Experimental evidence on sharing rules and additionality in transfer payments

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Abstract:

This study presents novel evidence showing that group payments distributed proportional to effort are as effective as payments targeted to individuals in increasing public good provision. The decision setting includes donors who make transfer payments to public good providers. The institutions under consideration are motivated primarily by payments for ecosystem services (PES), such as payments for climate protection. The decision settings, however, capture attributes of many forms of charitable giving where NGO type organizations support activities that provide public good externalities beyond those who directly benefit. Results are presented from two studies, varying the sharing rules for transfers among group members (equal share, proportional share, and individual targeting) and the presence of additionality, whereby transfers are received contingent on public good provision being at a level higher than in initial decision periods. The sharing rules studied result in significant differences in cooperation levels. Supported by higher transfer subsides, both the proportional share and targeted-transfers to individuals lead to greater public good provision relative to the equal share rule. Contrary to its alleged relevance in the literature, additionality does not lead to sustained increases in public good provision. Yet, additionality may improve the cost-effectiveness of transfer programs by precluding transfer payments when subsidies do not increase public good provision.

JEL Classification: D70, H41, C92

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1. Introduction

Evidence from the natural sciences warns about the disastrous threats of global warming, mass extinction of animal and plant species, and the preservation of the global ecosystems necessary for the well-being of present and future generations (Hagedorn et al., 2019; Ripple et al., 2019). Underlying these threats are economic incentives and institutions that induce individuals, firms, and countries to largely neglect the negative externalities from their decisions, under-providing the positive externalities associated with ecosystem conservation. Even in the Covid-19 dominated policy agenda in the spring of 2020, think tanks and political leaders continue to call for economic reconstruction policies to respond to the climate crisis and the ecological emergency to support human well-being in the future (see for example the open letter to the world leaders by the Club of Rome released in March 26, 2020, the European alliance for a Green Recovery launched on April 14, 2020, or the Covid-19 implications on the UN Sustainable Development Goals). A polycentric approach for conservation, combining unilateral, bilateral and multilateral policies between countries, regions, cities and individuals is emerging in the policy arena (see also for example https://www.americaspledgeonclimate.com/). Payments for ecosystem services (PES) represent one type of program designed to contribute to these objectives. Examples include the UN-REDD program (https://www.un-redd.org/) and the Trillion Tree Campaign (https://www.trilliontreecampaign.org/). Such programs allow individuals and organization who benefit from environmental conservation, but cannot directly take direct actions, to assist public good providers who can provide enhanced maintenance of the ecosystems (Chichilnisky and Heal, 1998; Kinzig et al., 2011).

In an earlier study, Blanco, Haller and Walker (2018), herein BHW, provided evidence from the first experimental study analyzing the effect of group payments for public good provision with endogenous transfer payments. In the decision settings studied, a group of individuals (*insiders*) provide a public good with benefits within their group and to an extended group (*outsiders*). Outsiders cannot directly provide the public good but can become donors who financially compensate the insiders for their efforts. In that study, transfers were shared equally among insiders in all treatments. Results show that donation transfers from outsiders, despite substantial, did not lead to greater public good provision by insiders. This result was robust to a setting where outsiders' transfers acted as a matching mechanism for contributions, with an upper threshold for matching based on the level of transfers offered. Thus, the results in BHW provided evidence questioning the use of programs designed around group payments shared equally among recipients: transfers from outsiders were realized, but did not induce a significant increase in public good provision.

In this study, we build on the decision setting in BHW and focus on the relative performance of alternative institutions specifically designed to incentivize greater public good provision with endogenous donors. The decision setting with endogenous insiders and outsiders broadens the scope of previous research on the provision of public goods in closed groups where all individuals are simultaneously providers and beneficiaries of the public good (e.g. Andreoni, 1988; Isaac and Walker, 1988; and Croson, 2007). It also extends previous research where public good provision by one group benefited another group composed of passive by-standers (Engel and Rockenbach, 2009; Delaney and Jacobson, 2014). In addition, the decision setting differs from previous experimental studies where the experimenter provides exogenous incentives framed as PES payments, that are either tied to individual performance (Vollan, 2008; Handberg and Angelsen, 2015; Midler et al., 2015; Alpízar et al., 2017) or based on collective performance (Travers et al., 2011; Narloch et al., 2012; Midler et al., 2015; Kaczan et al., 2017; Salk et al., 2017; Gatiso et al., 2018; Moros et al., 2019; Rodriguez et al., 2019). In both BHW, and this study, donors of transfer payments are active and the available funds to compensate insiders' efforts are endogenously determined. Thus, by considering the decisions of donors to subsidize the provision of public goods, this study also contributes to the large body of literature on the behavioral drivers of charitable donations (Andreoni, 1990; Vesterlund, 2003, Frey and Meier, 2004; Benabou and Tirole, 2006; Ariely et al., 2009; Gneezy et al., 2014; Garcia et al., 2020).

The study herein presents novel evidence showing that payments from outsiders can work. Broadly, we find that outsiders use the possibility of making transfer donations to compensate insiders for their effort, and that under certain institutional arrangements, insiders reciprocate by increasing public good contributions. More specifically, we show that group transfer payments allocated proportionally to relative contributions and individually targeted payments generate similar increases in public good provision. We also show that both do better than group payments when transfers are shared equally. These institutions incorporate key design attributes suggested by previous meta-analyses of payments for ecosystem services programs (e.g. Ferraro and Kiss, 2002; Jack et al., 2008; Pattanayak et al., 2010; Ferraro, 2011; Hejnowicz et al., 2014; Naeem et al., 2015; Engel, 2016; Wunder et al., 2018). These meta-analyses argue that PES design is complex and further emphasize the need for empirical evidence on the relevance and causal effects of institutional design in their success (e.g. Pattanayak et al. 2010;

Ferraro 2011; Naeem et al. 2015). Thus, as many prior social dilemma experimental studies (e.g. Ostrom et al., 1992), we contribute to the literature by providing a test bed for investigating the effects of alternative institutional arrangements.

We present the results of two studies, including six main treatments and one supplementary treatment, with observations based on decisions by 1,032 individuals in 129 groups. In Study 1, a 2x2 design, transfers from outsiders (donations) are made to insiders at the group level. The two rules for distributing transfers are *Equal* and *Proportional.* In *Equal*, transfers are distributed equally among insiders regardless of individual contributions to the public good. *Equal* serves as the baseline treatment for Study 1. In *Proportional,* transfers received by individual insiders are proportional to their contribution relative to other insiders in a group.[1] In addition, we examine settings with and without an *additionality* criterion. Additionality, motivated largely by the PES literature, requires that transfers by outsiders to insiders are implemented only if insiders increase their contributions relative to their prior behavior without transfers. *Equal(Add)* and *Proportional(Add)* implement the additionally requirement in conjunction with the two sharing rules. In Study 2 we examine two main decision settings, namely *Targeted-transfers* in which individual outsiders endogenously choose how to direct their transfers to individual insiders, and *Equal(baseline2)* which serves as the baseline treatment for Study 2.

In field settings, the implementation of sharing rules critically depends on the monitoring capacity of insiders, outsiders, and program administrators, and is based on technical feasibility, transaction costs and political support. All sharing rules under consideration require sufficient monitoring capability for outsiders to monitor the contribution decisions of insiders as a group. The equal share rule captures a setting where monitoring individual insider decisions is not feasible by insiders nor outsiders and donation transfers are shared equally, as a natural default. The proportional share rule captures a setting where outsiders only have information at the group level. At the same time, insiders have monitoring capacity of peers and conflict resolutions mechanism are in place, so that relative effort and relative compensation can be aligned. Lastly, the targeted-transfers rule requires that outsiders have the capacity to monitor individual insiders. Allegedly, donations targeted by outsiders to individual public good providers are the most effective, as the link between payments and performance is the most direct (Engel, 2016). In our study, a proportional sharing and an individual targeting of transfers

[1] This decision setting builds on previous studies that have analyzed alternative sharing rules in decision settings with an external party that allocates an endogenously provided good that is rival in consumption (Stoddard et al., 2014; Drouvelis et al., 2017; and Stoddard et al., 2018).

do similarly well, and both result in significantly higher public good provision than an equal share. This is relevant for policy design, as individual monitoring by outsider donors necessary to make individual targeted-transfers feasible may not be possible in all field settings. Our results from the *Proportional* decision setting support that even if individual payments are not feasible, transfer payment programs can be effective: if insiders have monitoring and enforcement capacity (for example, through collective action arrangements), group transfers can enhance public good provision.

The *Additionalit*y criterion is designed to examine settings where payments for public good provision are made only when public good provision exceeds a group-defined historical benchmark. Thus, implementation of additionality requires impact evaluation, using a counterfactual scenario, to identify the additional effects of the program (Wunder, 2005; Ferraro, 2011). When considering alternative counterfactual outcomes, historic baselines are a common approach (e.g. Engel, 2016). In practice, this not only requires historical monitoring of the efforts of public good providers; it also requires sufficient political and social commitment to distribute the payments to providers only if the additionality requirement is fulfilled. Despite its alleged benefits, many PES programs do not incorporate or enforce additionality (Wunder et al., 2008; Ezzine-de-Blas et al., 2015), considered by some as an important design flaw in program implementations (Pattanayak et al., 2010; Naeem et al., 2015). Contrary to its alleged relevance in PES design, we find that the inclusion of additionality does not significantly increase public good provision. Yet, our results also suggest that the relevance of the additionality criterion may be justified by taking cost-effectiveness into consideration, as it creates a setting where donations are only used if there is an increase in public good provision.

The remainder of this manuscript is organized as follows. Section 2 discusses the experimental design, hypotheses, and results for Study 1. Similarly, Section 3 discusses Study 2. Section 4 provides a discussion on the degree of variation in behavior across groups and individuals, within and across all experimental treatments. Section 5 serves as a conclusion.

2. Study 1: Group Sharing Rules and Additionality

2.1. Decision settings and parameters

As in BHW, an experimental group is composed of 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. Each experimental treatment condition consists of 15 decision making periods and includes two parts, 5 periods of

Part 1 and 10 periods of Part 2. In both Part 1 and Part 2, insiders participate in a repeated linear public good game in which provision of the public good creates a positive benefit for both insiders and outsiders. In Part 1, which is equivalent in all treatment conditions, outsiders are inactive and insiders make contributions g_i out of an endowment of $w = 100$ Experimental Currency Units (ECUs), with $g_i \in [0, w]$, to a Group Account $G = \sum_{i=1}^{n_I} g_i$. G constitutes a public good with a marginal per capita return (MPCR) of $a = 0.4$, for insiders and outsiders. Outsiders receive an equivalent endowment of $w = 100$ ECUs. In Part 1 outsiders do not make allocation decisions. They simply receive the benefits of the contributions made by insiders, which was common information. Part 1 is important because we are interested in institutional changes to environments in which there is a history where insiders' contribution decisions benefit 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.[2]

In Part 2 of each treatment condition, insiders make the same allocation decision as in Part 1 and outsiders make transfer decisions (donations) from their endowment. Thus, the decision setting changes to a two-stage game in each period in Part 2. Subjects learned the decision-making details of Part 2 only after the completion of Part 1. The institutional rules for the allocation of transfers in Part 2 varies depending on the specific treatment condition. Subjects participated in only one of the treatment conditions in a between-subjects design. Groups and participants' roles remained fixed for the duration of the experiment (see the Supplementary Materials for instructions, which are common knowledge among insiders and outsiders). At the end of each period in Part 1 and Part 2, insiders and outsiders were informed of their individual earnings and the total allocations to the Group Account by insiders. No individual behavior of other players was displayed. In addition, as discussed below, in Part 2 subjects received further information that varied depending on the treatment condition.

Table 1 provides an overview of the four treatment conditions implemented in Study 1, as well as the respective attributes of the decision settings that apply to Part 2. Recall that Part 1 is equivalent in all treatments. *Equal* serves as the baseline treatment to Study 1 and follows the

[2] BHW analyzed treatments equivalent to *Equal* referred to as "Donation" and "Donation II," where the latter did not have a Part 1 with inactive outsiders. Part 1 was included in the original design to control for group specific effects. No statistical difference was found between "Donation" and "Donation II". These results from BHW support the conclusion that the results observed in Part 2 were not driven by including a Part 1 in the experimental design.

equivalent protocol as the Donation treatment in BHW.[3] All data presented herein is previously unpublished, based on experimental sessions conducted during March 2018 and January 2020 at the University of Innsbruck, Austria. The experiments were programmed using zTree (Fischbacher, 2007) and subjects were recruited using the HROOT system (Bock et al., 2014). The sessions consisted of either 16 or 24 subjects and lasted between 60 to 70 minutes. At the completion of the experiment, subjects were paid privately in Euros. On average, subjects earned 13.5 Euros, which included a show-up payment of 4 Euros.

Table 1. Overview of Treatment Conditions in Study 1

Treatments	Sharing rule among insiders in Part 2	Additionality	Number of observations
Equal	Equal share	No	20 groups 160 subjects
Proportional	Proportional share	No	21 groups 168 subjects
Equal(Add)	Equal share	Yes	17 groups* 136 subjects
Proportional(Add)	Proportional share	Yes	19 groups 152 subjects

*The number of observations in the *Equal(Add)* treatment is smaller as we could not conduct one last remaining session originally scheduled for March 2020 due to the COVID-19 outbreak and associated constraints with running laboratory experiments.

Equal

With equally shared transfers, in stage 1 of each period each outsider j makes a non-contingent transfer, t_j, to the insiders, where $t_j \in [0, w]$. All transfers are added to a Transfer Account of size $T = \sum_{j=1}^{n_O} t_j$. The Transfer Account is divided equally among insiders, each insider receiving $\left(\frac{1}{\mathrm{n_I}}\right) T$, independent of their own contribution to the Group Account. Note that just as each insider has the opportunity to free ride on the contributions of other insiders, outsiders have the opportunity to free ride on the transfers made by other outsiders.

In stage 2 insiders make simultaneous contribution decisions to the Group Account. By design, transfers received by insiders cannot be used directly for contributions. Transfers are designed to represent an opportunity for outsiders to compensate through monetary payments the costly actions of insiders. Thus, the maximum amount an insider can contribute to the Group Account

[3] Comparing *Equal* to the "Donation" treatment in BHW (which follows the identical protocol), panel regression analysis shows no significant differences between treatments for both net contributions and net transfers, as defined in section 2.2. See section 1 in the online SM for these results.

is *w*, irrespective of the transfer received. At the end of each period in Part 2 of *Equal* insiders and outsiders receive the same information they received in Part 1, jointly with information on the collective amount of transfers sent by outsiders, and each insider receives information on the amount of transfers received. As transfers to all insiders are the same, all insiders observe exactly the same information at the end of each period.

The resulting profit functions for insiders and outsiders in each period are given in equations (1) and (2), respectively:

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

$$\pi_{Oj} = w + aG - t_j \tag{2}$$

where $a < 1$ and $(n_I + n_O)a > 1$. The Nash equilibrium for self-interested payoff maximizing agents who assume others have such preferences is zero contributions to the Group Account by insiders and zero transfers from outsiders. However, a broad range of previous research on social dilemma settings has shown that subjects make decisions that reflect diverse motivations beyond self-regarding income maximization (see Camerer, 2003; Camerer and Fehr, 2006; Chaudhuri, 2011; Ostrom and Walker, 2003). Thus, as in BHW, we incorporate simple social preferences into the respective utility functions, considering that insiders derive utility from contributing to the Group Account and that outsiders derive utility from making transfer donations. The resulting utility functions for insiders and outsiders are given in equations (3) and (4), respectively.

$$U(\mathrm{g_i})_{Ii} = w - g_i + aG + \frac{1}{n_I} T + f(g_i) \tag{3}$$

$$U(t_\mathrm{j})_{Oj} = w + aG - t_j + y(t_j) \tag{4}$$

where, $f(0) = 0$, $f'(g_i) > 0$ and $f''(g_i) < 0$. In this form, subject *i* receives additional utility from the act of contributing to the Group Account, which is decreasing in contributions by subject *i*. We expect that, at least for a subset of subjects, $-g_i + f(g_i)$ is positive for positive levels of g_i, resulting in positive contributions to the Group Account in equilibrium (e.g. Goeree, Holt, and Laury, 2002; Blanco, Haller, Lopez, and Walker, 2016). Similarly, $y(t_j)$ captures the assumption that outsiders may derive utility from making transfers, with $\mathrm{y}(0) = 0$, $y'(t_j) > 0$ and $y''(t_j) < 0$. Ultimately, the impact transfers have on total contributions of insiders depends on the level of transfers offered by outsiders and the responsiveness of insiders to the offers. BHW showed that although outsiders send substantial transfers, and although insiders did contribute positive amounts to the Group Account, the introduction of equally shared transfers did not result in higher contributions than in a setting were outsiders were inactive and could not send transfers.

Proportional

With a proportional sharing rule, the distribution of transfers is proportional to individual contributions to the public good, $\left(\frac{g_i}{G}\right)T$. In each period of Part 2, at the beginning of stage 2 insiders observe the total size of the Transfer Account from stage 1 and make simultaneous contribution decisions. At the end of each period, each insider is privately informed of the amount of transfers they receive, as well as the share of transfers it represents. As with the equal sharing rule, both insiders and outsiders are also informed of the collective contributions of insiders and the collective transfers of outsiders, as well as their individual earnings.

The resulting utility functions for insiders and outsiders in each period are given in equations (5) and (6), respectively:

$$U(\mathrm{g_i})_{Ii} = w - g_i + aG + \left(\frac{g_i}{\mathrm{G}}\right)T \ + f(g_i) \qquad (5)$$

$$U(t_\mathrm{j})_{Oj} = w + aG - t_j + y(t_j) \qquad (6)$$

The *Proportional* rule links relative effort of insiders to compensation. Assuming a positive level of transfers, ceteris paribus, *Proportional* reduces within-group incentives among insiders to free ride on the contributions of other insiders compared to *Equal*. Insiders contributing more than the average in their group, receive a greater proportion than in the case of equal transfers ($\frac{g_i}{G} > \frac{1}{n_i}$) and insiders contributing below the average receive a smaller proportion ($\frac{g_i}{G} < \frac{1}{n_i}$). Thus, the *Proportional* sharing rule can be viewed as creating a competitive rewarding scheme among insiders. The literature on selective reward systems, such as rank-order tournaments, suggests that effort-inducing mechanisms can outperform those that do not tie rewards to relative effort (see for example Lazear and Rosen, 1981; Nalbatanian and Schotter, 1997). Based on these findings, we conjecture that in our setting the positive effort-inducing effect for high performers will be larger than a discouraging effect for low performers. Further, because our setting includes multiple decision rounds, the proportional sharing rule allows for competition among insiders across rounds. In addition, a proportional share rule can be perceived as fairer than an equal share rule that ignores relative effort (see discussion in Stoddard et al., 2014). Given the evidence on conditional cooperation from prior public good experiments, increased insiders' public good provision would lead to greater transfers by outsiders (Croson, 2007). Based on these arguments, we expect the overall effect of using a proportional share rule relative to an equal share rule is to increase contributions by insiders leading to increased transfers by outsiders.

> **Hypothesis 1:** Average contributions by insiders and transfers by outsiders will be greater in treatment *Proportional* than in treatment *Equal*.

Additionality criterion

When the additionality criterion is present, the distribution of transfers among insiders is dependent upon contributions to the Group Account by insiders being strictly larger than the average aggregate contributions during Part 1. Otherwise, transfers are refunded to outsiders. Thus, the additionality criterion imposes a threshold that must be met by insiders for receiving the lump-sum transfers for the group. While the criterion is the same across groups, it entails a different threshold across groups based on their history from Part 1. Further, the value of meeting that threshold in a group varies across rounds depending on the level of transfers offered.

We differentiate between transfers offered by the outsiders and transfers received by the insiders. During decision making in stage 2, both insiders and outsiders are informed of the collective average contributions to the Group Account during Part 1 (the threshold to receive transfers). At the end of each period, both insiders and outsiders received information on whether the additionality criterion was fulfilled. Thus, insiders and outsiders learned whether the Transfer Account was shared among insiders or if transfers were refunded to the outsiders. In addition, insiders and outsiders in *Equal(Add)* and *Proportional(Add)* received the same information as their respective counterparts in *Equal* and *Proportional.*

Note that the decision setting with an additionality criterion is related to a provision point public good decision setting, but with important differences. First, in standard threshold public goods settings, in any given period and in any given group, the contribution threshold necessary for provision of the public good is the same and set externally (e.g. see Marks and Croson, 1998). But the threshold implied by the additionality criterion is not the same for all groups; it is defined from the group-specific history. Second, the public good benefits to insiders and outsiders from contributions by insiders is provided irrespective of whether the additionality threshold is met. If the additionality criterion is not met, insiders do not receive the donations from outsiders, but still receive public good benefits. In summary, these differences result in important differences in incentives as compared to a standard threshold public good.

Also note that the additionality setting captures elements of what is referred to in the public goods literature as a matching mechanism, where contributions are matched externally if they exceed an exogenously defined threshold (e.g. Baker et al., 2009). Importantly, such settings can lead to multiple equilibria, some of which imply contributions sufficient to meet the threshold for matching. In our setting, to receive endogenously determined transfers, insiders' contributions must meet the endogenously determined threshold based on their contributions from Part 1. As with public good matching mechanisms, the resulting discontinuity in the insiders' payoff function due to the additionality threshold generates incentives to increase contributions as compared to the decision-setting without additionality. That is, given positive contributions in Part 1 (the threshold to receive transfers is not zero), and as long as the amount of transfers to receive is sufficiently large, even purely self-interested payoff-maximizing insiders could find it optimal to contribute positive amounts that lead the group to meet the threshold. Further, one might speculate that the repeated nature of the game and the endogeneity of both contributions and transfers could lead groups of insiders to make contributions beyond the intra-period threshold.

Finally, from the perspective of outsiders, previous literature suggests that donations to charities increase in situations where perceived risk of performance is lower, by discouraging excuse-driven behavior apparent under uncertainty (Exley, 2015; Garcia et al., 2020). In this sense, conditional on choosing to make transfers, we conjecture transfers from outsiders will increase when outsiders know that transfers will be returned to them if insiders' contributions do not meet the additionality threshold.

Overall, these effects are expected to increase across-group reciprocity among insiders and outsiders (see Sugden, 1984 for a formal discussion of reciprocity and Croson, 2007 for experimental evidence in repeated public good settings).

> **Hypothesis 2**: In treatments *Equal(Add)* and *Proportional (Add)* average contributions by insiders and average transfers by outsiders will be greater than their counterpart treatments that do not include additionality.

2.2. Results

The presentation of results of Study 1 is organized around two primary results. Result 1 contrasts behavior in the two treatments *Equal* and *Proportional*, while Result 2 contrasts behavior between *Equal* and *Equal(Add)* and *Proportional* and *Proportional(Add)*. For each result we present a graphical overview focusing on contributions by insiders and transfers by outsiders in Part 1 and Part 2. This graphical overview is followed by panel-regression analyses of decisions in Part 2 that focus on net group contributions and net group transfers (defined below) that control for group specific differences based on decisions during Part 1.

> ***Result 1:*** *A proportional share rule significantly increases contributions of insiders and transfers of outsiders compared to an equal share rule.*

Figure 1 compares the average sum of contributions as well as average sum of transfers in the *Equal* and *Proportional* treatments. The solid lines display the average sum of contributions (sumG) of the insider groups to the Group Account. The dashed lines represent the average sum of transfers (sumT) of the outsider groups. The vertical solid line displays the start of Part 2.

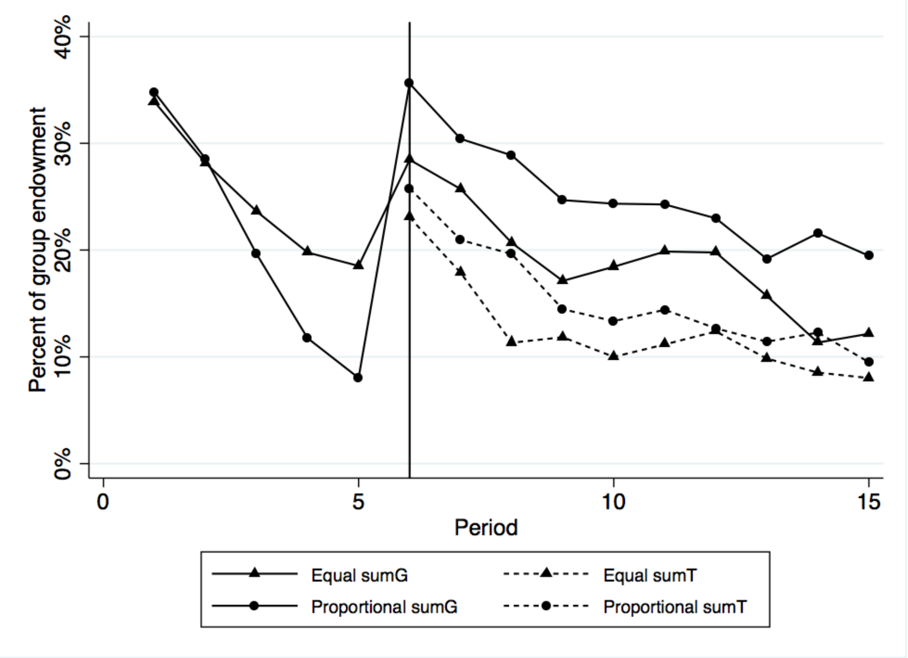

Fig 1. Average group contributions and transfers in Equal and Proportional across periods

Period 1 decisions are similar across both treatments, with insider's contributing approximately 35% of their endowment. In periods 2-5, however, average contributions to the Group Account decay at a slower rate in *Equal* compared to *Proportional*.[4] Because experimental conditions are equivalent in Part 1, this difference is attributed to group-specific effects. In period 6, average group contributions are higher in *Proportional* than in *Equal* and decay thereafter, but remain at a higher level in *Proportional* in all periods. Average transfers by outsiders in *Proportional* are as well above those in *Equal* in all periods.

[4] Two-sample t-tests show that contributions in periods 1 - 4 are not significantly different between Equal and Proportional (all p-values > 0.05), and period 5 contributions are significantly different from each other (p-value = 0.03).

Table 2 presents the results of multilevel regressions with random effects at the group and session level.[5] Analysis is based on decisions in periods 6-15 (Part 2 with transfers). The dependent variable in model (I) is each group's net contribution, and in model (II) the group's net transfers. The reference treatment is *Equal*. This analysis of Part 2 decisions controls for differences in decisions by groups of insiders in Part 1. In particular, for each group and each period of Part 2, we subtract the group's average contributions during Part 1 (denoted by avgG) from the group's contribution, yielding *net group contributions* = sumG – avgG. Similarly, we also report *net group transfers* (net group transfers = sumT – avgG). This difference-in-differences approach enables us to identify causal treatment effects that consider group specific pre-treatment effects (see Tables SM2 and SM3 in the online SM for robustness tests on the treatment effects).

Table 2. Treatment effects for average net group contributions and average net group transfers in Proportional and Equal

In % of group endowment:	(I) Net group contributions	(II) Net group transfers
Proportional	10.46***	7.283**
	(3.443)	(3.448)
Period	-1.586***	-1.392***
	(0.420)	(0.156)
Constant	10.79**	2.224
	(5.046)	(3.127)
Observations	*410*	*410*
Number of sessions	*14*	*14*
Number of groups	*41*	*41*
Reference Category	*Equal*	

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*

As shown, on average, net group contributions and net group transfers are significantly larger in *Proportional* than in *Equal*. Thus, in line with Hypothesis 1; introducing a proportional share rule for distributing transfers significantly increases average contributions by insiders and transfer donations from outsiders, relative to an equal share rule.

Next, Result 2 summarizes the effect of introducing additionality in each of the sharing rules.

[5] We use multilevel regressions to model the hierarchical structure of our data, and thus control for the existing intra-class correlations. Residual ICC estimates for groups within a session, or, respectively individuals within a group, range between 30% to 80% for all regression models under consideration.

Result 2: *For both sharing rules, introducing additionality does not significantly affect contributions of insiders.*

As shown in Panel A of Figure 2, Part 1 contributions are similar in *Equal* and *Equal(Add)*. In Part 2, contributions in *Equal(Add)* start and end at a similar level to *Equal*. In Panel B, average group contributions in *Proportional(Add)* are above those in *Proportional* in all periods in Part 1, but differences are not significant (all p-values > 0.05). During all periods of Part 2, average group contributions remain higher for *Proportional(Add)* as compared to *Proportional*, and these differences are non-significant as discussed in Table 3. For both sharing rules with additionality, transfers received (shown in grey in figure 2) are well below transfers offered, meaning that transfers offered by outsiders to insiders are often returned to the outsiders, as aggregate contribution to the public goods do not meet the additionality criterion. That is, groups of insiders often contribute less in Part 2 than their group average in Part 1.

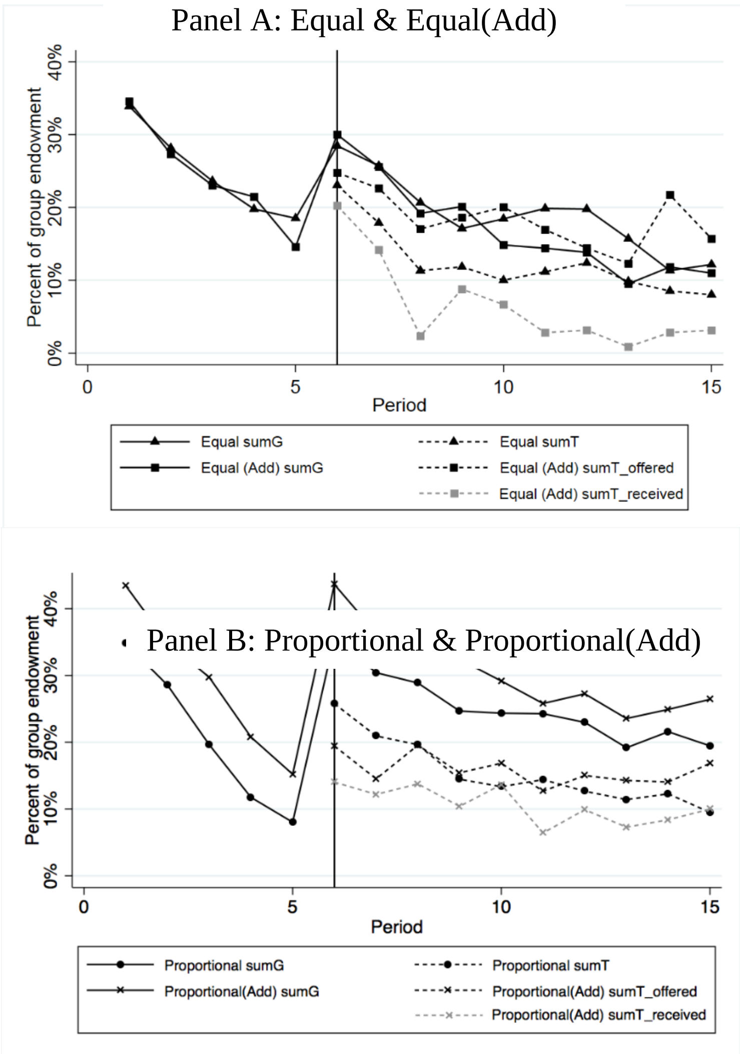

Fig 2. Average group contributions and transfers in Equal & Equal(Add) and Proportional & Proportional(Add) across periods.

Table 3 presents multilevel regressions with random effects at the group and session level for examining the effects of incorporating additionality into each of the sharing rules. Analyses are based on decisions in periods 6-15. The respective reference group is the treatment without additionality. As shown, with additionality, net group contributions are not statistically different compared to their respective reference treatments without additionality. This is so, despite some significant differences in the use of transfers. Both net transfers offered and net transfers received in *Equal(Add)* are not significantly different compared to *Equal*, but are significantly lower in *Proportional(Add)* than in *Proportional*.

Table 3. Treatment effects for net group contributions and net group transfers in Equal(Add) and Equal and in Proportional(Add) and Proportional.

	Equal			Proportional		
In % of group endowment:	(I) Net group contributions	(II) Net group transfers offered	(III) Net group transfers received	(IV) Net group contributions	(V) Net group transfers offered	(VI) Net group transfers received
Equal(Add)	-1.300 (2.468)	6.609 (4.057)	-5.308 (4.747)	N/A	N/A	N/A
Proportional (Add)	N/A	N/A	N/A	-2.933 (4.478)	-7.836** (3.708)	-13.098*** (4.424)
Period	-1.794*** (0.394)	-1.027*** (0.206)	-1.401*** (0.215)	-1.727*** (0.381)	-0.972*** (0.234)	-1.103*** (0.242)
Constant	12.97** (4.833)	-1.601 (3.403)	2.328 (3.471)	22.82*** (3.507)	5.153 (3.289)	6.478** (3.24)
Observations	*370*	*370*	*370*	*400*	*400*	*400*
Number of sessions	*13*	*13*	*13*	*14*	*14*	*14*
Number of groups	*37*	*37*	*37*	*40*	*40*	*40*
Reference Category		*Equal*			*Proportional*	

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*

Focusing on the costs for outsiders associated with the different treatments, average transfers received (focusing now on the gross measure) are smaller in the two additionality treatments compared to their no-additionality counterparts. Average transfers received in percent of group endowment in *Equal* are 12.4% and *Equal(Add)* 6.5% (p-value from t-test comparison with number of groups as independent observations is 0.006), while average transfers received in *Proportional* are 15.4% and in *Proportional(Add)* 10.6% (p-value=0.096).

In summary, we find lack of support for Hypothesis 2. The reduced free-riding incentives for insiders, as well as the reduced uncertainty for outsiders regarding the use of their transfers, did not have a positive effect on net contributions to the public good by insiders nor on net transfers offered. Note however, because average transfers received are smaller in the treatments with additionality, this result implies that a similar level of public good provision is generated at lower cost to the outsiders when the additionality criterion is present.

3. Study 2: Targeted Transfers in Individual Payments

3.1. Decision Settings and parameters

Table 4 provides an overview of the two main treatment conditions implemented in Study 2. Beyond the change in sharing rule, implementing *Targeted-transfers* required two changes relative to the treatments studied in Study 1: the order of decision making in Part 2 and the information available to insiders and outsiders in Part 1 and Part 2. By design, in Part 2 of *Targeted-transfers* outsiders made transfer decisions *after* observing insiders' contribution decisions. Further, because outsiders observed individual contributions in Part 2, we chose to provide the information on individual contributions in Part 1 as well. These changes required a new baseline for study 2, *Equal(baseline2)*, which uses an equal share of group transfers in a setting otherwise equivalent to *Targeted-transfers*.[6] Part 1 is equivalent for both treatments of Study 2. The game parameters for Study 2 were the same as in Study 1.

To avoid reputation building, we follow the common approach in the literature (Fehr and Gächter, 2000; and Sefton et al., 2007) of making information on individual contributions available only for the current period and provided in random order without revealing subject IDs. Note that these earlier studies considered a single group setting unlike our insider-outsider setting. As we do not allow insiders to gain reputation related to past contributions, examining the additionality condition is not feasible in Study 2.

Table 4. Overview of Treatment Conditions in Study 2

Main Treatments	**Sharing rule among insiders**	**Order of decision making in Part 2**	**Unit of feed-back information**	**Number of observations**
Equal(baseline2)	Equal share	Insiders First	Individual	20 groups 160 subjects
Targeted-transfers	Targeted transfers	Insiders First	Individual	21 groups 168 subjects

[6] To explore the relevance on behavior of these design choices, we also conducted *Equal(supplementary)*, isomorphic to *Equal(baseline2)*, but where subjects did not receive information on individual decisions (as in *Equal*, from study 1). As reported in Appendix A, treatment effects are not significantly different between *Equal(supplementary)* and *Equal(basline2)* nor between *Equal(supplementary)* and *Equal*.

Targeted-transfers

With *Targeted-transfers*, in stage 1 of each period insiders make simultaneous contribution decisions. At the beginning of stage 2 outsiders observe the decisions of individual insiders and each outsider *j* makes individual transfer decisions, t_{ji}, to each of the individual insiders i, where $\sum_{j=1}^{\mathrm{n_I}} t_{ji} \in [0, w]$ is the sum of transfers sent to all insiders by outsider *j*. The sum of transfers received by insider i from all outsiders in a group, is given by $\sum_{i=1}^{\mathrm{n_O}} t_{ij}$. At the end of each period, each insider is privately informed of the total transfers received from all outsiders. In addition, both insiders and outsiders are informed of the individual contribution decisions of each insider (with random ordering in each period), the total contributions of insiders, and the total transfers of outsiders. Outsiders are not informed of the total transfers received by each insider and insiders are informed only of their own transfers received.

Parallel to Study 1, the resulting utility functions for insiders and outsiders in each period are given in equations (7) and (8), respectively:

$$U(\mathrm{g_i})_{Ii} = w - g_i + aG + \sum_{i=1}^{\mathrm{n_O}} t_{ij} + f(g_i) \tag{7}$$

$$U(t_{\mathrm{j}})_{Oj} = w + aG - \sum_{j=1}^{\mathrm{n_I}} t_{ji} + y(t_j) \tag{8}$$

Similar to a proportional share of transfers, *Targeted-transfers* reduces within-group incentives to free ride as compared to an equal sharing rule. Targeting transfers can be viewed as encouraging a selective reward mechanism of insiders, inducing competitive pressures among insiders, as discussed in relation to Hypothesis 1. One can expect this competitive pressure to generate increased contributions to the public good relative to the equal sharing rule. Further, the flexibility of individual targeting of transfers also allows for a more direct (and endogenous) link between effort and compensation to insiders. Behavior based on conditional cooperation would imply an increase in transfers by outsiders upon observing increased contributions by insiders (e.g. Sudgen, 1984 and Croson, 2007).

> **Hypothesis 3***:* Average contributions by insiders and transfers by outsiders will be greater in *Targeted-transfers* than in *Equal(baseline2)*.

Direct comparisons of *Targeted-transfers* and *Proportional* are not feasible given the differences in the decision settings. First, outsiders receive different information between the two treatments regarding contributions made by insiders. Secondly, differences in behavior will depend on the endogenous use of and response to transfers in *Targeted-transfers* relative to a proportional rule setting. Thus, each must be compared to its corresponding baseline treatment.

In the limit, if outsiders in *Targeted-transfers* endogenously choose to allocate transfers based strictly on proportionality of contributions, one might presume the two institutions would generate similar changes in behavior, including the response by insiders to the change in marginal incentives to cooperate. Yet, in such a case, insiders' response to that choice could differ from a situation where the rule was public and exogenously enforced. Thus, to what degree a requirement of a proportional sharing rule or a more flexible targeted transfer rule is more effective in increasing public good provision relative to an equal sharing of transfers is an empirical question.

3.2. Results

Figure 3 displays the average sum of contributions, as well as the average sum of transfers, in *Targeted-transfers* and *Equal(baseline2).*

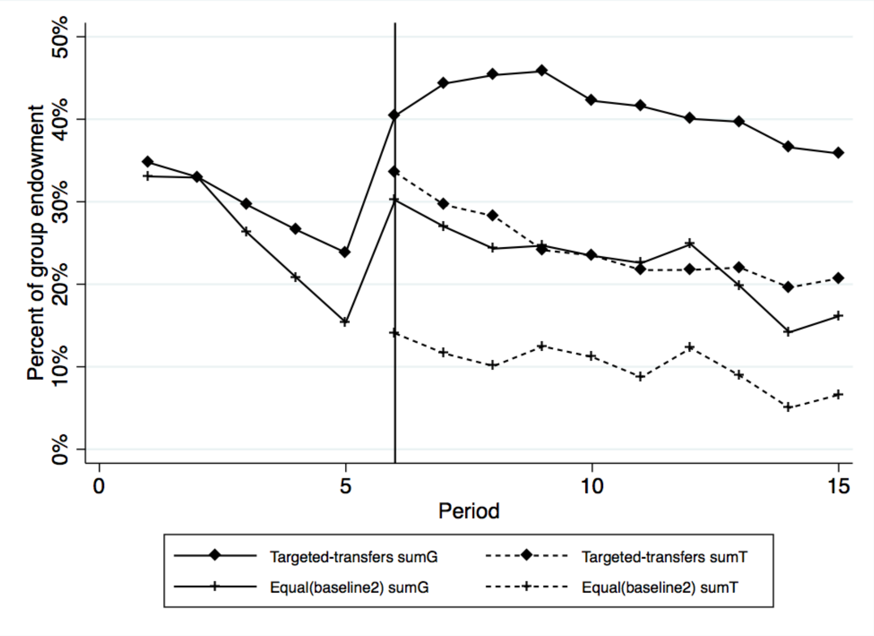

Fig 3. Average group contributions and transfers in Targeted-transfers and Equal(baseline2) across periods

As shown, contributions in period 1 are very similar in the two treatments but decay at a faster rate in *Equal(baseline2)* than in *Targeted-transfers.* Despite this difference in decay, none of the period differences between the two treatments are statistically significant (all p-values > 0.05). In all periods of Part 2, average group contributions and transfers in *Targeted-transfers* are well above those in *Equal(baseline2).*

Table 5 provides evidence from multilevel regressions with random effects on the group and session level. As for Study 1, the analysis is based on decisions in Part 2, periods 6-15, and focuses on net group contributions and net group transfers that control for group specific effects from Part 1. The results reported in columns I and II show that average net group contributions in *Targeted-transfers* are significantly larger and net group transfers are weakly larger than in *Equal(baseline2*).

Table 5. Treatment effects for net group contributions and net group transfers in Targeted-transfers and Equal(baseline2)

In % of group endowment:	(I) Net group contributions	(II) Net group transfers
Targeted-transfers	14.62*** (4.901)	10.51* (6.253)
Period	-1.162*** (0.245)	-1.048*** (0.125)
Constant	9.219** (4.084)	-4.597 (4.461)
Observations	*1,640*	*1,640*
Number of sessions	*14*	*14*
Number of groups	*41*	*41*
Reference Category	*Equal(baseline2)*	

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*

> ***Result 3:*** *When outsiders can explicitly target transfers to individual insiders, insiders' contributions are significantly higher than when transfers are distributed according to an equal share rule.*

Lastly, the treatment effect of *Targeted-transfers* as compared to its baseline is not significantly different from the treatment effect of *Proportional* as compared to its baseline. More specifically, the increase in net contributions in *Targeted-transfers* relative to *Equal(baseline2)* is 14.62 percent and the increase in net contributions in *Proportional* relative to *Equal* is 10.46 percent. The differences in the increases with respect to each baseline are not significantly different (p-value=0.24).

> ***Result 4:*** *Relative to their equal share baselines, a proportional sharing rule and targeted transfers do not generate significantly different increases in contributions to the public good by insiders.*

4. Heterogeneity

To establish overall treatment effects, the analysis above focused on aggregate group behavior across treatments. This section focuses on heterogeneity in behavior by examining three separate issues: (1) differences in Part 1 and Part 2 contributions across groups, (2) determinants of contributions decisions by insiders, and (3) the distribution of transfers made by outsiders in targeted transfer payments.

4.1. Are there systematic group differences in behavior?

We begin by classifying individual groups according to whether or not their Part 2 contributions are greater than those made in Part 1. Figure 4 displays the difference between Part 1 and Part 2 average contributions by group.

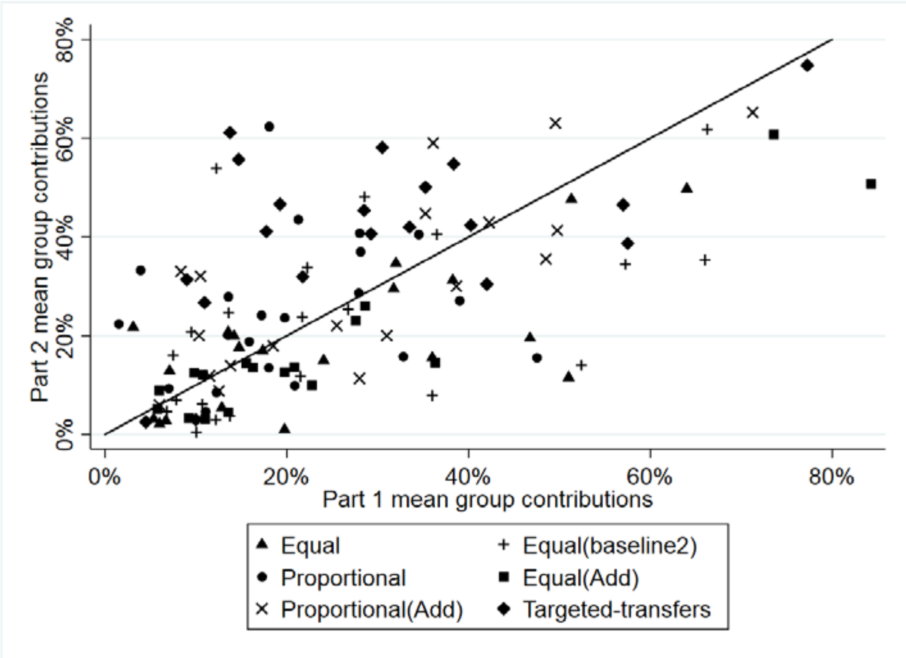

Fig 4. Correlation of mean Part 1 and mean Part 2 contributions for each group in each treatment

We refer to groups above the 45-degree line in Figure 4 as "*Groups that do better*" (meaning having positive mean net group contributions) after the introduction of the transfer institution, and those below the 45-degree line as "*Groups that do worse*" (having negative mean net group contributions).

As shown in Figure 4, positive net group contributions are only obtained for groups with Part 1 contributions below 50% of endowment. This might be expected, as higher contributions in Part 1 makes larger increases in public good provision in Part 2 more challenging. Figure 4 also illustrates that the sharing rule for transfers is relevant for both the number of groups that do better and the extent to which they do better (the vertical distance to the 45-degree line). Table B1 in Appendix B compares insiders' Part 2 contributions in *groups that do better* to those in *groups that do worse.* We observe that *groups that do better* have significantly higher Part 2 contributions in treatments with a proportional or targeted sharing rule.

4.2. What determinants affect insiders' behavior?

We also observe substantial variation in the response by insiders to transfers.[7] To better understand the determinants of this variation, we explore the response of insiders to the across period dynamics within their respective groups and how these responses vary across transfer institutions. Table 6 presents results from a multilevel regression for the determinants of insider's decision-making, focusing on the treatments that led to the highest percentages of groups that do better, as identified in section 4.1, namely the *Proportional*, *Proportional (Add)* and *Targeted-transfers* treatments. The dependent variable in all treatments is the insiders' *individual contribution* to the public good in a given period. Explanatory variables in columns I, II and III are: a) the average transfers offered (Transfers offered), b) the previous periods' average contribution of the other insiders in the group (Lagged other insiders), c) the relative share of transfers the insider received in the previous period (Lagged share of transfers) and d) if the group did not meet the additionality condition in the previous period (No Additionality, relevant only in *Proportional(Add)*).[8]

Table 6 reveals that a higher relative share of transfers in the previous period is associated with greater individual contributions in the current period for all treatments under consideration. However, the magnitude of the response to the relative share of transfers received is greater in the two treatments with a proportional share rule than the one with targeted transfers. Recall, in *Proportional* and *Proportional(Add)* insiders are explicitly informed of the share of transfers received in each period. This is not the case in *Targeted-transfers*, where information is provided for only own and group transfers received. As conjectured, we observe an effort-inducing effect on high performing individuals from the proportional sharing rule which outweighs the possible negative effect on low performers, resulting in an overall increase of aggregate public good provision, as noted in Result 1. Further, the lagged average contribution of other insiders is significant in the case of *Targeted-transfers* and *Proportional*, but not in *Proportional(Add)*. Lastly, as shown in Table 6, column II, not meeting the additionality threshold in *Proportional(Add)* has a non-significant effect on individual contributions. Table B3 in Appendix B shows that this result is mainly driven by the non-significant effect that not meeting the additionality criterion has on *groups that do better*. On the contrary, *groups that*

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[7] See Figures B1-B7 in Appendix B for more details.

[8] Appendix B presents additional analyses: Table B2 includes in addition the explanatory variable "being in a *group that does better"* as well as interaction effects, and Table B3 presents results for receiving an above average share of transfers in the previous period as the explanatory variable. Thus, Table B3 captures the comparative statics analysis for the *Proportional* treatment discussed in section 2.1. Further, Table B4 presents results for all treatments with an equal share rule, for completeness.

do worse significantly reduce public good contributions after not meeting the additionality criterion, compatible with a demotivation in prosocial behavior.

Table 6. Determinants of insider's contributions by treatment

	Group payments		Individual Payments
Dep. Var: individual contributions	(I) Proportional	(II) Proportional(Add)	(III) Targeted-transfers
Transfers offered	0.934*** (0.157)	1.026*** (0.185)	1.011*** (0.0739)
Lagged other insiders	0.205*** (0.0687)	0.0939 (0.0686)	0.251*** (0.0586)
Lagged share of transfers	16.07*** (4.185)	22.41*** (6.016)	8.736* (4.750)
No Additionality	-	-3.116 (2.246)	-
Period	-0.0950 (0.351)	-1.338*** (0.458)	0.435* (0.244)
Constant	2.766 (4.580)	21.32*** (6.670)	-0.300 (4.303)
Observations	*840*	*760*	*800*
Number of groups	*21*	*19*	*20*
Number of subjects	*84*	*76*	*80*

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*

Note: In order to have a consistent measure for the variable share of transfers received in previous period across all treatments, for Proportional(Add) subjects are classified according to the variable, even if the additionality criterion was not fulfilled in the given period. In every period in the experiment, insiders received feedback on their potential share of transfers even if transfers were not made.

4.3. How do outsiders use their opportunity to make targeted transfers?

Lastly, we examine how outsiders in *Targeted-transfers* make use of the opportunity to freely target transfers. Figure 5 displays the distribution of transfers received by individual insiders in a given period. The vertical axis represents the amount of transfers received and the horizontal axis represents insiders' deviation from the mean contributions of the other insiders in their group within a period (n=800). Those contributing below the average of the other insiders in their group are represented to the left of the zero value in the horizontal axis, and those contributing above the average of the other insiders in their group to the right of the zero value.

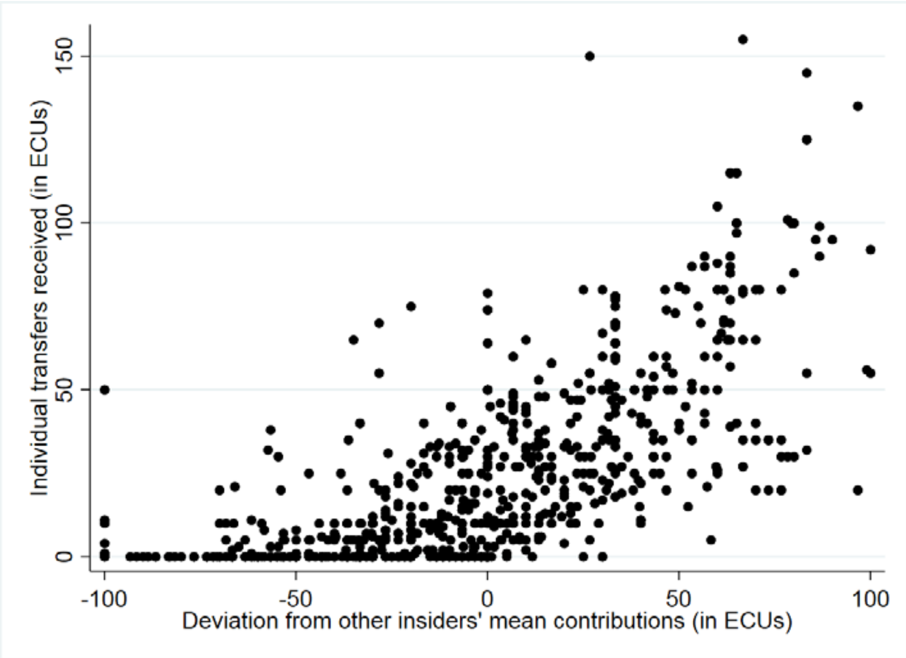

Fig 5. Individual transfers received relative to deviation from mean contribution of other insiders' in a group in Targeted-transfers

As shown, higher than average contributors receive higher transfers, and those transfers are greater the greater the contribution as compared to the average contribution of other group members (moving rightward in the figure). Below average contributors often receive lower transfers. These results are supported by further regression analysis reported in Table B5 in Appendix B. A further observation from Figure 5 is that lower than average contributors often receive zero transfers, even when their contribution is close to the average contribution.

Table 7 provides evidence from multilevel regressions with random effects on the group and subject level where the independent variable is individual transfers received by an insider in a given period in *Targeted-transfers* and the dependent variables are rank of contributions within a group and period. Rank one corresponds to the highest contributions, rank two to the second highest and rank three to the second lowest contributions in a group. Rank four corresponds to the lowest contributions and is the reference category. As shown, the relation between the rank of an insider's contributions in a group and the amount of transfers received is positive and highly significant. The coefficient is the largest for the top contributor, smaller for each lower rank, and all differences are highly significant (chi-squared tests confirm that all coefficients are significantly different, p-value <0.0001, for all comparisons).

Table 7. Individual transfers received in Targeted-transfers relative to where individual's contributions rank within group

	Individual transfers received
Rank in contributions in a group:	
1st rank	39.610***
	(6.054)
2nd rank	21.778***
	(3.193)
3rd rank	10.245***
	(2.621)
Period	-1.001***
	(0.354)
Constant	20.507***
	(4.624)
Observations	*800*
Number of groups	*20*
Number of subjects	*80*
Reference category	*4th Rank*

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1.*

In sum, the evidence presented here suggests that, on average, outsiders in *Targeted-transfers* use the opportunity to target transfers in a manner that is similar to that of the inflexible proportional share rule in *Proportional*. However, variations in use of transfers by outsiders suggests a variety of underlying motivations.

5. Summary and Conclusions

This study provides experimental evidence supporting that proportional group payments can be as effective as individual targeted payments in increasing public good provisions. This novel result emerges from a decision setting with endogenous public good providers and endogenous donors of transfer payments. Both sharing rules do better than group payments shared equally among insiders. Broadly, we find that outsiders use the possibility of making transfer donations to compensate insiders for their effort, and that under certain institutional arrangements, insiders reciprocate by increasing public good contributions. Our results point to the importance of guaranteeing that those who make higher efforts to benefit society receive higher financial support, as opposed to an equal support of all recipients. This not only increases efforts of recipients, but also the donations from donors, promoting a positive interaction between donors and recipients over time. In sum, if insiders have monitoring and enforcement capacity among peers for proportional distribution of transfers (for example, through collective action arrangements), group transfers can enhance public good provision. While our study is motivated primarily by payments for ecosystem services, the results are informative for a broader range of transfer payment programs, such as the widely implemented conditional cash transfer (CCT) programs aimed at reducing poverty (for an overview, see, for example, Fiszbein and Schady, 2009).

Our results complement previous experimental results questioning the capacity of group payments to enhance public good provision, by exploring a richer set of institutional designs and richer decision settings. We show that a variation in the sharing rule used for allocating transfer payments from those considered in BHW significantly improves the provision of the public good: First, moving from equal shares to proportional shares based on relative effort among insiders enhances public good provision. This is in line with previous results from studies using simpler settings where only insiders are present and transfers are grandfathered by the experimenter. For example, Narloch et al. (2012), Midler et al. (2015) and Gatiso et al. (2018) show that proportional group payments do better than equal share payments. Our study extends these findings to a richer decision environment with endogenous donors. In addition to validating these previous findings, our results show that outsiders can be sufficiently motivated to provide enough transfers, when these are proportionally distributed. Second, we compare for the first time individually targeted payments by donors to proportionally distributed group payments. This comparison is not straightforward and justifies the combination of the studies 1 and 2 reported here.

Our results also provide evidence that setting historical baselines as thresholds to receive financial support may not be critical to improving social objectives, although it may reduce overall program costs. Specifically, our experimental design includes a setting with an additionality criterion that requires insiders' contributions to meet a threshold for distributing transfers based on prior public good provision. We find that this criterion did not significantly increase contributions by insiders for both sharing rules under consideration. On average, however, the additionality criterion did result in lower costs to outsiders to achieve similar levels of public good provision. In implementing a historical threshold for the additionality requirement, our study complements the previous experimental literature considering exogenous thresholds for matching funds in public good provision (e.g. Rondeau and List, 2008; Baker et al., 2009), thresholds for receiving exogenous payments imposed by the experimenter (e.g. Midler et al., 2015), as well as exogenously imposed sanctions if not reaching a pre-defined additionality target (e.g. Kaczan et al., 2017). In the setting that we study, incentives to provide the public good depend on the size of the threshold that insiders need to meet (endogenously defined by insiders' history) and the benefits to be obtained if meeting the threshold (endogenously defined by outsiders' transfers). Further, adding an additionality criterion, where thresholds were based on early game behavior, our study complements the literature on the Rachet Effect (e.g. Gallier and Sturm, 2020; Charness et al., 2011; Amano and Ohashi, 2018; Chaudhuri, 1998). Subjects in our study did not know in initial decision periods (Part 1) that outsiders would be allowed to make transfer payments later in the game (Part 2). Therefore, subjects could not strategically adjust Part 1 behavior to the upcoming institutions in Part 2. While there are settings where upcoming institutions using historical baselines are pre-announced (such as the Paris Agreement), there are others where this is not the case due to technical impossibility or political unfeasibility. Thus, we see research adopting both approaches as relevant for institutional design.

We interpret our results as a call for additional research on the attributes of institutions that create the most successful use of donations to increase public good provision. For example, it would seem natural to examine settings where an additionality criterion is present and there are multiple groups of public good providers, who are eligible and mutually exclusive in receiving transfer funds contingent on their behavior. In such settings, the additionality criterion may further enhance efficiency in use of donations and public good provision by recipients. Moreover, a change in information allowing reputation building and additionality for individual payments might be relevant for some field application and thus worthy of future study. Our approach is pragmatic, acknowledging the complementary relevance of multiple methods to provide evidence that is cumulative, gaining insights from different methodological approaches and disciplines. We also interpret our results as pointing to the importance of further field research that examines monitoring capacity within public good provision programs that allow for transfer payments from outsiders, and how criteria such as additionality can be used effectively.

In light of the Covid-19 pandemic, the efficient design of PES programs becomes even more relevant. Many of the recent disease outbreaks, such as AIDS, SARS, Ebola, the swine flu and the most recent coronavirus, have likely been transmitted through zoonoses. These disease spill-overs from wildlife to humans represent a significant threat to global health (e.g. Jones et al., 2008). Research shows that human-induced changes in land-use such as deforestation and the associated losses in biodiversity and wildlife habitats, that are bringing wildlife and humans into closer contact with each other, are highly correlated with the increasing emergence of infectious diseases (Kilpatrick et al., 2012; Keesing et al., 2010; Jones et al., 2008; Patz et al., 2004). It has been shown that payments to reduce deforestation can have large returns on investments, even if considering only the benefits from reduction of future zoonosis outbreaks (Dobson et al., 2020). Further, a recent study on Indonesia’s national anti-poverty program shows the interrelation of poverty alleviation and conservation efforts by providing evidence on a reduction in deforestation as a side effect from the CCT (Ferraro and Simorangkir, 2020). These findings stress the importance of research aimed at identifying more efficient institutions for transfer donation programs designed to help sustain ecosystems as well as increase well-being of society – not only to reduce the impact of the climate crisis but also to decrease the likelihood of future pandemics such as Covid-19.

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Appendix A. Analysis of Supplementary Treatment

We introduced the supplementary treatment *Equal(supplementary)* in order to control for design changes in the two baseline treatments in Study 1 and Study 2, respectively. The treatment *Equal(supplementary)* is equivalent to *Equal* except the order of decision making is reversed, such that in Part 2 insiders decide first upon contributions to the Group Account and then outsiders make transfer decisions. The purpose of the following analysis is to assess the robustness of treatment responses to the introduction of transfers under different experimental protocols. We explore the robustness to i) reversing the order of decision making in *Equal(supplementary)* compared to *Equal*, and ii) the level of feedback information comparing *Equal(supplementary)* to *Equal(baseline2)*.

Starting with an analysis of the impact of the order of decision making, Figure A1 shows the average group contributions and average group transfers across periods in the *Equal(supplementary)* and the *Equal* treatment. As Part 1 follows an identical protocol for both treatments, we attribute the large difference in contributions between the two treatments to group specific effects. In Part 2 for all periods, contributions in *Equal(supplementary)* remain below those in *Equal*.

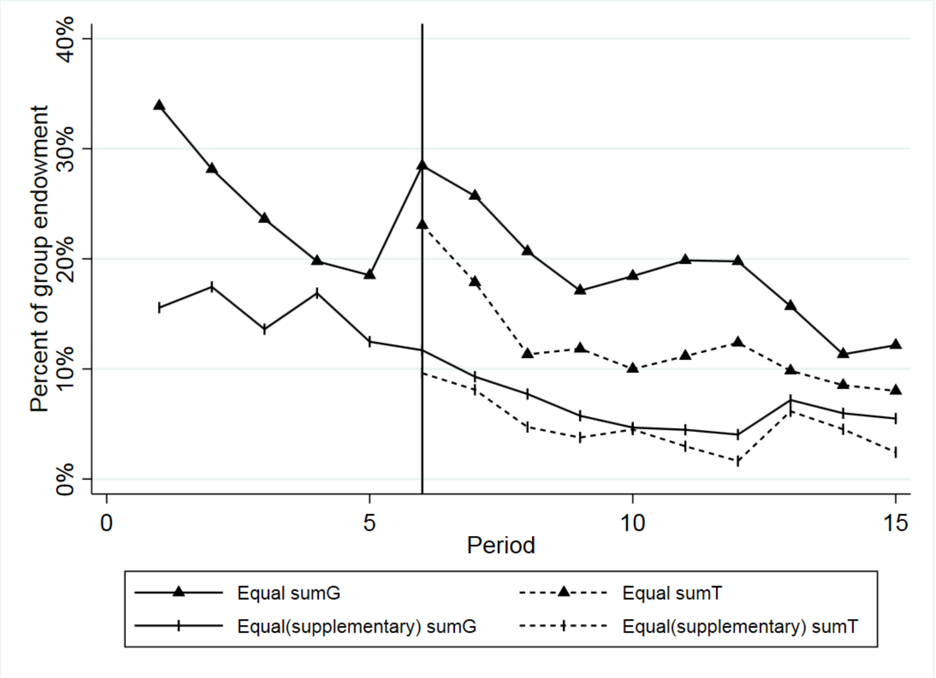


Fig A1. Average group contributions and transfers in Equal and Equal(supplementary) across periods

Using multilevel regressions with random effects on the group and subject level for decisions in periods 6-15, Table A1, provides evidence that treatment effects of introducing transfers are not significantly different between treatments where insiders move first in *Equal(supplementary)* compared to where outsiders move first in *Equal*.

Table A1. Treatment effects for group contributions and transfers in Equal and Equal(supplementary)

In % of group endowment:	(I) Net group contributions	(II) Net group transfers
Equal(supplementary)	-2.700	2.034
	(3.926)	(5.059)
Period	-1.215***	-0.998***
	(0.364)	(0.158)
Constant	6.890	-1.905
	(4.695)	(3.059)
Observations	*310*	*310*
Nr. of sessions	*11*	*11*
Nr. of groups	*31*	*31*
Reference Category	*Equal*	

*Note: Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1.*

Moving to an analysis of the role that the level of information has on public good provision, Figure A2 shows average group contributions and average group transfers across periods in the *Equal(supplementary)* and *Equal(baseline2)* treatments. Average group contributions in Part 1 in *Equal(supplementary)* are well below those in *Equal(baseline2)*. Note that Part 1 of these two treatments does not follow identical protocols. In *Equal(supplementary)* feedback about insiders' decisions is provided to subjects at the aggregate level, while in *Equal(basline2)* it is displayed at the individual level. Thus, unlike the analysis presented in the main body of the paper and in Figures A1 and Table A1, we cannot attribute Part 1 differences solely to group-specific effects. In Part 2 for all periods, average group contributions and transfers in *Equal(supplementary)* remain below those in *Equal(baseline2)*.

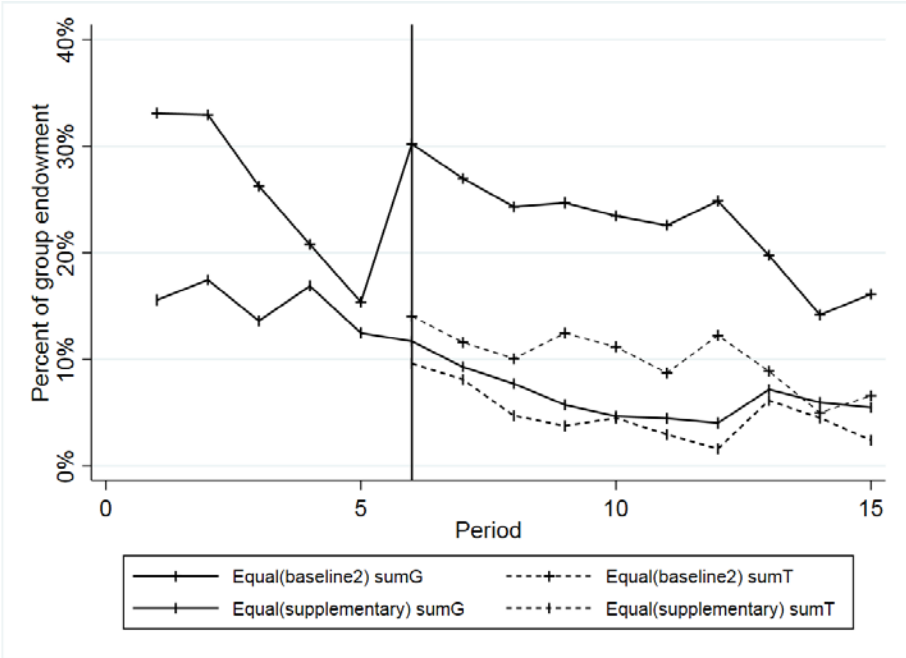


Fig A2. Average group contributions and transfers in Equal(baseline2) and Equal(supplementary) across periods

Table A2 provides the results for multilevel regressions with random effects on the group and subject level. Column I displays results for decisions of insiders in periods 1-5 with the dependent variable being the sum of group contributions in a period. Columns II and III provide results for decisions in periods 6-15, assessing treatment responses to transfers by analyzing net group contributions and net group transfers. First, the observed differences in contributions to the public good between *Equal(supplementary)* and *Equal(baseline2)* in Part 1 are not significant (column I). Further, the difference in differences approach shows that net group contributions and net group transfers in Part 2 are not significantly different between the two treatments (columns II and III). In summary, we find that providing individual as opposed to group feedback information does not result in significantly different contributions to the public good nor to different treatment responses to the introduction of transfers.

Table A2. Treatment effects for group contributions and transfers in Equal (baseline2) and Equal (supplementary)

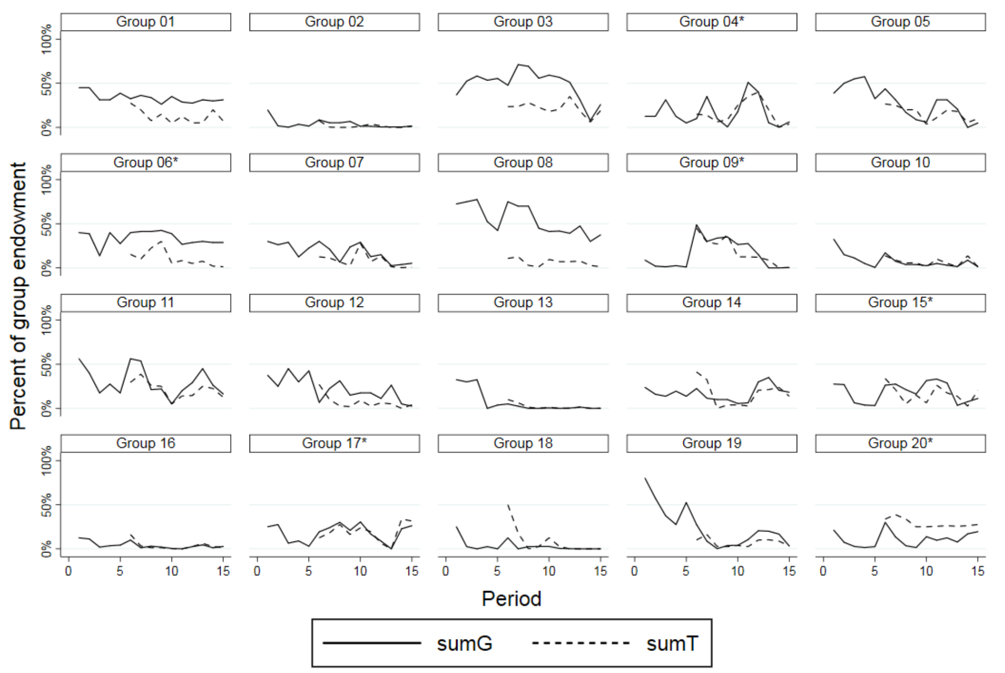
In % of group endowment:	(I) Group contributions (Part 1)	(II) Net group contributions (Part 2)	(III) Net group transfers (Part 2)
Equal(baseline2)	9.966	5.808	-4.874
	(7.269)	(5.619)	(6.056)
Period	-3.351***	-1.133***	-0.675***
	(0.876)	(0.238)	(0.0630)
Constant	25.7***	3.115	-3.635
	(5.965)	(4.706)	(4.550)
Observations	*320*	*320*	*320*
Number of sessions	*11*	*11*	*11*
Number of groups	*32*	*32*	*32*
Reference Category	*Equal(supplementary)*	*Equal(supplementary)*	

*Note: Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1.*

Appendix B. Analysis of variation within and across treatments

1. Across group heterogeneity

Figures B1-B7 below show for each group the sum of contributions by insiders (sumG, solid line) as well as sum of transfers by outsiders (sumT, dashed line) in each period, for each treatment separately. Groups classified as a being a *group that does better* are marked with a star.



Groups in Equal treatment

Fig B1. Sum of contributions and transfers by group in the Equal treatment.

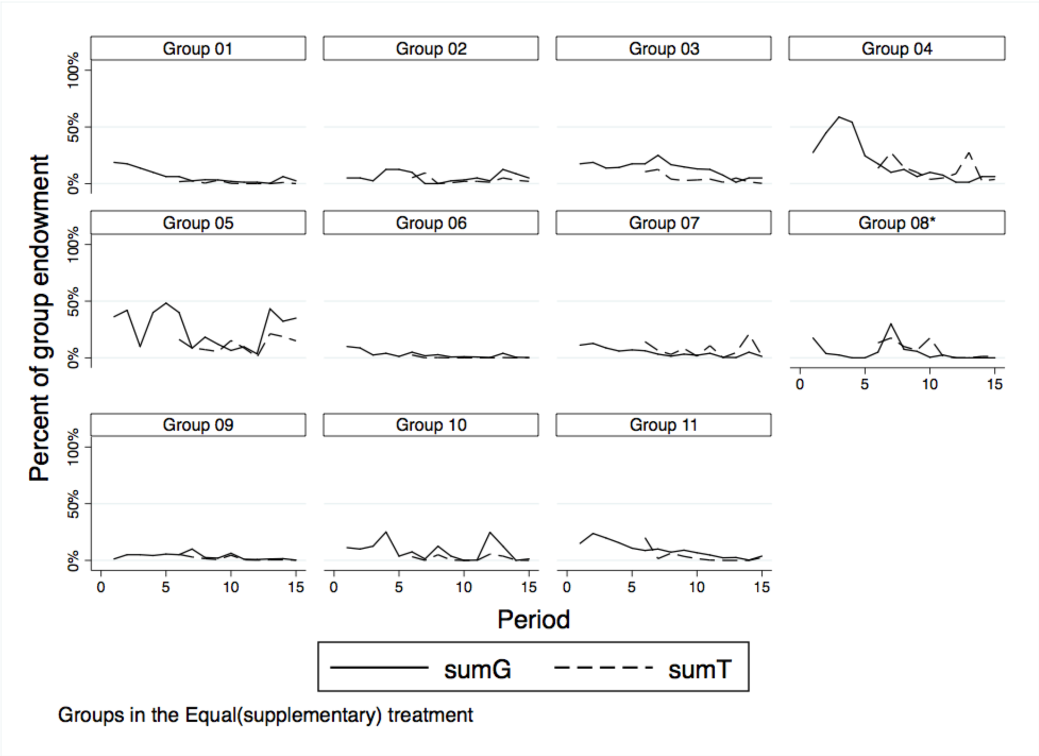


Fig B2. Sum of contributions and transfers by group in the Equal(baseline2) treatment

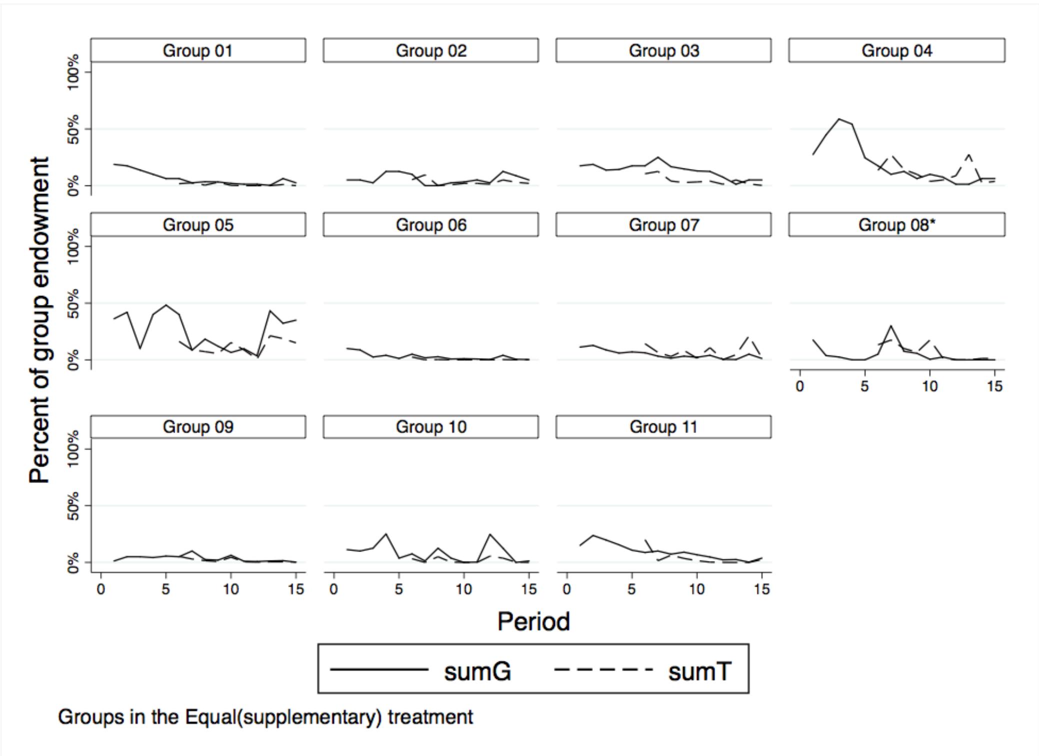


Fig B3. Sum of contributions and transfers by group in the Equal(supplementary) treatment

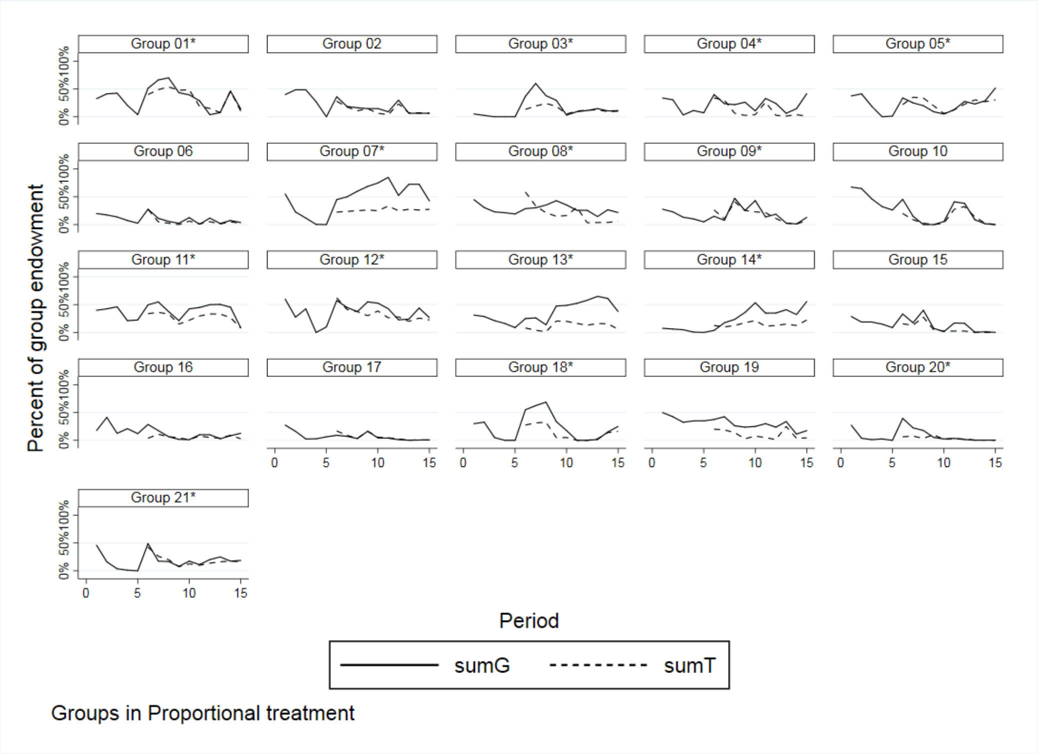


Fig B4. Sum of contributions and transfers by group in the Proportional treatment.

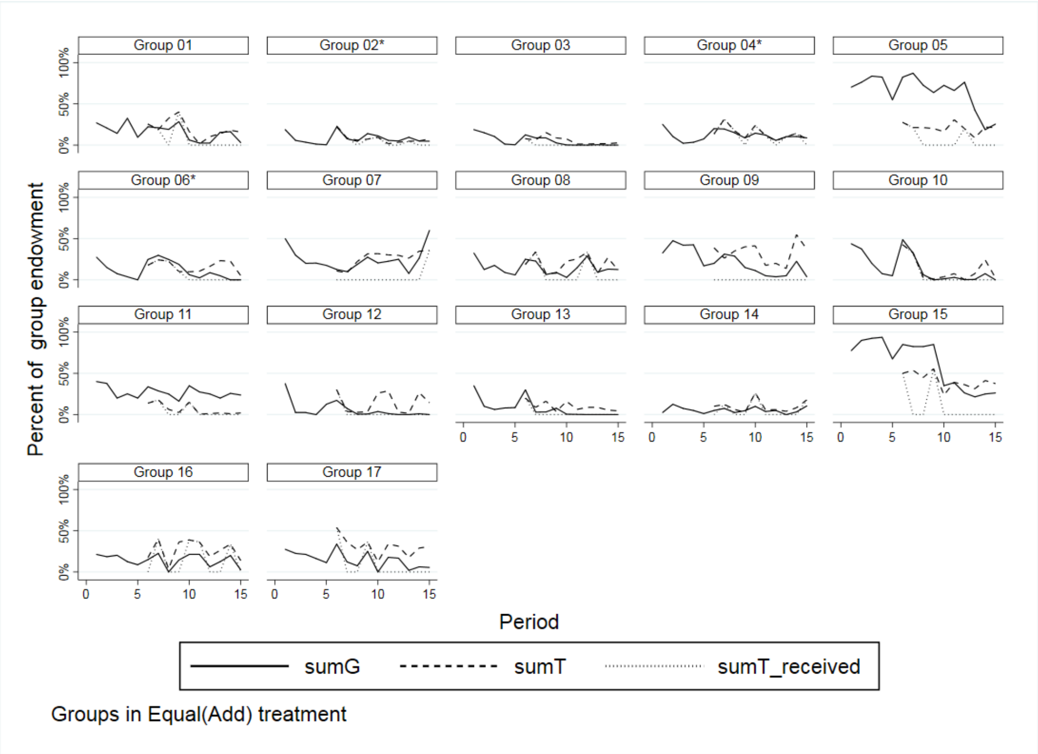


Fig B5. Sum of contributions and transfers by group in the Equal (Add) treatment.

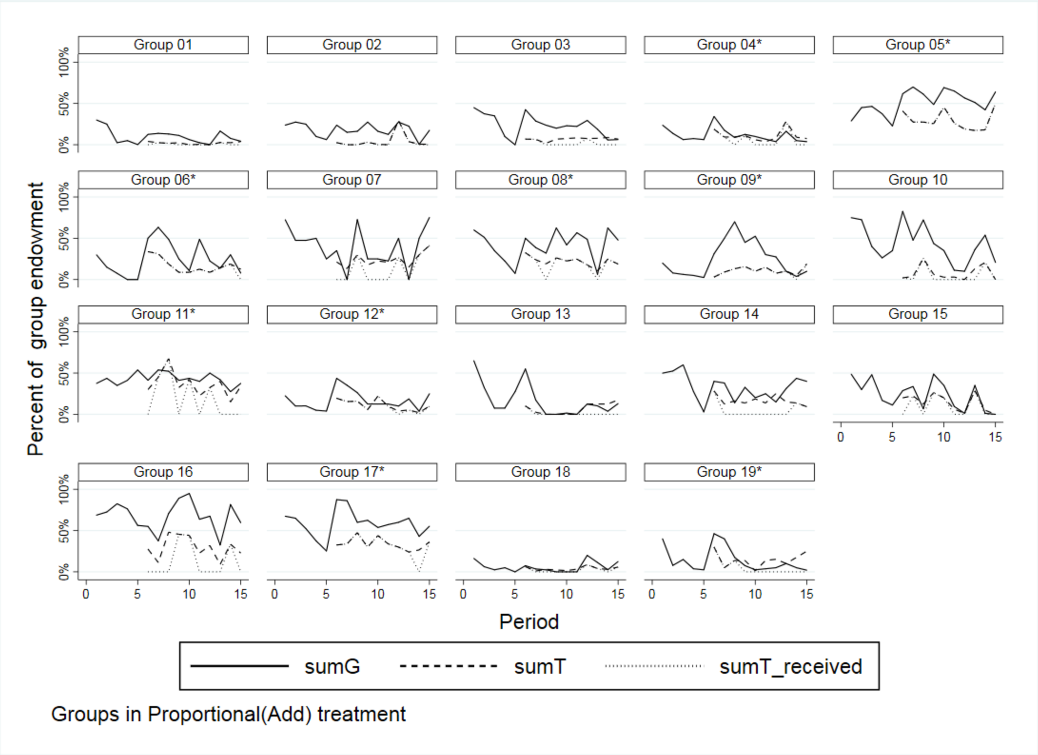


Fig B6. Sum of contributions and transfers by group in the Proportional (Add) treatment.

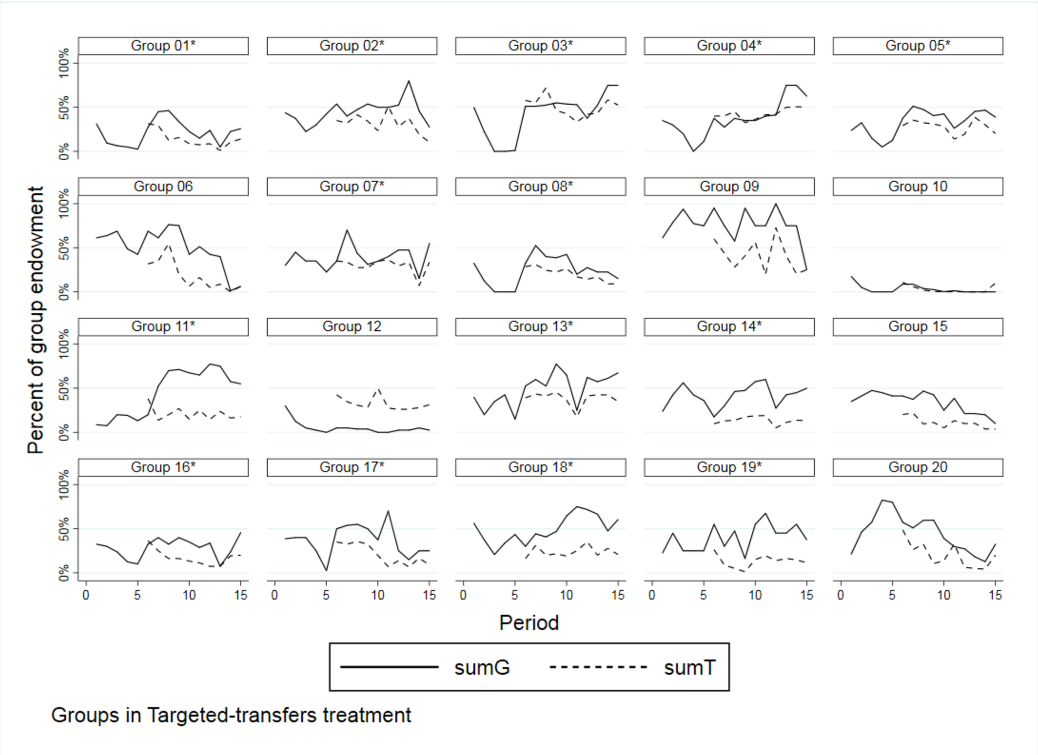


Fig B7. Sum of contributions and transfers by group in the Targeted-transfers treatment.

2. Within-group heterogeneity – Additional analyses

Table B1. Difference in avg. contributions by insiders in groups classified as doing better vs. doing worse, by treatment

	Avg. individual contributions in Part 2 (in % of endowment)		**Difference**
Treatment	*Groups that do better (GB)*	*Groups that do worse (GW)*	
Equal	21.25 (1.9)	17.93 (1.16)	3.32 (2.17)
Equal(baseline2)	32.67 (1.71)	16.58 (1.22)	16.09*** (2.10)
Equal(supplementary)	5.13 (16.92)	6.79 (13.55)	-1.66 (2.3)
Equal(Add)	11.18 (1.09)	18.28 (1.12)	-7.1*** (2.48)
Proportional	30.91 (1.37)	13.60 (1.13)	17.31*** (2.1)
Proportional(Add)	35.63 (1.80)	25.82 (1.63)	9.81*** (2.43)
Targeted-transfers	44.85 (1.55)	32.65 (2.45)	12.2*** (2.86)

*Standard errors in parentheses. P-values bases on two-sample t-tests. *** p<0.005.*

Note: Equal(baseline2) is the only treatment with equal sharing of transfers in which "groups that do better" have significantly higher Part 2 contributions compared to "groups that do worse". Note that in this treatment insiders did receive information of the individual contributions of other insiders.

Table B2 extends Table 6 by including interaction effects. The interaction effects provide evidence of the difference in behavior of *groups that do better (GB),* as compared to *groups that do worse (GW),* in *Proportional* and *Proportional(Add),* columns II and IV. *Groups that do better* in these treatments are composed of insiders that respond more strongly upon receiving a larger relative share of transfers than insiders in *groups that do worse*, shown by the significant positive coefficients 20.26 and 24.43, respectively. Turning next to *Targeted-transfers,* column VI, the share of transfers received has a positive significant effect on public good contributions, without significant differences in responses of insiders in *groups that do better* or *groups that do worse*, as the interaction term is non-significant. Lastly, as shown in Table 6, column IV, not meeting the additionality threshold in *Proportional(Add)* has a significant negative effect on contributions in *groups that do worse*, and a non-significant effect on *groups that do better*.

Table B2. Determinants of insider's contributions, including interactions

	Group Payments				Individual Payments	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dep. Var: individual contributions	Proportional	Proportional	Proportional (Add)	Proportional (Add)	Targeted-transfers	Targeted-transfers
Transfers offered	0.919*** (0.158)	1.137*** (0.143)	1.035*** (0.190)	1.418*** (0.223)	1.010*** (0.0740)	0.923*** (0.114)
Lagged other insiders	0.200*** (0.0674)	0.00170 (0.0924)	0.0959 (0.0681)	-0.00216 (0.112)	0.251*** (0.0576)	0.387*** (0.102)
Lagged share of transfers	16.08*** (4.213)	4.001 (4.352)	22.46*** (6.008)	13.00* (7.453)	8.704* (4.776)	15.10** (6.968)
GB	4.455* (2.480)	-1.728 (3.741)	-1.764 (5.045)	-3.721 (6.519)	5.226 (7.124)	12.34 (7.858)
Transfers offered**GB*	-	-0.292 (0.230)	-	-0.738** (0.280)	-	0.104 (0.145)
Lagged other insiders**GB*	-	0.250** (0.120)	-	0.146 (0.127)	-	-0.187 (0.129)
Lagged share of transfers**GB*	-	20.26*** (6.507)	-	24.43** (10.87)	-	-10.34 (9.139)
No Additionality	-	-	-3.253 (2.342)	-7.167** (2.943)	-	-
No Additionality **GB*	-	-	-	7.719 (5.653)	-	-
Period	-0.119 (0.352)	-0.216 (0.359)	-1.328*** (0.456)	-1.519*** (0.467)	0.433* (0.245)	0.563** (0.266)
Constant	0.404 (4.929)	5.487 (5.183)	21.90*** (6.680)	26.84*** (8.186)	-3.881 (7.732)	-9.727 (8.109)
Observations	*840*	*840*	*760*	*760*	*800*	*800*
Number of groups	*21*	*21*	*19*	*19*	*20*	*20*
Number of subjects	*84*	*84*	*76*	*76*	*80*	*80*

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1. GB: Groups that did Better (yes/no)*

Note: In order to have a consistent measure for the variable *share of transfers received in previous period* across all treatments, for *Proportional(Add)* subjects are classified according to the variable, even if the additionality criterion was not fulfilled in the given period. In every period in the experiment, insiders received feedback on their potential share of transfers even if transfers were not made.

Table B3 presents an extension of the regression model from Table B2, including interaction effects, while using as explanatory variable whether the insider received an above average share of transfers in the previous period (*Lagged above avg. transfers*), instead of the *lagged share of transfers* used in Table 6 and Table B2.

Table B3. Determinants of insider's contributions, using "above avg. share of transfers"

	Group Payments				Individual Payments	
Dep. Var: individual contribution	(I) Proportional	(II) Proportional	(III) Proportional (Add)	(IV) Proportional (Add)	(V) Targeted-transfers	(VI) Targeted-transfers
Transfers offered	0.907**** (0.153)	1.121**** (0.136)	1.039**** (0.189)	1.423**** (0.220)	1.017**** (0.0746)	0.931**** (0.115)
Lagged other insiders	0.180*** (0.0696)	-0.00482 (0.0948)	0.0536 (0.0662)	-0.0333 (0.103)	0.238**** (0.0551)	0.375**** (0.102)
Lagged above avg. transfers	10.44**** (1.995)	3.121 (2.078)	10.44**** (2.250)	7.512** (3.476)	3.485** (1.756)	5.305* (3.010)
GB	5.232** (2.517)	-1.088 (3.246)	-1.905 (5.202)	0.655 (6.637)	5.378 (7.167)	11.14 (7.220)
Transfers offered*GB	-	-0.288 (0.222)	-	-0.748*** (0.276)	-	0.0993 (0.147)
Lagged other insiders*GB	-	0.233* (0.125)	-	0.127 (0.118)	-	-0.180 (0.126)
Lagged above avg. transfers*GB	-	12.92**** (2.850)	-	5.875 (4.582)	-	-3.267 (3.733)
No Additionality	-	-	-2.909 (2.422)	-6.752** (2.928)	-	-
No Additionality*GB	-	-	-	7.158 (5.778)	-	-
Period	-0.108 (0.335)	-0.230 (0.324)	-1.318**** (0.448)	-1.498**** (0.457)	0.427* (0.248)	0.549** (0.274)
Constant	0.140 (4.556)	5.493 (4.552)	24.04**** (6.582)	27.32**** (7.440)	-2.861 (7.755)	-7.839 (8.137)
Observations	*840*	*840*	*760*	*760*	*800*	*800*
Number of groups	*21*	*21*	*19*	*19*	*20*	*20*
Number of subjects	*84*	*84*	*76*	*76*	*80*	*80*

*Robust standard errors in parentheses. **** p<0.005, *** p<0.01, ** p<0.05, * p<0.1*
GB: Groups that did Better (yes/no)

The results obtained in Table 6 and Table B2 are qualitatively robust to the change of the explanatory variable introduced in Table B3. Insiders receiving an above average share of transfers in the previous period significantly increase individual contributions in the next period, with the effect being more pronounced in the two treatments with proportional sharing of transfers. We do observe, however, that the difference in response of insiders in *groups that do better* from receiving above average transfers as compared to *groups that do worse* is only significantly in the *Proportional* treatment, and not significant in the *Proportional(Add)* and *Targeted-transfers* treatment.

Finally, Table B4 includes additional analyses for the treatments not included in Table 6. Recall that the variable "lagged share of transfers" is not relevant in treatments with an equal share rule. For treatment *Equal*, the results in Table B2 are comparable to those of Table 6. In treatments, *Equal(supplementary)* and *Equal(baseline2)*, where insiders made contributions prior to outsiders making transfers, we find evidence that insiders are more strongly influenced by decisions by other insiders in their group.

Table B4. Determinants of insider's contributions in the Equal treatments

	(I)	(II)	(III)	(IV)	(V)	(VI)
Dep. Var: individual contribution	Equal	Equal	Equal (supplementary)	Equal (supplementary)	Equal (baseline2)	Equal (baseline2)
Transfers offered	0.568***	0.425**	0.583*	0.558	0.620***	0.560***
	(0.125)	(0.153)	(0.336)	(0.374)	(0.127)	(0.160)
Lagged other insiders	0.113	0.233**	0.185***	0.201***	0.317***	0.292***
	(0.0804)	(0.0927)	(0.0404)	(0.0493)	(0.0379)	(0.0468)
GB	-1.603	-0.148	-2.528	-3.056***	8.366**	6.000
	(5.119)	(6.585)	(1.836)	(0.702)	(3.980)	(3.709)
Transfers offered*GB	-	0.320	-	0.178	-	0.151
		(0.206)		(0.309)		(0.236)
Lagged other insiders*GB	-	-0.306**	-	-0.118**	-	0.0329
		(0.114)		(0.0600)		(0.0767)
Period	-0.758**	-0.730**	-0.0657	-0.0495	-0.797**	-0.787**
	(0.294)	(0.277)	(0.293)	(0.266)	(0.288)	(0.308)
Constant	18.11***	16.92***	3.375	3.193	14.47***	15.27***
	(5.916)	(5.475)	(3.590)	(3.346)	(4.114)	(4.290)
Observations	*800*	*800*	*440*	*440*	*840*	*840*
Number of groups	*20*	*20*	*11*	*11*	*21*	*21*
Number of subjects	*80*	*80*	*40*	*40*	*84*	*84*

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*
GB: Groups that do better (yes/no)

3. Heterogeneity in the use of transfers – Additional analyses

Table B5. Individual transfers received relative to deviation from others' mean contributions in Targeted-transfers

	Individual transfers received
Average contribution of other insiders	0.313*** (0.0547)
Positive deviation	0.669*** (0.0753)
Absolute negative deviation	-0.382*** (0.0413)
Period	-1.120*** (0.166)
Constant	18.72*** (3.357)
Observations	*800*
Number of groups	*20*
Number of subjects	*80*

*Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1*

Note: Following the approach used in Fehr and Gächter (2000), the variable *absolute negative deviation* is the modulus of the deviation of an insider's contribution from the average of others in a group. It is zero in case the insiders' contribution is above or equal to the average of the others in a given period. The variable *positive deviation* is constructed equivalently. chi-squared test confirms that the coefficients on positive deviation from the mean contribution of others and absolute negative deviation from the mean contribution of others are significantly different (p-value < 0.0001).