Provision of Public Goods:
Unconditional and Conditional Donations from Outsiders

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Abstract

Public goods often benefit a larger group than those who can actively provide them. This paper addresses institutional arrangements between subjects who can provide a public good (insiders) and subjects who also benefit from the public good but cannot provide it (outsiders) due to technical, physical or institutional reasons. Using laboratory experiments, we compare a setting of passive outsiders to situations where outsiders can either make unconditional or conditional transfers to the group of insiders. The primary behavioral questions are to what extent outsiders will use the opportunity to subsidize the contributions of insiders and how insiders will respond to those subsidies. In summary, outsiders make transfers to insiders, but there is little evidence of reciprocal increases in contributions by insiders to transfers offered. Indeed, provision levels of the public good across decision periods are lower than the baseline condition of passive outsiders, where there are no opportunities for transfers from outsiders.

1 Introduction

The provision of public goods often originates in a subset of a population (insiders) who can provide the public good while its benefits extend to a broader community. That is, there exist individuals who benefit from the public good but cannot directly participate in its provision (outsiders) for physical, institutional or other reasons. At the local level, there are numerous examples of volunteer public services, such as fire protection and neighborhood security where only a subset of the citizens benefiting from the services can qualify to contribute to those services. On a global level, examples include conservation of natural resources and epidemic disease control, where efforts that only some can undertake result in global conservation or health safety benefits.

In some situations outsiders are completely passive bystanders. Previous experimental research has investigated the influence on provision levels from the presence of outsiders of this type (Engel and Rockenbach, 2011; Delaney and Jacobson, 2014; Engel and Zhurakhovska, 2014). However, in other situations outsiders have the opportunity to support the actions of insiders. This paper focuses on two institutions that can shape such opportunities, namely unconditional transfers that are de facto donations and conditional transfers where realized transfers are contingent upon the public goods provision by the insiders. The two institutions are based on transfers that are received by the insiders at the group level and evenly shared. Thus, we abstract from discretional individual payments to insiders. This approach is based on the observation that in many situations in the field, monitoring the individual insiders' behavior is not feasible or too costly. The primary research question is to what extent outsiders make use of transfers, and how insiders respond to the decisions of outsiders. To the best of our knowledge this is the first experimental study designed to analyze the behavioral properties of institutional variations of this type.

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Examples of unconditional transfers associated with the local-level public goods mentioned above include lump-sum benefits, such as free Christmas dinners or presents, that insiders receive from community members who cannot participate in the services provided by volunteers. In these contexts, conditional transfers could be vouchers or free meals provided for each day of service by the group of volunteers. At the international level, conditionality is a critical component that proponents of payments for ecosystem services stress for the design of successful conservation programs (Ferraro and Kiss, 2002; Ferraro, 2011; Engel, 2016). Yet, many such programs fail to implement conditional payments due to limitations on monitoring capacity or scientific uncertainty (Kinzig et al., 2011; Engel, 2016). By investigating behavioral responses to conditional and unconditional transfers, this study provides evidence of the relative performance of these two alternative institutions as compared to a baseline where outsiders are passive and cannot subsidize the actions of insiders.

2   Related literature

Broadly speaking the relevant literature most closely associated with this study falls into two main categories. The first category relates to studies that examine situations in which externalities are imposed on passive outsiders through actions of insiders. The second category relates to studies that examine the behavioral response to use of positive incentives to induce cooperative behavior.

2.1 Literature related to externalities to outsiders

Compared to the large literature on social dilemma interactions, there are relatively few studies of the type examined here that involve externalities from one distinct group being passed on to a second distinct group. Among the existing studies, Engel and Rockenbach (2011) examine public good settings where contributions impose negative, positive, or zero externalities on a passive group of outsiders, maintaining the condition

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that provision of the public good is pro-social at the aggregate level. The sign of the externality varies in combination with the initial endowment of outsiders such that insiders might be initially richer, poorer or equally endowed as outsiders. The results of this study suggest that the presence of an outside group enhances the social dilemma, significantly reducing insiders' contributions to the public good if they face a risk of falling behind outsiders in terms of individual payoffs. The authors attribute this finding to an interaction of conditional cooperation and inequity aversion.

Two related studies address the relevance of social distance and communication in strategic settings where insiders impose negative externalities on outsiders. Delaney and Jacobson (2014) vary the degree of contact between the two groups in a setting where the negative externalities on outsiders are sufficiently large such that overall provision of the public good can become anti-social. They find that greater contact entails a reduction in cooperation among insiders, decreasing the negative externalities on outsiders. On the other hand, Schwartz-Shea and Simmons (1990) examine the role of communication among insiders in the context of a prisoner's dilemma with negative externalities on outsiders. Their results show that communication among insiders leads to greater cooperation among them which increases the externalities on outsiders and decreases overall efficiency.

Further related literature, where externalities on outsiders play a role, includes intergenerational studies where the decisions of a current group of players may reduce the payoffs of another group of players that follows. For example, Hauser et al. (2014) study an intergenerational game where a given generation can extract a resource to exhaustion to maximize their own payoff, or leave some portion of the resource for the next generation (outsiders). Their primary finding is that a minority of subjects extract at high levels, resulting in resource exhaustion and inefficiencies in an intergenerational

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context. Yet, when extraction levels are democratically decided by a vote, the resource is sustained and available for the next generation. Similarly, Sherstyuk et al. (forthcoming) compare outcomes in an intergenerational game, contrasting decisions in settings where groups (generations) change across a sequence of games compared to a long-lived setting with a single group. Their results support the finding that achieving efficiency is more challenging in the intergenerational game. This outcome is associated with a lack of sufficient concern over following groups, as well as the increased strategic uncertainty of the intergenerational decision-setting.

In addition to the studies discussed above that examine settings with groups of individuals, various studies focus on settings in which the relevant interaction is between individuals. Supporting the findings of Sherstyuk et al. (forthcoming), Bland and Nikiforakis (2015) stress the relevance of strategic uncertainty in coordination failure in a two-person coordination game with externalities to a third party (regardless of whether they are positive or negative) as compared to a setting without externalities. The authors attribute this result to the uncertainty by each of the two active players (insiders) regarding the value the other active player places on the welfare of the third-party.

Additionally, the results in Ellman and Pezanis-Christou (2010), that show that the structure of decision making influences behavior towards a passive outsider, support the findings by Hauser et al. (2014) on the success of democratic voting rules already discussed. Ellman and Pezanis-Christou (2010) find that horizontal structures, where choices are based on average proposals, are more likely to take into account outsider's payoffs, in comparison to vertical structures or horizontal structures that require consensus.

Lastly, Engel and Zhurakhovska (2014) stress the relevance of guilt aversion in dealing with externalities to outsiders. They explore behavior in a prisoner's dilemma

with a passive third participant (outsider) who suffers a negative externality whenever at least one of two active players (insiders) chooses to cooperate. Cooperation is found to decrease when an outsider is harmed and inversely related to the level of harm. [1]

2.2 Literature related to Positive Incentives

From the perspective of institutional analysis, this study also contributes to the experimental literature on the use of positive incentives on groups of agents to subsidize desired strategies. This includes settings in which there is an exogenous payment and settings in which there is a single agent transferring to a second agent. No previous study has explored settings where a group of agents make transfers to a second group of agents.

The question of whether extrinsic positive incentives can modify behavior has a long tradition in economics and recent studies aim to narrow it down to when and why these incentives work in specific situations. Gneezy et al. (2011) provide an excellent review on this issue focusing on how extrinsic incentives may come into conflict with other (psychological) motivations. In what they refer to as pro-social behavior, the authors discuss crowding-out effects that may emerge when extrinsic incentives undermine social norms of trust (by signaling distrust, external control or monitoring), alter the frame of the social interaction in a manner that weakens social norms or beliefs about the cooperative behavior of others, and reduce image motivation.[2]

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[1] Additional strategic environments that are not characterized as social dilemmas, but include the presence of outsiders, include ultimatum games (Güth and Van Damme, 1998), lottery choice tasks (Bolton and Ockenfels, 2010), and bribery games (Abbink, 2005) among others.

[2] One specific stream of the literature on the use of positive incentives frames the institutional analysis on payments for ecosystem services. In this body of literature, exogenous "payments" to groups of agents that can provide a public good (insiders in our terminology) entail rewarding certain strategies based on pre-established institutional rules. In some studies, payments are tied to individual performance of players (Vollan, 2008; Narloch et al., 2012; Alpízar et al., 2015; Handberg and Angelsen, 2015; Midler et al., 2015), while in others the rewards are in form of collective payments to the group based on group

Focusing on the use of non-contingent extrinsic incentives, Falk (2007) shows that enclosing non-contingent gifts (a postcard drawn by children) to a contribution request by a charitable organization was effective in increasing donations, and donations increased with the value of the gift. More specifically related to our research question, Gneezy and Rey-Biel (2014) compare contingent and non-contingent incentives. They find support for the finding in Falk (2007) by showing that even small non-contingent monetary payments can raise effort compared to no payment. However, in line with Gneezy et al. (2011), they show that very small contingent payments may backfire and lower effort. Sefton et al. (2007) also support variable success of payments (rewards), in this case if these are not maintained throughout time. They investigate the effect of monetary rewards and sanctions within groups in a public goods game and find that they are initially successful in increasing contributions. However, rewards decline at a fast rate and are insufficient to sustain contribution levels above the baseline condition without the opportunity of rewards or sanctions.

Finally, institutional analyses related to the interaction between givers and receivers of positive transfers have a long tradition when restricted to interactions between individual agents. In this sense, our work is also related to the experimental literature on gift exchange games (Akerlof, 1982) and trust games (Berg et al., 1995) where the sequential nature of the game provides opportunities for cooperation and reciprocity, but equilibrium predictions based on self-regarding preferences predict suboptimal

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contributions (Narloch et al., 2012; Midler et al., 2015). Narloch et al. (2012) and Midler et al. (2015) argue that when payments are conditional on group performance, such payments may increase the potential payoffs an individual can earn, as well as increase the expectations of cooperation by other group members, thus inducing higher cooperation. Similarly, matters of fairness may come into play in such contexts in defining the sharing rules of collective payments. Our study moves the literature on payments for ecosystem services away from exogenous payments provided by an external authority to settings that incorporate voluntary endogenous payments by the outsiders.

outcomes. Our implementation of unconditional transfers extends the one-to-one setting found in both the gift-exchange and trust-game literatures to a group-to-group public goods setting. This change fundamentally alters the strategic nature of the problem, incorporating strategic uncertainty within and between groups.

3   Decision settings and parameters

The decision setting is a linear public good game in which provision of the public good creates a positive externality to both insiders and outsiders. In all decision making groups there are two randomly assigned types of subjects, n_I insiders and n_O outsiders, where $n_I = n_O = 4$, for a total group size of 8.

The experiment begins with a baseline condition of 5 decision periods (Part 1) where insiders make provision decisions and outsiders are inactive, only receiving information on insiders' decisions. Part 1 is important because we are interested in institutional changes to environments in which there is a history in which insiders' contribution decisions affect outsiders. In addition, Part 1 allows subjects to become familiar with the public goods aspect of the decision setting, and allows for statistical control of group specific effects.

In each period of Part 1, each subject receives an endowment of $w = 100$ Experimental Currency Units (ECUs) placed in their "Private Account". Each insider i privately decides how many g_i ECUs of his endowment to contribute to a "Group Account." Each ECU left in the Private Account earns the individual 1 ECU. Every ECU contributed to the Group Account yields a return of $a = 0.4$ ECUs for each insider and each outsider. This defines the Group Account as a pure public good with symmetric benefits to all subjects and incentives to free-ride among insiders.

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Insiders' payoff function in Part 1 is given by a standard linear public goods game, as defined in equation 1. This describes a social dilemma for self-interested payoff-maximizing agents for $a < 1$ and $(n_I + n_O)a > 1$.

$$\pi_{Ii}^{Baseline} = w - g_i + aG \qquad \text{where } G = \sum_{k=1}^{n_I} g_i \text{ and } g_i \in [0, w] \tag{1}$$

Because outsiders are inactive in Part 1, their payoff function is given by:

$$\pi_{Oj}^{Baseline} = w + aG \tag{2}$$

In Part 2 subjects play the game for additional 10 decision periods where the action set of outsiders varies across treatments. In the *Baseline* treatment outsiders remain inactive and continue to only receive information on insiders' decisions, as in Part 1. In the *Donation* treatment outsiders have the option to make non-contingent monetary transfers to insiders. In the *Contract* treatment outsiders have the option of making monetary transfers to insiders that are contingent on insiders' aggregate contributions to the public good.

3.1 Donation Treatment

Once the potential for transfers is included, the decision setting is a two-stage game. In the first stage each outsider j can make non-binding transfers, t_j, to the group of insiders, where $t_i \in [0, w]$. All transfers by outsiders are added together in a Transfer Account of size $T = \sum_{l=1}^{n_O} t_j$, which is then split equally among insiders. In the second stage, insiders observe the value of T and their equal share of transfers before making their contribution decisions. As in the *Baseline* treatment, each insider has the opportunity to free-ride on the public good contributions of other insiders, receiving a return of a for each ECU contributed to the public good. In addition, in this treatment insiders receive $\left(\frac{1}{n_I}\right) T$ independent of their own contribution.

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By design, transfers received by insiders cannot be directly used for contributions to the Group Account. That is, the maximum amount an insider can contribute to the public good is *w*, irrespective of the transfer received. Of course, for interior contribution levels to the public good, insiders can use transfers to substitute for or complement their own contributions. For example, suppose after observing an individual share of transfers $\hat{T}$ by outsiders, insiders contribute $G = \hat{T}$. This outcome could be viewed by outsiders as one in which their transfers are strictly a substitute for insiders contributions to the public good. Alternatively, suppose insiders' contributions are $G = 2\hat{T}$. Outsiders could interpret this outcome as one of pure reciprocity, where insiders match outsiders' efforts and both type of agents share the costs of the provision of the first-order public good equally.

The resulting payoff functions for insiders and outsiders are given in equations (3) and (4):

$$\pi_{Ii}^{Donation} = w - g_i + aG + \frac{1}{n_I}\, T \tag{3}$$

$$\pi_{Oj}^{Donation} = w + aG - t_j \tag{4}$$

Ultimately, the impact transfers have on total contributions depends on the level of transfers offered by outsiders and the responsiveness of insiders to these offers. Clearly there are multiple behavioral motivations that come into play that could affect the responsiveness of insiders to transfers from outsiders and the responsiveness of outsiders to decisions by insiders. Our analysis focuses on two such behavioral responses, motivated by the prior public goods literature. First, unconditional transfers constitute a donation and might be understood as a signal of trust for which insiders exhibit reciprocal behavior by increasing contributions to the Group Account. This would entail $\frac{\partial g_i}{\partial T} > 0$, and therefore transfers could be viewed as contributions to a second-order public good.

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A reciprocal reaction of this type is documented for one-to-one interactions in ultimatum, gift-exchange, and trust games (for a coprehensive summary see Fehr and Schmidt, 2006). Second, if insiders have prior expectations on outsiders' transfer levels T^E (based on social norms, experience, or other factors) and these expectations are not fulfilled $(T < T^E)$, the reaction could be to lower their own contributions to the public good $\left(\frac{\partial g_i}{\partial (T^E - T)} < 0 \right)$. Note that these two effects are not mutually exclusive.

3.2 Contract Treatment

Outsiders in the *Contract* treatment can make individual transfers to the Transfer Account that will be used to compensate insiders conditional on their collective contributions. We differentiate between *transfers offered* by the group of outsiders $T = \sum_{l=1}^{n_o} t_j$ and *transfers received* by the group of insiders T'. T can be understood as available funds to reward the group of insiders and defines the maximum aggregate reward insiders can receive. T' is contingent on contributions to the first-order public good. As long as funds are available, every insider receives an equal share of $\frac{1}{n_I}$ ECUs for each token any insider contributes to the Group Account. Once the Transfer Account is depleted, additional contributions to the Group Account good are not subsidized. In summary, if T $< G$, $T' = T$ and if $\geq G$, $T' = G$. By design, in the case that $T > G$ the transfers not distributed among insiders are returned to outsiders in proportion to their individual transfers, $(T - G)\frac{t_j}{T}$.

Note, as in the *Donation* treatment, in the *Contract* treatment each insider has the opportunity to free-ride on the contributions of other insiders by benefiting from the first-order public good and in addition obtain $\left(\frac{1}{n_I} \right) T'$ independent of their own contribution.

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Yet, given the contingency of transfers in the *Contract* treatment, the value of T' depends on each insiders' contribution decision as long as $T > G$. Thus, each insider's decision affects the "size of the pie" all insiders create, but does not alter the "share of the pie" each insider receives.

Individual payoffs are represented as:

$$if \ T > G \quad \begin{cases} \pi_{Ii}^{Contract} = e_I - g_i + aG + \frac{1}{n_I}T' \\ \pi_{Oj}^{Contract} = e_O + aG - t_j + (T - G)\frac{t_j}{T} \end{cases} \quad (5)$$

$$if \ T \leq G \quad \begin{cases} \pi_{Ii}^{Contract} = e_I - g_i + aG + \frac{1}{n_I}T \\ \pi_{Oj}^{Contract} = e_O + aG - t_j \end{cases} \quad (7)$$

Given our parameterization of $a = 0.4$, as long as $T \geq G$ in the *Contract* treatment, the individual marginal value of contributions to the first-order public good for insiders is 0.65. Thus, in this situation the marginal incentives for insiders' contributions are higher than in the *Baseline* and *Donation* treatments. As in the *Donation* treatment, outsiders have an incentive to free-ride on other outsiders. An important difference, however, is that the conditional transfers in the *Contract* treatment are less risky for outsiders than in the *Donation* treatment in the sense that outsiders' transfers only subsidize insiders if insiders' actions warrant the transfer.

3.3 Experimental Procedures

The instructions for both insiders and outsiders were read out loud. At the beginning of the experiment, subjects were told there would be two parts, but were only informed about the details of Part 2 after the completion of Part 1. The language used in the experiment was neutral. There were two groups, Type A and Type B. Types remain unchanged during the experiment. Type A subjects made allocations to a Group Account. In Part 2, for the *Donation* and *Contract* treatments, Type B subjects could make transfers

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to a Transfer Account benefiting the group of Type A subjects, and this was common information.

By design, Type A and B subjects do not make simultaneous decisions. In order to guarantee anonymity and elicit first-order beliefs, inactive Type A players typed in the number of ECUs they expected in the Transfer Account and inactive Type B players their expectation on allocations to the Group Account.[3] Both insiders and outsiders received feedback after every period on the insiders' total allocation to the Group Account, own individual earnings, and – if applicable – the amount of transfers allocated to the Transfer Account and distributed among the insiders. Before making decisions in Part 1 or Part 2, subjects answered quizzes to check their understanding of the games (see Supplementary Materials for instructions). At the conclusion of the experiment subjects were asked to answer a short questionnaire.

Sessions were conducted at the University of Innsbruck EconLab in June 2015 using z-Tree (Fischbacher, 2007). Table 1 summarizes the composition of the experiment. Subjects were paid privately in Euros using a conversion rate of €1 for every 200 ECUs. Sessions lasted for about an hour and participants earned an average of 12.24 Euros.

Table 1. Summary of experimental sessions

Treatment	Number of subjects	Number of groups	Number of sessions
Baseline	72	9	3
Donation	64	8	3
Contract	72	9	3
	208	26	9

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[3] In order to reduce the complexity of the instructions and the incentive structure of the experiment, we chose not to incentive the forecasts.

4   Results

For brevity, herein we refer to allocations to the Group Account as "contributions."
Pooling across individual decisions, Figure 1 shows the evolution of average individual
contributions (solid lines) and individual transfers (dashed lines) for Parts 1 and 2. In the
Contract treatment, the analysis uses individual transfers offered $\left(\frac{1}{n_I} T\right)$ in order to
capture the intent of outsiders.

In Part 1 there is a significant difference in contributions between the groups in the
Donation treatment and the other two treatments, which diminishes over time. We
attribute these differences to specific group effects, as all subjects were recruited from
the same subject pool, there were no differences in how Part 1 was presented to the
subjects, nor did the subjects know about any details of Part 2. In addition, experimental
sessions alternated across treatments. Importantly, towards the end of Part 1 differences
in contributions across treatments are not significant and thus initial group specific effects
disappear with repetition of the baseline condition.[4]

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[4] Unless noted, unpaired t-tests are used for the comparison of means. For periods 4 and 5, the p-values for differences between *Baseline* and *Donation* are 0.17 and 0.42, respectively. Differences between *Baseline* and *Contract* are insignificant as well, p-values of 0.84 and 0.27.

Figure 1 Average individual contributions (solid lines) and transfers (dashed lines) offered over time
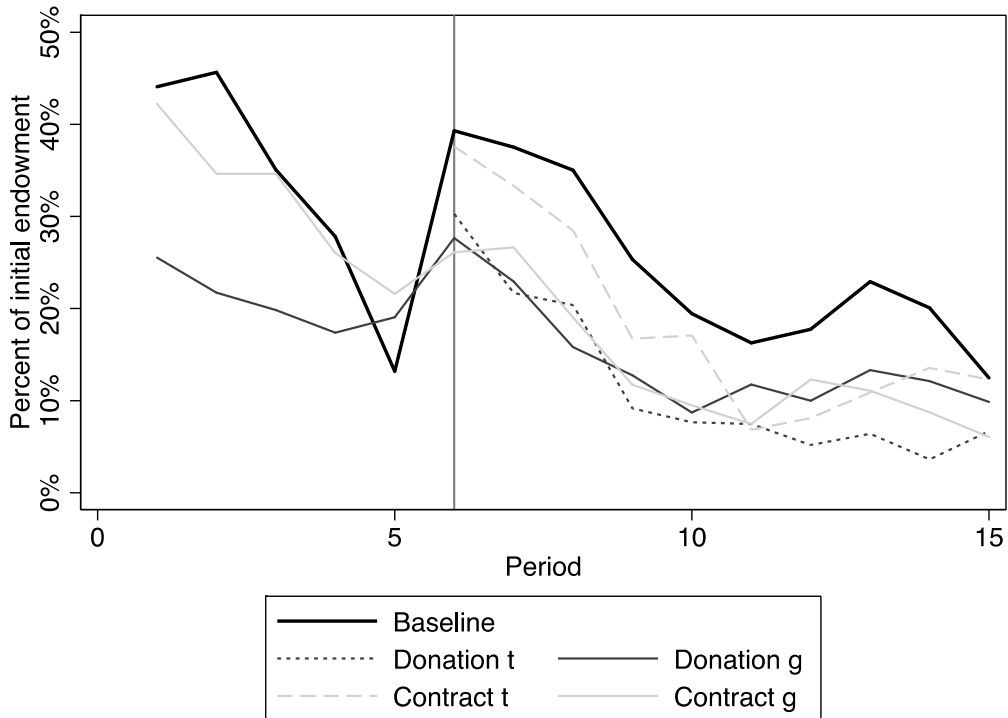
In Part 2, outsiders use the opportunity to make unconditional and conditional transfers to the insiders. In period 6, the average percentage of endowment transferred to insiders is 30% in the *Donation* treatment and 38% in the *Contract* treatment. In both treatments, transfers decay across periods. Importantly, in the *Contract* treatment, contributions are lower than transfers offered in most cases, resulting in substantial underutilization of transfers offered. Across all groups and all periods of Part 2 in the *Contract* treatment, only 69% of transfers offered were utilized. Figure 2 shows, by decision period, the average transfers returned to outsiders as a percentage of transfers offered. In sum, despite the increase in marginal value of contributions to the first-order public good with conditional transfers, insiders systematically underutilize the transfers offered leading to a loss in efficiency.

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Figure 2. Returned transfers as a fraction of transfers offered in the
Contract treatment
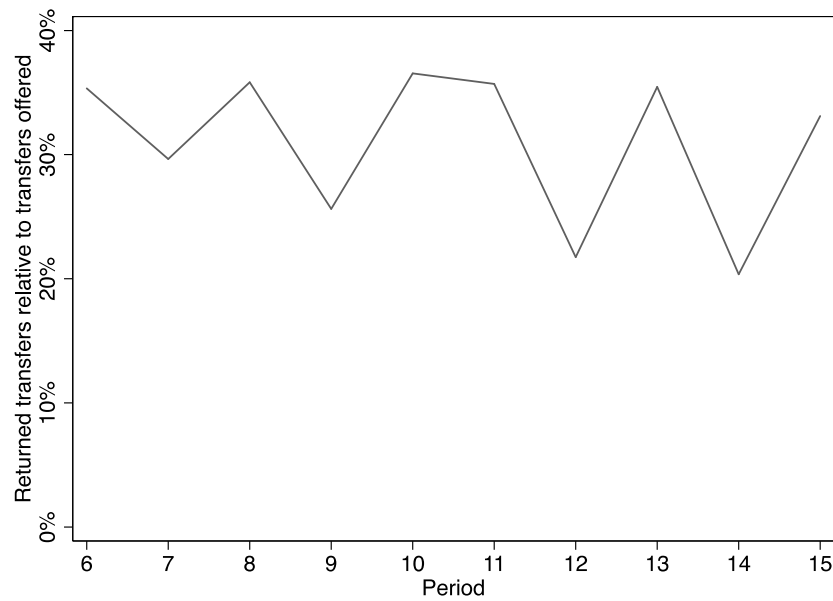
Concurrent to the decline in transfers, as shown in Figure 1, contributions follow a declining trend after a restart effect at the beginning of Part 2 (a phenomenon common in public good experiments, see for example Andreoni, 1988). Across the decision periods in Part 2, average contributions in the *Baseline* (24.6%) exceed contributions in the two treatments that allow for transfers (p=0.00 for both comparisons). Average contributions in the *Donation* treatment (14.5%) and the *Contract* treatment (13.9%) are not significantly different (p=0.73).

Broadly speaking, there is very little evidence of reciprocal increases in contributions by insiders to transfers offered. The first period decisions of Part 2 are indicative to what was to follow. In period 6, contributions exceeded the amount offered in transfers in only 50% (11%) of the groups in the *Donation* (*Contract*) treatment. Including group decisions in all periods of Part 2, contributions exceeded transfers offered in only 40% (34%) of the periods in the *Donation* (*Contract*) treatment. Thus, on average we do not find evidence that insiders' contributions match or exceed outsiders' transfers. Instead, contributions are well below the level of transfers.

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In addition, period 6 provides evidence of the first and second order free riding that occurs within groups, with 17% (17%) of outsiders in the *Donation* (*Contract*) treatment making transfers of zero and 25% (25%) of insiders in the *Donation* (*Contract*) treatment making contributions of zero. By the end of Part 2, the percentage of outsiders making transfers of zero increases to 66% (64%) in the *Donation* (*Contract*) treatment and the percentage of insiders making contributions of zero increases to 63% (47%) in the *Donation* (*Contract*) treatment.

Table 2 presents results from random effects GLS regressions to test for treatment effects on individual insiders' contributions and individual outsiders' transfers offered. The results are consistent with the group level data reported above. Contributions are significantly lower in the *Donation* and *Contract* treatments relative to the *Baseline* treatment. A post-estimation Wald-test confirms that the difference in contributions between the *Donation* and *Contract* treatments is not statistically significant (p=0.90). Moreover, column 2 shows that the difference in individual transfers offered between the reference category *Donation* and the *Contract* treatment is not statistically significant (p=0.13).

Table 2. GLS treatment effects for individual contributions and transfers offered

	(1) Contributions (Insiders)	(2) Transfers Offered (Outsiders)
Donation	-10.12^{**}	
	(0.049)	
Contract	-10.75^{**}	6.636
	(0.031)	(0.132)
Period	-2.143^{***}	-2.772^{***}
	(0.000)	(0.000)
Constant	47.11^{***}	40.96^{***}
	(0.000)	(0.000)
N	1040	680
Number of subjects	104	68
R-squared (overall)	0.078	0.101

p-values in parentheses, $^{*} p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$
*Baseline* and *Donation* are the reference categories for (1) and (2) respectively.

We next turn to an examination of differences in individual groups across treatment conditions. Figure 3 displays group contributions and transfers for the *Baseline*, *Donation*, and *Contract* treatments respectively. As shown, within all three treatment conditions, there is considerable between-group variation, with some groups sustaining relatively high contribution levels while others contributing close to zero across decision periods. See for example the contrast in group *Baseline* 8 versus *Baseline* 4, *Donation* 8 versus *Donation* 6, and *Contract* 1 versus *Contract* 5.

Panel b of Figure 3 illustrates that in the *Donation* treatment there is a close correlation between transfers and contributions. There is no consistent pattern, however, of insiders contributing more than what they receive from outsiders. The exception is group *Donation 8*, where cooperation was high in Part 1. Even in this case, transfers do not induce cooperation to increase in Part 2 relative to Part 1. Panel c shows that in the *Contract* treatment, transfers offered by outsiders are generally well above contributions made by insiders for most groups and most clearly illustrated by groups *Contract 2-4*. As discussed above, this implies a substantial return to outsiders of the transfers they offered.

Figure 3. Individual group decisions by treatment, group contributions (solid lines) and transfers offered (dashed lines).
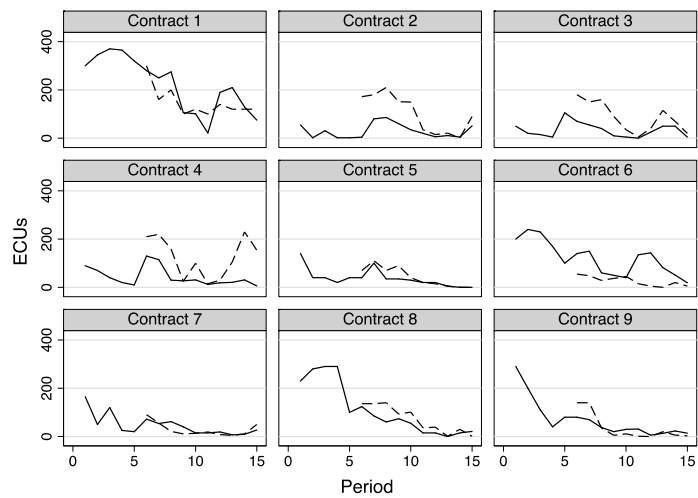
Panel a - Baseline
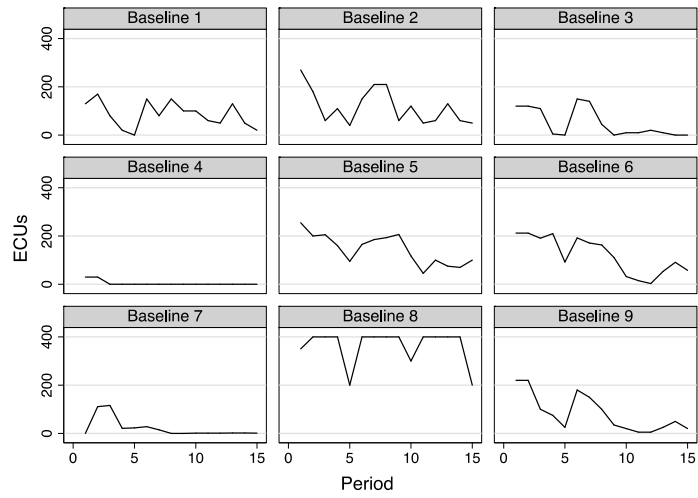
Panel b - Donation
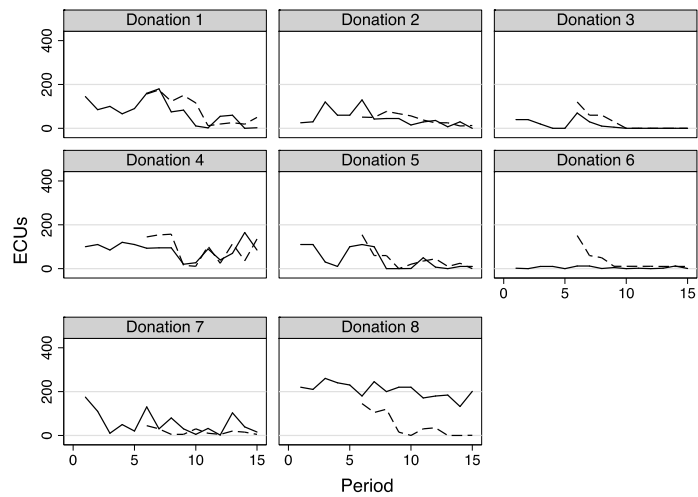
Panel c - Contract

Focusing on individual contributions, Table 3 presents the results from multilevel regressions designed to examine the temporal dynamics of insiders' contributions in all treatments, with random effects on the group and subject level. The independent variables include the one-period lagged average contribution of the other insiders in the group and, for the *Donation* and *Contract* treatments, the individual share of transfers offered by the outsiders in the current period.

As shown in Table 3, in the *Baseline* treatment there is evidence of conditional cooperation, common to other public goods experiments (e.g. Croson et al., 2005). This occurs even in the presence of outsiders who benefit from the public good without sharing in its provision. Interestingly, in neither the *Donation* nor the *Contract* treatment do we observe a significant effect related to other insiders' contributions. Further, in both the *Donation* and *Contract* treatments, at the margin, insiders increase their contributions by approximately 1/3 token for each token of transfer they are offered, suggesting a relatively weak reciprocal response to transfers offered by outsiders. The combination of these two effects suggests that in these treatments, insiders' decisions are focused more on transfers offered, and less on contributions of other insiders.

The evidence that in both the *Donation* and *Contract* treatments subjects have a similar response to transfers offered has different implications for earnings across the two treatments. In the *Donation* treatment, the group of insiders pocket the difference between the share of transfer received and their increase in contributions. In the *Contract* treatment, this is not the case, as unused transfers are returned to the outsiders.

Table 3. GLS temporal dynamics of insiders' contributions

	Contributions *Baseline*	Contributions *Donation*	Contributions *Contract*
Individual share of transfers offered	N/A	0.325*** (0.009)	0.329*** (0.000)
Lagged average contribution of others	0.182** (0.016)	0.006 (0.954)	0.118 (0.104)
Period	-2.492*** (0.000)	-0.700 (0.143)	-0.884** (0.013)
Constant	46.29*** (0.000)	17.90** (0.023)	15.25*** (0.006)
N	360	320	360
Number of subjects	36	32	36
Number of groups	9	8	9

p-values in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

To provide a more complete picture of the group dynamics, it is necessary to examine the drivers of transfers in more detail. Table 4 replicates Table 3, but for outsiders in the two treatments with a transfer option. The independent variables include the average individual contribution by insiders in the previous period, as well as the one-period lagged transfer of the other outsiders in an individual's group.

The results indicate that outsiders reciprocate higher contributions by insiders in the previous period by increasing their individual transfers. The magnitude of this response is, however, relatively small and similar in both treatments. For a one token increase in average individual contributions by insiders, an average outsider increases transfers by about 0.3 tokens. This suggests weak reciprocal behavior. At the group level, this implies that increased contributions by 4 tokens result in an increase in transfers of 1.2, which is lower than the positive externality each outsider receives from insiders' contributions, which equals $0.4 \times 4 = 1.6$.

Moreover, parallel to the results reported in Table 3, the effect of lagged average transfers of other outsiders is not significant. This suggests a tendency for outsiders to focus on the average contributions of insiders when making their transfer decisions,

instead of the past decisions of other outsiders in their group. In addition, the larger intercept term for the *Contract* treatment, relative to the *Donation* treatment, reflects an underlying greater willingness to provide transfers in the *Contract* treatment, which is in line with the security that comes with knowing that transfers are returned if not met by contributions.[5]

Table 4. GLS temporal dynamics of outsiders' transfers offered

	Transfers Offered *Donation*	Transfers Offered *Contract*
Lagged average contribution by each insider	0.258***	0.218*
	(0.004)	(0.095)
Lagged average transfer of others	0.0829	0.0789
	(0.364)	(0.420)
Period	-1.270***	-1.724***
	(0.004)	(0.002)
Constant	18.88***	30.61***
	(0.003)	(0.000)
N	288	324
Number of subjects	32	36
Number of groups	8	9

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5   Discussion, additional analyses and additional experiments

In summary, we observe positive responses from insiders with respect to the actions of outsiders, and *vice versa*. Contributions are positively correlated with higher transfers and transfers are positively correlated with higher contributions. However, consistent with the results from Sefton et al. (2007) in regard to use of within group rewards, transfers decline across decision periods and the positive correlation with contributions supports a cycle that reinforces the decline in both outcomes. Sections 5.1 and 5.2 test

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[5] Combining the two models of Table 4 in one, using interaction terms, a post-estimation Wald-test reveals that the difference between the two intercepts is not significant with a p-value of 0.26.

two hypotheses that might potentially trigger the partial breakdown in cooperation.

5.1 The role of expectations

Insiders' unfulfilled expectations in the actions of outsiders, due to insufficient transfers, may lead to punishment of outsiders by insiders via reduced levels of contributions, and counter-punishment by outsiders in further reducing transfers. Previous studies have shown that subjects in laboratory experiments are more cooperative with other subjects who display strategies perceived to be fair (Fischbacher et al., 2001), use opportunities for costly punishment to punish norm violators (Fehr and Gächter, 2000), and display counter-punishment strategies (Nikiforakis, 2008).

However, our data does not support the conclusion that unfulfilled expectations are the main driver of the erosion of cooperation. Based on regression analyses available in Table A1 in the Appendix we do not find a significant relationship between contributions and the difference between expectations and actual offers of transfers. Figure 4 provides an illustration of insiders' expectations of average individual transfers in comparison to actual transfers offered by outsiders. We observe that in period 6, average transfers offered are greater than average expectations in both the *Donation* and *Contract* treatments. However, following observed low contributions by insiders in period 6, the outsiders begin to decrease their transfers, which then become lower than expectations until the end of the sessions. Thus, following period 6, there is evidence of a deteriorating reciprocal relationship between insiders and outsiders.

**Fig. 4** Expected and actual transfers

5.2 Payoff differences between insiders and outsiders

After completing the initial experiments, we conjectured that the lack of strong reciprocity observed in the *Donation* and *Contract* treatments might possibly be driven by payoff-differences induced during Part 1 of the experiment. Engel and Rockenbach (2011) provide evidence that low cooperation levels for insiders in a setting with positive externalities to outsiders can be related to an aversion to being behind in terms of payoffs. In our experimental design, because in Part 1 outsiders are passive by-standers that benefit from the contribution efforts of insiders, and because insiders begin the game with the same endowment as outsiders, insiders begin Part 2 with lower payoffs. Average aggregate payoffs for outsiders are about 25% higher than for insiders at the end of Part 1.

In order to examine to what extent the five decision periods of Part 1 may have affected the decisions in Part 2, we conducted two additional sessions where outsiders were

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allowed the opportunity to make unconditional transfers beginning with Period 1.[6] We refer to this additional treatment as *Donation II*. Figure 4 presents the contribution and transfer data from the original *Baseline* and *Donation* treatments, as well as *Donation II*. As shown, both contributions and transfers beginning in Part 1 of the *Donation II* treatment are at levels similar to those observed in Part 2 of the *Donation* treatment. No statistical difference is found between the two treatments (p=0.50 for contributions, p=0.69 for transfers). Thus, we conclude that payoff differences resulting from Part 1 in the original experiment are not a primary driver of lower contribution levels in the *Donation* and *Contract* treatments as compared to the *Baseline* treatment.

Figure 5. Average individual contributions and transfers offered over time including the additional *Donation II* treatment
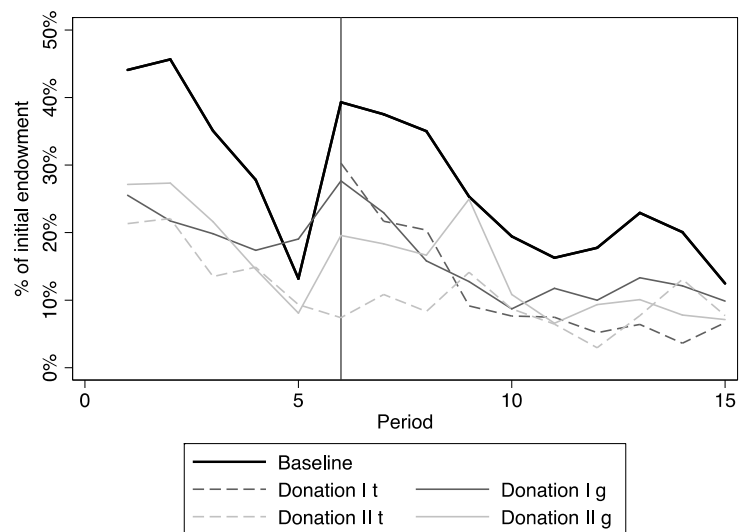
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6   Conclusion

The results presented above for both the *Donation* and *Contract* treatments present a rather dismal outlook in regard to how transfer options might influence cooperation by insiders. Broadly speaking, there is almost no evidence of systematic cooperation between outsiders and insiders, whereby provision of the public good is increased relative to the *Baseline* treatment as a result of an endogenous reciprocal relationship developing. In fact, on average, the existence of the institutions, namely the potential for transfers, is associated with a reduction in cooperation. The lack of cooperation in the *Contract* treatment is particularly remarkable. Despite the fact that, relative to the *Donation* treatment, insiders have a greater marginal incentive to make contributions to the public good, they do not contribute significantly more. This occurs even when though it implies a return of transfers to outsiders and a loss in efficiency.

The lower contributions to the public good by insiders under the two institutions that allow for transfers (relative to the baseline where transfers were not an option) raises the question of how to interpret the erosion of cooperation observed across periods. We address several possible answers, namely the particular dynamics and associated payoff differences that occur between insiders and outsiders, the incentives to free-ride on other group members, and the strategic uncertainty that is inherent in the decision setting. These explanations alone, however do not fully explain the reduced cooperation we observe under the institutions allowing for transfers.

At this point, we cannot explicitly identify the full set of mechanisms behind the decisions of insiders and outsiders that drive the poor performance of the unconditional and conditional transfers. Despite the fact that in all three treatment settings there are incentives for free-riding on one's sub-group, the relative performance of the two treatments with institutions as compared to the baseline suggests that introduction of the

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possibility of endogenous transfers accentuates the social dilemma aspects of this setting with active outsiders. One might conjecture that the act of offering transfers is deemed by subjects to be inappropriate (crowding-out). Yet we do observe a positive correlation between transfers offered and contributions. This suggests that if outsiders had offered zero transfers, cooperation by insiders would be even smaller than what we observe in our data.

In addition, transfers being passed on to the entire group of insiders with an even share distribution rule creates incentives to free-ride on the contributions of other insiders and moreover can be perceived as unfair, undermine pro-social norms, and can jeopardize their effectiveness (Narloch et al 2012, Midler et al 2015). The motivation of the two institutions examined in this study was to explore the use of transfers in settings where individualizing transfers was not feasible or too costly to be cost effective. Our study suggests that making transfers conditional to the group is not sufficient; overall performance of the conditional transfer institution is poor. Future research, could be designed to explore the behavioral consequences of contrasting institutions where transfers are group based versus individualized, testing further for the importance of conditionality and individualized incentives.

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Appendix – Additional Analyses

Table A1. GLS Insiders' expectations of outsiders' transfers

	Contributions *Donation*	Contributions *Contract*	Contributions *Donation*	Contributions *Contract*
Expectation higher than transfer	-1.733 (0.474)	-0.287 (0.872)		
Expectation minus individual transfer offered			-0.0705 (0.339)	-0.0193 (0.708)
Period	-1.546*** (0.000)	-2.095*** (0.000)	-1.495*** (0.000)	-2.087*** (0.000)
Constant	31.55*** (0.000)	35.99*** (0.000)	30.42*** (0.000)	35.78*** (0.000)
N	320	360	320	360
Number of subjects	32	36	32	36
Number of groups	8	9	8	9

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: In the first two columns of Table A1 the explanatory variable "Expectation higher than transfer" is a dummy variable equal to one if an insider's expectation is higher than the actual individual transfer offered by outsiders. In columns 3 and 4 "Expectation minus individual transfer offered" is a continuous variable measuring the deviation between expectations and transfers offered.

Provision of Public Goods:
Unconditional and Conditional Donations from Outsiders

by

Esther Blanco, Tobias Haller, and James M. Walker.

Experimental Instructions

The instructions were in German. Below we present an English translation for part one and two of the Donation treatment.

General Information

This is an experiment on decision making. You will have the chance to earn money based on your decisions and the decisions of others in your group. It is extremely important that you put away all materials including external reading material and turn off your cell phones. Now that the experiment has begun, we ask that you do not talk. If you have a question, please raise your hand and I will come by and answer your question privately. Please do not write in these instructions.

Your decisions will be recorded privately at your computer terminal. Your identity will never be disclosed to other participants.

Cash Payment: Your earnings in this experiment are expressed in EXPERIMENTAL CURRENCY UNITS, which we will refer to as ECUs. At the conclusion of the experiment you will be paid privately in Euros using a conversion rate of €1 for every 200 ECUs of earnings from the experiment.

Structure: This experiment consists of TWO PARTS, Part 1 and Part 2. This set of instructions details Part 1. The instructions for Part 2 will be provided after Part 1 is completed.

Information for Part 1 of the experiment
Part 1 is comprised of *5 decision periods*, each having the same structure. At the beginning of the section, you will be randomly and anonymously matched with 7 other participants to form a *group of 8*. You will remain in this same group for all of Part 1 and Part 2.

In every group there are *two types* of participants: 4 participants of Type A and 4 participants of Type B. Participant types are determined randomly. Your Type will remain unchanged for all of Part 1 and Part 2.

<u>Initial Endowments:</u>

Private Account: In each period, *participants* of *both types* receive an endowment of *100 ECUs* placed in their Private Account.

Group Account: In each period, each 8 person *group* begins with a Group Account of *0 ECUs*.

<u>Decision Tasks:</u>

Type A participants

Each Type A participant decides how many (if any) of the 100 ECUs he/she wants to allocate to the Group Account. Allocations can range from 0 to 100 ECUs in increments of 1 ECU. For every 1 ECU a Type A participant allocates to the Group Account, each of the 8 participants in his/her her group receives 0.4 ECUs**.**

Type B participants

Type B participants cannot make allocations to the Group Account. In every period they will estimate the amount allocated to the Group Account by the Type A participants. Their estimate, however, does not have an effect on the payoff of any group member and it will not be shared with members of their group.

<u>Period Earnings:</u>

Type A participants
The period earnings of Type A participants are the sum of the funds remaining in their Private Account after their allocations to the Group Account and the earnings from the Group Account.

> Earnings Type A participants =
> Private Account (Initial Endowment – Group Account allocations) + Group Account

Type B participants
The period earnings of Type B participants are the sum of their initial endowment of 100 ECUs and their earnings from the Group Account, which depends solely on the decisions of the Type A participants in their group.

> Earnings Type B participants =
> Private Account (Initial Endowment) + Group Account

<u>Feedback</u>: After every period, all group members will receive information on the total sum of allocations to the Group Account by Type A participants and on their individual earnings for the period.

TOTAL earnings: Your total earnings for Part 1 of the experiment will be the sum of your earnings in all periods of Part 1. Recall, at the conclusion of the experiment you will be paid in Euros using a conversion rate of €1 for every 200 ECUs of earnings from the experiment.

Example:

Suppose the four Type A participants allocate 0, 10, 50, and 90 ECUs respectively to the Group Account. Then the sum of group allocations is 150 and each group member receives 0.4x150=60 ECUs from the Group Account.

The individual payoffs per period of the Type A participants depend on the amounts they allocated to the Group Account:

- for the participant A who allocated 0: $(100 - 0) + 60 = 160$
- for the participants A who allocated 10: $(100 - 10) + 60 = 150$
- for the participants A who allocated 50: $(100 - 50) + 60 = 110$
- for the participant A who allocated 90: $(100 - 90) + 60 = 70$

The payoff per period for each participant of Type B is $100 + 60 = 160$.

Information for Part 2 of the experiment

Part 2 will consist of an additional *10 decision periods*. You remain in the *same group of 8 participants* as in Part 1. Your Type also remains unchanged. In this part, both participants of Type A and Type B make sequential decisions in every period. The four Type B participants in a group make their decisions first. Next, the four Type A participants in a group make their decision.

Initial Endowments (same as in Part 1):

Private Account: In each period, *participants of both types* receive an endowment of *100 ECUs* placed in their Private Account.

Group Account: In each period, each 8 person *group* begins with a Group Account of *0 ECUs*.

Task 1:

Type B participants

Each Type B participant can choose to make a transfer between 0 and 100 ECUs to a Transfer Account. The sum of transfers will be split equally among the Type A participants in the group before participants of Type A make their decisions.

Type A participants

Each Type A participant will estimate the amount of ECUs transferred to the Transfer Account by the Type B participants. Their estimate does not have an effect on the payoff of any group member and it will not be shared with members of their group.

Task 2:

Type A participants

Each participant of Type A observes the total funds available in the Transfer Account and his/her individual share of the transfer.

Type A participants then decide how many (if any) of the 100 ECUs in his/her endowment he/she wants to allocate to the Group Account. As in Part 1, for every 1 ECU a Type A participant allocates to the Group Account, each of the 8 participants in his/her her group receives 0.4 ECUs.

Notice that Type A participants are not allowed to use transfers from Type B participants for allocations to the Group Account.

Type B participants

As in Part 1, in every period each Type B participant will estimate the amount of ECUs allocated to the Group Account by the Type A participants. Also as in Part 1, their estimate does not have an effect on the payoff of any group member and it will not be shared with members of their group. Type B participants cannot make allocations to the Group Account.

Period Earnings:

Type B participants

The period earnings of Type B participants are the sum of the funds remaining in their Private Account after their transfers to the Transfer Account and the earnings from the Group Account.

> Earnings Type B participants =
> Private Account (Initial Endowment - Transfers) +
> Group Account

Type A participants

The period earnings of Type A participants are the sum of the funds remaining in their Private Account after their allocations to the Group Account, the earnings from the Group Account, and their earnings from the transfers made to the Transfer Account by Type B participants in their groups.

> Earnings Type A participants =
> Private Account (Initial Endowment - allocations) +
> Group Account +
> Transfers

Feedback: After every period, both types of participants will receive information on the funds available in the Transfer Account, the total funds available in the Group Account, and their individual earnings for this period.

TOTAL earnings: Your total earnings for Part 2 of the experiment will be the sum of your earnings in all periods of Part 2. Recall, at the conclusion of the experiment you will be paid in Euros using a conversion rate of €1 for every 200 ECUs of earnings from the experiment.

Your total earnings from the experiment will be the sum of your total earnings from Part 1 and Part 2.

Example:

Suppose participants of *Type B* transfer 0, 10, 30, and 60 ECUs respectively to the Transfer Account.

Also suppose participants of *Type A* allocate 0, 10, 50, and 90 ECUs respectively to the Group Account.

Group Account: The sum of allocations made by Type A participants is 150. Each participant of Type A and Type B receives 0.4 x 150 = 60 ECUs from the Group Account.

Transfer Account: The sum of transfers from Type B participants is 100 ECUs and therefore each participant of Type A receives 100 / 4 = 25 ECUs from the Transfer Account.

The individual payoffs (in ECUs) per period of the Type A and B participants depend on the transfers and the amounts allocated to the Group Account:

- for the participant A who allocated 0: $(100 – 0) + 60 + 25 = 185$
- for the participants A who allocated 10: $(100 – 10)+ 60 + 25 = 175$
- for the participants A who allocated 50: $(100 – 50) + 60 + 25 = 135$
- for the participant A who allocated 90: $(100 – 90) + 60 + 25 = 95$

- for the participant B who transferred 0: $(100 – 0) + 60 = 160$
- for the participants B who transferred 10: $(100 – 10) + 60 = 150$
- for the participants B who transferred 30: $(100 – 30) + 60 = 130$
- for the participant B who transferred 60: $(100 – 60) + 60 = 100$