# Favor Trading in Public Good Provision

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*Abstract*

Grassroots fundraising leverages favor trading in social networks to support the provision of a public good. We use a laboratory experiment to study the elements and dynamics of this type of institution. Peer-to-peer reciprocity is important, and having the ability to practice targeted reciprocity in our experiment increases contributions to the public good by 14%. Subjects reward group members who have previously been generous to them and withhold rewards from ungenerous group members. When someone is rendered unable to benefit from favor trading, he gives much less to the public good than he does in other settings. People thus excluded from the "circle of giving" provide a clean and strict test of indirect reciprocity, since they cannot benefit from a norm of cooperation. Contrary to previous studies, we do not observe indirect reciprocity.

**Keywords:** public goods, reciprocity, experiment, peer-to-peer fundraising

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[1] Corresponding author. James Cox, Vjollca Sadiraj, and participants in various workshops, conferences, and seminars (notably at Georgia State University) provided helpful comments.

"Do: Get excited. Engage your network, rally the masses and have fun doing it." – *charity:water advice on peer fundraising*

"If you don't give back no one will like you." – *Crowdrise tagline*

## *1. Introduction*

Social networks provide a tremendous resource for charities. An organization's supporters can be turned into active fundraisers, leveraging their connections with friends and family to raise money. As online social media have expanded people's social networks, information technology has also made it easier to make online purchases and donations to charities. These trends have led to even more use of grassroots fundraising through tools like Facebook Causes and DonorPages. For example, about one third of young people use email and social networking sites to inform friends of a charity (Preston, 2010). Brick-and-mortar institutions like the Girl Scouts of the USA use a combination of online solicitation and personal contact to fundraise through networks; Girl Scout troops send girls out into their communities every year to sell cookies in a $700 million business to raise money for their Scouting activities (Girl Scouts of the USA, 2011).

The popularity of grassroots fundraising suggests that the method is fruitful, yet it is an area that is little studied. In this paper, we examine why grassroots fundraising works and what elements of the institution are important to raising contributions.

We use a public goods experiment to examine contributions in a network. People are endowed with a favorite "cause" and benefit directly from the contributions of others. We can therefore quantify the value of building a good reputation and trading favors, and we find two important results. First, we show that direct reciprocity is a key element to the success of peer-to-peer fundraising. Allowing for public reputations and targeted rewards causes a 14.4% increase in contributions. This low-cost change to the fundraising mechanism taps into

reciprocal motives. Second, we show that indirect reciprocity does not seem to be an important factor in this institution: people who have no favorite cause of their own do not reward others' good behavior. This is a new result and suggests some limits to the power of indirect reciprocity.

Grassroots fundraising has two key features. First, volunteers who are strong supporters of the organization are enlisted to solicit contributions from their social networks. Second, donations are revealed to the fundraiser and in many cases to everyone who is solicited. For example, the Girl Scouts of the USA's most prominent fundraiser is the annual drive in which member girls and their families sell cookies to friends, family, and neighbors. The purchase of Girl Scout cookies is fairly public: donors write their names and contribution decisions on a common sheet, and cookie deliveries are often done in front of others.

How might this institution harness a network to raise money? Suppose Joe and Frank are coworkers. Joe's son is in Boy Scouts and Frank's daughter is in Girl Scouts. Each organization has an annual fundraiser: Joe's Boy Scout sells popcorn in January and Frank's Girl Scout sells cookies in February. Each man has an interest in his own child's fundraiser because of the family's stake in the organization's success. As a result, Joe will buy popcorn and Frank will buy cookies. In addition, Joe wants Frank to buy popcorn and Frank wants Joe to buy cookies. Even if Frank does not care about Boy Scouts (or popcorn), he may buy Joe's popcorn in January hoping Joe will reciprocate when Frank's cookie fundraiser comes around next month. These peers use the promise of future reciprocation to pressure each other to give to charity.[1]

[1] Social favor trading is not limited to charitable fundraising and may drive behavior in many cooperative settings. The same dynamic may exist when time and effort are solicited, for example, in a volunteer advisory board or a school's parent-teacher association. Klein (1990) argues that peer pressure played a role in the funding of turnpikes in early America.

This reciprocal giving may work in one of many ways.[2] It may be strategic, in that giving is done only to garner a reward later, and once future rewards are no longer possible, giving declines. It may be driven by direct reciprocity, models of which include Rabin (1993) and Cox, Friedman, and Sadiraj (2008), in that giving is targeted to reward those who have been nice to you because your benefactor's payoff is now part of your preferences. Direct reciprocity or gift exchange has been studied extensively in a variety of settings (e.g. Fehr, Kirchsteiger and Riedl 1993; Berg, Dickhaut and McCabe 1995; Charness and Rabin 2002; Cox 2004; List 2006; Gneezy and List 2006). Indirect reciprocity may play a role if an actor rewards a good deed done to a third party (e.g. Nowak and Sigmund 2005; Seinen and Schram 2006, Engelmann and Fischbacher 2009). [3]

While there is ample evidence that people contribute to public goods, it is also clear that cooperation is difficult to sustain (Ledyard, 1995). Reciprocal-type forces based on subjects' reputations have been observed to enable pro-social cooperative behavior (e.g. Trivers, 1971, Fischbacher, Gächter, and Fehr 2001; Milinski et al. 2002; Gächter 2007), including through punishment and reward (e.g. Fehr and Gächter 2000; Andreoni, Harbaugh and Vesterlund 2003; Masclet, Noussair, Tucker and Villeval, 2003; Bochet, Page and Putterman 2006; Houser, Xiao, McCabe and Smith 2008; Almenberg et al. forthcoming). There is growing evidence that social forces also drive giving outside the lab; in a field experiment, DellaVigna, List, and Malmendier (2010) find evidence of "social pressure" in door-to-door fundraising, but they study one-shot

[2] As discussed in Sobel (2005), the language used to describe reciprocal acts is imperfectly standardized in the literature. Throughout the paper, we will use phrases like "reciprocal act" to describe any act of apparent kindness that seems to respond to a kind act received in the past. We will describe these actions as "strategic" (or "instrumental," per Sobel) if they are self-serving. We will use the phrases "direct reciprocity" and "indirect reciprocity" to describe *only* acts that are non-strategic, i.e. are rooted in other-regarding preferences ("intrinsic," per Sobel).

[3] There are many subtle variants of indirect reciprocity; most relevant to our setting are the "downstream reciprocity" of Nowak and Sigmund (2005), the "third party reward" of Almenberg et al. (forthcoming), and the "social indirect reciprocity" of Stanca (2009).

interactions where future reciprocation is not possible and do not try to identify components of this pressure.

Our experiment closely examines how different kinds of reciprocity interact with public goods contributions to increase and sustain cooperation in grassroots fundraising. We use a linear public goods game experiment and abstract away from network formation and solicitation. This lets us investigate this fundraising institution more precisely by focusing on the roles of social preferences and information in determining contribution behavior in a group.[4]

We induce heterogeneous interests in "causes" by assigning asymmetric returns to the public good. In every round, one person (the "Stakeholder") gains more from the public good than the others in the group (just as Frank cares about and thus has a stake in the Girl Scouts' success). The game is repeated and every person in the group has a turn at being the Stakeholder. In one treatment, the group can see and track each member's contributions to and returns from the public good. This gives subjects the ability to condition their giving as they may in many social giving settings: they may use public good contributions to target rewards to those who have been kind. The difference between this treatment and a baseline in which reputation and payoff information is suppressed tells us the importance of direct reciprocity.

In a final treatment, we examine whether a group member who never has a "cause" will engage in indirect reciprocity, using his contribution to reward people who have been kind to others. Our investigation of indirect reciprocity differs from many studies (e.g. Engelmann and Fischbacher, 2009; Seinen and Schram, 2006) that have support for it in that the people we look

[4] Non-experimental studies of peer solicitation could suffer from endogeneity. For example, Long (1976) found that the more "personal" a donor solicitation, the more contributions were solicited. This was because a more personal solicitation allowed the fundraiser to exert peer pressure on the donor. However, the analysis will likely overestimate the relationship. Personal solicitations are more costly to perform, so charities may limit their most personal solicitations to donors known to be generous.

to for evidence of indirect reciprocity gain very little from a group norm of cooperation. In previous studies, subjects who indirectly reciprocate gain a large benefit if the group establishes a general norm of cooperation.

We find that the effects of allowing people to engage in targeted reciprocity, as they may in peer-to-peer fundraising, are significant. Average contributions increase by 14.4% when targeted reciprocal acts are possible. While some reciprocal acts may be strategic, we show that not all are. Some are more consistent with direct reciprocity. We do not find evidence of indirect reciprocity; when a person's benefit from a norm of cooperation is small, he does not reward kindness with kindness.

The paper proceeds as follows. The next section explains the general experimental design. Section 3 describes three experimental treatments. In Section 4, we present results. We conclude in Section 5.

## *2. Experimental Design*

The experiment is a linear public goods game with publicly revealed contributions and asymmetric payoffs. The design mimics the setup of a peer-to-peer fundraising network that allows favor trading. In each treatment, subjects are assigned into five-person groups. Each person has an endowment of $z$ tokens each round to allocate between a private investment with return $a$ to himself and a public investment with some return to all group members. In each round, one group member is the Stakeholder: he has a bigger stake in the public good because he gets a higher return (relative to other members) from tokens invested there. The Stakeholder position rotates through group members. The public good return is $b$ for non-Stakeholders and $c$

for Stakeholders. Person $i$'s contribution to the public good in round $t$ is $g_{it}$, and $Stake_t$ is the index of the person who is Stakeholder in round $t$. Payoffs are:

$$\pi_{it} = \begin{Bmatrix} c\sum_j g_{jt} + a\left(z - g_{it}\right) & if\ \ Stake_t = i \\ b\sum_j g_{jt} + a\left(z - g_{it}\right) & if\ \ Stake_t \neq i \end{Bmatrix}$$

The parameters are such that $b < a < c$ and $a < 4b + c$. The social optimum is achieved if everyone contributes fully. Since $(c - a)$ is positive, the Stakeholder maximizes profit by contributing his entire endowment to the public good, so even a selfish Stakeholder always contributes to the public good. Since $(b - a)$ is negative, non-Stakeholders face a dilemma: they maximize profit by keeping all of their tokens, but this free riding is anti-social. Non-Stakeholder contributions will be the focus of our analysis.

As in most public good environments, a selfish person would be predicted to free ride when he is non-Stakeholder. An altruist or a person with warm glow preferences would contribute a positive amount if his marginal gain in utility from increasing others' payoffs is larger than his marginal utility loss from the reduction in his own payoff. Against this backdrop, the strategic and reciprocal forces described above will be at play, given sufficient information.

If a subject can only see a list or summary of his group members' contributions, he may exhibit conditional cooperation as in other public goods settings. However, the asymmetry provided by the Stakeholder position and a more complete information set (information on when each group member will be Stakeholder and a contribution history for each member) allow targeted reciprocal actions to occur. This is because a subject benefits quite a bit from contributions others make when he is Stakeholder, so subjects can target each other for rewards. That is, others' past behavior can help a subject decide when to make or withhold non-

Stakeholder contributions. In particular, we expect that targeted reciprocal actions will be made to take advantage of the timing in which one is a Stakeholder. We expect that a subject's directly reciprocal acts will occur in response to contributions others made when he was Stakeholder (though he also benefits, albeit much less, from contributions others make when he is not Stakeholder). Similarly, we expect these reciprocations to take the form of increased (or decreased) contributions timed to the rounds when his benefactor (or malefactor) is Stakeholder.

These reciprocal acts can be of two varieties. On the one hand, they may be motivated by other-regarding preferences—that is, they may reflect direct reciprocity. A person's willingness to pay to increase another person's payoff may depend on the history he has observed. Thus, direct reciprocity rooted in other-regarding preferences can cause giving to be conditional on others' contributions from past rounds.

On the other hand, if a subject is strategic, observed history may change his beliefs about the best strategic action. If a group member seems to be potentially generous, a strategic subject may think that if he contributes when that person is Stakeholder he will gain favor and earn future benefits when the contribution is reciprocated. The benefits of this strategic behavior are greatly reduced after a subject passes his last stint as Stakeholder, so even in the full-information Stakeholder setting, strategic motivations are discontinuously reduced in final periods. Thus, conditional (reciprocal) giving in early rounds may also be caused by strategic self-interest.

In either of these ways, a full information set of contributions made by each group member and the timing of when each group member will be Stakeholder allows subjects to exhibit reciprocal giving.[5] If the information on Stakeholder timing and individual contribution

[5] History (and information about history) could also affect current behavior through contagion: a person treated well (badly) in the past could react by behaving well (badly) not because they wish to reciprocate but because they have

histories is suppressed while the game structure remains otherwise identical, targeted reciprocal acts (strategic or rooted in other-regarding preferences) are not possible.

*3. Experimental Treatments*

We use three treatments: Private, Public, and Ineligible, all described in detail below. All three use endowment $z$ = 20 tokens, private good return $a$ = \$0.02, non-Stakeholder public good return $b$ = \$0.01, and Stakeholder public good return $c$ = \$0.03. For non-Stakeholders, the personal return from public good contribution is half the return if the same tokens were invested in the private good; for Stakeholders it is1.5 times that return. We use a within subject design. Subjects made decisions in all three treatments, in a different group for each treatment, with treatment order varied across sessions.

The experiment is computerized and proceeds as follows. Subjects enter the lab and are given general instructions.[6] They are told that they will make decisions in three sets of multiple rounds with three different groups, but they do not know the exact nature of the decisions they will make in each set (treatment) until the treatment-specific instructions are read. The first treatment begins with instructions that explain the information condition and the number of rounds for that treatment. The subjects play through all of the rounds for the treatment. When the first treatment is over, the groups are randomly re-matched. The second and third treatments proceed in much the same way, each with treatment-specific instructions read first. After all three treatments are complete, a questionnaire is administered and the subjects are paid

"caught" a good (bad) mood from their experience. This is outside of these type of models. However, our data show no evidence of contagion across treatments (results available upon request).

[6] All instructions are available on the corresponding author's website.

anonymously. Subjects' total earnings are the sum of their earnings in each treatment, which in turn are the sum of earnings in each round.

In the software for all three treatments, subjects see first a decision screen and then, after making a decision, a review screen for each round. In both the decision and review screens, the central feature is the contribution table. This table contains a row for each round in the treatment. Columns contain information on the subject's contribution and the contributions of others in his group, the group's total contributions, and the subject's own earnings. Information is filled into this table after the decision stage of each round and remains visible for the rest of the treatment.

The Public treatment, which lasts ten rounds, follows the basic favor-trading public goods design outlined in the previous section. The Stakeholder position rotates through all five group members so everyone is Stakeholder twice. Contributions are publicly revealed and tracked individually, and Stakeholder assignments are common knowledge. Figure 1 shows the Public treatment decision screen (with simulated data). Each group member is randomly assigned a letter code (A, B, C, D, or E) and keeps the same letter code for all ten rounds. The contribution table shows in which rounds each subject will be the Stakeholder. Since contribution history is public and everyone knows when each group member will be Stakeholder, subjects can reward each other for past generosity. For example, returning to our previous analogy, if Joe is subject A and Frank is B, Joe can see how much Frank contributed in Round 1 when Joe was the Stakeholder (when he fundraised for the Boy Scouts). Joe can reward Frank with a large contribution when Frank is Stakeholder in Round 2 (when Frank fundraises for the Girl Scouts), or Joe may withhold that reward if he deems Frank's contribution stingy.

The Private treatment also lasts for ten rounds. As in the Public treatment, the Stakeholder position rotates through all group members so everyone is Stakeholder twice. However, the information environment differs from the Public treatment. Each subject still sees the disaggregated, individual contributions of his group members, but subjects are not assigned letter codes. It is no longer possible to track reputations. Figure 2 shows the review screen for the Private treatment. In each round's row, the contribution table reports the contributions of all group members in a randomly-ordered list, re-shuffled for each round. Further, even if a subject thinks he can identify a group member as being worthy (or unworthy) of reward, he still does not know when that person will be Stakeholder. He only knows when he himself will be the Stakeholder, so he cannot target reciprocal acts toward any other subject.

Finally, the Ineligible treatment is very much like the Public treatment, with randomly-assigned letter codes (not linked to the Public treatment letter codes), public reputations, and public Stakeholder timing. However, one subject in each five-member group, the "Bachelor," is ineligible to be the Stakeholder. Returning to our analogy, the Bachelor may be Rita, Joe and Frank's officemate who has no pet cause for which to fundraise. Because only four subjects are eligible to be Stakeholder, the Ineligible treatment lasts eight rounds so each eligible subject is still Stakeholder twice. The Bachelor is randomly chosen and remains the Bachelor for the entire treatment. The screens for the Ineligible treatment are like those for the Public treatment except that the Bachelor is indicated in the screen header and in the contribution table as the "Ineligible" person. Figure 3 shows the review screen for the Bachelor treatment. The Stakeholder position rotation skips the Bachelor: if person D is the Bachelor, the Stakeholder is A, then B, then C, then E, etc.

The main difference between the Public and Private treatments is that direct reciprocity, indirect reciprocity, and strategic reciprocity cannot motivate giving in the Private treatment. Subjects do not have the information they would need to respond to each others' actions. Unconditional altruism and general conditional cooperation, however, can affect giving in both treatments. Actions targeted directly at an individual are only possible in the Public treatment. This means that, in the Public treatment, all of these forces are in play because reputations and Stakeholder identities are public. Any difference between the Public and Private treatments must be due to targeted direct reciprocity, indirect reciprocity, and/or strategic giving. (As discussed earlier, indirect reciprocity can only be cleanly isolated in the behavior of Bachelors in the Ineligible treatment; however, it can still drive the behavior of potential Stakeholders in the Public and Ineligible treatments.)

Within the Public treatment, we will be able to see whether subjects are responsive to past generosity. That is, we can see whether they give larger contributions when the current Stakeholder is someone who was previously generous.[7] This is precisely the favor trading we would expect to see in peer-to-peer fundraising. We can identify direct reciprocity as responsiveness of this type that does not disappear after the subject's last Stakeholder stint.

The Ineligible treatment allows us to investigate two additional issues. First, the Bachelor herself (Rita, in our analogy) is not subject to direct reciprocity or strategic self-interest. If the Bachelor *does* give in a way that responds to the Stakeholder's past generosity, this would be evidence of indirect reciprocity. Second, the presence of a Bachelor shrinks the "circle of reciprocity" from five people to four people. Like agents in other public goods settings,

[7] In each round, subjects may respond to the past behavior of both the current Stakeholder and the current non-Stakeholders. However, if we detect this kind of responsiveness with regard to the current Stakeholder's past actions, this is sufficient to demonstrate reciprocal giving.

the Bachelor can reap benefits from other subjects' increased generosity even if she herself does not contribute. We can observe whether this change in the group dynamic affects non-Bachelor contributions. For example, others may be discouraged by supporting a Bachelor who freeloads off the public good.

The experiments were run in the Experimental Economics Center (E*x*CEN) at Georgia State University in six separate 20-subject sessions, for a total of 120 subjects. The software was written in z-Tree (Fischbacher, 2007). The protocol was double anonymous (subjects could not identify which subjects they were interacting with, and the experimenters could not identify which subject made any set of decisions). Of the 120 subjects, 75 (62.5%) were female, and the average age was 21.8. The experiment lasted about 90 minutes, and subjects earned on average $24.33 (standard deviation $2.67).

## *4. Results*

Our within subject design means that each subject participated in all three treatments. The three treatments were run in all six possible orders, with each order run once. We do not observe effects of treatment order on variables of interest so we pool the data across sessions.[8]

Figure 4 shows contribution data across rounds.[9] Stakeholder contributions in all treatments (the dashed lines) are close to the endowment. This is expected because the

[8] There is an order effect in that non-Stakeholder contributions are higher in the Private treatment if the Private treatment is run first. We believe this is due to error: that treatment is more difficult to understand, and this is supported by the fact that Stakeholder contributions are lower in the Private treatment if the Private treatment is first. To check that our main results are unaffected by this order effect, we exclude those 40 subjects who were in the Private treatment first and rerun all our analysis. All results still hold. Further evidence that order effects are not affecting our main results come from parametric tests that control for order. These results tell the same story as results reported in this paper (see Reviewer's Appendix for the parametric tests). These analyses give us confidence that our main results are not due to the order in which the treatments were run.

[9] The round numbers used in Figure 4 indicate the round number within that treatment. Since data are pooled across orders, the first round of a given treatment (e.g. Private) is also pooled across all orders. This means that round one

Stakeholder's return from the public good is greater than his return from the private good.[10] Non-Stakeholder contributions (the solid lines) for each treatment are lower but positive in all rounds. These contributions show the downward trend usually seen in public goods games. Bachelor contributions in the Ineligible treatment are well below contributions in the other treatments and do not decline across the rounds.

Contributions by non-Stakeholders in the Private treatment compare well to previous research using linear public goods games with similar symmetric "prices of giving." Non-Stakeholder contributions start at 41% in round 1 and end at 21% in round 10, averaging 33% across all rounds. In the final round, 47% of non-Stakeholders make positive contributions. In Ledyard's (1995) survey of public goods game results, first period contributions range from 31%-68% of endowment, and final period contributions range from 9%-19% of endowment.

Results from asymmetric-return public goods games are difficult to compare because of differences in the payoff structure. In a one-shot game with asymmetric returns, subjects with lower marginal per capita returns in somewhat similar treatments gave 20% on average in Goeree, Holt, and Laury (2002) and 18% in Glöckner et al. (2009). These results give us confidence that our overall results are not far off from previous work, despite the asymmetry of payoffs.

### *4.1 Treatment Effects*

Recall that the main difference between the Private and Public treatments is that the Public treatment opens the door to targeted direct reciprocity, indirect reciprocity, and strategic

is behavior in the first round, even though that might not be the subjects first round overall (e.g. if Private was the second or third treatment).

[10] Contributions are not strictly 100%. This could be caused by subject error or myopic inequity aversion.

self-interest. Thus, we can test whether these forces can increase the provision of a public good simply by determining whether non-Stakeholder contributions are higher in the Public treatment than they are in the Private treatment.[11]

Figure 4 shows that average non-Stakeholder contributions in the Public treatment exceed those in the Private treatment in all rounds. These differences are only statistically significant in a few rounds, but are significant when pooled across rounds. As shown in Figure 5, the average non-Stakeholder contribution is 14.4% larger in the Public (37.8% of endowment) than in the Private treatment (33.0%). Using a paired Wilcoxon signed-rank test to test the difference between the two averages yields a *p*-value of 0.051.[12] Thus, allowing these social forces to manifest increases cooperation by a significant amount. It is important to note that this increase was achieved by a small, low-cost change to the information structure of the game to allow for targeted reciprocity.

How does this increase in contributions compare to the effect of other public goods institutions that manipulate information on the contributions of others? Simply reporting disaggregated individual contributions, as in our Private treatment, rather than total contributions, increased contributions by 21% in Sell and Wilson (1991) but had no effect in Croson (2001). Revealing donors' contributions to each other increases contributions to external charities by 10% in Soetevent's (2005) study of church collections, but only for external causes and only temporarily. Andreoni and Petrie (2004) find an increase in giving of 59% when

[11] Results in this section are mostly based on non-parametric tests. All results in this section hold under parametric specifications as well, including pooled and panel regressions with individual fixed effects controlling for group average contributions, round number, and a dummy indicating whether the subject's last Stakeholder stint had passed. (Results of selected parametric tests are in the Reviewers' Appendix.)

[12] Note that because our design is within subjects, we are using paired statistical tests to take into account the non-independence across observations when comparing the behavior of the same subjects across treatments (within subjects). When we compare behavior across subjects within a treatment, we use standard non-paired tests.

subjects see a photograph and contribution history for each group member, but there is no increase in giving when only a photograph or (most relevantly) only contribution history is revealed.[13] In sum, providing the information structure needed to engage in favor trading does increase contributions as some similar institutional changes do. Favor trading requires only a simple change in information conditions and takes advantage of heterogeneous preferences for public goods to enable targeted reciprocity. The increase in contributions thus afforded may be less costly on net than other institutional changes that yield greater increases.

We now turn to behavior in the Ineligible treatment. Figure 6 shows that Bachelors contribute significantly less (23.4% of endowment) than they did in the Private (29.9%) or Public (37.6%) treatments (paired Wilcoxon signed-rank test $p$=0.043 and $p$=0.020, respectively). The reduction in contributions, however, is not due to idiosyncrasies of those subjects who were randomly assigned to be Bachelors. For example, those assigned to be Bachelors contribute no differently than those not assigned to be Bachelors in other treatments (e.g. the Private treatment or the Public treatment).[14] The low contributions of Bachelors in the Ineligible treatment may be caused by any of a number of factors. First, Bachelors may feel a weakened urge to conform to a contribution norm because of their different role in the group. Second, their reduced earnings potential may render them less willing to trade off their payoff to benefit others.

Additionally, although the game has changed from the perspective of non-Bachelors, shrinking the "circle of reciprocity" to four people and adding a public good beneficiary who is

[13] Costly punishment, another tool of interest in public good provision, has generally been found to increase giving by a large amount but often decreases efficiency overall because of the cost of punishment. An important paper in this area is Fehr and Gächter (2000), and Bochet, Page, and Putterman (2006) contains a useful discussion of the literature. Nonmonetary "punishment" has also been studied, as the use of social disapproval in Masclet et al. (2003) and Carpenter and Seki (2010). However, while social disapproval increased contributions by 37% in the former, its effects in the latter were mixed and contributions actually decreased for some populations.

[14] Bachelor contributions in the Private treatment are not statistically different from non-Bachelor (non-Stakeholder) contributions (Mann-Whitney test $p$=0.507). Also, Bachelor contributions and non-Bachelor (non-Stakeholder) contributions are not statistically different in the Public treatment (Mann-Whitney test $p$=0.653).

outside that circle, the effect of these changes is small and not statistically significant. There is no difference between non-Bachelor, non-Stakeholders' contributions in the Ineligible treatment (36.0% of endowment) and their behavior in the Private (33.8%) and Public (37.8%) treatments (paired Wilcoxon signed-rank test $p$=0.233 and $p$=0.410, respectively).

Finally, Figure 7 shows the distribution of non-Stakeholder contributions, pooled across all rounds of all sessions. All treatments show a peak at zero tokens, a possible peak at 6-10 tokens, a dip between 10 and 20, and a peak at 20 tokens. The only statistically significant differences are the following. Bachelors give zero tokens more often in the Ineligible than in the Private (paired Wilcoxon signed-rank test $p$=0.007) and the Public ($p$=0.014) treatments. Also, in the Public treatment, subjects give 20 tokens more often than in the Private ($p$=0.021) and Ineligible ($p$=0.098 for Bachelors, $p$=0.041 for non-Bachelors) treatments.

### *4.2 Direct Reciprocity and Other-Regarding Preferences*

We next look at direct reciprocity, i.e. responsiveness to the current Stakeholder's past behavior. We will first examine reciprocal acts that could either be strategic or rooted in other-regarding preferences, and then we will isolate reciprocity rooted in other-regarding preferences. To do this, we use within-subject tests of aggregate statistics. For each person, we examine whether, as non-Stakeholder, he gave more on average to the public good in rounds in which the current Stakeholder was previously generous to him as compared to rounds in which the current Stakeholder was previously ungenerous. Stakeholder past generosity is determined by the current Stakeholder's average contribution to the public good in rounds in which this subject was the Stakeholder.

To illustrate this point, let's look at an example using our analogy. Suppose Joe is Stakeholder in rounds 1 and 6, and Frank is Stakeholder in rounds 2 and 7. In round 2, Joe will remember how generous Frank was in round 1. "Stakeholder past generosity" will be Frank's contribution in round 1. In round 7, when Frank is Stakeholder, our measure of "Stakeholder past generosity" for Joe would be the average of Frank's contributions in rounds 1 and 6 when Joe was Stakeholder.

We look at the effects of generosity using nonparametric tests. To do so, we define a "generosity threshold" such that contributions greater than this amount are called generous. For each subject, we calculate his average contribution when facing a Stakeholder whose past generosity meets this threshold and his average contribution when facing a Stakeholder whose past generosity does not. We tried many thresholds, including 6, 8, 10, 12, 15, and 19 tokens and the group's cumulative average contribution, with robust results. We report results from a threshold of 10 tokens (50% of endowment). To clarify further how this works, suppose that a group contains only Joe, Frank, and Mary. Frank gave 15 tokens every time Joe was Stakeholder, and Mary always gave 2 tokens. Joe's average contribution to a generous Stakeholder is his average contribution when Frank was Stakeholder, and his average contribution to an ungenerous Stakeholder is his average contribution when Mary was Stakeholder.

A subject displays reciprocal behavior if he gives more when facing a previously-generous Stakeholder than when facing a previously-ungenerous Stakeholder. Figure 8 presents averages of these measures. In all treatments in which it is possible to attribute previous generous and ungenerous acts to a particular group member, generosity is rewarded: subjects give more to a previously-generous Stakeholder than to a Previously un-generous Stakeholder

(Public treatment 41.92% as compared to 27.09% of endowment, paired Wilcoxon signed-rank test $p$=0.000; Ineligible treatment 41.22% as compared to 23.92% of endowment, paired Wilcoxon signed-rank test $p$=0.000). In the treatment in which previous generosity cannot be attributed to a person, it is not rewarded (in the Private treatment, 27.57% was given to previously-generous Stakeholders as compared to 29.16% to previously-ungenerous Stakeholders, paired Wilcoxon signed-rank test $p$=0.773).[15] These results are intuitive. We would not expect rewards to generous behavior in the Private treatment because subjects cannot tell who is Stakeholder or what the current Stakeholder did in the past. In the Public and Ineligible treatments, however, subjects give over 50% more to previously-generous Stakeholders than they give to previously-ungenerous Stakeholders.[16]

Another way to look at direct reciprocation is to examine responsiveness, the difference between the amount given to a generous Stakeholder and the amount given to an ungenerous Stakeholder, between treatments. Responsiveness is greater in both the Public (14.8% of endowment) and Ineligible (17.3% of endowment) treatments than in the Private (-1.6% of endowment) treatment (paired Wilcoxon signed-rank test $p$=0.000 and $p$=0.000, respectively). Responsiveness does not differ between the Public and Ineligible treatments ($p$=0.966). This gives us evidence of directly reciprocal behavior, although this behavior may be rooted in strategic self-interest.

We look next at whether subjects discriminate with their contributions because of other-regarding preferences or because of strategic self-interest. We dispose of strategic concerns by

[15] We find similar results in panel regressions of non-Stakeholder contribution regressed on the current Stakeholder's past contributions to the subject, group average past contributions, round, and a dummy for whether the subject is past his last opportunity to be Stakeholder.

[16] Recall that subjects could respond to past actions of the current Stakeholder *and* the current non-Stakeholders, although their contributions benefit the former three times as much as the latter. If subjects were responding to non-Stakeholders in this way, this would attenuate our within-subject test of responsiveness to Stakeholder history.

looking for reciprocal giving after a person has passed his last Stakeholder stint. For example, again assume that Joe was Stakeholder in rounds 1 and 6 and Frank was Stakeholder in rounds 2 and 7. Assume no further fundraising rounds follow. If Frank was kind to Joe in rounds 1 and 6, will Joe reciprocate in round 7? If Joe is purely strategic, he has little to gain, so he should not contribute and therefore not reciprocate.

We test for non-strategic reciprocity by constructing statistics of each subject's average contribution to previously generous and ungenerous Stakeholders in rounds after this subject's last Stakeholder stint. These results, shown in Figure 9, imply that strategic concerns are not the sole motivator. Other regarding preferences are more strongly at play. Subjects in the Public treatment continue to discriminate between generous Stakeholders (to whom they give 30.0% of endowment) and ungenerous Stakeholders (16.9%) even after they have no strategic motive to do so.[17] This difference is statistically significant (paired Wilcoxon signed-rank test $p$=0.026). In the Ineligible treatment, the sample size is reduced because only non-Bachelors are considered and the treatment has fewer rounds. Because of this reduced power, discrimination in late rounds is not statistically significant, although the difference is in the same direction.

### *4.3 Indirect Reciprocity*

Our (perhaps strict) definition of indirect reciprocity is the action of a disinterested party who rewards one subject for generosity toward another subject. This kind of indirect reciprocity cannot be tested by looking at the responsiveness of a subject who has the opportunity to be Stakeholder because he is not disinterested. He can benefit from fostering a norm of cooperation. The behavior of Bachelors in the Ineligible treatment gives us a clean test of

[17] Again, similar results hold in panel regressions, only using rounds after which the subject is no longer Stakeholder.

indirect reciprocity. These randomly-selected subjects will never be Stakeholder, so they can never receive the benefits of targeted reciprocity. Therefore, direct reciprocity and strategic self-interest cannot drive Bachelor giving.

We have shown that Bachelors give significantly less than non-Stakeholders in the Ineligible treatment and less than they themselves gave in other treatments. We have also shown that Bachelors do behave reciprocally when they are part of the circle of reciprocity, in that they have positive responsiveness in the Public treatment (giving 35.02% of endowment to previously generous Stakeholders and 22.28% of endowment to previously ungenerous Stakeholders, significantly different with paired Wilcoxon signed-rank $p$=0.004). However, Bachelors in the Ineligible treatment, when they are no longer part of the circle of reciprocity, do not give more when facing previously generous Stakeholders. They give 21.9% of endowment when facing previously generous Stakeholders and 25.5% when facing previously ungenerous Stakeholders. These levels are not significantly different (paired Wilcoxon signed-rank $p$=0.823). Therefore, indirect reciprocity does not seem to be a motivator in this setting.

This result is intriguing because other studies have found evidence of indirect reciprocity (e.g., Engelmann and Fischbacher, 2009; Seinen and Schram, 2006). The re-matching structure of those experiments, however, allows subjects to have a financial interest in the group's overall cooperation. Subjects are not wholly disinterested as our Bachelors are. Both conditions are valid settings in which to examine cooperation. However, our results align more closely with the "bystander" interpretation of indirect reciprocity.

## *5. Conclusions*

Favor trading is a natural element of social networks. Grassroots fundraising can increase the provision of public goods by taking advantage of different preferences for charities and the desire to be nice to those who have been nice to you. In an experiment that allows different forms of reciprocity to be turned on and off, we explore the power of favor trading and the mechanisms through which institutions such as grassroots fundraising may work. In our setting, favor trading increases cooperation by 14.4%, an amount that is both statistically and economically significant.

Our results also provide a new window into reciprocity. We find evidence of direct reciprocal giving that is non-strategic. While some studies have found direct reciprocity in laboratory institutions like the investment game (e.g., Berg et al., 1995), others have criticized the abstraction of those institutions (e.g., List, 2006). The presence of direct reciprocity in our slightly richer setting may be a good step in understanding how institutions outside of the lab can take advantage of direct reciprocity for social gain. In particular, our reciprocity findings are a complement to the result that social pressure is important in door-to-door fundraising by DellaVigna, List, and Malmendier (2010).

Intriguingly, we find no evidence of indirect reciprocity in our Ineligible treatment. While most experiments that examine indirect reciprocity allow actors to directly benefit from an increased tendency to cooperate within the group, we strip our Bachelor of strong incentives to foster cooperative norms. When given the costly chance to reward a kind act without the possibility of future direct reciprocation, our Bachelors do not.

Nonprofit organizations clearly are aware of the benefits of soliciting donations from within social networks. In the past few years, more low-cost avenues for peer-to-peer

solicitation have become available, from Facebook Cause promotion to custom donor-based solicitation websites like DonorPages.com. Our results suggest that grassroots fundraising can yield significant financial benefit for the organization through a small, low-cost change to the standard public goods model. We view our results as a lower bound for the efficiency gains possible with grassroots fundraising. In a social situation with friends, coworkers or family, rewards and sanctions are much stronger than the incentives offered in the lab and social interactions are longer term. Of course, other factors in charitable giving could diminish this effect. Notably, a donor's peer-pressured gift to a friend's charity may reduce his gift to another charity. A field study could address these general equilibrium-type effects.

*Acknowledgements*

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## Reviewers' Appendix: Parametric Tests of Reciprocity

In this Appendix, we use regression techniques to identify reciprocal behavior resulting from direct reciprocity and strategic self-interest. These results may be biased because of the endogeneity inherent in group dynamic behavior. We take care to limit the influence of this bias, but it is to some extent unavoidable.

We perform a panel regression for one treatment at a time, with fixed effects and errors clustered by group. Non-Stakeholder contributions in each round $g_{it}$ are regressed on characteristics of that round, including $h_{ikt}$ (a summary of the current Stakeholder $k$'s past generosity toward subject $i$: here, the current Stakeholder's cumulative average contributions when subject $i$ was Stakeholder) and $\mathbf{X}_{it}$ (other variables):

$$g_{it} = a + bh_{ikt} + \mathbf{C}\mathbf{X}_{it} + \varepsilon_{it}$$

If direct reciprocity or strategic self-interest is important, $b$ (the coefficient on $h_{ikt}$) should be positive in both the Public and Ineligible treatments. In the Private treatment, $b$ should be zero, because in each round, no-one knows who the current Stakeholder is or what that person has done in the past. Group-level conditional cooperation could bias this coefficient upward, so we counteract that bias by including a control for group generosity in $\mathbf{X}_{it}$. Our control for group generosity is the group's cumulative average non-Stakeholder contribution in past rounds. For each subject in each round, this measure excludes his own past contributions and those of the current Stakeholder. In the Ineligible treatment, this group measure also excludes data from the Bachelor (although the same results obtain if the Bachelor's data is included).

The panel regression also includes in $\mathbf{X}_{it}$ the current round number and an indicator for whether this subject has passed his last Stakeholder stint. If the coefficient on the round number is negative, cooperation decreases from round to round. The coefficient on the post-last-Stakeholder stint dummy can be interpreted as the importance of strategic giving. If a subject gives strategically in the rounds before his last Stakeholder stint, there should be a discontinuity in contributions that should be reflected in a large, negative coefficient on this dummy.

Results are shown in Table A-1. Directly reciprocal behavior is supported for the Public and Ineligible treatments. The coefficient on the post-last-Stakeholder stint dummy in the Public and Ineligible treatments is insignificant. This implies that strategic motives are not important. The same results obtain in an AR1 specification (results available upon request), except that in the Private treatment the post-last-Stakeholder stint dummy is no longer significant.

We can further test for the importance of other-regarding preferences by restricting our attention to the rounds after a subject has passed his final Stakeholder stint. See results in Table A-2. Due to the reduced population size, particularly for the Ineligible treatment, the power of the test is significantly reduced and the Stakeholder past contribution coefficient is not statistically significant for the Ineligible treatment. However, the coefficient on Stakeholder past contribution is positive for the Public treatment. This implies that reciprocal behavior is at least partly rooted in other-regarding preferences.

Finally, we build error clustering by group and fixed effects into a test using aggregate statistics, since this should eliminate the bias of our panel analysis while checking for robustness to intra-class correlation. We create two stacked observations per subject: one to represent the subject's average contribution in rounds in which the current Stakeholder was previously

generous (using the 10 token, or 50%-of-endowment, threshold; similar results obtain for other thresholds) toward this subject, and one to represent his average contribution in rounds when the Stakeholder was ungenerous toward this subject. A "nice dummy" differentiates between the two observations for each subject. We perform a panel regression using these two observations per subject, in which we regress contributions on the "nice dummy." The same results obtain if we use group dummies, individual random effects, or individual fixed effects. In Table A-3 we show results of the individual fixed effects regression without group dummies. The "nice" dummy is significant and positive for the Public and Ineligible treatments, but not for the Private treatment. The result that reciprocal behavior continues after the last Stakeholder stint also persists in this specification.

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# Figures

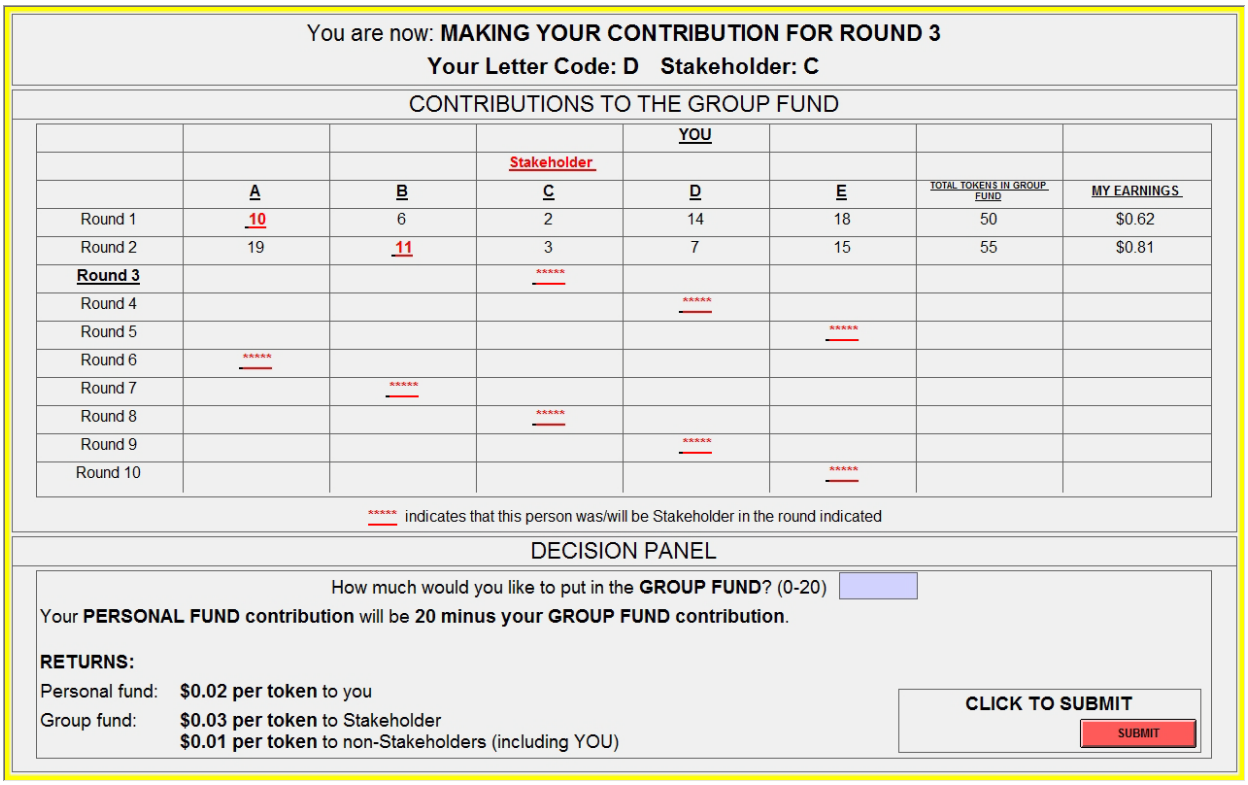



Figure 1. Public Treatment Decision Screen

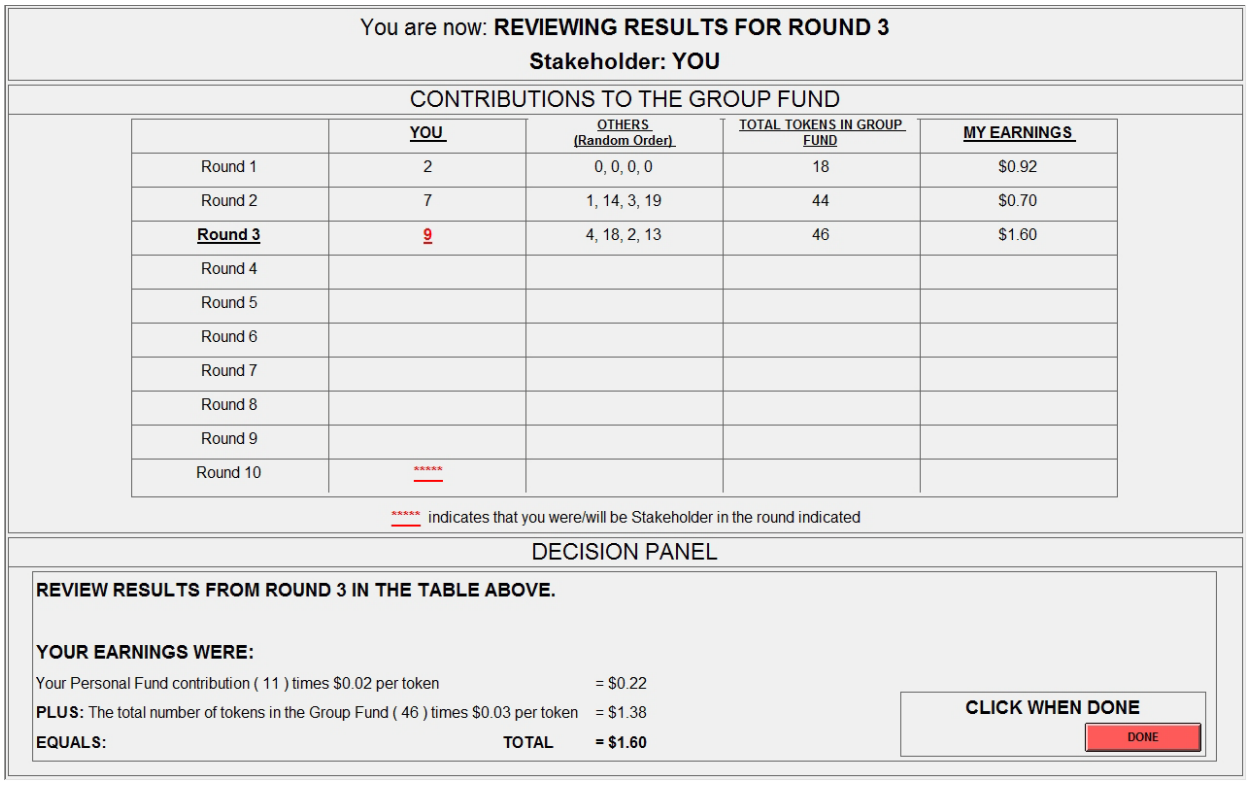



Figure 2. Private Treatment Review Screen

You are now: **REVIEWING RESULTS FOR ROUND 2**

**Your Letter Code: C  Stakeholder: B  Ineligible: D**

CONTRIBUTIONS TO THE GROUP FUND

| | | | YOU | | | | |
|---|---|---|---|---|---|---|---|
| | | Stakeholder | | Ineligible | | | |
| | A | B | C | D | E | TOTAL TOKENS IN GROUP FUND | MY EARNINGS |
| Round 1 | 1 | 4 | 2 | 16 | 8 | 31 | $0.67 |
| **Round 2** | 20 | 0 | 17 | 9 | 3 | 49 | $0.55 |
| Round 3 | | | ***** | | | | |
| Round 4 | | | | | ***** | | |
| Round 5 | ***** | | | | | | |
| Round 6 | | ***** | | | | | |
| Round 7 | | | ***** | | | | |
| Round 8 | | | | | ***** | | |

***** indicates that this person was/will be Stakeholder in the round indicated

DECISION PANEL

**REVIEW RESULTS FROM ROUND 2 IN THE TABLE ABOVE.**

**YOUR EARNINGS WERE:**

Your Personal Fund contribution ( 3 ) times $0.02 per token = $0.06

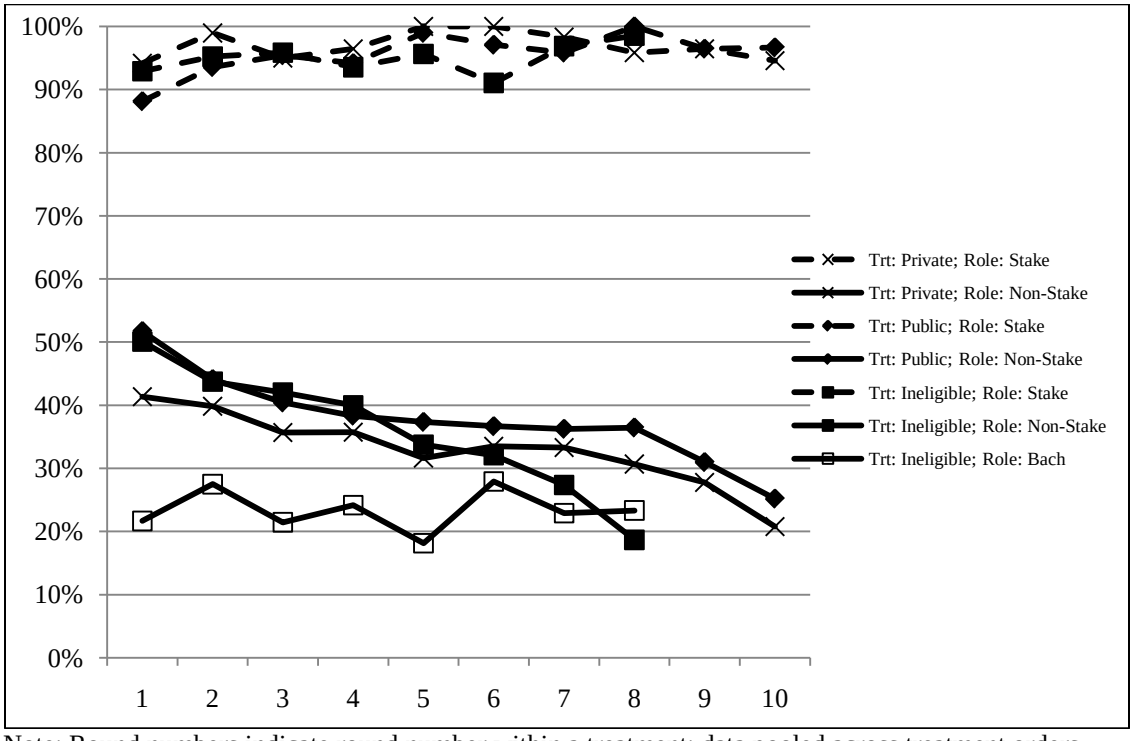
**PLUS:** The total number of tokens in the Group Fund ( 49 ) times $0.01 per token = $0.49

**EQUALS:** **TOTAL** **= $0.55**

**CLICK WHEN DONE**

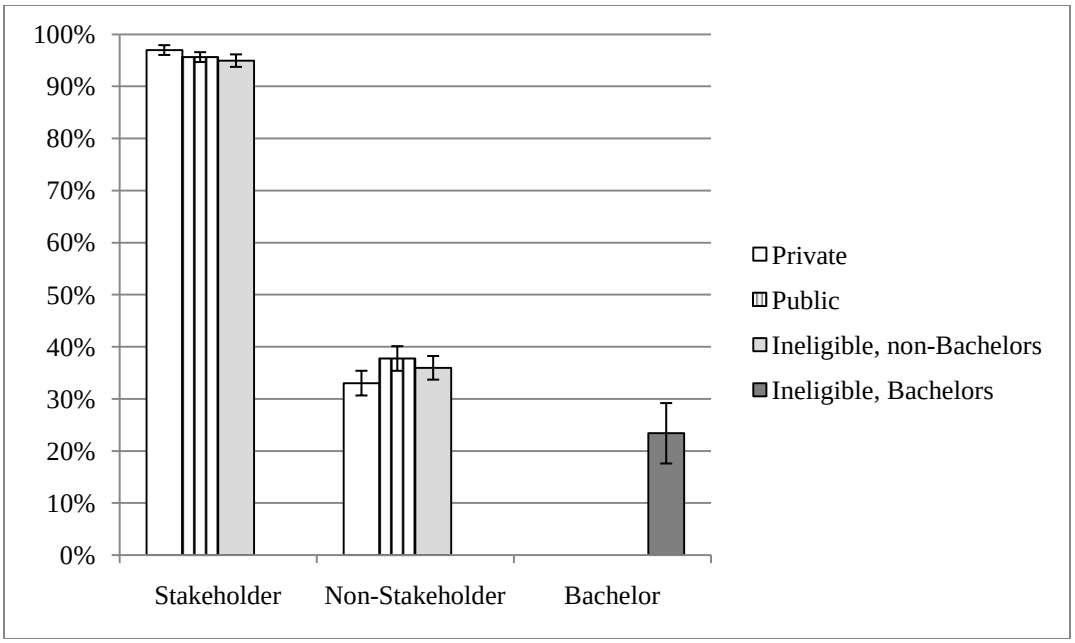
DONE

Figure 3. Ineligible Treatment Review Screen



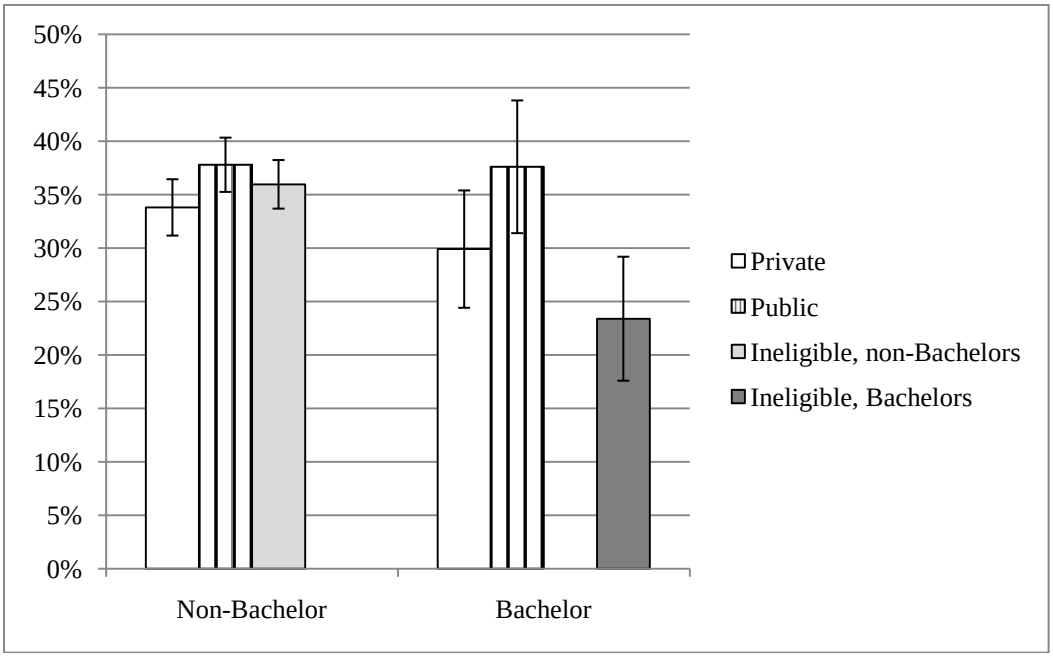

Note: Round numbers indicate round number within a treatment; data pooled across treatment orders

Figure 4. Contributions by Treatment and Role across Rounds (in Percent of Endowment)




Note: Error bars indicate standard error of mean, using each subject mean as an observation. N=120 for Private and Public treatments; N=96 for Ineligible non-Bachelors; N=24 for Ineligible Bachelors.

Figure 5. Average Contributions by Treatment and Role (Percent of Endowment)




Note: Error bars indicate standard error of mean, using each subject mean as an observation. N=96 for non-Bachelors; N=24 for Bachelors.

Figure 6. Average Non-Stakeholder Contributions by Treatment and Bachelor Status (Percent of Endowment)

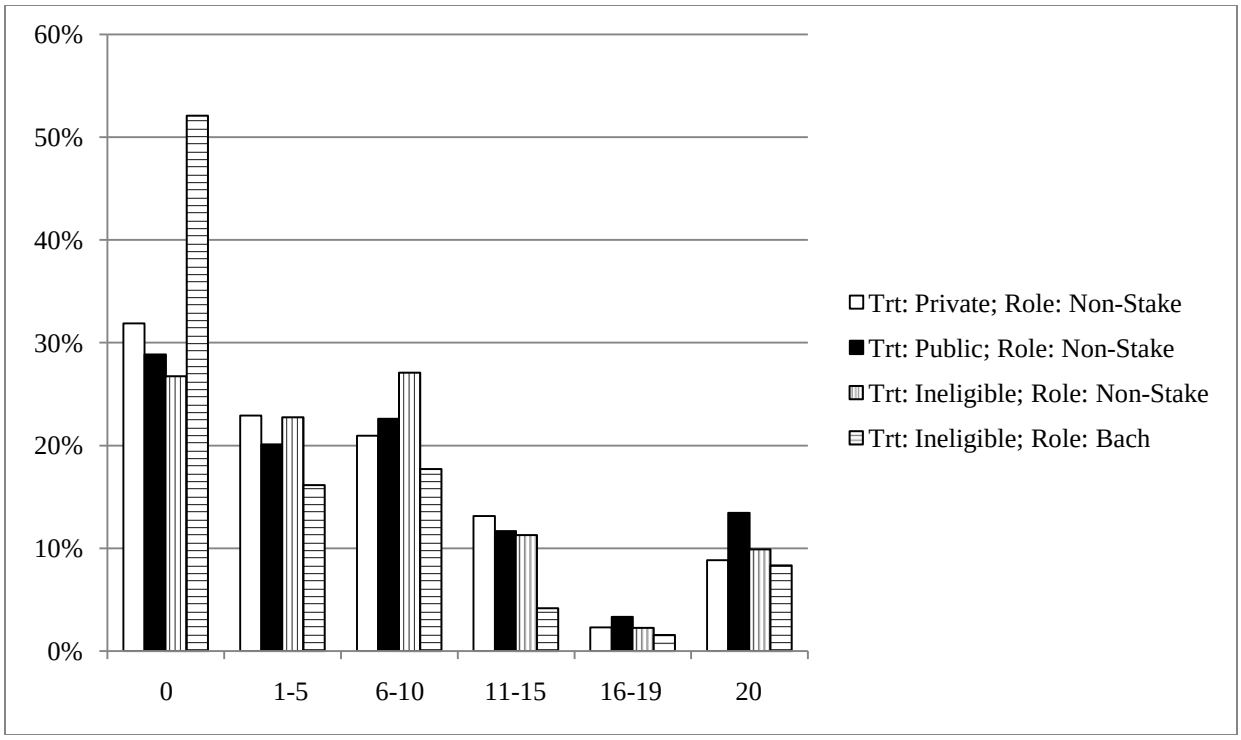
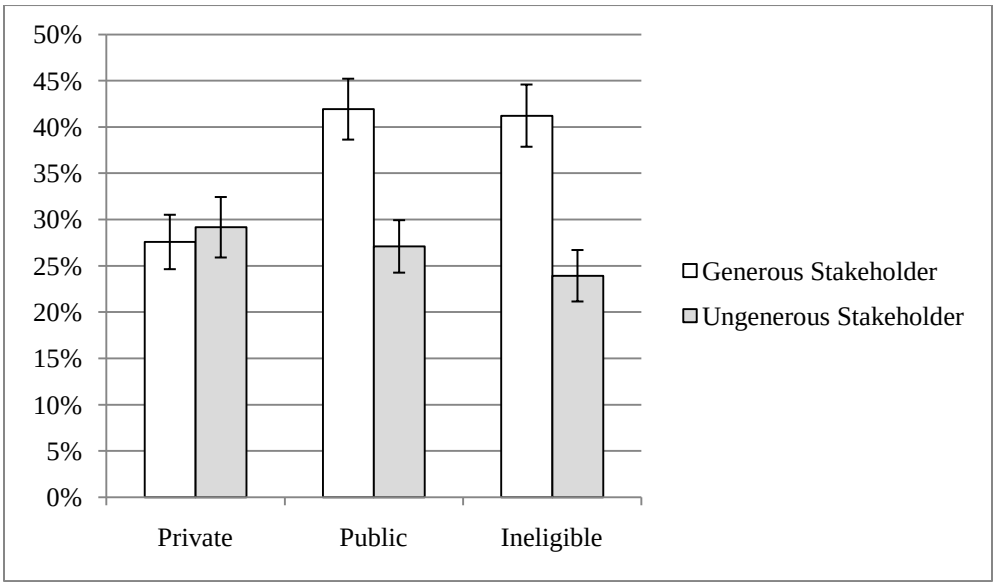
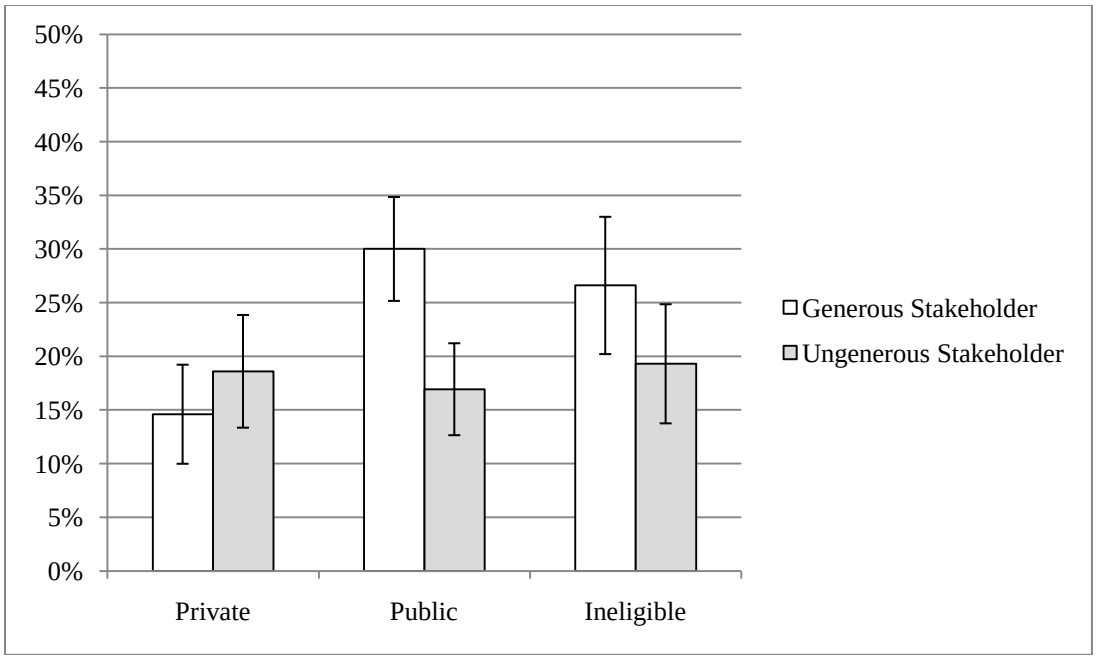



Figure 7. Distribution of Non-Stakeholder Contribution Amounts, Pooled across Rounds




Note: Error bars indicate standard error of mean, using each subject mean as an observation. N's are less than 120 because some subjects did not face both a generous and an ungenerous stakeholder. For this reason, Private N=82 (of 120), Public N=95 (of 120), Ineligible N=75 (of 96).

Figure 8. Evidence of Reciprocal Giving
Average Non-Stakeholder Contributions across All Rounds by Stakeholder's Past Generosity toward Subject (in Percent of Endowment)




Note: Error bars indicate standard error of mean, using each subject mean as an observation. N's are less than 120 because 48 subjects had to be dropped from each treatment because there were less than two rounds remaining after their last Stakeholder stint; additionally, more subjects had to be dropped from each treatment if they did not face both a generous and an ungenerous Stakeholder after their last Stakeholder stint. Private N=31 (of 120), Public N=41 (of 120), Ineligible N=25 (of 96).

Figure 9. Evidence of Direct Reciprocity
Average Non-Stakeholder Contributions by Stakeholder's Past Generosity toward Subject, after Last Stakeholder Stint (in Percent of Endowment)

Table A-1. OLS Fixed Effects Panel Regression of Non-Stakeholder Contribution (in Percent of Endowment) on Period-Level Covariates

| | Private Treatment | Public Treatment | Ineligible Treatment (excl. Bachelors) |
|---|---|---|---|
| Stakeholder average | 0.05 | 0.24*** | 0.23** |
| past contributions to me | (0.06) | (0.05) | (0.09) |
| Group average | 0.25 | 0.05 | -0.08 |
| contributions | (0.16) | (0.17) | (0.27) |
| Round number | 0.03 | -1.69 | -2.86** |
| | (0.65) | (1.22) | (1.34) |
| Post-last Stakeholder | -9.66** | -1.66 | -4.85 |
| Stint? (dummy) | (3.86) | (5.05) | (5.40) |
| Constant | 22.15*** | 34.65** | 42.50** |
| | (7.48) | (13.68) | (16.18) |
| Observations (rounds) | 720 | 720 | 432 |
| Number of subjects | 120 | 120 | 96 |
| F | 4.50 | 13.37 | 31.47 |
| $R^2$ (overall) | 0.078 | 0.182 | 0.156 |

Robust standard errors in parentheses; errors are clustered on groups; individual fixed effects

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A-2. OLS Fixed Effects Panel Regression of Non-Stakeholder Contribution (in Percent of Endowment) on Period-Level Covariates, Post-Last Stakeholder Stint

| | Private Treatment | Public Treatment | Ineligible Treatment (excl. Bachelors) |
|---|---|---|---|
| Stakeholder average | -0.19 | 0.21* | 0.17 |
| past contributions to me | (0.11) | (0.11) | (0.22) |
| Group average | 0.39 | -0.09 | 0.30 |
| contributions | (0.44) | (0.32) | (0.60) |
| Round number | -4.12** | -5.90*** | -4.89 |
| | (1.83) | (1.96) | (2.26) |
| Constant | 48.39** | 76.14*** | 42.89 |
| | (22.93) | (25.80) | (25.08) |
| Observations (rounds) | 240 | 240 | 144 |
| Number of subjects | 96 | 96 | 72 |
| F | 2.03 | 3.70 | 1.78 |
| $R^2$ (overall) | 0.036 | 0.106 | 0.083 |

Robust standard errors in parentheses; errors are clustered on groups; individual fixed effects

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A-3. Panel Stacked Regression of Average Contribution (in Percent of Endowment) on "Nice Dummy"

| | Private Treatment | Public Treatment | Ineligible Treatment (excl. Bachelors) |
|---|---|---|---|
| "Nice dummy" | -1.59 | 14.83*** | 17.30*** |
| | (2.72) | (2.68) | (2.72) |
| Constant | 29.16*** | 27.09*** | 23.92*** |
| | (1.36) | (1.34) | (1.36) |
| Subjects | 82 | 95 | 75 |
| Observations | 164 | 190 | 150 |
| $R^2$ (overall) | -0.001 | 0.058 | 0.096 |
| F | 0.34 | 30.54 | 40.37 |

Robust standard errors in parentheses; errors clustered on groups; individual fixed effects. There are two observations per subject: one to summarize the subject's average contribution when facing a Stakeholder who had been generous to him, and one for his average contribution when facing a previously-ungenerous Stakeholder. The "nice dummy" is the indicator that differentiates these two observations for each subject.

* significant at 10%; ** significant at 5%; *** significant at 1%