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COGNOME | d'Adda |

NOME | Giovanna |

Matricola di iscrizione al Dottorato | 1194786 |

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## **Fostering Collective Action: Three Artefactual Field Experiments on Local Public Good Provision**

Giovanna d'Adda 1194786

Bocconi University Milan

Thesis Committee:

Eliana La Ferrara, Department of Economics, Bocconi University, Milan

Roberto Weber, Department of Economics, University of Zurich, Zurich

Juan Camilo Cardenas, Department of Economics, Universidad de Los Andes, Bogotá

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Papà, this is for you.

## Preface

This dissertation consists of three essays in the field of development and experimental economics. Each of the papers makes use of laboratory experiments conducted in the field to answer different research questions related to the provision of local public goods. In particular, this dissertation focuses on a particular type of public good, i.e. environmental conservation. The first paper investigates factors affecting individual valuation of environmental conservation. The second paper explores how the introduction of incentives to conserve natural resources influences individual valuation of the environment. The third paper evaluates the role of formal leaders in shaping community members' valuations of environmental conservation.

Public good provision is a crucial element for the functioning of every social group. Social dilemmas, i.e. situations in which individuals who would benefit from the provision of the public good find it costly to contribute and would prefer to free-ride on others' contributions, are common in this context and often lead to the under-provision of public goods and services. Solutions to social dilemmas relying on governmental interventions and privatization are often unfeasible, especially in developing countries, as they require prohibitive amounts of resources and institutional capacity. In these settings, understanding the motivations of public goods users and the potential of informal institutions to help groups overcome social dilemmas is crucial for the design of interventions to promote efficient and sustainable provision of these goods.

Environmental conservation of particular interest as social dilemma, because users have no perfect knowledge of the consequences of their resource extraction choices on natural resources' rates of depletion, and this uncertainty reinforces individuals' tendency to over-exploit them. Moreover, research on how to foster conservation of common property resources can have a large impact on development and poverty reduction, as the poor rely heavily on this type of public goods - such as fresh water, pastures and forests - for their livelihoods and are severely exposed to environmental shocks. Women and children are most vulnerable to under-provision of these resources, the consequences of which they bear in terms of food security and time allocation between resource collection and productive activities.



The choice of methodology made in all chapters of this dissertation reflects a belief in the value added by experimental research conducted in a field setting. First, experiments allow the analysis of individual behavior within controlled decision environments, where participants' actions have actual economic consequences and the effect of specific incentives can be isolated. Second, when conducted in the field, experiments can access subjects who face in the real world social dilemmas similar to those reproduced by the experiment. Subjects bring a context from their daily lives into experiments, and the ability to explore the influence of contextual variables on individual behavior adds to the policy relevance of laboratory experiments conducted in the field.

The first chapter, titled “Leadership and Influence: Evidence from an Artefactual Field Experiment on Local Public Good Provision”, presents the findings from a study that I conducted in Colombia in August 2010. This paper investigates the effect of leadership on the level and evolution of pro-social behavior using a laboratory field experiment on local public good provision. Participants decide how much to contribute to an actual conservation project. They can then revise their donations after being randomly matched in pairs on the basis of their authority and having observed each other's contributions. Authority is measured through a social ranking exercise identifying formal and moral leaders within the community. I find that giving by a pair is higher and shows a lower tendency to decrease over time when a leader is part of a pair. This is because higher-ranked pair members in general and leaders in particular, donate more and are less likely to revise contributions downwards after giving more than their counterparts. Leadership effects are stronger when moral authority is made salient within the experiment, in line with the ethical nature of the decision under study. These findings highlight the importance of identifying different forms of leadership and targeting the relevant leaders in projects aimed at local public good provision. This essay is also my job market paper.

The second chapter is titled “Social Norms and Motivation Crowding in Environmental Conservation: Evidence from an Artefactual Field Experiment” and reports findings from an experiment that I conducted in Bolivia in 2009. This paper examines how motivation, crowding and social image affect environmental conservation decisions. A laboratory field experiment is used to reproduce the trade-off between individual and social benefits in natural resource use and test the effect of non-monetary and non-regulatory

incentives on pro-social behavior for environmental conservation. The results show the presence of a social norm prescribing positive contribution towards environmental protection, and that external incentives have heterogeneous effects on pro-social behavior depending on how they influence reputation and self-image. The experimental results differ from those of analogous experiments conducted in the laboratory, and are instead consistent with those from field experiments on common-pool resource management. This fact suggests caution in generalizing conclusions, reached in the laboratory, to different settings and populations and highlights the role that experimental research conducted in the field can play in the policy debate. This paper was published in *Ecological Economics* in 2011 (No.70, pp. 2083–2097).

The third chapter of this dissertation, titled “Determinants of Conservation Among the Rural Poor: A Charitable Contributions Experiment” is joint work with Deanna Karapetyan and presents the results from a laboratory field experiment that we conducted in Sierra Leone in June 2010. The paper examines factors affecting conservation decisions. Our outcomes of interest are donations to an environmental NGO and participation in actual conservation activities, which capture, respectively, experimental and real world measures of individual valuation of environmental conservation. We consider the influence on these choices of environmental degradation and individual social preferences. Environmental degradation is measured both using subjective survey experience of deforestation and environmental shocks, and through objective indices of deforestation constructed with GIS data. We find that being exposed to environmental degradation is correlated both with higher donations and conservation behavior. Individual social preferences, such as altruism, inequality aversion, trust, time preferences and civic engagement, also significantly affect conservation choices. However, we show that experimental and survey-based measures of social preferences are significantly correlated only with donation within the experiment and actual conservation choices, respectively. These findings show the role of environmental awareness in fostering environmental conservation even in very poor settings. They also highlight the importance of designing experiments that closely mirror real-world decisions, if we wish to derive from them conclusions generalizable to individual behavior outside of the laboratory.

The essays make relevant contributions to the literature on social preferences, pro-social behavior and collective action. The first chapter contributes to the growing literature on leadership and collective action. It complements laboratory evidence, by showing that leading-by-example is more effective if the actions of existing leaders are observed, that these benefits make cooperation more stable over time, and that leaders' effectiveness depends on how salient leaders' characteristics are to the choice under consideration. The second chapter speaks primarily to the literature on motivation crowding, which finds that monetary and regulatory incentives crowd-in or out agents' motivation to act pro-socially depending on their initial valuation of the altruistic choice. In the paper, I find that similar results obtain also when non-monetary and non-regulatory incentives are introduced. The third chapter contributes to the literature on social preferences and pro-social behavior, and to the methodological literature on laboratory field experiments. Through a novel combination of experimental, survey and GIS data, the paper shows that being exposed to environmental degradation increases individual valuation of the environment. From a methodological point of view, the paper demonstrates that, if experimental results are to predict behavior outside the laboratory, experiments conducted in the field need to closely reflect participants' choices in the real world.

## **Chapter II. Leadership and Influence: Evidence from an Artefactual Field Experiment on Local Public Good Provision**

### **1. Introduction**

Public good provision is a crucial element for the functioning of every social group. Social dilemmas, i.e. situations in which individuals who would benefit from the provision of the public good find it costly to contribute and would prefer to free-ride on others' contributions, are common in this context and often lead to the under-provision of public goods and services. Solutions to social dilemmas relying on governmental interventions and privatization are often unfeasible, especially in developing countries, as they require prohibitive amounts of resources and institutional capacity. Groups facing social dilemmas must frequently rely on informal solutions, designed and managed by users themselves.

Leadership is a potential solution to many important cooperation problems. Aside from the formal authority and sanctioning power often held by leaders, their ability to set an example and urge action can potentially mitigate free-riding, coordinate expectations, and otherwise encourage particular behaviors among followers. The potential value of leadership is further evident in the fact that most groups, teams and organizations function with some kind of leadership structure, even when it holds little or no formal authority. This paper examines the role of leadership in promoting the provision of local public goods. In particular, it investigates whether leaders' example can lead to higher aggregate contributions to public goods, and sustain cooperation over time. Moreover, this study asks how leaders' effectiveness depends on the type of authority they hold within the group.

This paper focuses on a particular type of public good, i.e. environmental conservation. Environmental problems are of particular interest as social dilemmas, because users have no perfect knowledge of the consequences of their resource extraction choices on natural resources' rates of depletion, and this uncertainty reinforces individuals' tendency to over-exploit them. Moreover, research on how to foster conservation of common property resources can have a large impact on development and poverty reduction, as the poor rely heavily on this type of public goods - such as fresh water, pastures and forests - for their livelihoods and are severely exposed to environmental shocks. Women and children are most vulnerable to under-provision of these resources, the consequences of which they bear

in terms of food security and time allocation between resource collection and productive activities.

The fieldwork for this study took place in a rural area of Northern Colombia, where over-exploitation of local ecosystems has led to the rapid loss of traditional sources of people's livelihood. Participants in the study were asked to make a donation to a biodiversity conservation project. They could revise their donation choices after observing the amount given by another participant, with whom they were randomly paired. The design of the study varied the leadership status of the person whose choices were observed. Leadership was defined through a collective ranking exercise, in which participants were divided in three groups - top, medium and bottom - depending on their leadership qualities along different dimensions. Using data from the experiment, it is therefore possible to observe how participants' contribution and revision choices varied depending on their own position within the ranking, on the position of their experimental partners, and on the dimension of leadership along which relative ranking was defined.

The empirical analysis yields the following main results. First, total contribution by a pair is significantly higher when the pair includes at least one leader. This difference is driven by the fact that leaders contribute more to environmental conservation, and not by the fact that lower-ranked participants donate significantly more when paired with leaders. Higher contributions by leaders are a consequence of two mechanisms: leaders value environmental conservation more; and the same person donates on average more, the higher her relative status within the pair. This result is consistent with previous findings in the leadership literature and with the idea that higher-ranked individuals feel a responsibility as role models for lower-ranked ones.

Second, type of authority matters. In particular, aggregate contributions are on average higher when leadership is defined along the moral dimension, rather than along the formal one. This result is interpreted as evidence of the fact that environmental conservation decisions fall predominantly within the realm of ethical norms.

Third, total contribution by a pair is also more stable over time when the pair includes at least one leader. Consistent with experimental studies on public good provision, cooperation in pairs that do not include a leader tends to unravel over time, as individuals conform more strongly to others' choices when doing so entails a reduction in giving. The

presence of a leader within a pair offsets this tendency, because leaders do not reduce giving when exposed to partners who donate less than they do. Once again, this pattern results from a general negative correlation between relative status and tendency to conform, which is particularly strong among leaders. This finding is consistent with sociological theories of social comparison, which claim that individuals look up on the status ladder when determining the appropriateness of their conduct.

This paper makes a series of contributions to the existing literature on leadership and social influence. First, the use of an artefactual field experiment (Harrison & List, 2004) makes it possible for this study to investigate the effect of leadership on donations to an actual public good. The use of a real world sample has shortcomings, first of all the loss of experimental control, but allows to investigate whether leadership effects observed in the laboratory with student samples are generalizable and empirically relevant in natural and policy relevant settings.

A second contribution of this research is its focus on *existing* leaders. Laboratory experiments on leadership typically assign status to participants either on the basis of their performance in small tasks within the laboratory, or randomly. This approach is chosen because it allows to cleanly evaluate the effect of (exogenously assigned) status on behavior. The approach adopted in this paper is complementary, in that it makes salient within the experiment the status with which individuals are endowed on the basis of characteristics they possess outside of the experiment. In doing so, this study can assess the relationship between long term determinants of leadership and individual behavior, and the effect of naturally occurring leadership on followers' choices.

A third novel element of this paper is its analysis of *different dimensions of leadership*: formal, moral and traditional. Participants within the experiment were ranked according to these three types of authority, so that it is possible to compare the behavior of those classified as leaders and non-leaders according to different criteria. Acknowledging the potential role of different types of leadership is particularly relevant in developing countries, where formal powers often co-exist with traditional structures of authority. In these settings, it is not obvious that rules of conduct established by formal leaders will be the most influential. This study is the first attempt at comparing the effect of different forms of leadership in fostering group cooperation. Finally, the design of the experiment is such

that one can observe how giving evolves over time. Existing field studies on the effect that information about others people's choices has on individuals' decisions to donate to charity typically investigate one-shot decision environments. This study complements the findings of this literature and tests their robustness in a dynamic setting.

The remainder of the paper is structured as follows. First, an overview of the relevant literature on leadership, status and pro-social behavior is presented (Section 2). Then Section 3 describes the setting and main features of the experimental design. Section 4 spells out the main hypotheses that are then tested in the empirical analysis (Section 5). A series of robustness checks is conducted in Section 6. The ability of different theoretical perspectives to account for the empirical findings is discussed, and evidence is offered in favor or against specific explanations (Section 7). A discussion of policy implications, limits to external validity and directions for further research concludes (Section 8).

## **2. Related literature**

Large literatures outside economics investigate the role of high status individuals in general, and leaders more specifically, in shaping collective outcomes. In economics, the study of leadership has received considerably less explicit attention. A small number of theoretical papers explore leadership in organizations (Hermalin, 1998; Komai, et al., 2007), and a growing stream of empirical research attempts to assess whether leadership has effects on outcomes such as economic growth (Jones & Olken, 2005), the provision of public goods (Chattopadhyay & Duflo, 2004), and firm profitability (Malmendier & Tate, 2009). Other empirical papers attempt to identify what characteristics or practices make good leaders (Lazear, 2010). These studies carefully document the existence of leadership effects on collective outcomes. This paper complements their findings by focusing on one particular form of leadership, i.e. leading-by-example, and by measuring its effect directly on followers' choices, rather than on variables derived from their aggregation – such as growth and type of public goods provided.

Perhaps the greatest attention to leadership in economics has been in the area of experimental economics, where a rapidly growing number of papers use simple laboratory experiments to study the effectiveness of leadership in the context of voluntary public good games. Some of these experiments consider situations in which a leader has private

information regarding the benefit obtained by provision of a public good (Potters, 2007), as in theoretical models by Hermalin (1998) and Vesterlund (2003). In the experiments, informed first-movers are able to influence the behavior of subsequent contributors. Other experiments consider situations in which there is no informational asymmetry, to study whether the presence of a first-acting leader can influence followers' contributions and increase public good provision. In general, these studies find that high contributions by leaders induce higher contributions by followers (Moxnes & Van der Heijden, 2003; Gächter & Renner, 2003) and nicely demonstrate the role of leaders in overcoming free-riding and coordination issues in social dilemmas. Most laboratory experiments induce status randomly, using small tasks or manipulating information within the laboratory. This paper takes a complementary approach, in that it wishes to explore the effect of already existing leadership on the behavior of leaders and followers. Moreover, by making salient the different degrees of authority with which subjects are endowed outside the experiment, the present study can focus on longer-term determinants of leadership.

Field experiments on leadership are rare, as they face the key methodological issue of endogeneity between selection into leadership and leader's performance. Studies that combine laboratory and field evidence find that local leaders' behavior is correlated with community members' contributions to public goods (Beekman et al., 2011; Kosfeld & Rustagi, 2011). Non-experimental studies of community-driven development underline the role of local leaders and elites in shaping the outcomes of development projects (Mansuri & Rao, 2004). Field studies and experiments on common pool resources show that communication, monitoring and sanctioning are effective in enforcing sustainable management systems among user groups (Cardenas & Carpenter, 2008), especially when management institutions and their leaders are chosen by users themselves (Ostrom, 2002). The present study contributes to these strands of the literature by examining what dimensions of authority are associated with leaders' effectiveness.

While not explicitly about leadership, two further strands of the literature are close in spirit to this study. Theoretical and empirical research on social networks investigates influence within groups as a function of the position, number and type of links that individuals have within the network (Jackson, 2008; Padgett and Ansel, 1993). While the empirical analysis in this paper will always control for the number of social links of each



participant, the focus of the present study is that of investigating the consequences of individual status, rather than its sources. Research on charitable giving shares this focus, and features a handful of field experiments in which donations are found to increase following the observation of others' contributions, especially if lead donors are high status individuals (e.g., Shang & Croson, 2009; Frey & Meyer, 2004; Alpizar & Martinsson, 2010). This paper observes how leaders and followers' tendency to conform to each other's choices evolves over time, and, by doing so, tests the findings of the charitable giving literature within a dynamic decision environment.

### 3. Setting and design

#### 3.1. Setting

A total of 251 individuals from 8 villages took part in the study. The villages are located in different municipalities of the province of Monteria, in the Northern Coast of Colombia. They are similar in terms of economic and environmental characteristics. Farming and fishing are the main economic activities. Rice, maize, yam, beans and plantain are grown across the region. Flooding and droughts are both frequent causes of harvest loss. Health posts and primary schools are present in 4 and 6 of the villages respectively. Access to other types of infrastructure differs across the sample. In particular, the largest village is reached by paved road and piped water, while the others are not. Regardless of the type of infrastructure, participants from all the communities mention contamination of drinking water as a major issue.

A local farmers' cooperative, ASPROCIG, acted as entry point to the communities. Representatives of ASPROCIG delivered invitations to their fellow community members. Since no show-up fee was paid to encourage attendance,<sup>1</sup> the invitation process followed a series of guidelines in order to reduce selection biases. Participants had to live in the village, be at least 18 years old and responsible for financial decisions within the household. We invited preferably the household head or the spouse and tried to limit participation to 1

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<sup>1</sup> ASPROCIG requested that no show-up fee should be paid. They were afraid that being paid to participate to a community meeting, which involved a decision about a common project, may lead people to always expect a private return from engaging in public initiatives.

person per family. An average of 20 individuals, from a minimum of 18 to a maximum of 27, participated to 12 experimental sessions.<sup>2</sup>

### 3.2. *Design*

Each session involved a ranking exercise, the mapping of the social network, a decision stage and an individual survey. An experimenter conducted the session, read out the instructions and answered questions from participants. Two assistants helped with the logistics and made sure that participants followed the experimental instructions. Sessions took on average three and a half hours.

#### 3.2.1. *Ranking participants' leadership*

The ranking exercise was aimed at isolating three dimensions of authority within the village: formal, moral and traditional. Formal authority concerns the dimension of social status associated with formal leadership roles and political power. Moral authority is related to respect and trust in one's ethical judgment. Finally, traditional authority refers to the qualities that anthropologists associate with leadership among indigenous societies in Latin America, e.g. the ability to speak in public and tell stories (Clastres, 1974). Isolating these types of authority allows me to assess which one is more relevant for decisions over local common resources, and thus to investigate the nature of such decisions in the study setting.

In order to isolate the different dimensions of authority, participants were presented with three hypothetical situations. The starting point for the formal authority ranking was the following: "The mayor has accepted to meet representatives from the village to discuss the most serious problems it faces (e.g. roads and drinking water). Who among you should go to talk to the mayor?". The moral authority ranking presented participants with the following choice instead: "There is a village member who is harming everybody with his behavior (e.g. contaminating the water with waste and chemicals). Who among you should go to talk to him about the harm he's doing to the community?". Finally, the traditional authority ranking was based around a third situation: "There is a municipal fair in which

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<sup>2</sup> 2 experimental sessions were run in each of the 4 largest villages in the sample. When in the same village, sessions took place over two subsequent days.

people from all villages are invited to tell stories, jokes and sing. Who among you should represent the community at the municipal fair?”.

Participants selected their representatives collectively for all rankings. The experimenter invited each participant to suggest someone else as representative. For each candidate, the experimenter asked remaining participants if they approved the candidature or not. If no objections were raised, a candidate would stand in front of the group, otherwise the experimenter prompted further suggestions. The experimenter solicited nominations in the most random and inclusive manner possible. As soon as the number of candidates reached one-third of participants, the experimenter interrupted the process. She asked one more time whether everyone agreed with the selection or whether more deserving candidates had been left out, and made changes according to participants' answers. This group represented the first choice as village representatives. Then the experimenter told participants that this first group would not be able to go to the meeting, and asked them to select a second group as substitutes. The process was repeated in a similar fashion for the group of substitutes. The experiment assistant recorded the order in which candidates joined the first and second group. The remaining one-third of participants went to form a third group.

The ranking process was conducted three times, once for each hypothetical situation. Their order was randomized across sessions.<sup>3</sup> At the end of the exercise, the experimenter led a group discussion on the qualities of top-ranked individuals, for each ranking type, and recorded the answers. Finally, one between the formal and the moral authority ranking was randomly drawn to be implemented.<sup>4</sup> Participants were then divided into groups according to it, seated in three different rows and given colored cards to mark their group assignment. First choices – members of the top group - received Orange cards; the substitutes – members of the middle group - received Blue cards; and the rest - bottom-ranked individuals - received Brown cards. Before proceeding to the decision stage, the experimenter reminded everyone of the ranking used to divide them into groups by referring to the corresponding hypothetical situation.

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<sup>3</sup> The randomization was between the formal and the moral ranking, while the traditional ranking was always conducted second. This choice was motivated by the desire to separate the moral and formal rankings, one of which would be implemented in the following stage of the experiment.

<sup>4</sup> Issues of statistical power forced me to leave out the traditional authority ranking from the draw and focus on the dimensions of authority which I expected to be more salient in the study area.

The ranking exercise was aimed at reproducing as closely as possible collective decision-making processes that take place during community meetings. This procedure is similar to those commonly implemented in participatory wealth rankings (Chambers, 1994). Extensive focus groups, conducted in the study area, guided the definition of the hypothetical situations used to identify each type of leaders. While the ranking process' lack of formal decision rules generates a loss of experimental control and makes the outcomes of the selection susceptible to being captured by vocal group members, research on deliberation processes in group decisions shows that inclusive information acquisition during deliberations yields accurate and informative decisions, and that deliberation processes are, under certain conditions, more critical for the achievement of such outcomes than decision rules (Lizzeri & Yariv, 2011).

Nevertheless, the ranking procedure is likely to have induced a series of biases in the resulting classifications. By imposing the division of participants to a session in three equally sized groups for each hypothetical situation, the ranking created discontinuity in individual status. Individuals above and below the threshold were probably similar, but belonged to different status groups. Moreover, the fact that members of the top and middle group had to be nominated by other session participants increases the likelihood that more vocal individuals took control of the process and suggested their friends as representatives. The empirical analysis will present evidence on the presence of these biases and their effect on leaders and followers' choices.

### 3.2.2. *Network mapping*

After the ranking exercise, the experiment assistants conducted a mapping of the social network. Subjects were interviewed individually about their relationship with each of the other session participants. For each possible pair  $(i, j)$  of participants to a session, therefore, we know whether individual  $i$  was a relative, friend, acquaintance or stranger to individual  $j$ . The social network data will be used in the empirical analysis to explore the correlation existing between individuals' status and the number and status of their social links.

### 3.2.3. *Contribution decision*

Participants to the experiment were asked to take the following basic decision: “Out of an endowment of 20,000 Pesos, how much do you wish to donate to a biodiversity conservation project?” Participants would keep the difference between contribution and endowment. 20,000 Pesos is equal to 10 USD, about one and a half times the daily farm laborer’s wage. This basic decision was taken a total of 13 times by each participant under different conditions, as explained below. To ensure that all 13 decisions of the session were taken seriously, the experimenter made clear to participants that each of them had the same chance of being paid. A random draw at the end of the session decided which choice was implemented.

Participants’ contributions financed the establishment of a tree nursery in a primary school. A random draw at the end of the study determined which of the schools serving the sample villages received the funds. Tree nurseries help biodiversity conservation in different ways. First, native trees grown there are used to reforest endangered ecosystems, such as canal banks, where they prevent soil erosion. Second, these ecosystems used to be habitats for endangered animal species, which left following deforestation. Restoring them would bring back native fauna in the area. Third, schools use tree nursery to teach environmental education to kids. Children learn about native species and how they can help preserve the soil and limit the use of chemicals. Finally, everyone in the community can plant trees from the nursery on their own land.

As mentioned above, the decision stage involved a total of 13 choices, divided across a private decision and 4 decision rounds. Participants first took the basic decision in private. The 4 decision rounds consisted of 3 choices each. Each choice was still taken individually, but participants were assigned a partner and received information about the partner’s ranking, i.e. the color of the group she belonged to. This information was given through a colored square - orange, blue or brown – drawn on participants’ decision sheets. Pairs changed each round, and nobody had the same partner twice. Table 1 summarizes the structure of the decision stage.

[Insert Table 1 here]

The experimental design varied exogenously pair composition on the basis of participants' ranking. In round 1, one possible group combination was randomly drawn to be implemented. In round 2, couples changed by drawing a second combination. In round 3 pairs were formed according to the combination still left to implement. Finally, in round 4 the color combination of round 1 was repeated with different partners. The pair formation process can be illustrated through an example, which is reproduced in Figure 1. In round 1 each member of the Orange group was paired with one member of the Blue group, while members of the Brown group were paired among themselves; in round 2 members of the Orange group were paired with members of the Brown group, while participants in the Blue group were paired among themselves; in round 3, members of the Blue and Brown groups were paired to each other, and members of the Orange group were matched among themselves; finally, in round 4, the round 1 combination was repeated. The random draws in round 1 and 2 determined the sequence of group combinations implemented.

[Insert Figure 1 here]

The design introduced a second variation. Within each round, decisions differed in terms of their observability and of the information available on partner's preferences at the time of choosing, as summarized in Table 2. When taking the first decision of the round, participants knew only their partner's ranking, which appeared as a colored square on their decision sheets. They also knew that their choice would be shown to their partner and that, in turn, they would observe their partner's contribution. Before taking the second decision, each participant was shown her partner's contribution in the first decision. Then the experimenter asked everyone to write again their contribution choice on the decision sheet, reminding them that they were free to choose any contribution amount and that the second decision would also be observed by their partners. Finally, before taking the third decision, each participant was shown her partner's contribution in the second decision and asked to make her choice a third time. The third decision differed in that participants knew that it would not be observed by their partner. Throughout the round, the experimenter reminded participants that they were free to contribute whatever they wished, regardless of their

previous choices. This process was repeated from the first to the fourth round, for a total of 12 decisions.

[Insert Table 2 here]

#### 4. Hypotheses

This section discusses the main hypotheses that will be tested in the empirical analysis, and cites existing theoretical and empirical research in support of each hypothesis. The first question that this study aims to address is how the presence of a leader affects average contribution by a group. Total contribution by a pair may be higher, when at least one leader is part of it, because leaders contribute on average more, because lower-ranked participants make on average higher donations when paired with a leader, or because of a combination of these two effects. We, therefore, have to make predictions concerning both leaders and lower-ranked participants' behavior. We expect that leaders will contribute higher amounts to the local public good. This prediction is based on the fact that both the formal and the moral rankings define leadership in relation to individual concerns for the common good, thus leading to the selection of individuals who are likely to have higher valuations of projects benefiting the community. Moreover, empirical evidence from laboratory studies on leadership, which find a positive relationship between individuals' relative status and contributions to a common project (Kumru & Vesterlund, 2010), suggests that individuals will contribute more when paired with lower-ranked partners than otherwise, and vice versa. This evidence is interpreted as indication that higher-ranked individuals are aware of their responsibility and influence as role models. Overall, these two mechanisms are expected to have a positive effect on leaders' contributions, and through them on total contribution levels by a pair when leaders are among its members. However, such positive effect of leadership may be attenuated by the negative effect of relative status on giving by leaders' partners. The question of which effect will prevail is ultimately an empirical one, that will be addressed in the next section. Predictions on contributions by participants when matched with leaders can also be made on the basis of signaling theories of altruism (Glazer & Konrad, 1996; Harbaugh, 1998). These models claim that individuals are more altruistic when observed by others, the more so the more they wish to acquire approval from the

observers. Based on this perspective, we expect lower-ranked participants to donate more when paired with leaders. Existing empirical evidence lead us to anticipate that the positive effects of leadership will dominate the negative ones, thus leading to an overall increase in pair composition thanks to the presence of a leader.

*HYPOTHESIS 1. Pair contribution is higher when leaders are members of a pair.*

A second question relating to aggregate contributions to the public good, addressed by this study, concerns which dimension of authority is associated with greater effectiveness of leaders. Theoretical and empirical studies of motivation crowding, and psychological studies of social comparison support the hypothesis that giving will be increased on average by making moral leadership salient. The notion of motivation crowding refers to those settings in which individual behavior is driven by social norms or preferences, or feelings of moral duty. In such contexts, the introduction of external regulations or incentives can change people's perception of the behavior. Voluntary goodwill is turned into a market-like interaction, resulting in fewer people willing to act altruistically (Frey et al., 1996; Frey and Götte, 1999). In the field of natural resource management, research on motivation crowding finds that the exogenous introduction of regulations, monetary sanctions and authorities weakens individuals' intrinsic motivation to contribute to local public goods (Ostrom, 2006; Vatn, 2006). Since contributing to support local biodiversity is not required by any formal law in the study setting, this type of decision has a predominantly moral dimension. According to the motivation crowding literature, therefore, we expect that participants will on average contribute more under the moral than under the formal ranking. Studies on leadership in social psychology support this claim, by showing that the relevance of leaders' qualities to the decision under consideration increases leaders' legitimacy. We thus predict that moral leaders will be more salient and legitimate sources of authority than formal leaders in the context of the experiment, and prompt higher contributions by lower-ranked participants.

*HYPOTHESIS 2. Moral authority is more effective, i.e. individuals contribute more when moral authority is salient within the experiment.*



Finally, this study asks how the presence of a leader within a group influences the evolution of contributions to the public good. An established result in the experimental literature on public good games is that, in the absence of communication or institutions, cooperation tends to unravel over time (Isaac, et al., 1985). This is due to the fact that most individuals are ‘conditional cooperators’, i.e. they contribute to the public good as long as others do, but withdraw their cooperation as soon as they observe others defecting (Croson, 1999; Fischbacher, et al., 2001). The evidence on complementarities across agents in charitable donations, mentioned in Section 2, supports the claim that individuals tend to conform to others’ actions. A number of mechanisms discussed in the literature on social preferences and learning can account for this empirical regularity. Theories of fairness and inequity aversion predict that individuals conform to others’ choices in order to minimize payoff inequality (Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000). According to fairness models, positive or negative examples by others trigger contribution change by conditionally cooperative individuals (Rabin, 1993; Charness & Rabin, 2002; Levine, 1998). Theories of conformism and social norms argue that individuals conform to others’ actions because deviating from standards of behavior generates disutility in terms of loss of status or painful emotions (Clark & Oswald, 1998; Lopez-Perez, 2008). Conformism is also endogenously generated by models of social preferences that introduce envy or disutility from deviating from group average behavior in individuals’ utility functions (Bernheim, 1994; Maccheroni, et al., 2010). If social status or prestige can be gained through contributions to a public good, for instance because giving is perceived as a signal of wealth or altruism, signaling models also predict that agents adjust their choices to guarantee themselves status at the minimum cost, given others’ actions (Benabou & Tirole, 2006; Glazer & Konrad, 1996; Ellingsen & Johannesson, 2008; Harbaugh, 1998). Beside social preference theories, models of social learning claim that others’ actions influence individual behavior because they convey information on the value of the public good (Conlisk, 1980; Banerjee, 1992; Bikhchandani, et al., 1992). Although the goal of this paper is not that of testing alternative theories, in Section 7 I will argue that some of these theoretical perspectives appear better suited than others to interpret the empirical findings. Here it suffices to say that all these models, together with the empirical evidence on conditional

cooperation, lead us to expect to observe a general tendency by individuals to conform to each other's choices.

The likelihood that participants revise their contribution level upon observing others' decisions will depend on their absolute and relative ranking. We base this prediction on psychological theories of upward social comparison. These studies claim that, in determining the appropriateness of their own behavior, individuals compare themselves to others who are believed to possess more knowledge, or fare better, along dimensions relevant to the decision under consideration (Suls, et al., 2002). The tendency to conform to experts and leaders is found to be increasing in their commitment to group goals (Price & Garland, 1981), attractiveness and relevance within the decision setting (Festinger, 1954). Based on this literature, we anticipate that individuals' tendency to conform to others' choices will be decreasing in their absolute and relative status. This prediction is also supported by laboratory experiments in economics, showing that first-moving leaders who have higher status or are more cooperative themselves induce higher contributions among followers, and that high status followers are less likely to conform to low status first-movers (Kumru & Vesterlund, 2010; Gächter, et al., 2011). These arguments are behind the third hypothesis that will be tested in the next section.

*HYPOTHESIS 3. Pair contribution is more stable over time when leaders are members of a pair.*

## **5. Empirical strategy and results**

The empirical analysis in this section follows a series of steps. First, a descriptive investigation of participants' characteristics and of individual traits correlated with altruism and status is conducted (Section 5.1). Then the main findings are presented (Section 5.2): giving is higher when leaders are part of pair, primarily because leaders give more; this effect is stronger when moral authority is made salient within the experiment; and giving decreases less over time when leaders are part of a pair, because leaders only weakly adjust contribution downwards after observing other give less.

### *5.1. Demographic and socioeconomic correlates of leadership and giving*

Table 3 shows participants' average characteristics. Their age and education attainments are in line with country averages. Almost 40% of them are women. Participants' average age and gender are consistent with the goal of the sampling process of recruiting the head or spouse within each household. The fact that only 10% of participants had no formal education minimizes concerns that they might not be able to understand the experiment. The majority of participants are smallholder farmers, while only 10% of them own livestock. Almost 80% of them reports having suffered income losses due to environmental shocks over the previous year, mostly flooding, droughts and water contamination. The large share of people who depend on farming for their livelihood and who were negatively hit by environmental shocks suggests that participants were likely to value the biodiversity conservation project, as reforestation of canal banks with native species greatly reduces the incidence of floods. This claim is supported by further survey evidence, showing that 94% of participants believe that the tree nursery project will be useful to their family. Mean farm size is above 2 hectares, and average earnings over the previous week are equal to 35,146 Pesos (17.5 USD). The experiment, therefore, endowed participants with a significant amount of money. Data on the number of associations in which each participant held leadership roles, such as president, secretary, treasures, was also collected: this figure ranges from a minimum of 0 to a maximum of 3 associations with a mean of .33. Each person has an average of 3.65 friends or relatives also attending the session. The share of participants who are ASPROCIG members (57%) is above that of ASPROCIG members in the study region, a likely consequence of the association's role in the recruitment process.

[Insert Table 3 here]

Participants ranked themselves according to three different criteria, as described in Section 3.2.1. The goal of the formal, moral and traditional authority rankings was to isolate corresponding dimensions of authority. During the discussion, conducted at the end of the exercise, participants listed the main qualities of top-ranked individuals for each ranking. A qualitative assessment of the results from the discussion shows that the three rankings indeed captured different leadership profiles: individuals at the top of the formal authority ranking are active in the life of the community, contribute to solving its problems and have

good links with municipal authorities; those at the top of the moral authority one are good speakers, diplomatic, morally sound, honest and in good relationships with fellow community members; finally, top-ranked individuals in the traditional authority classification are joyful, funny, talented, charismatic and full of enthusiasm.<sup>5</sup>

The three rankings are correlated but not collinear. 50% of top-ranked individuals in the formal ranking are also in the top group in the moral ranking. As shown in Table 4, pairwise correlation between the formal and moral ranking is 34.9%, between the formal and traditional ranking is 13%, and between the moral and traditional ranking is -14.2%. All correlations are significant at the 10% level. This preliminary overview is reassuring of the ability of the three rankings to distinguish between different leadership profiles.

[Insert Table 4 here]

Individual characteristics correlated with the different rankings are explored next. Table 5 shows results from the following ordered logit regression:

$$Prob(AbsStatus_{is}) = \beta_1 + \beta_2 X_{is} + \beta_3 Sess_s + \varepsilon_{is} \quad (1)$$

where  $AbsStatus_{is}$  is 3 if  $i$  is in the top group, 2 if she's in the middle group and 1 if she's in the bottom group,  $Sess_s$  are session fixed-effects, and  $X_{is}$  is a vector of individual characteristics: age, gender, marital status, household dependency ratio, a dummy equal to 1 if no kids under 12 live in  $i$ 's household, education, per capita household income over the previous week, number of community associations in which  $i$  holds leadership roles, number of participants to the session who say that  $i$  is a friend or relative, and a dummy equal to 1 if  $i$  is an ASPROCIG member. The regression is run for the formal, moral and traditional rankings in Columns 1, 2 and 3 respectively. Column 4 presents results using average rank as dependent variable.

Age and education are positively correlated with status in the formal and moral rankings. Holding leadership roles in associations increases the probability of being highly ranked in terms of formal authority. The coefficient on being a woman is negative

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<sup>5</sup> Table A1 reports, for each ranking, the top five qualities of top group members mentioned.

throughout, and significant for moral and average ranking. Having friends or relatives among session participants increases the likelihood of occupying a high position in the formal and moral ranking. Status in traditional ranking shows a positive and significant correlation only with the number of leadership roles one holds, probably due to the fact that public officers are often required to speak to community members. Overall, regression results are consistent with the purpose of the different rankings. Being educated and occupying positions in community organizations is more relevant for formal authority, while age matters more for moral authority. The fact that almost no proxy of socioeconomic status is significantly correlated with traditional authority is hardly surprising. The qualitative assessment conducted above shows that traditional authority is associated with being funny and enthusiast, qualities for which observable proxies are hard to find. Age, gender, education, roles in community associations and ASPROCIG membership are significant correlates of average ranking.

[Insert Table 5 here]

Now I explore which characteristics are correlated with giving in the experiment. Table 6 shows results from the following regression:

$$C_{is} = \beta_1 + \beta_2 X_{is} + \beta_3 Sess_s + \varepsilon_{is} \quad (2)$$

where  $X_{is}$  is the same vector of individual variables used above. The dependent variable  $C_{is}$  is contribution in the private decision in Column 1 and average contribution over rounds 1 to 4 in Column 2. Results are presented from OLS models for consistency with the specification adopted in the remaining of the section (see footnote 6 below).

ASPROCIG members contribute significantly more throughout the session. This result is consistent with ASPROCIG's mission of pursuing income growth through the protection and enhancement of traditional crops and farming techniques. ASPROCIG considers biodiversity conservation as a necessary condition for development, not as a constraint, and was therefore in favor of the establishment of tree nurseries in the area. The ratio between the number of kids and the number of adults living in a household affects

contribution negatively, probably through its impact on household needs. However, having no kids is negatively correlated with giving, both in private and on average, though only the correlation with private donations is significant. This result may reflect the nature of the biodiversity project, which directly benefits kids. Having children may also increase people's concern for the future in general, and environmental sustainability in particular (Dupont, 2004).

[Insert Table 6 here]

Note that the coefficients on household income are positive but insignificant throughout, probably because of the homogeneity in income levels among participants. The lack of significance of income may be also due to noisiness of the proxy used, i.e. income over the week prior to the experiment. A first evidence against this statement comes from the observation that the household income variable is positively and significantly correlated with respondents' assessments of their own subjective economic status. Moreover, replacing the income variable with asset measures, such as size of land owned, does not change the results. Here and in the rest of the analysis, regressions control for household income per capita and not for farm size, because the use of the latter variable, while not affecting the results, leads to dropping observations for those participants who did not own land or could not estimate precisely the size of their plots.

## 5.2. Main results

This subsection presents the main results from the experiment. It first analyzes aggregate giving and finds that it is a function of status and type of authority made salient within the experiment. It then explores the evolution of giving over time, again showing that contribution revisions differ between leaders and lower-ranked participants. These findings are consistent with the predictions derived from the literature in Section 4.

*RESULT 1. Pair contribution is higher when leaders are members of a pair. This is due to differences in average contribution levels depending on individual absolute and relative status.*

Total contribution by a pair is equal on average to 14,328 Pesos when at least one member of the pair is a leader, and to 12,713 Pesos otherwise. The presence of a leader in a pair, therefore, increases total pair contribution by 13% relative to the total amount contributed by pairs where both members are lower-ranked. This difference is statistically significant, as shown in Table 7, which present results from the following regression:

$$C_{pst} = \beta_1 + \beta_2 LeaderPair_{pst} + \beta_3 Sess_s + \varepsilon_{pst} \quad (3)$$

where  $C_{pst}$  denotes pair  $p$ 's total contribution at time  $t$  in session  $s$  (i.e. the sum of  $i$  and  $j$ 's contribution, where  $i$  and  $j$  are the members of pair  $p$ ), and  $LeaderPair_{pst}$  is equal to 1 if pair  $p$  features at least one leader at time  $t$ . The regression includes session fixed-effects and uses a linear random-effects model (Table 7).<sup>6</sup>

[Insert Table 7 here]

The sum of pair members' contributions is significantly higher when at least one of them is a leader. This difference is due to the fact that leaders contribute on average significantly more than lower-ranked participants. Table 8 confirms this claim, showing results from the following regression:

$$C_{ist} = \beta_1 + \beta_2 Leader_{is} + \beta_3 X_{is} + \beta_4 Sess_s + \varepsilon_{ist} \quad (4)$$

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<sup>6</sup> In the analysis, I assume the following structure for the error term  $\varepsilon_{kst}$ :  $\varepsilon_{ist} = \mu_k + \gamma_s + \vartheta_{kst}$ , where  $k = i, p$  depending on whether the outcome variable is at the individual or pair level respectively. The first term models the correlation existing between different choices by the same individual (pair). The second term captures the correlation between choices of different individuals (pairs) participating to the same session, generated by observable and unobservable factors varying across sessions. The third term reflects idiosyncratic variations in the error term. In order to control for these different sources of heteroskedasticity, in what follows I will adopt two main empirical models. When the regressors of interest are invariant at the individual level (pair), for instance absolute ranking and type of ranking made salient within a session, I will adopt a random-effects model, control for observable and unobservable factors at the session level using session fixed-effect, and cluster the standard errors at the individual level. When the regressions control for time-varying characteristics at the individual level, for instance relative ranking and partner's status, then they will include individual fixed-effects and feature robust standard errors. In order to exploit the advantages in terms of efficiency and control allowed by these model specifications, in the remaining of the session I show results exclusively from linear regressions. The results are robust to the use of alternative specifications, in particular Tobit (contributions are censored at 0 and 20,000 Pesos) and Probit (revision probabilities) models with session fixed-effects and observations clustered at the individual level. The regressions do not include round fixed-effects, unless explicitly stated, because they are never significant.

where  $C_{ist}$  denotes the contribution of individual  $i$ , taking part in session  $s$ , at time  $t$ , and  $Leader_{is}$  is equal to 1 if  $i$  is in the top group. The regression in Column 1 features  $i$ 's leadership status as the only regressor, while the one in Column 2 adds the following individual controls  $X_{is}$ : age, gender, education, number of community associations in which  $i$  holds leadership roles, number of participants to the session who say that  $i$  is a friend or relative, and ASPROCIG membership. Comparing the results in Columns 1 and 2, we observe that the difference in leaders' contribution is mainly due to different observable characteristics of leaders and lower-ranked participants: in fact, the inclusion of individual controls reduces the size of the coefficient on leadership by about 30% and affects its significance level. This finding confirms once again the claim that individuals' positions in the ranking reflect important characteristics within the decision environment under consideration, and suggests that differences in contribution levels cannot be simply induced by placing individuals in leadership positions, regardless of their qualities.

[Insert Table 8 here]

Unobservable characteristics of leaders may also contribute to determine their higher contributions relative to non-leaders. In particular, leaders may have a higher valuation of environmental conservation. The qualitative data derived from participants' discussion of leaders' characteristics support the idea that top-ranked individuals, being more committed than others to solving community problems, may also be more willing to promote the conservation of common natural resources. Moreover, survey data show that leaders are significantly more likely than non-leaders to have engaged in conservation activities over the year prior to the experiment, and that 92% of participants believe leaders to be the most knowledgeable people in the community about environmental issues.

While absolute status per se is not associated with significantly higher contributions, previous evidence on leadership suggest that there may be a positive correlation between relative ranking and giving. Laboratory studies on social status show that individuals contribute more to public goods when their followers are of lower standing than when they are matched with same-status partners (Kumru & Vesterlund, 2010). This finding is interpreted as a proof that higher-ranked individuals are aware of being role models for



lower-ranked peers, more so than for same-status ones. In order to test this claim in the setting of the present study, I examine participants' contribution depending on their status relative to that of their partner. Results from the following regression offer clean evidence on the positive relationship between relative status and giving:

$$C_{ist} = \beta_1 + \beta_2 \text{HigherRank}_{ist} + \beta_3 ID_{is} + \varepsilon_{ist} \quad (5)$$

where  $\text{HigherRank}_{ist}$  is equal to 1 if  $i$  is paired with a lower-ranked partner at time  $t$  in session  $s$ . The regression includes individual fixed-effects ( $ID_{is}$ ). Table 9 presents regression results. The positive and significant coefficients on the higher relative status dummy indicates that the same individual contributes significantly more when she is the higher-ranked member of a pair than otherwise.

[Insert Table 9 here]

In order to test whether the effect of relative status is stronger for leaders, I interact the relative ranking dummy with variables equal to 1 if individual  $i$  is in the top or middle group respectively:

$$C_{ist} = \beta_1 + \beta_2 \text{HigherRank}_{ist} + \beta_3 \text{Leader}_{is} + \beta_4 \text{Middle}_{is} + \beta_5 \text{HigherRank}_{ist} * \text{Leader}_{is} + \beta_6 \text{HigherRank}_{ist} * \text{Middle}_{is} + \beta_7 X_{is} + \beta_8 \text{Sess}_s + \varepsilon_{ist} \quad (6)$$

Individual controls replace individual fixed-effects in this regression, as we wish to investigate the effect of (time invariant) absolute status. Regression results, reported in Table 10, show that both leaders and middle-ranked participants give more than bottom group members (omitted category). In addition, they confirm that higher relative ranking is associated with higher donations. The sum of the coefficients on the leader and higher-rank dummies, and on their interaction term, is significantly different from 0 ( $p=.060$ ), while the corresponding sum of coefficients for middle-ranked participants is not ( $p=.274$ ). However, the former sum of coefficients is not significantly different from the latter ( $p=.296$ ),

suggesting that the effect of relative status on giving is not significantly stronger among leaders than among middle-ranked participants.

[Insert Table 10 here]

The findings presented in Tables 9 and 10 support previous laboratory evidence on individuals' awareness of being role models for their lower-ranked peers, which we find to be equally strong among leaders and middle-ranked participants. This mechanism combines with leaders' higher valuation of the conservation project in determining the difference in contribution levels between leaders and other participants.

On the contrary, contributions by lower-ranked individuals do not significantly vary depending on whether they are paired with a leader or not. Table 11 reports results from the following regression, which support this claim:

$$C_{ist} = \beta_1 + \beta_2 \text{NotLeader}_{is} + \beta_3 \text{PartnerLeader}_{ist} + \beta_4 \text{NotLeader}_{is} * \text{PartnerLeader}_{ist} + \beta_5 X_{is} + \beta_6 \text{Sess}_s + \varepsilon_{ist} \quad (7)$$

*NotLeader<sub>is</sub>* is equal to 1 if *i* is in the middle or bottom group, and *PartnerLeader<sub>ist</sub>* is equal to 1 if *i*'s partner at time *t* is a leader. Individual controls *X<sub>is</sub>* are included in the regression only in Column 2. The negative coefficients on the two main effects confirm findings from previous regressions, i.e. that giving is decreasing in absolute and relative status. Participants give more when paired with a leader, but this effect is not significant. The desire to impress leaders by donating high amounts does not appear to significantly motivate lower-ranked participants contribution choices.

[Insert Table 11 here]

To summarize, the first main finding reported in this section is that the presence of a leader in a pair increases total pair contribution. This effect is driven by the fact that leaders give more than non-leaders, especially if their partners are lower-ranked. Two mechanisms combine to produce this result: first, leaders value environmental conservation more than

non-leaders; second, there is a general tendency of individuals to increase giving when paired with lower-ranked partners. On the contrary, non-leaders do not make significantly higher contributions when paired with a leader. These results are consistent with previous findings from the experimental literature on leadership and with predictions of social comparison models, while they do not suggest the presence of signaling motives behind participants' choices.

*RESULT 2. Moral authority is more effective, i.e. mean contribution is higher when the moral ranking is salient. In particular, leaders and bottom group members contribute significantly more when moral authority is salient.*

Next, I examine whether aggregate contribution differs depending on the type of authority made salient within a session. Recall that participants ranked themselves across three different dimensions of authority – formal, moral and traditional – and that one between the formal and the moral ranking was drawn in each session to be implemented. Therefore, each ranking was made salient in half of the sessions and it is possible to compare contribution levels across sessions, depending on which ranking was implemented.

Average pair contribution is higher when moral ranking is salient. The results from the following regression demonstrate this claim:

$$C_{pst} = \beta_1 + \beta_2 \text{MoralRank}_{ps} + \beta_3 \text{Sess}_s + \varepsilon_{pst} \quad (8)$$

$\text{MoralRank}_{ps}$  is equal to 1 if moral authority was made salient for pair  $p$  in session  $s$ .

Regression results are presented in Table 12, where the dependent variable is total pair contribution at time  $t$  and the regression model is GLS estimation of random-effects model with standard errors clustered at the individual level. Total giving by a pair is on average 2,400 Pesos higher when the implemented group classification is based on the moral authority ranking.

[Insert Table 12 here]

This increase masks differences in behavior across status groups depending on ranking applied. Figure 2 shows average contribution by group, when the moral ranking is salient (dark grey columns) and when the formal ranking is salient (light grey columns). Both leaders and bottom group members give significantly more under the moral than the formal ranking ( $p$ -values of the two-sided  $t$ -tests are  $p=.004$  and  $p=.002$  respectively). Middle group members, on the contrary, contribute more on average when the formal ranking is salient ( $p=.073$ ).

[Insert Figure 2 here]

Insights from theories of motivation crowding and social comparison theories shed some light on these contribution patterns. The arguments that follow are based on the observation that in the study setting the decision to conserve local biodiversity is a voluntary expression of civic engagement and valuation of the environment. Indeed, no formal laws exist to sanction or reward natural resource use, and decisions to preserve the environment fall in the realm of ethical rather than legal norms. As discussed in Section 4, the literature on motivation crowding supports the prediction that individual motivation to contribute will be crowded-in by making the moral dimension of the decision salient, and crowded-out by stressing the role of formal authorities. This prediction applies to all status groups. In addition, theories of social comparison offer a second reason for lower-ranked individuals to contribute more under the moral than the formal authority: if moral leadership is based on attributes perceived to be more salient to the decision under consideration than formal leadership, then lower-ranked individuals will be more inclined to match contributions by moral than by formal leaders. Indeed, a significantly higher share of participants believe leaders to be experts of environmental issues when moral leadership is salient (95%) than when formal leadership is salient (89%), and this difference is statistically significant ( $p=.081$ ). The combination of these two explanations can account for the behavior of leaders and bottom group members, but is inconsistent with that of middle group members.

A tentative explanation for the fact that middle-ranked individuals contribute on average less under the moral than the formal ranking relies on insights from psychological theories of counterfactual thinking. These theories argue that social comparison processes

depend not only on the existing social ranking, but also on the most salient counterfactual for the individual in a specific situation (Medvec et al., 1995). According to this literature, people's emotional responses to events are influenced by their thoughts about 'what might have been'. Through an analysis of emotional responses of bronze and silver medalists at the Olympics, Medvec et al. (1995) find that bronze medalists tend to be happier than silver medalists. They attribute this result to the fact that the most salient counterfactual for silver medalists is winning the gold, while for bronze medalists is winning no medals. In the context of this study, if the moral dimension is the most relevant to participants' decisions, the loss of status felt by middle group members relative to leaders could be stronger under the moral than formal ranking. In other words, middle-ranked participants may perceive their own status as 'lower than leaders' status' more strongly under the moral than under the formal ranking. If this were the case, the relationship between relative ranking and giving, established above, would account for the difference in average contribution by middle-ranked participants depending on the type of authority implemented.

To summarize, the second main finding of this study is that average giving is higher when moral leadership is salient. In particular, leaders and bottom group members contribute significantly higher amounts when the moral ranking is made salient. Theories of motivation crowding and social comparison account for these results, given the predominantly moral dimension of the experimental decision.

*RESULT 3. Pair contribution is more stable over time when leaders are members of a pair. This is due to different tendencies to conform to others' observed choices depending on individual absolute and relative status.*

The first two results presented in this section have focused on aggregate levels of contribution. In particular, Result 1 showed that contribution levels are on average higher when pairs feature at least one leader. Examining the evolution of giving over time, we observe that contribution levels are also more stable when leaders are members of a pair. The following regressions explore contribution trends depending on pair composition:

$$C_{pst} = \beta_1 + \beta_2 LeaderPair_{pst} + \beta_3 Decision_t + \beta_4 LeaderPair_{pst} * Decision_t + \beta_5 Sess_s + \varepsilon_{pst} \quad (9)$$

$$C_{pst} = \beta_1 + \beta_2 LeaderPair_{pst} + \beta_3 Decision_t + \beta_4 LeaderPair_{pst} * Decision_t + \beta_5 Sess_s + \beta_6 Round_t + \varepsilon_{pst} \quad (10)$$

where  $LeaderPair_{pst}$  was defined above and  $Decision_t$  denotes the order of decision over time. Regression (9) examines the evolution of total pair contribution over the entire course of a session, while regression (10), through the inclusion of round fixed-effects ( $Round_t$ ), focuses on contribution trends within each round. Regression results are presented in Table 13.

[Insert Table 13 here]

The negative coefficients on the time variable indicates that there is a decreasing trend in contribution over time, which is significant within rounds. This result confirms a robust finding in laboratory and field experiments on public good contributions: cooperation starts at positive levels, but deteriorates over time. The presence of leaders in a pair offsets such downward trend: the interaction term  $LeaderPair_{pst} * Decision_t$  is positive and significant, and the sum of the coefficients on the main effects and interaction terms is not significantly different from zero in both regressions ( $p=.179$  and  $p=.520$  respectively).

The general downward trend observed among pairs of non-leaders is due to the tendency of individuals, on average, to conform to partners decisions. Recall that participants could revise their contribution choices after observing those of their partners. We can therefore observe how participants' revision choices in  $t$  depend on the relative size of own and partner's donation in  $t-1$ , by regressing the direction of contribution change in  $t$  relative to  $t-1$  on the sign of the difference between own and partner's contribution in  $t-1$ :

$$Y_{ist} = \beta_1 + \beta_2 I(C_{ist-1} > C_{jst-1}) + \beta_3 I(C_{ist-1} < C_{jst-1}) + \beta_4 ID_{is} + \varepsilon_{ist} \quad (11)$$

where  $Y_{ist}$  is the likelihood of upward revisions in  $t$  relative to  $t-1$  [ $Y_{ist} = I(C_{ist} > C_{ist-1})$ ] in Column 1 of Table 14, and of downward revisions [ $Y_{ist} = I(C_{ist} < C_{ist-1})$ ] in Column 3.  $I(C_{ist-1} > C_{jst-1})$  is equal to 1 if  $i$  gave more than partner  $j$  in  $t-1$ , whereas  $I(C_{ist-1} < C_{jst-1})$  is equal to 1 if  $i$  gave less than  $j$  in  $t-1$ . Results are shown using a linear probability. All

regressions include individual fixed-effects. Regression coefficients show that participants tend to increase giving after negative lag relative contributions ( $C_{ist-1} < C_{jst-1}$ ), and decrease it after positive ones ( $C_{ist-1} > C_{jst-1}$ ). This finding is consistent with field evidence on the complementarity between own and others choices in the realm of charitable giving discussed in Sections 2 and 4.

[Insert Table 14 here]

The tendency to conform does not explain, alone, the general downward trend in giving. For it to produce decreasing levels of aggregate giving, the tendency to conform must be stronger when individuals are exposed to lower than to higher contributions than their own. Indeed, we observe that the sign of lag relative contribution influences not only the direction, but also the magnitude of contribution revisions. Figure 3 shows the relationship between the difference between  $i$  and  $j$ 's donations in  $t-1$  ( $C_{ist-1} - C_{jst-1}$ ) on the x-axis, and the size of contribution revision by  $i$  ( $C_{ist} - C_{ist-1}$ ) on the y-axis. The regression line appears flatter for negative than for positive lag relative contributions. In fact, participants on average revise donations by 2,662 Pesos after contributing more than their partners, and by 2,183 Pesos after contributing more. This difference is statistically significant ( $p=001$ ), meaning that participants tend to conform more to others' choices if conformity requires decreases in donation. Indeed, the mean amount of contribution change is -173 Pesos, significantly different from 0.

[Insert Figure 3 here]

The different reactions, that leaders and non-leaders have to others' contributions, lie behind the more stable trend in giving by pairs featuring leaders among their members. In particular, leaders are less likely to decrease donations after contributing a lower amount than their partners in  $t-1$ . This claim is confirmed by the following regressions, examining both  $i$ 's likelihood to revise giving, and the amount of revisions by  $i$ , as a function of  $i$  being a leader, of  $i$  giving more or less than her partner in  $t-1$  and of their interaction. All

regressions control for  $i$ 's contribution in the private decision,  $PrivateC_{is}$ , for the amount donated by  $i$ 's partner in  $t-1$ ,  $C_{jst-1}$ , and for session fixed-effects:

$$Increase_{ist} = \beta_1 + \beta_2 Leader_{is} + \beta_3 I(C_{ist-1} < C_{jst-1}) + \beta_4 Leader_{is} * I(C_{ist-1} < C_{jst-1}) + \beta_5 PrivateC_{is} + \beta_6 C_{jst-1} + \beta_7 Sess_s + \varepsilon_{ist} \quad (12a)$$

$$Decrease_{ist} = \beta_1 + \beta_2 Leader_{is} + \beta_3 I(C_{ist-1} > C_{jst-1}) + \beta_4 Leader_{is} * I(C_{ist-1} > C_{jst-1}) + \beta_5 PrivateC_{is} + \beta_6 C_{jst-1} + \beta_7 Sess_s + \varepsilon_{ist} \quad (12b)$$

Regressions (12a) focus on upward revisions following negative lag relative contributions, whereas (12b) on downward revisions following positive ones. Table 15 shows regression results for the amount of upward revisions in Column 1 [ $Increase_{ist} = C_{ist} - C_{ist-1}$ ], for the likelihood of upward revision in Column 2 [ $Increase_{ist} = I(C_{ist} > C_{ist-1})$ ], for the amount of downward revisions in Column 3 [ $Decrease_{ist} = Abs(C_{ist} - C_{ist-1})$ ], and for the likelihood of downward revision in Column 4 [ $Decrease_{ist} = I(C_{ist} < C_{ist-1})$ ]. Leaders are significantly less likely to decrease giving when they see their partners donating lower amounts, and when they do, they reduce donations by smaller amounts than non-leaders. Leaders do not behave differently from non-leaders when they face partners who donated more than they did in  $t-1$ .

[Insert Table 15 here]

Consistent with the analysis conducted on contribution levels, I now investigate whether the observed differences in leaders' revision choices are, at least partially, due to a more general effect of relative status on the tendency to conform. Results from the following regression are presented in Table 16:

$$Increase_{ist} = \beta_1 + \beta_2 HigherRank_{ist} + \beta_3 I(C_{ist-1} < C_{jst-1}) + \beta_4 HigherRank_{ist} * I(C_{ist-1} < C_{jst-1}) + \beta_5 C_{jst-1} + \beta_6 ID_{is} + \varepsilon_{ist} \quad (13a)$$



$$\begin{aligned}
Decrease_{ist} = & \beta_1 + \beta_2 HigherRank_{ist} + \beta_3 I(C_{ist-1} > C_{jst-1}) + \beta_4 HigherRank_{ist} \\
& * I(C_{ist-1} > C_{jst-1}) \\
& + \beta_5 C_{jst-1} + \beta_6 ID_{is} + \varepsilon_{ist}
\end{aligned} \tag{13b}$$

The outcome variables are the same as in the previous table. The regressions focus on the effect of varying relative status on individuals' revision amount (Columns 1 and 3) and likelihood of revision (Columns 2 and 4), by including individual fixed-effects and controlling for a dummy equal to 1 if individual  $i$  in session  $s$  is the highest-ranked member of a pair at time  $t$ ,  $HigherRank_{ist}$ . Relative status is negatively correlated with an individual's tendency to conform, both upwards and downwards. In fact, being the higher-ranked member of a pair is associated with a significantly lower likelihood to revise donation upwards following negative lag relative contributions, and downwards following positive ones. Equivalently, these findings show that individuals are more likely to conform to partners' choices when the latter have higher status. The results on revision amounts go in the same direction, but regression coefficients on the interaction terms are not significant.

[Insert Table 16 here]

In order to test whether the effect of relative status alone is responsible for the observed differences in leaders' downward revision choices, I run t-tests of the likelihood to decrease donations,  $I(C_{ist} < C_{ist-1})$ , following positive lag relative contributions,  $I(C_{ist-1} > C_{jst-1})$ , when  $i$  is ranked higher than her partner, depending on whether  $i$  is in the middle or in the top group. Middle-ranked participants revise giving downward 54.5% of the times in such situations, while the corresponding figure for leaders is only 39.3%. This difference is statistically significant ( $p=.008$ ). On the contrary, no significant differences are observed in upwards revision choices by leaders and middle group members following negative lag relative contributions ( $p=.564$ ). Consistent with previous results on donation levels, leaders' behavior appears to be driven by a combination of effects. There exist a general tendency by higher-ranked individuals to conform less to partners' choices, which is in line with predictions of upward social comparison models. In addition, leaders are even less likely than other higher-ranked participants to lower their contribution to match those of their

partners', a fact which could be explained by their higher valuation of the conservation project.

We observed that lower-ranked members of a pair are more likely to conform to their partners' choices than their higher-ranked counterparts. In order to test whether further differences in revision choices by lower-ranked participants exist depending on whether their partners are leaders, I show results from the following regressions, which focus exclusively of non-leaders (Table 17):

$$\begin{aligned} Increase_{ist} = & \beta_1 + \beta_2 PartnerLeader_{ist} + \beta_3 I(C_{ist-1} < C_{jst-1}) + \beta_4 PartnerLeader_{ist} * \\ & I(C_{ist-1} < C_{jst-1}) + \beta_5 C_{jst-1} + \beta_6 ID_{is} + \varepsilon_{ist} \end{aligned} \quad (14a)$$

$$\begin{aligned} Decrease_{ist} = & \beta_1 + \beta_2 PartnerLeader_{ist} + \beta_3 I(C_{ist-1} > C_{jst-1}) + \beta_4 PartnerLeader_{ist} * \\ & I(C_{ist-1} > C_{jst-1}) + \beta_5 C_{jst-1} + \beta_6 ID_{is} + \varepsilon_{ist} \end{aligned} \quad (14b)$$

The dependent variables are the same as in the previous tables. As above, regressions control for partner's contribution amount in  $t-1$  and individual fixed-effect, and results are derived using linear probability models. After giving less than their partners, participants are more likely to revise their donation upwards if partners are leaders than if they are not, and the amount of contribution increase is also higher in this case. However, neither effect is statistically significant. Similarly, there are no significant differences in downward revision choices depending on partner's leadership status.

[Insert Table 17 here]

Non-leaders' tendency to conform doesn't significantly differ depending on the type of authority made salient within the experiment. In particular, the likelihood that participants revise their donations upwards, after observing a higher-ranked partner contribute more, is higher when the moral ranking is salient (49%) than when it is not (42.5%), but this difference is not statistically significant ( $p=.232$ ).

This final part of the section has demonstrated that the presence of leaders in a pair makes cooperation sustainable through the combination of two mechanisms. Individuals are in general less likely to conform to their partners' choices when they are the higher-ranked

members of their pair. Moreover, when paired with partners who donate lower amounts, leaders tend to decrease contributions even less frequently than other higher-ranked participants. The next section checks whether the results presented so far are determined by biases deriving from the ranking procedure used within the experiment.

## 6. Robustness checks

The ranking process that was used to divide participants into groups may have introduced biases in the attribution of status to participants. This section examines two main potential sources of bias. The first concerns the constraint imposed by the procedure, that status groups be equally-sized. The second derives from the relationship between leadership and friendship links among session participants. In what follows, I will provide evidence that demonstrates how the main results of this paper are not a by-product of the ranking procedure used. On the contrary, the classification process may cause an under-estimation of true leadership effects.

By imposing exogenously that one-third of participants belong to the top group, one-third to the middle group and the remaining third to the bottom group, the ranking determined exogenously a discontinuity in ranking. It is likely that a ranking process, which left the size of groups unrestricted, would result in a different number of participants classified as leaders. In order to investigate whether a misalignment between underlying leadership and status within the experiment exists, and what consequences it has on the empirical results, I examine the differences in behavior within groups and near the thresholds between status groups.

The analysis of within-group differences in contribution is possible because the experimenter recorded the exact order in which participants were selected into the top two groups. Since the bottom group was defined in a residual way, no within group differences can be defined there. For the top and middle groups, therefore, we can explore whether individuals selected early on into the group behave differently than fellow group members nominated later. A simple distinction is between the first half of participants selected into the group and the remaining members of the same group. Figure 4 shows mean contribution of participants by absolute status, distinguishing between the top and the bottom half of each group. Focusing on the top group, we observe that those selected first as leaders give

significantly more than those selected last ( $p=.013$ ). The middle group displays an opposite pattern, i.e. the lower-ranked components of the group contribute on average significantly more than the higher-ranked ones ( $p=.002$ ).

[Insert Figure 4 here]

Within group differences in behavior can result from the fact that the qualities related with leadership are stronger among the individuals nominated first, and progressively get diluted as we move down the ranking. Since intrinsic valuation of local public goods is a prominent quality of leaders according to qualitative and survey data, this would explain the fact that ‘top leaders’ donate more to environmental conservation than all lower-ranked participants. Indeed, once we control for observable characteristics of participants, the differences in giving between top and bottom-ranked members of a group lose significance, as shown by the results of the following regression:

$$C_{ist} = \beta_1 + \beta_2 TopHalfGroup_{is} + \beta_3 X_{is} + \beta_4 Sess_s + \varepsilon_{ist} \quad (15)$$

where  $TopHalfGroup_{is}$  is equal to 1 if  $i$  is in the top half of her group and 0 otherwise. Column 1 of Table 18 considers top group members only, while Column 2 focuses on members of the middle group. Regression results tells us that within group differences in giving are primarily driven by individual characteristics correlated with ranking order. Although not significant, the negative coefficients on the  $TopHalf - Group_{is}$  dummies suggest that giving by lower-ranked members of a group is higher than that by their fellow group members, once their individual characteristics are controlled for. This result is consistent with psychological theories of counterfactual thinking. According to this perspective, for lowest-ranked individuals within a group the most salient counterfactual is represented by members of the lower status group (because they could have easily ended there). Their behavior would therefore be driven by a feeling of being role models for those ranked below, rather than by a feeling of relative deprivation for not having reached higher positions in the ranking. The positive correlation existing between relative ranking and giving, found in the previous section (Result 1), further supports this argument.

[Insert Table 18 here]

The differences in contribution levels between participants in the lower half of the top group and those in the upper half of the middle group, significant when we run a simple t-test ( $p=.002$ ), also lose significance once we control for individuals characteristics. A similar regression to (15) is run, focusing this time only on participants around the status threshold between top and middle group:

$$C_{ist} = \beta_1 + \beta_2 \text{TopHalfMiddleGroup}_{is} + \beta_3 X_{is} + \beta_4 \text{Sess}_s + \varepsilon_{ist} \quad (16)$$

where  $\text{TopHalfMiddleGroup}_{is}$  is equal to 1 if  $i$  is in the top half of the middle group and to 0 if  $i$  is in the bottom half of the top group. The results, presented in Table 19, show that there is no statistically significant difference in contribution between the lowest-ranked among the leaders and the highest-ranked within the middle group, once we control for individual characteristics. This finding further reassures us of the ability of the ranking to reflect actual differences in individual characteristics.

[Insert Table 19 here]

The presence of within-group differences in giving has relevant implications, especially in terms of leadership effects. If the ranking process led to the inclusion of individuals with progressively weaker leadership profiles into the top group, then the leadership effects observed here are lower bounds of what we would observe, had the selection into the leaders' group been restricted to fewer individuals.

I now turn to examining the second potential source of bias generated by the ranking process. By accepting as candidates in the top two groups only those nominated by fellow session participants, the ranking may have induced the selection of leaders on the basis of friendship networks rather than individual qualities. If this were the case, the fact that leaders do not adjust their contributions to match lower ones by non-leaders, while non-leaders revise giving upwards in order to conform to leaders, could be a consequence of the

effect of friendship on influence. This outcome would result if individuals were more inclined to conform to the choices of friends than of strangers, if those, whom leaders consider friends, belonged to their own group, and if, concurrently, lower-ranked participants had more friends in the top group than in other groups. Table 20 shows average number of friends by status group among leaders and non-leaders. Overall, leaders say to have fewer friends also attending the session than non-leaders. This difference is mainly due to the smaller number of friends that leaders declare to have among lower-ranked participants, relative to non-leaders. The difference between leaders and non-leaders in the number of top-ranked friends mentioned is also small and not significant.

[Insert Table 20 here]

Table 20 shows that leaders do not appear to have significantly fewer friends among non-leaders than lower-ranked participants, and that non-leaders have only slightly more friends among leaders than top-ranked participants. This is preliminary evidence against the possibility that experimental results be driven by status-specific network differences. Still, we wish to check whether differences in friendship relationships can account for the differences we observe in contributions depending on absolute and relative status. If individuals contribute to the conservation project because it can be beneficial to their friends, the more so the needier their friends are, then giving should be increasing in the number of lower-ranked friends. Moreover, if donations are believed to please friends who will benefit from them, then we expect giving to respond to partner's group, depending on the number of friends one has in that group. I test these predictions through the following regressions:

$$C_{ist} = \beta_1 + \beta_2 LeaderFriends_{is} + \beta_3 NonLeaderFriends_{is} + \beta_4 X_{is} + \beta_5 PrivateC_{is} + \beta_6 C_{jst-1} + \beta_7 Sess_s + \varepsilon_{ist} \quad (18a)$$

$$C_{ist} = \beta_1 + \beta_2 LeaderFriends_{is} + \beta_3 PartnerLeader_{ist} + \beta_4 LeaderFriends_{is} * PartnerLeader_{ist} + \beta_5 NonLeaderFriends_{is} + \beta_6 NonLeaderFriends_{is} PartnerNonLeader_{ist} + \beta_7 PrivateC_{is} + \beta_8 C_{jst-1} + \beta_9 Sess_s + \varepsilon_{ist} \quad (18b)$$

where (18a) examines how contribution by individual  $i$  at time  $t$  depends on the number of friends  $i$  has among leaders ( $LeaderFriends_{is}$ ) and non-leaders ( $NonLeaderFriends_{is}$ ), controlling for contribution in the private decision, partner's donation in  $t-1$ , individual characteristics (including absolute status) and session fixed-effects. Regression formula (18b) adds to these variables dummies equal to 1 if  $i$ 's partner at time  $t$  is a leader ( $PartnerLeader_{ist}$ ), and interaction terms between partner's status and number of friends  $i$  has in the corresponding status category ( $LeaderFriends_{is} * PartnerLeader_{ist}$  and  $NonLeaderFriends_{is} * PartnerNonLeader_{ist}$ ). The constant in (18b) captures average contribution when  $i$ 's partner is not a leader, and regression coefficients reflect deviations from this baseline contribution level.

Table 21 shows results from (18a) in Column 1 and from (18b) in Column 2. The number of friends among leaders and non-leaders does not appear to significantly affect contributions, nor does the interaction between partner's status and number of friends  $i$  has in the corresponding status group. These findings demonstrate that leadership effects are not driven by the influence of friendship networks on status and giving.

[Insert Table 21 here]

Overall, the results presented in this section reassure us of the ability of ranking within the experiment to reflect leadership status within the community, and mitigate concerns that leadership effects observed here may be a by-product of the specific ranking procedure used. On the contrary, the ranking process, by assigning leadership status to as many as one-third of participants, may have attenuated its effects.

## 7. Mechanisms

This section reviews the experimental results with the purpose of interpreting them in light of existing theories of social preferences, learning and social comparison. In the course of the analysis, evidence in support or against specific perspectives will be offered. This section is not meant to offer an exhaustive account of all theoretical perspectives that can

account for the empirical results presented so far. The goal of this review is simply to focus on specific theoretical frameworks and discuss their consistency with the experimental data.

A common framework used in economics to explain social influence is offered by models of learning (Conlisk, 1980; Banerjee, 1992; Bikhchandani et al., 1992). Under this perspectives, individuals conform because others' choices convey information about the value of alternative outcomes under consideration. The heterogeneity in the tendency to conform that we observe between leaders and non-leaders can be explained by assuming that information conveyed by leaders' choices is more valuable, and thus individuals conform more to the actions of leaders than of lower-ranked peers. If learning were the only mechanism at work, we would observe a decreasing marginal effect of information, reflected in the likelihood that observing others' choices induces individuals to revise their own. Observing a decreasing frequency of revisions over time would, therefore, be evidence of the role of learning within the experiment. The frequency of revisions is 77.8%, 77.1%, 78.1% and 79.1% in the first, second, third and fourth round respectively. Rather than decreasing, the frequency of revisions increases over time, which is evidence against the presence of powerful learning effects within the experiment.

Signaling theories of altruism also predict a positive correlation between own and others' contribution, stronger when the latter are of higher status (Glazer & Konrad, 1996; Harbaugh, 1998). According to these models, agents' pro-social behavior is motivated by the desire to gain approval from their peers. Such desire is stronger the more respected their peers are. In the setting of this study, these assumptions imply that low status participants contribute to the public good in order to impress their high status partners. Upon observing their high-ranked counterparts contribute less than they did, and realizing that approval could be bought more cheaply, they reduce their donations. The same framework predicts the low tendency to conform to the choices of lower-ranked partners on the part of leaders. The role of giving as a signal of desirable qualities to others depends on the fact that contribution choices are observable. When they are not, the signaling motive to contribute disappears. In order to test whether this motive is at work within the experiment, individual contributions are compared depending on whether they are observable or not. Table 22 shows results from the following regressions:



$$C_{ist} = \beta_1 + \beta_2 \text{Observed}_{ist} + \beta_3 C_{jst-1} + \beta_4 ID_{is} + \varepsilon_{ist} \quad (19a)$$

$$C_{ist} = \beta_1 + \beta_2 \text{PartnerLeader}_{ist} + \beta_3 \text{Observed}_{ist} + \beta_4 \text{PartnerLeader}_{ist} * \text{Observed}_{ist} \\ + \beta_5 C_{jst-1} + \beta_6 ID_{is} + \varepsilon_{ist} \quad (19b)$$

where (19a) regresses  $i$ 's contribution at time  $t$  on whether the choice was observed, partner's contribution at  $t-1$  and individual fixed-effects (Column 1), while (19b) tests whether the effect of observability depends on  $i$ 's partner being a leader (Column 2). Regression results show that contribution amounts are not significantly higher depending on whether choice is observed or not. The status of the partner also doesn't matter. These findings are inconsistent with the presence of signaling motives behind participants' choices. However, signaling models claim that individuals care about projecting a good image not just to others, but also to themselves (Benabou & Tirole, 2006). Unfortunately the available data does not allow testing whether self-signaling motives are relevant within the experiment.

[Insert Table 22 here]

Theories of inequity aversion make predictions consistent with the empirical findings of this study: after observing others' contribution amounts, individuals revise their choices so as to minimize payoff inequality. Moreover, these models assume that agents are more averse to disadvantageous inequality, and thus more likely to reduce giving after learning that their partners earned more, than to increase it after learning that their partners earned less. Although no formal test exists of whether inequity aversion is at work within the experiment, a remark can be made. According to inequity aversion theory, we would expect revisions choices by bottom group members to be correlated with the perceived income of top-ranked individuals: if top group members are believed to be the richest in the community, then by earning more than others through the experiment they would further increase inequality. Inequality would be reduced instead if leaders were believed to be the poorest in the community. In the survey, participants were asked if they thought that top group members were among the richest people in the community. Only 24% of bottom-

ranked participants answered affirmatively to this question. Moreover, the probability that low status participants decrease giving in  $t$  after learning that their top-ranked partners gave less than they did in  $t-1$ , is not correlated with the belief that top-ranked partners are rich.

As for reciprocity models, the asymmetry we observe in revision patterns is consistent with what Charness and Rabin (2002) call ‘concern withdrawal’: individuals do not display strong positive reciprocity, but are quick to withdraw their concern for other agents’ wellbeing when the latter act uncooperatively. This theoretical framework can account for the fact that participants to the experiment tend to revise giving downwards more than upwards, and for the absence of effects of observability.

In order to explain why the tendency to conform to others’ actions is negatively correlated with individuals absolute and relative ranking, all theories reviewed so far need to be combined with models of social comparison, which argue that agents look upwards on the status ladder when assessing their own behavior. Survey data confirm that participants’ opinions on their own ability to influence others depend on status: asked to rate on a scale from 1 to 4 - where 1 is ‘very’ and 4 is ‘not at all’ - how much influence they had on community outcomes, leaders and non-leaders’ mean answers were on average 1.4 and 1.7 respectively. Such difference is statistically significant ( $p=.011$ ), even more so if we focus on moral leaders ( $p=.006$ ), whose answer was 1.3 on average.<sup>7</sup>

The only models that do not require to be complemented by social comparison theories, in order to account for the different behavioral patterns that we observe in the data, are social norms and conformity models. There, the asymmetry between upward and downward revision amounts results from that between honor from complying with the norm and shame from deviating from it. Moreover, the presence of differences in honor and stigma depending on individual status would justify the different revision patterns by leaders and non-leaders. Honor from complying could be decreasing in status, thus explaining lower-ranked willingness to revise contributions upwards upon observing higher-ranked partners donate more. On the other hand, the shame from not contributing could be

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<sup>7</sup> While social comparison theories can account for leadership effects in giving and revision choices, they cannot explain the fact that bottom-ranked participants within a group contribute more than top-ranked members of the same group. We noted that theories of counterfactual thinking can explain why participants, who just missed-out being in a lower group, tend to compare themselves primarily to lower-ranked peers and feel the responsibility of being role models for them, much in the same way as leaders feel towards non-leaders. While interesting, this effect is not significant once individual characteristics are controlled for.

increasing in status, which would explain why leaders fail to conform to lower-ranked partners who contribute lower amounts. The presence of context-dependent social norms has been demonstrated by empirical studies (Krupka & Weber, 2010), showing how people's opinions on what is appropriate behavior are strongly dependent on the decision environment. Since differences across, and within, groups enter the definition of participants' choice environment in the setting of this study, theories of social norms would predict them to be associated with heterogeneities in individual behavior.

To summarize, among social preference theories, some appear to perform better than others in explaining the main empirical findings of this study. In particular, theories of conformism and social norms, and a combination of reciprocity and social comparison models appear to be capable of explaining the larger set of empirical findings from this study. This is, of course, no conclusive evidence in favor of one perspective over others. On the contrary, different mechanisms may combine to produce observed behavior. Further experiments would be needed to formally test the predictive power of the different theories reviewed in this section.

## 8. Conclusions

Through a novel methodological approach, combining a participatory ranking exercise, which identified different types of existing leaders within the community, and a public-good game, in which participants contributed to an actual biodiversity conservation project, this paper has shown that the presence of leaders is associated with higher and more stable contributions by the group over time. First, leaders give more, and this by itself makes total pair contribution significantly higher when leaders are part of it. Second, top-ranked individuals show a low tendency to conform to (lower) partners' contribution. These results are driven by the combination of leaders' high valuation of the local public good provided through their donations, and of a general positive relationship between relative status and giving, both on average and over time. These effects are enhanced when leadership is defined along a dimension that is relevant for the decision under consideration. The results also show that, beyond the general relationship between relative status and behavior, non-leaders' actions do not significantly vary depending on whether their partners are leaders.

It is an established fact in sociology and economics that innovation processes take off when opinion leaders and highly connected individuals decide to adopt (Rogers, 1962; Katz & Lazarsfeld, 1955). In practice, identifying these key individuals in unfamiliar settings may be challenging and costly. This study presents a solution to the targeting problems, by demonstrating how a simple ranking exercise can help identify natural leaders within a community. The empirical results presented here suggest that the identity of effective leaders depends on the nature of the decision under consideration. For leaders to feel responsibility as role models, it is therefore crucial that they are selected on the basis of characteristics salient to the specific issue at hand. Once these conditions are fulfilled, this study suggests that interventions targeted to local leaders, for instance environmental education programs, may have a significant impact on the broader community.

The results from this study go against conventional wisdom in development economics. The literature on community driven development warns against the risk of elite capture of development programs and looks at the power of local elites as a negative factor. I show instead that elites can play a positive role. This result may depend on the way leaders are selected within the experiment or on other social and cultural features of the study area. Indeed, the ranking process provided legitimacy to leaders in the context of the experiment. Testing the robustness of the experimental findings to leaders' selection process and characteristics could be an interesting direction for further research.

Generalizability of the results could be interestingly explored along two other dimensions, which would address limitations of this study. First, the positive role played by local leaders in the experiment may depend on specific features of the experimental design. In particular, before deciding how much to contribute, participants discussed the qualities of top group members for each ranking. By spelling out what was expected of them, this discussion may have influenced top group members' behavior. The notion that placing responsibility for the common good in the hands of local elites could have a positive effect on their conduct has great policy relevance and would deserve further empirical testing.

Second, this study shows that social status affects choices when individuals face a decision with a strong normative content. The 'right' choice there depends more on ethical concerns than on objective considerations. Still, the experiment faces participants with a decision whose outcomes are uncertain. Under this respect, the decision environment within

the experiment is similar to those confronting farmers when they take information-based choices, such as technology and innovation adoption. An additional direction for further research would explore the role of leadership for behavior transmission in decision contexts with varying ethical and informational contents.

Besides its limitations and possible extensions, this research is the first to identify the effect of different types of naturally occurring leadership on group cooperation. Field experiments offer a unique opportunity to investigate long-term determinants of the voluntary provision to public goods in a natural environment. This experiment demonstrates that the presence of leaders can lead to improvements in group cooperation, especially if leadership is based on criteria relevant to group decisions and on legitimate selection processes.

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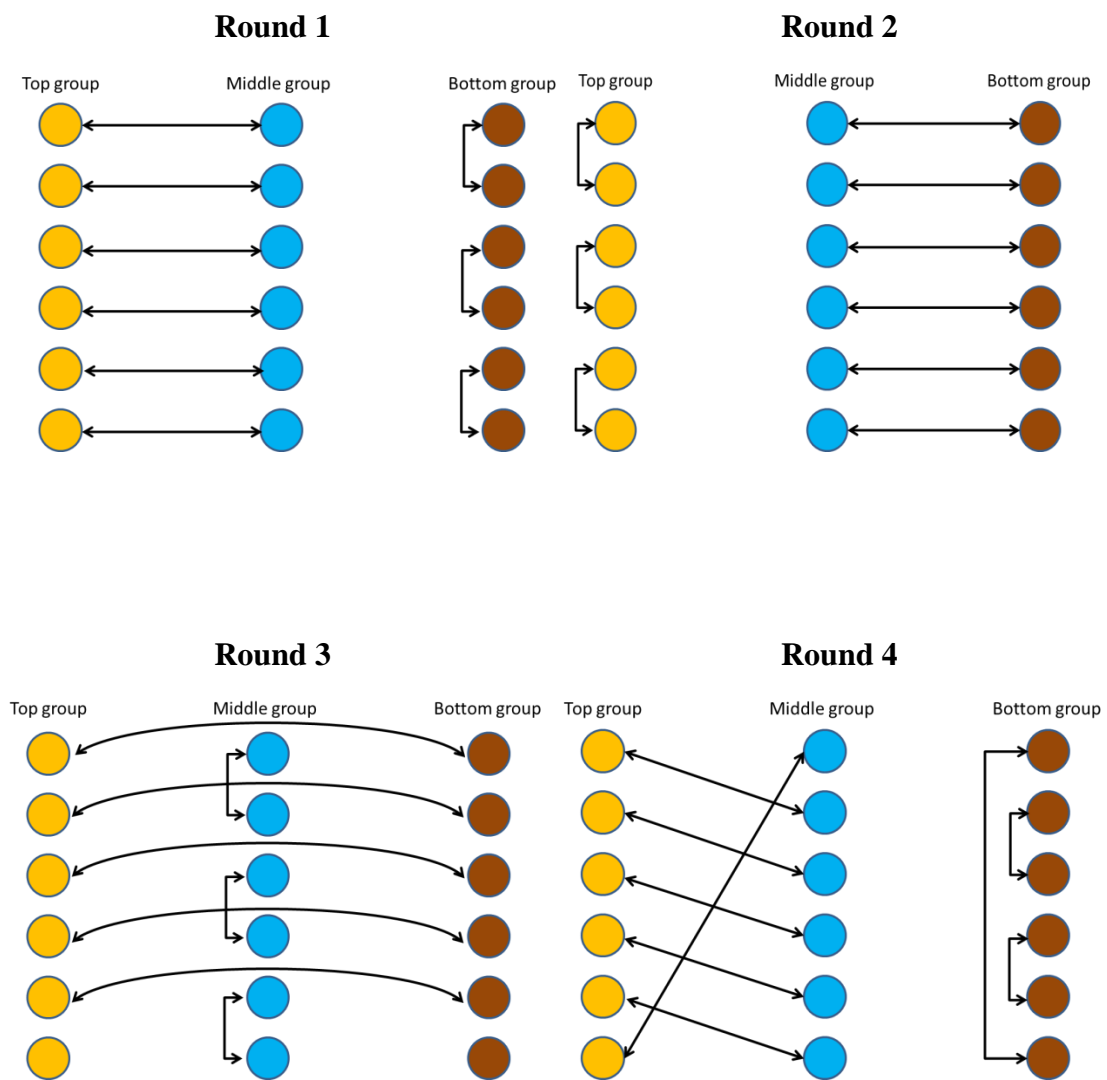
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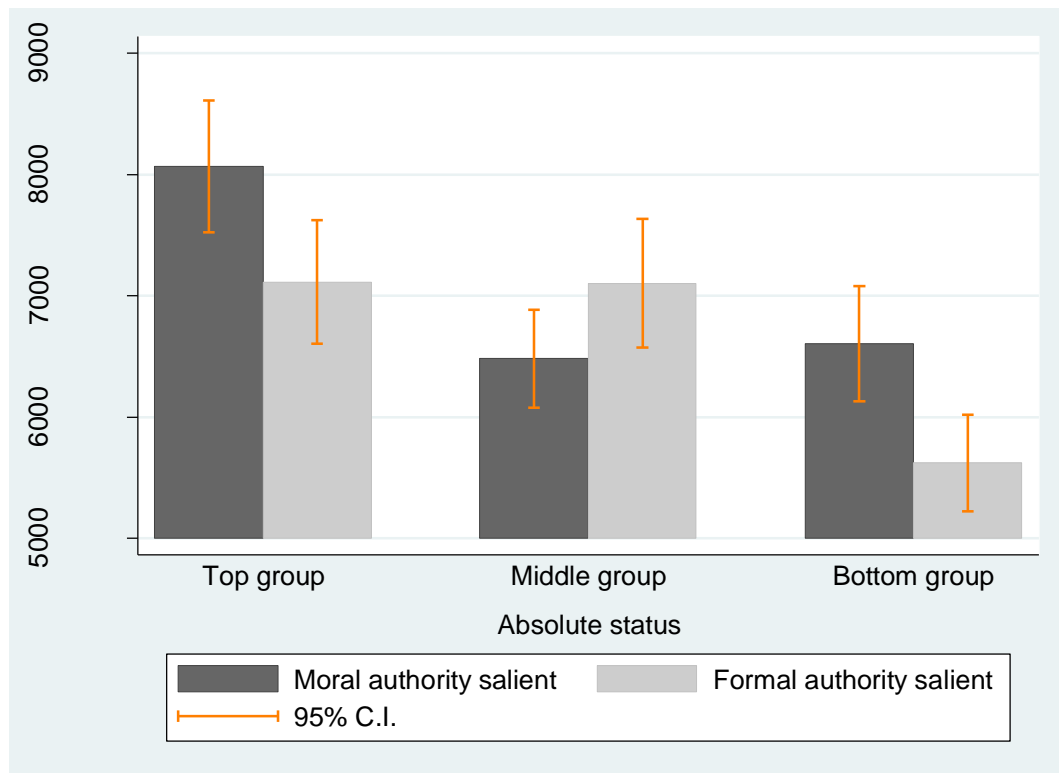
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## Tables and figures

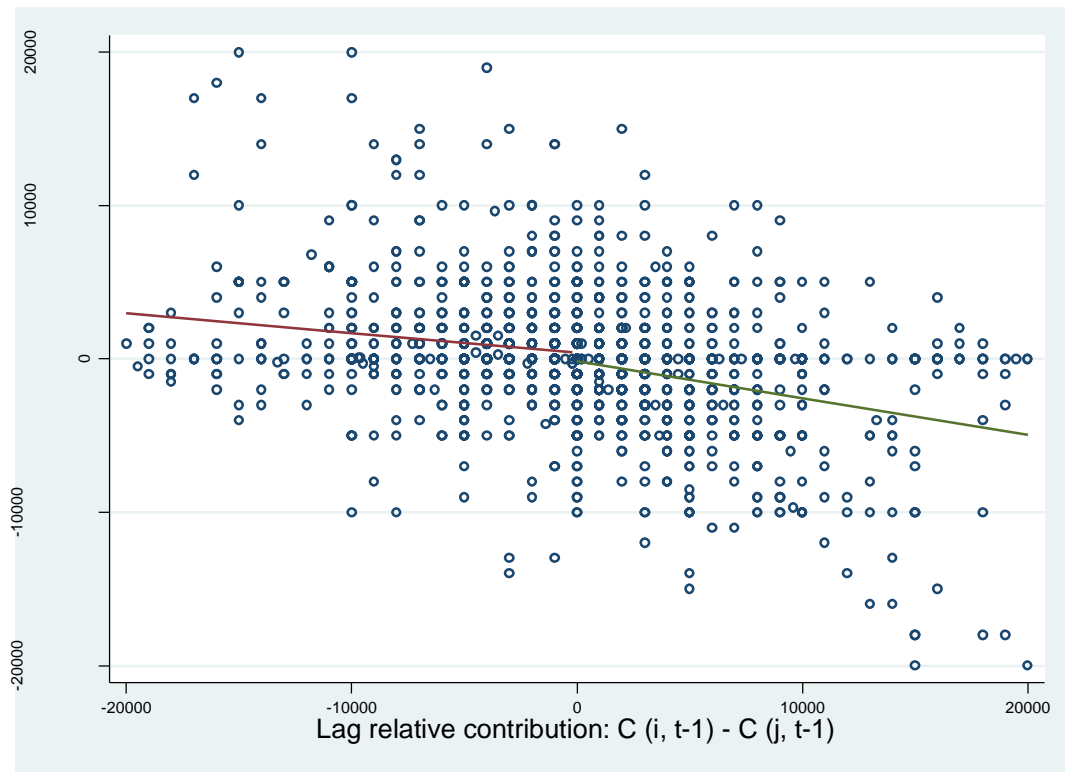
Figure 1. Pair formation over rounds, an example



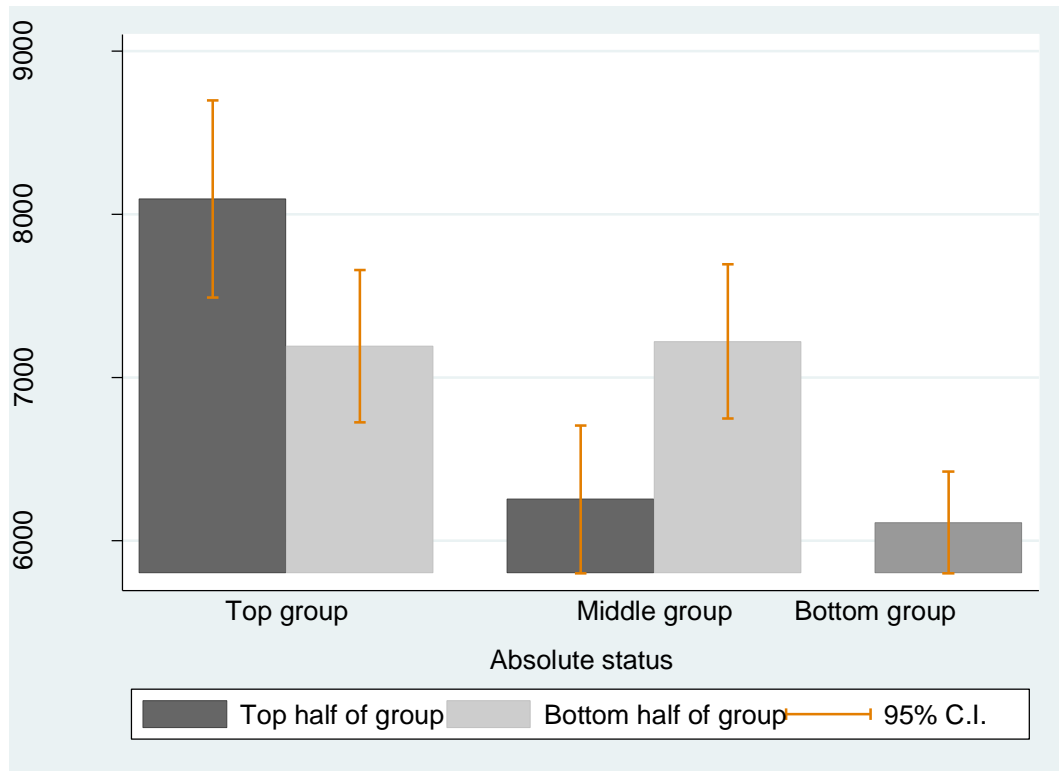
**Figure 2. Contribution by absolute status, over type of authority salient**



**Figure 3. Revision amount and lag relative giving**



**Figure 4. Within group differences in contribution**





**Table 1. Structure of session**

<b>Decision</b>	<b>Round</b>	<b>Partner</b>
1	Private	
2-3-4	1	A
5-6-7	2	B
8-9-10	3	C
11-12-13	4	D

**Table 2. Decision environment within rounds**

	<b>Partner's rank known</b>	<b>Partner's previous choice known</b>	<b>Partner will know own current choice</b>
1 <sup>st</sup> choice of round	Y	N	Y
2 <sup>nd</sup> choice of round	Y	Y	Y
3 <sup>rd</sup> choice of round	Y	Y	N

**Table 3. Participants' characteristics**

	Mean n = 251	Std. Dev.
Age	41.94	[14.93]
Female (%)	39.84	[.49]
Household size	5.16	[2.11]
No education (%)	10.36	[.31]
Primary school (%)	41.83	[.49]
Secondary school (%)	40.64	[.49]
More than secondary school (%)	7.1	[.26]
Individual income, previous week (Pesos)	35,146	[56,397]
Farming main source of income (%)	65.74	[.48]
Farm size (he)	2.34	[6.55]
Owens livestock (%)	10.44	[.31]
Suffered income loss due to environmental shock, previous year (%)	78.09	[.41]
Number of session participants who say ID is friend or relative	3.65	[3.19]
Number of community associations in which ID has a leadership role	.339	[.60]
Member of ASPROCIG (%)	56.97	[.49]

**Table 4. Correlation between rankings**

	Formal authority ranking	Moral authority ranking	Traditional authority ranking
Formal authority ranking	1		
Moral authority ranking	0.351*	1	
Traditional authority ranking	0.130*	-0.149*	1.0000

Note: \* significant at 10%, \*\* significant at 5%, \* significant at 1%

**Table 5. Characteristics correlated with status**

	Dependent variable			
	Formal	Moral	Traditional	Average rank
	authority rank	authority rank	authority rank	
	(1)	(2)	(3)	(4)
Age	0.037*** (0.014)	0.065*** (0.014)	0.021* (0.013)	0.063*** (0.012)
Female	-0.774** (0.317)	-0.581* (0.329)	-0.125 (0.281)	-0.830*** (0.281)
Married	0.252 (0.346)	-0.216 (0.403)	-0.357 (0.364)	-0.178 (0.325)
HH dependency ratio	0.224 (0.272)	0.248 (0.195)	-0.070 (0.228)	0.252 (0.208)
No children in HH	0.431 (0.504)	-0.298 (0.510)	-0.313 (0.462)	0.021 (0.493)
Primary education	1.587*** (0.548)	1.039* (0.542)	-0.660 (0.589)	0.990** (0.463)
Secondary education	2.725*** (0.657)	1.663*** (0.595)	-0.124 (0.636)	2.215*** (0.524)
More than secondary education	4.013*** (0.905)	3.600*** (0.979)	-1.377 (0.912)	2.770*** (0.828)
HH income per capita over previous week (000 Pesos)	0.014 (0.011)	0.012 (0.012)	0.007 (0.012)	0.016 (0.012)
Number of session participants who say ID is friend or relative	0.120*** (0.046)	0.183*** (0.043)	0.054 (0.046)	0.176*** (0.042)
Number of community associations in which ID has a leadership role	1.090*** (0.313)	0.190 (0.265)	0.394* (0.213)	1.029*** (0.286)
Member of ASPROCIG	-0.624* (0.354)	-0.657* (0.359)	-0.052 (0.321)	-0.808** (0.335)
Session fixed-effects	x	x	x	x
Number of Obs	251	251	251	251
Pseudo R-squared	0.177	0.140	0.038	0.136

Note: Ordered logit regression. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 6. Characteristics correlated with contribution**

	Dependent variable	
	Avg C <sub>i</sub>	
	C <sub>i</sub> private	(Round 1-4)
	(1)	(2)
Age	-28.189 (27.939)	-16.663 (23.112)
Female	34.609 (657.014)	-0.131 (539.432)
Married	792.991 (736.237)	850.110 (596.784)
HH dependency ratio	-847.703 (565.130)	-484.722 (530.083)
No children in HH	-1827.128* (1011.780)	-564.614 (826.932)
Primary education	-808.227 (1220.035)	430.157 (1117.748)
Secondary education	-416.414 (1422.804)	1348.755 (1266.919)
More than secondary education	-231.710 (1909.158)	1031.941 (1756.634)
HH income per capita over previous week (000 Pesos)	17.065 (23.124)	25.675 (21.199)
Number of session participants who say ID is friend or relative	-57.667 (97.889)	50.812 (82.372)
Number of community associations in which ID has a leadership role	267.468 (573.127)	224.303 (516.249)
Member of ASPROCIG	1441.665** (692.492)	1452.707** (572.798)
Constant	675.138** (2185.343)	1691.230 (1613.899)
Session fixed-effects	x	x
Number of Obs	251	251
R-squared	0.293	0.409

Note: Linear regression. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%,

\* significant at 1%.

**Table 7. Total pair contribution by pair composition**

	Dependent variable
	Total pair contribution
	(1)
Pair features at least one leader	1694.548*** (469.787)
Constant	6402.576*** (595.157)
Session fixed-effects	x
Number of Obs	1791
Number of Clusters	251
R-squared	0.414

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 8. Leadership and individual contribution**

	Dependent variable	
	Contribution	
	(1)	(2)
Leader	1112.831** (555.550)	850.697 (635.719)
Constant	3314.099*** (442.800)	2358.563* (1422.506)
Individual characteristics		x
Session fixed-effects	x	x
Number of Obs	3262	3262
Number of Clusters	251	251
R-squared	0.278	0.301

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, and ASPROCIG membership. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 9. Higher relative status and contribution, individual fixed-effects**

	Dependent variable Contribution
	(1)
Higher rank	286.177** (127.168)
Constant	6773.655*** (71.115)
Individual fixed-effects	x
Number of Obs	3262
R-squared	0.020

Note: Linear regression with fixed-effect estimator. Robust standard errors in parentheses.

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

**Table 10. Contribution, relative and absolute status**

	Dependent variable
	Contribution
	(1)
Higher rank	1733.036*** (414.924)
Leader	1205.207* (727.573)
Middle rank	623.835 (551.528)
Higher rank*Leader	-1630.455*** (442.896)
Higher rank*Middle rank	-1761.525*** (463.007)
Constant	2120.446 (1396.808)
Individual characteristics	x
Session fixed effects	x
Number of Obs	3262
Number of Clusters	251
R-squared	0.305

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, and ASPROCIG membership. \* significant at 10%, \*\*significant at 5%, \* significant at 1%.



**Table 11. Contribution among non-leaders, by partner's status**

	Dependent variable	
	Contribution	
	(1)	(2)
Non-Leader	-1165.471** (554.387)	-903.635 (633.122)
Partner Leader	-103.179 (154.774)	-102.798 (154.832)
Non Leader*Partner leader	176.661 (214.683)	177.582 (214.948)
Constant	4457.533*** (538.071)	3239.405** (1540.322)
Individual characteristics		x
Session fixed-effects	x	x
Number of Obs	3262	3262
Number of Clusters	251	251
R-squared	0.278	0.302

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses.

Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, and ASPROCIG membership.

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

**Table 12. Total pair contribution by type of leadership salient**

	Dependent variable
	Total pair contribution
	(1)
Moral leadership salient	2420.960*** (601.010)
Constant	5043.476*** (291.364)
Session fixed-effects	x
Number of Obs	1791
Number of Clusters	251
R-squared	0.406

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 13. Total pair contribution over time, by pair composition**

	Dependent variable	
	Total pair contribution	
	(1)	(2)
Pair features at least one leader	649.074 (538.900)	602.617 (540.681)
Decision (t)	-69.678 (45.396)	-382.337*** (125.519)
Pair features at least one leader*Decision (t)	114.752* (62.103)	121.034* (62.274)
Constant	6918.722*** (1196.125)	10839.754*** (1871.020)
Round fixed-effects		x
Session fixed-effects	x	x
Number of Obs	3010	3010
R-squared	0.414	0.415

Note: Random effect model with GLS estimator. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

**Table 14. Contribution revision by lag relative contribution**

	Dependent variable	
	Likelihood of upward revision	Likelihood of downward revision
	(1)	(2)
Gave more than partner in t-1	-0.154*** (0.031)	0.219*** (0.032)
Gave less than partner in t-1	0.215*** (0.031)	-0.171*** (0.032)
Constant	0.288*** (0.026)	0.336*** (0.027)
Individual fixed-effects	x	x
Number of Obs	2008	2008
R-squared	0.122	0.126

Note: Linear probability fixed-effect model. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

**Table 15. Leadership and contribution revision**

	Dependent variable			
	Amount of upward revision	Likelihood of upward revision	Amount of downward revision	Likelihood of upward revision
	(1)	(2)	(3)	(4)
Leader	-370.779 (225.771)	0.017 (0.029)	-115.848 (236.724)	0.026 (0.037)
Gave less than partner in t-1	677.073*** (204.746)	0.346*** (0.032)		
Leader*Gave less	-17.716 (320.127)	-0.055 (0.051)		
Gave more than partner in t-1			2022.197*** (236.861)	0.399*** (0.031)
Leader*Gave more			-587.138* (320.199)	-0.138*** (0.050)
Constant	793.078*** (295.595)	0.232*** (0.055)	335.282 (276.911)	0.247*** (0.061)
Session fixed-effects	x	x	x	x
Individual controls	x	x	x	x
Number of Obs	1288	2008	1380	2008
Number of Clusters	251	251	251	251
R-squared	0.081	0.094	0.154	0.117

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, ASPROCIG membership, private contribution and lag partner contribution. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

**Table 16. Higher relative status and contribution revision**

	Dependent variable			
	Amount of	Likelihood of	Amount of	Likelihood of
	upward	upward	downward	upward
	revision	revision	revision	revision
	Linear		Linear	
	OLS	probability	OLS	probability
	(1)	(2)	(3)	(4)
Higher rank	-99.662 (220.488)	0.004 (0.031)	186.167 (218.605)	0.039 (0.033)
Gave less than partner in t-1	690.319*** (215.031)	0.418*** (0.031)		
Higher rank*Gave less	-250.190 (298.650)	-0.089** (0.044)		
Gave more than partner in t-1			1880.184*** (213.109)	0.450*** (0.031)
Higher rank*Gave more			-315.404 (287.742)	-0.086* (0.045)
Constant	1201.033*** (150.132)	0.225*** (0.021)	248.549 (225.197)	0.065** (0.032)
Individual fixed-effects	x	x	x	x
Number of Obs	1288	2008	1380	2008
R-squared	0.028	0.120	0.074	0.127

Note: Linear regression fixed-effects models. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 17. Contribution revision of non-leaders, by partner's status**

	Dependent variable			
	Amount of	Likelihood of	Amount of	Likelihood of
	upward revision	upward revision	downward revision	upward revision
	(1)	(2)	(3)	(4)
Partner leader	-4.423 (270.791)	-0.016 (0.035)	105.589 (251.039)	0.035 (0.034)
Gave less than partner in t-1	479.797* (273.864)	0.400*** (0.038)		
Partner leader*Gave less	129.885 (360.380)	0.028 (0.052)		
Gave more than partner in t-1			2026.313*** (285.923)	0.471*** (0.038)
Partner leader*Gave more			24.434 (363.435)	-0.009 (0.053)
Constant	1230.815*** (178.563)	0.221*** (0.024)	235.728 (280.841)	0.047 (0.036)
Individual fixed-effects	x	x	x	x
Number of Obs	848	1344	914	1344
R-squared	0.028	0.130	0.084	0.154

Note: Linear regression fixed-effects models. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.

**Table 18. Within-group differences in contribution**

	Dependent variable	
	Contribution	
	Top group	Middle group
	(1)	(2)
Top half group	-147.762 (597.453)	-634.577 (678.082)
Constant	-3069.344* (1636.405)	2734.291 (2490.071)
Session fixed-effects	x	x
Individual characteristics	x	x
Number of Obs	664	671
Number of Clusters	251	251
R-squared	0.683	0.435

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, ASPROCIG membership, private contribution and lag partner contribution.

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

**Table 19. Differences in contribution between bottom half of leaders' group and top half of middle group**

	Dependent variable
	Contribution
	(1)
Top half - Middle group	208.235 (537.867)
Constant	-538.975 (1768.173)
Session fixed-effects	x
Individual characteristics	x
Number of Obs	671
R-squared	0.576

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses. Individual characteristics include: age, gender, education, number of community associations in which *i* holds leadership roles, number of participants to the session who say that *i* is a friend or relative, and ASPROCIG membership, private contribution and lag partner contribution.

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

**Table 20. Friendship networks by status**

	Not		p-value
	Leaders	Leaders	
Total number of friends	5.16	5.47	.398
Number of friends in leaders' group	2.19	2.28	.655
Number of friends not in leaders' group	2.96	3.19	.400

**Table 21. Contribution and friendship networks**

	Dependent variable	
	Contribution	
	(1)	(2)
Number of friends in leaders' group	-17.019 (175.009)	-15.716 (183.417)
Number of friends not in leaders' group	-75.253 (119.041)	-40.363 (118.901)
Partner is leader		-148.803 (318.702)
Number of friends in leaders' group*Partner leader		-6.353 (104.141)
Number of friends not in leaders' group*Partner not leader		-53.455 (70.273)
Constant	-1410.246 (1422.767)	-1344.836 (1431.204)
Individual characteristics	x	x
Session fixed-effects	x	x
Number of Obs	1999	1999
Number of clusters	251	251
R-squared	0.465	0.466

Note: Random effect model with GLS estimator. Standard errors clustered at the individual level in parentheses.

Individual characteristics include: age, gender, education, number of community associations in which  $i$  holds leadership roles, number of participants to the session who say that  $i$  is a friend or relative, ASPROCIG membership, private contribution, lag partner contribution and absolute status. \* significant at 10%, \*\*significant at 5%, \* significant at 1%.

**Table 22. Contribution and choice observability**

	Dependent variable	
	Contribution	
	OLS (1)	OLS (2)
Choice observed	32.374 (124.752)	45.033 (153.026)
Partner is leader		16.551 (192.977)
Choice observed*Partner is leader		-37.832 (264.339)
Constant	5964.803*** (134.397)	5959.084*** (145.875)
Individual fixed-effects	x	x
Number of Obs	2007	2007
(Pseudo) R-squared	0.029	0.029

Note: Linear regression fixed-effects models. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \* significant at 1%.



## Appendix A

**Table A1. Top 5 qualities of top-ranked individuals, by ranking type**

<i><b>Formal authority ranking</b></i>	
Are active in the community, think about the common good	22%
Have experience, knowledge and capacity to solve community problems	15%
Are in good relationships with the mayor	13%
Are leaders, influential people in the community	8%
Are trusted, respected	8%
Know the problems of the community	8%
<i><b>Moral authority ranking</b></i>	
Speak well, have good argument, are persuasive	23%
Are diplomatic, pacific, conciliatory	21%
Have moral qualities: responsible, serious, honest, determined	12%
Are in good relationships with community members	11%
Have experience, knowledge, capacity to solve community problems	10%
<i><b>Traditional authority ranking</b></i>	
Are happy and funny	24%
Are talented, have charisma	19%
Are extroverted and enthusiastic	15%
They have experience and skills, know many stories	14%
They are dynamic and creative	10%

Note: Percentages are derived from the ratio between the number of times a certain quality was mentioned in the discussion and the total number of qualities mentioned.

## **Chapter II. Motivation Crowding in Environmental Protection: Evidence From an Artefactual Field Experiment**

### **1. Introduction**

Common-pool resources (CPR) are characterized by non-excludability and rivalry in consumption. The difficulty of excluding individuals from use and the fact that consumption by one individual reduces the amount of resource available to others imply that CPR users face a typical cooperation dilemma. Each individual depends on the resource for her livelihood and has the incentive to maximize her own benefit by increasing extraction. However, if everyone follows the same rationale, the resource will be depleted and will not generate benefits for anyone in the long term. In an influential article, Hardin (1968) claims that the behavior of rational, self-interested individuals is bound to result in overexploitation of CPR. This conclusion is consistent with game theoretical predictions and is confirmed by numerous examples of overharvesting of renewable natural resources, such as fisheries, forests and groundwater.

Solutions to the cooperation dilemma have focused on the establishment of external regulations for extraction, property rights to the resource or, more recently, payment for environmental services schemes. These interventions assume that individuals are rational and self-interested. However, research on CPR management questions this vision, by offering evidence of effective cooperation to solve commons problems. Field experiments show that collective action is most effective when communities are able to self-organize, design and enforce their own rules (Wade, 1986; Ostrom, 1990; Baland and Platteau, 1996). Other studies report cases in which changes from a system of self-governance to one of external regulation generate a shift from community norms of cooperation to selfish strategies of extraction (Ostrom, 2006; Vatn, 2006).

One explanation for the failure of external interventions on the sustainability of CPR management is that these measures crowd-out intrinsic motivation, leading to a change in behavior among community members. Individuals may engage in conservation of CPR because they think it is important or because they feel a moral duty to do so. If this is the case, the introduction of external regulations or incentives can change people's perception of the behavior. Voluntary goodwill is turned into a market-like interaction, resulting in

fewer people willing to sacrifice for the common good. Benabou and Tirole (2006) argue that motivation crowding acts through the effect of external incentives on individual social and self-image. By lowering the value of pro-social choices as signals of one's own moral qualities, external incentives can crowd-out individuals' intrinsic motivation to behave pro-socially. The empirical relevance of the crowding-out effect is confirmed by a number of studies, starting from Titmuss' (1970) seminal contribution on blood donation. Field experiments show that pro-social behavior decreases after the introduction of monetary rewards (Frey and Gotte, 1999; Frey et al., 1996) and that the crowding-out effect is heterogeneous across individuals (Charness and Gneezy, 2009).

This study uses an artefactual field experiment on CPR conservation to explore two under-researched issues in the literature on crowding-out. The first is the effect of non-monetary and non-regulatory external incentives on motivation crowding in a field setting. The second is the heterogeneity of motivation crowding effects depending on individuals' intrinsic motivation. This topic is best explored using an artefactual field experiment as methodological tool. This type of experiment selects its participant pool from actual users of the natural resource and confronts participants with a natural task, reflecting the trade-off between individual short-term and social long-term benefits that they face in their daily use of the CPR.<sup>8</sup> Survey data complement the experimental results, which makes it possible to examine the effect of cultural, social and other contextual factors on individual behavior.

The experiment was conducted in two rural villages in the South-East of Bolivia, with users of forest and groundwater resources. The experimental choice was that of contributing to the conservation of these CPR. By donating part of their endowment, participants could finance the purchase and planting of trees around the water source and thus increase the future social benefits from CPR. The design introduced external incentives to donate, in the form of priming for socially approved behavior. The empirical analysis investigates whether the effect of priming differs depending on participants' intrinsic motivation, captured by their level of civic engagement and individualism. The data analysis also examines whether motivation crowding acts through the effect of incentives on social or self-image, by exploiting the public nature of choice under one experimental treatment and existing relationships between participants observing each other's choices.

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<sup>8</sup> For a discussion of different types of experiments used in CPR research, see Anderies et al. (2011).

On average, participants contribute a positive amount, around two-fifth of their endowment. This result is consistent with the presence of a social norm of cooperation for the conservation of CPR. All treatments have a positive effect on contributions to the reforestation project by individualistic participants. On the contrary, civically engaged individuals appear less sensitive to the priming embodied in the experimental treatments. When decisions are private, individuals who belong to the same family or community associations give similar amounts. When decisions are public, the amounts donated by members of the same family are more diverse, while those donated by members of the same community associations are still homogeneous. The different effect on observable and unobservable choices of sharing a social link in the public rather than in the private sphere is interpreted as evidence of the role of social image on pro-social behavior.

The next section examines relevant contributions in the literature on crowding-out and CPR management and presents testable predictions. Section 3 describes the setting and design of the study. The experimental results are discussed in Section 4. Section 5 concludes with some policy implications for the design of CPR interventions.

## **2. Literature and behavioral predictions**

According to Frey and Stutzer (2006), three conditions increase the probability that external incentives lead to crowding-out of pro-social behavior. Crowding-out is more likely to occur if incentives are perceived as restrictive and controlling; if they reduce the degree of individual self-determination; and if the setting in which they are introduced is one where norms of cooperation and reciprocity are in place. In this section, I will present theoretical contributions and empirical evidence in support of these claims, focusing in particular on experimental studies that show these effects at work in the realm of CPR management.

A number of theoretical studies model the mechanisms behind motivation-crowding effects. Two main approaches are used. In the first, external incentives affect intrinsic motivation by changing preferences (Frey, 1997). The second approach models external interventions as changing the perceived nature of a task, the task environment or the agent's self-perception, and through these channels influence the motivation to perform the task. Benabou and Tirole (2006) claim that external incentives affect intrinsic motivation to behave altruistically by lowering the signaling value of pro-social choices. Ellingsen and

Johannesson (2008) also formalize the damaging effect on morale of pecuniary incentives and control systems.

Frey and Jegen (2002) offer a review of motivation crowding theory, where they discuss two psychological processes behind the effect of external incentives on intrinsic motivation. The first process focuses on self-determination: external interventions perceived to impair self-determination, reduce intrinsic motivation by replacing it with external control. The second channel focuses on self-esteem: an agent's intrinsic motivation is rejected by interventions that do not acknowledge her involvement and competence. Intrinsically motivated individuals are deprived of their chance of showing their involvement in an activity when someone offers a reward or orders them to do it (Frey and Jegen, 2002).

Monetary sanctions and restrictive regulatory systems have been shown to lead to lower levels of pro-social behavior in a wide range of settings. In a field experiment, Gneezy and Rustichini (2000) look at the introduction of fines for parents who arrive late to pick-up their kids from a day-care center. Introducing the fines leads to an increase in late arrivals by parents. Even after the removal of the fine, the initial level of cooperation by parents cannot be reached anymore. In a laboratory experiment, Falk and Kosfeld (2006) show that similar crowding-out effects are produced by the introduction of regulations restricting participants' choice set in a principal-agent relationship.

The existing literature also demonstrates how the crowding-out effect is heterogeneous depending on individual level of intrinsic motivation. Charness and Gneezy (2009) conduct a field experiment in which they introduce monetary incentives to encourage people to exercise. The incentives have a different impact on gym attendance depending on its level before the introduction of the reward: a positive one on non-regular attendees, and a negligible, and negative, one on individuals who previously attended the gym regularly. The crowding-in effect of incentives prevails for individuals with low intrinsic motivation, while this effect is absent, or even reversed, for highly motivated subjects.

In the field of CPR management, a large number of artefactual experiments focus on the effect of the introduction of regulation by an external authority. When sanctions are imposed without negotiation with resource users they cause crowding-out by undermining self-determination and shifting responsibility away from users to an outside entity (Ostmann

et al., 1997; Cardenas et al., 2000). Experiments show that giving CPR users the possibility to decide over rules increases the efficiency of the management system. Being allowed to vote for sanctions fosters cooperation (Vyrastelkiva and van Soest, 2003), as does the introduction of enabling rather than controlling interventions (Vollan, 2008). Both in laboratory and field settings, introducing the possibility of face-to-face communication reduces the level of CPR extraction (Ostrom and Walker, 1991; Cardenas, 2000). Finally, settings where both rule formation and sanctioning are decentralized lead to CPR usage close to the social optimum (Ostrom et al., 1992).

In some cases, external incentives can crowd-in pro-social behavior. A large number of conventional experiments, i.e. experiments conducted in the laboratory with student samples, show that priming on the socially approved behavior has a positive effect on altruism. Increasing observability of choices and reducing social distance among participants generate higher average contributions in dictator games (Hoffman et al. 1994; Bohnet and Frey 1999), as does observing others behaving altruistically and focusing one's attention on the existence of a norm (Krupka and Weber, 2009). The introduction of decentralized costly punishment increases investment in the common project in public good games (Fehr and Gächter, 2002). Crowding-in is more rarely observed in field settings and CPR artefactual experiments. Castillo and Saisel (2005) show that external regulation triggers higher cooperation levels among fishermen on a Caribbean island, while Rodriguez-Sickert et al. (2008) find that increasing sanctions and enforcement probability eventually yields to cooperation levels close to those under self-governing systems.

Artefactual and conventional experiments yield different predictions on the effect of external incentives on intrinsic motivation to behave pro-socially: a negative effect in the former set of studies and a positive one in the latter. This difference may be due to the different types of incentives analyzed by the two streams of literature. Regulatory and monetary incentives are the main focus of field experiments on CPR management, while non-monetary and non-regulatory factors, such as priming, are generally studied in laboratory studies on norms compliance. Regulations and monetary rewards are likely to be perceived as controlling and lead to crowding-out, according to Frey and Stutzer's (2006) theory. More subtle incentives, such as those used in priming, are less likely to trigger such

reaction. The positive effect of priming on norm compliance has rarely been tested in the context of CPR management. The present study aims to fill this gap.

The difference between the conclusions reached by conventional and artefactual experiments may also depend on the fact that the two sets of studies use different subject pools. Student samples may differ from community members and CPR users in the crucial dimension of the social norms that they share. Frey and Stutzer (2006) argue that the level of crowding-out depends on existing norms of cooperation and reciprocity. Vollan (2008) shows that the introduction of controlling regulations produces stronger crowding-out of cooperative behavior among groups with high levels of trust. The bulk of evidence on crowding-in comes from subject pools linked by weak norms of cooperation. The present study complements this literature by bringing treatment designs typical of laboratory experiments to a subject pool of actual CPR users.<sup>9</sup>

The empirical and theoretical literatures on crowding-out suggest that intrinsically motivated individuals may be less pro-social when decision environments signal in a strong and salient way the desired behavior. In such cases “the individual will attribute the performing of the [...] task to the external incentives”, while in their absence “the individual would have attributed the execution of the task to the intrinsic features of the task” (Fehr and Falk 2002, 714). Non-monetary and non-normative incentives, priming individuals to the appropriate behavior, may have motivation crowding effects similar to monetary and regulatory ones. Whether priming leads to heterogeneous motivation crowding, depending on individual intrinsic motivation to behave pro-socially, is the main focus of this study.

Two testable predictions follow from the discussion of the literature conducted here. First, priming on the approved behavior will negatively affect pro-social choices of individuals with high valuation of the CPR<sup>10</sup> because the negative effect of priming on self-image should be stronger for socially engaged individuals. Second, priming on the approved behavior will affect pro-social choices differently depending on whether one’s donation is observed and on who observes it. If behaving unselfishly has a positive signaling value on one’s moral qualities, then this value will vary depending on the type of relationship

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<sup>9</sup> The decision to conduct the research in a field setting presents both advantages and disadvantages. It maximizes the relevance of the study for the design of CPR management systems and fills a research gap. However, these benefits come at the cost of lower experimental control and higher levels of heterogeneity of the sample. These advantages and disadvantages will be apparent in the discussion of the experimental results.

<sup>10</sup> This equals saying that crowding-in effects are expected to be stronger for less motivated individuals.

between a player and those who observe her choices. These predictions will be tested in the empirical analysis.

### **3. Experimental setting and design**

#### **3.1. Setting**

The study took place in Bolivia, on the edge of the Andean rainforest. Two communities were selected in the municipality of Quirusillas, in the south-west of the Department of Santa Cruz. Although only five percent of the municipal area is suitable for farming activities, due to the presence of steep mountains, people practice agriculture and livestock raising on sixty five percent of the municipal land. Ninety four percent of households own land, 21 ha on average in size (INE 2001). Low productivity subsistence agriculture is the dominant production system, monoculture is common and soil conservation practices, such as crop rotation, are rarely adopted. Land clearing occurs mainly due to the widespread practice of slash-and-burn agriculture, since timber extraction for commercial purposes is not frequent. Overall, overexploitation of land is associated with increasing incidence of soil erosion and flooding in the area (Plan de Desarrollo Municipal 2003).

The study area was identified through collaboration with a local NGO, Fundacion Natura Bolivia ( FN). Since 2003 FN has promoted environmental conservation through the establishment of Payment for Environmental Services schemes in Santa Cruz. At the time of the project, FN was about to start work in the study area. Municipal authorities were consulted to identify communities that suffered from deforestation-related environmental problems. The shortlisted communities were visited to assess the presence of communal land in need of reforestation, its size and proximity to the water source. Presence of communal land was necessary to ensure that participants perceived the project as a common good. Proximity to a water source was crucial to guarantee feasibility of the reforestation project. It is important to note that trees planted along stream banks prevent soil erosion and thus improve water quality.

The two villages that took part in the study are located along the same valley, one at the feet of the mountains and the other at higher elevation. The former is larger and closer to the municipal capital, while the latter is smaller and more isolated. The two communities are connected by a dirt road and the distance between them can be covered in half an hour by



car. Seventy eight individuals participated to the experiment, which took place over two one-day sessions. One member from each household, preferably the household head or the spouse, was invited to the experiment several days in advance. Attendance was around 80% downstream and nearly perfect upstream, thanks to the monetary compensation offered for participation, which minimized selection concerns.<sup>11</sup>

Table 1 presents basic characteristics of participants and of the two communities. Participants are similar in terms of age, education and gender, and of their behavior and opinions towards the environment. They rely on the forest for firewood, timber, other forest products and water. The belief that forest cover is linked to quality and quantity of water is shared by more than half of the participants, and about 70% of them identify deforestation as the main threat to the environment. The two communities differ in terms of infrastructural development and environmental problems. Around half of participants' households in the more remote upstream community rely on local streams for domestic water supply, while virtually everyone downstream has access to piped water within their homestead. Droughts and floods are the main cause for the loss of harvest in the downstream and upstream community respectively.<sup>12</sup>

[Insert Table 1 here]

Participants could contribute money to plant trees along the community's water source. Native trees, commonly known as ceibo<sup>13</sup>, were chosen for the reforestation project. Local biologists suggested this type of tree for different reasons. First, its deep roots make it effective for soil conservation. Second, ceibo would favor biodiversity in the area, since an endangered species of parrots likes to feed on its flowers. Third, if planted at the time of the study, ceibo was likely to survive requiring neither irrigation nor work on the part of community members. Finally, it has no commercial value and is planted only for soil and water conservation. A local saying on ceibo claims that it *attracts the water*.

In order to minimize uncertainty on the actual use of players' contributions, tree seedlings were brought to the experiment sites. Participants were informed that the trees

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<sup>11</sup> Participants were given a show up fee equal to one day's wage (40 Bolivianos, about 6 USD). Although the experiment and post-game interview took about two hours, participants were required to wait both before and after play, in order to ensure rigorous randomization across treatments and minimize contamination respectively.

<sup>12</sup> The frequency of floods upstream is a consequence of the fact that land is very steep there due to closeness with the mountains.

<sup>13</sup> *Erythrina crista-galli*.

would be planted the following day. Since there was more than one water source in both communities, it was agreed that the allocation of plants between sources would be decided by participants at the time of planting. To reduce the influence of self-interested motives on experimental decisions, the possibility of being remunerated for planting the trees was not mentioned.<sup>14</sup> Results from the game were presented and discussed in a meeting with community members the day following the experiment. Participants to the meeting decided on the allocation of the trees and were invited to plant them. Their remuneration was agreed with local authorities.

This section has shown how the experiment was designed so as to prevent the reforestation project from being a potential source of income for participants. Contributions to the experiment should thus be driven by the desire to contribute to the conservation of a common resource.

### **3.2. Design**

Each participant in the experiment decided how much to contribute to a reforestation project from an endowment of 50 Bolivianos.<sup>15</sup> The possible choices ranged from 0 to 50 in intervals of 5 Bolivianos, the amount needed to purchase and plant 2 trees. Each participant could therefore purchase and plant up to 20 trees. The decision of whether to contribute some unearned money for planting trees on public land differs under important respects from farmers' resource-use decisions. However, it induces a similar trade-off between certain, short term private benefits and uncertain, long term social costs. It is also similar to actual conservation decisions taken by community members, such as supplying labor or materials for the protection of springs. The assumption behind this design choice is that contributions are positively correlated with individual valuation of the reforestation project in particular, and of environmental conservation in general.<sup>16</sup>

The design has a between-subjects, four-by-one structure. Each participant was randomly assigned to one of four treatment groups. Relative to the control treatment (private treatment), the other three conditions introduce different types of non-monetary, non-

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<sup>14</sup> A failure to control for expectations about future labor income adds an unobservable source of heterogeneity that should be orthogonal to treatment and not bias results across experimental groups.

<sup>15</sup> This amount is slightly larger than a day's wage, and corresponds to about 7 USD.

<sup>16</sup> Beliefs on the appropriateness of the reforestation intervention, on the survival probability of trees and on the private benefits that could be gained from the project vary across individuals and affect contributions within the experiment, but this should not invalidate the basic assumption. Moreover, beliefs should not vary systematically across treatments thanks to randomization.

regulatory priming on the socially approved behavior. The treatments are inspired by designs used in the experimental literature to identify drivers of pro-social behavior. They prime participants on the appropriate conservation choice in different ways – giving information on others’ choices (information treatment), making decisions public (public treatment) and introducing the possibility of punishment (punishment treatment) respectively – each leveraging a specific mechanism found to sustain social norms.<sup>17</sup> Each treatment is described in detail below.

The design allows a comparison of choices under different conditions, which I conduct in two stages. First, by considering each treatment separately, I explore which mechanisms behind norm compliance are relevant in this setting. Second, by pooling all forms of priming together, I analyze the effect of priming on intrinsic motivation. Survey questions on social values, cooperation, trust in local institutions, knowledge and opinions on environmental issues complement the experimental evidence and help identify factors correlated with decisions within the game.

Table 2 tests the presence of statistically significant differences between members of different treatment groups using the Kruskal-Wallis H test.<sup>18</sup> Participants in different treatments do not differ significantly along any demographic characteristic, nor along any of the variables that will be used in the empirical analysis.

[Insert Table 2 here]

The sessions proceeded as follows. As participants arrived, they were randomly assigned to one of the four treatment groups, each of which was seated in a separate waiting area. The order of treatments was also randomized. Once the first group finished, the second group was called in, and so on. Each group was taken to a room, where the experimenter read the instructions and explained the experimental decision in detail. Participants then proceeded

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<sup>17</sup> The labels given here to the experimental treatments –private, information, public and punishment- are for exposition purposes only. No mention of such labels was made during the experiment. Appendix 2 contains an English version of the experimental instructions.

<sup>18</sup> The Kruskal-Wallis test is a multiple sample generalization of the two-sample Mann-Whitney rank sum test. Samples from different groups are pooled and ranked in ascending order of magnitude. The ranks of observations from each group are summed. The Kruskal-Wallis test tells the probability that the different groups rank-sum distributions come from the same distribution. The small size of the sample makes this non-parametric test preferable to parametric k-sample significance tests.

one by one to a second room, where they made their decision in private. The experimenter was present to make any clarifications, ask comprehension questions and assist illiterate participants with filling in the decision sheet.<sup>19</sup> Participants capable of completing the decision sheet on their own were left alone in the room to write down their contribution. When the experimenter re-entered the room, he asked the participant to guess the most frequent choice by people who had previously faced the same decision. These steps were common to all treatments.

Participants in the private and information treatments the second room at this point left and proceeded directly to be interviewed by an enumerator. Participants in the public and punishment treatments were taken to a third room, where they waited for all members of their groups to make their choices. The specific features of each treatment are as follows.

In the private treatment, the contribution choice was kept secret. Each person assigned to this treatment was told that nobody, apart from the researcher handing out the payments, would know her contribution. This treatment isolates intrinsic valuation of the reforestation project. When the amount given is unobservable, intrinsic valuation should be its main determinant. Experiments in the laboratory show that greater anonymity is associated with lower contributions in dictator games (Eckel and Grossman 1996). Since the main objective of this study is analyzing the effect of external incentives on conservation choices, relative to a situation where no priming takes place, the contribution in the private treatment is used here as the basic proxy of intrinsic motivation. This treatment serves as a baseline and is the omitted category in all regressions in the data analysis, which allows me to directly observe the effect of the different forms of priming relative to the case where no priming takes place.

In the information treatment, each participant was shown a card and told that it reported the contribution of someone who had played the game before.<sup>20</sup> This information was given to participants just before they made their choices, while alone with the experimenter. This treatment primes participants on the appropriate behavior in different ways: they learn the appropriate behavior by observing the actions of others; their attention

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<sup>19</sup> Group members waiting to make their decisions remained in the first room. There they waited in the company of an experiment assistant, who made sure that they did not talk to each other.

<sup>20</sup> Results from a pilot test of the game were used to draw the decision shown to participants in this treatment. The same contribution, equal to 35 Bolivianos, was shown to all participants to this treatment.

is focused on the existence of a norm; and the observed contribution suggests what behavior is considered as appropriate by other participants. Krupka and Weber (2009) refer to these three channels as the informational, focusing and prescriptive roles of social norms, respectively. In their study, which inspired this treatment, they find that individuals exhibit greater compliance with a norm when they observe others doing so and when their attention is focused on the existence of a norm.<sup>21</sup>

Participants in the public treatment were informed that they would announce their contribution to others in their group. This information was given to them while in the group and again when alone with the experimenter. Group members made their choice in private and then went to a third room. There they were asked to announce their contribution to each other. Participants from other treatment groups were not allowed to listen to the contribution announcements. Experiments in the laboratory where behavior is observable by others have been used to measure the effect of social pressures on conformity with the norm (Andreoni and Bernheim 2009). Pro-social behavior typically increases when decisions are made public. The difference between private and public outcomes is believed to capture the reputation effect of norm compliance. If natural resource conservation sends positive signals on the type of person one is, then this treatment should prime participants on the appropriate behavior through the reputational effect of contributing to reforestation.

The punishment treatment randomly assigned participants to the role of Player 1 or of Player 2. Player 2s could, at a cost to themselves, sanction choices by Player 1s that they believed to be socially inappropriate. Player 2s payoffs within the game were not directly affected by Player 1s' reforestation decisions. However, as Player 1s and 2s were members of the same community, all of them would be affected by the reforestation project outside the game context. The impact of Player 1's contribution on Player 2's utility depended on the latter's valuation of the reforestation project and preferences for fairness.

Players in both roles made their choices in private. The procedure for Player s mirrored the one for participants in the private treatment. Player 2s were given an endowment of 25 Bolivianos<sup>22</sup> and were asked if they wanted to reduce their own winnings by 5 Bolivianos in order to reduce Player 1's winnings by 10 Bolivianos, or if instead they

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<sup>21</sup> The information treatment in this study combines the informational, focusing and prescriptive channels and therefore does not allow disentangling the role of each one in affecting experimental outcomes.

<sup>22</sup> Equal to half of Player 1s' endowment and worth about 3.5 USD.

wanted to leave things as they were.<sup>23</sup> Designs allowing for costly punishment have been used in the laboratory to identify the role of social sanctions in norm compliance. These studies show that the possibility of being sanctioned increases pro-social behavior, and that participants are willing to sacrifice some of their own endowment in order to punish others, even if they are not directly affected by their decisions (Fehr and Fischbacher 2004). The introduction of the threat of sanction is the mechanism through which this treatment primes participants on the appropriate behavior.

The strategy method was used for Player 2s, so they took the punishment decision for each possible contribution to the reforestation project. Participants knew before playing that they would be randomly paired with another player. They also knew how the combination of the decisions of Player 1 and 2 would determine each person's winnings. The matching procedure was public and transparent, so as to make clear to all that it was anonymous and random: each participant's decision was placed in an envelope, and envelopes were put in two boxes labeled 1 and 2 respectively. After all participants had played, the group was taken to a third room where the experiment assistant randomly paired each envelope from box 1 to one envelope from box 2.

The decision to use the strategy method was influenced mainly by the desire to make the methodology comparable to that used in laboratory third-party punishment experiments (Fehr and Fishbacher 2003), and by logistical considerations which made the application of the direct-response method in a field setting extremely challenging (Casari and Cason 2009). The strategy method, while having the advantage of allowing higher statistical depth in the analysis of punishers' decisions, especially at the nodes that are rarely reached in sequential play, may affect behavior relative to the direct-response method. For instance, it could reduce the influence of emotions on experimental choices. Whether the strategy method leads to different choices than when participants respond to actual choices is still an open question.<sup>24</sup>

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<sup>23</sup> A table with all possible combinations of payoffs was shown to the group: each combination was explained to the participants using the word reduce instead of the word punish.

<sup>24</sup> The effect of the choice methodology used on subjects' behavior varies across studies (Casari and Cason 2009; Oxoby and McLeish 2004; Brandt and Charness 2000). Roth (1995) discusses the behavioral reasons behind such differences. For a recent meta-study of the effect of strategy versus direct-response method, see Brandts and Charness, 2009.

The experiment also had a belief elicitation component. After deciding how much to contribute to the reforestation project, participants to all treatments were asked to guess what the majority of players, who faced the same decision that they had just taken, had contributed in previous sessions of the experiment. Correct guesses were rewarded with an additional 10 Bolivianos. Elicited beliefs were specific to the treatment each participant had been randomly assigned. They are therefore expected to respond to the different decision environments embodied in the treatments. The experimental literature uses similar belief elicitation methodologies to identify the social norms at work in specific decision setting. Krupka and Weber (2008) show how elicited beliefs on average behavior respond to changes in the decision environment. They believe this finding to suggest that there are no absolute social norms, but that the socially approved behavior is sensitive to the context. The empirical analysis conducted in the next section tests the effect of experimental treatments both on contributions and stated beliefs.

#### **4. Experimental results**

This section is articulated in four parts. In the first, differences in contributions across sites and treatments are discussed. The presence and direction of motivation crowding is tested in the second part, where survey data are used to identify sources of heterogeneous treatment effects. The third part uses dyadic data to test the social image hypothesis, by exploring the relationship between social distance and experimental decisions. Finally, the generalizability of the results beyond the field of environmental conservation is discussed in the fourth part.

##### ***4.1. Experimental results by treatment and community***

Table 3 presents individual contributions to the reforestation project (Column 1) and guesses of the majority's contribution among people facing the same decision (Column 2) on average by treatment. Mean overall contribution is about 19.4 Bolivianos. Average contribution is lowest in the Information treatment and highest in the private and public treatments. Guesses of the most frequent contribution are also sensitive to group assignment. In particular, participants in the Information treatment display the highest guesses. This is likely to be a consequence of the high contribution example shown to them before their choice.

[Insert Table 3 here]

In order to test whether differences in outcomes across treatments are significant, Table 4 compares average contributions across pairs of treatments, using a parametric and a non-parametric test. The t-test of pairwise group differences (Column 1 and 2) is almost never significant. This is to be expected, given the small group sizes. Column 3 and 4 show results from the Mann-Whitney test, more appropriate with small samples. The probability of a randomly drawn contribution from the first group being higher than a randomly drawn contribution from the second group is reported in Column 3. Column 4 shows the p-value with which the null hypothesis of equal distributions is rejected. Only the difference between the Information and the Public treatment is significant at the 10% level.

[Insert Table 4 here]

On average, the effect on giving of the information and punishment treatments relative to the private one is negative. This result, though not statistically significant, hints to the negligible role played by information and social sanctions in the decision of contributing to reforestation. The reputational and sanctioning channels have been found to sustain norm compliance in other contexts, but do not appear to be at work in the study setting. This fact may suggest the absence of an established norm of behavior for environmental conservation. This conclusion is supported by the results on giving under the public treatment. When public, donations are on average equal to those in the private treatment. More interestingly, average giving in the public treatment is the same across communities, a possible result of the presence of a norm for contributing to village projects in general, rather than to environmental conservation in particular.

Experimental outcomes clearly differ across communities. Figure 1 and Figure 2 show individual and average contributions by treatment in the two study communities. Downstream, overall average contribution is equal to 14 Bolivianos. Contributions in the private, information and punishment treatments are not statistically different from each other. Participants in the public treatment are the highest contributors in the community: the



t-test of the difference in average contribution between the public and the remaining three treatments downstream is significant at the 5% level. For the upstream community the picture is different: contributions are higher than downstream in all treatments but the public one, and differences across treatments are never significant. Overall average contribution upstream is of 24.8 Bolivianos, nearly half of the total endowment. Although a formal test is not possible because only two villages took part in the study, this picture is consistent with the presence of a negative correlation between existing norms of cooperation and motivation crowding: while priming has no effect on donation where initial cooperation is high, it significantly increases contributions, at least in one of form, where cooperation is low.

[Insert Figure 1 and 2 here]

Next, I use regression analysis and consider four experimental outcomes: contribution amounts, guesses on the majority's contribution, the probability of giving above the average contribution in the community and the probability of giving above one's guess. The first two dependent variables are the two decisions taken by participants in the experiment. The third dependent variable gives a measure of individual cooperation relative to the community average, while the fourth captures the probability that one contributes above what she believes to be the socially approved level.

Regressions in Table 5 include interactions between treatment dummies and community fixed effects:

$$y_i = \beta_1 + \beta_2 Treatment_i + \beta_3 Comm_i + \beta_4 Treatment_i * Comm_i + \varepsilon_i \quad (1)$$

where  $y_i$  denotes each of the four experimental outcomes. The private group is used as the control group relative to which the effect of priming is measured. This choice is maintained throughout the empirical session.

Treatment dummies do not appear to be significant. Insignificant treatment effects are likely to be an unavoidable consequence of the small sample problem that affects this study. The results confirm the differences in treatment effects across communities suggested by Figure 1. A pattern similar to that outlined for contribution amounts can be detected for

other experimental outcomes. Beliefs on average contributions are higher upstream than downstream by 4.6 Bolivianos.<sup>25</sup> Even so, members of the upstream community contribute more than their believed average contribution 72% of the time. The corresponding figure is 55% downstream. Participants upstream contribute more, have higher beliefs on the appropriate contribution level and are more likely to give above such level.

[Insert Table 5 here]

The different behavior of participants living upstream and downstream does not appear to be motivated by different socio-demographic characteristics across locations. Table 6 presents results from regressions of experimental outcomes on age, education and gender<sup>26</sup>, controlling for community:

$$y_i = \beta_1 + \beta_2 \text{Age}_i + \beta_3 \text{Education}_i + \beta_4 \text{Female}_i + \beta_5 \text{Comm}_i + \varepsilon_i \quad (2)$$

Regression coefficients for each socio-demographic variable appear to be rarely significant. Education is positively correlated with outcomes, while the opposite holds for age. They appear to be significant only for contribution levels. The female indicator variable is negatively correlated with all outcomes but one. The upstream community dummy remains positive and significant even after controlling for individual characteristics.

[Insert Table 6 here]

A second potential explanation for the differences in experimental outcomes across villages concerns the expected returns from the reforestation project. The intervention could have been perceived as more beneficial and useful in the upstream community.<sup>27</sup> Indeed, survey

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<sup>25</sup> 23 Bolivianos on average upstream against 18.4 Bolivianos downstream: the difference is significant at the 10% level.

<sup>26</sup> The dependent variables are absolute amount contributed (Column 1), dummy equal to 1 if contribution is above the community average (Column 2), beliefs on average contribution (Column 3) and contribution above belief (Column 4).

<sup>27</sup> This would be the case if planting trees near the community mitigated negative environmental externalities more in one place than in the other. If much of the contamination of the water occurred before the stream reached the

data confirm this claim. Upstream, 60% of participants believed that the project would be good for the environment and the community. The corresponding figure is 37.5% downstream. Since participants were asked for an opinion on the reforestation project *after* choosing their contribution, these data can at most be suggestive. While one can argue that individuals downstream did not contribute because they thought that the project was not useful, the opposite claim is equally plausible, i.e. that individuals downstream said that the project was not useful because they had not contributed much to it.<sup>28</sup>

A third possible explanation of community level differences in outcomes focuses on the relative population sizes in the two villages. Population downstream is about twice as large as upstream. *Ceteris paribus*, smaller groups are found to be more effective at ensuring participation in common good provision (Ostrom 1990), as free-riding incentives increase with group size.

Although the data available do not allow distinguishing between these alternative explanations, it seemed nonetheless important to me to highlight the presence of heterogeneity across villages and discuss its potential causes. While I am not able to explain community level differences, I can explore sources of heterogeneity in giving and in treatment effects at the individual level. This will be the topic of the next subsection.

#### **4.2. *Heterogeneous treatment effects***

This subsection looks at sources of heterogeneous effects of treatments. The goal is to test the first behavioral prediction made in Section 2, i.e. that priming on the approved behavior negatively affects pro-social choices if one has a high valuation of the common good. In order to do this, I use a variable equal to 1 if a participant was assigned to the Information, Public and Punishment treatments, and 0 otherwise. This dummy variable identifies situations where some form of priming on the socially approved behavior takes place, as opposed to the Private treatment, where no priming occurs. The priming dummy is interacted with proxies for intrinsic motivation in order to test the motivation-crowding hypothesis. Two variables are considered: civic engagement, captured by the number of days of community work performed over the previous year; and individualism, revealed by

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downstream community, for instance, reforestation of a piece of land within the community's boundaries would only result in minor improvements in water quality.

<sup>28</sup> More formally, psychologists say that individuals tend to justify their own choices *ex-post*, both to themselves and to others, in ways that preserve their self-image (Fehr and Falk 2002).

the belief that independence is one of the most important qualities to teach a child. These two variables reflect two correlated, but not overlapping, dimensions of social preferences.<sup>29</sup>

Community work days are a common practice in the region under study. Village members regularly join forces to work on common projects, such as cleaning the square or filling holes in the road. Participation to community work days is not compulsory, but noncompliance is subject to social disapproval.<sup>30</sup> Survey data show that participation in community work is positively correlated with the number of organizations active in the community known, and with the probability of having helped others in the previous month.<sup>31</sup> I therefore use participation in community work as a proxy for civic engagement and intrinsic valuation of the common good.

On the contrary, participants who think that independence is one of the main qualities to teach a child are less likely to be members of community organizations and to take part in community meetings.<sup>32</sup> The use of this variable as a proxy of individualism is justified by research in the field of social psychology. Hofstede (2001) defines individualism in terms of independent self-construct, which denotes a state where an individual views himself as 'an independent, autonomous person' (Markus and Kitayama 1991). In a study specifically aimed at identifying indicators of individualism, Gustavsson (2008) finds this particular variable, taken from the World Values Survey, to be a significant proxy.

First of all, I look at how the two intrinsic motivation proxies are correlated with experimental outcomes. Table 7 reports regressions of the four experimental outcomes on community work days and the independence dummy, controlling for community fixed effects. The following regressions are estimated:

$$y_i = \beta_1 + \beta_2 Commwork_i + \beta_3 Individ_i + \beta_4 Comm_i + \varepsilon_i \quad (3)$$

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<sup>29</sup> The pairwise correlation coefficient is -18% and not statistically significant.

<sup>30</sup> A small survey implemented in a neighboring municipality by the local partner, FN, supports this claim.

<sup>31</sup> Individuals in the top 2 deciles in terms of participation to community work mention on average 32% more institutions who have been active in the village. They are also 25% more likely to have lent money or things to neighbors or to have helped strangers over the previous month. One-sided t-tests are significant at the 1% level.

<sup>32</sup> They are 15% less likely to be members of the Organizacion Territorial de Base (OTB), the main institution at the village level; and 17% less likely to attend community meetings. One-sided t-tests are significant at the 10% level.

Civic engagement is positively and significantly correlated with all experimental outcomes. Individuals who are more engaged in community work give more, are more likely to give above the average in their village, have higher beliefs on others' contributions and are more likely to give above what they believe to be the norm. The opposite holds for individualism, which is negatively correlated with experimental outcomes, significantly only for the probability of contributing above the community average.

[Insert Table 7 here]

Next I consider how civic engagement and individualism, in turn, interact with the priming embodied in experimental treatments. Table 8 shows results from regressions of experimental outcomes on the priming dummy, community work days and the interaction between them:

$$y_i = \beta_1 + \beta_2 \text{Priming}_i + \beta_3 \text{Commwork}_i + \beta_4 \text{Priming}_i * \text{Commwork}_i + \beta_5 \text{Comm}_i + \varepsilon_i \quad (4)$$

The positive correlation between community work and all experimental outcomes is confirmed. The coefficients on the interaction term are positive in all but one case. The net effect of priming, computed by summing the coefficients on the priming dummy and the interaction term, is negative with one exception, the probability of contributing above the norm. Priming negatively affects behavior of participants with high valuation of the good of the community. While not statistically significant, this result is consistent with the prediction of negative motivation crowding of treatments for individuals intrinsically motivated to behave pro-socially.

[Insert Table 8 here]

Table 9 shows results from a similar exercise, only community work is replaced by the independence dummy:

$$y_i = \beta_1 + \beta_2 \text{Priming}_i + \beta_3 \text{Individ}_i + \beta_4 \text{Priming}_i * \text{Individ}_i + \beta_5 \text{Comm}_i + \varepsilon_i \quad (5)$$

Individualism is negatively correlated with experimental outcomes. Coefficients on interaction terms are positive, large in size and significant in 3 out of 4 cases. In particular, there is a positive and significant correlation between contributions and priming for individualistic participants. The net effect of priming is also positive for this type of individuals across outcomes, with the exception of the probability of contributing above the norm. Comparing Table 8 and 9 suggests that priming indeed has a different effect depending on individuals' intrinsic valuation of the common good: while it does not seem to affect highly motivated individuals, it crowds-in pro-social behavior of individualistic ones. This finding mirrors Gneezy and Rustichini's (2000) results on the effect of incentives to exercise.

[Insert Table 9 here]

The most direct evidence of heterogeneous motivation-crowding effects of priming is shown in Table 10. There, contribution amount is regressed on the priming dummy, the civic engagement and independence proxies and the interaction between the priming dummy with the latter two:

$$\begin{aligned} \text{Contribution}_i = & \beta_1 + \beta_2 \text{Priming}_i + \beta_3 \text{Commwork}_i + \beta_4 \text{Individ}_i + \beta_5 \text{Priming}_i * \text{Commwork}_i \\ & + \beta_6 \text{Priming}_i * \text{Individ}_i + \beta_7 \text{Comm}_i + \varepsilon_i \end{aligned} \quad (6)$$

This regression uses a different proxy of civic engagement: a variable equal to 1 if individual participation in community work is in the top 2 deciles. This change should make coefficients more comparable across regressors and allow a cleaner identification of intrinsically motivated individuals.

The coefficients on the main effect of community work and independence confirm the results presented above: more socially engaged individuals contribute more, while the opposite holds for more individualistic participants. Experimental treatments have a

negative impact on socially engaged individuals' contributions<sup>33</sup> and a positive impact on individualistic participants' contributions. Focusing attention on the socially approved behavior has opposite effects depending on an individual's pro-social preferences. These results echo findings from the literature on the impact of monetary and regulatory incentives and support the claim that non-monetary and non-regulatory incentives generate similar heterogeneous motivation crowding effects. The next subsection attempts to test one mechanism through which this effect may act.

[Insert Table 10 here]

### 4.3. *Social image and experimental outcomes*

In this subsection I test the claim that external incentives crowd-out intrinsic motivation to behave pro-socially through their effect on social image. An implication of such claim is that one's pro-social behavior should respond to its observability and to the social distance of those observing one's choices. By rectangularizing the individual level dataset, I can look at the relationship between experimental choices of pairs of players, the type of relationship between them and their relative treatment assignment. This analysis uses dyadic regressions (Fafchamps and Gubert, 2007) and considers two dependent variables: the absolute value of the difference between player  $i$  and  $j$ 's contributions to the reforestation project; and the average between player  $i$  and  $j$ 's contributions. The former captures similarity of two participants' choices. The latter summarizes the pair's level of pro-social behavior.

The influence of social distance on these outcomes is tested using two proxies of social links between participants. The first is a dummy equal to 1 if  $i$  and  $j$  are relatives, i.e. they share the same surname. The second is the number of community associations which  $i$  and  $j$  are both members of. These variables are imperfect proxies of two different types of social links. The former is correlated to closeness between two individuals in the realm of their private life. The latter approximates the intensity of interaction between two individuals in the public sphere. The assumption made here is that family relationships are

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<sup>33</sup> The coefficient on the interaction term is not significant.

less salient to the experimental decision than relationships in the public sphere. If so, the negative impact on social image of a selfish choice will be lower if observed by relatives than by co-members in community organizations. To test this claim, the two social link proxies are interacted with a dummy variable equal to 1 if player  $i$  and  $j$  are in the same public treatment group:

$$y_{ij} = \beta_1 + \beta_2 \text{Samepub}_{ij} + \beta_3 \text{Rel}_{ij} + \beta_4 \text{Samepub}_{ij} * \text{Rel}_{ij} + \beta_5 \text{Comm}_i + \varepsilon_i \quad (7)$$

$$y_{ij} = \beta_1 + \beta_2 \text{Samepub}_{ij} + \beta_3 \text{Sameassoc}_{ij} + \beta_4 \text{Samepub}_{ij} * \text{Sameassoc}_{ij} + \beta_5 \text{Comm}_i + \varepsilon_i \quad (8)$$

Table 11 presents dyadic regression results.<sup>34</sup> The dependent variable in Columns 1 and 2 is the absolute value of the difference between  $i$  and  $j$ 's contributions. The dependent variable in Column 3 and 4 is the average of  $i$  and  $j$ 's contributions. Columns 1 and 3 regress pairs' outcomes on the dummy for  $i$  and  $j$  being relatives, the dummy for  $i$  and  $j$  being in the same public treatment group, and their interaction. Regressions in Columns 2 and 4 replace the relative dummy with the association co-membership variable.

Columns 1 and 2 show that individuals who are related or interact with each other more often in community organizations choose closer contribution levels. The interaction terms have different signs in the two regressions. Being observed by a relative rather than by a co-member of community associations appears to have opposite effects on the degree of similarity between one's choice and that of the observer. Individuals who interact with each other more frequently in their public life tend to choose closer contribution levels when assigned to the same public treatment group (although this correlation is not significant). On the contrary, in the same situation relatives display significantly larger differences in contributions. Columns 3 and 4 show the effect of social links and publicity of decision on a pair's average contribution. Relatives appear to give less on average when they are in the same public treatment group than when they are in other treatment groups.

[Insert Table 11 here]

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<sup>34</sup> To correct for correlation between observations, we use the standard error formula proposed by Fafchamps and Gugerty (2005) for dyadic regressions. Individual characteristics feature in dyadic regressions in two forms: the absolute value of the difference between  $i$  and  $j$ 's characteristic; and the sum of  $i$  and  $j$ 's characteristics (Fafchamps and Gugerty, 2005).



These results may be explained by endogenous sorting of individuals with similar traits into the same organization or family through marriage.<sup>35</sup> Indeed, Table 11 shows that, when individuals are relatives or belong to the same associations, their contribution levels are closer. This is true across treatments. Endogenous sorting does not explain, however, the difference of the sign for the interaction terms across regressions. When decisions are public, contributions of pairs of relatives are less homogeneous. The opposite holds when the pair is formed by individuals who are members of the same associations.<sup>36</sup>

This difference can be interpreted in terms of the social image costs of different decisions. There is a cost in contributing an amount different from what one expects others to give. The different signs of interaction terms coefficients hint to the fact that this social cost is lower between individuals who interact in the private than in the public sphere. Overall, dyadic regression results are consistent with contribution decisions being affected by their costs in terms of social image. I now turn to the question of generalizability of these results beyond the scope of the experiment presented here.

#### **4.4. *Environmental-specific versus general pro-social preferences.***

Earlier in this section I observed that experimental giving is positive and fairly constant across treatments. This indicates the presence of social preferences prescribing positive contributions. Such preferences could be specific to environmental conservation, or they could instead be pro-social preferences towards helping the community, with natural resources simply acting as a conduit. This sub-section presents arguments in support of the latter interpretation.

Environmental degradation is a community problem: 73% of participants rate water-related problems as one of the main issues in their community. The reforestation interventions could have been perceived by participants as a generic project addressing community problems. Unfortunately the experimental design, by focusing on a unique type of intervention, does not allow comparing contribution patterns across different community projects. However, the presence of general pro-social preferences towards helping the

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<sup>35</sup> Similar preferences within the family could be observed even in the absence of endogenous sorting. For instance, they could be due to genetic factors.

<sup>36</sup> Table A1 shows that these results are robust to the inclusion of participants' age, gender and education level. Obviously, this is only marginally reassuring. If people sort on their propensity to be communal, and this trait is imperfectly proxied by age, gender and education, these results do not rule out endogeneity of association membership.

community is suggested by participants' behavior in the Public treatment. I observed earlier how the only group experiencing significant treatment effects is the Public one in the downstream community. The Public treatment is also the only one resulting in the same average contribution across communities. Such uniformity might derive from the presence of a standard contribution rule for public projects in both communities. It is unlikely that previous reforestation projects contributed to the formation of such rule. No reforestation activities of the kind presented here had ever taken place in the area.<sup>37</sup> On the contrary, members of both communities meet regularly to decide contributions to common projects. The practice of community work, as seen earlier in the section, is also widespread.

Another argument in favor of the generalizability of the results focuses on the lack of correlation between experimental outcomes and proxies of environmental valuation. The survey administered to participants included questions on importance given to the environment in general and forests in particular; perception of environmental threats; reforestation conducted on own land; and loss of income due to environmental shocks. Table 11 shows how none of these variables is significantly correlated with experimental outcomes. Proxies of more general social preferences, such as civic engagement and individualism, show more significant correlation patterns with behavior in the game.

Finally, the results on experimental punishment appear to be due to general preferences for fairness rather than to specific preferences for reforestation. Player 2s sanctioned Player 1s 70% of the times for contributing less than half of the endowment, but only 21% of the times otherwise (Figure 3). This result can be driven by a desire to punish norm violators, or by spiteful preferences, i.e. by "the desire to reduce another's material payoff for the mere purpose of increasing one's relative payoff" (Fehr et al. 2008, 494). Figure 4 is consistent with the presence of inequality aversion: sanctions start decreasing for contributions above the amount considered the norm for reforestation contributions, which is 20 Bolivianos, but the largest drop in punishment occurs around 25 Bolivianos, i.e. the contribution amount at which Player 1s would go home with the same winnings as Player 2s (Figure 4).

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<sup>37</sup> The only reforestation project, that was mentioned to us, was conducted by the Municipal government about 10 years ago. It consisted in planting pine trees along the slope of the mountain near the upstream village for commercial purposes.

[Insert Figure 3 and 4 here]

The evidence presented here, although not conclusive, supports the idea that general social preferences, rather than specific norms concerning the environment, are at work in the experimental setting. This speaks in favor of the generalizability of the results beyond the specific intervention conducted in this study.

## 5. Conclusions

This study uses an artefactual field experiment centered on a reforestation project to analyze social values for CPR conservation. Focusing attention on the social norm increases altruistic choices of selfish individuals. The opposite holds among participants with high valuation of the common good. The results from dyadic regressions suggest that motivation crowding occurs through the effect of external incentives on social image. Experimental results, though of limited statistical significance due to the small sample, are nonetheless valuable and justify a series of considerations and avenues for further enquiry.

The study identifies factors correlated with contributions to a community project. These factors proxy civic engagement and altruism in general, rather than environmental valuation in particular. This makes the findings from this study speak both to the literature on CPR management and to the literature on other-regarding preferences more in general. Research on motivation crowding-out shows how the introduction of monetary rewards or regulatory sanctions can in some settings reduce pro-social behavior. I claim here that even non-monetary external incentives, by reducing the signaling value of pro-social decisions, can have similar effects. This finding goes against the claim, based on conventional experiments, that priming leads to crowding-in of pro-social behavior and highlights the risk of generalizing the results from laboratory experiments to infer behavior of actual resource users.

Further empirical work may be worthwhile to test the generalizability of the results. Generalizability should be investigated along two dimensions. First, by conducting similar experiments on a larger scale, the empirical relevance of non-monetary and non-regulatory incentives on motivation crowding could be assessed on a more representative sample. Second, by varying the type of project funded by participants' donation, similar experiments

could be used to detect the presence of conservation-specific norms and disentangle their effect from that of norms regulating local public good contributions more in general.

It is commonly believed that regulations and monetary incentives are needed to overcome the incentive problems in common resource use. The crowding-out literature suggests, on the contrary, that external incentives may ultimately be counterproductive. This study finds that the most effective approach may depend on the initial presence of civic values, with external incentives being more effective in settings where intrinsic motivation is low, while solutions generated and owned by the community may be preferable where individuals share civic values and social norms of cooperation.

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Tables and Figures

Figure 1. Individual contributions by community.

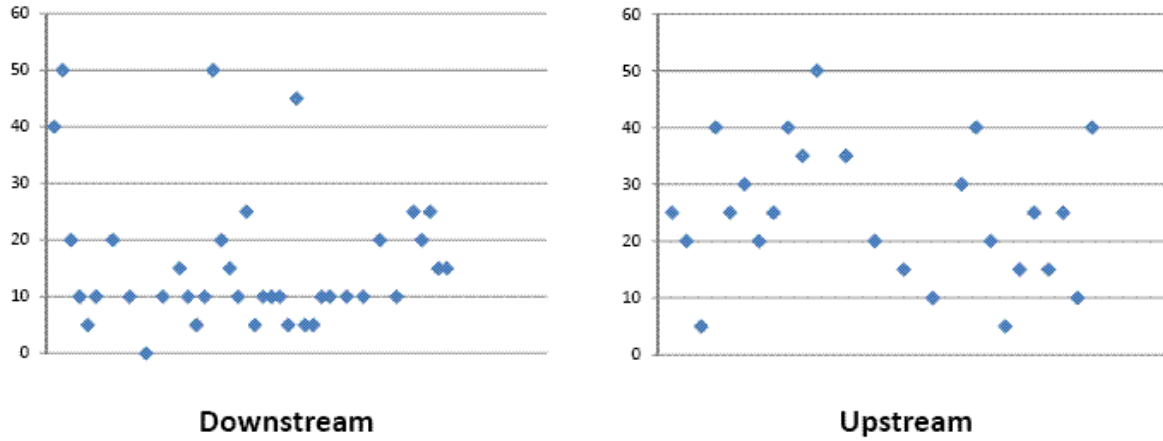
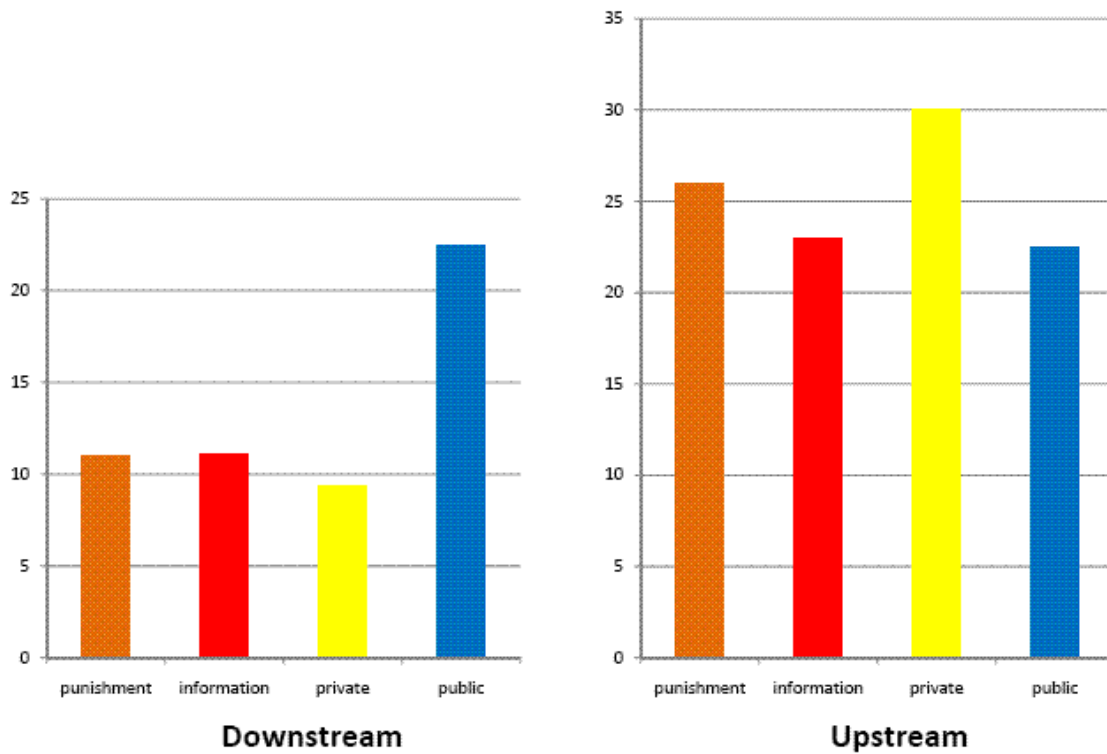
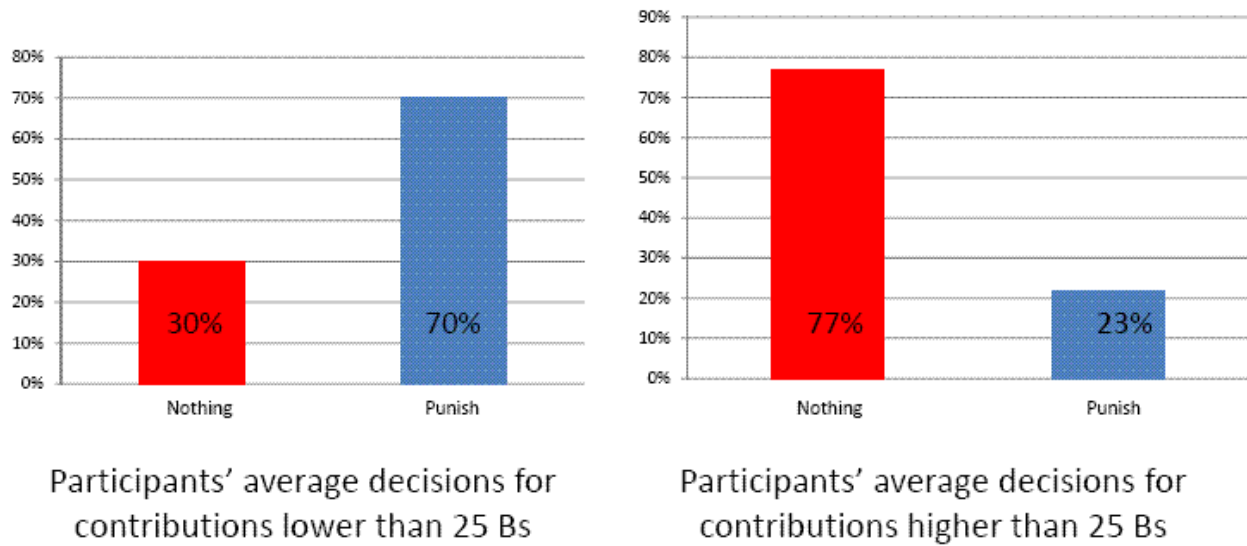


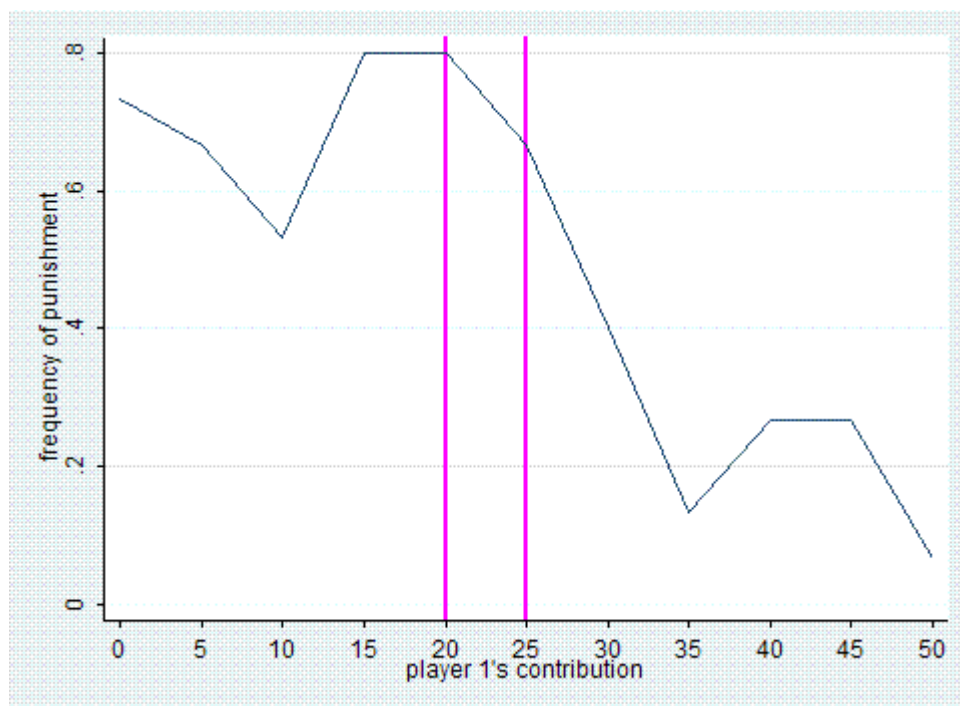
Figure 2. Average contributions by treatment and community.



**Figure 3. Punishment decisions for contributions below and above the endowment mean.**



**Figure 4. Punishment percentage for each possible contribution.**



**Table 1 - Characteristics of participants in the two communities taking part in the study: t-test for equal group means**

	(1)	(2)	(3)
	Mean of [var]	Mean of [var]	P-value
	among participants	among participants	
	in the downstream	in the upstream	
	community	community	
	(n = 48)	(n=30)	
<i>Socio-demographic characteristics</i>			
Age	40.2 (2.168)	42.7 (2.920)	.494
Female (%)	47.9 (.073)	43.3 (.088)	.210
Years of education	5.937 (.535)	5.517 (.531)	.602
Has piped water (%)	97.9 (.021)	53.3 (.093)	.000***
Has electricity (%)	52.1 (.073)	10 (.056)	.000***
Owens land (%)	79.2 (.059)	86.7 (.063)	.408
Owens livestock (%)	66.7 (.069)	53.3 (.092)	.244
<i>Benefits from the forest (% who mentions the following)</i>			
Water quantity or quality	54.2 (.073)	50 (.093)	.724
Firewood or timber	31.2 (.067)	36.6 (.089)	.627
Extracts products from the forest (%)	77.1 (.061)	72.4 (.084)	.650
Deforestation is main threat (%)	70.8 (.066)	76.7 (.085)	.578
<i>Main cause for loss of harvest in the past 3 years (% who mentions the following)</i>			
Drought	60.4 (.071)	43.3 (.092)	.145
Flood	16.7 (.054)	46.7 (.093)	.004**
<i>Community problems (% who mentions the following)</i>			
Water	70.8 (.066)	76.7 (.078)	.578
Erosion	41.6 (.072)	36.6 (.089)	.666
<i>Social preferences</i>			
Community work	4.667 (1.105)	2.517 (.402)	.145
Independence (%)	37.5 (.071)	30 (.085)	.504

Note: Std. Errors in parenthesis. \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%

**Table 2 - Randomization table: Kruskal-Wallis H test of between group differences across participants from both communities assigned to the four treatment groups**

	(1) H-statistics	(2) Probability that the groups were drawn from the same chi-square distribution
<i>Socio-demographic characteristics</i>		
Age	2.991	39.3
Female (%)	4.029	25.8
Years of education	.569	90.3
<i>Services and land use</i>		
Has piped water (%)	2.222	52.8
Owens land (%)	1.463	69.1
Owens livestock (%)	3.590	30.9
<i>Main cause for loss of harvest in the past 3 years (% who mentions the following)</i>		
Drought	1.098	77.7
Flood	.554	90.7
<i>Social Preferences</i>		
Community work	.050	99.7
Independence (%)	1.378	71.1

Note: Column 1 shows the H-statistics, which represents the variance of the ranks among groups, with an adjustment for the number of ties, and is approximately chi-square distributed. Column 2 gives the P-value corresponding to a chi-square equal to H, representing the probability of getting a particular value of H by chance if the null hypothesis, that the groups are drawn from the same distribution, is true. The degrees of freedom of the chi-square distribution are the number of groups minus 1.

**Table 3 - Mean of experimental outcomes, by treatment group**

	(1) Contribution (Bolivianos)	(2) Guess of average contribution to reforestation among others facing same decision (Bolivianos)
Private treatment	22.5 (15.441)	20.71 (9.579)
Information treatment	15.357 (10.278)	23.571 (10.082)
Public treatment	22.5 (12.407)	20.5 (10.748)
Punishment treatment	16 (12.276)	18.167 (10.462)
Overall	19.365 (12.841)	20.192 (10.302)
Number of Obs	63	78

Note: Standard deviations in parenthesis.

**Table 4 - Pairwise differences in contribution across treatments: t-test for equal group means and Mann-Whitney non-parametric test**

	T-test		Mann-Whitney test	
	(1) Difference in mean contribution (1st group mean contrib - 2nd group mean contrib)	(2) P-value	(3) Prob (contrib. from 1st group >= contrib. from 2nd group)	(4) P-value
Private versus Information	7.143	.161	.622	.263
Private versus Public	0	1.000	.48	.846
Private versus Punishment	6.5	.218	.61	.314
Information versus Public	-7.143	.086**	.32	.076
Information versus Punishment	-.643	.880	.49	.891
Public versus Punishment	6.5	.133	.69	.058

Note: Column 3 reports the probability of a randomly drawn value from the first group to be greater than a randomly drawn value from the second group. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 5 - Regressions of experimental outcomes on treatment dummies, community and interaction of treatment dummies and community**

	(1) Contribution (Bolivianos)	(2) Prob (Contribution ≥ average village contribution)	(3) Guess of average contribution among others facing same decision (Bolivianos)	(4) Prob (Contribution ≥ guess)
Information treatment	-7.222 (6.166)	-0.275 (0.210)	2.222 (4.867)	-0.214 (0.230)
Public treatment	4.167 (7.279)	0.265 (0.226)	1.556 (4.853)	0.187 (0.155)
Punishment treatment	-7.333 (6.104)	-0.152 (0.221)	-4.194 (4.469)	0.245 (0.133)*
Information*Upstream	0.222 (8.851)	0.079 (0.442)	1.778 (7.288)	-0.877 (0.045)***
Public*Upstream	-11.667 (8.882)	-0.431 (0.168)**	-4.556 (6.536)	-0.950 (0.027)***
Punishment*Upstream	3.333 (9.886)	-0.231 (0.299)	5.194 (5.687)	-0.894 (0.034)***
Upstream	11.667 (6.738)*	0.472 (0.257)*	3.556 (4.280)	0.962 (0.025)***
(Pseudo) R-squared	0.23	0.14	0.11	0.19
Number of Obs	63	63	78	63

Note: Private is the omitted category among treatment groups. Upstream dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



**Table 6 - Regressions of experimental outcomes on demographic characteristics and community dummy**

	(1) Contribution (Bolivianos)	(2) Prob (Contribution ≥ average village contribution)	(3) Guess of average contribution among others facing same decision (Bolivianos)	(4) Prob (Contribution ≥ guess)
Female	-1.094 (2.882)	-0.005 (0.131)	1.093 (2.415)	-0.108 (0.129)
Age	-0.159 (0.077)**	-0.007 (0.005)	-0.046 (0.057)	-0.006 (0.004)
Years of education	0.132 (0.042)***	0.013 (0.015)	0.126 (0.033)***	-0.002 (0.003)
Upstream	9.912 (3.183)***	0.308 (0.133)**	5.327 (2.402)**	0.165 (0.128)
(Pseudo) R-squared	0.19	0.13	0.08	0.05
Number of Obs	63	63	78	63

Note: Community dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 7 - Regressions of experimental outcomes on days of community work and individualism proxy**

	(1) Contribution (Bolivianos)	(2) Prob (Contribution ≥ average village contribution)	(3) Guess of average contribution among others facing same decision (Bolivianos)	(4) Prob (Contribution ≥ guess)
Community work	0.743 (0.146)***	0.036 (0.019)*	0.198 (0.091)**	0.033 (0.016)**
Independence	-4.140 (3.170)	-0.247 (0.131)*	-2.422 (2.509)	-0.154 (0.133)
Upstream	9.809 (2.997)***	0.286 (0.133)**	4.246 (2.398)*	0.184 (0.124)
(Pseudo) R-squared	0.29	0.13	0.06	0.08
Number of Obs	62	62	77	62

Note: Community work denotes the number of days of community work that the respondent did over the previous 12 months. Independence is a dummy equal to 1 if the respondent mentioned independence among the 3 most important qualities to teach a child. Community dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 8 - Regressions of experimental outcomes on the priming dummy, days of community work and interaction between the priming dummy and days of community work**

	(1) Contribution (Bolivianos)	(2) Prob (Contribution ≥ average village contribution)	(3) Guess of average contribution among others facing same decision (Bolivianos)	(4) Prob (Contribution ≥ guess)
Priming	-5.134 (4.339)	-0.260 (0.176)	-1.090 (2.994)	0.040 (0.187)
Community work	0.591 (0.163)***	0.011 (0.008)	0.160 (0.116)	0.047 (0.032)
Priming*Community work	0.697 (0.616)	0.045 (0.022)**	0.178 (0.324)	-0.021 (0.037)
Upstream	10.263 (2.925)***	0.294 (0.132)**	4.483 (2.398)*	0.185 (0.121)
Number of Obs	62	62	77	62
(Pseudo) R-squared	0.287	0.122	0.055	0.065

Note: Priming is a dummy equal to 1 if a participant is in the Information, Public and Punishment treatment, 0 if she is in the Private treatment. Community work denotes the number of days of community work that the respondent did over the previous 12 months. Community dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 9 - Regression of the priming dummy, individualism proxy and interaction between treatment dummies and individualism proxy**

	(1) Contribution (Bolivianos)	(2) Prob (Contribution ≥ average village contribution)	(3) Guess of average contribution among others facing same decision (Bolivianos)	(4) Prob (Contribution ≥ guess)
Priming	-5.279 (4.552)	-0.123 (0.170)	-2.122 (2.964)	0.004 (0.166)
Independence	-13.997 (5.144)***	-0.966 (0.015)***	-13.758 (3.373)***	-0.105 (0.376)
Priming*Independence	11.242 (6.071)*	0.988 (0.005)***	12.189 (4.251)***	-0.045 (0.401)
Upstream	8.407 (3.173)**	0.219 (0.125)*	3.981 (2.427)	0.164 (0.123)
Number of Obs	63	63	78	63
(Pseudo) R-squared	0.189	0.103	0.079	0.04

Note: Priming is a dummy equal to 1 if a participant is in the Information, Public and Punishment treatment, 0 if she is in the Private treatment. Independence is a dummy equal to 1 if the respondent mentioned independence among the 3 most important qualities to teach a child. Community dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 10 - Regression of contributions on the priming dummy, being in the top 2 deciles in terms of community work done, individualism proxy, and interaction between priming and community work/individualism proxy**

	(1) Contribution (Bolivianos)
Priming	-5.539 (4.042)
Community work	22.209 (7.933)***
Priming*Community work	-7.526 (9.839)
Independence	-22.791 (7.933)***
Priming*Independence	20.788 (8.495)**
Upstream	9.511 (2.874)***
Number of Obs	63
R-squared	0.359

Note: Community work is a dummy equal to 1 if participant is in the top 2 deciles of the distribution of days of community work done over the past 12 months. Independence is a dummy equal to 1 if the respondent mentioned independence among the 3 most important qualities to teach a child. Community dummy equal to 1 for the upstream community and to 0 for the downstream community. Marginal Effects reported for discrete change of dummy variable from 0 to 1. Robust standard errors. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 11 - Dyadic regressions of difference between i and j's contributions/average between i and j's contributions on type of social link between i and j, and pair's assignment to public group**

	Abs(i - j contribution)		Avg(i - j contribution)	
	(1)	(2)	(3)	(4)
i-j same public group	0.555 (2.460)	4.742 (3.334)	3.550 (1.574)**	4.787 (3.428)
i-j relatives	-3.327 (1.717)*		-1.813 (1.461)	
(i-j same public group)*( i-j relatives)	10.264 (4.951)**		-3.592 (3.367)	
i-j co-members in associations		-1.156 (0.581)**		-0.820 (0.397)**
(i-j same public group)*(i-j co-members in associations)		-1.248 (1.527)		-0.447 (1.230)
<b>Number of Obs</b>	<b>3906</b>	<b>3906</b>	<b>3906</b>	<b>3906</b>

Note: The dependent variable is the difference between i and j's contributions in Column 1 and 2, and the average between i and j's contributions in Column 3 and 4. "i-j same public group" is a dummy equal to 1 if i and j assigned to the same public treatment group. Columns 1 and 3 control for family relationship between i and j: "i-j relatives" is a dummy equal to 1 if i and j are relatives. Column 2 and 4: "i-j co-members in associations" is a dummy equal to 1 if i and j are members of the same community association(s). Marginal effects reported for discrete change of dummy variable from 0 to 1. Standard errors adjusted for heteroskedasticity using White's correction in parenthesis. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 12 - Correlation between indicators of individual environmental valuation and contribution amount**

	(1) Contribution (Bolivianos)
Thinks that there are threats to the environment	-0.1990
Has forest on own land	-0.0751
Plants trees on own land	-0.0612
Extracts products from forest	-0.0453
Number of environmental institutions known	0.0148

Note: Correlation coefficients of row variables with contribution amount.

### Appendix A. Dyadic regressions.

**Table A1. Dyadic regressions of experimental outcomes on social link and group assignment, controlling for demographic characteristics**

	Abs(i - j contribution)		Avg(i - j contribution)	
	(1)	(2)	(3)	(4)
i-j same public group	-0.191 (2.518)	5.607 (2.051)***	3.151 (1.774)*	6.578 (2.023)***
i-j relatives	-3.962 (1.639)**		-2.668 (1.358)**	
(i-j same public group)*(i-j relatives)	11.615 (4.703)**		-1.567 (3.369)	
i-j co-members in associations		-1.223 (0.586)**		-0.879 (0.385)**
(i-j same public group)*(i-j co-members in associations)		-1.864 (1.456)		-1.378 (1.046)
abs(i's age - j's age)	-0.046 (0.039)	-0.062 (0.038)	0.014 (0.043)	0.002 (0.043)
i's age + j's age	-0.017 (0.056)	-0.014 (0.056)	-0.024 (0.061)	-0.023 (0.060)
abs(i female - j female)	-0.158	-0.201	-0.016	-0.061
i female + j female	-2.334 (1.275)*	-1.937 (1.213)	-0.821 (1.549)	-0.534 (1.464)
abs(i's education - j's education)	0.142 (0.271)	0.246 (0.254)	-0.017 (0.231)	0.057 (0.234)
i's education + j's education	0.083 (0.327)	0.076 (0.324)	0.369 (0.341)	0.365 (0.337)
<b>Number of Obs</b>	<b>3906</b>	<b>3906</b>	<b>3906</b>	<b>3906</b>

Note: The dependent variable is the difference between i and j's contributions in Column 1 and 2, and the average between i and j's contributions in Column 3 and 4. "i-j same public group" is a dummy equal to 1 if i and j assigned to the same public treatment group. Columns 1 and 3 control for family relationship between i and j; "i-j relatives" is a dummy equal to 1 if i and j are relatives. Column 2 and 4: "i-j co-members in associations" is a dummy equal to 1 if i and j are members of the same community association(s). Marginal effects reported for discrete change of dummy variable from 0 to 1. Standard errors adjusted for heteroskedasticity using White's correction in parenthesis. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



## Chapter III. Determinants of Conservation Among the Rural Poor: A Charitable Contributions Experiment<sup>38</sup>

### 1. Introduction

Promoting sustainable use of natural resources is one of the main challenges facing policy makers in developed and developing countries alike. While developed countries adopt laws and sanctions to regulate the use of common property resources (CPR), developing countries often lack the institutional capacity to design and enforce solutions. Sustainable management of natural resources in poor countries often relies on informal systems managed by users themselves. Given the role of collective action in promoting sustainable resource use in these settings, understanding what influences environmental valuation and generates support for locally owned solutions is a priority both for policy makers and researchers.

Research on these issues can have a large impact on development and poverty reduction. The benefits from sustainable use of natural resources are likely to accrue primarily to the poor. The poor rely more heavily on CPR, such as fresh water, pastures and forests, for their livelihoods. They are also more exposed to environmental shocks, such as flooding, droughts and soil erosion. Women and children are particularly vulnerable to environmental degradation, the consequences of which they bear in terms of food security and time allocation between resource collection and productive activities.

This paper examines factors associated with environmental valuation. Through an artefactual field experiment (Harrison & List, 2004) and associated survey we conducted in Sierra Leone, the relationships between people's donations to a local environmental NGO and their individual characteristics are investigated. We focus on two potential correlates of environmental valuation: exposure to environmental degradation and social preferences. We proxy exposure to environmental degradation using a subjective and an objective measure, the former derived from survey questions and the latter from GIS deforestation data. Social preferences are measured using experimental and survey data. External validity of the experimental results is also tested for by observing how these variables affect actual conservation behavior.

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<sup>38</sup> Joint with Deanna Karapetyan (University of San Francisco)

Our findings show that, when dependence on natural resources is high, suffering the consequences of environmental degradation is positively correlated with both participants' willingness to support environmental organizations and their likelihood of engaging in conservation activities. On the other hand, simply living in areas which have experienced environmental degradation is not sufficient to raise people's valuation of the environment. On the contrary, the weak preferences for conservation that have led to overexploitation of forest resources in the past appear to persist in current conservation choices. Experimental proxies of social preferences are correlated with donations, but not with actual conservation activities. The opposite holds for survey-based measures of social preferences, which explain environmental valuation outside but not within the experiment.

These findings are consistent with the existing literature on CPR management and social preferences. They also allow us to make a methodological point concerning the possibility to draw policy lessons from experimental findings: in order to generalize behavior from the laboratory to the field, experimental designs need to be carefully tailored to the decision setting and actual behavior one wishes to explain. In our case, the results show the importance of environmental awareness in fostering conservation choices, and point to the role of environmental education messages explaining the costs of natural resource misuse.

The paper is articulated as follows. First, we discuss the relevant literature and derive theoretical predictions (Section 2). We then give an overview of the experimental setting and design, and define the main variables used in the empirical analysis (Section 3). Finally, we describe the empirical strategy and results (Section 4), and conclude (Section 5).

## 2. Related literature

A number of studies show how environmental degradation in general, and deforestation in particular, affect those who rely on natural resources for their livelihoods (Bucknall, Kraus, & Pillai, 2000). Since firewood is the main source of energy for the rural poor, deforestation leads to increased firewood collection time among rural households, at the expense of time for other productive activities. This effect is stronger among more vulnerable family members: a study conducted in Malawi shows that school attendance is lower, and girls are more likely to be collecting resources while attending school, in districts

where wood is scarcer (Nankhuni & Findeis, 2004). Increased firewood collection time also makes the female population of a developing country more exposed to danger in a conflict zone, such as Darfur, where “firewood collection was consistently indicated as one of the key vulnerability factors exposing women to the risk of sexual assault” (Bizzarri, 2009).

Common-pool resources (CPR) are characterized by non-excludability and rivalry in consumption. The difficulty of excluding individuals from use, combined with the fact that consumption by one individual reduces the amount of resources available to others, imply that CPR users face a typical cooperation dilemma. Each individual depends on the resource for her livelihood and has the incentive to maximize her own benefit by increasing extraction. However, if everyone follows the same rationale, the resource will be depleted and will not generate benefits for anyone in the long term. In an influential article, Hardin (1968) claims that the behavior of rational, self-interested individuals is bound to result in overexploitation of CPR. This conclusion is consistent with game theoretical predictions and is confirmed by numerous examples of overharvesting of renewable natural resources, such as fisheries, forests and groundwater.

However, a large literature on CPR management questions this vision, by offering evidence of effective cooperation to solve commons problems. Field experiments show that collective action is most effective when communities are able to self-organize, and design and enforce their own rules (Wade, 1986; Ostrom et al., 1999; Baland and Platteau, 1996). Among the factors identified by this literature as fostering sustainable management of CPR, those related to resource abundance and social preferences within the population are the most relevant to our study. In what follows, the main contributions within this strand of the CPR management literature are reviewed.

The relationship between environmental degradation and CPR management is complex: while overexploitation of natural resources leads to environmental degradation, a certain degree of resource degradation is necessary to trigger collective action for conservation. Among the different types of resource attributes that contribute to self-organized forest management, Elinor Ostrom (1999) underscores the importance of feasible improvement. Feasible improvement refers to a resource that is “not at a point of deterioration such that it is useless to organize or so underutilized that little advantage results from organizing” (Ostrom, 1999). Empirical evidence shows that cooperation levels are low when the CPR is

either abundant or extremely degraded, but high when the level of degradation is at a moderate level (Bardhan, 2000).

Dependence on the CPR for a major portion of one's livelihood is also claimed by Ostrom (1999) to be a factor leading to greater interest in conservation of the resource. Empirical evidence from Malawi shows that, where forests serve as safety nets for people, individuals have higher rates of participation in CPR management (Jumbe & Angelson, 2007).

Social preferences, such as altruism, inequality aversion, trust, time preferences and civic engagement, are likely to affect CPR management since they shape individuals' response to the trade-offs between individual and social benefits from environmental conservation. Their role is bound to be particularly relevant in developing country settings, where social norms often substitute for formal institutions lacking regulatory and enforcement capacity (Narayan, 1999; Khan, 2006). The empirical evidence on the relationship between social preferences and environmental conservation widely support this view.

We expect an individual's level of altruism to be positively correlated with her contribution to a local public good because an altruistic person's utility is a positive function of others' consumption. This view is in contrast with the traditional notion of self-interested individuals, whose utility depends solely on own consumption (Becker, 1976; Reece, 1979; Collard, 1978). Empirical evidence supports the presence of a positive correlation between altruism and contribution to public goods (Goeree, Holt & Laury, 2002).

Preferences for fairness are likely to foster sustainable management of CPR through their influence on people's willingness to contribute to public goods and to punish over-exploitation by others. Direct evidence on the link between inequality aversion and public good contribution is scarce, but research in psychology (Lerner, 1980; Bégue & Hafer, 2005) and economics (Andreoni, Harbaugh, & Vesterlund, 2003) shows that people express their preferences for fairness by punishing inequality in resource allocation.

The literature on social capital and collective action identifies trust as a necessary condition for cooperation within a society (Ostrom, 1998; Cramb, 2005; Pretty, 2003; Pretty & Smith, 2004). Experimental studies show the presence of a positive correlation between trust towards strangers, contributions to public goods (Gächter, Herrmann, & Thöni, 2004)

and other social preferences, such as fairness (Walker & Ostrom, 2007). Field evidence supports the results from laboratory experiments: combining data from a trust game with information on investments in soil and water conservation, Bouma et al. (2008) find a positive and significant correlation between the amount sent in the trust game and participation in CPR management.

Investing in conservation involves a trade-off between short term costs and uncertain returns in the future. The degree to which individuals discount the future is therefore likely to affect the perceived benefits from contributing to natural resource conservation. The evidence on whether the poor discount the future more heavily, and on how discount rates translate into conservation activities, is mixed. In a three country study, Holden et al. (1998) show that poverty is associated with higher discount rates and, they argue, with lower conservation efforts. On the contrary, research based on food consumption and asset holding during famines shows that the poor reduce caloric intake during periods of food scarcity in order to avoid selling off productive assets (Moseley, 2001), a fact that would suggest the presence of a relatively low discount rate among the poor. Regardless of the evidence on the relationship between poverty and time preferences, theory predicts a negative correlation between an individual's discount rate and her environmental conservation efforts.

Natural resources are a local public good and their management requires collective action on the part of the community. Evidence from high-income countries shows that participation in city council and school meetings is associated with a higher probability of engaging in collective action for conservation (Wakefield, Elliott, & Cole, 2007). Membership in community associations is found to be associated with higher contribution to conservation projects in two artefactual field experiments in Latin America (d'Adda, 2011a; d'Adda, 2011b).

The paper by Voors et al. (2011) represents the closest parallel research to that conducted here. Participants to their study play two public good games, a framed and an unframed one. Experimental choices are compared to survey data on illegal exploitation of forest resources and support for conservation activities. The main findings of the study are that behavior in the two experimental games is only weakly correlated, and that positive contributions in the framed experiment are associated with higher conservation efforts outside of the experiment.

In this paper, we consider an experimental choice that more closely mirrors actual conservation decisions that participants face in their daily lives. We relate the experimental choice with survey measures of actual conservation behavior and explore its correlation with a rich set of variables. The design of our study permits us to analyze the relationship between environmental valuation and other types of social preferences. Finally, the use of subjective and objective measures of environmental degradation allows us to test how they correlate with conservation choices. Our results are generally consistent with those in Voors et al. (2011), but differ from theirs in an important dimension, as we will discuss below.

## 2. Design of the study and data

### 2.1. Setting

The study took place in Sierra Leone. The country has one of the lowest HDI rankings in the world – 158<sup>th</sup> out of 169 countries (Human Development Report, 2010) and experienced a devastating civil war between 1991 and 2002. Coupled with its high levels of poverty, the fact that Sierra Leone has suffered severe environmental degradation over the past thirty years makes it a suitable setting for our study. Figure 1 shows that resource extraction in the country over the past decades has been steadily approaching the capacity of natural resources to regenerate themselves. This trend is likely to threaten the livelihood of the 69% of the population who live in rural areas and directly depend on natural resources for their survival.<sup>39</sup>

[Insert Figure 1 here]

The study area is in the Northern part of the country, within the district of Bombali (Figure 2). Bombali district has experienced high rates of deforestation like the rest of the country, as shown in Figure 3. The fact that people rely on natural resources for their livelihoods and are negatively affected by environmental problems emerges also by looking at our survey data: 90% of the participants in our study extract products from the forest, 59% mention bush fires as an environmental problem in their village, and 69% report an increase in the price of firewood.

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<sup>39</sup> World Bank data, 2009. Link: [data.worldbank.org/country/sierra-leone](http://data.worldbank.org/country/sierra-leone).

[Insert Figure 2 and 3 here]

The experiment took place in 21 villages within Bombali district, with 560 individuals between the ages of 18 and 84 participating in the study. The experiment was part of a larger research project, investigating the relationship between conflict exposure and social preferences, and the transmission of preferences across generations. Consistent with these goals, the villages in our sample were selected on the basis of an index of exposure to civil war violence, and the experiment was conducted in primary schools with pupils and their parents. Only adult participants completed the task analyzed in the present paper, therefore in what follows we will discuss exclusively the adult component of the study.<sup>40</sup>

Table 1 summarizes characteristics of study participants. Many children in our sample were living with grandparents after their parents died due to the war, or moved to the city for work: this explains the relatively high average age of participants for a developing country. Only 26 percent of participants had some schooling, 75 percent of them worked in agriculture, and their average weekly income per capita was about 49,000 Leones (less than 10 USD). The percentage of households that fled from their villages during the civil war is 87.

[Insert Table 1 here]

## ***2.2. Experimental design***

Participants to the experiment completed a series of tasks, designed to capture different dimensions of social preferences. The first four tasks were binary choice dictator games inspired by Fehr et al. (2008). By combining choices in these tasks, it is possible to assign participants to different profiles: generous, selfish, spiteful and inequality averse. In the last three tasks, participants played a dictator and ultimatum games (both roles). Participants' choices in a subset of these tasks provide the experimental measures of social preferences that will be used in the empirical analysis. Details on variables' definition are given in the next sub-section.

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<sup>40</sup> For a detailed account of the broader research, within which the present study was set, of its design and results, see Bauer, Cassar, Chytilova and Henrich (2011).

After completing all the tasks, participants were asked whether they would like to donate a small part of their earnings to an environmental nonprofit organization called the Conservation Society of Sierra Leone (CSSL). CSSL is based in Freetown, its main objective is ‘to promote the wise use and management of Sierra Leone’s natural resources through education, advocacy, research and site action’ (CSSL). Their programs range from sea turtle and forest conservation to environmental education and sensitization campaigns. Participants were given brief information about CSSL before being asked for a donation.

Participants could decide to donate 0, 300, 800 or 1000 Leones from their winnings to CSSL.<sup>41</sup> The experimenter emphasized that the donation would be subtracted from their winnings from the day, that no other tasks would follow, and that contributions were completely voluntary. Participants didn’t know how much they earned through the tasks at the time of choosing their donation since they received their winnings only at the end of the experimental session, after completion of the survey. Each participant was given what she earned for participation, what she earned for the choice she made in a randomly chosen task, minus her donation amount to CSSL. Each task had different earnings potential. The earnings were calculated in the following way: 5,000 Leones (about 1.25 USD) for experiment participation plus anywhere between 0 and 16,000 Leones (about 4 USD) depending on which game was chosen and what decision was made, subtracted by the amount they donated to CSSL.

In order to test whether donation amounts depend on the perceived beneficiary of the service, we introduced an experimental treatment. CSSL’s activities were said to be beneficial for ‘people in the whole country’ in the out-group treatment, and for ‘people in this region’ in the in-group treatment. The allocation of treatment across sessions was random. We conducted two sessions in each village, in order to have observations for both treatments from each village.

### **2.3. Data**

Experimental data are complemented by survey and GIS information. The survey collected information on demographic and socioeconomic characteristics, social preferences, knowledge and opinions on the environment, and civic engagement. Village level satellite observations of changes in forest cover between 2006 and 2010 were

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<sup>41</sup> The price of a cup of rice, staple food in Sierra Leone, is 500 Leones.

Tesi di dottorato “Fostering collective action: three artefactual field experiments on local public good provision in developing countries”  
di D’ADDA GIOVANNA  
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constructed based on NASA Landsat images, and village GIS coordinates were obtained from the Community Forest Conservation and Agricultural Development Association of Sierra Leone. In this sub-section, we describe in detail the main variables that will be used in the empirical analysis.<sup>42</sup>

Our main outcome variables are different proxies of environmental valuation and conservation behavior. First, we use the amount donated to CSSL as our experimental measure of environmental valuation. Donations went to support non-rival and non-excludable conservation efforts. Under this respect, the experiment is similar to most public good games. However, our donation experiment differs from a public good game in a crucial dimension: the return from the investment in the public good is not exogenously given, but is subject to the same uncertainty that characterizes real world investments in common natural resources. This feature of our study, while generating a loss of experimental control, makes the experimental decision more generalizable and directly comparable to participants' real world conservation choices.

We investigate whether environmental valuation, as captured by experimental donation, generalizes to actual conservation behavior by using survey data. Conservation behavior is defined here as the preservation and management of the environment and common natural resources. Consequently, our two other dependent variables, participation in town cleaning and maintenance of the village's water sources, measure actual conservation behavior. Town cleaning is a common practice among sample villages, where community members get together to clean common spaces. Maintenance of public water sources is also done on a voluntary basis by community members, who clear the area surrounding the source from dirt and waste, and fence it in order to protect it from contamination by animals. Both variables are equal to one if the respondent participated in the activity at least once in the twelve months prior to the survey. While donation to an environmental NGO reflects preferences for conservation more narrowly, participation in maintenance and cleaning are likely to capture social preferences and civic engagement more broadly. The different nature of the outcome variables is reflected in the empirical results, and will be addressed further in section 4.

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<sup>42</sup> A complete overview of the survey questions from which these variables were constructed is offered in Appendix B.

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In the empirical analysis, we focus on six factors potentially correlated with conservation behavior: an index capturing exposure to environmental degradation and dependence on natural resources, altruism, inequality aversion, trust, time preferences and civic engagement. We also control for a set of individual and household characteristics: age, gender, marital status, education level, religion, ethnicity, occupation, household size, number of years living in the village, household per capita expenditure and an index of conflict exposure<sup>43</sup>. To construct the set of explanatory variables, data are gathered from experimental tasks, survey questionnaires, and Landsat images.

In a first specification, we proxy exposure to environmental degradation using a subjective measure of perceived environmental degradation. This variable is defined through survey questions on income lost due to environmental degradation, either in the form of increased time to collect firewood or of loss of harvest due to shocks. The environmental degradation variable is equal to one if the respondent experienced increased firewood collection time or lost income due to an environmental shock over the two, or three, years prior to the survey, respectively. In order to combine exposure to degradation with dependence on natural resources, and thus test Elinor Ostrom's claim that the combination of these two factors fosters conservation behavior, the environmental degradation variable is interacted with a variable counting the number of products that individuals extract from the forest, such as firewood, timber, fruits, honey, etc. In what follows, we label the resulting variable as the *exposure-dependence* index.

Using subjective perceptions as a proxy of environmental degradation makes the establishment of any causal link between environmental degradation and donation questionable. Unobserved individual characteristics may determine both individuals' awareness of environmental degradation and their willingness to contribute to conservation activities. For instance, it is likely that, for a given level of environmental quality, characteristics such as education, income and exposure to conservation campaigns may influence both the perception of environmental degradation and the willingness to support conservation activities. In order to address the issues associated with the use of experienced

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<sup>43</sup> The conflict exposure index counts the number of ways in which respondents say to have been affected by the war. The list of conflict-related events considered in the survey ranged from having family members killed, injured or abducted, to having one's house burned down, or having had to flee the village because of the war.

environmental degradation, we complement our subjective proxy of environmental degradation with more objective measures of deforestation.

In an alternative specification, we replace the experience of environmental degradation with actual deforestation rates over the 5 years prior to the study. This approach guarantees that the environmental degradation variable used to construct the *exposure-dependence* index under this specification reflects more closely the effect of loss of forest cover on respondents' exposure to environmental degradation.

The village level deforestation measure was constructed in ArcGIS from cloud free NASA Landsat images of Sierra Leone for the years 2006 and 2010. These images had to be corrected for atmospheric scattering and absorption of light, which is based on the methodology that Chavez (1996) streamlined. After these corrections were made, the soil adjusted vegetation index (SAVI) was calculated:

$$SAVI = \frac{N-R}{N+R+L} (1 + L) \quad (1)$$

where N is the near-infrared band (Landsat TM Band 4); R is the red band (Landsat TM Band 3); and L is a correction factor between 0 and 1 (in this study, a mid-range value of L = 0.5 was used). The difference between the SAVI in 2006 and 2010 was taken, and village GPS coordinates for 19 out of the 21 villages were manually added in ArcGIS. A 2-mile zone around each village was constructed, and the average level of vegetation cover decrease within each zone was used as the deforestation variable for that village.

The use of actual deforestation, although addressing the issues related to the adoption of experienced degradation, also involves important shortcomings. While mining and illegal logging by foreign companies are major causes of deforestation in other regions of Sierra Leone, deforestation in the study area is primarily the result of firewood collection and slash-and-burn agriculture by local communities. It is possible that present conservation choices are the product of common resources' exploitation in the past, or that unobservable individual preferences or characteristics lie behind both past deforestation and donation choices within the experiment. Therefore, the actual deforestation measure, while capturing individuals' exposure to degradation, also reflects past preferences for conservation of village members. We will show in section 4 that this latter effect appears to dominate.

Participants' altruism and inequality aversion measures are derived from experimental data. In the dictator game, each subject could send any number of tokens between zero and four. We use the number of tokens sent as an ordered categorical proxy of altruism (Camerer, 2003). Inequality aversion is a variable equal to one if a participant equally split her endowment both in the ultimatum and in the dictator games. About 30.9 percent of participants can be defined as egalitarian according to this index<sup>44</sup>.

Our measure of trust is derived from a series of standard survey questions, taken from the World Value Survey. Respondents are asked to state their trust towards different groups of people: family members, friends, neighbors, and people in general. Trust variables range from one to three, where three represents the highest level of trust. We build a trust index as the ratio of personalized to generalized trust by dividing the average trust towards family, friends and neighbors by the level of trust towards people in general. This index can be interpreted as a measure of social capital within the village: it is on average equal to 1.26 in our sample, ranging from a minimum of 0.5 to a maximum of 3.

A standard time preference question, facing respondents with six hypothetical situations where they had to choose between receiving a certain amount of money in the present or a larger sum in a month, is used to compute participants' discount rate. The amount offered in the future ranged from 100,000 Leones (25 USD), equal to the amount offered in the present, up to 300,000 Leones. Almost 25 percent of participants always preferred to receive money in the present, regardless of how much was offered in the future. Since the discount rate is not defined for these individuals, we drop these observations from the regressions. The average discount rate for the rest of the sample is 66 percent per month.

A series of survey questions on participation to community meetings, local and general elections and membership in community associations is used to derive an index of civic engagement. These activities all signal an individual's involvement in public life. The index is constructed as follows: for each dimension of civic engagement, individual participation is divided by the average level of participation at the village level; the different dimensions

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<sup>44</sup> Alternative measures of inequality aversions could be used. Combining choices in the four binary allocation games, Fehr et al (2008) construct an index of inequality aversion. We do not adopt this approach because only 9.6 percent of subjects (54 observations) can be defined as inequality averse based on their choices in the binary allocation games. A less demanding version of the inequality aversion proxy would require participants to split their tokens equally either in the ultimatum or in the dictator game. We prefer the stronger definition of egalitarianism used here because it identifies participants who consistently chose equal splits in the two tasks. However, the results reported in Section 4 are robust to the inequality aversion index used.

are then summed to form a unique index. The index is normally distributed, with a mean of 4 and a standard deviation of 1.08.

When regressions control for village level characteristics, the following variables are included: population; distance to the nearest town; presence of health center and daily market; a measure of conflict intensity (number of houses burnt in the village during the war); an indicator of whether living conditions in the village have improved; and average dictator and ultimatum game choices among participants from the same village.

Table 2 summarizes this section by showing summary statistics of the main outcome and control variables, and of the measures used to construct the environmental degradation and civic engagement indices. The experimental and non-experimental measures of conservation behavior, social preferences, and environmental degradation described here are the focus of the empirical analysis conducted in the next section.

[Insert Table 2 here]

#### 4. Empirical strategy and results

In this section we want to identify factors behind environmental donation within the experiment, with a special focus on environmental degradation and social preferences. Following the discussion of section 2, we expect the following correlations to hold: conservation behavior should be positively correlated with dependence on natural resources combined with experience of environmental degradation, altruism, inequality aversion, trust and civic engagement, while it should be decreasing in individuals' discount rate.

##### 4.1. Empirical strategy

In order to analyze the factors correlated with conservation behavior within the experiment, we run the following regression, whose results are shown in Table 3:

$$Y_{ij} = \alpha + \beta Z_{ij} + \gamma X_{ij} + \delta V_j + \varepsilon_{ij} \quad (2)$$

where the dependent variable  $Y_{ij}$  is donation amount, participation in water maintenance or in town cleaning. We use ordered probit regressions for donation, and probit regressions for participation in conservation activities.  $Z_{ij}$  is a vector of six variables, capturing the six

correlates of conservation we focus on: *exposure-dependence*, altruism, inequality aversion, trust, time preference and civic engagement.  $X_{ij}$  is the vector of individual and household level controls.  $V_j$  are village fixed-effects or village level characteristics.  $\beta$  and  $\gamma$  are coefficient vectors. The observations are clustered at the village level.<sup>45</sup> In order to address concerns related to the use of fixed-effects in non-linear regression models, in what follows we present results for (ordered) probit and OLS specifications for each outcome variable.

## 4.2. Results

Average donation within our sample was about 550 Leones, and 82.7 percent of participants donated a positive amount to conservation. Figure 4 shows the distribution of donation amount. 58 and 50.4 percent of participants said to have taken part, respectively, in town cleaning and water source maintenance over the year prior to the survey. The three measures of environmental conservation are positively correlated, although at differing levels of significance. The correlation is significant between town cleaning and the other two outcome variables, while it is not between donation and water maintenance. Participants who engaged in town cleaning donate significantly higher amounts to conservation within the experiment and were significantly more likely to have done maintenance work on the community's water source<sup>46</sup>. These differences in pairwise correlation coefficients suggest that the three outcome variables capture different combinations of civic engagement, social preferences and environmental valuation.

[Insert Figure 4 here]

Table 3 shows regression results for the different specifications using donation as the dependent variable. Columns 1 and 3, and 2 and 4, show (ordered) probit and OLS results from equation (2), respectively. The exposure-dependence index is constructed using experience degradation in Columns 1 and 2, and actual deforestation in Columns 3 and 4.

<sup>45</sup> Assuming that village fixed-effects control for unobservable differences across villages and that observations from the same village are uncorrelated if individuals did not participate to the same experimental session, an alternative specification clusters the data at the session level. This specification, bringing the number of clusters from 21 to 42, also solves the issue of having too few clusters (Cameron and Miller, 2010). All the findings reported in this section are robust to the level of clustering chosen.

<sup>46</sup> The p-values of the one-sided t-tests of the difference in donation and rate of participation in water maintenance, depending on a participant's engagement in town cleaning, are 0.002 and 0.000 respectively.

All regressions include village fixed-effects, since all our regressors of interest, and in particular the exposure-dependence index, vary at the individual level.

[Insert Table 3 here]

Experienced environmental degradation is positively and significantly correlated with conservation behavior within the experiment. The sign and significance of the coefficients on the exposure-dependence index is robust to the model used (probit versus OLS) under the first specification. These results support Elinor Ostrom's claim on the effect of dependence and vulnerability to environmental shock being positively correlated with individual willingness to contribute to conservation activities. When actual deforestation rates are used to construct the index, the coefficient on exposure to degradation becomes insignificant. Such lack of significance is probably due to the fact that the deforestation measure captures, beside exposure, the effect of low valuation of the environment in the past, which is likely to persist in the present and be among the determinants of individual donations within the experiment.

Among social preferences variables, indicators of altruism and inequality aversion are positively and significantly correlated with donation, as predicted by the theory. More pro-social play and egalitarian choices in the dictator and ultimatum games are associated with higher donations. Survey measures of social preferences, such as time preferences, trust and civic engagement, instead show no significant correlation with the dependent variable.

Table 4 shows results from the similar specifications, with participation in water source maintenance (Columns 1 to 4) and participation in town cleaning (Columns 5 to 8) as dependent variables. The regressions are run using both non-linear (Columns 1, 3, 5 and 7) and linear (Columns 1, 3, 5 and 7) models. The exposure-dependence index is constructed using experienced degradation in Columns 1-2 and 5-6, and actual deforestation rates otherwise. The regressions feature, as above, individual controls and village fixed-effects.

[Insert Table 4 here]

Experienced environmental degradation is positively correlated with conservation choices outside the experiment, both with water source maintenance and town cleaning activities. On the contrary, when environmental degradation is measured through actual deforestation, its correlation with conservation behavior is negative and significant. This result is explained if we think that overexploitation of common natural resources (i.e. past deforestation by village members) and lack of participation to village conservation activities are close expressions of a unique underlying individual (low) valuation of common goods.

Only a few social preference measures are correlated with conservation behavior outside the experiment. Individual discount rates are negatively and significantly correlated with participation in town cleaning, while higher trust levels translate in significantly higher participation in water source maintenance. None of the experimental measures of social preferences is correlated with the outcome variables.

Figure 5 shows the marginal effects of a change from 0 to 1 of the environmental degradation variable on the three outcome variables, based on the (ordered) probit model, and confirms the claim that experienced degradation has a consistent impact across the conservation choices examined here. In general, these results suggest that, within each village, those individuals who are more vulnerable to environmental degradation are also more willing to contribute to the conservation of the environment and maintenance of the common resources.

[Insert Figure 5 here]

The different results obtained when focusing on experimental versus non-experimental measures of environmental valuation may be explained, as discussed above, by the fact that the three outcome variables capture different combinations of social preferences related to the environment and more general ones. In order to further investigate this issue, we conduct factor analysis on the three outcome variables, in order to extract their underlying sources of variation. Such factors capture independent variables that affect the three types of conservation choices, even though these independent variables cannot be measured directly.

Factor analysis reduces the three outcome variables to two main factors, that represent two orthogonal dimensions underlying their variation. Table 5 presents regressions of the



two factors on the usual set of independent variables. Columns 1 and 2 use Factor 1 as dependent variable, while Columns 3 and 4 use the Factor 2. The exposure-dependence index is constructed using experienced degradation in Columns 1 and 3, and actual deforestation elsewhere.

[Insert Table 5 here]

The results reproduce the same pattern observed above. Exposure to environmental degradation has a positive effect on conservation when it captures experienced degradation, while it has a negative effect, significant only in the case of Factor 1, when it reflects past deforestation activities. Experimental measures of social preferences, i.e. altruism and inequality aversion, have the predicted effect only on the second factor underlying conservation behavior, while survey-based measures of social preferences, such as trust and time preferences, have the predicted effect only on the first component behind conservation choices. It appears that the underlying dimensions of conservation behavior reflect distinct sets of individual traits. Remarkably, experienced degradation is the only variable that significantly explains both dimensions of conservation choices.

A final step of the empirical analysis explores treatment effects. In order to do so, we focus on donation as outcome variable and interact each of the social preference independent variables with a dummy equal to 1 if  $i$  was assigned to the ingroup treatment. Regression results are shown in the Appendix (Table A6). Being told that the NGO's activity will benefit people from one's own region doesn't increase donations: the coefficients on the ingroup variable are generally insignificant and switch sign depending on the specification. None of the interaction terms are significant, implying that none of the dimensions of social preferences examined here lead to increased donations for conservation when the benefits are perceived to be directed to one's own community.

## 5. Conclusions

All the most often cited determinants of conservation behavior are explored in this research, and our main result is that the experience of environmental degradation in rural Sierra Leone makes individuals more likely to support conservation. Within each village,

those most exposed to the consequences of deforestation are also more willing to contribute to conservation. On the other hand, living within a village where deforestation was conducted is not by itself conducive to higher valuation of the environment. These results are consistent with Elinor Ostrom's claim that conservation behavior is fostered by a combination of environmental degradation and dependence on natural resources, but at the same time shows that living with the consequences of overexploitation of common resources is not enough to raise individual valuation of the environment. On the contrary, the preferences that led to such overexploitation appear to persist over time.

The findings of our study suggest that there is potential for sustainable natural resource use in an extremely poor, rural, and environmentally degraded setting. We show that willingness to contribute to conservation requires awareness of the consequences of environmental degradation, since we find that perceived environmental degradation varies within villages and is positively associated with conservation behavior. Environmental education, by disseminating information on the costs of environmental degradation, may therefore be effectively used to build support for locally-owned conservation initiatives, even in very poor settings. Since many development pathways are critically dependent upon the maintenance and exploitation of natural resources, this research is critical for policy makers seeking to manage developing countries' resources.

Consistent with these policy implications, the donations collected through our experiment were used by CSSL to offer environmental education across villages in the project area on the consequences of bush fires and on the correct procedures to minimize deforestation due to slash-and-burn agriculture. An interesting follow-up to this study would explore the effect of the education campaign on participants' conservation behavior. In light of the findings from this study, this and other similar programs are likely to have profound implications for the livelihood of individuals living in areas subject to natural resource depletion in developing countries.

A second extension to this paper would address its main limitations, due to the available measures of environmental degradation. Both subjective and objective proxies used are subject to issues of endogeneity. Experienced degradation may be correlated with individual characteristics that also influence conservation choices, and actual deforestation may reflect preferences for conservation that persist in the present. In the future, we plan to identify

exogenous sources of environmental degradation within the study area, in order to explore the causal effect of environmental degradation on conservation behavior.

A second contribution of this study is methodological. Existing research on the relationship between experiment and survey measures is also validated in this paper. The lack of correlation between experimental indices of social preferences and survey measures of conservation is consistent with psychology studies (Lee and Nisbett, 1991) and with the main findings in Voors et al. (2011). The weak relationship between behavior in one setting and another led these authors to claim that social preferences are unstable and highly dependent on the setting. On the contrary, we find our survey-based measure of individual experience of environmental degradation to be significantly correlated with conservation behavior both within and outside the experiment. However, consistent with the previous literature, we find that more abstract measures of social preferences are unable to account for behavior in the real world. As in Voors et al. (2011), in our setting too behavior in a simple game does not appear translate to behavior in the real world.

To reconcile these two sets of findings, it is important to note that, where there exist a strong connection between experimental and real world decisions, such as in the case of our donation task, behavior is consistent across realms. On the contrary, lack of correlation between behavior within and outside the experiment is the result of experimental designs that do not closely reproduce real world decision environments. Indeed, the experiment we employed may be thought of as a modified version of a public goods game, where CSSL represents the environmental public good. However, it more closely mirrors the real world in that the time of repayment and distribution to the public pool is unknown. The experimental choice adopted in our study involved a loss of control relative to the use of standard public good games, but this cost was outweighed by the possibility of drawing policy lessons from our results. Our research informs policy makers that the generalizability of laboratory findings in a field setting crucially relies on the experimental design mirroring real world conditions.

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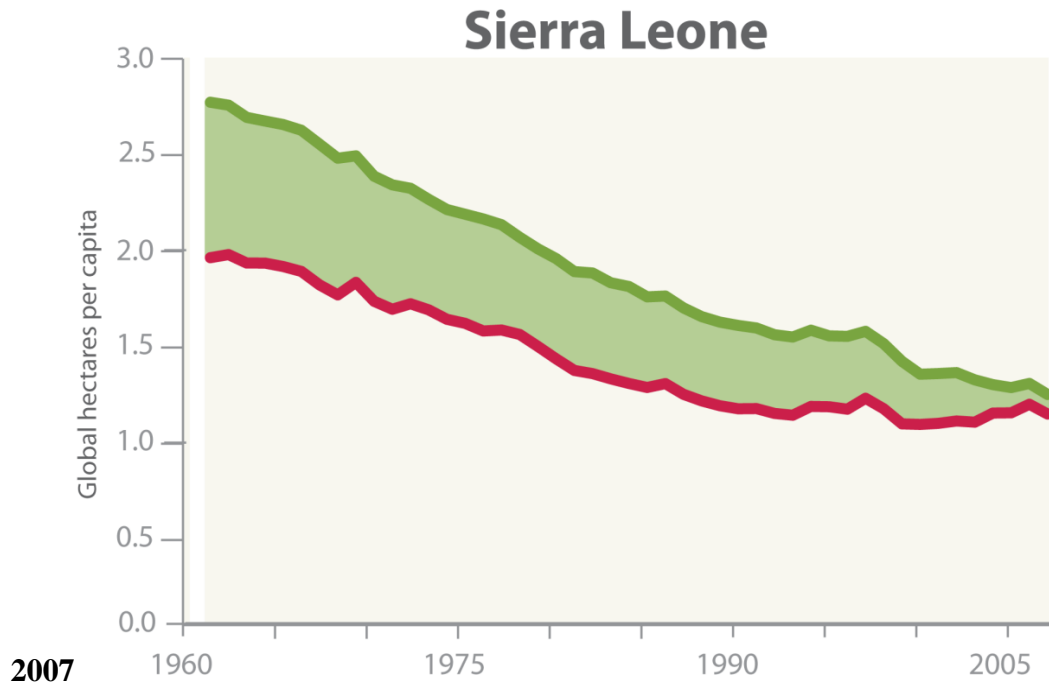
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## Tables and Figures

**Figure 1. Ecological Footprint (red) and biocapacity (green) of Sierra Leone, 1961-**



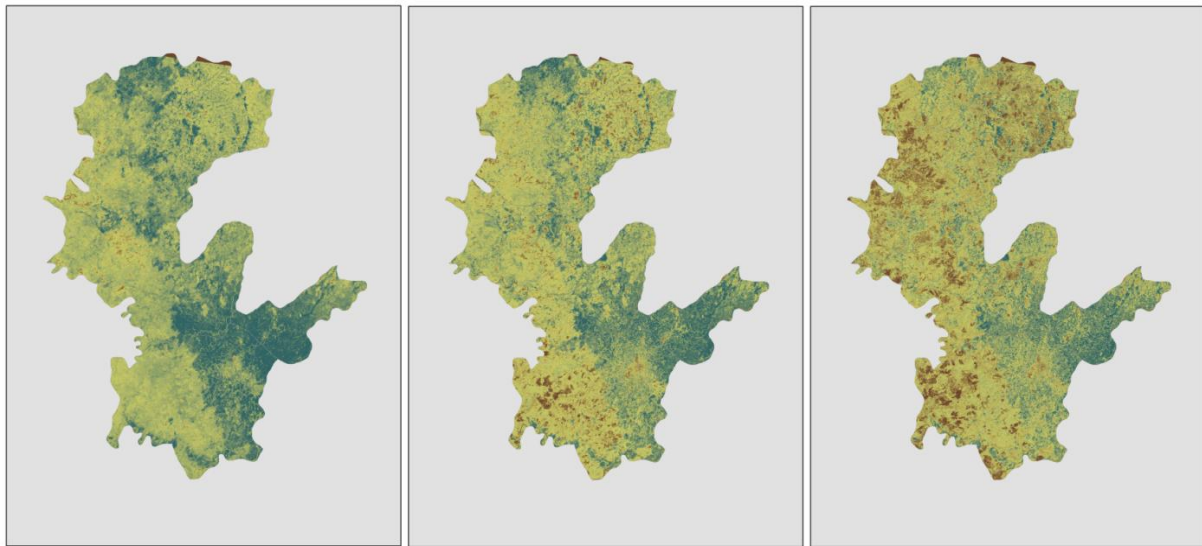
Note: The Ecological Footprint of production represents the rate of resource extraction and waste generation; biocapacity represents the rate of resource re-generation and waste sequestration. A situation where the Ecological Footprint exceeds biocapacity indicates that domestic resources may be degraded. Sierra Leone seems to be approaching this point, and may cross it within a few years if there are no conservation efforts (Ewing, Moore, Goldfinger, Oursler, Reed, & Wackernagel, 2010).

**Figure 2. Map of Sierra Leone with sampled chiefdoms highlighted in green**



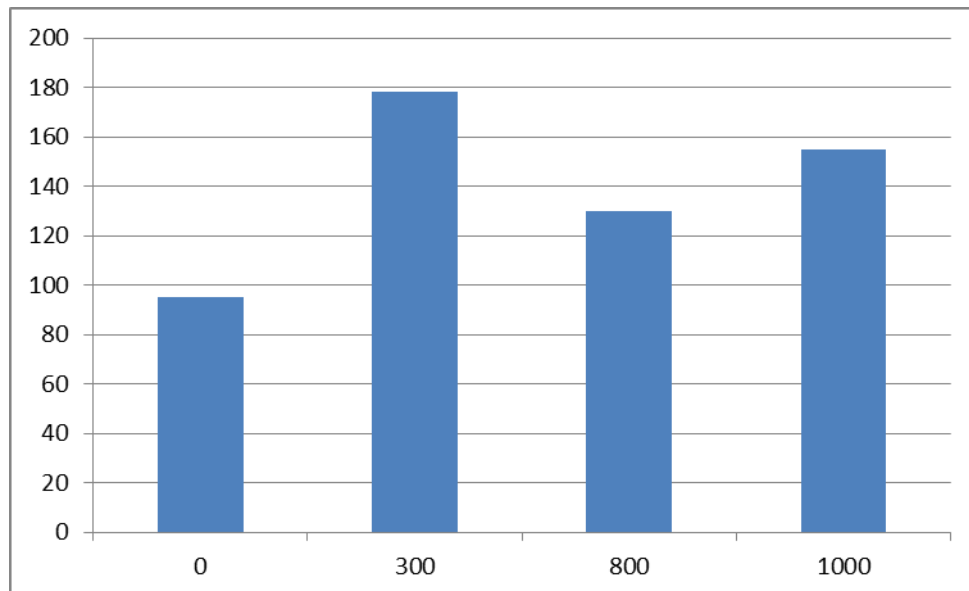


**Figure 3. GIS Maps of Deforestation in Bombali District in 1991, 2006 and 2010**

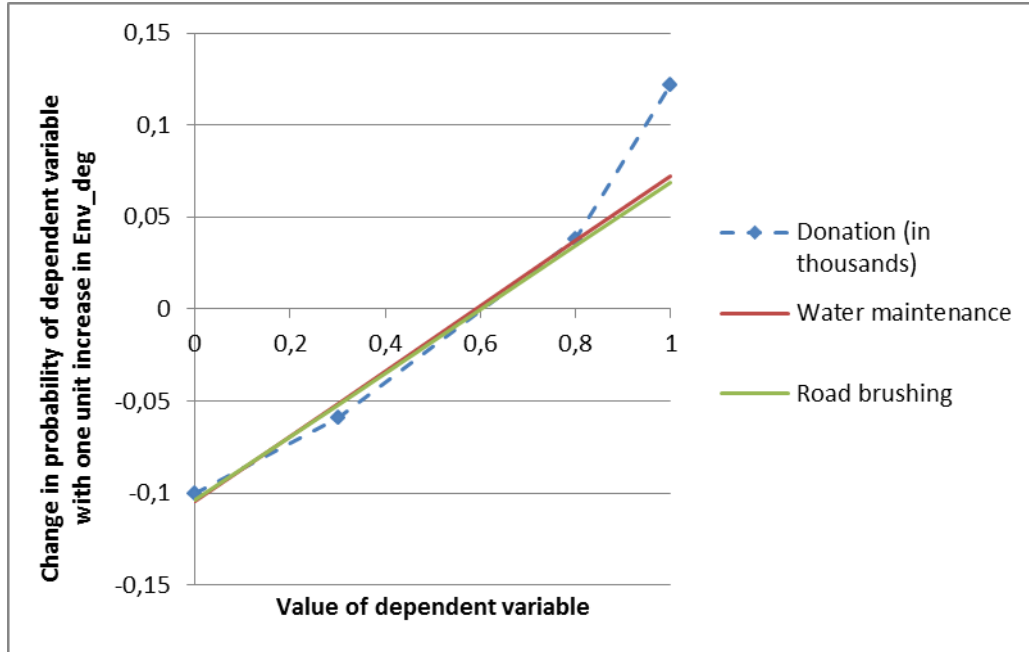


Note: Maps show the soil-adjusted vegetation index (SAVI): dark green areas represent the highest vegetation cover; red-brown areas represent bare ground. Source: NASA Landsat Program, 2010. ETM+ and TM. Bands 3 and 4.

**Figure 4. Distribution of donations: frequency of donation amounts**



**Figure 5. Marginal effects of a change from 0 to 1 of perceived environmental degradation on conservation choices**



Note: Donation amount expressed in thousands in order to use the same scale as for the water maintenance and town cleaning dummy variables. The positive slopes of the lines indicate that exposure to environmental degradation is positively associated with donation amounts and probability to participate in water maintenance and town cleaning.

**Table 1. Summary statistics**

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>
Age	40.76	13.70
Female	.69	.46
Married	.79	.40
Christian	.34	.47
Temne	.65	.48
Household size	9.01	4.38
Attended school	.26	.44
Total weekly expenditure per capita (/000 Leones)	49.46	59.25
Owns land	.77	.42
Farmer	.75	.43
Years living in village	25.98	17.94
Suffered from health shocks over the past year	.49	.50
Uses forest products	.90	.29
Time to collect firewood (in minutes)	89.04	52.21
Thinks there are environmental problems	.99	.07
Forced to flee during war	.87	.34
Number of conflict-related events suffered	5.31	1.57

**Table 2. Dependent variables and regressors of interest: summary statistics**

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>
<i>Conservation behavior</i>		
Donation to CSSL	559.86	377.37
Participated in water source maintenance over the previous year	.59	.49
Participated in road brushing over the previous year	.60	.49
<i>Perceived environmental degradation index and variables used to construct it</i>		
Perceived environmental degradation index	.68	.47
Suffered from environmental shocks over the past 3 years	.37	.48
Time to collect firewood increased over past 2 years	.37	.48
<i>Social preferences</i>		
<i>Ratio of personal to general trust</i>	1.26	.51
Discount rate	65.86	49.24
Inequality averse	.09	.29
Strong egalitarian	.31	.46
Weak egalitarian	.61	.49
Dictator game giving (number of tokens sent)	1.41	1.22
Ultimatum game giving (number of tokens sent)	1.78	1.00
<i>Civic engagement index and variables used to construct it</i>		
<i>Civic engagement index</i>	4.00	1.08
Number of community meetings attended over the previous year	5.77	4.46
Member of Parents-Teachers group	.71	.45
Member of Village Development committee	.22	.41
Member of credit group	.24	.43
Member of labor sharing group	.50	.50
Member of social group	.29	.45
Member of religious group	.51	.50
Member of saving group	.28	.45
Member of traditional society	.39	.49
Voted in past general elections	.97	.17
Voted in past local elections	.93	.26

**Table 3. Determinants of donation amount**

	<b>Dependent variable: Donation amount</b>			
	<i>Subjective</i>	<i>Subjective</i>	<i>Objective</i>	<i>Objective</i>
	<i>exposure to</i>	<i>exposure to</i>	<i>exposure to</i>	<i>exposure to</i>
	<i>degradation</i>	<i>degradation</i>	<i>degradation</i>	<i>degradation</i>
	<i>(oprobit)</i>	<i>(OLS)</i>	<i>(oprobit)</i>	<i>(OLS)</i>
	(1)	(2)	(3)	(4)
Exposure-dependence index ( <i>experienced degradation</i> )	0.128** (0.056)	37.410* (17.961)		
Exposure-dependence index ( <i>actual deforestation</i> )			-1580.202 (2535.690)	-6.36e+05 (7.33e+05)
Altruism	0.214*** (0.064)	69.791*** (18.525)	0.246*** (0.070)	76.679*** (19.451)
Strong egalitarian	0.426*** (0.152)	142.754*** (47.688)	0.372** (0.176)	138.888** (54.037)
Discount rate	0.001 (0.001)	0.122 (0.347)	0.001 (0.001)	0.155 (0.384)
Personal to general trust ratio	0.011 (0.134)	9.847 (44.642)	0.083 (0.143)	33.711 (46.994)
Civic engagement	-0.059 (0.073)	-20.607 (23.228)	-0.051 (0.073)	-22.077 (20.092)
Individual controls	x	x	x	x
Village fixed-effects	x	x	x	x
Observations	339	339	303	303
(Pseudo) R-squared	0.089	0.234	0.091	0.248
Number of clusters	21	21	19	19

Notes. Individual controls: ingroup treatment, age, gender, education, religion, marital status, ethnicity, household per capita expenditure, household size, number of years spent in the village. Village controls: population (no. of households), distance to nearest town, health center in the village, daily market in the village, indicator of improved living conditions in the village over the previous 5 years, mean participants' choices in dictator and ultimatum games. Observations clustered at the village level.

**Table 4. Determinants of conservation behavior**

	Dependent variable							
	<i>Water maintenance</i> (probit) (1)	<i>Water maintenance</i> (OLS) (2)	<i>Water maintenance</i> (probit) (3)	<i>Water maintenance</i> (OLS) (4)	<i>Townclean</i> (probit) (5)	<i>Townclean</i> (OLS) (6)	<i>Townclean</i> (probit) (7)	<i>Townclean</i> (OLS) (8)
Exposure-dependence index ( <i>experienced degradation</i> )	0.317*** (0.072)	0.076*** (0.018)			0.392*** (0.093)	0.066*** (0.019)		
Exposure-dependence index ( <i>actual deforestation</i> )			-1.16e+04*** (3924.641)	-2437.858** (894.012)			-1.92e+04*** (6347.065)	-3073.957** (1110.635)
Altruism	-0.025 (0.088)	-0.004 (0.023)	-0.054 (0.093)	-0.010 (0.026)	-0.034 (0.101)	-0.001 (0.025)	-0.032 (0.095)	0.003 (0.027)
Strong egalitarian	-0.107 (0.198)	-0.018 (0.055)	-0.090 (0.192)	-0.023 (0.052)	0.206 (0.217)	0.044 (0.046)	0.142 (0.213)	0.026 (0.054)
Discount rate	-0.002 (0.002)	-0.001 (0.000)	-0.002 (0.002)	-0.001 (0.001)	-0.006*** (0.002)	-0.001** (0.001)	-0.005** (0.002)	-0.002** (0.001)
Personal to general trust ratio	1.052** (0.450)	0.238*** (0.064)	1.086** (0.464)	0.251*** (0.072)	0.212 (0.238)	0.063 (0.043)	0.315 (0.242)	0.083 (0.052)
Civic engagement	0.052 (0.077)	0.015 (0.022)	0.119 (0.092)	0.037 (0.026)	0.256* (0.152)	0.045 (0.031)	0.249 (0.152)	0.051 (0.031)
Individual controls	x	x	x	x	x	x	x	x
Village fixed-effects	x	x	x	x	x	x	x	x
Observations	337	337	301	301	338	338	302	302
(Pseudo) R-squared	0.329	0.355	0.324	0.356	0.413	0.409	0.392	0.401
Number of clusters	21	21	19	19	21	21	19	19

Notes. Individual controls: ingroup treatment, age, gender, education, religion, marital status, ethnicity, household per capita expenditure, household size, number of years spent in the village. Village controls: population (no. of households), distance to nearest town, health center in the village, daily market in the village, indicator of improved living conditions in the village over the previous 5 years, mean participants' choices in dictator and ultimatum games. Observations clustered at the village level.

**Table 5. Determinants of conservation behavior, factor analysis**

	Dependent variable			
	<i>Factor 1</i>	<i>Factor 1</i>	<i>Factor 2</i>	<i>Factor 2</i>
	(1)	(2)	(3)	(4)
Exposure-dependence index ( <i>experienced degradation</i> )	0.185*** (0.038)		0.090* (0.050)	
Exposure-dependence index ( <i>actual deforestation</i> )		-7192.757*** (2182.381)		-1826.882 (2068.253)
Altruism	-0.014 (0.050)	-0.019 (0.052)	0.177*** (0.050)	0.199*** (0.053)
Strong egalitarian	0.011 (0.102)	-0.018 (0.101)	0.389*** (0.122)	0.370** (0.134)
Discount rate	-0.002** (0.001)	-0.003** (0.001)	-0.000 (0.001)	-0.000 (0.001)
Personal to general trust ratio	0.408*** (0.112)	0.449*** (0.127)	-0.044 (0.105)	0.019 (0.108)
Civic engagement	0.077 (0.062)	0.115* (0.065)	-0.037 (0.061)	-0.047 (0.054)
Individual controls	x	x	x	x
Village fixed-effects	x	x	x	x
Observations	336	300	336	300
R-Squared	0.444	0.439	0.222	0.235
Number of clusters	21	19	21	19

Notes. GIS deforestation: village deforestation rate. Individual controls: ingroup treatment, age, gender, education, religion, marital status, ethnicity, household per capita expenditure, household size, number of years spent in the village. Village controls: population (no. of households), distance to nearest town, health center in the village, daily market in the village,

indicator of improved living conditions in the village over the previous 5 years, mean participants' choices in dictator and ultimatum games. Observations clustered at the village level.



**Table A1. Social preferences and donation**

	Dependent variable:					
	Donation	Donation	Donation	Donation	Donation	Donation
	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure-dependence index ( <i>experienced degradation</i> )	0.128** (0.063)					
Altruism		0.191*** (0.044)				
Strong egalitarian			0.468*** (0.113)			
Discount rate				0.000 (0.001)		
Personal to general trust ratio					0.025 (0.105)	
Civic engagement						0.061 (0.049)
Individual controls	x	x	x	x	x	x
Village fixed-effects	x	x	x	x	x	x
Observations	456	548	553	414	553	540
(Pseudo) R-squared	0.108	0.047	0.045	0.039	0.032	0.033
Number of clusters	20	21	21	21	21	21

**Table A2. Social preferences and water source maintenance**

	Dependent variable:					
	Water	Water	Water	Water	Water	Water
	maintenance	maintenance	maintenance	maintenance	maintenance	maintenance
	(probit)	(probit)	(probit)	(probit)	(probit)	(probit)
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure-dependence index ( <i>experienced degradation</i> )	0.380*** (0.064)					
Altruism		0.010 (0.040)				
Strong egalitarian			0.048 (0.146)			
Discount rate				-0.004** (0.001)		
Personal to general trust ratio					1.304*** (0.334)	
Civic engagement						0.271*** (0.072)
Individual controls	x	x	x	x	x	x
Village fixed-effects	x	x	x	x	x	x
Observations	469	545	552	413	552	539
(Pseudo) R-squared	0.252	0.149	0.148	0.156	0.249	0.174
Number of clusters	21	21	21	21	21	21

**Table A3. Social preferences and town cleaning**

	Dependent variable:					
	Townclean	Townclean	Townclean	Townclean	Townclean	Townclean
	(probit)	(probit)	(probit)	(probit)	(probit)	(probit)
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure-dependence index ( <i>experienced degradation</i> )	0.418*** (0.083)					
Altruism		0.061 (0.065)				
Strong egalitarian			0.057 (0.114)			
Discount rate				-0.006*** (0.002)		
Personal to general trust ratio					0.707*** (0.164)	
Civic engagement						0.367*** (0.092)
Individual controls	x	x	x	x	x	x
Village fixed-effects	x	x	x	x	x	x
Observations	471	547	554	414	554	541
(Pseudo) R-squared	0.333	0.224	0.219	0.267	0.255	0.267
Number of clusters	21	21	21	21	21	21



**Table A6. Treatment effects**

	Dependent variable:							
	Donation	Donation	Donation	Donation	Donation	Donation	Donation	Donation
	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)	(oprobit)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ingroup* Exposure-dependence index ( <i>experienced degradation</i> )	0.011 (0.142)							
Ingroup*Altruism		0.140 (0.117)						
Ingroup*Strong egalitarian			-0.131 (0.341)					
Ingroup*Discount rate				-0.000 (0.003)				
Ingroup*Personal to general trust ratio					-0.179 (0.204)			
Ingroup*Civic engagement						-0.072 (0.138)		
Ingroup*Years living in village							-0.000 (0.006)	
Ingroup*War exposure								0.145 (0.092)

Ingroup	-0.172 (0.304)	-0.351* (0.213)	-0.123 (0.193)	-0.161 (0.239)	0.060 (0.265)	0.126 (0.573)	-0.153 (0.238)	-0.936* (0.507)
Exposure-dependence index ( <i>experienced degradation</i> )	0.191 (0.121)	0.407** (0.159)	0.410*** (0.158)	0.411*** (0.158)	0.403*** (0.155)	0.412*** (0.160)	0.410*** (0.159)	0.412*** (0.156)
Altruism	0.232** (0.113)	0.141 (0.096)	0.218*** (0.058)	0.219*** (0.058)	0.222*** (0.057)	0.218*** (0.056)	0.220*** (0.055)	0.221*** (0.058)
Strong egalitarian	-0.057 (0.255)	0.417*** (0.159)	0.468* (0.249)	0.400** (0.156)	0.399*** (0.154)	0.411*** (0.158)	0.401*** (0.154)	0.378** (0.149)
Discount rate	0.000 (0.002)	0.000 (0.001)	0.000 (0.001)	0.000 (0.002)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Personal to general trust ratio	-0.017 (0.244)	-0.094 (0.142)	-0.095 (0.144)	-0.094 (0.140)	0.002 (0.158)	-0.101 (0.142)	-0.094 (0.143)	-0.084 (0.143)
Civic engagement	-0.136 (0.104)	0.012 (0.061)	0.017 (0.064)	0.013 (0.063)	0.009 (0.065)	0.049 (0.086)	0.013 (0.062)	0.009 (0.062)
Individual controls	x	x	x	x	x	x	x	x
Village fixed-effects	x	x	x	x	x	x	x	x
Observations	330	370	370	370	370	370	370	370
(Pseudo) R-squared	0.155	0.090	0.088	0.088	0.088	0.088	0.088	0.091
Number of clusters	20	21	21	21	21	21	21	21

### Appendix B. Variable description

Variable	Type	Description
Donation	Ordered Response	Amount donated to CSSL: 0, 300, 800, or 1000 Leones
WaterMaintenance	Dummy	Equal to 1 if answer to the following question = Yes: <i>Did you contribute last time this water source (the one your HH uses) needed maintenance?</i>
Townclean	Dummy	Equal to 1 if answer to the following question = Yes: <i>Have you participated in road brushing or town cleaning in the past year?</i>
Firewood time increased	Dummy	Equal to 1 if answer to the following question = Increased: <i>Has the time it takes to collect firewood increased/decreased over the last 2 years?</i>
Environmental shocks	Dummy	Equal to 1 if answer to the following question = Yes: <i>In the past 3 years, have you lost any income due to flooding, draught, water contamination, pollution or other</i>

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		<i>environmental shocks?</i>
Environmental Degradation	Dummy	Equal to 1 if Firewood time increased = 1 or Environmental shocks = 1
Altruism	Ordered Response	Number of tokens sent in Dictator game: 0, 1, 2, 3 or 4
Strong egalitarian	Dummy	Equal to 1 if tokens sent in Dictator game = 2 AND tokens sent in Ultimatum game = 2
		Equal to 0, 20, 50, 100, 150 or 200 depending on answers to the following series of questions: <i>Imagine you have won the lottery. You can choose between being paid today or a different amount in a month. Which option do you prefer? Imagine that you are certain that the money will come for sure in one month.</i> <i>? 100,000 Le today or ? 100,000 in one month</i> <i>? 100,000 Le today or ? 150,000 in one month</i> <i>? 100,000 Le today or ? 200,000 in one</i>
Discount rate	Ordered Response	

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*month*

*? 100,000 Le today or ? 250,000 in one*

*month*

*? 100,000 Le today or ? 300,000 in one*

*month*

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