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## The Market for Talent: Competition for Resources and Self-Governance in Teams


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# The Market for Talent: Competition for Resources and Self-Governance in Teams

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**Abstract**

In a laboratory setting, we investigate the effect of competition for the resources of team members with 'divided loyalties', and the role of such competition in overcoming the free-rider problem associated with the provision of team-level public goods. We find that competition alone creates 'winners' and 'losers'. However, if groups have access to more information on the actions of team members, or are able to determine their membership through ostracism, they are more successful in attracting the 'loyalties' of team members. By eschewing the study of additional mechanisms that require external intervention or alterations of payoff functions, our work highlights the potential of *implicit* competition in promoting cooperation.

**Keywords**: public goods, experiment, divided loyalties, competition, resources, endogenous membership

**JEL codes**: C72, C91, C92, H41

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## 1. Introduction

Free-riding can be ubiquitous in social dilemma settings, leading to significant inefficiencies in the provision of group public goods (see, for instance, Chaudhuri, 2011). Proposed solutions to raise cooperation levels within groups and teams include, among others, costly sanctioning or punishment (for instance, Ostrom et al., 1992; Fehr and Gächter, 2000) and rewards (Sefton et al., 2007). These solutions however involve the introduction of additional institutions or enforcement mechanisms and beg the question of how these institutions come into being. Moreover, such institutions are not always efficiency-enhancing (see Gächter et al., 2008).

Another stream of literature focuses on the incentive effects of inter-group competition in contests or tournaments between groups that each face a social dilemma. Competition between groups has been found to alleviate, to some extent, the free-rider problem while also increasing efficiency (for instance, Bornstein et al., 1990; Nalbantian and Schotter, 1997; Gunnthorsdottir and Rapoport, 2006; Hargreaves Heap et al., 2015). Such competition, however, requires the introduction of an additional prize (such as monopoly rents) that changes the incentive structure, thus inducing teams to compete. Further, it often requires the intervention of an external 'contest designer'.

By contrast, we examine the effect on group cooperation of competition between teams for the resources provided by individuals who have joint team membership. This form of competition is inherent in many production settings and does not require the imposition of additional mechanisms, changes in the payoff/incentive structures or the intervention of designers.

We begin with the observation that resources that enhance team production are limited and scarce, and teams often compete to attract members who can provide additional resources. Such situations arise naturally when individuals can simultaneously belong to multiple teams. For instance, at the micro level, researchers simultaneously work on multiple projects with different sets of co-authors. Musicians may play in several bands simultaneously. At the macro level, countries often belong to multiple international organisations. Our study is based on the premise that in these situations, group members want to belong to teams that maximise their earnings potential, while teams want individuals to devote (more) resources to them rather than to other teams. Competition, and the possibility of free-riding, is thus inherent in the production process.

One way current members can attract other members to their team is to increase their own input (and hence their output), signaling higher earnings potential in their team. That is, interaction between teams in a naturally occurring 'market for talent' may itself provide a boost to team effort. We ask the following questions: (1) Do team members increase effort when competing for the resources of team members with 'divided loyalties'? (2) How do team members with 'divided loyalties' respond to the efforts of team members across the teams in which they are a member? (3) Does competition for the resources of team members help mitigate the free-rider problem inherent in team production? (4) How are the answers to the questions above related to the level of information team members have about other teams' actions, as well as by the ability to ostracise team members to encourage cooperation?

We use laboratory experiments to examine behaviour in pairs of teams producing independent team-level public goods. Our design captures the divided-loyalties settings described above in a context where all members have the same resource endowments, but a subset of members may belong to multiple groups simultaneously. To isolate the effects of competition, only one individual (referred to as the common-member) is a member of both groups and receives benefits from the public good produced in each group. The other individuals (referred to as dedicated-members) are members of only one of the two paired groups.

The literature has paid little attention to this source of competition and its potential as a solution to social dilemmas. Two recent studies, however, investigate cooperation in settings related to ours. Falk et al. (2013) investigate multiple group membership in team production, where every player belongs to two teams simultaneously, but no two players belong in more than one team together (there is no overlap in team membership). Each player receives separate resource endowments for each team, implying multiple team membership has no implications for within team resources.

Similarly, in McCarter et al. (2014), every member belongs to two teams simultaneously. In their "different" treatment, there is no overlap in team membership, as in Falk et al. (2013). In their "same" treatment, there is perfect overlap in team membership. However, in their treatments, each player receives only one resource endowment that must be shared between the two teams. Note that in these studies, *all* players have 'divided loyalties'. Both studies find that individuals increase contributions to more cooperative groups, but only when there is no overlap between team members.[1]

Our setting is riskier for those with single group membership. Unlike in the above mentioned studies, in our decision settings, dedicated team members do not have the option to 'take their talents' elsewhere. Their only option to increase earnings is to attract the member with 'divided loyalties' to contribute to their team.

We find that, in fixed groups, competition for the resources of the common-member is a mixed blessing, creating 'winners' *and* 'losers'. Particularly, the overall performance of groups in a competing pair crucially depends on initial cooperation levels. Groups that start out with higher cooperation levels successfully attract the 'loyalty' of the common-member, and stem the decline in contributions in their groups usually observed. Common-members reduce contributions to the initially low-performing group. The common-member's switching behaviour has a strong, and lasting, *negative* impact on this group; contributions of dedicated-members decline over time.[2] Thus, competition alone might be insufficient to improve cooperation and performance in *all* teams, particularly in the initially low-performing team.

We next investigate the role of information in augmenting cooperation. When dedicated-members are additionally informed about the common-member's contributions in the *other* group, they can make better decisions on whether he/she is worth competing for. In the presence of such information, we find that common-members increase their contributions and treat both groups equally. The initially low-performing groups recover to a certain extent, with dedicated-members also increasing contributions. However, they still perform worse than the initially better-performing groups, though now only marginally so. Thus, we find that while additional information has some success, there is still room for improvement.

Finally, inherent in many team production settings is the ability of individuals *and* organisations to endogenously decide on their membership. Previous work established the power of the threat of expulsion (Masclet, 2003; Cinyabuguma et al., 2005), the ability to leave one's current team and move to a different team (Gürerk et al., 2006; Ahn et al., 2008, 2009),

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[1] There is a stream of the literature that investigates individuals' choices of investment in multiple public goods (e.g., Cherry and Dickinson, 2008; Bernasconi et al., 2009). Another stream explores investment in a hierarchy of public goods, i.e., local vs. global public goods (e.g., Blackwell and McKee, 2003). However, individuals all belong to the same team and thus these settings do not capture divided loyalties across groups or teams.

[2] We thus observe a spillover in behaviour from one team to the other in a competing pair. For a more general discussion of learning across multiple experimental games, see Bednar et al. (2012), Cason et al. (2012) and Grimm and Mengel (2012).

or a combination of these (Charness and Yang, 2014) to improve team outcomes.[3] Building on the initial decision setting with fixed teams, we also investigate the extent to which endogenous group composition, in the form of ostracism from teams, alleviates inefficiencies in team production when teams compete for resources. We find that ostracism of team members by majority vote enables both teams in a competing pair to stem the decline in cooperation. Initial performance does not dictate overall performance of competing groups and both groups successfully use the threat of expulsion to attract the 'loyalty' of the common-member *and* the dedicated-members. Ostracism allows groups to exclude the least cooperative individuals, thus 'punishing' free-riding.[4]

Section 2 presents our setting with divided loyalties. Section 3 presents a model of reciprocity in this setting, and behavioural hypotheses. Section 4 presents the design of, and results from, our first set of experiments investigating the pure effect of 'divided loyalties' in fixed groups. Section 5 presents experimental results from our second set of experiments investigating the role of information and ostracism on behaviour in the setting. Section 6 concludes. Appendix A in the Electronic Supplementary Material contains our experimental instructions and Appendix B presents additional analyses.

## 2. Team production with divided loyalties

The decision setting studied is a stylised simplification of the earlier field examples where one player is a member of two teams, while other players belong to only one of the two teams. Groups of $n$ subjects participate in a repeated linear public goods game (VCM). Thus, team production is in the form of a local public good that benefits team members. Each individual receives an endowment $e > 0$ that he/she can allocate between a group account ($0 \leq g_i \leq e$) and a private account ($e - g_i$). The return from the private account is one while the return from the group account is a fraction $m$ ($0 < m < 1 < mn$) of the total allocation to the group account by all members of the group, $G = \sum_j g_j$.

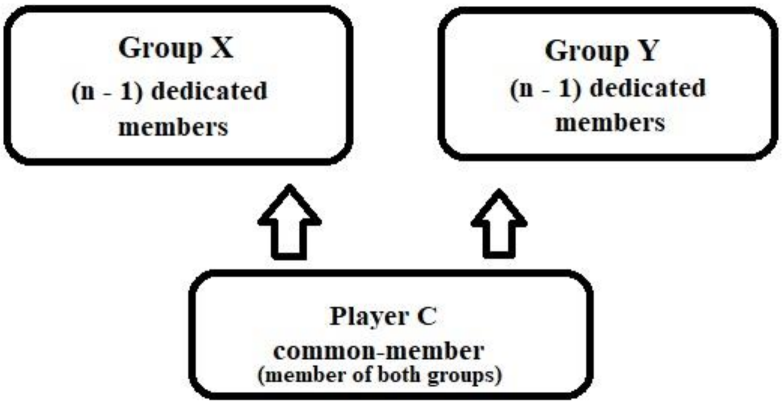
Subjects play identical VCM games in **pairs of two** groups of $n$ members each – Group X and Group Y. As noted above, in the presence of competition, one common-member

[3] In all these works, individuals can only be a member of one team at a time. Hence, they face no divided loyalties as in this study.

[4] An additional treatment was investigated that allowed team members to exit their group in a given decision round. Members almost never exited their groups and no effect was found relative to that observed with fixed groups. Details of this treatment and summary results are reported in Appendix B5.

simultaneously belongs to two groups, while dedicated-members belong to one group. Each Group consists of ($n$ - $1$) 'dedicated members' who belong only to that Group. Additionally, there is one common-member who belongs to both groups. Figure 1 describes the interaction structure in the game.

**Figure 1. Structure of interaction with divided loyalties**




Each of the $2(n-1)+1$ members receives an endowment of $e > 0$. Note that the common-member does not receive an additional endowment for belonging to multiple groups. Within the stage game, contributions by members of groups X and Y impact only their group. That is, there are no direct production spillovers across groups. Each of the $(n-1)$ dedicated members can contribute to, and receive returns from, the public good in his/her group alone. The common-member can contribute to, and receives returns from, the public goods in Groups X and Y.

The payoff of a player $i$ who only belongs to Group X is given by

$$(e - g_{iX}) + m \sum_{j \in X} g_{jX}$$

and the payoff of a player $i$ who only belongs to Group Y is given by

$$(e - g_{iY}) + m \sum_{j \in Y} g_{jY}$$

where $j$ includes the common-member. The payoff of the common-member, $c$, is given by

$$(e - g_{cX} - g_{cY}) + m \sum_{j \in X} g_{jX} + m \sum_{k \in Y} g_{kY}.$$

Based on subjects having own-regarding preferences and an assumption that all players assume each other group member has own-regarding preferences, the unique Nash equilibrium contribution level in the stage game is to contribute 0 tokens to a team's local public good. The unique social optimum (maximizing group income) contribution level is for each player to contribute *e* to the team's local public good. For the common-member, any allocation between the two public goods is socially optimal as long as he/she contributes *e*.

Previous findings, however, show that neither the Nash equilibrium nor the social optimum strictly predicts group behaviour in public goods experiments. Average contributions typically lie between the two extremes (Chaudhuri, 2011). This robust finding is the basis of our first hypothesis.

**Hypothesis 1**: *Average contributions to the public good(s) are positive*.

Based on a model of reciprocity, we next develop behavioural hypotheses specific to our setting.

## 3. Reciprocity in a setting with divided loyalties

Sugden (1984) first formalised a model of reciprocal behaviour in simultaneous voluntary contribution games. This modelling approach has been particularly useful in explaining positive contributions in a wide range of public goods settings. In particular, Croson (2007) compares the behavioural predictions of three models of behaviour – altruism, commitment and reciprocity – in linear VCMs, and finds support only for Sugden's model of reciprocity. We appeal to Sugden's theory of reciprocity to generate testable hypotheses for behaviour in a VCM setting with 'divided loyalties'.

Sugden (1984) introduces the '*principle of reciprocity*' which states that, *in each possible hypothetical subgroup* that a person can be in (with at least one other person), he/she is 'obliged to' contribute at least the minimum of: (i) at least as much as he/she would like everyone in the subgroup to contribute, as long as the others are contributing the same, or (ii) the minimum contribution by the others in the subgroup. The principle itself is neither a description of behaviour nor an appeal to social preferences, but a constraint on behaviour. Thus, individuals choose contribution levels by "maximising their self-interest subject to the principle of reciprocity" (Croson, 2007, p. 204). Note that even though there are several constraints to be met, a player still chooses only one contribution level for the group as a whole.

Sugden (1984) examines reciprocity when there is one group, i.e., when there are no players with divided loyalties. We first present the decision problem for dedicated-members who are reciprocal and then extend the model to reciprocal common-members. A dedicated member's problem can be stated as[5]

$$\max_{g_{iX}} (e - g_{iX}) + m \sum_{j \in X} g_{jX}$$

subject to

$$g_{iX} \geq \min\{g^{O}_{ilX}, \; g^{l}_{jX} \; \forall \, j \in l\} \, \forall \, l \subseteq X$$

$$\text{and } g_{iX} \leq e,$$

where $g^{O}_{ilX}$ is the member's preferred (optimal) contribution level for all members (including him/herself) in each sub-group $l \subseteq X$ to which the member can belong. A player's preferred optimal contribution in a sub-group is defined as his/her utility maximising contribution level, assuming the contributions of all other members of the sub-group are the same (Sugden 1984, p. 777). In the linear VCM setting, assuming a monotonic relationship between wealth and utility, Croson (2007) shows that a player's preferred contribution is the entire endowment (the group payoff maximizing contribution) as long as public good provision is socially optimal for the subgroup (Croson 2007, p. 202, footnote 6). In our setting, an MPCR of 0.6 ensures that contribution is socially optimal in the smallest possible sub-group of two players. Note that since the optimisation problem that determines $g^{O}_{ilX}$ is carried out independently for each sub-group, players will also prefer 100% contribution in *each* sub-group. Hence $g^{O}_{ilX} = e \; \forall \, l \subseteq X$ and $\forall \, i \in X$. In a single-group setting, it is feasible to prefer contributions that are 100% of endowment, and to also achieve this goal.

The common-member's decision (assuming he/she follows the principle of reciprocity), can be described by

$$\max_{g_{cX}, \, g_{cY}} (e - g_{cX} - g_{cY}) + m \sum_{j \in X} g_{jX} + m \sum_{k \in Y} g_{kY}$$

subject to

[5] For brevity, we only state the problem for a member of Group X. The problem for a member of Group Y is symmetric.

$$g_{cX} \geq \min\{g^{O}_{clX},\ g^{l}_{jX}\ \forall\ j \in l\}\ \forall\, l \subseteq X$$

$$g_{cY} \geq \min\{g^{O}_{cpY},\ g^{p}_{kY}\ \forall\ k \in p\}\ \forall\, p \subseteq Y$$

$$\text{and } g_{cX} + g_{cY} \leq e,$$

where $l$ and $p$ are subgroups of $X$ and $Y$ to which the common-member can belong, and $g^{O}_{clX}$ and $g^{O}_{cpY}$ are the common-member's utility-maximising preferred (optimal) contribution levels for all members (including him/herself) in sub-groups $l$ and $p$ of Groups $X$ and $Y$ respectively. The third constraint is the resource constraint faced by the common-member. Once again, the fact that the optimisation problems which determine the common-member's preferred contributions in each sub-group are carried out independently for each sub-group implies that $g^{O}_{clX} = e\ \forall\, l \subseteq X$ and $g^{O}_{cpY} = e\ \forall\, p \subseteq Y$.

Note that, like dedicated-members, it is feasible for common-members to attain their preferred contributions in one Group, under the same full contribution scenario. However, unlike dedicated-members, it is not possible for common-members to attain their preferred contribution levels in all Groups of which they are a member. Full contributions by all members in one of the Groups implies that the common-member's contribution in the other Group *will* be zero. That is, while preferred contributions are 100% in every sub-group, the common-member's actual contributions are subject to the resource constraint.

The above implies that in our linear setting, for both dedicated- and common-members, contributions are not constrained by their preferred contribution level, as this is always 100% of endowment in each sub-group. The binding constraint is thus likely to be the contribution of others, i.e., the requirement that they are never obliged to contribute more than the minimum contribution of others in the sub-group. Thus, players' contributions react only to the observed contributions of other players in the (sub-) group. We use this implication of the theory of reciprocity to generate testable hypotheses in our setting.

### 3.1 Contributions of the common-member

Hypothesis 1 implies that there is at least one subgroup in each Group where a player makes positive contributions to the public good. The first two constraints for a reciprocal common-member state that he/she must meet his/her obligations in all subgroups. Thus, the common-member cannot completely ignore either Group.[6]

**Hypothesis 2**: *The common-member's contributions are positive in both Groups X and Y.*

Suppose player $j$ is the player with the minimum contribution in the sub-group. As mentioned above, a player's contribution is only constrained by that of another player. Thus, if player $j$'s contribution increases, player $i$ ($i \neq j$) is obliged to increase his/her own contribution in response. Note that if, instead, player *i* were the player with the minimum contribution in the sub-group, he/she would already be obliged to increase his/her contributions to match that of another player *j* with a higher contribution than his/her own. Thus, an implication of the theory of reciprocity is conditional cooperation; reciprocal individuals' contributions are positively correlated with the contributions of others in their group, i.e., $\partial g_{iX}/\partial g_{jX} > 0$ for some $j \neq i \in X$ (and similarly for Group *Y*). In a setting without divided loyalties, Croson (2007) tests, and finds support for, this comparative statics prediction. More broadly, this is a robust finding in the VCM literature. Group members are often conditional co-operators, where contributions are increasing in the contributions of the other group members (e.g., Fischbacher et al., 2001 and Kocher et al., 2008).

In our setting, conditional cooperation implies a shifting of the common-member's loyalty (i.e., resources) from one Group to the other. This is because a higher contribution by even one individual raises the common-member's obligation in the subgroup with that individual. To meet this obligation, his/her contribution in the Group with that individual must increase. That is, he/she must contribute more in the Group with higher contributions by dedicated-members (henceforth, *HighC* groups). Conversely, the common-member's obligations in the other Group (the group with lower contributions by dedicated members – henceforth, *LowC* groups) are lower, thus leading to lower contributions in that Group. Note that subjects receive feedback on others' contributions only after the first decision round. Thus, this argument only applies from the second round onwards. This gives our next prediction.

**Hypothesis 3**: *Following the first decision round, the common-member will contribute more to the Group with higher contributions by dedicated members*.

[6] Based on the endowment constraint, the hypotheses that follow presume contributions will be below 100% of the endowment.

### 3.2 Contributions of dedicated-members

Hypothesis 3 implies that, following the first decision round, the common-member favours one of the two Groups. That is, by increasing (decreasing) his/her contributions in one Group (the other Group), he/she is increasing (decreasing) obligations for dedicated-members in that (the other) Group, at least in the subgroup that includes him/her. The implication is that contributions would increase (decrease) in the Group that he/she favours (does not favour). This gives our next hypothesis.

**Hypothesis 4 (Dedicated-member's conditional cooperation)**: *Contributions of dedicated-members in Groups X and Y will tend to diverge*.

The previous three hypotheses only require reciprocal players to follow the principle of reciprocity. They do not depend on other group members also being reciprocal. If, however, players expect others to be reciprocal as well, they can then use their choices to influence the choices of others in their (sub-) Group. In particular, they can increase the contribution obligations of other players by increasing their own contributions to the public good. It is under this circumstance that reciprocity predicts that competition for 'talent' can increase effort. Dedicated-members can increase their effort in an attempt *to oblige* the reciprocal common-member to increase effort in their Group. The logic of dedicated- members competing for the resources of the common-member provides Hypothesis 5 as an alternative to Hypothesis 4.[7]

**Hypothesis 5 (Competition for the common-member)**: *Contributions of dedicated-members in Groups X and Y will tend to converge*.

## 4. Contributions in the presence of divided loyalties

### 4.1 Experimental design and procedures

Treatment *CM* implements the above setting with divided loyalties. Group X and Group Y consist of two dedicated members each, while one common-member is a member of both Groups, i.e., $n$ = 3. Each of the five players receives a per-period endowment of 20 tokens. Players simultaneously choose how many tokens to contribute to their respective group

[7] Motivations for individual behaviour as captured by reciprocity are independent of the number of players or groups. Our hypotheses can be extended to cases with multiple common-members and to cases where the common-member is a member of more than two Groups. A discussion of these extensions is reported in Appendix C.

accounts and how many to retain in their private accounts. As is the standard, although the experimental instructions used neutral language, we refer to allocations to the group account as contributions to the group public good (hereafter as "contributions").

Each token retained in the private account yields a return of 1 token to the individual. Each token contributed to the public good yields a return of 0.6 tokens to each non-excluded group member, i.e., MPCR = $m$ = 0.6. Note that only the common-member can contribute to the group account in both Groups, and thus receive group returns from both Groups. Subjects interact repeatedly for $T$ = 20 decision rounds, and this is public information provided before the first decision round.

The treatment *No-CM* is designed to contrast behaviour in *CM*. In *No-CM,* groups of $n$ = 3 members play independent VCM games, where all three members belong to only one Group, and no information is shared across Groups.

After all subjects make contributions decisions, each member is informed of the total allocation to the group account and individual contributions of all members in the group. Common-members receive this information for both Groups while dedicated-members receive information only for their Group. Importantly, dedicated-members are not informed of the common-member's contribution (or those of dedicated-members) in the other Group.

Subjects' individual contributions are identified by ID letters that are assigned randomly at the beginning of the experiment and then remain fixed throughout the session. In *CM*, subjects are assigned IDs A through E. Group X is composed of members A, B and C while Group Y is composed of members C, D and E. Thus, Member C is the common-member. In *No-CM*, each independent group is composed of members A, B and C. In addition, subjects are shown a history table with the total allocation to the group account in all previous rounds. The common-member receives this information for Groups X and Y.

All sessions are conducted at the University of South Dakota using student subjects. No subject participated in more than one session of the experiment, i.e., a between-subject design.[8] At the beginning of each session in *CM*, subjects are randomly divided into groups of five, with the role of common or dedicated members and assignment to Groups X or Y also being determined randomly. In *No-CM*, subjects are randomly divided into groups of three. Groups and roles within groups remained fixed throughout a session.

[8] Sessions for each treatment were conducted at different times of the day to minimize systematic timing effects.

Subjects received printed instructions that they read at their own pace. To ensure that important elements of the game were common information to all subjects, an experimenter also read aloud a pre-prepared summary of the instructions. Before the experiment could begin, all subjects had to correctly answer a quiz that tested their understanding of the game and calculation of payoffs. At the end of the 20 rounds in a session, subjects answered a short demographic questionnaire.

The experiment was programmed in z-Tree (Fischbacher, 2007). A total of 60 subjects (12 independent paired-groups of five players) participated in *CM*, and 30 subjects (10 independent groups of three players) participated in *No-CM*. Subjects were paid their token earnings from all 20 rounds. Token earnings were converted to cash at the rate of 30 tokens to US$1. Each session lasted approximately 60 minutes and subjects earned an average of $19.48 (min = $11.85, max = $38.31, st. dev. = 3.89). Subjects were not paid a separate show-up fee.

**4.2 Results**

The discussion of results is based on the order of the hypotheses presented above, with additional results that complement the results related to the hypotheses. When making comparisons across treatments, unless otherwise stated, p-values are reported from two-sided Wilcoxon *ranksum* tests (RS). When making comparisons within treatments, p-values are reported from two-sided Wilcoxon *signrank* tests (SR) for zero difference. In both cases, an independent observation is the average value of the relevant variable of interest. The number of observations in each *ranksum* test is the combined number of groups/pairs in the treatment comparisons, while *signrank* tests depend on the number of groups/pairs within a treatment. All results are supported by regression analysis. However, for the sake of brevity, we do not report all regression results. They are available upon request.

*LowC* (*HighC*) groups in a pair are defined as those with lower (higher) combined contributions by dedicated-members in the **first round**.[9] In *CM*, groups that had lower contributions in the first round also had lower average contributions over all 20 rounds in 92% of pairs.[10]

[9] There were two pairs in *CM* where group contributions were tied in the first round. For these pairs, the tie-breaking rule for determining *LowC* (*HighC*) was lower (higher) group contributions by dedicated-members in the second round. There were no ties in the second round. Further, for these two pairs, the group with higher contributions in the second round also had higher contributions across all additional rounds. In addition, there are no systematic effects of the group labels (X and Y). Pooling across all pairings in *CM*: mean contribution in Group X = 23.35 tokens (st dev = 12.31), mean contribution in Group Y = 25.78 tokens (st dev = 17.18), SR $p > 0.10$.

[10] An alternative check for the robustness of the definition of *LowC* (*HighC*) is to check the percentage of rounds in which group contributions for *HighC* were greater than or equal to *LowC*. These percentages are very similar to the pair percentages across all rounds in *CM*: 86% of rounds.

**Figure 2. Average individual contributions in *CM***

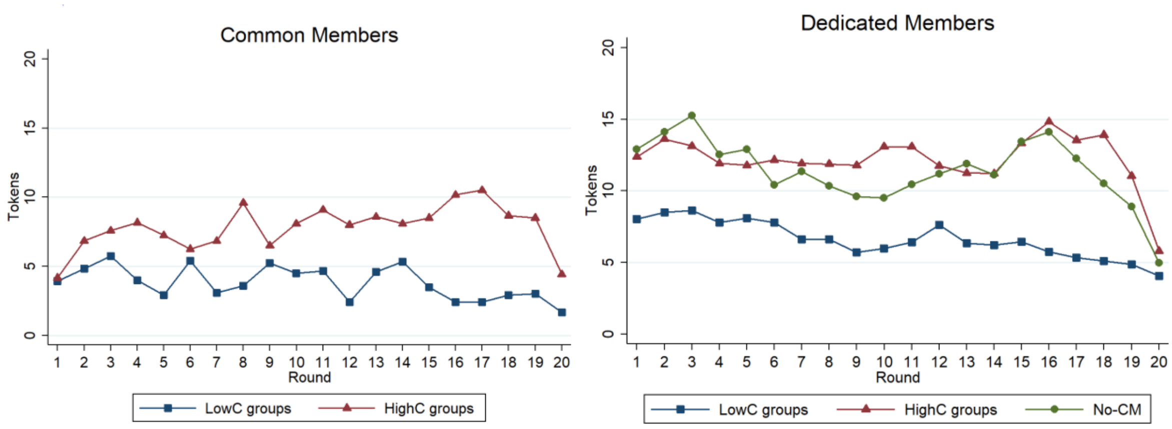



Figure 2 presents time trends of average individual contributions in *LowC* and *HighC* groups by common-members (left panel) and dedicated-members (right panel) in *CM*. For purposes of comparison, the right panel also presents average individual contributions in *No-CM*. As can be seen, common-members and dedicated-members in *CM* and members in *No-CM* contribute positive amounts on average throughout the game.

**Table 1. Average (st dev) individual contributions in *CM***

| | ***CM*** **(12 (X, Y) pairs)** | | | | ***No-CM*** |
|---|---|---|---|---|---|
| | **Common-member** | | **Dedicated-members** | | **(10 groups)** |
| **Round** | ***HighC*** | ***LowC*** | ***HighC*** | ***LowC*** | **All members** |
| **First** | 4.17 | 3.92 | 12.38 | 8.04 | 12.90 |
| | (3.66) | (3.68) | (2.87) | (3.43) | (3.72) |
| **Second** | 6.83 | 4.83 | 13.63 | 8.50 | 14.1 |
| | (3.61) | (3.56) | (4.66) | (4.84) | (4.06) |
| **All 20** | 7.79 | 3.81 | 12.17 | 6.59 | 11.39 |
| | (6.50) | (5.13) | (6.46) | (6.03) | (5.86) |

Table 1 presents summary statistics of individual contributions of common-members and dedicated-members in both groups in *CM,* as well as for group members in *No-CM*. Average contributions in the first round, the second round, and over all rounds are positive for all roles, and tests show that they are significantly greater than zero (SR $p < 0.01$ in all cases). Thus, as in previous studies using the VCM setting, we find support for Hypothesis 1.

**Result 1**: *Average contributions are positive in both groups in CM and in groups in No-CM.*

The left panel of Figure 2 and Table 1 show that common-members do not completely abandon either group. As mentioned above, contributions are significantly greater than zero in both groups. Thus we find support for Hypothesis 2.

**Result 2**: *The common-member's contributions are positive in both HighC and LowC groups.*

Based on reciprocity, contributions of the common-member in each group depend on his/her obligations in each group and subgroup. In Group X, the common-member is a member of three subgroups: {A, C}, {B, C} and {A, B, C}, and analogously for Group Y. The common-member must meet his/her obligations in each of these subgroups. However, as mentioned above, he/she must choose only one contribution for the whole Group. Thus, following Croson (2007), we use the average contribution of the two dedicated-members in the group as a proxy measure of the obligations of the common-member.[11]

Figure 2 shows that common-members start out in round 1 by contributing, on average, an equal amount of about 4 tokens to the public good in both groups. In the remaining rounds, common-members contribute a lower amount (around 3 tokens) to the *LowC* groups. On the other hand, they increase contributions to around 7-8 tokens in the *HighC* groups. Table 1 confirms these patterns. There is no significant difference in the contributions of the common-member between *LowC* and *HighC* groups in the first round (SR $p = 0.496$). However, average contributions of the common-members are significantly higher in *HighC* groups than in *LowC* groups in the second round (SR $p = 0.027$), and in all 20 rounds overall (SR $p = 0.054$).[12] Thus, we find support for Hypothesis 3.

**Result 3**: *In CM, common-members on average contribute similar amounts to the public good in Groups X and Y in the first round. In the remaining rounds, common-members' average contributions are higher (lower) in the HighC (LowC) groups.*

Figure 2 and Table 1 show that contributions of common-members are lower than those of dedicated-members in both *LowC* and *HighC* groups. This difference in average (over all 20 rounds) contributions is statistically significant for *HighC* (SR $p = 0.003$) and *LowC* (SR p =

[11] Average contributions of the two dedicated-members within each group are not significantly different from each other in Group X (A vs. B: $p = 0.5829$) or in Group Y (D vs. E; $p = 0.6949$), suggesting that using the average contribution of the two dedicated-members in either Group is reasonable.

[12] To check the consistency with which common-members contributed equal or greater amounts to the *HighC* groups than to the *LowC* groups in their pairs, we compared average contribution decisions across all rounds (excluding the first round). Common-members in *CM* contributed equal or greater amounts to the *HighC* groups than to the *LowC* groups in 75% of all decisions.

0.002) groups. Although common-members make positive contributions to both groups, common-members free-ride to some extent on the contributions of dedicated-members.[13]

**Result 4**: *Average contributions of common-members in CM are lower than the contributions of dedicated-members in both LowC and HighC groups.*

Result 4 is similar to the finding in van Leeuwen et al. (2018) who study public goods games where group members have heterogeneous 'power'. In their *Centrality* treatment, one group member (the central player) connects two otherwise separate sub-groups, enabling the group as a whole to create a larger public good and thus generate greater surplus. They find the central player takes advantage of his position and contributes less than other members of the group. In *CM*, common-members receive returns from both groups while dedicated-members receive group returns only from their own group. In this sense, common-members enjoy a 'privileged position' relative to dedicated-members. Result 4 suggests that common-members, as in van Leeuwen et al. (2018), take advantage of their position. Note that their total contribution in both groups is 11.6 tokens on average (over all 20 rounds), well below their endowment of 20 tokens.[14] Thus, on average, their endowment is not a binding constraint for contributions, suggesting they have opportunities to increase contributions in both groups.

Turning to the contributions of dedicated members, Figure 2 shows that contributions of those in *HighC* groups are sustained at between 12-14 tokens each throughout the game, except for the last round. However, contributions of dedicated-members in *LowC* groups in the first round are about 8 tokens, but they decrease to about 4 tokens each by round 20. The summary statistics presented in Table 1 confirm these observations. SR tests show that there is a significant difference in average contributions of dedicated-members in *LowC* and *HighC* groups in the first round ($p = 0.003$), in the second round ($p = 0.005$), and in all 20 rounds overall ($p = 0.008$). Contributions of dedicated-members in *HighC* and *LowC* groups diverge over time. Thus, we find evidence in support of Hypothesis 4, and against Hypothesis 5.[15]

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[13] To check the consistency with which common-members contributed less than dedicated-members in their groups, we compared average contributions across all rounds (excluding the first round). Common-members in *CM* contributed less than dedicated-members in 83% of all decisions in *HighC* groups and in 100% of all decisions in *LowC* groups.

[14] The average contribution of common-members is not significantly different from the average contribution of 12.17 tokens by dedicated-members in *HighC* groups (RS $p > 0.10$).

[15] See Appendix B1 for individual regressions exploring differences in contribution behaviour. The regressions support the results of the aggregate tests reported here.

**Result 5**: *After the first round, average contributions of dedicated-members in HighC groups in CM are stable at higher levels throughout the game. Average contributions of dedicated-members in LowC groups decline steadily over time.*

The above Results suggest that, in *CM*, there is path dependence in the contributions of common and dedicated-members. On average, members of groups that *start out* with higher (lower) contributions continue to contribute higher (lower) amounts in their groups in the rest of the game. The Results lend support to the conditional cooperation Hypothesis 4 (similar to McCarter et al., 2014); common-members 'switch their loyalty' away from *LowC* groups, and these reductions in the contributions of the common-member are met with reductions by dedicated-members.

The combination of higher (lower) contributions by both common and dedicated-members implies that *group contributions* are likely to be higher (lower) in *HighC* (*LowC*) groups throughout the experimental session. A SR test confirms that average group contributions (over all 20 rounds) are significantly higher in *HighC* than in *LowC* groups (32.13 tokens vs. 17.00 tokens; SR p = 0.010). Further, neither is higher than group contributions in *No-CM*. See Appendix B2.1 for an analysis of group contributions.

Finally, Figure 2 and Table 1 show that the contributions of dedicated-members in *HighC* groups are not significantly higher than contributions of members in *No-CM*. However, contributions of dedicated-members in *LowC* groups are significantly lower than contributions in *No-CM* (p = 0.0068). These two results suggest further evidence of the effects of conditional cooperation. In all treatments, each subject was endowed with 20 tokens each decision round, thus common-members must divide their endowment between groups in order to make contributions in both groups. Even prior to round 1 decisions, it appears that dedicated members anticipated this limitation on a common-member's contributions and lowered their contributions relative to group members in No-CM. This effect is magnified across decision rounds as contributions in *LowC* groups decline at a faster rate than *HighC* groups. Thus, in the presence of divided loyalties in *CM*, individual contributions do not increase relative to levels observed in the groups of *No-CM*. It is in this sense that we do not find support for Hypotheses 5 that competition for the common-member in the *CM* treatment will lead to more cooperation.

## 5. Accentuating reciprocity: information and ostracism

Competition for the resources of the common-member has the potential to sustain cooperation in teams. However, based on the results presented above, this potential is realised in only one group in the pair, i.e., it creates clear 'winners' and 'losers'. Moreover, initial performance determines which group benefits from the competition. Thus, the above results suggest that, even in the presence of competition between groups, there is room for improvement. As seen in *CM*, the common member's contributions are significantly lower than the dedicated members' contributions in both *HighC* and *LowC* groups. In particular, despite having a single endowment to divide between the two groups, on average the common-member has the resources to increase contributions to each group in order to decrease the difference between his/her contributions and the contributions of the dedicated members in the *HighC* and *LowC* groups.

The hypothesis that competition increases cooperation in both groups (Hypothesis 5) relies on players knowing that the common-member is reciprocal. It is only under this circumstance that dedicated-members can raise their contributions anticipating that this will lead to increased contributions by the common-member. We next consider two mechanisms that have the potential to allow dedicated-members some insight into the common-member's reciprocity. The first gives dedicated-members information on the common-member's contribution in the both groups. The second is stronger, and allows group members to 'enforce' reciprocity in their groups – players can exclude other group members from their group by majority voting.

### 5.1 Additional information on the common-member

The between-group information available to dedicated-members in *CM* was limited. In particular, they could only observe the contributions of the common-member and the other dedicated-member in their own group. They could not observe the common-member's *total* contribution in both groups. If dedicated-members knew the common-member's total contribution, they would have more complete information on his/her contribution 'type'. If his/her contributions were known to be high, particularly in the other group, dedicated-members might reasonably conclude that he/she was reciprocal, and might therefore be encouraged to contribute higher amounts in their group in response to higher contributions by dedicated-members.

This information about the common-member's contribution is thus potentially crucial to allow dedicated-members to draw inferences on whether the common-member is worth competing for. In this sense, information transparency concerning the common member's contributions weaken the common member's 'privileged position'. Relative to the dedicated members, the common-member no longer has an information advantage on contributions. This could lead to higher contributions by the common member.

To remove the asymmetric information surrounding the common member's contributions, we created an additional treatment, *CM-Info*. In this treatment, the common member's contributions to both groups are observed by all dedicated members. This was the only change relative to *CM*. As in *CM*, dedicated-members in *CM-Info* did not receive any information on the contributions of dedicated-members in the other group. In *CM-Info,* data was collected on 10 (X, Y) pairs (a total of 50 subjects).

As in the analysis of *CM*, *LowC* (*HighC*) groups in a pair are defined as those with lower (higher) combined contributions by dedicated-members in the **first round**.[16] In *CM-Info*, groups that had the lower contributions in the first round also had the lower average contributions over all 20 rounds in 90% of the (X,Y) pairs.[17]

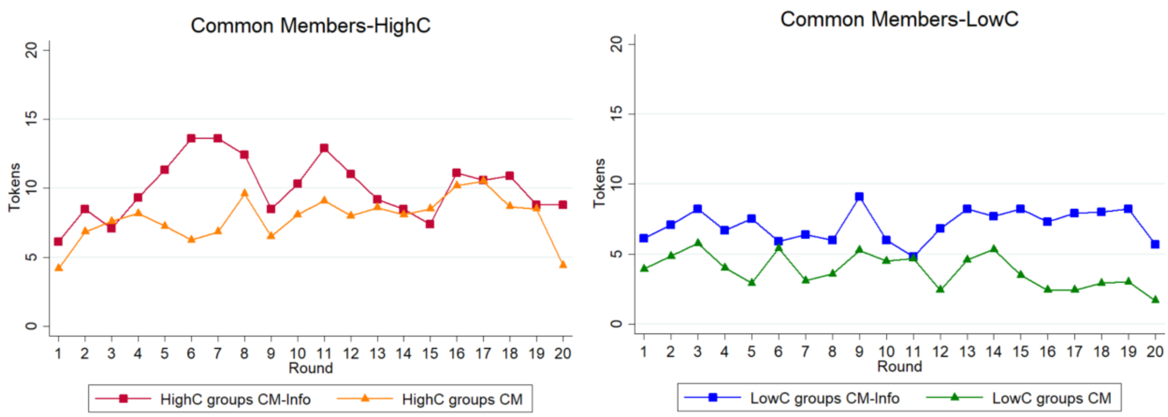
Figure 3 (a) displays average individual contributions over time by common-members in *HighC* groups (left panel) and in *LowC* groups (right panel). For purposes of comparison, the figure also presents the corresponding information from *CM*. Figure 3 (b) presents the contribution trends for dedicated-members. Table 2 presents average individual contributions by common- and dedicated-members in *HighC* groups and *LowC* groups in *CM-Info*.

[16] As with *CM*, there are no systematic effects of the group labels (X and Y). Pooling across all pairings in *CM-Info*: mean contribution in Group X = 26.28 tokens (st dev = 12.49), mean contribution in Group Y = 28.03 tokens (st dev = 15.42), SR $p > 0.10$.

[17] An alternative check for the robustness of the definition of *LowC* (*HighC*) is to check the percentage of rounds in which group contributions for *HighC* were greater than or equal to *LowC*. These percentages are similar to the pair percentages across all rounds in *CM*: 77% of rounds.

**Figure 3. Average individual contributions in *CM-Info***

**(a) Common-members**




**(b) Dedicated-members**

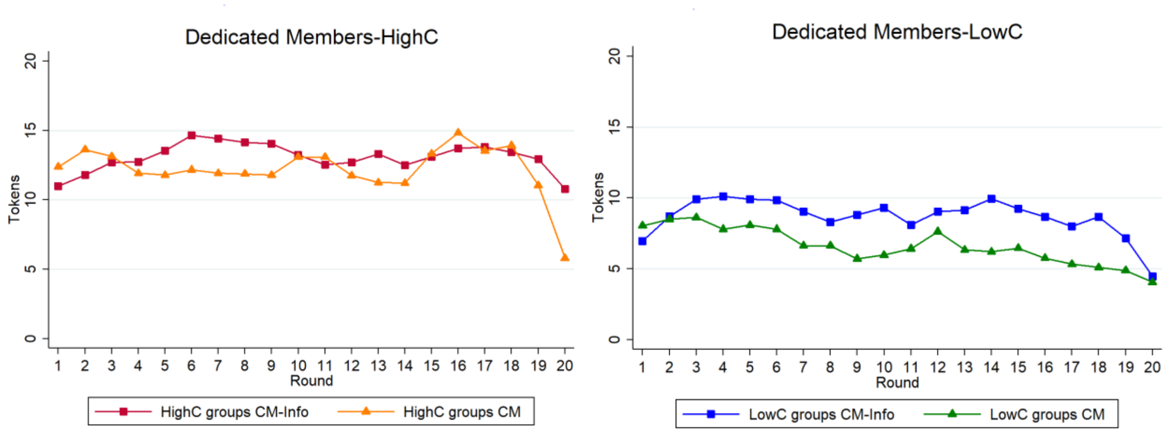



**Table 2. Average (st dev) individual contributions in *CM-Info***

| | CM-Info - 10 (X, Y) pairs | | | |
|---|---|---|---|---|
| | Common-member | | Dedicated-members | |
| **Round** | **HighC** | **LowC** | **HighC** | **LowC** |
| **First** | 6.10 | 6.10 | 11.00 | 6.95 |
| | (3.00) | (3.14) | (4.71) | (4.26) |
| **Second** | 8.50 | 7.10 | 11.80 | 8.70 |
| | (4.67) | (3.54) | (4.90) | (4.04) |
| **All 20** | 10.00 | 7.09 | 13.06 | 8.66 |
| | (5.52) | (4.80) | (5.31) | (6.05) |

As in *CM,* the common-member in *CM-Info* pairs contributes positive amounts to both groups. Further, as in *CM*, average contributions of the commom member over all 20 rounds are higher in *HighC* groups than in *LowC*. However, unlike in *CM*, this difference is not significant in *CM-Info* (SR p = 0.1688). Thus, on average, relative to *CM,* the common-member in *CM-Info* discriminates less between groups in the presence of information about his/her overall contributions. In the presence of information, we do not find strong support for Hypothesis 3.

**Result 6**: *Unlike in CM, the common-member contributes similar amounts to HighC and LowC groups in CM-Info.*

Relative to *CM*, the common-member's average contributions are slightly higher in *HighC* groups in *CM-Info* (10 vs. 7.79 tokens), but the difference is not statistically significant. However, the common-member's average contributions (over all 20 rounds) are significantly higher in *LowC* groups in *CM-Info* than in *CM* (7.09 vs. 3.81 tokens; RS p = 0.0479). The common-member's total contributions to both groups are also significantly higher in *CM-Info* than in *CM* (17.09 vs. 11.6 tokens; RS p = 0.0192).

**Result 7**: *The common-member's contributions to LowC groups and to both groups combined are higher in CM-Info than in CM.*

Further, while common-members' contributions are lower than those of dedicated-members, the difference is only marginally significant in both *HighC* and *LowC* groups (SR p = 0.0745 and 0.0926 respectively). Note, however, the endowment constraint on common-members is becoming somewhat of a factor in the ability of common-members to significantly increase their contributions. On average, the common-member is now contributing an average of 17.09 tokens in total, just over 84% of their endowment. Thus, information successfully raises contributions by common-members to near 100%.[18]

Average contributions (over all 20 rounds) of dedicated-members in *HighC* groups are still higher than in *LowC* groups, and this difference is significant (SR p = 0.024). Once again, *HighC* groups sustain contributions throughout, while contributions decline over time in *LowC* groups. Thus, even in the presence of additional information, we find support for Hypothesis 4, and not Hypothesis 5.

[18] Common-members in *CM-Info* contribute their entire endowment of 20 tokens in 124 out of 200 decisions (62%). One common-member contributed all 20 tokens in all 20 rounds, and 6 out of 10 common-members contributed at least 18 tokens on average over the 20 rounds.

Relative to *CM*, contributions of dedicated members in *HighC* groups are no different in *CM-Info*. While the decline is much less pronounced, and contributions are higher in *LowC* groups in *CM-Info* than in *CM*, the difference is not significant (RS p = 0.3912).

**Result 8**: *Average contributions of dedicated-members are higher in HighC groups than in LowC groups in CM-Info. The contributions of dedicated-members in CM-Info relative to CM are not significantly different in HighC and LowC groups.*

Thus, the additional information in *CM-Info* is unsuccessful in leading to a significant increase in the contributions of dedicated-members, particularly in *LowC* groups. It does, however, lead to a significant increase in contributions of common-members. Further, at the group level, unlike in *CM*, the difference in contributions between *HighC* and *LowC* groups is only marginally significant (36.11 vs. 24.42 tokens; SR p = 0.0593). See Appendix B2.2 for an analysis of group contributions in *CM-Info*.

### 5.2 Ostracism by majority voting

Inherent in many team production settings is the opportunity for individuals *and* organisations to endogenously decide on their membership. Previous work established the power of the threat of expulsion to improve team outcomes (Masclet, 2003; Cinyabuguma et al., 2005).[19] Group members can be ostracised for not contributing 'sufficiently' to the public good, i.e., for not reciprocating others' contributions. Thus, ostracism can be a powerful tool to ensure that group members act reciprocally. By helping to reduce the uncertainty related to the reciprocity of other members, ostracism has the potential to raise contributions by all members in a group.

In *CM-Ostracism*, we retain the information structure from *CM*, i.e., dedicated-members only see the contribution of the common-member and dedicated-members in their own groups. However, we add an additional stage to each round. In this second stage of each round, group members anonymously vote, at zero cost, whether or not they want to exclude *other* members of the group. Any group member who receives at least 50% of possible exclusion votes is then excluded from the group in the next round. The common-member votes in both groups and thus can also be excluded from both groups. An ostracised member cannot make a contribution decision or vote in the next round, and also does not receive earnings from the group account in that round. This member simply retains his/her endowment. The group members who are

[19] In all these works, individuals can only be a member of one group at a time. Hence, they face no divided loyalties as is the case in this study.

not ostracised make a contribution decision, and participate in the ostracism vote, in the next round. If a common-member is excluded from one group, he/she can still contribute and vote in the group from which he/she is not excluded.[20]

Note that with ostracism, more than one member can be excluded in any round. If two or more members are excluded in a round, there is no contribution decision in that group. All players receive their endowment. As noted above, exclusion is only for one round. Precisely, if a player is excluded from group membership in round $t$, he/she does not make contribution or voting decisions in round $t$. In round $t + 1$, players excluded for round $t$, automatically re-enter their groups and make first and second stage decisions in round $t + 1$.[21]

When making exclusion decisions, all non-excluded group members are shown the individual contribution decisions of the other non-excluded players in the round. Excluded members are not shown individual decisions in their group in the round in which they are excluded. At the end of the second stage in a round, non-excluded members in treatments with *Ostracism* are shown the number of votes for exclusion received by each non-excluded member. All group members, however, whether excluded or not, are shown the *total* contributions in their group in the round, and in all previous rounds. In addition, all members are informed of which members are not excluded in the next round.

For purposes of comparison, we also conducted a treatment without a common-member where group members can ostracise one another. In *No-CM-Ostracism*, as in *No-CM*, groups are composed of three members and are isolated. In a second stage in each round, group members vote on ostracism. Ostracism works the same way as in *CM-Ostracism*. We collected data on 11 (X, Y) pairs (55 subjects) in *CM-Ostracism* and 8 groups (24 subjects) in *No-CM-Ostracism*.

We first investigate how ostracism is used. Figure 4 presents the average number of instances (rounds) in which the common and dedicated-members in *CM-Ostracism* were ostracised. The horizontal line presents the same information for group members in *No-CM-Ostracism*.

[20] Group membership can also change by members exiting voluntarily (see, for example, Ahn et al., 2008 & 2009, and Charness and Yang 2014). We conducted a pair of treatments with and without a common-member – *CM-Exit* and *No-CM-Exit* – where individuals could unilaterally exit their groups for the next round. We find that the exit option is very rarely used and that the availability of this option does not change outcomes relative to those observed in *CM*. We present this analysis in Appendix B5.

[21] Temporary exclusion was implemented since previous work has shown the beneficial effects on cooperation of the opportunity to 'redeem oneself' (Charness and Yang, 2014).

**Figure 4. Average number of rounds a group member is ostracised**

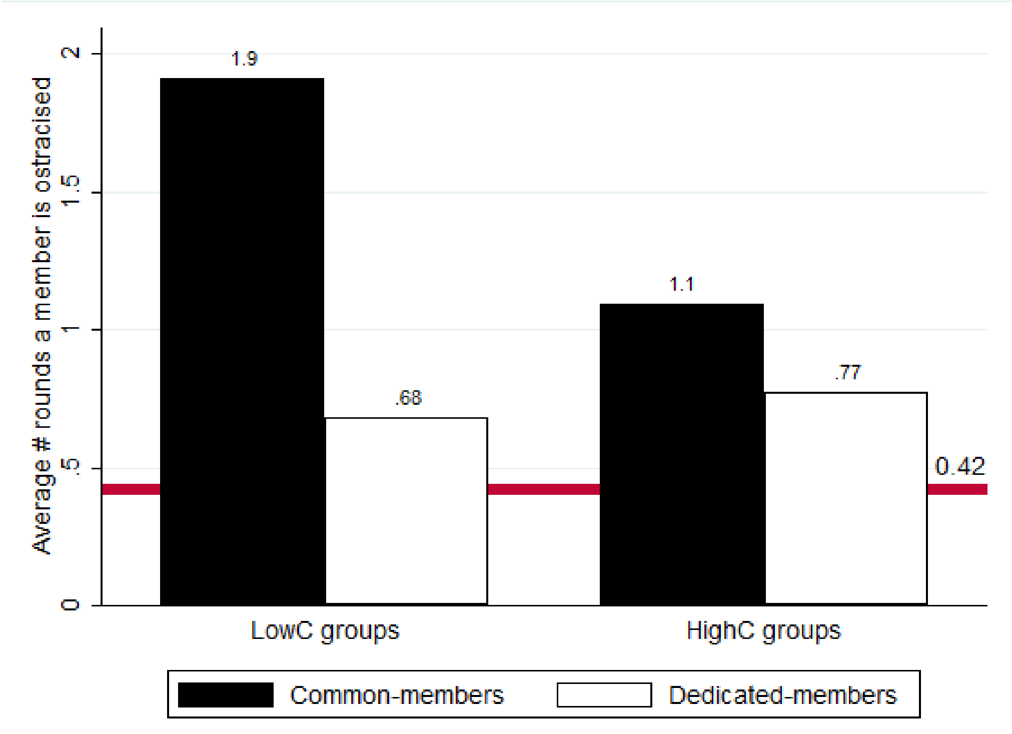



Figure 4 shows that ostracism is used rarely in the absence of a common-member; a group member is ostracised for an average of 0.42 rounds out of 20. However, in the presence of a common-member, both common and dedicated-members are ostracised more often. Common-members are ostracised more often than are dedicated members in *HighC* and *LowC* groups. However, the difference in ostracism rates between common-members and dedicated-members is significant only in *LowC* groups (SR p = 0.011). [22]

Common-members with negative deviations, i.e., those who contributed less than the average contributions of others in the group, were ostracised in 32 out of 319 instances and dedicated-members in 33 out of 301 instances. Common-members with positive (non-negative) deviations were ostracised in only 3 out of 117 instances, and dedicated-members in 4 out of 571 instances.[23] The fact that groups almost never ostracise high contributors implies that the

[22] Regression analysis shown in Appendix B3 shows that this difference is not significant once we control for relative contribution levels.
[23] There were 4 instances of groups with more than one group member excluded. This results in four common-member observations and 8 dedicated-member observations being dropped from ostracism analysis.

groups in this treatment condition are successful in targeting punishment at low contributors, and in avoiding ‘anti-social punishment’.[24]

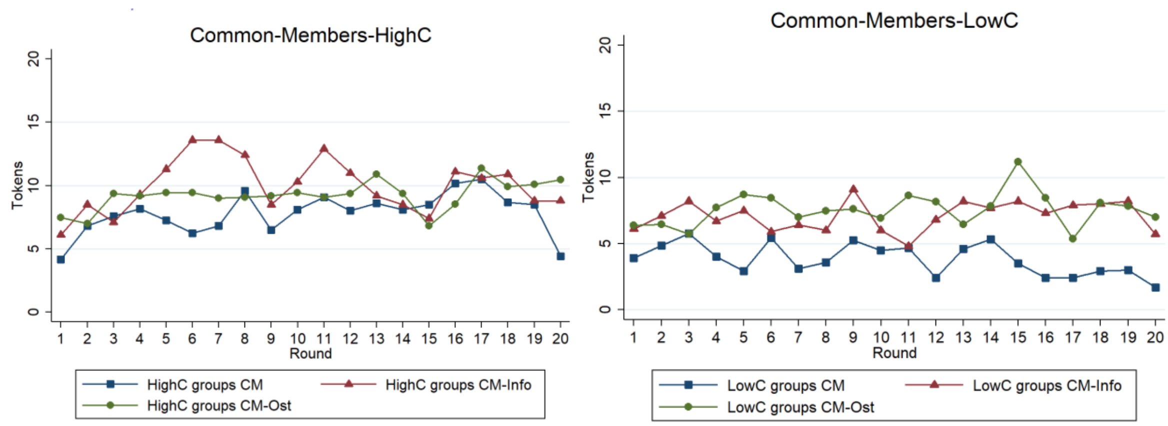
In the context of costly peer punishment, previous work has shown that targeting of high contributors is prevalent, and is inimical to the achievement of cooperation (Hermann et al., 2008; Rand et al., 2010). However, Casari and Luini (2009) find that a consensual peer punishment rule, where at least two group members must target a group member for that member to receive any punishment ‘endogenously filtered out the anti-social norm of a minority that was targeting cooperators’ (p. 277). A majority voting rule requires consensus in our setting as well, and almost eliminates anti-social punishment. This combination of (almost) non-existent targeting of high contributors and targeting ‘punishment’ at low contributors allows both groups to sustain cooperation (as discussed below).

We next examine individual contributions when ostracism is available, and compare those to individual contributions in the other treatments with common members. Figure 5 (a) presents time trends of average individual contributions by common-members in *HighC* and *LowC* groups in the three treatments with a common-member. Figure 5 (b) presents contributions trends for dedicated-members. Table 3 presents summary statistics of individual contributions in *CM-Ostracism*. We leave an analysis of contributions in *No-CM-Ostracism* for Appendices B2.4 and B4.

[24] This is also true in *No-CM-Ostracism*. Members with negative deviations in *No-CM-Ostracism* were ostracised in 14 out of 157 instances, while individuals with positive deviations were *never* ostracised in 323 instances.

**Figure 5. Average individual contributions in *CM-Ostracism***

**(a) Common-members**




**(b) Dedicated-members**

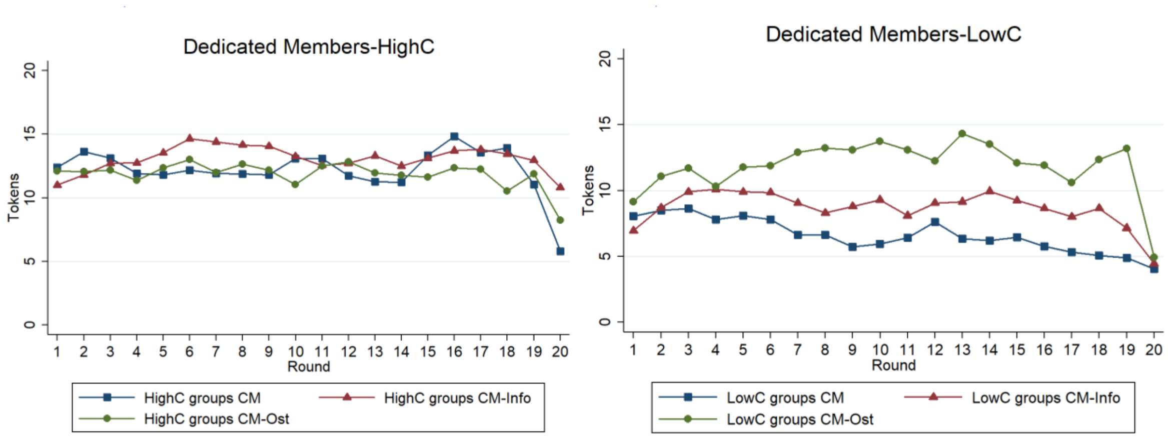



**Table 3. Average (st dev) individual contributions in *CM-Ostracism***

| | CM-Ostracism (11 X, Y pairs) | | | |
|---|---|---|---|---|
| | Common-members | | Dedicated-members | |
| **Round** | **HighC** | **LowC** | **HighC** | **LowC** |
| **First** | 7.45 | 6.36 | 12.09 | 9.14 |
| | (3.62) | (2.69) | (3.89) | (3.82) |
| **Second** | 7.00 | 6.46 | 12.05 | 11.09 |
| | (4.89) | (4.16) | (4.79) | (3.35) |
| **All 20** | 9.23 | 7.57 | 11.84 | 11.85 |
| | (4.58) | (4.30) | (5.69) | (5.13) |

Unlike in *CM* and *CM-Info*, the common-member's contributions in *HighC* and *LowC* groups are not visibly different; there is no significant difference between the two across all rounds

(SR p = 0.213). Thus, as in *CM-Info*, the common-member tends to treat both groups equally. As with *CM-Info*, we do not find support for Hypothesis 3 in the presence of opportunities for ostracism.

**Result 9**: *The common-member contributes similar amounts to both HighC and LowC groups in CM-Ostracism.*

Again, as with the comparison of *CM* to *CM-Info*, the common-member's average contributions are slightly higher in *HighC* groups in *CM-Ostracism* than *HighC* groups in *CM* (9.23 vs. 7.79 tokens), but the difference is not statistically significant. However, the common-member's average contributions (over all 20 rounds) are significantly higher in *LowC* groups in *CM-Ostracism* than *LowC* groups in *CM* (7.57 vs. 3.81 tokens; RS p = 0.016). The common-member's total contributions to both groups are also significantly higher in *CM-Ostracism* than in *CM* (16.80 vs. 11.6 tokens; RS p = 0.0226). The common-member is now contributing just under 84% of endowment in total. Thus, ostracism successfully raises contributions by common-members, approaching 100%.

**Result 10**: *The common-member's contributions to LowC groups and to both groups combined are higher in CM-Ostracism than in CM.*

*In CM-Ostracism,* common-members' contributions are lower than those of dedicated-members in *HighC* groups, but the difference is only marginally significant (SR p = 0.091). However, their contributions are significantly lower than those of dedicated-members in *LowC* groups (SR p = 0.003). Unlike in *CM*, however, this is not because contributions of both are languishing at low levels. On the contrary, contributions of dedicated-members in *LowC* groups are much higher than in *CM* (see below).

Unlike the other two treatments with a common-member, contributions in *LowC* groups do not decline over time. Both *HighC* and *LowC* groups are able to sustain contributions throughout. There is no significant difference between the contributions of dedicated-members in *HighC* and *LowC* groups (SR p = 0.722) in *CM-Ostracism*. Thus, contributions of dedicated-members in the two groups converge. Combined with the above result that ostracism is almost never used, we find support for the competition hypothesis (Hypothesis 5).

Relative to *CM* and *CM-Info*, contributions of dedicated members in *HighC* groups are no different in *CM-Ostracism*. Contributions of dedicated members are higher in *LowC* groups in

*CM-Ostracism* than in the other two, but the difference is significant only relative to *CM*. (RS p = 0.012).

**Result 11**: *Average contributions of dedicated-members are similar in HighC groups and in LowC groups in CM-Ostracism. Their contributions in LowC groups are higher than those in CM.*

Thus, while *CM-Info* was only partially successful, ostracism is successful in raising the contributions of common-members *and* dedicated-members in *LowC* groups. Unlike in *CM* and *CM-Info*, group contributions in *HighC* and *LowC* groups are not significantly different from one another (32.91 vs 31.27 tokens; SR p = 0.859). See Appendix B2.3 for an analysis of group contributions in *CM-Ostracism*.

Unlike in *CM*, initial performance does not determine group performance over time in *CM-Ostracism*. The groups with the initially lower contributions in a pair successfully use the threat of ostracism as a disciplining mechanism, and prevent the decline observed in *LowC* groups in *CM*. In the presence of ostracism, *LowC* groups sustain higher cooperation from dedicated- and common-members. The common-member does not display 'divided loyalties'; both groups attract the loyalty of the common-member.

Thus, ostracism is successful in enforcing reciprocity from all group members. But, this may be a mixed blessing. As shown above, common-members contribute almost all of their endowment and tend to split their contributions almost equally between the two groups. Based on norms of reciprocity, dedicated-members are not obliged to contribute more than the contribution of the common-member, at least in the two subgroups with the common-member. That is, they are not obliged to contribute more than 50% of their endowments either.

As seen above, dedicated-members in both *HighC* and *LowC* groups contribute just over half of their endowments. Tests show that average contributions of dedicated-members are not significantly different from 10 tokens in *HighC* or *LowC* groups in *CM-Ostracism* (SR p > 0.10 in each case). Thus, the strengthening of reciprocity has imposed an implicit constraint on the contributions of dedicated-members even though they do not, unlike common-members, face a binding resource constraint. Further, this is so in both groups in a pair.[25]

[25] Appendix B6 reports an analysis of earnings in treatments with a common-member. Since earnings and contributions have a one-to-one relationship in the linear VCM games we examine in *CM* and *CM-Info*, the earnings analysis parallels the contribution analysis in these treatments reported above. Ostracism has the potential

## 6. Conclusion

We study a feature inherent in many production settings, competition between groups for team members who benefit from membership in both teams. In the treatment condition of primary concern, one individual is a common-member of two groups. The two groups are allowed to compete for his/her contributions to team output. This treatment is contrasted with a setting where there is no common-membership between groups. These two treatments allow us to examine if the opportunity to compete for the resources of the common-member helps mitigate free-riding. We find that competition for the resources of the common-member leads to a divergence of contributions across groups in a pair. The group that begins with higher contributions continues to contribute at higher levels, partly as a result of the common-member becoming more 'loyal' to this group after the first round. Contributions in the *initially* low-performing group are negatively affected by the competition. Upon observing lower contributions in this group, the common-member focuses more effort on the other group in the pair. Conditional cooperation, as implied by reciprocity, ensures that these groups never recover, and contributions are significantly lower than in the *HighC* group. Thus, competition alone creates 'winners' and 'losers'.

Knowing that other group members are also reciprocal may be important in allowing group members to compete for their resources, i.e., influence others' contributions by increasing one's own contributions. We examine two mechanisms that could potentially impact the degree of reciprocity in group members. First, we make public the common-member's contributions in both groups in a pair. With this change, dedicated-members of each group are allowed more complete information on the cooperation 'type' of the common-member. This information is only partly successful; it raises contributions of the common-member, but fails to raise the contributions of dedicated-members in the low-performing groups.

Next, we allow groups the opportunity to determine their membership through ostracism by majority voting. The threat of exclusion incentivises the common-member to be equally 'loyal' to both groups in the pair, thus encouraging higher contributions from dedicated members as well. Teams accomplish this by effectively targeting 'punishment' by ostracism of low contributors. However, while ostracism does raise cooperation, the privileged position of the common-member renders it less effective in raising contributions relative to groups without a

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to decrease earnings if group members are frequently ostracised. However, since ostracism is rarely used, earnings and contributions in *CM-Ostracism* are very similar.

common member. This latter result appears to be related to how norms of reciprocity affect behaviour in the setting we study, where agents are homogenous in resources that might be used for team production. More specifically, dedicated-members respond to the actions of the common-member, who has limited resources to share across teams. This strong norm of reciprocity becomes an implicit constraint on groups' productivity.

Our experimental setting is simple in that there are only two groups and only one common-member. However, our results are informative of behaviour in more general settings, particularly those with a greater number of groups and/or members with divided loyalties. As evidenced by our findings, reciprocity is a strong driver of behaviour in our setting. We draw on the theory of reciprocity and draw inferences for (expected) behaviour in more general settings. We present these implications in Appendix C.

Our study highlights the influence that competitive market forces (between teams) can have on team productivity. Further, it highlights the role of transparency of actions and self-governance of membership at the group level. Our study also identifies limits to the positive effects of competition when all agents are identical in productive capacity. This limitation suggests avenues for future studies such as settings in which common-members are more productive or have greater resources to offer than dedicated members, thus enhancing the importance of gaining the loyalties of the common-member.

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ONLINE ONLY

Electronic Supplementary Material for

# The Market for Talent: Competition for Resources and Self-Governance in Teams

Abhijit Ramalingam, Brock V. Stoddard, James M. Walker

# Appendix A. Experimental Instructions

## A1. Instructions for *CM*

Thank you for coming. This is an experiment about decision-making. Your cash payment will be based on your earnings in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of 20 decision rounds. Your total earnings will be the sum of your earnings from all decision rounds.

At the beginning of the experiment, participants will randomly be divided into groups of 3.

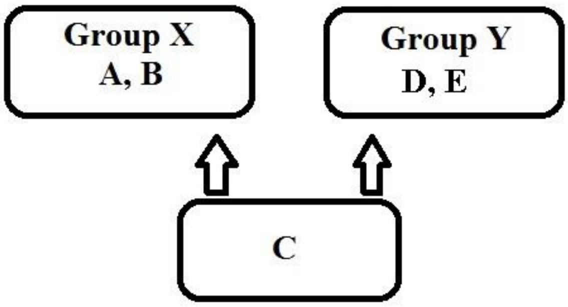
For record keeping purposes, the computer will randomly assign half of the groups with the label Group X and half with the label Group Y. Thus, there will be several groups with the label Group X and several with the label Group Y.

The members of your group will remain the same for the rest of the experiment. In addition, your group will have the same label for the rest of the experiment. Thus, if you are assigned to a Group X, you will be in the same Group X in all 20 decision rounds.

The computer will randomly assign each individual in a Group X an ID letter, either A, B or C. The computer will randomly assign each individual in a Group Y an ID letter, either C, D, or E. The ID letter assigned will not change. Thus, if you are assigned to a Group X and the ID letter A, your ID will be A in all 20 decision rounds. Other than the people conducting this experiment, you are the only person who will know your group label and ID letter.

Your group will also be matched with another group of three people in the lab. If you are in Group X, your group will be matched with a Group Y, and vice versa. **If your ID letter is A or B**, you will be a member of only one group - labeled Group X. **If your ID letter is D or E**, you will be a member of only one group - labeled Group Y. **If your ID letter is C, you will be a member of both groups** (Group X *and* Group Y). That is, person C is the same person in *both* groups. Figure 1 shows the composition of groups in the experiment.

**Figure 1. Composition of groups**




In summary, the members of each group will remain the same across all decision rounds. Also, in each round, your group will be matched with the same group. This means that you will interact with the same other ***four*** people in your group(s) throughout the experiment. You will not be informed of the identities of the members of your group or the members of the other group.

You will record your decisions privately at your computer terminal.

During the experiment, all decisions are made in tokens (more details are provided below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Dollars at the following rate:

**30 tokens = $1**

You will be paid individually and privately in cash at the end of the experiment.

**Decision Task**

At the beginning of each round, each member of each group receives an endowment of 20 tokens. If your ID letter is C, you will *also* receive one endowment of 20 tokens each round.

**If your ID letter is A, B, D, or E**, your task is to allocate your endowment of 20 tokens between your *Private Account* and a *Group Account* in only your group. Each token not allocated to the *Group Account* will automatically remain in your *Private Account*.

**If your ID letter is C**, your task is to allocate your endowment of 20 tokens among your *Private Account*, a *Group Account* in Group X, and a *Group Account* in Group Y. Each token not allocated to either *Group Account* will automatically remain in your *Private Account*.

**Earnings from your *Private Account* in each round**: You will earn one (1) token for each token allocated to your *Private Account*. No one else will earn from your *Private Account*.

**Earnings from the *Group Account* <u>in each group</u> in each round**: For each token you allocate to the *Group Account*, you will earn 0.6 tokens. Each of the other two members of your group will also earn 0.6 tokens for each token you allocate to the *Group Account*.

Thus the allocation of 1 token to the *Group Account* yields a total of 1.8 tokens for your group. Your earnings from the *Group Account* are based on the total number of tokens allocated to the *Group Account* by all members in your group. In summary, each member will profit equally from the tokens allocated to the *Group Account* – for each token allocated to the *Group Account*, each member of your group will earn 0.6 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the *Group Account* as well as from the allocations to the *Group Account* of your group members. Earnings from the *Group Account* are calculated in the same manner in *both* groups.

**<u>Your total earnings in each round</u>**

**<u>If your ID letter is A or B</u>:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group X**

**<u>If your ID letter is D or E</u>:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group Y**

**<u>If your ID letter is C</u>:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in Group X**

**+ Earnings from the *Group Account* in Group Y**

**The following examples show the calculation of earnings in <u>each</u> group in a round. These examples are for illustrative purposes only.**

**Example 1**. Suppose you are in a Group X, your ID letter is B, and you allocated 0 tokens to the *Group Account*. Further suppose that group members A and C also each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 0.

Your earnings in this round would be 20 tokens (= 20 tokens from your *Private Account* and 0 tokens from the *Group Account*). The earnings of group member A would also be 20 tokens. In this example, the earnings of group member C would be 0 tokens from the *Group Account* in their Group X. However, the total earnings of group member C would also depend on decisions in their Group Y. This is covered in more detail in Example 4 below.

**Example 2**. Suppose you are in a Group Y, your ID letter is E, and you allocated 10 tokens to the *Group Account*. Further suppose that group members C and D each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 10.

Your earnings in this round would be 16 tokens (= 10 tokens from your *Private Account* + 0.6*10 = 6 tokens from the *Group Account*. The earnings of group member D would be 26 tokens (= 20 tokens from the *Private Account* + 0.6*10 = 6 tokens from the *Group Account*). In this example, the earnings of group member C would be 6 tokens from the *Group Account* in their Group Y. However, the total earnings of group member C would also depend on decisions in their Group X. This is covered in more detail in Example 4 below.

**Example 3**. Suppose you are in a Group Y, your ID letter is D, and you allocated 20 tokens to the *Group Account*. Further suppose that group members C and E also each allocated 20 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 60.

Your earnings in this round would be 36 tokens (= 0 tokens from your *Private Account* + 0.6*60 = 36 tokens from the *Group Account*). The earnings of group member E would also be 36 tokens. The earnings of group member C would be 36 tokens from your *Group Account* plus the earnings based on the decisions in Group X (see Example 4 below).

Note, if group member C allocates 20 tokens to the *Group Account* in one group, he/she will have no tokens remaining in his/her *Private Account* to allocate to the *Group Account* in the other group

**Example 4**. **(This example will focus only on the earnings for group member C.)** Suppose your ID letter is C and you allocated 7 tokens to the *Group Account* in Group X and 8 tokens to the *Group Account* in Group Y. Further suppose group members A and B in Group X **each** allocated 13 tokens to the *Group Account*. Additionally, group members D and E in Group Y **each** allocated 12 tokens to the *Group Account*. This means a total of 33 tokens were allocated to the *Group Account* in Group X and 32 tokens were allocated to the *Group Account* in Group Y.

Your earnings in this round would be 44 tokens (= 5 tokens from your *Private Account* + (0.6*33 = 19.8 tokens from the *Group Account* for Group X) + (0.6*32 = 19.2 tokens from the *Group Account* for Group Y)).

After all individuals have made their decisions in the round, the computer will tabulate the results. You will be informed of the total allocation to the *Group Account* in your group and the individual allocation decisions of each member of your group, identified by their ID letters (which will remain the same in each round). Your allocation will be shown on top. The other group members' allocations will be listed below, alphabetically by ID letters.

In addition, you will be shown the total allocation to the *Group Account* in your group in all previous rounds. You will **not** be shown the individual allocations of the members of your group in previous rounds.

**If your ID letter is A or B**, you will see the above information only for your group - Group X. In particular, you will not see C's allocation to the *Group Account* in Group Y.

**If your ID letter is D or E**, you will see the above information only for your group - Group Y. In particular, you will not see C's allocation to the *Group Account* in Group X.

**If your ID letter is C**, you will see the above information for *both* groups (Groups X *and* Y). In particular, you will see the allocations to the *Group Account* by A and B in Group X and the allocations to the *Group Account* by D and E in Group Y.

You will also be informed of your *individual* earnings in tokens from the round.

Your earnings from earlier decision rounds cannot be used in future rounds. You will receive a new endowment in each of the 20 decision rounds.

**Questions to help you understand the decision task**

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## A2. Instructions for *No-CM*

Thank you for coming. This is an experiment about decision-making. Your cash payment will be based on your earnings in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of 20 decision rounds. Your total earnings will be the sum of your earnings from all decision rounds.

At the beginning of the experiment, participants will randomly be divided into groups of 3.

For record keeping purposes, the computer will randomly assign each individual in a group an ID letter, either A, B or C. Each individual will keep their same ID for the rest of the experiment. Thus, if you are assigned to be individual A in your group, your ID will be A in all 20 decision rounds. Other than the people conducting this experiment, you are the only person who will know your ID letter.

The members of your group will remain the same across all decision rounds. This means that you will interact with the same other ***two*** people in your group throughout the experiment. However, you will never be informed of the identity of the others in your group.

You will record your decisions at your computer terminal.

During the experiment, all decisions are made in tokens (more details are provided below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Dollars at the following rate:

**30 tokens = $1**

You will be paid individually and privately in cash at the end of the experiment.

## Decision Task

**At the beginning of each round, each member of each group receives an endowment of 20 tokens.**

Your task is to allocate your endowment of tokens between your *Private Account* and a *Group Account*. Each token not allocated to the *Group Account* will automatically remain in your *Private Account*.

**Earnings from your Private Account in each round**: You will earn one (1) token for each token allocated to your *Private Account*. No one else will earn from your *Private Account*.

**Earnings from the Group Account in each round**:

For each token you allocate to the *Group Account*, you will earn 0.6 tokens. Each of the other two members of your group will also earn 0.6 tokens for each token you allocate to the *Group Account*. Thus the allocation of 1 token to the *Group Account* yields a total of 1.8 tokens for your group.

Your earnings from the *Group Account* are based on the total number of tokens allocated to the *Group Account* by all members in your group. In summary, each member will profit equally from the tokens allocated to the Group Account – for each token allocated to the *Group Account*, each member of your group will earn 0.6 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the *Group Account* as well as from the allocations to the *Group Account* of your group members.

**Your earnings in each round =**

**Earnings from your Private Account + Earnings from the Group Account**

**The following examples show the calculation of earnings in each group in a round. These examples are for illustrative purposes only.**

**Example 1**. Suppose that you allocated 0 tokens to the Group Account and each of the other group members also allocated 0 tokens to the Group Account. The total number of tokens in the Group Account would be 0.

Your earnings in this round would be 20 tokens (= 20 tokens from your Private Account and 0 tokens from the Group Account). The earnings of the other members of your group would also be 20 tokens each.

**Example 2**. Suppose that you allocated 10 tokens to the Group Account and each of the other group members allocated 0 tokens to the Group Account. The total number of tokens in the Group Account would be 10.

Your earnings in this round would be 16 tokens (= 10 tokens from your Private Account + 0.6*10 = 6 tokens from the Group Account). The earnings of the other members of your group would be 26 tokens each (= 20 tokens from the Private Account + 0.6*10 = 6 tokens from the Group Account).

**Example 3**. Suppose that you allocated 20 tokens to the Group Account and that each of the other group members also allocated 20 tokens to the Group Account. The total number of tokens in the Group Account would be 60.

Your earnings in this round would be 36 tokens (= 0 tokens from your Private Account + 0.6*60 = 36 tokens from the Group Account). The earnings of the other members of your group would also be 36 tokens each.

After all individuals have made their decisions in the round, the computer will tabulate the results. You will be informed of the total allocation to the *Group Account* in your group and the individual allocation decisions of each member of your group, identified by their ID letters (which remain the same in each round). Your allocation will be shown on top. The other group members' allocations will be listed below, alphabetically by ID letters.

In addition, you will be shown the total allocation to the *Group Account* in your group in all previous rounds. You will **not** be shown the individual allocations of the members of your group in previous rounds.

You will also be informed of your *individual* earnings in tokens from the round.

Your earnings from earlier decision rounds cannot be used in future rounds. You will receive a new endowment in each of the 20 decision rounds.

## Questions to help you understand the decision task

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

### A3. Instructions for *CM-Info*

Thank you for coming. This is an experiment about decision-making. Your cash payment will be based on your earnings in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of 20 decision rounds. Your total earnings will be the sum of your earnings from all decision rounds.

At the beginning of the experiment, participants will randomly be divided into groups of 3.

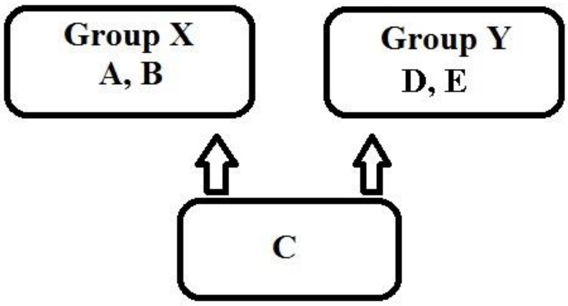
For record keeping purposes, the computer will randomly assign half of the groups with the label Group X and half with the label Group Y. Thus, there will be several groups with the label Group X and several with the label Group Y.

The members of your group will remain the same for the rest of the experiment. In addition, your group will have the same label for the rest of the experiment. Thus, if you are assigned to a Group X, you will be in the same Group X in all 20 decision rounds.

The computer will randomly assign each individual in a Group X an ID letter, either A, B or C. The computer will randomly assign each individual in a Group Y an ID letter, either C, D, or E. The ID letter assigned will not change. Thus, if you are assigned to a Group X and the ID letter A, your ID will be A in all 20 decision rounds. Other than the people conducting this experiment, you are the only person who will know your group label and ID letter.

Your group will also be matched with another group of three people in the lab. If you are in Group X, your group will be matched with a Group Y, and vice versa. **If your ID letter is A or B**, you will be a member of only one group - labeled Group X. **If your ID letter is D or E**, you will be a member of only one group - labeled Group Y. **If your ID letter is C, you will be a member of both groups** (Group X *and* Group Y). That is, person C is the same person in *both* groups. Figure 1 shows the composition of groups in the experiment.

**Figure 1. Composition of groups**




In summary, the members of each group will remain the same across all decision rounds. Also, in each round, your group will be matched with the same group. This means that you will interact with the same other ***four*** people in your group(s) throughout the experiment. You will not be informed of the identities of the members of your group or the members of the other group.

You will record your decisions privately at your computer terminal.

During the experiment, all decisions are made in tokens (more details are provided below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Dollars at the following rate:

**30 tokens = $1**

You will be paid individually and privately in cash at the end of the experiment.

**Decision Task**

At the beginning of each round, each member of each group receives an endowment of 20 tokens. If your ID letter is C, you will *also* receive one endowment of 20 tokens each round.

**If your ID letter is A, B, D, or E**, your task is to allocate your endowment of 20 tokens between your *Private Account* and a *Group Account* in only your group. Each token not allocated to the *Group Account* will automatically remain in your *Private Account*.

**If your ID letter is C**, your task is to allocate your endowment of 20 tokens among your *Private Account*, a *Group Account* in Group X, and a *Group Account* in Group Y. Each token not allocated to either *Group Account* will automatically remain in your *Private Account*.

**Earnings from your *Private Account* in each round**: You will earn one (1) token for each token allocated to your *Private Account*. No one else will earn from your *Private Account*.

**Earnings from the *Group Account* <u>in each group</u> in each round**: For each token you allocate to the *Group Account*, you will earn 0.6 tokens. Each of the other two members of your group will also earn 0.6 tokens for each token you allocate to the *Group Account*.

Thus the allocation of 1 token to the *Group Account* yields a total of 1.8 tokens for your group. Your earnings from the *Group Account* are based on the total number of tokens allocated to the *Group Account* by all members in your group. In summary, each member will profit equally from the tokens allocated to the *Group Account* – for each token allocated to the *Group Account*, each member of your group will earn 0.6 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the *Group Account* as well as from the allocations to the *Group Account* of your group members. Earnings from the *Group Account* are calculated in the same manner in *both* groups.

<u>**Your total earnings in each round**</u>

<u>**If your ID letter is A or B**</u>**:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group X**

<u>**If your ID letter is D or E**</u>**:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group Y**

<u>**If your ID letter is C**</u>**:**

**Your earnings in each round = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in Group X**

**+ Earnings from the *Group Account* in Group Y**

**The following examples show the calculation of earnings in <u>each</u> group in a round. These examples are for illustrative purposes only.**

**Example 1**. Suppose you are in a Group X, your ID letter is B, and you allocated 0 tokens to the *Group Account*. Further suppose that group members A and C also each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 0.

Your earnings in this round would be 20 tokens (= 20 tokens from your *Private Account* and 0 tokens from the *Group Account*). The earnings of group member A would also be 20 tokens. In this example, the earnings of group member C would be 0 tokens from the *Group Account* in their Group X. However, the total earnings of group member C would also depend on decisions in their Group Y. This is covered in more detail in Example 4 below.

**Example 2**. Suppose you are in a Group Y, your ID letter is E, and you allocated 10 tokens to the *Group Account*. Further suppose that group members C and D each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 10.

Your earnings in this round would be 16 tokens (= 10 tokens from your *Private Account* + 0.6*10 = 6 tokens from the *Group Account*. The earnings of group member D would be 26 tokens (= 20 tokens from the *Private Account* + 0.6*10 = 6 tokens from the *Group Account*). In this example, the earnings of group member C would be 6 tokens from the *Group Account* in their Group Y. However, the total earnings of group member C would also depend on decisions in their Group X. This is covered in more detail in Example 4 below.

**Example 3**. Suppose you are in a Group Y, your ID letter is D, and you allocated 20 tokens to the *Group Account*. Further suppose that group members C and E also each allocated 20 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 60.

Your earnings in this round would be 36 tokens (= 0 tokens from your *Private Account* + 0.6*60 = 36 tokens from the *Group Account*). The earnings of group member E would also be 36 tokens. The earnings of group member C would be 36 tokens from your *Group Account* plus the earnings based on the decisions in Group X (see Example 4 below).

Note, if group member C allocates 20 tokens to the *Group Account* in one group, he/she will have no tokens remaining in his/her *Private Account* to allocate to the *Group Account* in the other group.

**Example 4**. **(This example will focus only on the earnings for group member C.)** Suppose your ID letter is C and you allocated 7 tokens to the *Group Account* in Group X and 8 tokens to the *Group Account* in Group Y. Further suppose group members A and B in Group X **each** allocated 13 tokens to the *Group Account*. Additionally, group members D and E in Group Y **each** allocated 12 tokens to the *Group Account*. This means a total of 33 tokens were allocated to the *Group Account* in Group X and 32 tokens were allocated to the *Group Account* in Group Y.

Your earnings in this round would be 44 tokens (= 5 tokens from your *Private Account* + (0.6*33 = 19.8 tokens from the *Group Account* for Group X) + (0.6*32 = 19.2 tokens from the *Group Account* for Group Y)).

After all individuals have made their decisions in the round, the computer will tabulate the results. You will be informed of the total allocation to the *Group Account* in your group and the individual allocation decisions of each member of your group, identified by their ID letters (which will remain the same in each round). Your allocation will be shown on top. The other group members' allocations will be listed below, alphabetically by ID letters.

In addition, you will be shown the total allocation to the *Group Account* in your group in all previous rounds. You will **not** be shown the individual allocations of the members of your group in previous rounds.

**If your ID letter is A or B**, you will see the above information for your group - Group X. You will also see C's allocation to the *Group Account* in Group Y. Thus, you will see C's allocations in *both* groups. You will **not** see the allocations of D and E in Group Y.

**If your ID letter is D or E**, you will see the above information for your group - Group Y. You will also see C's allocation to the *Group Account* in Group X. Thus, you will see C's allocations in *both* groups. You will **not** see the allocations of A and B in Group X.

**If your ID letter is C**, you will see the above information for *both* groups (Groups X *and* Y). In particular, you will see the allocations to the *Group Account* by A and B in Group X and the allocations to the *Group Account* by D and E in Group Y.

You will also be informed of your *individual* earnings in tokens from the round.

Your earnings from earlier decision rounds cannot be used in future rounds. You will receive a new endowment in each of the 20 decision rounds.

## Questions to help you understand the decision task

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## A4. Instructions for *CM-Ostracism*

Thank you for coming. This is an experiment about decision-making. Your cash payment will be based on your earnings in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of 20 decision rounds. Your total earnings will be the sum of your earnings from all decision rounds.

At the beginning of the experiment, participants will randomly be divided into groups of 3.

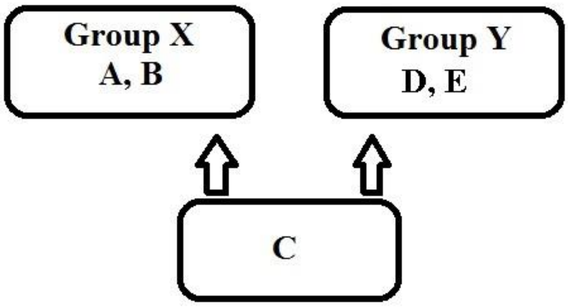
For record keeping purposes, the computer will randomly assign half of the groups with the label Group X and half with the label Group Y. Thus, there will be several groups with the label Group X and several with the label Group Y.

The members of your group will remain the same for the rest of the experiment. In addition, your group will have the same label for the rest of the experiment. Thus, if you are assigned to a Group X, you will be in the same Group X in all 20 decision rounds.

The computer will randomly assign each individual in a Group X an ID letter, either A, B or C. The computer will randomly assign each individual in a Group Y an ID letter, either C, D, or E. The ID letter assigned will not change. Thus, if you are assigned to a Group X and the ID letter A, your ID will be A in all 20 decision rounds. Other than the people conducting this experiment, you are the only person who will know your group label and ID letter.

Your group will also be matched with another group of three people in the lab. If you are in Group X, your group will be matched with a Group Y, and vice versa. **If your ID letter is A or B**, you will be a member of only one group - labeled Group X. **If your ID letter is D or E**, you will be a member of only one group - labeled Group Y. **If your ID letter is C, you will be a member of both groups** (Group X *and* Group Y). That is, person C is the same person in *both* groups. Figure 1 shows the composition of groups in the experiment.

**Figure 1. Composition of groups**




In summary, the members of each group will remain the same across all decision rounds. Also, in each round, your group will be matched with the same group. This means that you will interact with the same other ***four*** people in your group(s) throughout the experiment. You will not be informed of the identities of the members of your group or the members of the other group.

You will record your decisions privately at your computer terminal.

During the experiment, all decisions are made in tokens (more details are provided below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Dollars at the following rate:

**30 tokens = $1**

You will be paid individually and privately in cash at the end of the experiment.

**Decision Task**

At the beginning of each round, each member of each group receives an endowment of 20 tokens. If your ID letter is C, you will *also* receive one endowment of 20 tokens each round.

**There will be two decision stages in each round.**

**First stage of each round**

**If your ID letter is A, B, D, or E**, your task is to allocate your endowment of 20 tokens between your *Private Account* and a *Group Account* in only your group. Each token not allocated to the *Group Account* will automatically remain in your *Private Account*.

**If your ID letter is C**, your task is to allocate your endowment of 20 tokens among your *Private Account*, a *Group Account* in Group X, and a *Group Account* in Group Y. Each token not allocated to either *Group Account* will automatically remain in your *Private Account*.

**Earnings from your *Private Account* in each round**: You will earn one (1) token for each token allocated to your *Private Account*. No one else will earn from your *Private Account*.

**Earnings from the *Group Account* <u>in each group</u> in each round**: For each token you allocate to the *Group Account*, you will earn 0.6 tokens. Each of the other two members of your group will also earn 0.6 tokens for each token you allocate to the *Group Account*.

Thus the allocation of 1 token to the *Group Account* yields a total of 1.8 tokens for your group. Your earnings from the *Group Account* are based on the total number of tokens allocated to the *Group Account* by all members in your group. In summary, each member will profit equally from the tokens allocated to the *Group Account* – for each token allocated to the *Group Account*, each member of your group will earn 0.6 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the *Group Account* as well as from the allocations to the *Group Account* of your group members. Earnings from the *Group Account* are calculated in the same manner in *both* groups.

**<u>Your total earnings in the first stage each round</u>**

**<u>If your ID letter is A or B</u>:**

**Your earnings in the first stage = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group X**

**<u>If your ID letter is D or E</u>:**

**Your earnings in the first stage = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in your Group Y**

**<u>If your ID letter is C</u>:**

**Your earnings in the first stage = Earnings from your *Private Account***

**+ Earnings from the *Group Account* in Group X**

**+ Earnings from the *Group Account* in Group Y**

**The following examples show the calculation of earnings in <u>each</u> group in a round. These examples are for illustrative purposes only.**

**Example 1**. Suppose you are in a Group X, your ID letter is B, and you allocated 0 tokens to the *Group Account*. Further suppose that group members A and C also each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 0.

Your earnings in the first stage of this round would be 20 tokens (= 20 tokens from your *Private Account* and 0 tokens from the *Group Account*). The earnings of group member A would also be 20 tokens. In this example, the earnings of group member C would be 0 tokens from the *Group Account* in their Group X. However, the total earnings of group member C would also depend on decisions in their Group Y. This is covered in more detail in Example 4 below.

**Example 2**. Suppose you are in a Group Y, your ID letter is E, and you allocated 10 tokens to the *Group Account*. Further suppose that group members C and D each allocated 0 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 10.

Your earnings in the first stage of this round would be 16 tokens (= 10 tokens from your *Private Account* + 0.6*10 = 6 tokens from the *Group Account*. The earnings of group member D would be 26 tokens (= 20 tokens from the *Private Account* + 0.6*10 = 6 tokens from the *Group Account*). In this example, the earnings of group member C would be 6 tokens from the *Group Account* in their Group Y. However, the total earnings of group member C would also depend on decisions in their Group X. This is covered in more detail in Example 4 below.

**Example 3**. Suppose you are in a Group Y, your ID letter is D, and you allocated 20 tokens to the *Group Account*. Further suppose that group members C and E also each allocated 20 tokens to the *Group Account*. The total number of tokens in the *Group Account* would be 60.

Your earnings in the first stage of this round would be 36 tokens (= 0 tokens from your *Private Account* + 0.6*60 = 36 tokens from the *Group Account*). The earnings of group member E would also be 36 tokens. The earnings of group member C would be 36 tokens from your *Group Account* plus the earnings based on the decisions in Group X (see Example 4 below).

Note, if group member C allocates 20 tokens to the *Group Account* in one group, he/she will have no tokens remaining in his/her *Private Account* to allocate to the *Group Account* in the other group

**Example 4**. **(This example will focus only on the earnings for group member C.)** Suppose your ID letter is C and you allocated 7 tokens to the *Group Account* in Group X and 8 tokens to the *Group Account* in Group Y. Further suppose group members A and B in Group X **each** allocated 13 tokens to the *Group Account*. Additionally, group members D and E in Group Y **each** allocated 12 tokens to the

*Group Account*. This means a total of 33 tokens were allocated to the *Group Account* in Group X and 32 tokens were allocated to the *Group Account* in Group Y.

Your earnings in the first stage of this round would be 44 tokens (= 5 tokens from your *Private Account* + (0.6*33 = 19.8 tokens from the *Group Account* for Group X) + (0.6*32 = 19.2 tokens from the *Group Account* for Group Y)).

After all individuals have made their decisions in the first stage of the round, the computer will tabulate the results. You will be informed of the total allocation to the *Group Account* in your group and the individual allocation decisions of each member of your group, identified by their ID letters (which will remain the same in each round). Your allocation will be shown on top. The other group members' allocations will be listed below, alphabetically by ID letters.

In addition, you will be shown the total allocation to the *Group Account* in your group in all previous rounds. For each of the previous rounds, you will also see who was eligible to make decision in your Group in that round (more details are provided below). You will **<u>not</u>** be shown the individual allocations of the members of your group in previous rounds.

**If your ID letter is A or B**, you will see the above information only for your group - Group X. In particular, you will not see C's allocation to the *Group Account* in Group Y.

**If your ID letter is D or E**, you will see the above information only for your group - Group Y. In particular, you will not see C's allocation to the *Group Account* in Group X.

**If your ID letter is C**, you will see the above information for *both* groups (Groups X *and* Y). In particular, you will see the allocations to the *Group Account* by A and B in Group X and the allocations to the *Group Account* by D and E in Group Y.

You will also be informed of your *individual* earnings in tokens from the round.

Your earnings from earlier decision rounds cannot be used in future rounds. You will receive a new endowment in each of the 20 decision rounds.

## <u>Second stage of each round</u>

*In the discussion that follows, we describe how group members can **vote to exclude** group members from making decisions in the **<u>next</u>** decision round. We refer to **eligible members** as group members who are **not excluded** from decision making in the **<u>current</u>** decision round. We refer to **excluded members** as those members **who have been excluded** from decision making in the **<u>current</u>** round.*

In this stage, eligible members can **vote to exclude** other eligible members from the ***next*** decision round. Thus, i**f you are an eligible member and your ID letter is A or B**, you can vote to exclude eligible members from making decisions in the next round in your Group X. **If you are an eligible member and your ID letter is D or E**, you can vote to exclude eligible members from making decisions in the next round in your Group Y.

**If your ID letter is C**, you may be an eligible member in only one group (X or Y) or in both groups simultaneously. You will decide separately for each group. **If you are an eligible member in Group X**, you can vote to exclude eligible members from making decisions in the next round in your Group X. **If you are an eligible member in Group Y**, you can vote to exclude eligible members from making decisions in the next round in your Group Y.

To vote to exclude an eligible member in their group, an eligible member will click the "Yes" circle next to the ID letter of that person. If an eligible member does not want to vote to exclude another eligible member in their group, they will click the "No" circle. Voting decisions can be changed by clicking again inside the other circle. Eligible members in a group can vote to exclude 0, 1, or two other eligible members in their group, depending upon how many eligible members there are in their group in a given decision round.

When voting, eligible members will see the individual allocation decisions in the current round of every eligible member of the group. Once voting is completed, those voting will click the 'Confirm' button at the bottom of the screen.

If half (50%) or more eligible members in a group vote to exclude a particular eligible member, that person is excluded from participation in the next round in that group. Note that more than one person can be excluded in any round. After all eligible members have made their decisions in the second stage of the round, each eligible group member will be informed of the number of votes received by each eligible member of the group. In addition, *all* group members will be informed of who will be eligible to make decisions in the next round in your Group.

**If your ID letter is A, B, D or E**: Excluded group member(s) do not make an allocation decision or voting decisions in the next round in their Group. This member's entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round. Further, this member will not receive any earnings from the *Group Account* in the next round.

**If your ID letter is C**: Excluded group member(s) do not make an allocation decision or voting decisions in the next round only in the Group they have been excluded from. This member will not receive any earnings from the *Group Account* in this Group in the next round. An excluded member C will still decide how to allocate the endowment of 20 tokens among his/her *Private Account* and the

*Group Account* in the other Group, i.e., in the Group the member has **not** been excluded from. Further this member will also make voting decisions in the other Group. If the member C has been excluded from *both* Groups, the excluded member will not make any allocation decisions or voting decisions in the next round and his/her entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round.

Only those who are **not** excluded will receive earnings from the *Group Account*. Further, regardless of the number of individuals in a group, each token allocated to the *Group Account* yields 0.6 tokens for those who are not excluded.

All group members (whether or not they were excluded in the round) will be informed of the total allocation to the *Group Account* in your group in the first stage of the round *and* the total allocation to the *Group Account* in your group in all previous rounds. However, only eligible group members will be informed of the individual allocation decisions in their Group in the round.

If two or more members of a group are excluded, there will be no first or second stage decisions in the next round in that group. Each group member's endowment will be automatically allocated to their *Private Account.*

In summary, if a group member is excluded from the next round, this means he/she does not participate in either stage of the next round and does not receive earnings from the *Group Account*. His/her endowment is automatically allocated to his/her *Private Account*. Then, he/she is automatically eligible to participate in both stages of the round that follows the round in which he/she is excluded.

## Questions to help you understand the decision task

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## A5. Instructions for *No-CM-Ostracism*

Thank you for coming. This is an experiment about decision-making. Your cash payment will be based on your earnings in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of 20 decision rounds. Your total earnings will be the sum of your earnings from all decision rounds.

At the beginning of the experiment, participants will randomly be divided into groups of 3.

For record keeping purposes, the computer will randomly assign each individual in a group an ID letter, either A, B or C. Each individual will keep their same ID for the rest of the experiment. Thus, if you are assigned to be individual A in your group, your ID will be A in all 20 decision rounds. Other than the people conducting this experiment, you are the only person who will know your ID letter.

The members of your group will remain the same across all decision rounds. This means that you will interact with the same other ***two*** people in your group throughout the experiment. However, you will never be informed of the identity of the others in your group.

You will record your decisions at your computer terminal.

During the experiment, all decisions are made in tokens (more details are provided below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Dollars at the following rate:

**30 tokens = $1**

You will be paid individually and privately in cash at the end of the experiment.

## Decision Task

At the beginning of each round, each member of each group receives an endowment of 20 tokens.

**There will be two decision stages in each round.**

## First stage of each round

Your task is to allocate your endowment of tokens between your *Private Account* and a *Group Account*. Each token not allocated to the *Group Account* will automatically remain in your *Private Account*.

**Earnings from your Private Account in each round**: You will earn one (1) token for each token allocated to your *Private Account*. No one else will earn from your *Private Account*.

**Earnings from the Group Account in each round**:

For each token you allocate to the *Group Account*, you will earn 0.6 tokens. Each of the other two members of your group will also earn 0.6 tokens for each token you allocate to the *Group Account*.

Thus the allocation of 1 token to the *Group Account* yields a total of 1.8 tokens for your group. Your earnings from the *Group Account* are based on the total number of tokens allocated to the *Group Account* by all members in your group. In summary, each member will profit equally from the tokens allocated to the Group Account – for each token allocated to the *Group Account*, each member of your group will earn 0.6 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the *Group Account* as well as from the allocations to the *Group Account* of your group members.

**Your earnings in the first stage each round =**

**Earnings from your Private Account + Earnings from the Group Account**

**The following examples show the calculation of earnings in each group in a round. These examples are for illustrative purposes only.**

**Example 1**. Suppose that you allocated 0 tokens to the Group Account and each of the other group members also allocated 0 tokens to the Group Account. The total number of tokens in the Group Account would be 0.

Your earnings in this round would be 20 tokens (= 20 tokens from your Private Account and 0 tokens from the Group Account). The earnings of the other members of your group would also be 20 tokens each.

**Example 2**. Suppose that you allocated 10 tokens to the Group Account and each of the other group members allocated 0 tokens to the Group Account. The total number of tokens in the Group Account would be 10.

Your earnings in this round would be 16 tokens (= 10 tokens from your Private Account + 0.6*10 = 6 tokens from the Group Account). The earnings of the other members of your group would be 26 tokens each (= 20 tokens from the Private Account + 0.6*10 = 6 tokens from the Group Account).

**Example 3**. Suppose that you allocated 20 tokens to the Group Account and that each of the other group members also allocated 20 tokens to the Group Account. The total number of tokens in the Group Account would be 60.

Your earnings in this round would be 36 tokens (= 0 tokens from your Private Account + 0.6*60 = 36 tokens from the Group Account). The earnings of the other members of your group would also be 36 tokens each.

After all individuals have made their decisions in the first stage of the round, the computer will tabulate the results. You will be informed of the total allocation to the *Group Account* in your group and the individual allocation decisions of each member of your group, identified by their ID letters (which remain the same in each round). Your allocation will be shown on top. The other group members' allocations will be listed below, alphabetically by ID letters.

In addition, you will be shown the total allocation to the *Group Account* in your group in all previous rounds. For each of the previous rounds, you will also see who was eligible to make decision in your Group in that round (more details are provided below). You will **not** be shown the individual allocations of the members of your group in previous rounds.

You will also be informed of your *individual* earnings in tokens from the round.

Your earnings from earlier decision rounds cannot be used in future rounds. You will receive a new endowment in each of the 20 decision rounds.

**<u>Second stage of each round</u>**

*In the discussion that follows, we describe how group members can* ***vote to exclude*** *group members from making decisions in the* ***<u>next</u>*** *decision round. We refer to* ***eligible members*** *as group members who are* ***not excluded*** *from decision making in the* ***<u>current</u>*** *decision round. We refer to* ***excluded members*** *as those members* ***who have been excluded*** *from decision making in the* ***<u>current</u>*** *round.*

In this stage, eligible members can **vote to exclude** other eligible members from the ***next*** decision round.

To vote to exclude an eligible member in their group, an eligible member will click the "Yes" circle next to the ID letter of that person. If an eligible member does not want to vote to exclude another eligible member in their group, they will click the "No" circle. Voting decisions can be changed by clicking again inside the other circle. Eligible members in a group can vote to exclude 0, 1, or two other eligible members in their group, depending upon how many eligible members there are in their group in a given decision round.

When voting, eligible members will see the individual allocation decisions in the current round of every eligible member of the group. Once voting is completed, those voting will click the 'Confirm' button at the bottom of the screen.

If half (50%) or more eligible members in a group vote to exclude a particular eligible member, that person is excluded from participation in the next round in that group. Note that more than one person can be excluded in any round. After all eligible members have made their decisions in the second stage of the round, each eligible group member will be informed of the number of votes received by each eligible member of the group. In addition, *all* group members will be informed of who will be eligible to make decisions in the next round in your Group.

Excluded group member(s) do not make an allocation decision or voting decisions in the next round in their Group. This member's entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round. Further, this member will not receive any earnings from the *Group Account* in the next round.

Only those who are **not** excluded will receive earnings from the *Group Account*. Further, regardless of the number of individuals in a group, each token allocated to the *Group Account* yields 0.6 tokens for those who are not excluded.

All group members (whether or not they were excluded in the round) will be informed of the total allocation to the *Group Account* in your group in the first stage of the round *and* the total allocation to the *Group Account* in your group in all previous rounds. However, only eligible group members will be informed of the individual allocation decisions in their Group in the round.

If two or more members of a group are excluded, there will be no first or second stage decisions in the next round in that group. Each group member's endowment will be automatically allocated to their *Private Account.*

In summary, if a group member is excluded from the next round, this means he/she does not participate in either stage of the next round and does not receive earnings from the *Group Account*. His/her endowment is automatically allocated to his/her *Private Account*. Then, he/she is automatically eligible to participate in both stages of the round that follows the round in which he/she is excluded.

**Questions to help you understand the decision task**

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## A6. Second stage instructions for *CM-Exit (Treatment reported in Appendix B5)*

*The instructions for the first stage of each round was the same as in CM-Ostracism.*

**Second stage of each round**

*In the discussion that follows, we describe how group members can **opt-out** from making decisions in the **next** decision round. We refer to **eligible members** as group members who **did not opt-out** from decision making in the **current** decision round. We refer to **excluded members** as those members who **chose to opt-out** from decision making in the **current** round.*

In this stage, eligible members can **opt-out** from the ***next*** decision round. Thus, i**f you are an eligible member and your ID letter is A or B**, you can choose to opt-out from making decisions in the next round in your Group X. **If you are an eligible member and your ID letter is D or E**, you can choose to opt-out from making decisions in the next round in your Group Y.

**If your ID letter is C**, you may be an eligible member in only one group (X or Y) or in both groups simultaneously. You will decide separately for each group. **If you are an eligible member in Group X**, you can choose to opt-out from making decisions in the next round in your Group X. **If you are an eligible member in Group Y**, you can choose to opt-out from making decisions in the next round in your Group Y.

If an eligible member wants to opt-out of the next decision round, an eligible member will click the 'Yes' circle. If an eligible members does **not** want to opt-out of the next decision round, an eligible member will click the 'No' circle. The choice can be changed simply by clicking the other circle.

When deciding whether to opt-out, eligible members will see the individual allocation decisions in the current round of every eligible member of the group. Once you have made your choice, please click the 'Confirm' button at the bottom of the screen.

If an eligible member in a group chooses to opt-out, that person is excluded from participation in the next round in that group. Note that more than one person can opt-out in any round. After all eligible members have made their decisions in the second stage of the round, *all* group members will be informed of who will be eligible to make decisions in the next round in your Group.

**If your ID letter is A, B, D or E**: Excluded group member(s), i.e., those who have chosen to opt-out, do not make an allocation decision or an opt-out decision in the next round in their Group. This member's entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round. Further, this member will not receive any earnings from the *Group Account* in the next round.

**If your ID letter is C**: Excluded group member(s), i.e., those who have chosen to opt-out, do not make an allocation decision or an opt-out decision in the next round only in the Group they have opted out of. This member will not receive any earnings from the *Group Account* in this Group in the next round. An excluded member C will still decide how to allocate the endowment of 20 tokens among his/her *Private Account* and the *Group Account* in the other Group, i.e., in the Group the member has **not** opted out of. Further this member will also make a decision to opt-out of the other Group. If the member C has opted out of *both* Groups, the member will not make any allocation decisions or opt-out decisions in the next round and his/her entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round.

Only those who are **not** excluded, i.e., those who have **not** opted out, will receive earnings from the *Group Account*. Further, regardless of the number of individuals in a group, each token allocated to the *Group Account* yields 0.6 tokens for those who are not excluded.

All group members (whether or not they opted out of the round) will be informed of the total allocation to the *Group Account* in your group in the first stage of the round *and* the total allocation to the *Group Account* in your group in all previous rounds. However, only eligible group members will be informed of the individual allocation decisions in their Group in the round.

If two or more members of a group are excluded, i.e., choose to opt-out, there will be no first or second stage decisions in the next round in that group. Each group member's endowment will be automatically allocated to their *Private Account.*

In summary, if a group member chooses to opt out of the next round, this means he/she does not participate in either stage of the next round and does not receive earnings from the *Group Account*. His/her endowment is automatically allocated to his/her *Private Account*. Then, he/she is automatically eligible to participate in both stages of the round that follows the round in which he/she opted out.

**Questions to help you understand the decision task**

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## A7. Second stage instructions for *No-CM-Exit (Treatment reported in Appendix B5)*

*The instructions for the first stage of each round was the same as in No-CM-Ostracism.*

**Second stage of each round**

*In the discussion that follows, we describe how group members can* ***opt-out*** *from making decisions in the* ***next*** *decision round. We refer to* ***eligible members*** *as group members who* ***did not opt-out*** *from decision making in the* ***current*** *decision round. We refer to* ***excluded members*** *as those members who* ***chose to opt-out*** *from decision making in the* ***current*** *round.*

In this stage, eligible members can **opt-out** from the ***next*** decision round.

If an eligible member wants to opt-out of the next decision round, an eligible member will click the 'Yes' circle. If an eligible members does **not** want to opt-out of the next decision round, an eligible member will click the 'No' circle. The choice can be changed simply by clicking the other circle.

When deciding whether to opt-out, eligible members will see the individual allocation decisions in the current round of every eligible member of the group. Once you have made your choice, please click the 'Confirm' button at the bottom of the screen.

If an eligible member in a group chooses to opt-out, that person is excluded from participation in the next round in that group. Note that more than one person can opt-out in any round. After all eligible members have made their decisions in the second stage of the round, *all* group members will be informed of who will be eligible to make decisions in the next round in your Group.

Excluded group member(s), i.e., those who have chosen to opt-out, do not make an allocation decision or an opt-out decision in the next round in their Group. This member's entire endowment of 20 tokens will automatically be allocated to his/her *Private Account* in the next round. Further, this member will not receive any earnings from the *Group Account* in the next round.

Only those who are **not** excluded, i.e., those who have **not** opted out, will receive earnings from the *Group Account*. Further, regardless of the number of individuals in a group, each token allocated to the *Group Account* yields 0.6 tokens for those who are not excluded.

All group members (whether or not they opted out of the round) will be informed of the total allocation to the *Group Account* in your group in the first stage of the round *and* the total allocation to the *Group Account* in your group in all previous rounds. However, only eligible group members will be informed of the individual allocation decisions in their Group in the round.

If two or more members of a group are excluded, i.e., choose to opt-out, there will be no first or second stage decisions in the next round in that group. Each group member's endowment will be automatically allocated to their *Private Account.*

In summary, if a group member chooses to opt out of the next round, this means he/she does not participate in either stage of the next round and does not receive earnings from the *Group Account*. His/her endowment is automatically allocated to his/her *Private Account*. Then, he/she is automatically eligible to participate in both stages of the round that follows the round in which he/she opted out.

**Questions to help you understand the decision task**

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. You will answer these questions in private on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.

## Appendix B. Additional Analyses

### Appendix B1. Individual regressions – contribution decisions

Table B1 presents individual level panel random-effects regressions of contributions. We report standard errors clustered on independent pairs (groups) in treatments with (without) a common member.

**Table B1. Determinants of individual contributions: panel random-effects regressions**

| | Contributions *No-CM* and *CM* | Contributions *CM* and *CM-Info* | Contributions *CM* and *CM-Ostracism* |
|---|---|---|---|
| Lagged deviation from average contribution of others | $0.062^{*}$<br>(0.033) | 0.036<br>(0.032) | $0.062^{**}$<br>(0.032) |
| *CM* treatment dummy | $-4.876^{***}$<br>(1.901) | - | - |
| *CM-Info* treatment dummy | - | 2.007<br>(1.349) | - |
| *CM-Ostracism* treatment dummy | - | - | $2.577^{**}$<br>(1.296) |
| *HighC* dummy | $5.589^{***}$<br>(1.770) | $5.055^{***}$<br>(1.209) | $2.863^{**}$<br>(1.332) |
| Common-member dummy | $-2.454^{***}$<br>(0.774) | $-2.088^{***}$<br>(0.850) | $-3.16^{***}$<br>(0.614) |
| *HighC* × Common-member | -1.306<br>(1.463) | -1.331<br>(0.973) | 0.126<br>(0.942) |
| Constant | $12.926^{***}$<br>(1.151) | $6.849^{***}$<br>(1.176) | $7.992^{***}$<br>(1.085) |
| Observations | 1938 | 2508 | 2622 |

Dep. variable is an individual's contribution. SE clustered at group/pair level in parentheses. Includes round dummies (not reported). $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

The regressions confirm the findings reported in the text.

(i) Contributions are lower in *CM* than in *No-CM*,

(ii) Contributions are higher in *HighC* groups than in *LowC* groups, except when group members can be ostracised (individual regression with *CM-Ostracism* data only-not reported, *p*-value = 0.941).

(iii) The common-member's contributions are lower than the contributions of dedicated-members in *CM* and *CM-Ostracism* (*p*-value < 0.01 in each case), but the difference is only weakly significant in *CM-Info* (*p*-value = 0.065). [*p*-values from individual regressions with data only from one treatment-not reported]

## Appendix B2. Group contributions to public goods

### B2.1 No-CM vs. CM

Figure B1 presents time trends of average group contributions in *HighC* and *LowC* groups in *CM*, and groups in *No-CM*. Table B2 presents average group contributions over all 20 rounds.

**Figure B1. Average group contributions in fixed groups**

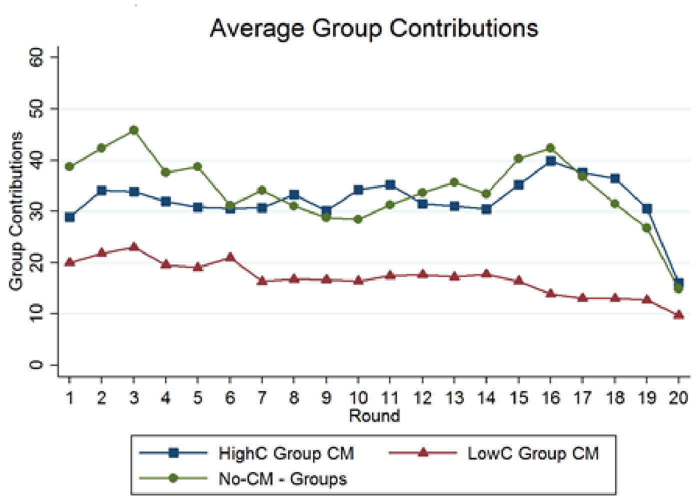



**Table B2. Average (st dev) group contributions in fixed groups**

| | Obs. | *HighC* groups | *LowC* groups |
|---|---|---|---|
| ***CM*** | 12 | 32.13<br>(12.06) | 17.00<br>(13.39) |
| ***No-CM*** | 11 | 34.16<br>(10.93) | |

There are two primary observations from Figure B1. First, the time trends for *HighC* groups in *CM*, and groups in *No-CM* are very similar.[1] Across all rounds, there is no significant difference in average contributions across *HighC* groups in *CM*, and groups in *No-CM* (RS $p > 0.10$).

The second primary observation from Figure B1 is the time trend for *LowC* groups in *CM* is much lower than the other time trends. Across all rounds, average percentage contributions for *LowC* groups in *CM* are significantly lower than each of the other comparisons ($p < 0.01$ for each SR and RS test).

[1] While average group contributions in *No-CM* do decline over time, levels are higher than typically observed in VCM experiments. This is likely due to the MPCR of 0.6, which is higher than typical values (0.3 – 0.5). There is evidence that contributions are increasing in the MPCR (Isaac and Walker, 1988).

**Result B1**: *Average group contributions over all 20 rounds in HighC groups in CM are no higher than that of groups in No-CM. Average group contributions of LowC groups in CM are lower than that of groups in No-CM.*

### B2.2 *CM-Info* vs. *CM*

Figure B2 presents time trends of average group contributions in *HighC* and *LowC* groups in *CM* and *CM-Info*. Table B3 presents average group contributions over all 20 rounds.

**Figure B2. Average group contributions in *CM-Info***

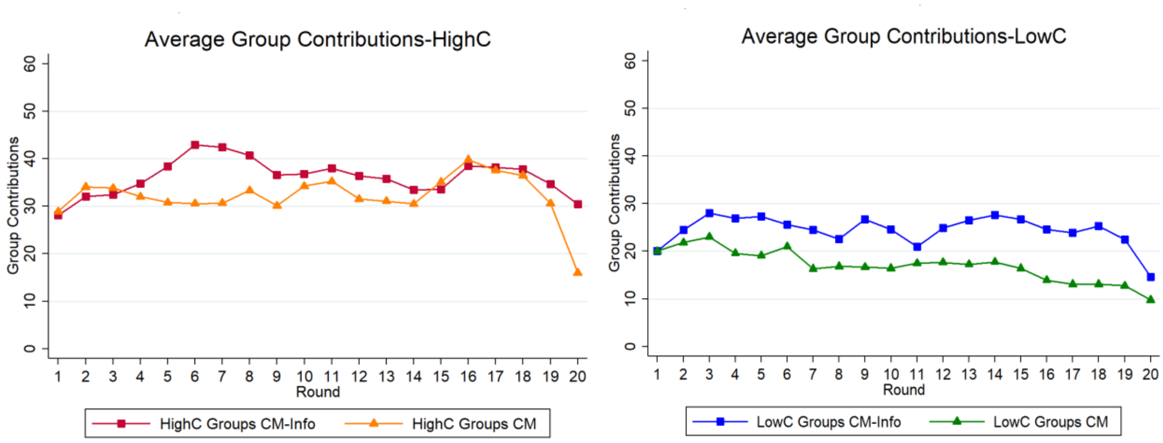



**Table B3. Average (st dev) group contributions in *CM* and *CM-Info***

| | Obs. | *HighC* groups | *LowC* groups |
|---|---|---|---|
| ***CM*** | 12 | 32.13 | 17.00 |
| | | (12.06) | (13.39) |
| ***CM-Info*** | 10 | 36.11 | 24.42 |
| | | (9.77) | (12.73) |

There are two primary observations from Figure B2. First, the time trends for *HighC* and *LowC* groups in *CM-Info* start at the same levels as groups in *CM*.

The second primary observation from Figure B2 is the time trends for *HighC* groups in *CM* and *CM-Info* are very similar. Across all rounds, average contributions for *HighC* groups in *CM* and *CM-Info* are not significantly different (RS p = 0.4681). The time trend for *LowC* groups in *CM-Info* is higher than the trend in *CM*. Across all rounds, average contributions for *LowC* groups in *CM* and *CM-Info* are not significantly different (RS p = 0.1872).

**Result B2**: *Average group contributions over all 20 rounds in CM-Info are not significantly different from that in CM, for both HighC and LowC groups.*

### B2.3 *CM-Ostracism* vs. *CM-Info* vs. *CM*

Figure B3 presents time trends of average group contributions in *HighC* and *LowC* groups in *CM, CM-Info* and *CM-Ostracism*. Table B4 presents average group contributions over all 20 rounds.

**Figure B3. Average group contributions in *CM-Ostracism***

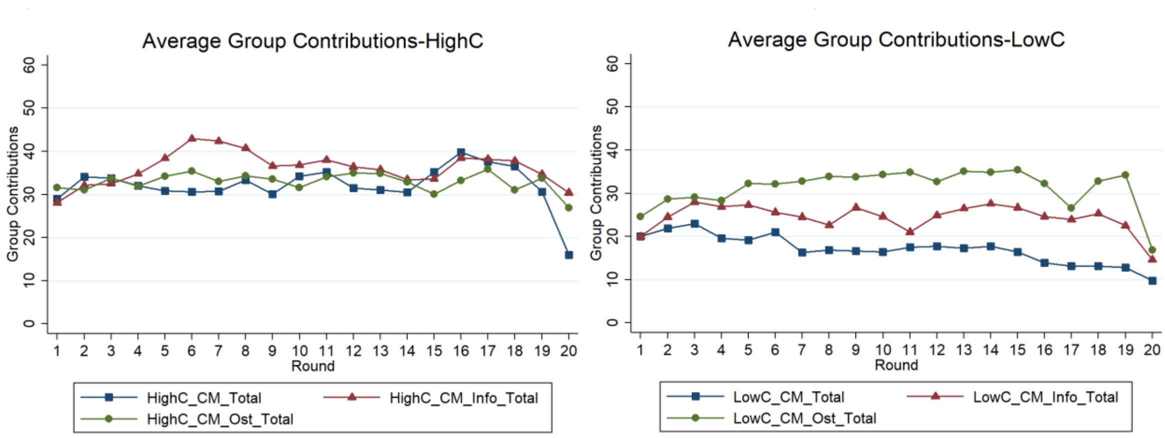



**Table B4. Average (st dev) group contributions in *CM, CM-Info,* and *CM-Ostracism***

| | Obs. | *HighC* groups | *LowC* groups |
|---|---|---|---|
| ***CM*** | 12 | 32.13 | 17.00 |
| | | (12.06) | (13.39) |
| ***CM-Info*** | 10 | 36.11 | 24.42 |
| | | (9.77) | (12.73) |
| ***CM-Ostracism*** | 11 | 32.91 | 31.27 |
| | | (12.57) | (9.21) |

There are two primary observations from Figure B3. First, the time trends for *HighC* groups are very similar across all treatments with a common-member.

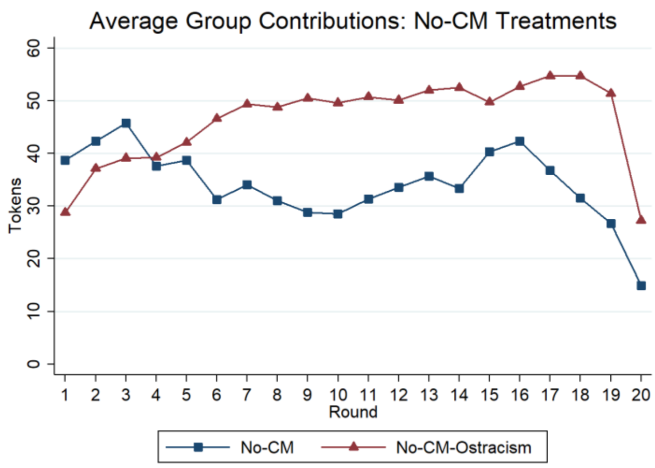
The second primary observation from Figure B3 is that contributions in *LowC* groups are higher in the presence of ostracism. However, the availability of ostracism in *HighC* groups has little effect on contributions. The averages in Table B4 and statistical tests confirm the patterns noted in Figure B5. In the presence of a common-member, ostracism significantly raises contributions in *LowC* groups (RS p = 0.016) but not in *HighC* groups (RS p = 0.758). As a result, unlike in *CM*, the *LowC* groups "catch up" with the *HighC* groups after the initial decision rounds; there is no significant difference in average contributions between *HighC* and *LowC* groups in *CM-Ostracism* (SR p = 0.859).[2]

**Result B3**: *Average group contributions are higher in LowC groups in CM-Ostracism than in CM, but there is no difference in average contributions of HighC groups.*

### B2.4 *No-CM-Ostracism* vs. *No-CM*

Figure B4 presents time trends of average group contributions in *No-CM* and *No-CM-Ostracism* groups. Table B5 presents average group contributions over all 20 rounds.

**Figure B4. Average group contributions in *No-CM* and *No-CM-Ostracism***




[2] Pooling contributions of *HighC* and *LowC* groups within a pair, average contributions are (weakly) significantly higher in *CM-Ostracism* than in *CM* (64.18 vs. 49.13, RS p = 0.065).

**Table B5. Average (st dev) group contributions in *No-CM* and *No-CM-Ostracism***

| | **Obs.** | ***Group*** |
|---|---|---|
| ***No-CM*** | 11 | 34.16<br>(10.93) |
| ***No-CM-Ostracism*** | 8 | 46.36<br>(6.93) |

The primary observations from Figure B4 are, first, that average group contributions are initially lower in *No-CM-Ostracism*. However, over time average contributions increase in *No-CM-Ostracism*. Average group contributions across all rounds are significantly higher in *No-CM-Ostracism* than in *No-CM* (RS p = 0.026). Previous evidence shows that the threat of permanent exclusion raises contributions in groups (e.g., Cinyabuguma et al., 2005). Our finding shows that even temporary exclusion raises contributions, as in Charness and Yang (2014).

**Result B4**: *Average group contributions are higher in No-CM-Ostracism than in No-CM.*

## Appendix B3. Individual regressions – ostracism

### Ostracism of low contributors: *HighC* and *LowC* groups

Table B6 presents individual Probit regressions for the determinants of ostracism of group members whose contributions were below the average of the other eligible members in their group. The regression models also including a *HighC* group dummy and a *HighC*-common-member interaction term. As seen in Figure 4 in the main text, common-members are more likely to be targeted in *LowC* groups. However, the likelihood a common-member is targeted is diminished when controlling for a common-member's absolute deviation in contribution compared to the eligible dedicated-members in his/her group (Absolute deviation × Common-member coefficient).

**Table B6. Determinants of ostracism of high contributors: Individual Probit regressions**

| | Negative Deviations *CM-Ostracism* |
|---|---|
| Absolute deviation from average contribution of non-excl. others | 0.164*** (0.044) |
| Dummy for two other non-excl. members in group | -0.609*** (0.216) |
| *CM-Ostracism* treatment dummy | - |
| *HighC* group dummy | 0.059 (0.185) |
| Common-member dummy | 0.661*** (0.248) |
| *HighC* × Common-member | -0.479*** (0.155) |
| Absolute deviation × Common-member | -0.126*** (0.042) |
| Constant | -1.640*** (0.479) |
| Observations | 563 |

Dep. variable = 1 if excluded in a round and = 0 otherwise. SE clustered at group/pair level in parentheses. Includes round dummies (not reported). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Ostracism of high contributors**

Table B7 presents the counterpart of the first regression in Table B6 for members with positive deviations. We only present the regression for *CM-Ostracism* as high contributors were never ostracised in *No-CM-Ostracism*.

**Table B7. Determinants of ostracism of high contributors: Individual Probit regressions**

| | Positive Deviations *CM-Ostracism* |
|---|---|
| Absolute deviation from average contribution of non-excl. others | -0.009 (0.066) |
| Dummy for two other non-excl. members in group | -1.745*** (0.274) |
| *HighC* dummy | -0.658 (0.537) |
| Common-member dummy | 0.221 (0.780) |
| *HighC* × Common-member | 0.433 (0.779) |
| Absolute deviation × Common-member | 0.111 (0.129) |
| Constant | -1.065 (1.039) |
| Observations | 239 |

Dep. variable = 1 if excluded in a round and = 0 otherwise. SE clustered at group/pair level in parentheses. Includes round dummies (not reported). Dummy variables for rounds 1, 2, 4-9, 13, 15, 17, and 18 are dropped because no members were excluded in these rounds. There is no regression for positive deviations in *No-CM-Ostracism* as no one with positive deviations was ostracised in the treatment. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

As mentioned in the text, there were very few instances of ostracism of high contributors. Hence, the above regression most likely captures spurious correlations. As a result, we do not interpret the estimates, and present them only for completeness.

**Appendix B4.** ***No-CM-Ostracism*** **vs.** ***CM-Ostracism***

Figure B5 presents time trends of average group contributions in *No-CM-Ostracism* and *CM-Ostracism* groups. Table B8 presents average group contributions over all 20 rounds.

**Figure B5. Average group contributions in** ***No-CM-Ostracism*** **and** ***CM-Ostracism***

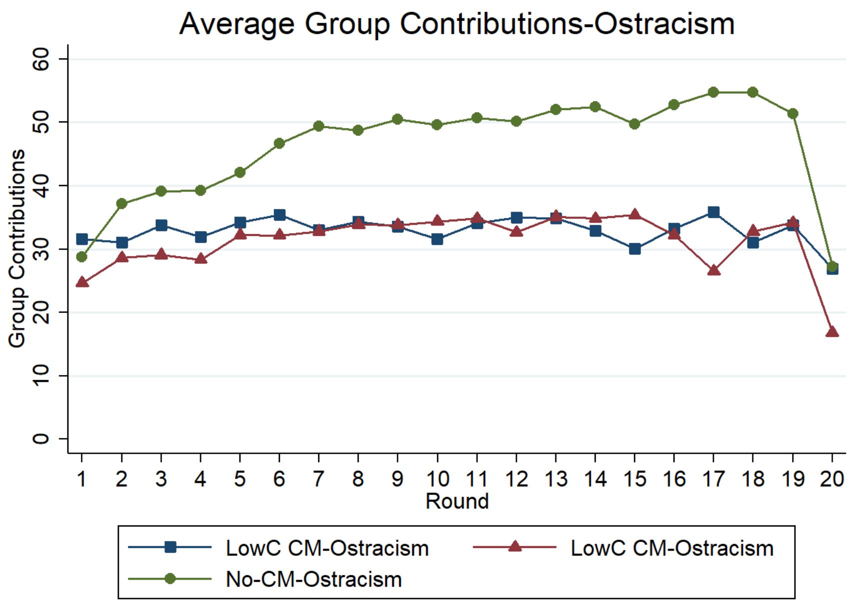



**Table B8. Average (st dev) group contributions in** ***No-CM-Ostracism*** **and** ***CM-Ostracism***

| | **Obs.** | ***HighC* groups** | ***LowC* groups** |
|---|---|---|---|
| ***CM-Ostracism*** | 11 | 32.91<br>(12.57) | 31.27<br>(9.21) |
| ***No-CM-Ostracism*** | 8 | 46.36<br>(6.93) | |

Figure B5 and Table B8 show that contributions in *HighC* and *LowC* groups in *CM-Ostracism* are unable to reach levels observed in *No-CM-Ostracism*. This difference is significant for *HighC* (RS $p = 0.032$) and *LowC* (RS $p = 0.002$) groups. Thus, while ostracism raises contributions, the increase is lower in the presence of a common-member.

**Result B5**: *When ostracism is available, average group contributions are lower in the presence of a common member in HighC and LowC groups than in groups without a common member.*

This result is likely due to the fact that the common-member, while increasing contributions to both groups, cannot contribute more than 10 tokens (on average) to each group (as discussed in section 5.2 in the main body of the paper). Given this constraint on the common-member's contributions, matching the contribution levels of groups in *No-CM-Ostracism* thus requires dedicated-members to contribute nearly their entire endowment to one group.

## Appendix B5. Treatments with *Exit*

In the paper, we discuss treatments where group members could decide on membership at the group level using majority voting. We also ran a pair of treatments (*CM-Exit* and *No-CM-Exit*), where group members could unilaterally decide if they wanted to remain a member of their group(s) in the next round. Previous evidence shows that individuals do exit from lower contributing groups (Ahn et al., 2008, 2009; Charness and Yang, 2014) when they have the opportunity to join other groups. In our setting, the common-member may exit from the *LowC* group for a round to signal his/her displeasure with the low level of contributions, and to 'encourage' the dedicated-members to increase contributions.

In *CM-Exit,* if common-members use exit to send a signal to *LowC* groups, it is likely to increase contributions in such groups. Ahn et al. (2008, 2009) and Charness and Yang (2014) find that when there is an option to exit and switch groups, contributions do increase. However, we find that voluntary exit is rarely used and the results are not different from those found in *No-CM* and *CM*. Thus, we briefly summarize the design and results here so as to not distract from the original *CM* treatment.

### Design

As in treatments with *Ostracism*, subjects interact in two stages in each decision round. The first stage is the contribution stage. In the second stage, subjects decide on group membership for the next round. In the second stage in each round, each group member unilaterally decides, at zero cost, whether to opt out (leave the group) for the next round. In treatments with a common-member, the common-member makes this decision separately for each group. If a group member opts out, he/she does not make a contribution or opt-out decision in the next round and does not receive earnings from the group account in that round. This member retains his/her endowment. The remaining members make a contribution decision, and make opt-out decisions, in the next round. If a common-member opts-out from one group, he/she can still contribute and make an opt-out decision in the group from which he/she did not exclude him/herself.

As with *Ostracism*, more than one member could choose to be excluded in any round, and excluded members re-joined their groups automatically in the following round. Information provided during and after rounds was the same as in treatments with *Ostracism*.

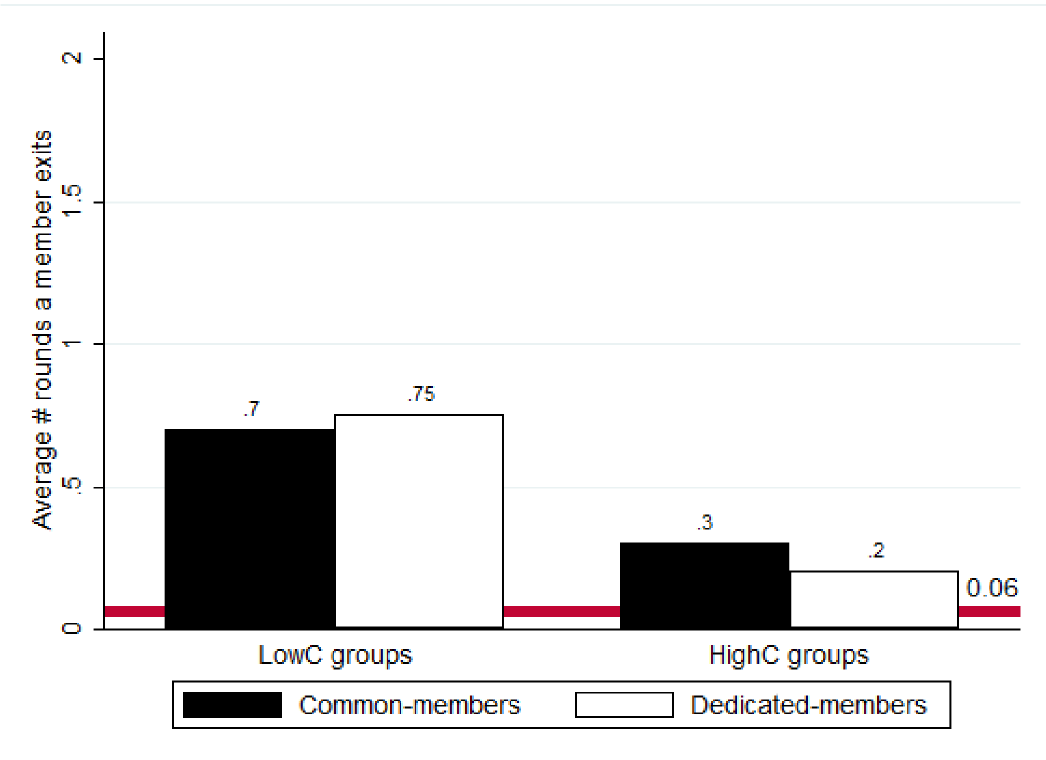
**Results**

We find, similar to *CM*, that initial performance is a strong predictor of overall performance. In particular, groups that start out with higher contributions also have the higher contribution level over all 20 rounds in 90% of pairs in *CM-Exit*.

***Use of the Exit Option***

Figure B6 shows the average number of rounds in which common and dedicated-members exit their groups. The horizontal line represents the average number of rounds group members exit their groups in *No-CM-Exit*. Figure B6 shows that there is almost no voluntary exit from groups, especially in the absence of a common-member.

**Figure B6. Average number of rounds individuals exit from their groups**




***Exit and group contributions***

Figure B7 presents time trends of average group contributions in *LowC* and *HighC* groups in *CM-Exit*. Table B9 presents average group contributions (over 20 rounds) in both treatments. For purposes of comparisons, they also present average contributions in *CM*.

**Figure B7. Average group contributions in the presence of *Exit***

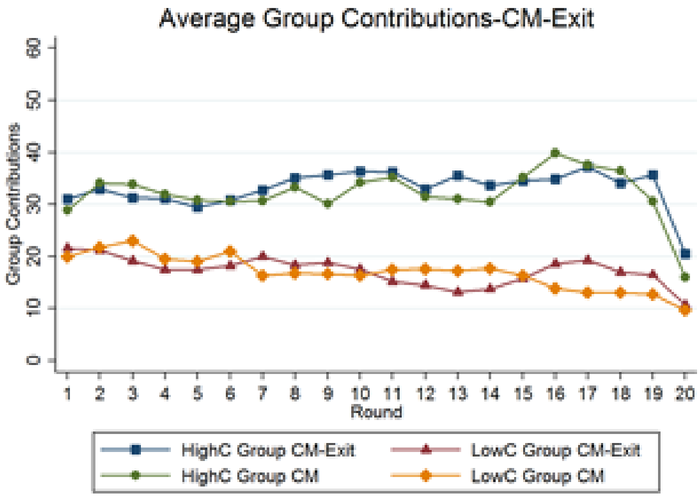



**Table B9. Average (st dev) group contributions in the presence and absence of an exit option**

| | Obs. | HighC groups | LowC groups |
|---|---|---|---|
| ***CM*** | 12 | 32.13 | 17.00 |
| | | (12.06) | (13.39) |
| ***CM-Exit*** | 11 | 33.10 | 17.24 |
| | | (14.23) | (8.01) |

Figure B7 shows that contributions in *HighC* and *LowC* groups are not affected much by the availability of exit opportunities. The averages in Table B9 and statistical tests confirm the patterns noted in the Figure. Compared to *CM*, *CM-Exit* does not significantly raise contributions in *HighC* groups (RS p = 0.792) or *LowC* groups (RS p = 0.553). As a result, similar to *CM*, the *LowC* groups fall behind the *HighC* groups after the initial decision rounds; there is a significant difference in average (across all 20 rounds) contributions between *HighC* and *LowC* groups in *CM-Exit* (SR p = 0.037).

**Result B6**: *The Exit option does not significantly affect average group contributions.*

**Appendix B6. Earnings in treatments with a common-member**

There are two sources for reduced earnings and efficiency. First, low contributions directly lead to low earnings. Second, due to the constant MPCR, ostracism of individuals lowers potential earnings by lowering the number of group members who can benefit from the same level of group contributions. However, as seen above, ostracism is almost never used. Thus, we focus on the effect of contributions, and analyse absolute earnings of individuals. Table B10 presents summary statistics of individual total earnings in treatments with a common-member.

**Table B10. Average (st dev) individual total earnings (US$) in the presence of a common-member**

| Treatment | Common-member | Dedicated-members | |
|---|---|---|---|
| | | *HighC* | *LowC* |
| ***CM*** | $25.25 | $18.07 | $15.74 |
| | ($5.57) | ($2.04) | ($2.05) |
| ***CM-Info*** | $26.15 | $19.07 | $17.32 |
| | ($6.22) | ($1.57) | ($1.80) |
| ***CM-Ostracism*** | $26.30 | $18.34 | $17.75 |
| | ($5.96) | ($1.85) | ($1.51) |

As seen in Table B10, common-members always earn more than do dedicated-members in both *HighC* and *LowC* groups. This difference is statistically significant in all three treatments (SR $p < 0.01$ in all cases). This is not surprising as common-members have an additional source of income, i.e., they receive benefits from the public goods in both groups. However, there is no significant difference in the earnings of the common-member across the three treatments.

Dedicated-members in *HighC* groups earn more than do those in *LowC* groups in all treatments. However, the difference is statistically significant only in *CM* and *CM-Info* (SR $p = 0.0150$ and 0.0926, respectively). As with contributions, earnings of dedicated-members in *HighC* groups and *LowC* groups in *CM-Ostracism* are not significantly different (SR $p = 0.8589$).

Earnings of dedicated-members in *HighC* groups are similar across treatments, and not significantly different (RS $p > 0.10$ in all comparisons). Earnings of dedicated-members in *LowC* groups in *CM-Info* and *CM-Ostracism* are similar, and not significantly different (RS p = 4813). However, earnings of dedicated-members in *LowC* groups in *CM* are significantly lower than in the other two treatments (RS $p = 0.0750$ for *CM-Info* and 0.0267 for *CM-Ostracism*).

The analysis of earnings confirms earlier findings related to contribution behaviour. In particular, both information and the opportunity to ostracise group members improve outcomes, particularly for dedicated-members in *LowC* groups. Moreover, in *CM-Ostracism*, both groups do equally well despite differences in initial performance, i.e., groups that start out worse are able to overcome their initial disadvantaged position.

**Appendix C. Extensions to settings with more players and/or groups**

As mentioned in the Conclusion of the paper, our Results are informative of behaviour that is likely to be observed in settings with a greater number of groups and/or players. Given that we find support for the predictions from Sugden's model with reciprocal agents, we further appeal to that model to extrapolate our findings to settings with more agents or groups. In particular, the logic behind reciprocal actions is used below to provide predictions for cases with more dedicated-members, more common-members, and more groups. The logic behind the arguments below relies on using average contribution of dedicated members in a group as the fundamental for reciprocal decisions by common members. Further, the arguments are specific to our linear VCM setting and may not apply to nonlinear settings, which may have interior equilibria.

(a) More common-members: Reciprocal common-members, however many there may be, will all favour the higher performing group (H3 in the paper); reciprocity implies that it is not possible for dedicated-members in a group to attract a strict subset of common-members to their group. This is because all common-members will be obliged to contribute higher amounts to the higher performing group. That is, the model predicts all common-members will gravitate toward those groups with the highest effort from dedicated members. This result holds regardless of the number of dedicated-members in each group. Of course, this would change if there were additional factors such as complementarities where payoffs are higher for a common-member in a particular group.) Thus, the model suggests that if two (or more) common-members abandoned a low-contributing group, that group's performance would fall further behind high-performing groups, thus increasing the gap between 'winners' and 'losers'.

(b) More groups: Once again, reciprocity implies that common-members will focus their contributions on the highest performing group. However, with more than two groups, it is now likely that there will be a hierarchy of groups. For instance, with three groups, there will be a *HighC* group, a *MidC* group, and a *LowC* group. Reciprocity dictates that the common-member's obligations are highest in the *HighC* group, followed by the *MidC* group, and then the *LowC* group. Note that, Hypothesis 2 in the paper predicts that the common-member will not completely abandon any group, and our results support this prediction for the case of two groups. However, the CM faces an endowment constraint, which implies he would have to spread his/her resources across the larger number of groups or begin to abandon groups as the number of groups grows.

Assuming reciprocal agents in all groups, and given our finding that dedicated-members tend to match the common-member's contribution, one might expect that contributions by dedicated-members will also drop to very low levels in *all* groups as the number of groups grows. In this sense, reciprocity could be harmful to group productivity.

(c) Ostracism with a large number of groups: Adding ostracism to the above scenarios could lead to different results than those found in *CM-Ostracism* with two groups. With a large number of groups, the performance of the common-member is likely to be "overstretched." Based on our arguments above, with a large number of groups, dedicated-members will likely be contributing low amounts. If so, it is less costly for a common-member to be ostracised from a group. In this scenario, a common-member is likely to focus his/her resources on a few groups (presumably the top performing groups) and be ostracised from the rest of the groups. However, as we argue below with examples, the optimal "sharing" decision for common-members across groups (as well as for dedicated members) becomes more complicated as the number of groups increases. Thus, it is possible that group member's actions may be a result of cognitive limitations regarding the marginal payoffs of various levels of effort/contributions, rather than simply due to total payoff considerations.

In our experiment, using linear VCM as the payoff function for group effort, the common-member contributes roughly 10 tokens to each group in *CM-Ostracism*, and this is matched by dedicated-members in each group. Assuming a total contribution of 30 tokens in each group in a round, per-round payoffs to the common-member are thus 36 tokens (= 30 * 0.6 = 18 tokens from each group). Suppose the common-member had focused entirely on one of the groups and had contributed all 20 tokens to that group. Suppose that he/she will be ostracised from the other group, and that both dedicated-members in his/her chosen group also contribute 20 tokens each. The common-member's payoff in this round would again be 36 tokens (= 60*0.6 from the chosen group, and 0 from the other group due to being ostracised). The common-member is thus indifferent between the two options.

If there were three groups to spread resources across, the best a common-member could do would be to contribute 6, 7, and 7 tokens to the three groups. Assuming his/her contributions are exactly matched once again, the common-member's payoff in a round would be 10.8, 12.6 and 12.6 tokens from the three groups, for a total of 36 tokens. If there were four groups to split across, he/she would contribute 5 tokens each. Again assuming perfect matching by dedicated-members, payoffs in a round would be 36 tokens (9 from each group). And so on. No matter how the common-member splits his/her resources, perfect matching by dedicated-members will earn him/her a payoff of 36 tokens in the round, as long as he/she contributes all 20 tokens. Thus, the common-member is indifferent as to the number of groups he/she supports. The constraint would be his/her endowment – in our experiment, 20 tokens. Thus, precisely how many groups the common-member will choose to focus on is an empirical question for future work.