did not find any effect for the other treatments. Participants seemed to already factor in the existence of local co-

benefits and seemed not to be questioning the credibility of the selected reforestation programmes.

The remainder of the paper is organised as follows. Section "Methodology" introduces our hypotheses, the experimental design, and the econometric approach. Section "Results" presents our data and results. Section "Conclusion" concludes.

Methodology

Economic background and hypotheses

In this paper, we focus on reforestation programmes. The potential for climate change mitigation of forest projects is considered substantial (Bellassen and Luyssaert, 2014), given the generally low marginal costs of reforestation (van Kooten et al., 2004; Tavoni et al., 2007; Nielsen et al., 2014). In addition, it is estimated that 20% of global greenhouse gas emissions are caused by deforestation, twice as much as transportation (IPCC, 2014). As a result, avoided deforestation and af-/re-forestation programmes may play an important role in climate change mitigation. For instance, Potter et al. (2007) estimate that up to 20% of US emissions could be offset through forests sinks. Forest offsets are encouraged since the Kyoto Protocol within the LULUCF (Land Use, Land Use Change, and Forestry) activities of the Clean Development Mechanism (UNFCCC, 2007) and may also play an important role in the achievement of the recent agreement that the International Civil Aviation Organization reached in October 2016 to limit the growth of carbon emissions in the civil aviation sector. According to this voluntary agreement, from 2020, any increase in airline carbon emissions should be compensated through the purchase of carbon offsets.

The abundance of opportunities for carbon sinks in forests is only one of the reasons for focusing on forest offsets. From an experimental perspective, forests provide two additional benefits. First, forest-based offsets are cognitively easy to understand for participants. Second, while trees and forests may differ across countries in many characteristics, they can still represent the ideal of a homogeneous good in terms of CO_2 sequestration. Indeed, the effect on climate change mitigation of one ton of abated CO_2 is the same irrespective of the abatement location. In our experiment, relatively precise information on the CO_2 sequestration ability of each tree is available for both reforestation programmes in our study.

We are, however, aware of the concerns that have been raised about the limits of forest sinks. Unlike decarbonisation processes, such as the development of renewable energy, forests sinks are affected by the so-called "permanence problem" (Gren and Zeleke, 2016). Indeed, uncertainties regarding climate change, the occurrence of wildfires or future anthropogenic activities, provide no guarantee that all new forests (and thus the stored carbon) will stand in the long run (Galik and Jackson, 2009). Given that carbon sequestration in forests is potentially reversible (Watson et al., 2000), some national policies do not include international afforestation programmes in their eligible offset programmes (e.g. Swiss Federal Council, 2016).

On top of these forest-specific concerns, one may have general reservations regarding the additionality, or ethical foundations, of offset programmes in general (Anderson, 2012; Tirole, 2012; Schneider and Kollmuss, 2015; Carattini and Tavoni, 2016). Practical reservations may be related to the (in)effectiveness of carbon credits. Ethical considerations may be related to the "commodification" of nature, which is an argument often used by environmentalists to oppose the use of market-based solutions to environmental externalities (Baron and Leshner, 2000; Sandel, 2012; Braaten et al., 2015).

In this paper, we analyse the demand for local and international forest offsets despite their potential weaknesses. While our main research question concerns the preference for domestic vs. international carbon offsets, in our experimental setting we also consider the general demand for carbon offsets and take care of potential concerns that our participants may have towards them.

From an economic perspective, purchasing carbon offsets is a real-life decision with a private cost to the individual. Individuals may be willing to voluntarily contribute to a public good such as climate change mitigation if, for instance, they derive some utility from the public good being provided (in case of pure altruism) or if they derive some utility from their contribution, due to warm glow (Andreoni, 1990) or positive self-image (Nyborg et al., 2006). In the case of offsets, individuals may also be willing to engage in the private provision of a public good if this may allow compensating other activities to which they contributed and that might have reduced the overall level of the same public good (Kotchen, 2009). Following the environmental psychology literature, we would expect pro-environmental behaviour to depend positively on the following two arguments. First, the feeling of responsibility to contribute to the environmental public good at stake, the so-called "ascription of responsibility". Second, the perception of the environmental impact that behaving in a pro-environmental way would generate, the so-called "awareness of consequences" (see e.g. Stern et al., 1999).

Concerning the preferences for domestic vs. international carbon offsets, we considered three main drivers. Cost-effectiveness reasons justify international offsetting. However, experimental evidence from markets with externalities suggest that people may overlook efficiency gains, even with salient pay-off structures. This problem is particularly relevant for climate change mitigation. Kallbekken et al. (2011) show how tax aversion can affect Pigouvian taxes, hampering the implementation of instruments that would increase efficiency in the experiment, and allow for pay-off maximisation (cf. also Kallbekken et al., 2010). When it comes to internalising externalities, "half" measures such as subsidies may be preferred to "full" measures such as carbon taxes. That is, also in the lab, where the most cost-effective solution can be relatively easily identified, people may prefer sub-optimal solutions, even though these may imply lower pay-offs (Cherry et al., 2012).

People's ethical and practical reservations to the use of carbon offsets, as described above, may also be influenced by the location of the offset project. We conjecture that these reservations, of practical character in particular, may be stronger in the case of projects undertaken in emerging economies. For instance, Gampfer et al. (2014) find that international climate transfers receive more public support if the donation is made to a trustworthy government. Blasch and Farsi (2014) find that certifications by a trusted government agency or a United Nations body increase the willingness to pay for carbon offsetting. People may also have genuine preferences for local offsets. For instance, people could expect substantial local co-benefits from offsetting, which would increase the propensity to choose a domestic project (Torres et al., 2015).

Hence, we formulate the following hypotheses on the potential effect of each type of informational treatment applied in our experiment:

Efficiency hypothesis: Participants may pay attention to the amount allocated to carbon offsets, but not necessarily to the total quantity of emissions abated. Reminding them the cost differential between domestic and international reforestation programmes increases the amount allocated to foreign programmes and thus the overall abatement of carbon emissions.

Confidence hypothesis: Participants may not find projects abroad trustworthy. Providing guarantees on the trustworthiness of reforestation project providers increases the amount allocated to programmes abroad and thus overall abatement.

Local benefits hypothesis: Given that the main focus of the considered reforestation programmes is on greenhouse gas emissions, participants may neglect their local benefits. Reminding them the benefits of local forests increases the amount allocated to domestic reforestation programmes.

Most of the recent literature has examined the demand for carbon offsets relying on stated preferences, while only a few papers attempted to provide evidence based on revealed preferences by using lab and field experiments.[1] Since stated preferences are subject to several well-known biases (see e.g. Alberini and Kahn, 2006), in this paper, we empirically address the acceptability of international carbon offsets using an experimental approach. Such an approach is arguably the best tool for inferring from revealed preferences, testing the effect of alternative policy designs that are not yet observed in reality, and causally identifying the effect of our treatments on people's preferences (Falk and Heckman, 2009). In addition, the type of behaviour observed in the lab can be very similar to the one undertaken in a similar natural setting, and the behavioural responses of student and non-student participants in lab experiments are often the same (cf. Alm et al., 2015). When it comes to analysing pro-social behaviour, or preferences over policies, one may argue that the likelihood that behaviour in the lab differs from a real-life situation increases. While this can be true, pro-social behaviour in the lab remains strongly correlated with pro-social behaviour in the field (Benz and Meier, 2008). That said, we are aware that each methodological decision involves a trade-off and we devote a section, below, to the external validity of our results, and how it may have implications for policy recommendations.

Experimental design

Following from the previous section, we selected two real reforestation programmes providing the same abatement per tree in both the domestic (developed) and the foreign (developing) country, but with a much lower price in the latter. The programme in the home country was located in Visp, Switzerland, while the programme in the developing country was located in Limay, Nicaragua. In these programmes, a tree in both Switzerland and Nicaragua captured 15 kg of CO_2 per year, while its price was 10 Swiss francs (CHF) in the former and only 3 in the latter country.[2] That is, given the price differential, with the same budget (e.g. with the same fiscal revenues from a carbon tax), emissions abatements could be three times larger in Nicaragua.

We ran the experiment in Geneva, Switzerland, in December 2015, with a sample of more than 300 undergraduate students in business administration (management) in their first or second year, all enrolled in mandatory microeconomics classes at the introductory or intermediate level.[3] The experiment was conducted during class time, to prevent students' self-selection. After entering the class, we briefly presented the experiment and instructed participants as per standard procedure in lab experiments.

The experiment was organised in two stages. A first stage determined participants' endowment, and their voluntary contribution to carbon offset projects. The allocation of this contribution between domestic and international projects was the focus of the second stage.

Table 1
Reforestation programmes.

	Programme 1	Programme 2
Place	Visp, Switzerland	Limay, Nicaragua
CO_2/tree/year	15 kg	15 kg
Cost/tree	CHF 10	CHF 3

In the first stage, participants were randomly provided with 4 very general questions about microeconomics, whose answers determined their monetary endowment, along with a show-up fee of 2 Swiss francs. Each correct answer was rewarded with 2 francs, and so participants had the possibility to earn up to 8 additional francs.

Once the endowment was determined, participants were given the option to donate a share of it to the purchase of carbon offsets through reforestation programmes. At this stage, participants only decided how much money they wanted to spend on the purchase of carbon offsets and how much to keep for themselves, without further information on the specificities of the reforestation programme. Participants were informed about some basic facts of climate change; were introduced to the role of deforestation in increasing the stock of greenhouse gas emissions in the atmosphere; and were made aware of the role of reducing deforestation or increasing afforestation in helping mitigating climate change. All participants had also been informed that a nominal reforestation certificate could have been made available to all purchasers of carbon offsets, if they were willing to declare their identity once completed the experiment. This procedure might have reassured participants that the purchase of carbon offsets was really taking place, besides providing some reputational effects, which in general tend to have a significant positive impact on the contribution to a public good (Milinski et al., 2002).

In the second stage, once the amount dedicated to reforestation had been elicited, participants were asked to split it between the two specific programmes. This decision represented our outcome of interest, as it allowed understanding the preferences of people towards generating carbon offsets through a domestic or an international reforestation programme. Basic information about both reforestation programmes was provided to all participants as done in Table 1.[4]

Furthermore, additional information was randomly provided in the form of the following three treatments. Treatment 1 (T1) stressed the price differential between a tree in Nicaragua and in Switzerland, emphasising that funding the least-cost programme would have resulted in higher emissions abatement, for a fixed contribution. T1 had thus been designed to test the efficiency hypothesis. Treatment 2 (T2) informed participants that both programmes had been guaranteed by reputable and independent institutions: the United Nations Environment Programme for the Nicaraguan project and the local government for the domestic programme. Hence, this treatment had been designed to test the confidence hypothesis. Treatment 3 (T3) introduced the role of local ancillary benefits of reforestation. We recalled to participants the recreational activities that the Swiss population uses to undertake in local forests, the importance of these forests for the local biodiversity, their benefits in terms of wood and non-wood products, as well as their contribution to local jobs and economic growth. T3 had been designed to test the local benefits hypothesis, favouring the domestic reforestation programme. A control group was assigned

[1] Stated preference studies include Brouwer et al. (2008), MacKerron et al. (2009), Carlsson et al. (2012), Blasch and Farsi (2014), Gampfer et al. (2014), Blasch and Ohndorf (2015), and Torres et al. (2015). Ovchinnikova et al. (2009), Löfgren et al. (2012), Diederich and Goeschl (2014, 2017), and Kesternich et al. (2016), are examples of revealed preference studies.

[2] 1CHF ≈ 1USD at the time of the study.

[3] See Appendix B for the full questionnaire (translated from French).

[4] Information on these reforestation programmes is available at https://www.helvetia.com/ch/content/fr/qui-sommes-nous/engagement/foret-protectrice.html (last accessed on November 26th, 2015) and http://www.tree-nation.com/plant (last accessed on November 26th, 2015).

a very neutral messaging. Following the standard procedure, we administered a short debriefing survey to understand students' contributions and collected the usual socio-economic characteristics.

Econometric approach

We analysed separately the data from the two stages of our experiment. The first stage determined participants' contributions to the purchase of carbon offsets. The second stage captured the allocation decision between the domestic and international reforestation programmes. In the empirical analyses, the second stage addressed our main research question. In the first stage, given that our outcome variable, the ratio of contribution to forest programmes over endowment, was continuous and bounded between 0 and 1, we estimated both an ordinary least square (OLS) model and a specific generalised linear model for fractional outcomes (GLM), as recommended by Baum (2008).[5]

In the econometric analysis of the second stage, we tested whether the differences among treatments were statistically significant, conditional on covariates, and assessed the magnitude of the treatment effects. We tested the following specification:

$$Y_i = \alpha + \beta_1 T_1 + \beta_2 T_2 + \beta_3 T_3 + \gamma X_i' + \epsilon_i \quad (1)$$

in which our dependent variable Y is the percentage of participant i's contribution allocated to the reforestation programme implemented abroad, α a constant and β_j the treatment effect for treatments $j = 1, 2, 3$. X_i is a vector of control variables and γ the vector of associated coefficients. Controls take into account the possible heterogeneity across individuals, along with ϵ_i, the heteroskedasticity-robust standard error.[6] Since the dependent variable was bounded between 0 and 1, we also estimated this model with OLS and GLM.

We then checked whether the treatment effects occurred on the intensive or extensive margins. For each treatment, we could have observed the same proportion of participants contributing to the international programme as in the control group, but these could on average have been contributing a different amount (intensive margin). Alternatively, we could have observed a different proportion of participants contributing a positive sum to the international programme, without necessarily providing a different contribution, on average, than the control group (extensive margin).

To isolate the role of the extensive margin, we assessed, with OLS and logit models, the effect of the treatments on the proportion of individuals contributing a strictly positive amount to the international programme. We provided a further robustness test exploiting a two-part model "à la Cragg", which is appropriate for limited dependent variables and integrates both first stage and second stage decisions into a single two-parts model. Following Cragg (1971), we considered that the decisions to contribute and the level of this contribution might have been two different but simultaneous decisions, potentially driven by different factors. The first part of the model thus explained the probability to contribute to forest carbon offsetting with a probit model, and the second part explained the level of this contribution, conditional on strictly positive contributions.[7]

Table 2
Descriptive statistics.

Variable	Contributors	Non-contributors
Endowment	7.15	7.34
	(1.90)	(1.93)
Contribution	5.81	0
	(2.59)	(0)
Contribution (% of initial endowment)	0.83	0
	(0.30)	(0)
Observations	261	46

Standard deviations in parentheses.

Results

Descriptive statistics and first stage

Table 2 provides information on the first stage for the full sample. Descriptive statistics of the explanatory variables are available in Table A.1 in Appendix A. On average, participants contributed to climate change mitigation with about 6 francs each, i.e. about 80% of the average endowment of about 7 francs. Yet, 15% of them were not willing to contribute to reforestation at all.

In this stage, we analysed the propensity to contribute to a generic reforestation programme generating carbon offsets, relative to the initial endowment, and its determinants. To measure ascription of responsibility, we used two variables. The first variable was the standard measure of climate concern from the Gallup survey (cf. Lee et al., 2015) and the World Value Survey (WVS). Individuals were asked to answer on a 5 Likert scale from "I do not agree at all" to "I totally agree" to the following statement: "I consider that climate warming is a serious threat for the future". We transformed this variable into a binary measure (called *climate concern*) taking the value 1 if an individual "pretty much agrees" or "totally agrees", and 0 otherwise. As shown by the descriptive statistics in Table A.1 in Appendix A, the variable for climate concern scored particularly high, with 86% of the sample declaring to be concerned by climate change. For comparison, in the 2007 wave of the World Values Survey, climate concern in Switzerland was about 89%. The second variable was a dummy taking value 1 if participants felt morally obliged to contribute to climate change mitigation (we call it *moral obligation*). This variable resulted from the "pretty much agree" and "totally agree" answers to the following statement: "I feel morally obliged to protect the climate." Compared to climate concern, a relatively lower proportion (67%) stated to feel morally obliged to contribute to climate change mitigation.

To measure awareness of consequences, we used a variable capturing the belief that even small contributions to climate change can be important, such as the ones under examination in this study. This question was worded as follows: "How do you agree to the following statement? 'In my opinion, even small contributions are

[5] A tobit model could also be a potential candidate for a non-linear fit of our data. We thus followed Papke and Wooldridge (1993) and applied a specification link test to select the most appropriate model between the fractional logit GLM, and a tobit model. The specification test rejected the null hypothesis of good link specification for the tobit model (p-$value < 0.001$), whereas it did not for the fractional logit GLM (p-$value > 0.99$). Based on the test outcome, we selected GLM as our preferred non-linear specification. All additional estimations are available by the authors upon request.

[6] Due to the randomised allocation of the treatments, the inclusion of control variables did not affect the coefficients of the observed treatment effects, but it did increase the model's precision. Descriptive statistics for these variables are available in Table A.2 in Appendix A. The number of observations only slightly decreased when introducing control variables. The use of heteroskedasticity-robust standard errors was justified by standard heteroskedasticity tests such as modified Wald and Breusch-Pagan/Cook-Weisberg tests.

[7] The Cragg model is intuitively similar to the Heckman two-stage model. However, our data did not suffer from a selection issue, as in Heckman (1977). In our experiment we, indeed, did not face missing data, but a "corner at 0" issue (see Wooldridge, 2010, chapter 16). That is, zeros were not present because of non-observable responses but were rather the result of an optimal choice made by the respondent. The Cragg model allows for two separate simultaneous decisions but does not correct for selection. It was thus the most appropriate approach for our context. It also allowed to have the same covariates in both parts of the model without the risk of collinearity (Madden, 2008).

useful to protect the climate' ". 85% of the sample considered that even small contributions can be important.

We note that considering a public good as important is a necessary, but not sufficient, condition for its voluntary provision (Nyborg et al., 2006). That is, people cannot contribute to the provision of all public goods that they deem important. Whether an individual is willing to contribute to a given good also depends on the descriptive norm concerning the provision of such good, i.e. what others do. Much evidence has been provided on conditional cooperation in local environments (cf. Fehr and Fischbacher, 2003). However, conditional cooperation in the climate commons may appear less likely. Yet, according to Ostrom (2009), managing global dilemmas requires as much trust as managing local dilemmas does. Ostrom's claim relies on the observed existence of reciprocity and trust at the local level, which may benefit the provision of any social good, regardless of its local or global characteristics. Supporting Ostrom's intuition, Carattini et al. (2015) find for instance a negative correlation between trust and greenhouse gas emissions among European countries. Ostrom's element of trust reconciles with the model of Nyborg et al. (2006): since the descriptive norm is not always salient, individuals may form expectations on other people's contributions (see also Carattini et al., 2017b). This case applied to our experiment since communication was strictly forbidden between players. Hence, to estimate the effect of expected cooperation, we used a measure of participants' belief of others' contribution. This variable was based on the answers to the following question: "In your opinion, what share of their endowment other participants on average contributed to the reforestation programme?".

We also added to the model a few variables that were related to the specificity of the public good under scrutiny. Since no details on the location of the reforestation programmes were provided at this stage, it is plausible that some individuals, especially those who were used to visit local forests, might have been more likely to contribute than others. Frequent usage is indeed a common determinant of contribution to the provision of ecosystem services in general (Czajkowski et al., 2014). We thus asked how often the participant used to visit forests, in general, and added to the model a dummy variable to account for regular or frequent visits.

Since no guarantee on the quality of the project was given at the first stage, we captured possible practical reservations to the use of forest carbon offsets. Our variable measured the degree of agreement with the following statement: "Reforestation is effective in reducing the stock of CO_2 in the atmosphere in the long run". To capture general ethical considerations related to the commodification of nature, we exploited answers to the following statement: "I do not want to consider natural resources as a marketed commodity."

Table 3 presents our estimates. Columns (1) and (2) show our coefficients for OLS and the average marginal effect of a fractional logit GLM, respectively. Since all estimates were statistically the same in both OLS and GLM models, and to allow for straightforward interpretation, we comment in what follows the estimated effects based on OLS.

All the coefficients had the expected sign, except the one associated with green membership, but the latter was not statistically significant. Our results suggests that the demand for carbon offsets generated by reforestation programmes is dominated, statistically speaking, by attitudinal variables, in particular, the belief that small contributions do help to make a difference, as well as the belief about others' contributions. Results about the belief of others' contributions match the recent evidence of Blasch and Farsi (2014), Blasch and Ohndorf (2015) and Schwirplies and Ziegler (2016). All these studies indeed find a positive effect on the demand for carbon offsets for variables very similar to our measure of beliefs about others' behaviour, namely, and respectively, "expected cooperation", "expected share of offset customers in society" and "expectation of society". Along with related literature showing similar patterns for other climate-friendly behaviours, this evidence can be used to support the existence of conditional cooperation in the climate commons (Carattini et al., 2017b).

Table 3
Average marginal effects on contributions.

	(1) OLS	(2) GLM
Climate concern	0.039	0.016
	(0.08)	(0.07)
Small contributions are important	0.13*	0.11*
	(0.07)	(0.06)
Green member	−0.001	−0.008
	(0.05)	(0.06)
Moral obligation	0.0099	0.016
	(0.05)	(0.04)
Belief about others' contribution	0.71***	0.68***
	(0.06)	(0.05)
Frequent forest user	0.071	0.070
	(0.05)	(0.05)
Practical reservations w.r.t. reforestation	−0.069	−0.055
	(0.05)	(0.04)
Ethical reservations w.r.t. the commodification of nature	−0.024	−0.016
	(0.04)	(0.04)
Observations	299	299
Adjusted-R^2	0.347	

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Not surprisingly for a lab experiment, even for those with a relatively large sample, none of the other covariates reached the standard threshold for statistical significance, despite the expected sign. We note in particular that the frequent use of forests, or having practical reservations related to forest offsets, had no significant impact on the average contribution to reforestation programmes.

In the questionnaire, we also asked for participants' income. Given the non-negligible decline in observations that the inclusion of the income variable implied, we did not consider income differences in our model. Yet, we note that running additional estimations with such variable did not statistically affect the estimates of Table 3, while the coefficient for the income variable was found to be statistically insignificant. This result was unsurprising in our context, also because the private demand for environmental quality was likely to be only partially expressed, due to the (global) public good characteristics of climate change mitigation (cf. Roca, 2003).

Second stage

The second stage included only participants providing a strictly positive monetary contribution to the generic reforestation programme. We examined the decision to allocate such contribution between the domestic and the international reforestation programme. Participants were randomly allocated to one of the three treatments or the control group, which resulted in 59–70 observations for each treatment. We created our variable of interest as a ratio, with the participant's contribution to the reforestation programme abroad as numerator, and her total contribution as denominator. We expected this ratio to be affected by the informational treatments as discussed in Section "Economic background and hypotheses". Table 4 shows some statistics for our dependent variable for each treatment group. Interestingly, 86% of all contributors who faced the neutral treatment accepted to contribute a positive amount to the international programme, with the average contribution at 63%. This suggests that participants to the experiment might not have opposed the principle of having emissions

Table 4
Allocation of the monetary contributions to the programme abroad, per treatment.

	T0	T1	T2	T3
Mean contribution to the international programme (% of total contribution)	0.63	0.73	0.64	0.59
	(0.35)	(0.36)	(0.34)	(0.33)
Frequency of contributions to the international programme > 0	0.86	0.88	0.87	0.86
	(0.35)	(0.33)	(0.34)	(0.35)
Observations	59	66	70	66

Standard deviations in parentheses.

Table 5
Average treatment effects.

	(1) OLS	(2) GLM
Efficiency treatment (T1)	0.11*	0.12*
	(0.06)	(0.06)
Confidence treatment (T2)	0.026	0.025
	(0.06)	(0.06)
Local benefits treatment (T3)	−0.025	−0.024
	(0.06)	(0.05)
Covariates	Yes	Yes
Observations	256	256
Adjusted R^2	0.15	
AIC	148.5	1.08

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

abatements taking place abroad. For comparison, Diederich and Goeschl (2017) find that when the cost of abating at home or abroad is (artificially) the same, people seem to have no preference for either one or the other location. Hence, a large proportion of our participants seemed to pay some attention to the price differential, even though they might have not fully internalised its implications for cost-effectiveness. A substantial part of the sample might have however been overlooking this differential, unless they had specific preferences or concerns in favour of one project or another. As expected, we observed some variation across treatments. In particular, contributions to the international reforestation programme were the highest with the efficiency treatment, and the lowest with the local benefits treatment.

As shown by Table 5, the estimates for the variables of interest were robust across OLS and GLM specifications. In what follows, we thus again interpret the results based on the OLS estimates.[8]

Compared to the control group, the reference in the regressions, we found that all treatments have the expected sign. The informational treatment that reminded the importance of efficiency reasons (T1) and the treatment that provided guarantees on the quality of the offset programmes (T2) had both a positive impact on the relative allocation to the reforestation programme in Nicaragua. Likewise, the local benefits treatment (T3) increased the likelihood of funding the domestic programme. However, only the efficiency treatment had a statistically significant impact. This result suggested that participants tended to not completely factor in the efficiency argument supporting the use of international carbon offsets. Our causal estimate suggested that the efficiency treatment led to a 11 percentage point increase in the contribution to the programme generating carbon offsets abroad, compared to the neutral framing of the control group.

The statistical insignificance of T2 suggested that a potential lack of credibility of the international programme was not a major concern for the individuals in the sample. Debriefing questions reported that only 12% of participants did not trust the Nicaraguan government for the implementation of the international reforestation programme, while no participant stated distrust in the Swiss government. Furthermore, we note that trust in the Nicaraguan government for the sub-sample having experienced T2 was not statistically different than the reported average for the whole sample, supporting this explanation. Other reasons could contribute to this result. It could be that the scepticism towards carbon offsets affected domestic and international reforestation programmes in the same way.

In the same spirit, we found that participants accounted already to a large extent for the potential benefits derived by the local programme, including how it might have supported the local biodiversity, which explained the limited effectiveness of T3 in boosting contributions to the local programme. It is worth noting that, in recent times, Swiss forests have been growing in both standing wood volume and surface and that their health is generally considered as good. The expectation of local co-benefits might thus have been limited in our context. In addition, in Switzerland, the forestry sector contributes to only 0.1% of total employment and 0.06% of GDP (Federal Statistical Office, 2017).

Our results showed that the efficiency treatment increased the average contribution to the international reforestation programme relative to the domestic reforestation programme. This increased contribution could take two forms. In the efficiency treatment, we could have either observed the same proportion of participants contributing to the international programme as in the control group, but these would have been on average be contributing more. On the other hand, we could have observed a higher proportion of participants contributing a positive sum to the international programme, without necessarily having a different average contribution. That is, the change in behaviour could have taken place both on the intensive and extensive margins, respectively. To isolate the effect of the extensive margin, we looked at the treatment effects on the proportion of individuals contributing a positive amount to the international programme. In the same spirit, we also looked at heterogeneous treatment effects to determine whether responses to this treatment varied based on some of the participants' characteristics.

Intensive vs. extensive margin

Descriptive statistics in Table 4 show that the proportion of strictly positive contributions to the international programme did not differ significantly across treatments. This is confirmed by the

[8] The estimates for the control variables are displayed in Table A.3 in Appendix A. All coefficients had the expected sign, but most variables were not statistically significant. Declaring to be a frequent visitor of forests did not significantly affect the contribution to the local programme, nor did having previous experience with the domestic forest mentioned in the experiment. General ethical reservations such as being unwilling to consider natural resources as a marketed commodity, as well as other ethical concerns related to international offsets, such as opposition to carbon markets or concerns on the fairness of offsetting domestic emissions abroad, did not reach statistical significance either. Given the relatively low number of observations and low variability of these variables, these results were not particularly surprising. Related to the previous discussion on conditional cooperation in the climate commons, we found that expectations about others' behaviour also shaped the allocation decision. Finally, a variable taking value 1 for second-year students was associated to higher contributions to the international reforestation programme. This result seemed consistent with Braaten et al. (2015), who maintain that students in economics are typically trained to focus on outcomes, i.e. on efficiency. A relatively large strand of literature on the behaviour of economists tends to confirm this result. The main reference is, arguably, Marwell and Ames (1981), who find with lab experiments that graduate students in economics are more likely to respond to economic incentives than other subpopulations, in particular by free riding in the provision of public goods. Other notable studies on economists include Frey and Meier (2003) and O'Roark and Wood (2011).

Table 6
Average treatment effects on the probability to contribute to the programme abroad (extensive margin).

	(1) OLS	(2) Logit
Efficiency treatment (T1)	0.030	0.022
	(0.058)	(0.058)
Confidence treatment (T2)	0.039	0.032
	(0.059)	(0.056)
Local benefits treatment (T3)	0.018	0.0048
	(0.060)	(0.055)
Covariates	Yes	Yes
Observations	256	256

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

OLS and logit models presented in Table 6, showing that the effect of the treatments on this outcome variable was not statistically significant.[9]

As presented in Table A.5 in Appendix A, the Cragg model provided very similar results to those in Tables 5 and 6. That is, it showed that T1 was not effective on the extensive margin, but it was on the intensive margin, and so increased average contributions to the international programme by about 11 percentage points.

Hence, while T1 had a positive impact on the average contribution to the international programme, this treatment did not affect the proportion of individuals contributing a positive amount to this programme, i.e. the extensive margin. That is, participants that were already predisposed to contribute to the programme abroad were likely to increase their contribution, whereas the remaining participants were likely to be unaffected. Hence, in presence of strong preferences for the local programme, the efficiency treatment may not be effective.

Heterogeneous effects

To disentangle the heterogeneous effects of our most effective treatment (T1) on different subgroups of the sample, we tested several extensions of Eq. (1), adding interaction terms. We expected some sub-samples to be particularly affected by the efficiency treatment. We tested the interaction between the efficiency treatment and the following dummy variables: *offsetting abroad is acceptable*; *ethical reservations with respect to the commodification of nature*; and *economic growth, rather than environmental protection, is the priority*. Similarly to the main model in the second stage, we estimated the coefficients with OLS. All the results were statistically the same if estimated with GLM.

Column (1) shows the heterogeneous effect of T1 on individuals who think that it is morally acceptable to compensate CO_2 emissions abroad. Not surprisingly, as presented in Table 7, only those considering carbon offsets generated abroad as acceptable reacted to the informational treatment, whereas those expressing ethical concerns were more likely to remain on their positions. This supported the evidence provided on the treatment effect on the extensive margin. Relatedly, column (2) shows that only the participants that did not have ethical reservations related to the commodification of nature were affected by the efficiency treatment. Finally, we looked at whether "green" individuals were more or less responsive to the efficiency treatment than the rest of the sample. We used as proxy for greenness the WVS question "Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent". Interestingly, we found that, on average, "green" participants tended to react more than the average individual to the efficiency treatment. This suggested that, absent any external intervention, people caring for the environment might have been reticent to contribute in "large" proportions to the international programme, but stressing the higher environmental impacts achieved abroad with the same amount of money might have been effective in spurring participation to the international reforestation programme.

Discussion

We found that informational treatments emphasising the cost-effectiveness of international offset programs could increase the demand for the latter. Our lab experiment suggested that there were information asymmetries, between our participants and economists, on the benefits of international abatements. In our context, an informational treatment was sufficient to address part of these asymmetries. We consider that our findings can have important implications for policy makers, with a caveat, related to their external validity. In what follows, we first discuss the policy implications, and then address the caveat.

Following the recent scandals related to Joint Implementation projects, most attention has been given to re-establishing the credibility of international offset programmes. Efforts in this direction are welcome, but our results seem to imply that credibility may not be the main concern for the general public. While for economists it is obvious that efficiency reasons would play in favour of abating emissions where it is cheapest, assuming that this is obvious also for lay people may be misleading. Information should thus be provided to make people understand why it is so important to undertake emissions abatements in developing countries. Other valid arguments oppose the use of international carbon abatements, but our results suggest that stressing the importance of providing a higher environmental benefit could lead an important share of contributions to switch from the local to the international programme. Even though our paper differs in perspective and results, we join Diederich and Goeschl (2017, p. 17) in their conclusion: "locational preferences need not stand in the way of realising the gains from comparative advantage in climate change mitigation". Our policy implications may also extend to linked carbon markets, an option that is currently receiving serious consideration in many jurisdictions having implemented emissions trading schemes. Besides the issue of reliability, linking carbon markets between developed and emerging countries would also require sufficient political support in the former, backing the purchase of carbon allowances from low- and middle-income countries. Therefore, reducing opposition to abatements taking place abroad may be highly beneficial for the prospect of future climate policy.

These policy implications depend on whether our findings can be applied to a broader context. Proving the external validity of our results is beyond the scope of this experimental investigation, hence the caveat. While the evidence covered the background section supports the external validity of lab experiments, one can always argue that preferences for policy are context-specific. To put our results into perspective, we refer to the growing literature on public support for environmental policies, to which our paper is closely related. This literature has provided a set of recurrent findings, regardless of whether the methods used consisted in experimental approaches with students (e.g. Cherry et al., 2012, 2014; Kallbekken et al., 2011), qualitative surveys and focus groups (e.g. Dresner et al., 2006; Kallbekken and Aasen, 2010), quantitative surveys and choice experiments (e.g. Bristow et al., 2010; Sælen and Kallbekken, 2011; Baranzini and Carattini, 2017), survey panels in a quasi-experimental setting (Schuitema et al., 2010; Carattini et al., 2016), or surveys combined with the observation of real ballots (Thalmann, 2004; Carattini et al., 2017a). All these studies provide

[9] Results including covariates are presented in Table A.4 in Appendix A. Estimates from a probit model would lead to the same conclusion.

Table 7
Heterogeneous treatment effects.

	(1) Offsetting abroad is acceptable	(2) Ethical reservations w.r.t. commodification of nature	(3) Economic growth is the priority (vs. the environment)
T1 × Offset abroad	0.16*		
	(0.08)		
T1 × NO offset abroad	0.096		
	(0.07)		
T1 × Ethical reservations		0.068	
		(0.08)	
T1 × NO ethical reservations		0.15**	
		(0.08)	
T1 × Economy the priority			0.055
			(0.13)
T1 × Economy NOT the priority			0.12*
			(0.06)
Confidence treatment	0.024	0.023	0.025
	(0.06)	(0.06)	(0.06)
Local benefits treatment	−0.022	−0.023	−0.022
	(0.06)	(0.06)	(0.06)
Constant	0.44***	0.422***	0.44***
	(0.09)	(0.09)	(0.09)
Covariates	Yes	Yes	Yes
Observations	256	256	256
R^2	0.19	0.19	0.19
Adjusted-R^2	0.15	0.15	0.15

Heteroskedasticity-robust standard errors in parentheses. T1 represents the efficiency treatment. In all specifications we controlled for beliefs about others' contribution and frequent forest users, experience with the domestic site, acceptability of offsets abroad, ethical reservations against the commodification of nature, climate concern, green membership and economic growth as the priority (vs. the environment).

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

evidence of a gap between people's perceptions and economists' prescriptions, which contributes to explain an important part of the resistance to cost-effective environmental policies, such as carbon taxes.

This gap is very similar to that observed in our lab experiment. Hence, one could extrapolate to our context and support the external validity of our results. Furthermore, given that the participants in our study have some knowledge of economics, our experimental results are likely to provide lower-bound estimates. That is, if anything, asymmetries of information are likely to be larger with a fully representative sample. In our opinion, however, the main contribution of our paper relies on its novelty, rather than on its generalisability. We provide original findings and put forward a set of potential policy implications, whose relevance for other contexts may be investigated in future studies. Our paper, along with the concurrent studies by Anderson and Bernauer (2016) and Diederich and Goeschl (2017), represents indeed an initial investigation into a new research area on people's preferences for local and international abatements.

Several avenues for future research follow from our paper. While we consider reforestation programmes, the same research question applies also to other offset programmes, for which the difference in cost-effectiveness between programmes in developed and developing countries may be even larger. In addition, future research may include more than two countries, with varying costs and institutional features. Methodologically speaking, such analyses may not only be possible in the lab. Choice experiments, for instance, would be particularly suited to analyse the demand for carbon offsets, including location as one of many attributes and split designs to allow for randomised treatments. Researchers could also partner with companies offering carbon offsets, as in Kesternich et al. (2016), and analyse this question directly in the field. The larger and more representative the sample, with choice-experiment surveys or field experiments, the stronger the external validity. Qualitative studies could also offer a complementary perspective to this emerging literature, providing valuable information on how people's backgrounds and knowledge about efficiency and international carbon offsets may affect their preferences. Qualitative studies could also involve policy-makers, to understand the political economy of climate policies that restrict the use of international carbon offsets. Finally, further research could also extend the analysis to the role of local pollution. The more international carbon offsets can be used, the lower the benefits of climate policy in terms of local air pollution and health. Especially in the presence of carbon trading schemes, and potential hot spots (cf. Fowlie et al., 2012), each additional unit of abatement that takes place abroad can have negative implications for the local population because of the co-generation of local and global pollutants.

Conclusion

Turning the Paris Agreement's Nationally Determined Contributions into operational policies is the next challenge for policy makers. However, many political obstacles hamper the realisation of pledges in a cost-effective way. One of these is public resistance to the use of carbon credits and carbon offsets associated with greenhouse gas abatements in foreign countries. We addressed this issue in an experimental framework, in which participants were requested to allocate funding between a domestic and an international reforestation programme, the latter taking place in a developing country, where reforestation is cheaper.

We applied several informational treatments and found that the allocation decision was responsive to the provision of information on the cost-effectiveness of the reforestation programme implemented abroad. On the contrary, the decision was not particularly responsive to guarantees addressing a potential lack of credibility of the reforestation programme in the developing country and to information on the local benefits associated with the domestic programme. Our results suggest that stressing the potential for higher abatements in foreign countries is effective in changing par-

ticipants' priors in favour of international carbon offsets. Hence, individuals may be willing to increase their support for the use of international carbon offsets and related carbon markets, provided that they are in position to appreciate their environmental benefits.

Our novel findings contribute to the literature on the acceptability of climate policy instruments and on the emerging literature on carbon offsets. They suggest that some of the potential resistance to the use of carbon credits and carbon offsets generated in foreign countries may be, to some extent, spurious. Effective communication from policy makers could then address, and partly overcome, as in our experiment, such resistance. As policy-makers take their time to implement the required policies, the level of stringency requested to meet the climate targets increases. International carbon offsets could represent an important solution to ensure that the current pledges are met, thus supporting the Paris Agreement's ratchet mechanism, and the durability of the whole agreement.

Appendix A.

Table A.1
Descriptive statistics (1st stage).

Variable	Mean	Std. Dev.	Min.	Max.	*N*
Endowment CHF	7.2	1.87	2	10	299
Contribution > 0 0/1	0.86	0.35	0	1	299
Contribution (% of initial endowment)	0.70	0.4	0	1	299
Climate concern 0/1	0.86	0.34	0	1	299
Small contributions are important 0/1	0.85	0.36	0	1	299
Green member 0/1	0.09	0.29	0	1	299
Moral obligation 0/1	0.67	0.47	0	1	299
Belief about others' contribution (% of initial endowment)	0.53	0.30	0	1	299
Frequent forest user 0/1	0.19	0.39	0	1	299
Practical reservations w.r.t. reforestation 0/1	0.27	0.45	0	1	299
Ethical reservations w.r.t. the commodification of nature 0/1	0.48	0.5	0	1	299

Table A.2
Descriptive statistics (2nd stage).

Variable	Mean	Std. Dev.	Min.	Max.	*N*
Belief about others' contribution abroad 0/1	0.70	0.46	0	1	256
Second-year student 0/1	0.43	0.520	0	1	256
Frequent forest user 0/1	0.19	0.39	0	1	256
Experience with domestic site 0/1	0.35	0.48	0	1	256
Offsetting abroad is acceptable 0/1	0.29	0.45	0	1	256
Ethical reservations w.r.t. the commodification of nature 0/1	0.49	0.50	0	1	256
Carbon markets are acceptable 0/1	0.21	0.41	0	1	256
Green member 0/1	0.10	0.30	0	1	256
Economy the priority 0/1	0.11	0.31	0	1	256

Table A.3
Average treatment effects

	(1) OLS	(2) GLM
Efficiency treatment (T1)	0.11*	0.12*
	(0.06)	(0.06)
Confidence treatment (T2)	0.026	0.025
	(0.06)	(0.06)
Local benefits treatment (T3)	−0.025	−0.024
	(0.06)	(0.05)
Belief about others' contribution abroad	0.26***	0.24***
	(0.05)	(0.04)
Second-year student	0.068*	0.067*
	(0.04)	(0.04)
Frequent forest user	0.033	0.034
	(0.06)	(0.06)
Experience with domestic site	−0.043	−0.043
	(0.04)	(0.04)
Offsetting abroad is acceptable	0.019	0.023
	(0.04)	(0.04)
Ethical reservations w.r.t. to the commodification of nature	−0.031	−0.032
	(0.04)	(0.04)
Carbon markets are acceptable	0.0083	−0.0069
	(0.05)	(0.05)
Green member	0.10	0.11
	(0.06)	(0.07)
Observations	256	256
Adjusted R^2	0.15	

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table A.4
Average treatment effects on the probability to contribute (extensive margin).

	(1) Logit	(2) OLS
Efficiency treatment	0.022	0.030
	(0.058)	(0.058)
Confidence treatment	0.032	0.039
	(0.056)	(0.059)
Local benefits treatment	0.0048	0.018
	(0.055)	(0.060)
Belief about others' contribution abroad	0.19***	0.22***
	(0.029)	(0.054)
Second-year student	0.029	0.025
	(0.039)	(0.041)
Frequent forest user	0.042	0.040
	(0.059)	(0.048)
Experience with domestic site	−0.024	−0.022
	(0.040)	(0.042)
Offsetting abroad is acceptable	0.068	0.056
	(0.051)	(0.042)
Ethical reservations w.r.t. to the commodification of nature	0.013	0.010
	(0.039)	(0.040)
Carbon markets are acceptable	−0.040	−0.030
	(0.049)	(0.051)
Green member	0.13	0.081
	(0.11)	(0.051)
Covariates	Yes	Yes
Observations	256	256

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Table A.5
Average marginal effects from Cragg model: second stage.

Contributions to the international programme > 0 (0/1)	
Efficiency treatment (T1)	0.021
	(0.056)
Confidence treatment (T2)	0.029
	(0.054)
Local benefits treatment (T3)	0.0038
	(0.054)

Table A.5 (*Continued*)

Belief about others' contribution abroad	0.18***
	(0.037)
Second-year student	0.033
	(0.039)
Frequent forest user	0.030
	(0.054)
Experience with domestic site	−0.026
	(0.039)
Offsetting abroad is acceptable	0.052
	(0.046)
Ethical reservations w.r.t commodification of nature	0.013
	(0.038)
Carbon markets are acceptable	−0.021
	(0.048)
Green member	0.092
	(0.088)
Contribution to the international programme (% of total contribution)	
Efficiency treatment (T1)	0.11**
	(0.046)
Confidence treatment (T2)	−0.0050
	(0.047)
Local benefits treatment (T3)	−0.044
	(0.047)
Belief about others' contribution abroad	0.13***
	(0.040)
Second-year student	0.059*
	(0.032)
Frequent forest user	0.0070
	(0.047)
Experience with domestic site	−0.027
	(0.037)
Offsetting abroad is acceptable	−0.018
	(0.034)
Ethical reservations w.r.t commodification of nature	−0.046
	(0.033)
Carbon markets are acceptable	0.024
	(0.041)
Green member	0.052
	(0.051)
Observations	256

Heteroskedasticity-robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.jfe.2018.02.004.

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