The Good of the Few: Reciprocity in the Provision of a Public Bad

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Abstract:

People have been shown to engage in favor-trading when it is efficiency-enhancing to do so. Will they also trade favors when it reduces efficiency, as in a series of wasteful public projects that each benefits an individual? We introduce the "Stakeholder Public Bad" game to study this question. In each round, contributions to a common fund increase the earnings of one person (the "Stakeholder") but reduce the earnings of the rest of the group so much that overall efficiency is reduced. The Stakeholder position rotates through members of the group and the promise of the high reward associated with this position may enable subjects to behave reciprocally. We hypothesize that some people will help a current Stakeholder by contributing in hopes of being rewarded later with a reciprocal gift. In a lab experiment, we find evidence of such favor trading. We also find that Stakeholders in this situation seem perfectly willing to sacrifice the good of the group to reap their own personal rewards, and this is true even when their contribution decisions are public. While the revelation of information about others' actions and roles has previously been shown to enable efficiency-increasing reciprocity, we show that it also enables efficiency-decreasing reciprocal acts. Subjects who are more risk-averse behave in a way that is more myopically self-interested as compared to less risk-averse people when information conditions preclude favor trading, and subjects who identify with the Democratic Party show more restraint when they are Stakeholder than those who do not.

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1. Introduction

Members of a group must frequently decide on the provision of a project that has both winners and losers. A defense contract may benefit one constituency while incurring large tax-funded expenses; a factory siting decision brings jobs to one area but may have environmental consequences; an appropriations bill may fund wasteful "bridges to nowhere" to the benefit of individual committee members. Further, many decisions of this kind occur as repeated games in which different agents have stakes in different projects. This structure may give rise to reciprocal behavior: you support my project and I'll support yours. Existing evidence shows that this trading may work for pro-social projects. Does the same dynamic occur when projects are overall anti-social—when the harms they cause are greater than the benefits they generate? In a more general sense, can reciprocity, a force championed for pro-sociality in settings from interpersonal interactions to the macroeconomy to evolution, be destructive?

We study this question using a model that allows strategic or other-regarding reciprocal behavior to enter into a group's provision of a common project with heterogeneous costs and benefits. We create a game called the "Stakeholder Public Bad" game. In each round, members of a group decide how much to contribute to a common fund. The common fund contributions determine the provision of an overall efficiency-reducing project in which one member has a stake (i.e., is directly compensated) while the other members' payoffs are reduced by project provision. This Stakeholder role rotates so that each group member will eventually be the beneficiary from the project. In some settings, public information makes reciprocal acts possible, but in others information is hidden so that reciprocal behavior is impossible. How people behave in these settings depends crucially on whether they have social preferences (and if so, what kind) and what their expectations are for reciprocation by others.

In a lab experiment implementing this model, we find evidence of anti-social reciprocal behavior. We also find that subjects contribute nearly fully in the role of Stakeholder regardless of the information condition, even though this is an anti-social act. More risk-averse subjects behave in a more myopically self-interested way (as compared to less risk-averse subjects) when information conditions preclude favor trading, and subjects who identify with the Democratic Party show more restraint as Stakeholder than do non-Democrats.

2. Favor-Trading in Public Good and Public Bad Provision

Agents' behavior in a public bad game with rotating high return has, to our knowledge, not yet been studied. The literature on public goods is extensive (useful surveys of which include Chaudhuri, 2011; Ledyard, 1995). A major lesson from that literature is that experimental subjects contribute much more than selfish rational models predict. Suggested motives for this cooperation include altruism (e.g., Marwell and Ames, 1981) and conditional cooperation (Gächter, 2007). Many institutions for project provision have been examined, the most relevant of which is the linear voluntary contributions mechanism game in which individuals' contributions to the common fund have constant returns to each member of the group. This game is the basis for our Stakeholder Public Bad game.

Projects that reduce overall efficiency have received less attention. This is in part because many models treat public bads as dual to public goods. For example, one can argue that preferences against (the public bad of) pollution are the same as preferences for (the public good of) pollution abatement. The theoretical and experimental literatures agree that treating bads as isomorphic to goods causes problems, however. First, because the Nash equilibrium can lead to unbounded amounts of a public bad, it is unclear how the dual of a public good is to be treated theoretically (Shitovitz and Spiegel, 2003). Second, due to systematic differences in the way

people respond to goods and bads, cooperation and individual decisions differ based on the framing of isomorphic conditions. Schwartz-Shea (1983), Andreoni (1995), and Sonnemans et al. (1998) demonstrate that people are more pro-social under a public goods framing than a public bad framing. Barr and Serra (2009, 2010) have studied corruption in the lab as an implementation of public bads (in which the briber and the bribed benefit, but others bear costs) and find a surprising amount of engagement in antisocial acts, but also show that less bribery occurs when the negative externality is higher and that internalized social norms have some effect on behavior. When moves are sequential, Moxnes and van der Heijden find that subjects will show more restraint following a "leader" (first-mover) who contributes less to a public bad (Moxnes and van der Heijden, 2003) and that such leaders tend to contribute less than followers do (van der Heijden and Moxnes, 2003). This leadership differs importantly, however, from our concept of a project Stakeholder who receives large benefits from the project.

Reciprocity has been shown to be important in pro-social settings in general, and reciprocal acts are central to our model. Sobel (2005) provides a useful discussion of the related literature. He classifies "instrumental reciprocity" as favor-trading rooted in other-regarding preferences, as opposed to "intrinsic reciprocity" which is favor-trading that is simply strategic in the sense of seeking a future reward. This literature includes theoretical development (e.g., Cox et al., 2008; Dufwenberg and Kirchsteiger, 2004; Rabin, 1993; Wilson, 2008) and experimental evidence (e.g., Berg et al., 1995; Charness and Rabin, 2002; Cox, 2004; Fehr et al., 1993; List, 2006).

Reciprocal behavior in the form of conditional cooperation is important in public good games (Gächter, 2007). However, information conditions and payoff asymmetries can provide additional leverage for reciprocity of all types within a group provision setting. Information

provision alone may increase giving (e.g., Andreoni and Petrie, 2004; Sell and Wilson, 1991). But information is also a lever for reciprocity since it is impossible to reciprocate without knowing who has been kind to you (Wilson, 2008). Asymmetric returns have mostly been studied to look at either responsiveness to returns to self and others (e.g., Goeree et al., 2002), or to look at leadership (e.g., Brandts et al., 2007; Glöckner et al., 2011), sometimes in the spirit of Olson's (1965) "privileged groups" (Reuben and Riedl, 2009). Jacobson and Petrie (2011), quite relevantly, demonstrated that other-regarding preference-based (intrinsic) reciprocity can boost public good provision given rotating payoff asymmetry and sufficient information. Isaac et al. (2011) study common projects which benefit some people and hurt others, and find that people who have negative returns give less to project provision and will even pay to reduce provision.[2] Isaac et al. (2011) do not investigate the possibility of a rotating position of privilege as we do.

We extend the existing literature by examining reciprocal acts in a project provision setting where the common project is anti-social. We do not seek the kind of "negative reciprocity" (also known as spite) examined in work like Abbink et al. (2000), where reciprocal preferences cause people to reduce each other's payoffs through punishment. In such settings, negative reciprocity is actually socially positive because it encourages and enforces norms of trust and reciprocity. In our setting, reciprocal acts are socially harmful.

Our work is also related to the logrolling literature in which politicians who pursue their own constituencies' interests support each other's projects (Buchanan and Tullock, 1966). This literature has focused primarily on voting mechanisms and coalition formation (Miller, 1977; Shubik and Van der Heyden, 1978; Tullock, 1970; Walker et al., 2000). In many cases, the literature has found or assumed that vote-trading and logrolling increase efficiency (Buchanan

[2] Separate work examines behavior when the project affects people with no power to decide on provision of the project, e.g., "bystanders" in Engel and Rockenbach (2011) and "outsiders" in Delaney and Jacobson (2011).

and Tullock, 1966; Walker et al., 2000). However, instances of a small number of jurisdictions with extreme preferences for a project with large but distributed costs abound, such as in the case of ethanol policy (Holland et al., 2011). Our study could be compared to political logrolling in which agents support bills that benefit their own district but are wasteful uses of taxpayer money. The linear nature of provision in our model reflects a kind of support that varies continuously, such as lobbying or support in drafting of favorable legislation or influence peddling, rather than discrete support such as voting. As a result, our model demonstrates a novel way for logrolling-type behavior to occur using trading of continuous support rather than formation of coalitions.

3. Model

We model a "Stakeholder Public Bad" game. In this game, members of a group make repeated simultaneous individual decisions to contribute to a common fund. These contributions generate a public project with asymmetric returns: some group members benefit from provision while others are hurt, and the socially optimal level of provision is zero. One can interpret contributions in this setting as either public bad provision or common pool resource extraction.

Agents belong to groups of size *N*. Group membership is fixed for a series of periods. Each member has an endowment of z tokens each period to allocate between a private fund and a common fund. The private fund represents the opportunity cost of support for the common fund and provides a return of $a > 0$ per token not contributed. Agent *i* earns return b_{it} to for every token contributed by any group member to the common fund. This return varies across roles and may be negative for some group members. Each agent also earns a role-specific baseline return from the "status quo" (no contributions) level of public project provision: G_{it}.[3]

[3] This fixed status quo can be compared to Isaac et al. (2011) who instead model agents who can choose to contribute to an "alternative" version of the public project, which action actually reduces project provision.

Agent *i*'s payoff in period *t* is given by:

$$\pi_{it} = G_{it} + b_{it}\left(\sum_{j=1\ldots N} g_{jt}\right) + a\left(z - g_{it}\right)$$

In each period *t*, agents are exogenously assigned roles. The values of G_{it} and b_{it} vary according to agent *i*'s role in period *t*. Each agent then chooses his contribution g_{it}. The simple net return to i for any token he contributes to the public fund is $b_{it} - a$.

In each period, one member of the group has the role of Stakeholder (role *S* if $Stakeholder_t = i$). The Stakeholder benefits enough from the common project to overcome his opportunity cost: the Stakeholder return from the common fund is $b_S > a > 0$, thus making this a privileged group (Olson, 1965). The Stakeholder role rotates through all group members from period to period.[4]

The remaining $N-1$ group members in each period are Non-Stakeholders (role *NS if* $Stakeholder_t \neq i$). Non-Stakeholders prefer the status quo to positive project provision; their per-token return from the public fund is $b_{NS} < 0 < a$. Agent *i*'s payoffs for period *t* are then:

$$\pi_{it} = \begin{cases} G_S + b_S\left(\sum_{j=1\ldots N} g_{jt}\right) + a\left(z - g_{it}\right) & \text{if } Stakeholder_t = i \\ G_{NS} + b_{NS}\left(\sum_{j=1\ldots N} g_{jt}\right) + a\left(z - g_{it}\right) & \text{if } Stakeholder_t \neq i \end{cases}$$

This project is a public bad if the total return from a token contributed is negative. This happens if the total losses of Non-Stakeholders are larger than the gains of Stakeholders. Thus, the project is a public bad if $b_S + (N-1)b_{NS} > a$, or, given that $b_{NS} > 0$, if $b_S > \left|(N-1)b_{NS}\right|$.

[4] It is worth noting that in some situations, a Stakeholder in a potential project that would be anti-social may be able to (in addition to withholding his own contributions) "bury" his project so that no-one has opportunity to contribute. In some situations, however, a Stakeholder may have no such power.

Since payoffs are linear in own-contribution, each role has a simple dominant strategy if all agents are rational and self-regarding: Stakeholders contribute fully to the common fund and Non-Stakeholders contribute nothing.

If agents are other-regarding, they may face a dilemma. If they contribute, they help one member of the group quite a bit but hurt others and overall reduce efficiency. Altruism may cause Stakeholders to reduce their privately beneficial but socially harmful contributions to the common fund. Altruistic Non-Stakeholders generally should not contribute to the common fund unless they have preferences that privilege the current Stakeholder above other group members.

If agents have reciprocal preferences, group members may use the rotating Stakeholder position to alternately "help" each other. Imagine that in three sequential periods, first Adam is Stakeholder, then Beatrice, then Cynthia. Imagine further that in the first period, Beatrice contributed a large amount while Cynthia contributed nothing. Beatrice's contribution was personally costly in that she sacrificed her own payoff to increase Adam's. Cynthia made no such sacrifice. If Adam is a reciprocator, he may let these acts affect his contributions in the following periods. He may contribute a large amount when Beatrice is Stakeholder and less when Cynthia is Stakeholder.

If agents have truly reciprocal other-regarding preferences ("intrinsic reciprocity"), this discrimination happens because Adam's preferences for Beatrice's and Cynthia's payoffs were changed by their previously kind and unkind, respectively, acts. On the other hand, this reciprocation could be wholly instrumental. If Adam is self-regarding but believes other agents may be reciprocators, he might hope to earn future rewards by strategically contributing when a likely reciprocator is Stakeholder. He might guess from her past generosity that Beatrice is reciprocator. He could then mimic a reciprocating type in pursuit of a higher payoff. If there is

common knowledge that no-one is a reciprocator and everyone is fully forward-looking, then this kind of "cooperation" would wholly unravel. If agents are fully self-interested but myopic the unraveling might be incomplete and might generate early strategic contributions. Relatedly, one might be tempted to think that Non-Stakeholders will contribute because of conditional cooperation, trying to lead others to also contribute or responding to others' earlier contributions. While targeted reciprocity (person-to-person favor-trading) is plausible, conditional contributions to spur or respond to contributions by the group at large are unlikely because an increased group tendency to contribute in all rounds would reduce all agents' earnings.

Even Stakeholder contributions could be affected by intrinsic or instrumental reciprocity. A Stakeholder who wishes to earn higher contributions in future Stakeholder stints or to reward the kindness of past benefactors may reduce his common fund contributions now since those contributions hurt all of his group members.

Reciprocity requires that agents observe each other's history of actions and schedule of Stakeholder timing. If history or roles are not observable, reciprocity in the sense of targeted rewards for individuals' past actions cannot influence contributions. We model two information conditions. In the Public condition, all group members know one another's contribution history and one another's roles in each period. In the Private condition, group members know only their own role and history; they learn the individual amounts contributed in past periods but cannot associate them with any particular group member and know nothing about the timing of others' Stakeholder stints.

If agents are inequity-averse, how should they behave? It depends on their expectations of others' actions. Since the Stakeholder role rotates through all group members, if other agents contribute as Stakeholder and withhold when they are Non-Stakeholder, then an inequity-averse

agent should do the same to ensure equal payoffs. If group members deviate from that pattern, an inequity-averse agent should match that deviation.

To summarize, in the Private information condition, there is little reason for Non-Stakeholders with any kind of preference to contribute so Non-Stakeholder contributions in this setting are at some baseline level near zero. In the Public condition, Non-Stakeholder contributions could be increased because of targeted reciprocity. If Non-Stakeholders reduce contributions (relative to the baseline) to previously unkind Stakeholders, however, these forces may offset one another so that the effect on Non-Stakeholder contributions of Public information is ambiguous. Regardless, direct favor-trading as described in the example above can occur in the Public condition only. Stakeholder contributions may be reduced in the Public as compared to the Private condition because of reciprocity.

Other elements of preferences may affect behavior. Trusting is a risky choice because one cannot be certain that the other group member will reciprocate a kind act. As a result, we expect that risk preferences would be correlated with contribution behavior in this setting. Agents who contribute as Non-Stakeholders in the Private information condition are taking a particular risk, since other agents cannot directly reciprocate. Beliefs about how individuals and groups relate to each other, and thus political preferences, could also play a role. People with beliefs that privilege social duties should contribute less in all roles.

4. Experiment

To test the model and study the operative preferences, we implement the Stakeholder Public Bad game in a lab experiment based on a linear public bad game with rotating asymmetric payoffs. We use two treatments corresponding to the Private and Public information conditions, which we describe in detail below.

In each treatment, subjects are randomly assigned to fixed four-person groups for eight rounds. In each round, each subject is endowed with $z = 10$ tokens. He then must choose how many tokens ($g_{it} \in \{1,\ldots,10\}$) to invest in a Group Fund, while the remaining tokens are kept in a Personal Fund. Each group has one Stakeholder and three Non-Stakeholders in each round. The Stakeholder role rotates through all members of each group so that each subject is Stakeholder twice and Non-Stakeholder six times in each eight-round treatment.

The per-token payoff from the Personal Fund is $a = \$0.02$ for all group members. For Stakeholders, the Group Fund yields no base payment ($G_S = 0$) but the per-token payoff from the Group Fund is $b_S = \$0.10$. In round *t*, the Stakeholder who contributes g_{it} earns:

$$Stakeholder_t = i : \pi_{it} = \$0.10\sum_j g_{jt} + \$0.02\left(10 - g_{it}\right) = \$0.20 + \$0.08 g_{it} + \$0.10\sum_{j \neq i} g_{jt}$$

For Non-Stakeholders, the Group Fund pays a base payment of $G_{NS} = \$2.00$. This base payment ensures that Non-Stakeholders can never earn a negative amount in any round; the Stakeholder base payment G_S is zero because this concern does not exist for them. This is reduced by $b_{NS} = -\$0.05$ per token in the Group Fund. If Non-Stakeholder subject *i* contributes g_{it} in round *t*, his payoff is:

$$Stakeholder_t \neq i : \pi_{it} = \$2.00 - \$0.05\sum_j g_{jt} + \$0.02\left(10 - g_{it}\right) = \$2.20 - \$0.07 g_{it} - \$0.05\sum_{j \neq i} g_{jt}$$

Given these parameters, the net marginal social return to each token in the Group Fund is $\$0.08 - 3*\$0.05 = -\$0.07$ (or $-\$0.09$, if the \$0.02 opportunity cost is considered). If all subjects are purely self-regarding and myopic, there is a dominant strategy equilibrium in each round: Stakeholders contribute fully and Non-Stakeholders do not contribute, so that the total group investment is 10 and the Stakeholder earns \$1.00 and the Non-Stakeholders earn \$1.70. The total

group payoff is then \$6.10. The socially optimal outcome is for no tokens to be invested in the Group Fund, in which case $\pi_S = \$0.20$ and $\pi_{NS} = \$2.20$, and total group earnings are \$6.80. If all agents contribute all tokens, the total group investment is 40, $\pi_S = \$4.00$, $\pi_{NS} = \$0.00$, and total group earnings are \$4.00.

In the Public information condition, each subject is assigned a letter code. Subjects see a table in which the timing of Stakeholder position for all group members is reported and in which each group member's contribution history is displayed. In the Private condition, subjects' contributions to the Group Fund are reported in a disaggregated list (it has been noted, e.g., Sell and Wilson, 1991, that disaggregated reporting of group member contributions may affect giving). Because contributions are listed in a random order that is reshuffled each round, norms may be established and subjects may follow each other. However, reputations cannot be established and Stakeholder timing is private information so targeted reciprocity is impossible.

The experiment interface is computerized using software written in z-Tree (Fischbacher, 2007). Subjects enter the lab and are given general instructions.[5] They are told that they will make decisions in two sets of eight rounds with two different groups and that they will then make one unrelated decision, but are not told the exact nature of the decisions they will make in each treatment until directly before the treatment begins.

The first treatment begins with instructions that explain the roles and the information condition for that treatment. The software randomly assigns subjects into four-person groups. The subjects then play through all of the rounds for the treatment. After the first treatment, subjects are randomly assigned into new four-person groups. The second treatment features the complementary information condition and proceeds in much the same way, with treatment-

[5] Instructions are available on the corresponding author's website: http://econ.williams.edu/people/saj2

specific instructions read first. After both treatments are complete, subjects receive instructions for a risk preference elicitation task (similar to Holt and Laury, 2002). After the risk task, subjects complete a questionnaire and receive payment anonymously. Each subject's total earnings is the sum of his earnings in each treatment, which in turn are the sum of his earnings in each round plus his earnings from the risk task.

5. Results

The experiment was run at the Experimental Economics Center (E*x*CEN) at Georgia State University in March 2010 in four separate 20-subject sessions, for a total of 80 subjects. All subjects played two treatments of eight rounds, one in a Public and one in a Private information condition. Half of the sessions ran the Public treatment first, and half ran the Private treatment first. Some small order effects are detectable, so all analysis includes only data from subjects' first treatment.[6] The protocol was double anonymous: subjects could not identify which subjects were in their group, and the experimenters could not identify which subject made any set of decisions. Of the 80 subjects, 40 (50%) were female, and the average age was 20.1. Each session lasted about 90 minutes, and subjects earned on average $23.38 (standard deviation $1.85).

Contribution Level Results

Figure 1 shows the path of contribution decisions across the rounds of each treatment. Stakeholder decisions in both treatments are close to the endowment, which is consistent with the selfish dominant strategy of full contribution by Stakeholders. Non-Stakeholder contributions

[6] Order effects are: Non-Stakeholder contributions are higher in a subject's first treatment; and Stakeholder contributions are higher in both conditions if the Private treatment is first. Results change little when the full data set is used: Stakeholder contributions are significantly greater in the Public than in the Private treatment; and the difference-in-difference test comparing favor-trading between the Public and Private treatments is significant.

are low but positive in all rounds. Contributions show the downward trend usually seen in public goods games, even though this public investment is actually a public bad.[7]

Table 1 shows summary statistics of the distribution of individual contributions across rounds. The majority of contributions follow the selfish dominant strategy, but many subjects deviate from perfect adherence. In particular, Non-Stakeholders seem to have a greater tendency to give nonzero amounts than do Stakeholders tend to give less than full endowment.

We compare means of contributions by role and treatment in Table 2. Both Stakeholders and Non-Stakeholders contribute slightly less in the Public treatment as compared to the Private treatment, but this is not significant. It must be the case, then, either that reciprocity is not playing a large role here or that subjects' increased contributions to kind Stakeholders are offset by decreased contributions to unkind Stakeholders. In the next section we present evidence that reciprocity does indeed occur in the Public treatment, which implies the latter interpretation.

Total (combined across roles) group contributions do not differ between the Public and Private conditions. Figure 2 shows that the trend across periods for the two treatments. Across-round average total contribution is 41.77% of the maximum total group contribution as compared to 40% of the maximum in the Public treatment, and these numbers are not statistically different (Wilcoxon rank-sum test *p*-value 0.626).

Because of the novel structure of induced preferences, it is difficult to compare contributions in this experiment to contributions in other experiments. In Jacobson and Petrie (2011), with a similar asymmetric payoff setup but a public good instead of a public bad, Stakeholders gave slightly more than they do here (95-97% of endowment), Non-Stakeholders gave much more than they do here (33-38%), and both roles show trends similar to the trends

[7] Obviously, interpretation of our results depends on the assumption that subjects understand the game they are playing and in particular understand the public bad nature of the common fund. While it is impossible to prove this with any certainty, we find at least some questionnaire responses to imply an understanding of this feature.

shown here. This reduction in contributions is clearly due to the public bad nature of the public project in the Stakeholder Public Bad game as compared to the public good nature of the public project in Jacobson and Petrie (2011). Indeed, we find it remarkable that subjects give as much as they do in this public bad setting. In particular, Stakeholders' willingness to purely follow self-interest to the detriment of their group appears to be uninhibited by social preferences.

Presence of Reciprocal Contribution

Reciprocal contributions may be caused by intrinsic or instrumental reciprocity. We test for reciprocity by comparing how much a Non-Stakeholder contributes in two different conditions. The first condition is that the Non-Stakeholder is facing a Stakeholder who contributed generously (more than half his endowment) in the period in which this person was Stakeholder. The alternative condition is that the Non-Stakeholder is facing a Stakeholder who contributed ungenerously (less than half of his endowment) when this person was Stakeholder.[8]

As shown in Table 3, we test whether subjects discriminate between these generous and ungenerous Stakeholders in both the Private and Public treatments. Recall that the reciprocity is impossible in the Private treatment, and indeed we do not detect spurious evidence of reciprocity. However, in the Public treatment, the data show that Non-Stakeholders do respond to the current Stakeholder's past kindness, i.e., they reciprocate: they contribute more when the current Stakeholder was previously generous than when he was previously ungenerous. This test is within-subject and is thus robust to group-level correlation of contributions. However, the within-subject nature of the test greatly reduces the sample size because most people do not face

[8] The results that follow hold qualitatively for alternative specifications of the threshold for generosity.

both a previously-kind and previously-unkind Stakeholder.[9] Even so, some subjects' tendency to discriminate seems quite strong. If we perform a difference-in-difference test for the difference in this sort of discrimination across the Private and Public treatments, the result is not significant (Wilcoxon rank-sum *p*-value 0.241), but this is clearly due to reduced sample size. The evidence of significant discrimination in the Public treatment demonstrates reciprocal giving.

We note that that anti-social favor-trading, which is clearly a socially bad activity, is enabled by the provision of information on subjects' histories and the timing of their interest in the common fund. Thus in this case, reciprocity and the information that enables it serve as a force for evil. We contrast this with the result in Jacobson and Petrie (2011), who show that providing information that allows reciprocity in a similar game (a "Stakeholder Public Good" rather than a "Stakeholder Public Bad" game) increases efficiency by leveraging pro-social favor-trading.

Correlates of behavior

Final insights into contribution behavior come from subjects' questionnaire responses. It should be noted that the questionnaire could not have primed subjects, since it was filled out after the experiment decisions were complete. Characteristics that vary with contribution decisions are described in Table 4.

First, we see that subjects who identify with the Democratic Party tend to give less as Stakeholders in the Public treatment as compared to subjects who do not identify with that party. In the Private treatment the same pattern exists but is not statistically significant (Democrats give 89.71 as compared to 96.74 percent of endowment, Wilcoxon rank-sum *p*-value 0.122). This

[9] Each subject experiences only 3-6 rounds after his first Stakeholder stint. Since the majority of Non-Stakeholder contributions are zero in both treatments, is it not surprising that fairly few subjects face both types of Stakeholders after their first Stakeholder stint in this small number of rounds.

accords with the results from other social sciences that Democrats are more oriented toward duties toward society and a feeling of obligation to help others (Coffé and Bolzendahl, 2011).[10]

Next, we look at risk aversion as measured by a subject's switch point in the Holt-Laury (2002) style lottery choice instrument. An early switch point indicates that the person is less risk-averse. We consider those who are risk-seeking to mildly risk-averse as one group and compare their contributions to those of the more risk-averse subjects.[11] Less risk-averse subjects give more as Non-Stakeholder and less as Stakeholder than more risk-averse subjects do in the Private treatment. This implies a positive relationship between risk aversion and adherence to the selfish dominant strategy. This is sensible if we recall that there's no clear way for non-dominant giving in the Private condition to be rewarded, while non-dominant giving in the Public condition can be associated with targeted reciprocity. While we do not have direct evidence that cooperating in the Public condition is less risky, we find it reasonable to infer that trusting to the group in general to reward sacrifice (as must happen in the Private treatment) feels riskier than does trusting to a specific group member (as is possible in the Public treatment).

Finally, we included a simple comprehension test in the questionnaire. This gave a simple scenario with two funds with different returns, and asked the subject how many tokens he'd put into the fund with the higher return to maximize his profit. Out of the 80 subjects in the experiment, 68 (85%) answered this question correctly. A tendency to make non-dominant contributions—to contribute high amounts as Non-Stakeholder and to contribute low amounts as Stakeholder—is correlated with tendency to answer this comprehension question incorrectly.[12]

[10] Subjects who identify as black are more likely to identify as Democrats, as are subjects who have not taken economics classes. Stakeholder contributions do not vary significantly by whether a subject has taken economics classes. Black subjects do give less as Stakeholder in the Public treatment, but not the Private treatment.

[11] This result is robust to other thresholds of the "more risk-averse" classification.

[12] Subjects who answered the comprehension question incorrectly were much more likely to have reported taking no economics classes.

6. Conclusion

In this paper, we examine reciprocal behavior in the provision of a public bad. Individuals may have competing motivations when a group of people must decide on the provision of a common project. We model sequences of inefficient projects, each of which is nonetheless privately desirable to a booster within the group. Natural analogies include political logrolling or influence peddling. Reciprocity has been shown to be a force for social good in many settings; our results show that it can also cause social harm.

We use a novel "Stakeholder Public Bad" model in which asymmetric returns create a public bad that is privately beneficial to a single constituent. In our model, we show that intrinsic or instrumental reciprocity could lead to favor-trading in the provision of these projects and that overall provision could be increased by reciprocity given this structure of payoffs if sufficient information is available to agents. In an experiment implementing this model, we find that some subjects discover the opportunity to trade favors and actively engage in this favor-trading when they have the necessary information. In this context, reciprocal behavior does not increase the level of public bad provision. Given the existence of reciprocity, however, overall public bad provision might increase or decrease under different parameters or with a different subject pool.

In this way, reciprocity may in some situations reduce efficiency. On a related note, provision of information in this context enables this anti-social reciprocal behavior—this again can be contrasted with the perhaps more common case in which information provision increases efficiency. This potential for misuse of information is clearly noticed by some attempting to reform campaign finance in the United States. Ackerman and Ayres (2002) argue that all campaign contributions should be anonymous to render political favor-trading impossible.

Beyond an overall tendency to engage in reciprocity, we also observe how people behave when a privately optimal decision actively hurts others. We argue that this is a subtly but fundamentally different issue than people's failure to provide a public good. When subjects benefit directly from a public bad, as in our Stakeholder role, we see that they contribute nearly fully. Even some subjects who bear a private cost from the public bad (Non-Stakeholders) contribute a positive amount to the public bad. Although some of this may be due to subject error, some of it is clearly caused by subjects' hopes of garnering future rewards when their "pet project" is the one being provided (i.e., when they are Stakeholder). Risk aversion seems to inhibit some subjects' Non-Stakeholder contributions when a reward for such action seems unlikely to be forthcoming. Subjects who identify as Democrats quite significantly restrain their contributions to project provision as compared to subjects who do not, and this may be caused by differences in attitudes about how the individual relates to the group.

The direct rewards reaped by a person with a stake in a common project appear to be so tempting that they can overwhelm a person's inherent social preferences. Despite the negative social effects of provision of the public bad, subjects from both roles contribute positively to the provision of the public bad to their mutual detriment. Altruism and pro-social reciprocity are real and have been proven repeatedly. In this setting, however, individuals are able to harness reciprocity and information as a force for the good of the few but against the good of the many.

7. Figures and Tables

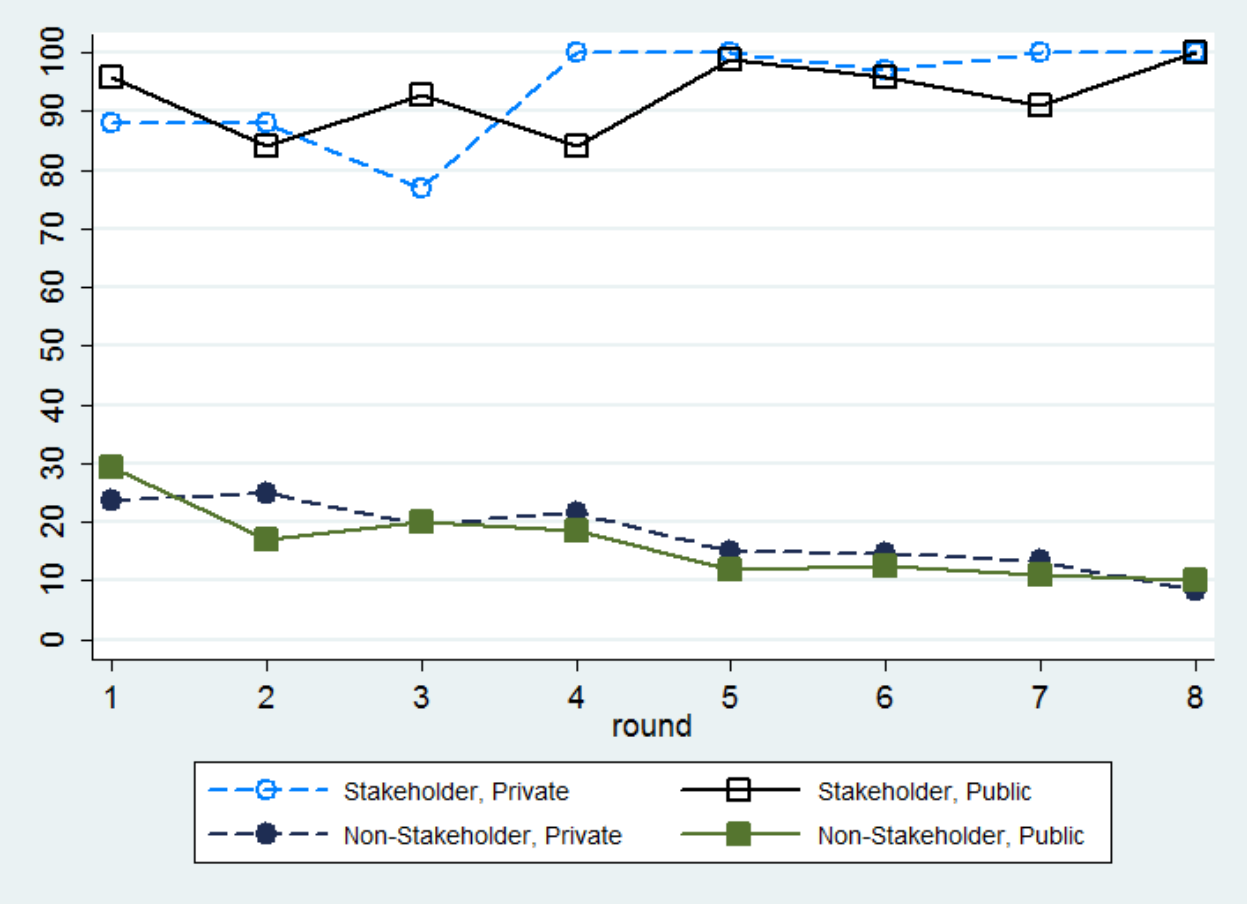

Figure 1: Contributions across rounds by role and treatment (in percent of endowment)

Table 1: Distribution of contribution amounts by treatment and role

	Non-Stakeholder		Stakeholder	
	Private	**Public**	**Private**	**Public**
Gave 0% of endowment[a]	161 (67.08%)	140 (58.33%)	3 (3.75%)	2 (2.5%)
Gave intermediate amount[a]	60 (25%)	86 (35.83%)	8 (10%)	12 (15%)
Gave 100% of endowment[a]	19 (7.92%)	14 (5.83%)	69 (86.25%)	66 (82.5%)
Median contribution	0	0	Endowment	Endowment
Subjects who always follow selfish dominant strategy[b]	13 (32.5%)	14 (35%)	29 (72.5%)	27 (67.5%)
Number of contributions	240	240	80	80
Number of subjects	40	40	40	40

[a] Cells contain number of contributions with percent of contributions in parentheses.
[b] Selfish dominant strategy is to contribute 0 as Non-Stakeholder and 100% of endowment as Stakeholder.

Table 2: Mean contributions by role and treatment (in percent of endowment)

	Non-Stakeholder	Stakeholder
Private	17.67	93.75
	(24.58)	(13.95)
Public	16.33	92.88
	(21.79)	(15.34)
Wilcoxon rank-sum test *p* value	0.992	0.680

N = 40 in each cell. Standard deviations in parentheses.

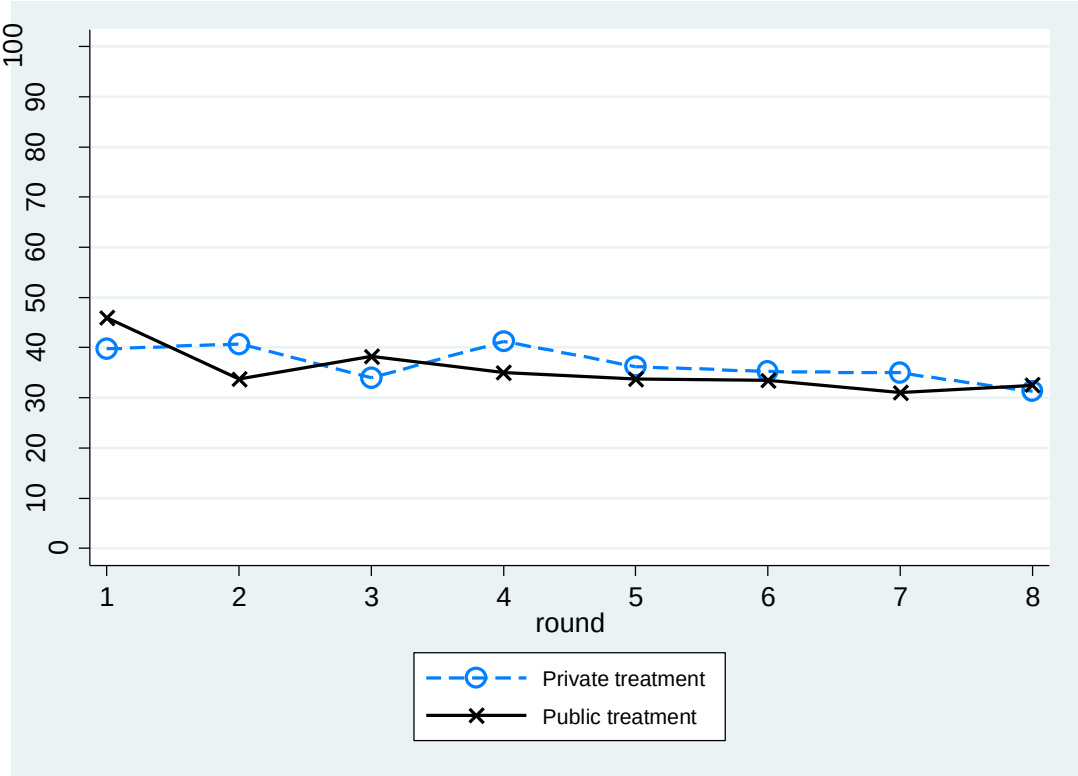

Figure 2: Group average public bad provision by treatment (in percent of total group endowment)

Table 3: Evidence of reciprocal contributions

	Private	Public
Stakeholder extracted > 50% when I was Stakeholder in past	25.00	29.32
	(9.64)	(10.02)
Stakeholder extracted ≤ 50% when I was Stakeholder in past	19.23	9.06
	(8.42)	(3.22)
N	13	11
Wilcoxon signed-rank test *p*-value	0.420	0.058

N < 40 in each cell because subjects who did not face both "nice" and "mean" Stakeholder were dropped. Standard deviations in parentheses.

Table 4: Correlates of contribution decisions

Characteristic	**Subjects with Characteristic**	**Treatment**	**Role**	**Difference**
Democrat	21 of 40	Public	Stakeholder	Democrats give less (88.81 vs. 97.37, *p*=0.009)
Risk averse	17 of 40	Private	Non-Stakeholder	Less risk averse give more (27.94 vs. 10.07, *p*=0.026)
Risk averse	17 of 40	Private	Stakeholder	Less risk averse give less (87.65 vs. 98.26, *p*=0.054
Comprehension question wrong	6 of 40	Private	Non-Stakeholder	Wrong answer give more (42.50 vs. 13.28, *p*=0.022)
Comprehension question wrong	6 of 40	Public	Non-Stakeholder	Wrong answer give more (35.00 vs. 13.04, *p*=0.008)

Amounts given in percent of endowment. *P*-values are for Wilcoxon rank-sum test

8. References

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