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Competition Among Public Good Providers for Donor Rewards

Natalie Struwe[a], Esther Blanco[a,b], James M. Walker[b,c]

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Abstract:

We present experimental evidence for decision settings where public good providers compete for *endogenous* donations offered by outside donors. Donors receive benefits from public good provision but cannot provide the good themselves. The performance of three competition mechanisms is examined in relation to the level of public good provision and transfers offered by donors. In addition to a contest with rewards proportional to effort to all public good providers, we study two contests with exclusion from transfers, namely a winner-takes-all and a loser-gets-nothing. We compare behavior in these three decision settings to the default setting of no-transfers. Results for this novel decision environment with endogenous prizes show that contributions to the public good are not significantly different in the winner-takes-all and loser-gets-nothing settings, but donor's transfers are significantly lower in winner-takes-all. Initially, the winner-takes-all and loser-gets-nothing settings lead to a significant increase in public good contributions compared to the setting where transfers are proportional to contributions for everyone; but this difference diminishes over decision rounds. All three contest with endogenous prizes generate consistent and significantly higher public good provision compared to the setting with no-transfers.

JEL Classification: D70, H41, C92

Keywords: Public Good, Institution, Externality, Contests, Laboratory Experiment

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1. Introduction

In a wide array of charitable donation situations, donors care about a public good that they cannot directly provide. Consider for example biodiversity and conservation decisions of rainforests, or education and reduced poverty in lower income countries. In such situations, there is a group of individuals (*insiders*) that can undertake the effort (herein contributions) to provide a public good that benefits themselves and a broader group of individuals (*outsiders*). Outsiders cannot directly provide the public good, for example due to technical, institutional, or geographical restrictions, but can make donations to the insiders to financially support them in their efforts. Numerous forms of institutions supporting charitable giving, such as local, national, or international charitable organizations, allow outsiders to make donations to insiders who provide an array of goods and services to those in need, efforts to environmental conservation, or healthy living conditions. Prominent examples are Payments for Ecosystem Services (PES) or conditional cash transfer programs for poverty alleviation. Charitable organizations typically face more requests for support than financial resources available. Thus, a critical institutional design question is how to allocate limited donations among the different public good providers. For example, previous literature has proposed tournaments as a mechanism to distribute foreign aid to alleviate poverty (see, for example, Epstein & Gang, 2009; Svensson, 2003). Similarly, conservation auctions are used to distribute pre-defined PES contracts among ecosystem providers (see Ferraro, 2008). Field trials have shown that such discriminative-prize auctions can have the potential of increasing program outcomes (Khalumba, Wünscher, Wunder, Büdenbender, & Holm-Müller, 2014; Ulber, Klimek, Steinmann, Isselstein, & Groth, 2011). In this study we address allocation mechanisms based on competition between recipients of donations in a dynamic setting where donors and public good providers interact over multiple rounds.

Thus, the main novelty of the experimental evidence presented herein is that in the contest settings under consideration public good providers compete for the *endogenous* funding from outsiders. The primary question being examined is whether the degree of exclusion in the endogenous contest mechanisms significantly affects the level of public good provision by insiders and the level of donations from outsiders. By focusing explicitly on contests, this study differs from the previous experimental studies investigating endogenous donations by outsiders to insiders of public goods (see Blanco, Haller, & Walker, 2018, BHW henceforth; Blanco, Struwe, & Walker, 2021, BSW henceforth). One of the results from this previous literature is that donations from outsiders do not increase public good provision if donations are allocated equally (BHW) while it significantly increases public goods provision if donations are distributed proportional to effort (BSW). Other institutional characteristics such as conditionality of payments or additionality requirements were not found to be critical. By considering endogenous prizes (donation transfers), this study contributes to the literature on competition among providers, investigating competition in settings where prizes are not fixed and stable over time, but rather are based on the repeated prosocial decisions by outsiders.

Specifically, we consider a *W*inner takes *A*ll contest (*WA*) where the insider with the highest contributions in a group receives all transfers and a *L*oser gets *N*othing *(LN*) contest where the insider with the lowest contribution in a group receives no transfers and transfers are proportionally shared among the remaining three insiders. *WA* and *LN* are compared to a contest where transfers are distributed proportionally based on insiders' relative contributions, *Prop,* and a setting with no transfers, *No-T*. Note that *WA* and *LN* can be viewed as two extreme approaches in applying exclusion based on relative contributions. *WA* is a contest with extreme exclusion (all insiders excluded except one) while *LN* is a contest with the mildest exclusion (one insider excluded). To the best of our knowledge, the impact of *WA* and the *LN* contests on the endogenous interaction between donors and public good providers has not been explored in the literature.

There is consensus in the theoretical and experimental literature that contests increase efforts, both in individual tasks (see Dechenaux, Kovenock, & Sheremeta, 2014; and Sheremeta, 2018 for overviews), and in public good investments tasks (Corazzini, Faravelli, & Stanca, 2010; Lange, List, & Price, 2007; Morgan, 2000; Morgan & Sefton, 2000; Orzen, 2008). Yet, the results for comparisons of single versus multiple-prize contests are mixed, suggesting that the relative performance of winner or loser contests is context dependent. For example, Moldovanu & Sela (2001) provide theoretical evidence for contests with multiple prizes in which agents have private information about their effort ability affecting costs. The authors show that for linear or concave effort cost functions, single prizes maximize expected efforts, however when costs are convex multiple prizes might be optimal. Cason, Masters, & Sheremeta (2018) compare both theoretically and experimentally a single winner-take-all prize lottery and a deterministic contest in which prizes are shared proportional to effort. The single prize contest leads to higher effort (desirable to contest designers), while the proportional share rule generates more equitable payoffs to the contest participants. Similarly, Sheremeta (2011) show that a single prize lottery outperforms a multiple-prize lottery in terms of aggregate effort. In contrast to these studies, Dutcher, Balafoutas, Lindner, Ryvkin, & Sutter (2015) use rank-order tournaments with deterministic prizes and find that a proportional mechanism including a top, middle and bottom prize induces the highest effort, followed by a single loser contest, and a single winner contest being the worst performing contest.[1]

In addition, the specific literature on competition for *exogenous* prices in public good environments measures effort as prosocial investments in a group, and contributions of one group member have positive externalities to all other group members.[2] The *size* of contest prizes is exogenously pre-defined and financed either by the experimenter or by being deducted from the groups' contributions to the public good. The *distribution* of prizes is subsequently based on individual contributions relative to the group's aggregate contributions to the public good, either probabilistically through lotteries or deterministically through all-pay auction settings. In these settings, often a single prize (winner takes all) yields higher public good provision compared to multiple prizes (excluding a loser). For example, by extending the single-prize lottery in Morgan (2000) and Morgan & Sefton (2000) to a lottery with multiple-prizes, Lange, List, & Price (2007) find that the winner takes all outperforms the loser gets nothing in terms of total provision of a public good. Similarly, using a field experiment on donations, Landry, Lange, List, Price, & Rupp (2006) find that average donations are larger in a single prize lottery compared to a multiple prize lottery. Finally, using all-pay auction type contests, Faravelli & Stanca (2012) study public good provision within closed groups, comparing single winner prizes to a case with multiple winners receiving equal prizes and excluding the lowest contributor. They find that public good contributions are the highest with a single winner prize. As compared to these settings, our decision setting is the first to include active donors benefiting from the public good investments and making *endogenous* donation decisions to public good

[1] Further experimental evidence considering contests for the allocation of an exogenously provided, divisible resource suggests that a proportional prize contests leads to higher expenditures than both a multiple and single prize contest (Shupp, Sheremeta, Schmidt, & Walker, 2013).

[2] In addition to the literature discussed in the main text, previous studies show that competition for *external* rewards *between* groups providing a public good enhances provision (Gunnthorsdottir & Rapoport, 2006; Heap, Ramalingam, Ramalingam, & Stoddard, 2015; Nalbantian & Schotter, 2016). An exception to this finding is Chambers et al. (2018), where groups consisting of heterogeneous subjects contributed less in a winner-takes-all scenario compared to a non-competitive setting. Importantly, in all of these studies, the provision of the public good originates in a closed group (what we refer to as only insiders) with no externality to members outside the group; and the prize in the competitive environment is exogenously defined and fixed by the experimenter.

In addition, another set of related studies on within-group competition considers prices defined by the aggregate contributions to the public good and distributed to individual contributors through changes in the marginal benefit they receive from the public good based on relative contribution levels (e.g. Angelovski, Neugebauer, & Servátka, 2019; Colasante, García-Gallego, Georgantzis, Morone, & Temerario, 2019). Note that while these prizes can be understood as *endogenous,* they differ from the prizes we consider as they are not rewards received in addition to the return from the public good.

providers, as well as comparing single and multiple prize contests with exclusion, to a proportional contest without exclusion from prizes.

Further, by considering the *decisions of donors* to subsidize the provision of public goods, this study contributes to the large body of literature on the behavioral drivers of charitable donations (e.g. Andreoni, 1990; Vesterlund, 2003; Frey & Meier, 2004; Bénabou & Tirole, 2006; Ariely, Bracha, & Meier, 2009; Gneezy, Keenan, & Gneezy, 2014; Garcia, Massoni, & Villeval, 2020). By allowing interactions between donors and public good providers over multiple decision rounds, we address the relevance of competition in the dynamic interaction between donations and the public good efforts that donations support.

We find that all three contest settings increase contributions to the public good relative to the setting with no transfers. We find that the *WA* and the *LN* contests yield similar increases in public good provision. Moreover, they outperform the proportional sharing contests initially, but this difference vanishes over time. From the perspective of efficiency in use of transfers from donors, we find that transfers in the *WA* setting are significantly lower yet yield similar levels of public good provision. In this sense, our results point to the value of competition in allocating scarce donations. On the other hand, the results suggest that contests that fully exclude subsets of public good providers from receiving transfers or donations may not achieve better outcomes than mechanisms distributing prizes proportional to effort, which might be politically more attractive.

The remainder of this manuscript is structured as follows. In Section 2 we present the decision setting and hypotheses. In section 3 we describe the experimental design and procedures. Section 4 presents an overview of the data, average treatment results and determinants of individual behavior across treatments. We conclude by discussing the results and respective policy implications in Section 5.

2. Competition in insider-outsider settings

The insider-outsider decision settings consist of a group of n_I insiders and n_o outsiders. Insiders can make contributions g_i out of endowment w, with $g_i \in [0, w]$ to a Group Account $G = \sum_{i=1}^{n_i} g_i$ that constitutes a public good with an equal marginal return of a for insiders and outsiders, where $\frac{1}{(n_I+n_O)} < a < 1$, so that the cumulative value of a contribution across all recipients (insiders and outsiders) exceeds the marginal cost of a contribution. Outsiders cannot make contributions but benefit from public good provision. However, outsiders can send transfers $t_j \in [0, w]$ out of an endowment w to compensate insiders for their contributions.

Transfers from outsiders are added together in a Transfer Account of size $T = \sum_{j=1}^{n_o} t_j$. The Transfer Account is distributed to insiders through different contest mechanisms based on the treatment condition.

A broad range of research has analysed the complex and diverse motivations in social dilemma settings beyond simple self-income maximization (see Sugden, 1984; Ostrom & Walker, 2003; Camerer & Fehr, 2006; Chaudhuri, 2011). One of them is the basic human motivation of cooperation (Andreoni, 1995; Henrich et al., 2001; Goeree, Holt, & Laury, 2002; Brandts, Saijo, & Schram, 2004). Previous evidence in the donors – public good providers environment studied here (BHW and BSW) shows significant positive levels of public good provision and transfers under varied allocation mechanisms for transfers. Thus, we assume that (at least a subset of) outsiders derive some non-monetary utility from offering transfers to insiders, given by $y_j(t_j)$, with $y_j(0) = 0$, $y_j'(t_j) > 0$, and $y_j''(t_j) < 0$. Equation (1) gives outsiders' utility function in a given period:

$$U_{Oj} = w + aG - t_j + y_j(t_j) \tag{1}$$

The marginal utility of sending transfers by outsiders is then given by $\frac{\partial U_{Oj}}{\partial t_j} = -1 + y_j'(t_j)$ which is positive as long as $y_j'(t_j) > 1$. Given this, we expect the optimal level of transfers sent to be positive leading to outsiders' offering positive transfers $(T > 0)$.

For the *competition settings*, an insider's utility function in a given period is given by equation (3).

$$U_{Ii} = w - g_i + aG + z(g_i, \boldsymbol{g_{-i}})T + f_i(g_i) \tag{3}$$

Similarly to outsiders, we assume the insiders derive utility from the act of giving, given by $f_i(g_i)$, with $f_i(0) = 0$, $f_i'(g_i) > 0$ and $f_i''(g_i) < 0$.[3] As in Orzen (2008), $z(.)$ represents the allocation rule of the prize in a given contest and $\boldsymbol{g_{-i}}$ is the vector of contributions of the other members of the group. The function $z(.)$ links relative contributions of insiders to the amount of rewards to be received, designating a competitive rewarding scheme defined for each specific contest, as described in sections 2.1-2.3.

[3] For the case of *no transfers*, the utility function of an insider is given by: $U_{Ii} = w - g_i + aG + f_i(g_i)$. Notice that given this simple modelling assumption, extreme free-riding (i.e. zero contributions by all insiders) is not a sensible prediction, as long as $f_i'(g_i) > 1 - a$, implying positive contributions.

One can observe that, irrespective of the contest: (i) if $T = 0$, the objective function reduces to the standard linear VCM game (*without* transfers and with outsiders receiving a positive externality), and (ii) if $T > 0$, the marginal utility for insiders from contributing is larger in all contests than in the VCM with no transfers, as insiders receive a higher (expected) marginal utility from contributing due to transfers from outsiders.

2.1. Proportional contest

With the proportional contest mechanism, the distribution of transfers from outsiders is proportional to individual public good contributions made by insiders, thus $z(g_i, \boldsymbol{g}_{-i}) = \left(\frac{g_i}{\mathrm{G}}\right)$.[4]

Adding $z(.)$ into equation (3) gives an insider's utility function for the proportional contest.

$$U_{Ii} = w - g_i + aG + \left(\frac{g_i}{\mathrm{G}}\right)T + f_i(g_i) \tag{4}$$

An insiders' marginal utility from contributing to the public good is given by

$$\frac{\partial U_{Ii}}{\partial g_i} = \left(\frac{G_{-i}}{\mathrm{G}^2}\right)T - 1 + a + f_i{}'(g_i) \tag{5}$$

where G_{-i} is the sum of contributions of other insiders (excluding i). As can be seen from equation (4), insiders in the proportional contest have a higher incentive to contribute to the public good as compared to insiders in the no-transfers condition (where $T = 0$), due to the additional marginal utility from contributing associated with transfers.

2.2. Winner-takes-all contest

In the winner-takes-all contest, the insider with the highest contribution in a group receives the entire Transfer Account of size *T*. Thus, this contest formally resembles an all-pay auction, in which all agents have the same endowment, which is public information, and the distribution of the prize to the highest contributor is deterministic.[5] This type of game has been formally

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[4] In BHW transfers were shared equally among insiders. BHW found little evidence of increased public good provision, even when outsiders offered substantial transfers. This result was robust to a setting that included a matching mechanism for contributions, with an upper threshold based on the level of transfers offered. BSW extended the decision setting in BHW to investigate alternative transfer institutions. In particular alternative sharing rules (proportional distribution of group payments and targeting of payments to individual insiders) were examined, as well as whether an additionality criterion was in place. BSW found that both the proportional and targeted-transfers sharing rules lead to greater public good provision relative to the equal share rule. The inclusion of additionality did not significantly increase public good provision.

[5] Notice the difference to Morgan (2000) where the single-winner prize is probabilistically distributed through a *Tullock* (1980) lottery contest, with the probability of winning depending on a subject's relative contribution to the public good. The all-pay auction is limiting case of such a *Tullock* lottery contest, where the probability to win for the individual who exhibits highest effort reaches certainty. See Baye, Kovenock, & de Vries (1996) for a

analyzed in Orzen (2008). As in that model, $z(.)$ defines here a deterministic allocation of the contest prize, where the insider with the highest contribution wins, subject to a tie-breaking rule. Thus,

$$z(g_i, \boldsymbol{g}_{-i}) = \begin{cases} 1 & if\, g_i > \max(\boldsymbol{g}_{-i}) \\ \frac{1}{m} & in\ case\ i\ ties\ with\ m-1\ other\ players \\ 0 & if\ g_i < \max(\boldsymbol{g}_{-i}) \end{cases} \quad (6)$$

Considering the potential earnings from winning, an insider's optimal behavior in this contest depends both on the expectation of the behavior of other insiders, and on the size of the prize. Specifically, following the proof presented in Orzen (2008), one can show on the one side that (i) if $0 < T < (1-a) * n * w$, insiders will randomize their contributions following the cumulative distribution function $F(g) = \left(\frac{(1-a)g}{T}\right)^{\frac{1}{n-1}}$ on the interval $\left[0, \frac{T}{(1-a)}\right]$. This implies, based on payoff maximization, that the *maximum* amount an insider is willing to contribute is $\widehat{g_{\iota}}_{WA} = \frac{T}{(1-a)}$, independent of expectations regarding the behavior of others. Notice that there can be situations where it is profitable for the insider to contribute more than the Transfer Account, and contribute up to w, even if $T < w$. How much to contribute below this threshold $\widehat{g_{\iota}}_{WA}$, will depend on the expectations of others' behavior. Generally, one might assume insiders would want to win with the lowest possible contribution. In the limit, if an insider *i* expects $\boldsymbol{g}_{-i} = 0$, for any positive T, the best response of *i* would be to contribute one unit and thereby receiving the full Transfer Account, as opposed to tying with the other insiders and receiving only 25% of T. Then, the best response of a different insider would be to increase their contribution by one unit above that of insider *i*. Thus, strategically, one can assume that insiders in this contest form an expectation at the margin of "beating" the second highest contributing insider. This iterative argument holds true until $\widehat{g_{\iota}}_{WA}$. Contributions above this level are strictly payoff dominated by contributing zero.

Alternatively, (ii) if $T \geq (1-a) * n * w$, insiders have an incentive to contribute their full endowment (i.e. $g_i = w$). The intuition is the following: an insider expecting others in their group to contribute $w - 1$ can increase their payoff by investing $g_i = w$, making them strictly better off as compared to $g_i = 0$. At $T = (1-a) * n * w$, insiders are exactly indifferent

general closed form solution for the individual all-pay auction with complete information (without a public good component). The authors show that with homogeneous valuations of the prize, there exists a unique symmetric equilibrium in mixed-strategies as well as a continuum in asymmetric equilibria.

between tying with all others with contributions of w or deviating individually to zero contributions.

2.3. Loser-gets-nothing contest

In the loser-gets-no transfers mechanism, the single insider with the lowest contribution in a group in a given period is excluded from receiving transfers. The Transfer Account is then shared among the remaining three insiders based on an insider's contribution relative to the sum of contributions of the three remaining insiders.[6] In case there is no unique loser (i.e. if there is a tie for the lowest contribution between at least two insiders), the Transfer Account is shared proportionally among all insiders. Thus,

$$z(g_i, \boldsymbol{g}_{-i}) = \begin{cases} \left(\frac{g_i}{G_w}\right) & if\, g_i > \min\left(\boldsymbol{g}_{-i}\right) \\ \left(\frac{g_i}{G}\right) & in\ case\ of\ any\ ties \\ 0 & if\ g_i < \min\left(\boldsymbol{g}_{-i}\right) \end{cases} \qquad (7)$$

where G_w equals the sum of contributions of the top three insiders.

Observe that this contest has similarities with symmetric multiple-prize all-pay auctions with complete information (without a public good provision environment). Barut & Kovenock (1998) show that in such a contest only mixed strategy equilibria exist and that expected expenditures are highest by defining the lowest prize equal to zero, as we do.[7] Note, however, that the size of the individual prizes in the contest described herein are not fixed but distributed proportional to contributions. This feature makes our loser-gets-nothing contest very similar to the proportional contest. Specifically, note that there are two cases when the payoff structure is identical to that of the proportional contest, namely (i) in case of ties at the lowest contribution, and (ii) in case that at least one insider in the proportional contest contributes zero to the public good. Increasing the number of insiders in a group, the loser-gets-nothing contest converges to the proportional contest.

[6] Note the difference to the decision setting in Lange et al. (2007) who model a lottery with three probabilistically distributed prizes and exclusion at the bottom.

[7] See Faravelli (2011) for the formal solution of a multiple-prize all-pay auction in a public good setting with heterogeneous endowments and incomplete information. In such a scenario, there exists a pure-strategy equilibrium in which contributions are increasing in the endowment. See Faravelli & Stanca (2012) for experimental evidence related to Faravelli's model. Note that agents in those setting are heterogeneous in income and the prizes are pre-defined (and equal, in the case of Faravelli & Stanca, 2012). To our knowledge, no one has yet provided a general solution for a multiple prize all-pay auction in a public good environment where there is exclusion for the lowest contributor, and where prizes are being distributed proportional to effort (and endogenously defined by a group of outsiders).

As in the winner-takes-all contest, if an insider expects the other group members to contribute zero, she has an incentive to contribute one unit and thereby receiving the full Transfer Account (the same holds true for the proportional contest). However, contrary to the winner-takes-all scenario, increasing contributions further in order to be the highest contributing individual, only results in an increase in the proportional share of transfers received, not T. Thus, for a given level of contributions $\boldsymbol{g}_{-i}$ and payoff maximization, the *maximum* amount an insider is willing to contribute depends directly on the expected behavior of others, and is given by $\widehat{g_{\iota}}_{LN} = \frac{T}{(1-a)} - g_{-k}$, where g_{-k} are the *expected* contributions of the other two members in a group receiving transfers (i.e. excluding the expected contribution of the lowest contributor). Contributions above $\widehat{g_{\iota}}$ entail that the proportional share from transfers received (for an insider that is not the lowest contributor) and the return from the public good is strictly lower than the individual contribution, and so the insider is better off contributing zero. For a given level of T, unless g_{-k} is expected to be zero, notice that $\widehat{g_{\iota}}_{LN}$ is per definition strictly lower than $\widehat{g_{\iota}}_{WA}$.

2.4. Behavioral conjectures

As compared to *No-T*, all three contests increase the marginal incentives for an insider to contribute to the public good for $T > 0$. This can be attributed to the contest increasing the expected benefits of contributions by receiving the endogenous prize from the contest, as long as the expectation of receiving transfers is larger zero (i.e. $z(g_i, \boldsymbol{g}_{-i}) > 0$). Based on these results, as well as the previous evidence suggesting that contests within closed groups yield higher public good contributions than a simple voluntary contribution mechanism (Corazzini et al., 2010; Lange et al., 2007; Morgan, 2000; Morgan & Sefton, 2000; Orzen, 2008), we expect all three contest treatments to result in higher contributions than the *No-T* treatment, as formulated in conjecture 1.

> ***Conjecture 1:*** *On average, contributions will be higher in the three contests compared to the no-transfer, inactive outsiders setting.*

Next, we provide behavioral conjectures for the comparisons of the different contests. The winner-takes-all contest constitutes the strongest form of competition, excluding all but a single winner from receiving transfers in a given period in a given group. Given positive transfers by outsiders, the incentives to win the contest are highest in the winner-takes-all setting.[8] As

[8] Meaning, the incentive to increase the individual contribution by one additional unit in order to “win” a given contest and be the highest contributing insider, is highest in the winner-takes-all contest. This is because the

discussed, the previous experimental literature focusing on contests in closed groups providing a public good and comparing single or multiple prizes supports the finding that winner–takes – all prizes outperform multiple prizes (with a loser-gets-nothing structure) in terms of public good provision (e.g. Faravelli & Stanca, 2012; Lange et al., 2007). Based on these findings, and the arguments developed in section 2.2; we expect the winner-take-all contest to induce the highest average contributions of insiders. Through reciprocity from outsiders, we expect this to also result in the highest average transfers (see Sugden, 1984 for a formal discussion of reciprocity and Croson, 2007 for experimental evidence in repeated linear VCM public good settings). For a given $\boldsymbol{g_{-i}}$, generally the share an insider can receive in transfers is larger in the loser-gets-nothing contests than in the proportional contest, i.e. $\left(\frac{g_i}{G_W}\right) > \left(\frac{g_i}{G}\right)$. Thus, one might assume the incentives to contribute to be larger for insiders in the contest with exclusion at the bottom. Note however, as discussed in section 2.3., this holds true only as long as there are no (*expected*) ties in loser-gets-nothing and no (*expected*) zero contributions of any insider in a given round in the proportional contest. Based on these considerations, we formulate conjecture 2 on the relative comparison of the three contests under consideration.

> ***Conjecture 2:*** *On average, contributions and transfers will be higher in the winner-takes-all contest than in the proportional and the loser-gets-nothing contest.*

3. Experimental Design and Procedures

Table 1 provides an overview of the four treatment conditions (*WA, LN, Prop and No-T)* implemented and the respective attributes of the decision settings. The data from *Prop* were initially reported in BSW. All remaining 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, Baetge, & Nicklisch, 2014). Our sample consists of 53.7% females and participants are on average 22.4 years old (sd=0.14).

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marginal benefit from this additional contribution is largest in this setting – moving from an equal share of the Transfer Account (equally shared between the number of tying insiders) to the full Transfer Account; as opposed to marginally increasing the share of transfers received in both the proportional and the loser-gets-nothing contest.

Table 1: Overview of implemented treatment conditions

Treatment	Contest	Nr. of observations
WA	winner-takes-all contest	13 groups 104 subjects
LN	loser-gets-nothing contest	12 groups 96 subjects
Prop	proportional contest	21 groups* 168 subjects
No-T	no contest	14 groups 112 subjects

*Note: The data collection took place in two waves, one in 2018, with 12-14 groups per treatment, and one in 2020 that started with the proportional treatment, reaching the full set of planned observations (about 20 groups in each treatment). Due to the outbreak of Covid-19 in the spring of 2020 and ongoing restrictions with running laboratory experiments, we could not complete the observations for the other treatments. Section A in the appendix presents robustness on treatment effects considering only the 2018 observations for *Prop*. The main text includes all observations, for transparency.[9]

An experimental group is composed of two randomly assigned types of subjects, $n_I = 4$ insiders and $n_O = 4$ outsiders, for a total group size of 8. An experimental session consists of multiple decision-making periods and includes two parts, 5 periods of Part 1 and 10 periods of Part 2. Part 1 is equivalent in all treatments. Subjects learned the decision-making details of Part 2 only after the completion of Part 1. 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. Instructions were read aloud by the experimentalist (see the Supplementary Materials for instructions, which were common knowledge among insiders and outsiders) and subjects were required to answer a series of control questions on the screen before making decisions.

In **Part 1**, in all treatment conditions, outsiders are inactive and insiders make contributions g_i from an endowment of $w = 100$ ECUs (Experimental Currency Units), with $g_i \in [0,100]$ to the Group Account G that constitutes a public good with an equal marginal per capita return of $a = 0.4$ for insiders and outsiders. Outsiders have an equivalent endowment of $w = 100$ ECUs, but cannot make active decisions, they simply receive the benefits of the public good provision by insiders, which is common information. Outsiders were, however, asked to provide an estimate of the average individual contribution of insiders to the Group Account in the given period. It can be argued that most insider-outsider interactions have a history with insiders providing a public good with benefits extending to a broader population. Including a Part 1 in

[9] See section A in appendix for robustness on treatment effects considering only the first wave of data collection (i.e. taking into account only the first 12 groups in the *Prop* treatment). All results are robust.

the experimental design is important as we are interested in such a history, where insiders have not been compensated for their contribution efforts. Thus, Part 1 serves to introduce within-treatment variation and therefore enables to consider both the within-group reaction to the treatment introduction, as well as across treatment comparisons when estimating treatment effects.

The decision-making setting in **Part 2** depends on the specific treatment condition. The role of outsiders, and the specific allocation of transfers varies depending on the specific treatment condition. In the *No-T* decision setting, Part 2 is equivalent to Part 1. In the treatments with transfers, Part 2 becomes a two-stage game. In stage 1, each outsider makes a decision on transfers $t_j \in [0{,}100]$ to be sent to the insiders in the form of the Transfer Account. In stage 2, insiders are informed of the size of the Transfer Account and make their group account contribution decisions, as in Part 1. Similar to the estimate that outsiders provided on insiders' expected behavior, insiders were asked to provide an estimate on their expectations about outsiders' average transfer offers.[10] At the end of each period in Part 2, the sum of contributions is communicated to all subjects in a group. 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. Importantly, in none of the contest treatments is the group informed about individual insiders' contributions and which insider in a group won or lost the respective contest, such that there is no reputation building across decision rounds.

Insiders only receive information on their own actions. In the *Prop* treatment, 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. In the *WA* treatment, at the end of each period, insiders receive feedback on whether or not they are the highest contributor in the group and thus whether or not they receive the Transfer Account. Importantly, if there is a tie for the highest contributor, the group is informed of this and the Transfers Account is shared equally among the winners who are informed of their share of transfers in that case. In the *LN* treatment with a unique lowest contributor, at the end of a period, the lowest contributor learns (s)he was the insider with the lowest contribution in the group and thus receives no transfers. The remaining group members are privately informed of their share of the Transfer Account. If there is a tie for the lowest contribution (i.e. no unique lowest contributor), the group is informed of this and the

[10] Insiders' and outsiders' estimates were not considered a central focus of the experimental design. They were not incentivized in order to have subjects focus on contribution and transfer decisions.

Transfer Account is shared among all four insiders in a group with each insider receiving a share dependent on their contribution relative to the other insiders in their group.

4. Results

The presentation of results is organized around three sub-sections. In section 4.1, we provide a descriptive overview of the data. Section 4.2 reports the results from a regression analysis designed to test for differences in average treatment effects for period 6 decisions and for decisions in all periods of Part 2. Section 4.3 focuses on heterogeneous responses of insiders to the transfer mechanisms.

4.1. Description of data

Figure 1 presents average group contributions (sumG, solid lines) and average group transfers (sumT, dashed lines) for all treatments. In addition, Figures B1-B4 in the appendix B show average contributions and transfers for each group in each treatment separately.

In Period 1 insiders contribute on average 35% to 43% of their endowment, with the differences not being statistically significant between treatments, nor is the difference significant pooling across all periods of Part 1 (p-value > 0.1 for all relevant t-test comparisons).[11] Moving to Part 2, in all treatments, contributions decay after an initial increase from period 5 to period 6. Throughout Part 2, contributions in *WA, LN* and *Prop* remain at a higher level compared to *No-T.* Average group transfers are similar in all contests.

[11] We also observe that average contributions in periods 2-5 decay at different rates between some of the treatments: t-tests reveal that the difference between *No-T* and *Prop* is significant in both period 4 and period 5 at $p<0.05$, as is the difference between *No-T* and *LN* at $p<0.05$ in period 04. Given that experimental conditions are equivalent in Part 1 in all treatments and prior to Part 2 subjects are not informed of the treatment differences in Part 2, these differences are attributed to group-specific dynamics.

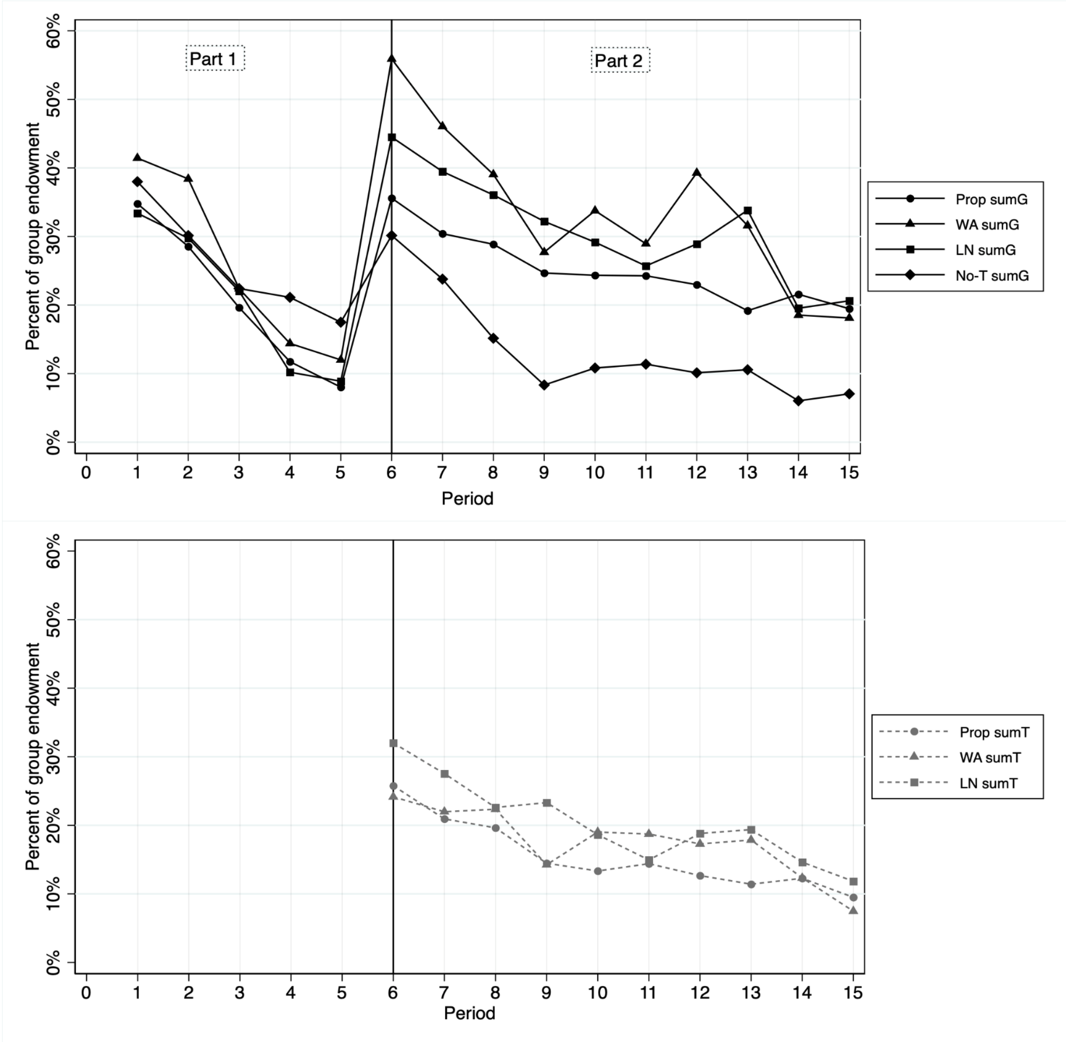


Fig 1. Average group contributions (top figure) and group transfers (bottom figure) across periods.

4.2. Aggregate treatment effects

To formally analyze the impact on contributions and transfers of the introduction of the different contests, we use a difference-in-differences estimation approach, controlling for Part 1 group decisions. We define net contributions for each group and each period of Part 2, as contributions relative to the group's average contributions during Part 1 (**net contributions** = sumG – $avgG_{1\text{-}5}$). Similarly, we also create a net transfers variable (**net transfers** = sumT – $avgG_{1\text{-}5}$).[12] This approach allows for controlling for Part 1 differences in contributions between groups across treatments.

[12] Not controlling for differences in contributions across groups in Part 1, Period 6 differences in contributions are significant only for the comparison of *WA* with *No-T* and with *Prop* (p-values from t-test < 0.05) and weakly significant for the comparison of *LN* with *No-T* (p-value = 0.08). Period 6 comparisons of *LN* with *Prop* and with *WA* are both insignificant (p-values > 0.1). Similarly, the differences in average Part 2 contributions are significant for the comparison of *WA* with *No-T*, and with *Prop* (all p-values < 0.05), and weakly significant for the comparison of LN with No-T (p-value = 0.07). Average Part 2 comparisons of *LN* with *Prop* and with *WA* are

Figure 2 presents the coefficient plots for average treatment effects for differences in net-contributions and net-transfers, separately for period 6 and for the average of Part 2. The reference treatment for net contributions is *No-T*, and for net transfers it is *Prop*.[13] Compared to *No-T* all contest treatments generate higher net contributions in period 6, with *WA* and *LN* having significantly higher net contributions than *Prop*. Pairwise comparisons of net contributions between treatments based on post-estimation Wald tests are significant for *Prop* and *WA* (p-value = 0.006) and for *Prop* and *LN* (p-value = 0.027). We do not find a significant difference for net contributions between *WA* and *LN* in period 6 (p-value = 0.24). Moving to transfers, the two treatments that allow for exclusion do not generate significantly different net transfers as compared to *Prop* for period 06 (p-value = 0.14 for *WA* vs *Prop* and p-value = 0.32 for *LN* vs *Prop*), and the comparison between net transfers for *WA* and *LN* is weakly significant (p-value = 0.067).

Considering all periods of Part 2 (periods 6-15), Figure 2 shows that, as observed for Period 6, all contest treatments exhibit higher levels of net contributions relative to *No-T*. Contrary to our conjecture, the *LN* treatment results in the highest net contributions. However, all pairwise comparisons of net contributions between treatments based on post-estimation Wald tests are insignificant. Moving to transfers, net transfers are not significantly different for the comparison of *WA* and *LN* with *Prop* (p-values are 0.36 and 0.1, respectively), but significantly lower in *WA* as compared to *LN* (p=0.033).

again not significant (p-values > 0.1). Average group transfers are not significantly different for either period 6 or the average of Part 2 (p-value > 0.1 for all relevant t-test comparisons).

See Figure B5 in appendix B for robustness tests on average treatment effects, using average group contributions (and transfers) as the dependent variable (instead of net contributions and net transfers), using average Part 1 contributions of each group as a control variable. Results are qualitatively stable, except for the comparison in average contributions between WA and Prop - where both Period 6 and Part 2 contributions are significantly higher in *WA*.

[13] For the analysis that includes multiple decision periods, multilevel regressions are used to model the hierarchical structure of our data, thus controlling for the existing intra-class correlations. Residual ICC estimates for groups within a session, or, respectively individuals within a group, range between 22% to 68% for all regression models under consideration.

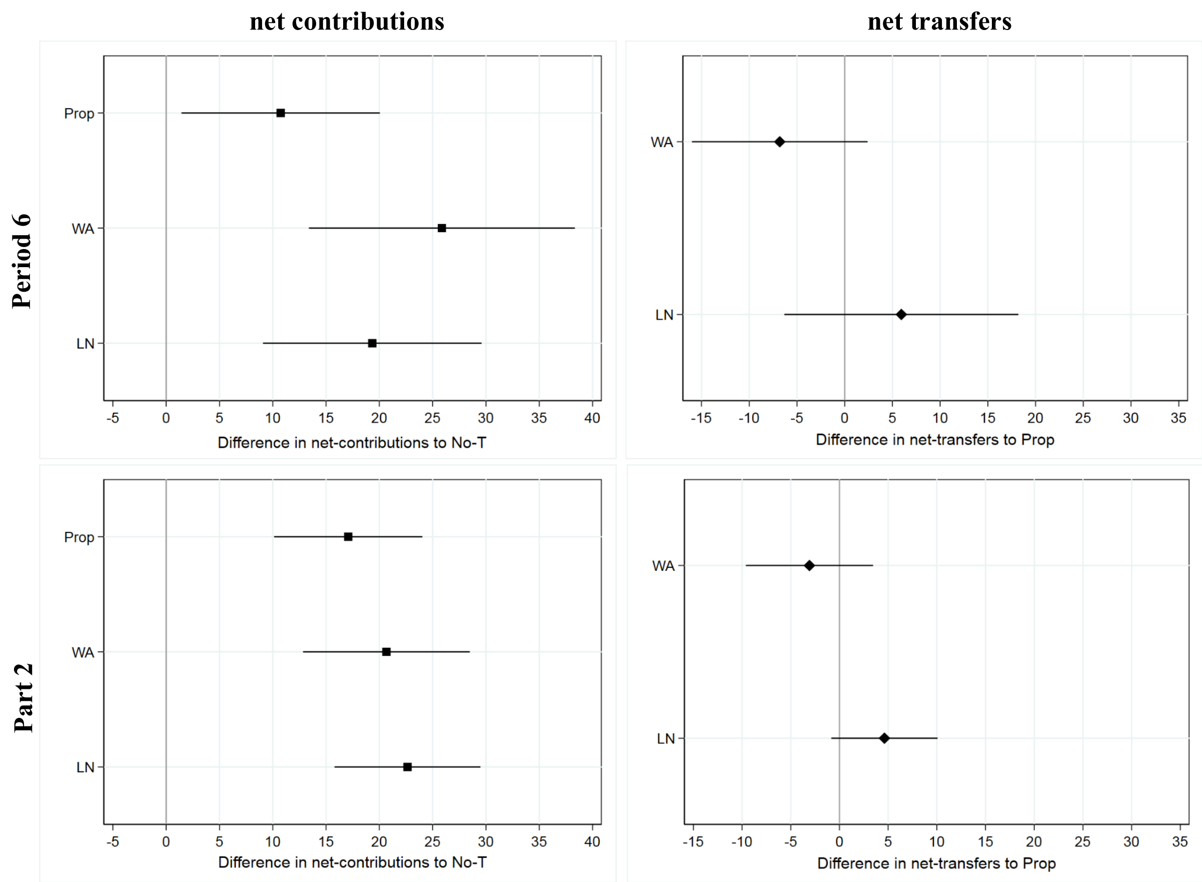


Fig 2. Period 6 Treatment effects for average net contributions and average net transfers, period 6 only**.** Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from OLS regressions, clustering on sessions. **Part 2:** Treatment effects for average net contributions and average net transfers, decision periods 6-15. Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from multilevel regressions with random effects on the group and session level.

Results 1 and 2 summarize the findings on average treatment effects.

> **Result 1:** *All contest treatments generate significantly higher net contributions relative to No-T. WA and LN generate similar net contributions, which are initially higher than in Prop, but this difference vanishes in later decision periods.*
>
> **Result 2:** *Net transfers are significantly lower in WA relative to LN.*

4.3. Determinants of Insiders' Behavior under Competition for Transfers

In addition to the treatment effects based on average group behavior, we observe, similar to past social dilemma studies, substantial heterogeneity in individuals' behavior. For example, Fig. B6 in appendix B shows the histograms of average individual contribution decisions for all treatments, with the distribution of insiders' decisions being significantly different for all treatment comparisons (all p-values < 0.0001 from respective Kolmogorov-Smirnov tests). As can be seen from Fig. B6, considering all decision periods of Part 2, strong free-riding (defined as zero contributions of a given insider in a given period) accounts for 49.8% of all observations in *No-T*. This is significantly reduced to 30.4% in *WA*, 25% in *Prop*, and 21% in *LN* (all p-values < 0.0001 from t-test comparisons). The difference between *WA* and *Prop* is significant (p-value = 0.038), as is the difference between *WA* and *LN* (p-value < 0.0001).[14]

We now turn to identifying determinants of individual decision making that help explain the observed differences in insiders' behavior across treatments. The repeated insider-outsider setting we study is a complex decision environment in that it includes attributes of reciprocity within the groups of insiders and outsiders, as well as between insider-outsider groups. As compared to previous public good studies with contests in closed groups and exogenously provided prizes, the potential dynamic between those providing the contest prizes and those competing in the contest is a novel aspect of our study. The analysis below examines a) the effect of unmet or exceeded expectations of transfers offered on contributions, and b) the effect of winning or losing in the respective contest.

The rationale behind this additional analysis is the following: First, since contest prizes are subject to outsider's endogenous and dynamic decisions over time, it is reasonable to assume that insiders could be disappointed by the transfers that do not meet endogenous expectations and disappointed insiders might be less willing to contribute to the public good. Second, being excluded from transfers in a given period provides a basis for losers to be demotivated in relation to future contributions.

We observe that on average, in all treatments, transfers offered by outsiders fall short of insiders' average expectations (see Table B1 column 4, in appendix B). But this average effect hides individual heterogeneity. Based on the difference between individual expectations and transfers offered, we construct two continuous variables: unmet-expectation$_t$, measuring the

[14] We further identify 10.7% of insiders as full free riders (meaning zero contributions in *all* decision periods in Part 2) in *No-T*. This number is reduced to 3.6% in *Prop*, 3.8% in *WA* and 4.2% in *LN*. The differences, however, are not significant (all p-values > 0.05 from all t tests comparisons).

extent to which transfers are lower than insiders' expectations in a period, relevant for subjects that might be disappointed about the offers; and exceeded-expectation$_t$, measuring the extent to which transfers offered are higher than insiders' expectations in a period, relevant for subjects that might be pleased with the offers.

Table 2 presents the results from a multilevel regression where the dependent variable is insiders' *individual* contribution to the public good in each period t of Part 2 (considering periods 6-15). Explanatory variables in column I (for *Prop*), column II (for *WA*) and column III (for *LN*) include (i) the previous periods' average group contribution (other insiders$_{t-1}$), (ii) unmet-expectation$_t$, (iii) exceeded-expectation$_t$, (iv) the insider's average contribution during Part 1 (avg$_{1-5}$) and (v) the period. Column II for *WA* also includes whether the insider was the winner of the contest in the previous round (winner$_{t-1}$) and the number of winners in the previous period (#winners$_{t-1}$). Similarly, column III for *LN* includes whether the insider was the (sole) loser of the previous contest (loser$_{t-1}$).[15]

[15] For *LN*, if there was a tie for the lowest contribution in a group in a given round, no insider was classified as having lost the contest and all insiders received a proportional share from the Transfer Account. In *WA*, if there was a tie for the highest contributions, the tying insiders were classified as having won the contest and received an equal share from the Transfer Account. Overall, in the *WA* treatment there were 38 ties for the winner within 130 group observations, and in the *LN* treatment there were 27 ties for the loser out of 120 group observations.

See Table B2 in the appendix for the results of this regression when considering instead average transfers offered as explanatory variable, as opposed to (un)met expectations. All results are robust, except for the coefficient on *other insiders$_{t-1}$* in Prop, which is significant in Table B2 (appendix B).

Table 2. Determinants of insiders' behavior in contests, Periods 6-15. Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1

Dep. Variable: individual contribution in period t, in % of endowment	(I) *Prop*	(II) *WA*	(III) *LN*
other insiders$_{t-1}$	0.282***	-0.0273	0.0995
	(0.0659)	(0.0584)	(0.0658)
unmet-expectation$_t$	0.123	0.0391	-0.0747
	(0.120)	(0.117)	(0.0732)
exceeded-expectation$_t$	0.359*	0.895**	0.462*
	(0.200)	(0.334)	(0.246)
avg$_{1\text{-}5}$	0.478***	0.451***	0.540***
	(0.144)	(0.0959)	(0.101)
winner$_{t-1}$	-	8.753*	-
		(5.151)	
#winners$_{t-1}$	-	0.460	-
		(2.759)	
loser$_{t-1}$	-	-	-6.928***
			(2.121)
period	-1.338***	-2.973***	-1.955***
	(0.464)	(0.645)	(0.502)
constant	20.15***	47.35***	37.18***
	(5.434)	(10.50)	(7.413)
Observations	*840*	*520*	*480*
Number of groups	*21*	*13*	*12*
Number of subjects	*84*	*52*	*48*

Note: Given the well-established gender competition effect in the literature (see Niederle & Vesterlund, 2011 for a review), we also included the explanatory variable *female* into the regression models. We do not find any significant difference in behavior in male vs females in our contest settings.

On average, unmet-expectations do not have a significant effect on individual contributions in any of the treatments. Exceeded-expectations have a positive effect on contributions in all three treatments, which is weakly significant for *Prop* and *LN* and significant at p<0.005 for *WA*.

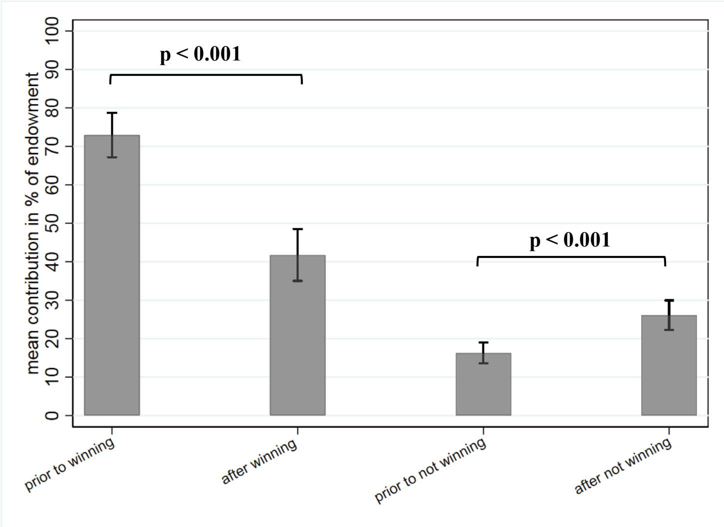
Table 2 also reveals qualitatively different responses to winning in *WA* or losing in *LN*. Within a group, insiders who won in *WA* (column II) contribute more on average in the next period compared to those who did not win. However, the effect is not significant at the 5% level. In *LN* (column III), we find a significant negative and relatively large effect from losing. Those who lost in the previous period contribute significantly less in the next period compared to those who did not lose. This informs us of the relative (between-subjects) behavior of winners and losers.

The within-subject change in behavior after winning (or losing) is presented in Figure 3. Panel-a shows mean contributions of insiders before and after winning or not winning in *WA*. Panel-b shows mean contributions of insiders before and after not losing or losing in *LN*.[16] Not winning in *WA* or being the sole loser in *LN* induces individuals to increase contributions in the next round. This is consistent with a motivation of trying to win in next round. Further, winning in *WA* or not losing in *LN* reduces contributions in next round. This is consistent with a motivation for trying to still win but with a lower contribution in next round. This effect is stronger in *WA*. These results are also supported by regression analysis considering the within-subject change in contributions for winners and losers, controlling for group and time dynamics (see Table B3 in appendix). Nevertheless, Figure 3 also shows that contributions of previous winners remain at a higher level than those of previous non-winners (in *WA*) and contributions of previous losers remain lower than those of previous non-losers (in *LN*), reinforcing the results from Table 2.

[16] In support of this observation, Figure B7 in the appendix shows the distribution of the change in contributions from t-1 to t for winners in t-1. While many insiders do not change their contributions in period t as compared to the period in which they won, there is considerable variation in responses. Note that 56% of insiders winning in *WA* have won by contributing 100% of their endowment. Thus, not changing contributions in future periods means again contributing the full endowment. In this sense, the reaction of winners from t-1 to t is somewhat bounded to the right of the figure. There is also variation in the response of losers in *LN* (see again Figure B6 in appendix).

See also Figures B8-B9 in appendix for the evolution of insiders' ranks in each treatment over time. These graphs show that (i) often times, insiders ranked last in *LN* (first in *WA*), continue to keep the last rank (first rank) for some time, while this observation is less systematic for winners in *WA* (as suggested also by the only weakly significant coefficient in Table 2), and (ii) in the majority of groups we find variation with respect to ranks between insiders, meaning they change over time.

a) *WA*



b) *LN*

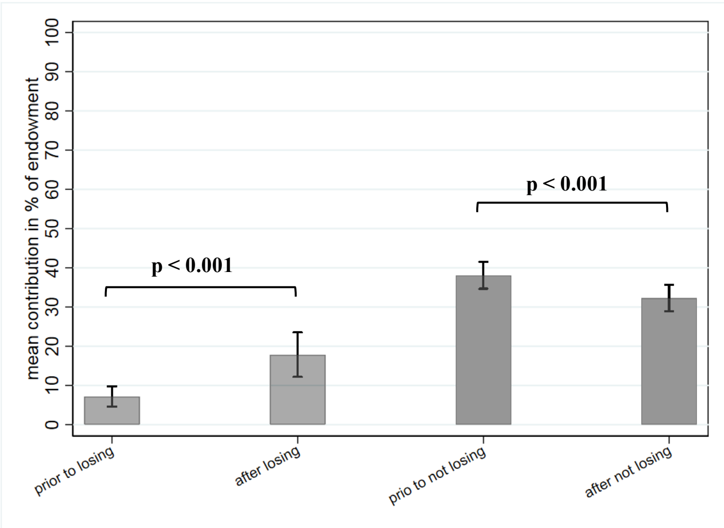


Fig 3. a) Mean contributions and 95% confidence intervals indicated by error bars of insiders in *WA* before (not) winning in t-1, as well as in period t after (not) winning, thus excluding period 6. P-values based on paired t-tests. **b)** Mean contributions and 95% confidence intervals of insiders in *LN* prior to (not) losing in t-1, as well as after to (not) losing in t-1, thus excluding period 6. P-values based on paired t-tests.

Result 3 summarizes the main results from Table 2 and Figure 3 on expectations and the reaction of winners and losers.

> **Result 3:** *Unmet-expectations do not significantly decrease insiders' contributions. Exceeded-expectations significantly increase contributions in all contest treatments, with the effect being largest in WA. On average, winners tend to continue to be winners and losers tend to continue to be losers. But, the differences in contributions are reduced across decision rounds, due to directional learning.*

5. Discussion and Conclusion

In a repeated decision setting where donors provide funding designed to facilitate public good provision, this study examines the behavioral response to three contest mechanisms used for distributing rewards from outsiders (donors) to insiders who contribute to a public good. In all three mechanisms, transfers to individual insiders are based on contributions relative to others in their group. The mechanisms differ in the strength of competition, by excluding some members from receiving transfers in a group. Specifically, we consider a winner takes all contest where the insider with the highest contributions in a group receives all transfers and a loser gets nothing contest where the insider with the lowest contribution in a group receives no transfers (and transfers are proportionally shared among the remaining three insiders). These two contests with exclusion are contrasted to a mechanism where insiders received transfers based on their contribution proportional to other insiders and a no-transfers setting. Thus, this study contributes to the research on the effect of competition in public goods by extending the decision setting to include donors and providers of public goods, interacting over multiple rounds.

We report three main results. First, we find that all contest mechanisms generate an increase in public good provision by insiders relative to the setting with no-transfers. Second, strengthening exclusion from prizes significantly increases public good contributions in the short run. This increase, however, disappears across repeated periods of the decision setting. As compared to *Prop,* the *LN* and the *WA* treatments generate greater public good provision in the first period in which transfers are allowed, and differences fade across all decision periods. Third, the two treatments with exclusion from receiving transfers, *WA* and *LN*, do not generate significant differences in public good provision, while the *WA* treatment yields this result with lowest transfers from outsiders.

The results above differ somewhat from previous studies examining contests in public good provision settings with exogenously provided prizes, where the consensus is that single winner prizes generate greater contributions, both for *Tullock*-style lottery contests and all-pay auctions (e.g. Faravelli & Stanca, 2012; Lange et al., 2007). Our results suggest the importance of the decision environment under consideration for the effectiveness of competition, as is also found in the literature examining contests with real effort tasks.

We also explored two main mechanisms as drivers of behavior in the contest settings: a) the effect of unmet or exceeded expectations regarding transfers offered by outsiders, and b) the effect of winning the prize in *WA* or being the sole loser in *LN*. Broadly, we find that unmet-expectations do not significantly decrease insiders' contributions. Exceeded-expectations, however, are found to significantly increase contributions in all contest treatments, with the effect being largest in *WA*. We interpret this as evidence for positive reciprocity from insiders as a reaction to the positively perceived behavior of outsiders.

In addition, we find that winner in *WA* tend to continue to be winners and losers in *LN* tend to continue to be losers. But, the differences in contributions are reduced across decision rounds, due to directional learning. Importantly, we found no evidence of being demotivated to the extent of not participating in the contests via contributions. This result on directional learning of insiders in a given contest is in line with that of previous studies on rank order contests without exclusion (Dutcher et al., 2015) and on competition between groups (Chambers, Glenn Dutcher, & Mark Isaac, 2018).

Our results contribute to the study of effective institutional design choice and implementation in a broad range of programs where donors provide transfer payments or donations, by exploring settings where there is "competition" by recipients for the limited funding. For example, in conservation programs based on payments for ecosystem services, there is a recurring discussion is how to efficiently allocate scarce funds via compensation payments among landowners qualifying to participate. In pro-poor aid, competition has been suggested as an allocation mechanism. We show that competition can be a useful mechanism to increase program outcomes in terms of public good provision and cost-effectiveness. Generally, all competitive environments we study generate similar increases in public good provision. Thus, exclusion does not bring significantly and stable increases in public good provision. We interpret this result as suggestive evidence supporting programs that rely on proportional, inclusive, payments. Such programs are simpler to implement in field settings: simpler to communicate; simpler to enforce as exclusion in winner-takes-all and loser-gets-nothing entail discontinuities in payoff that might generate higher conflict among potential recipients, thus require stronger institutions for enforcement and conflict resolution; and possibly outcome-based fairer (Wells, G., Ryan, C., Fisher, 2020). Finally, we believe the findings in this study illustrate the need for further research on the role of endogeneity in prizes when studying competition mechanisms, and specifically for the distribution of prizes associated to public good provision. Such research could provide valuable insights into the role of outsiders' endogenous choices in providing transfers through competition between individual public good providers.

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Appendix A. First wave of data collection only

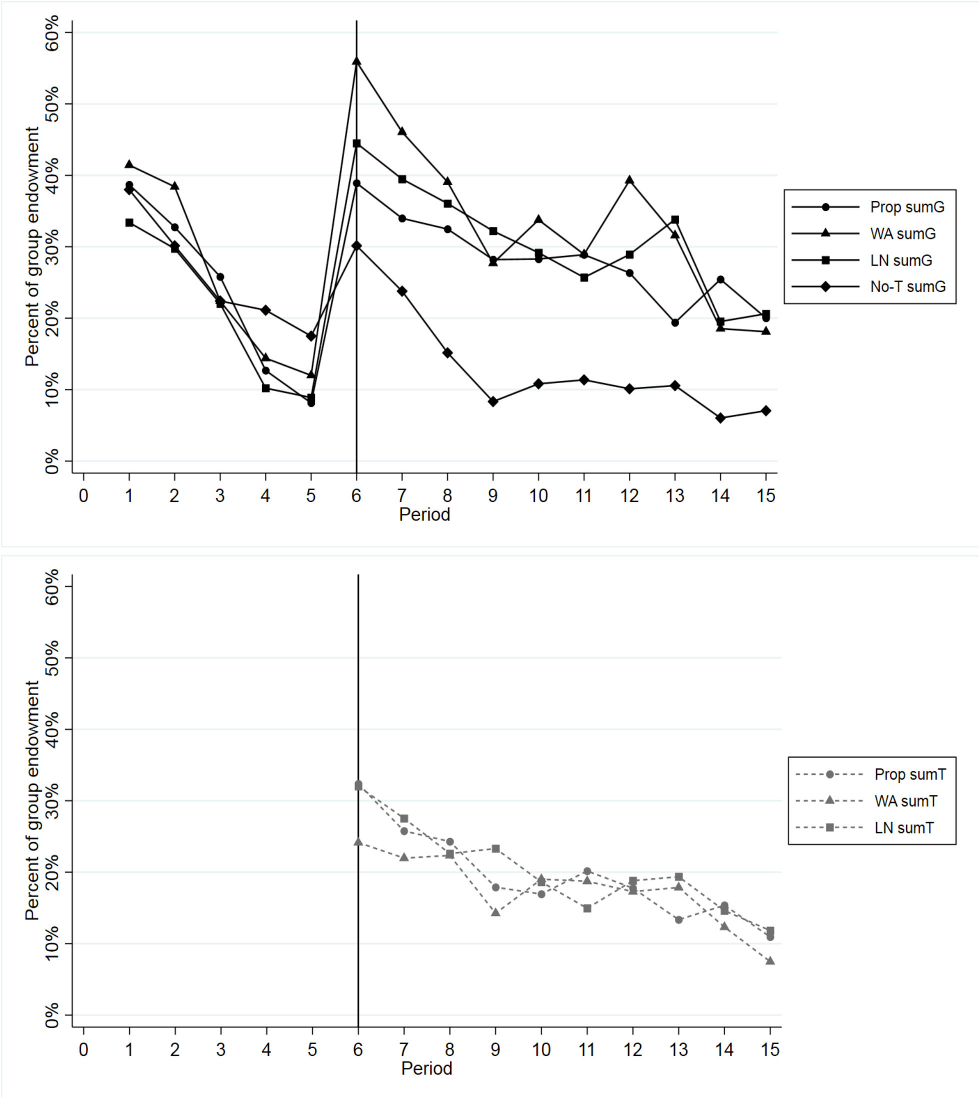

Fig A1. Average group contributions (top figure) and group transfers (bottom figure) across periods, using only first wave of data collections

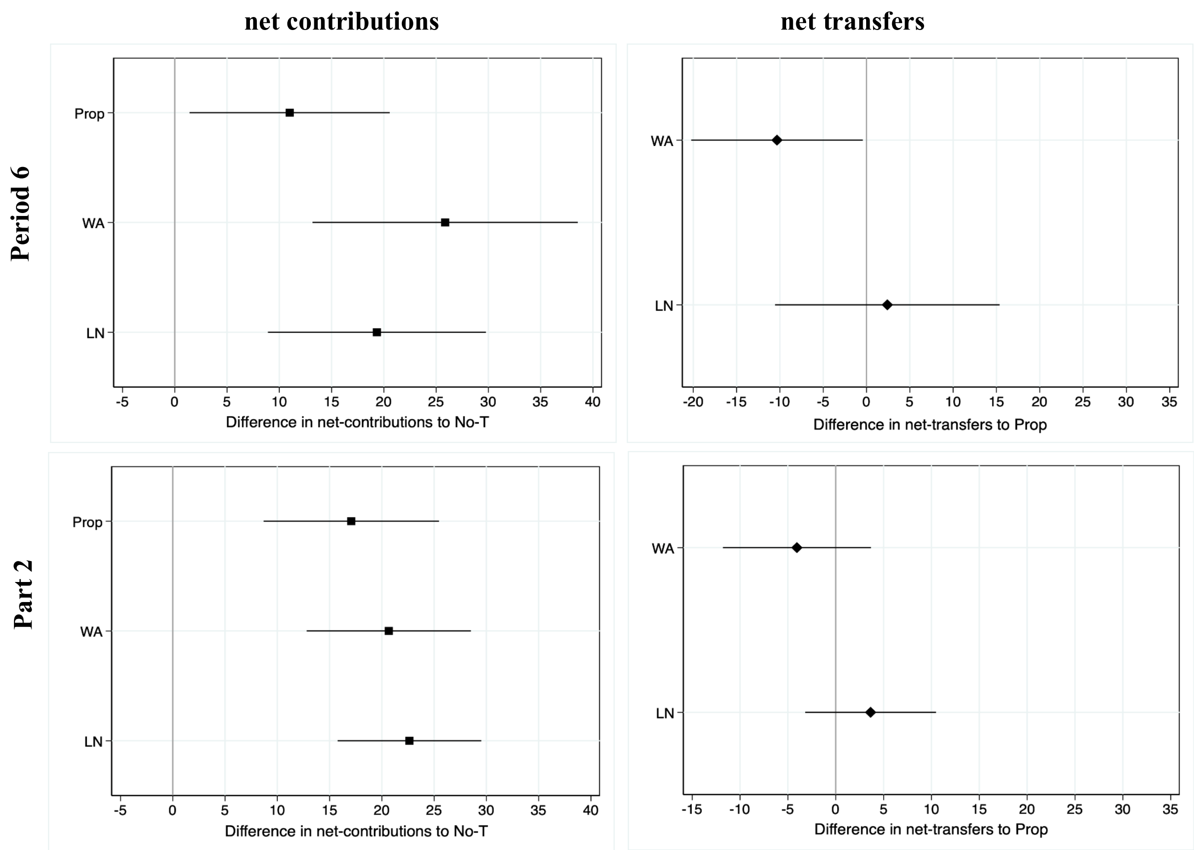

Fig A2. Period 6 Treatment effects for average net contributions and average net transfers, period 6 only, using only first wave of data**.** Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from OLS regressions, clustering on sessions. **Part 2:** Treatment effects for average net contributions and average net transfers, all decision periods, using only first wave of data. Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from multilevel regressions with random effects on the group and session level.

Note: Considering only the first wave of data (reduced nr. of groups in *Prop*), net contributions in Period 06 are significantly higher in all contests as compared to *No-T*. Pairwise comparisons from post-estimation Wald-tests show that the difference in *WA* and *Prop* (p-value = 0.009) and in *LN* and *Prop* (p-value = 0.037) is significant, while the difference in *WA* and *LN* (p-value = 0.243) is not significant. Net transfers are significantly higher in *WA* as compared to *Prop*, as well as in *WA* as compared to *LN* (p-value = 0.07 from post-estimation Wald test). Considering now all decision periods of Part 2, net contributions are significantly higher in all contests as compared to *No-T*, however all pairwise comparisons of net contributions between the different contests are insignificant (all p-values from post-estimation Wald tests > 0.1). Net transfers are as well not significantly different in *WA* and *LN* as compared to *Prop*, but the difference between *WA* and *LN* is significant (p-value = 0.034).

Appendix B. Additional Analyses

Contributions and Transfers by Group:

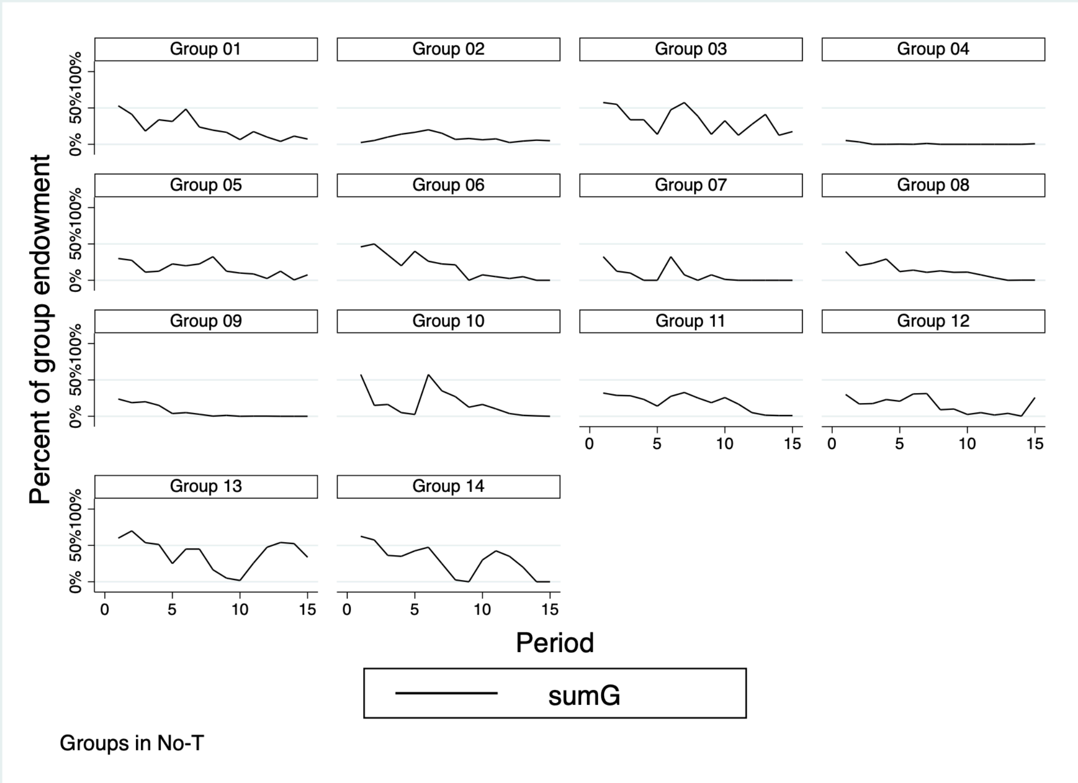

Fig B1. Sum of contributions by group in *No-T*

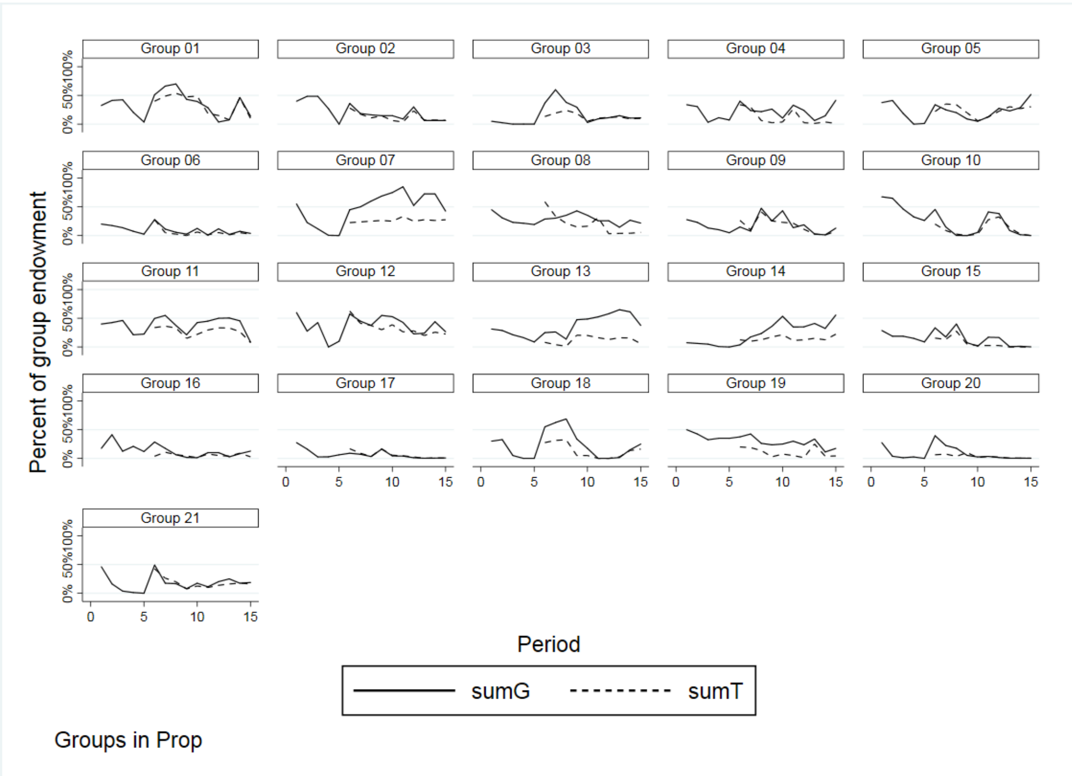

Fig B2. Sum of contributions and transfers by group in *Prop*.

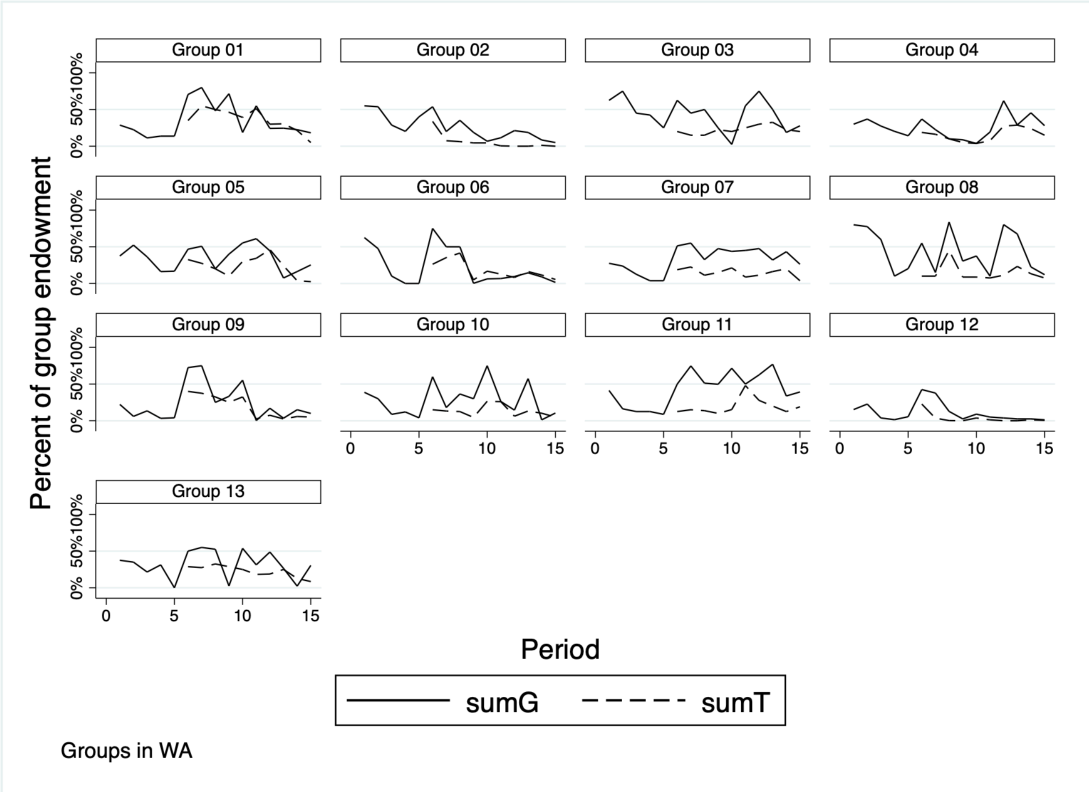

Fig B3. Sum of contributions and transfers by group in *WA*.

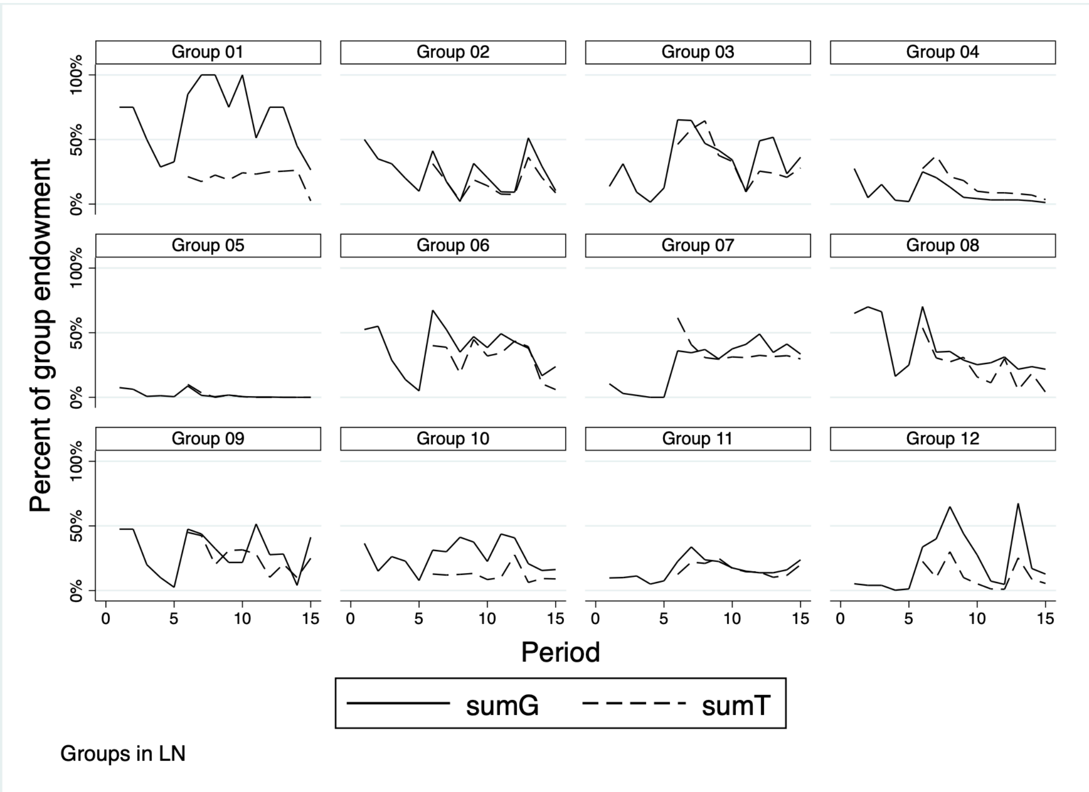

Fig B4. Sum of contributions and transfers by group in *LN*.

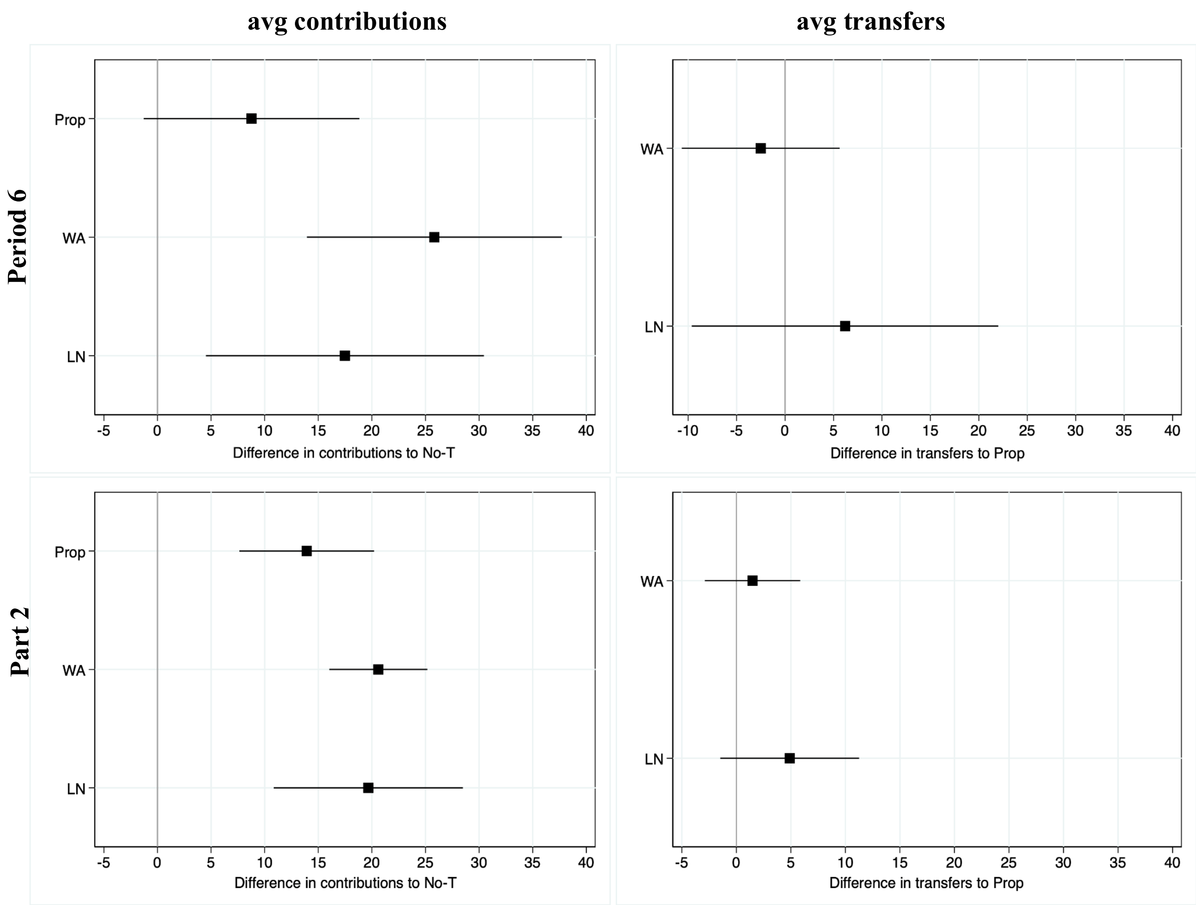

Fig B5. Period 6 Treatment effects for average contributions and average transfers, period 6 only, controlling for average Part 1 group contributions**.** Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from OLS regressions, clustering on sessions. **Part 2:** Treatment effects for average contributions and average transfers, all decision periods, controlling for average Part 1 group contributions. Point estimates and 95% confidence intervals based on robust standard errors for treatment differences from multilevel regressions with random effects on the group and session level.

Note: Contributions in Period 06 are significantly higher in all contests as compared to *No-T*. Pairwise comparisons from post-estimation Wald-tests show that the difference in *WA* and *Prop* (p-value = 0.002) is significant, while the difference in both *LN* and *Prop* (p-value = 0.103) and in *WA* and *LN* (p-value = 0.186) is not significant. Transfers in *WA* and *LN* are not significantly different as in Prop, as well as in *WA* as compared to *LN* (p-value = 0.222 from post-estimation Wald test). Considering all decision periods of Part 2, contributions are significantly higher in all contests as compared to *No-T*. Further, contributions in *WA* are significantly higher than in *Prop* (p-value 0.02 from post-estimation Wald-tests). Differences in contributions between *LN* and *Prop* (p-value = 0.234) as well as between *WA* and *LN* (p-value = 0.827) are not significant. Net transfers are as well not significantly different in *WA* and *LN* as compared to *Prop*, as is the difference between *WA* and *LN* (p-value = 0.18).

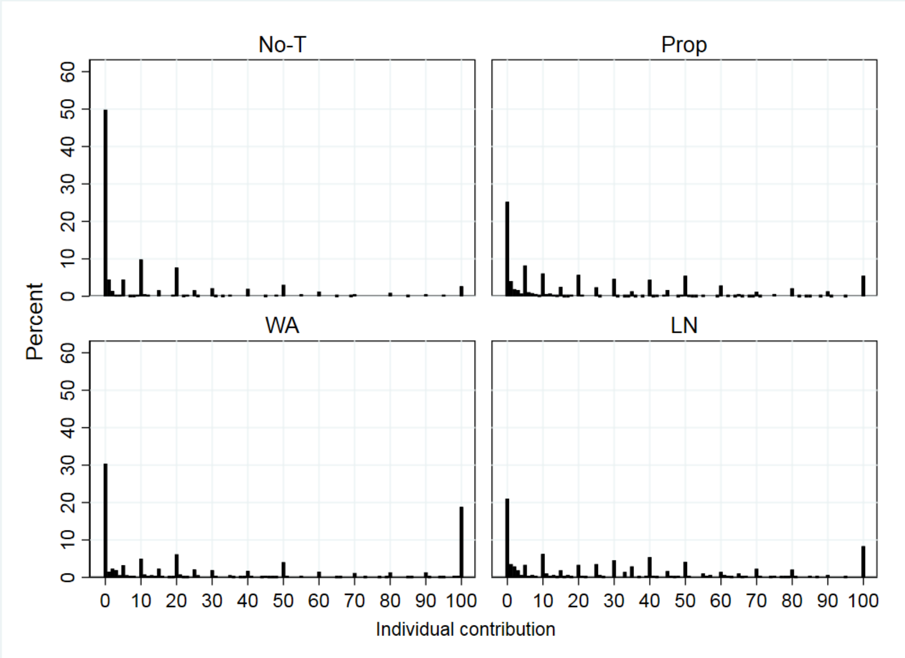

Fig B6. Distribution of insiders' contributions in Part 2 for each treatment.

Table B1. Average expectations of insiders and average transfers offered by outsiders across treatments. Standard errors in parentheses. Within treatment differences based on paired t-tests, denoted by *** p<0.005, ** p<0.05. All reported means and t-tests are computed using one observation per subject, pooled over periods.

Treatment	**Avg. expectation Part 2, in % of endowment**	**Avg. transfers offered Part 2, in % of endowment**	**Difference (avg. exp. – avg. transfers)**
Prop	20.06 (1.36)	15.44 (0.95)	4.62*** (1.15)
WA	26.28 (2.11)	17.54 (1.11)	8.74*** (1.76)
LN	25.10 (2.21)	20.37 (1.41)	4.72** (1.96)

Table B2. Determinants of insiders' behavior in contests, Periods 6-15, controlling for avg. transfers offered. Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1

Dep. Variable: individual contribution in period t, in % of endowment	(I) *Prop*	(II) *WA*	(III) *LN*
other insiders$_{t-1}$	0.156**	-0.166***	0.0278
	(0.0678)	(0.0588)	(0.0781)
avg_transfers$_t$	0.942***	1.136***	0.776***
	(0.165)	(0.167)	(0.141)
avg$_{1-5}$	0.415***	0.420***	0.485***
	(0.125)	(0.0733)	(0.0877)
winner$_{t-1}$	-	6.196	-
		(5.334)	
#winners$_{t-1}$	-	-0.947	-
		(2.284)	
loser$_{t-1}$	-	-	-6.735***
			(1.810)
period	-0.0971	-1.846***	-0.884
	(0.380)	(0.492)	(0.673)
constant	-0.645	27.25***	14.84
	(4.709)	(9.195)	(9.402)
Observations	*840*	*520*	*480*
Number of groups	*21*	*13*	*12*
Number of subjects	*84*	*52*	*48*

Table B3. The effects of winning or losing the contest on the difference in contributions from period t-1 to period t. Robust standard errors in parentheses. *** p<0.005, ** p<0.05, * p<0.1.

Dep. Variable: change in contribution from t-1 to t	(I) *WA*	(II) *LN*
other insiders$_{t-1}$	-0.544***	-0.643***
	(0.0894)	(0.0948)
winner$_{t-1}$	-37.58***	-
	(7.611)	
#winners$_{t-1}$	5.655**	-
	(2.683)	
loser$_{t-1}$	-	17.87***
		(3.925)
period	-3.498***	-2.545***
	(0.496)	(0.602)
constant	61.78***	44.46***
	(9.744)	(8.938)
Observations	*520*	*480*
Number of subjects	*52*	*48*
Number of groups	*13*	*12*

Note: In the *WA* treatment the case of 4 insiders winning did not occur.

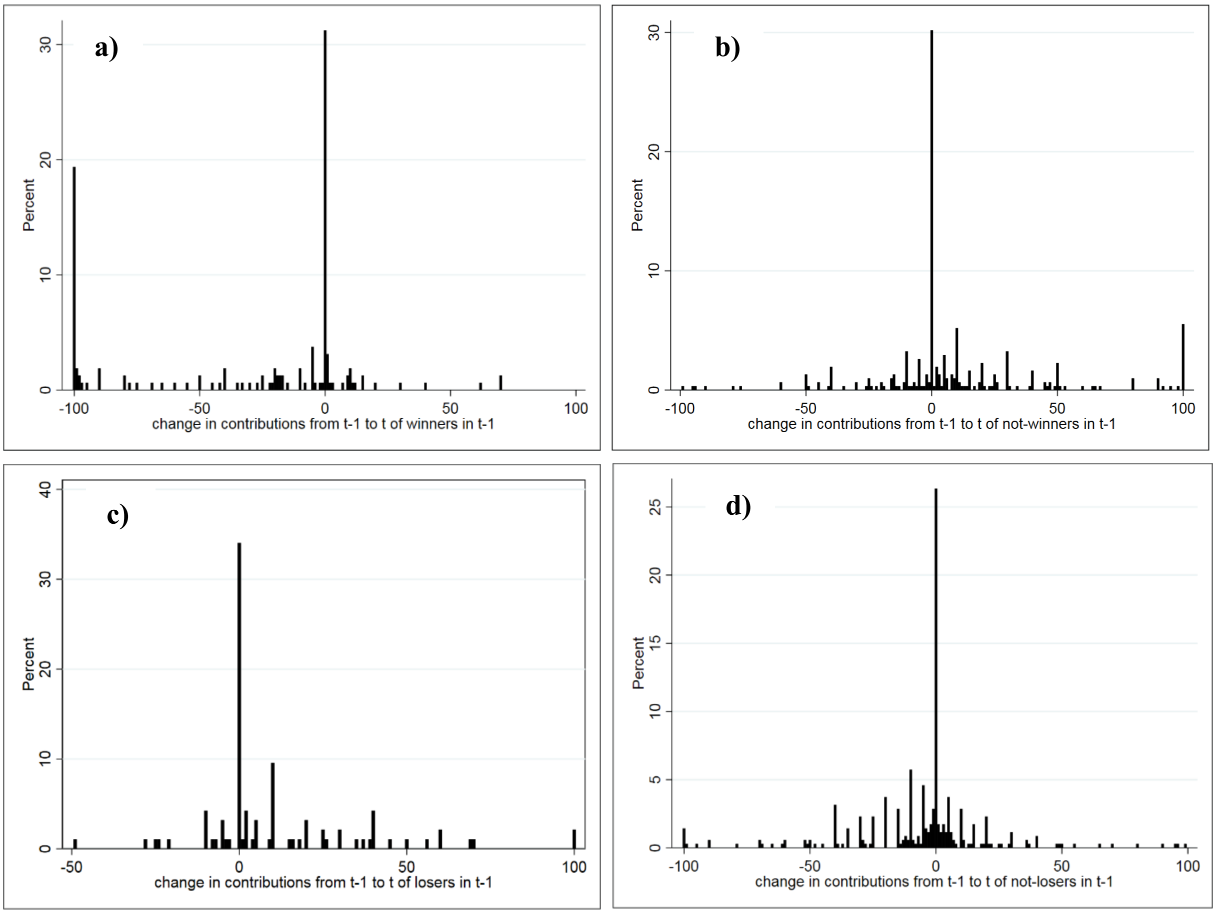

Fig B7. Histogram of change in contributions from t-1 to t of winners in *WA* in t-1 (**Panel a**) and not-winners in *WA* in t-1 (**Panel b**), and losers in *LN* in t-1 (**Panel c**) and not-losers in *LN* in t-1 (**Panel d**), excluding period 06.

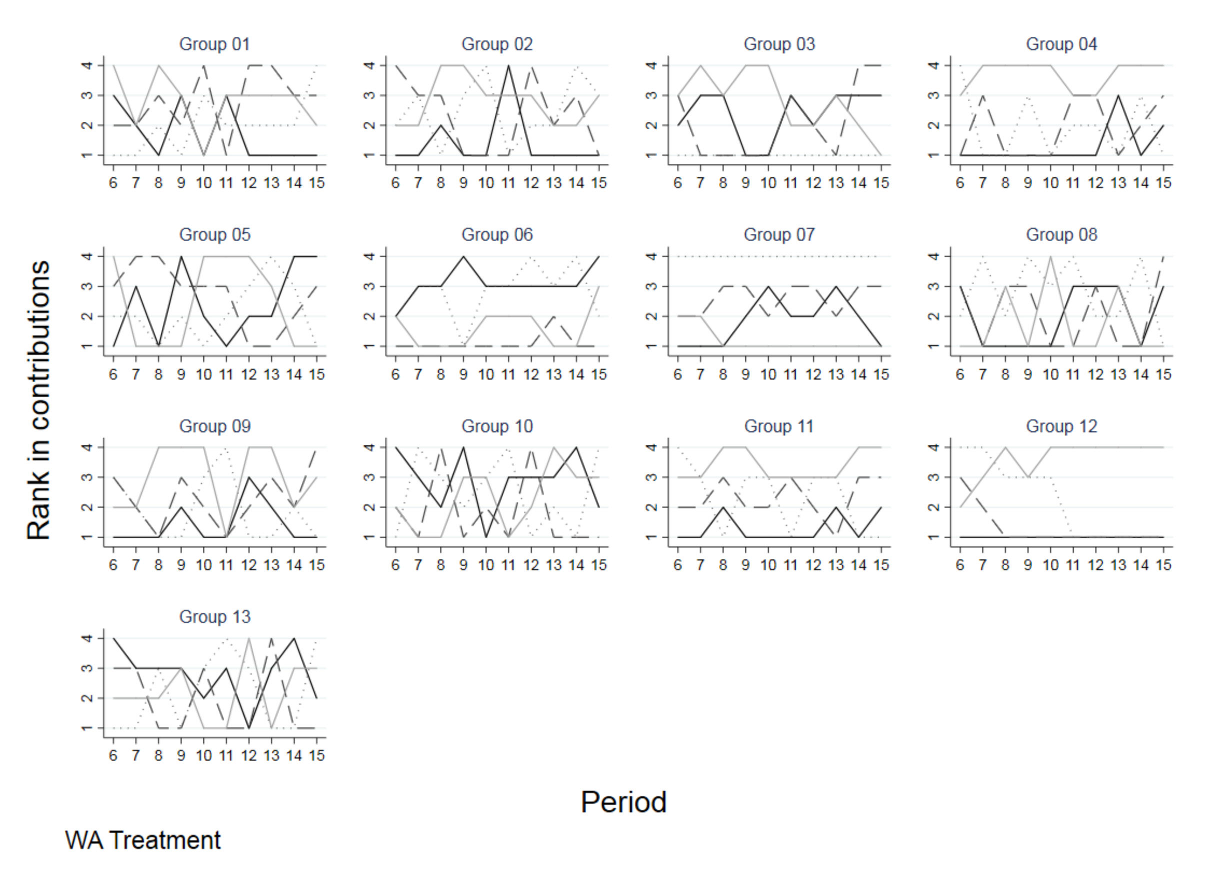

Fig B8. Evolution of insiders' ranks over time, by group in *WA*

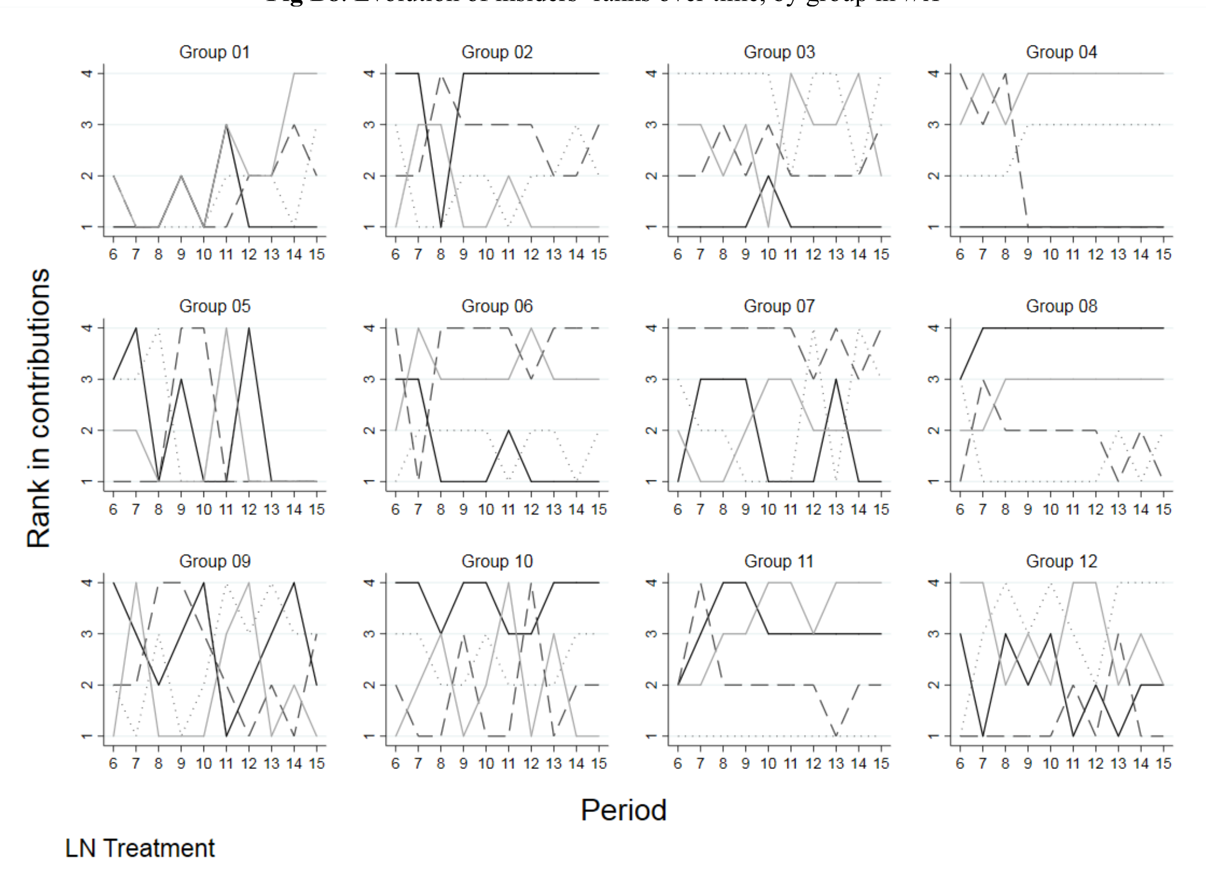

Fig B9. Evolution of insiders' ranks over time, by group in *LN*

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Natalie Struwe, Esther Blanco, James M. Walker

Competition Among Public Good Providers for Donor Rewards

Abstract
We present experimental evidence for decision settings where public good providers compete for endogenous donations offered by outside donors. Donors receive benefits from public good provision but cannot provide the good themselves. The performance of three competition mechanisms is examined in relation to the level of public good provision and transfers offered by donors. In addition to a contest with rewards proportional to effort to all public good providers, we study two contests with exclusion from transfers, namely a winner-takes-all and a loser-gets-nothing. We compare behavior in these three decision settings to the default setting of no-transfers. Results for this novel decision environment with endogenous prizes show that contributions to the public good are not significantly different in the winner-takes-all and loser-gets-nothing settings, but donor's transfers are significantly lower in winner-takes-all. Initially, the winner-takes-all and loser-gets-nothing settings lead to a significant increase in public good contributions compared to the setting where transfers are proportional to contributions for everyone; but this difference diminishes over decision rounds. All three contest with endogenous prizes generate consistent and significantly higher public good provision compared to the setting with no-transfers.

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