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Doing good or doing harm: experimental evidence on giving and taking in public good games

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Abstract We replicate Andreoni (Quarterly Journal of Economics 110: 1–21, 1995)'s finding that agents behave more selfishly when taking from a public account than when giving to a public good. Based on a neutral language setting we add new insights into motivations to give or take in a linear public good setting: we find that Andreoni's result is partly driven by the complete elimination of giving options in the taking frame. However, a pure extension of the action space into the taking domain also leads to a significant increase in selfish behavior.

Keywords Public good · Voluntary provision · Taking · Experiments

JEL Classification H41 · C91

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1 Introduction

Andreoni (1995) has shown that subjects are more willing to cooperate in a giving than in a taking frame even if both are identical with respect to their potential outcomes. Dufwenberg et al. (2011), Park (2000), and Sonnemans et al. (1998) also identify differences between contribution decisions to public goods versus public bads.[1] Cox et al. (2013) however do not establish these differences when comparing games on public goods provision vs. common pool appropriation. In this paper, we replicate Andreoni's finding using neutral language instructions. We add further insights into the motivations to give or take in a linear public good setting by varying the extent to which subjects actually can do good or do harm. In particular, we consider a situation where both giving and taking are possible. Examples where individuals may either contribute to a public good or reduce its provision include emitting environmental pollutants or reducing pollutant levels by investing in carbon offsets (Kotchen 2009), paying or evading taxes and taking actions as a manager that enhance the performance of a firm or that benefit only the manager personally while imposing a cost on the firm. A better understanding of individual behavior in both giving and taking domains is therefore crucial for creating institutions that secure a sufficient provision of public goods.

With our set of experimental treatments, we confirm Andreoni (1995)'s finding that agents are more cooperative in a giving treatment with zero initial endowment in the public account than in the payoff-equivalent taking treatment where all wealth is initially allocated to the public account. However, when starting with an intermediate initial endowment in the public account, we find that subjects reach similar provision levels as in the giving treatment despite the presence of taking options. This indicates that the difference between a pure giving and a pure taking frame in Andreoni (1995) may be driven by the respective one-sided action spaces. These three treatments kept the set of potential payoffs identical and therefore simultaneously changed the set of available actions and the starting levels in both private and public accounts. To explore the impact of a pure extension of the action space to the taking domain, we add a final treatment that also starts with an intermediate level of the public account, but limits actions to the giving domain. Comparing this treatment with the intermediate give and take treatment, we find that allowing for taking leads fewer individuals to give strictly positive amounts even though the giving domain is kept unchanged. With this result, we extend findings on the impact of adding an opportunity to take from dictator games (List, 2007; Bardsley, 2008) to a linear public good setting. Our findings indicate that subjects evaluate their actions relative to the set of all feasible actions such that giving is not necessarily 'doing good' and taking is not necessarily 'doing harm'.

The remainder of this article is organized as follows. Section 2 presents the experimental design of the study. Results are presented and discussed in Sect. 3. Section 4 provides a concluding discussion.

[1] Cubitt et al. (2011) follow a similar approach in a one-shot setting with second-stage punishment option and ex-post elicitation of emotions, but largely find insignificant results. For a broader comparison of framing effects in public good experiments, see Cookson (2000).

2 Experimental design

Our experimental design consists of four treatments. We use the structure of a linear public good game:

$$\pi_i = w^t - a_i + h\left(E^t + \sum_{j=1}^{n} a_j\right)$$

where h denotes the per capita return to the public good with $0 < h < 1 < hn$, w^t represents the initial endowment of i in treatment t (and is the same for all n group members), $a_i \in A^t$ denotes i's transfer to the public good account, A^t is the available action set and E^t is the initial allocation to the public good account. In the experiment, we chose $n = 4$ and $h = 0.4$.

The treatments differ in the initial allocation to the public good, E^t, the initial endowment, w^t, and in the action set that is available to agents. We first replicate Andreoni (1995) using neutral framing[2] by having a standard voluntary contribution mechanism (*GIVE*, $E^{GIVE} = 0$, $w^{GIVE} = 20$, $A^{GIVE} = [0, 20]$) and the inverse setting (*TAKE*, $E^{TAKE} = 80$, $w^{TAKE} = 0$, $A^{TAKE} = [-20, 0]$). We further consider an intermediate treatment (*GITA* = *GI*ve and *TA*ke), where agents can either add to or subtract from an existing public account ($E^{GITA} = 32$, $w^{GITA} = 12$, $A^{GITA} = [-8, 12]$).[3] These three treatments are identical in the range of potential outcomes. We add another voluntary contribution mechanism *GIVE** which uses the same intermediate initial endowment as *GITA* ($E^{GIVE^*} = E^{GITA} = 32$, $w^{GIVE^*} = w^{GITA} = 12$), but limits the action space to the giving domain ($A^{GIVE^*} = [0, 12]$). Comparing *GIVE** with *GITA* allows us to explore how a simple extension of the action space to the taking domain affects behavior in a public good setting.

The standard game theoretic prediction for selfish agents clearly is that agents will contribute no units of their endowments to the public good and—if taking is possible—transfer the maximal allowable amount to their private account. We therefore predict $a^{GIVE} = 0$, $a^{TAKE} = -20$, $a^{GITA} = -8$, and $a^{GIVE^*} = 0$.

All experimental sessions were conducted in the computer laboratory of the School of Business, Economics, and Social Sciences, University of Hamburg, Germany in January and April 2011. Each session lasted approximately one hour. We used z-Tree (Fischbacher 2007) to program and ORSEE (Greiner 2004) for recruiting. In total, 160 subjects participated in the experiment. All were students with different academic backgrounds, including economics.

Each of our 8 sessions consisted of 10 periods. Once the participants were seated and logged into the terminals, a set of instructions was handed out and read out loud by the experimenter.[4] Experimental instructions included several numerical

[2] Subjects were asked to transfer tokens between their private and the group account.

[3] We deliberately chose asymmetric bounds in the negative and positive domain in order to avoid a potential focal point at the mid-point of the action space to coincide with '0' contribution decisions.

[4] We mainly followed the instructions of Fehr and Gächter (2000), but slightly changed the wording. For instance, instead of 'contributions to a project', instructions asked participants to divide tokens between a private and a group account. Instructions can be found in Supplementary material.

Table 1 Summary of experimental sessions

Session	Number of groups	Number of participants	Treatment
1	5	20	TAKE
2	6	24	GITA
3	5	20	GIVE
4	6	24	TAKE
5	4	16	GITA
6	4	16	GIVE
7	5	20	GIVE*
8	5	20	GIVE*

Numbers of groups across treatments are not equal due to some registered subjects not showing up

examples and participants had to answer control questions via their computer terminals.[5] At the beginning of the experiment subjects were randomly assigned to groups of four. The subjects were not aware of whom they were grouped with, but they did know that they remained within the same group of subjects for all periods. At the end of each period, participants received information about their earnings, the cumulative group contribution to or extraction from of the group account and the final amount of units in the group account. Subjects were never able to identify individual behavior of group members. At the end of the experiment, one of the periods was randomly selected as the period that determined earnings with an exchange rate between Euro and token of 3 EUR = 10 tokens. Including a show-up fee of 4 EUR, the average payment over all treatments was 11.70 EUR. Table 1 summarizes the information for all 8 sessions.

3 Results

The data summarizing the decisions made by participants in the four treatments are presented in Table 2. Data are reported for the mean give (or take) decision (a_i) for the first period and for the mean give (or take) decision pooled across the ten periods. Give decisions are positive and take decisions are negative. In addition to the mean individual decisions, the mean individual contributions (($a_i + E^t/4$) are reported in order to allow a better comparison of public good provision in the treatments. We also include standard deviations of the decisions and contributions. Further, Table 2 shows the percentage of all decisions that are consistent with the standard theoretical model, i.e. the most selfish option, the percentage of all decisions in which individuals give a positive amount and the percentage of all decisions which result in an individual contribution that exceeds 8 endowment units (which is the most selfish option in *GIVE** and corresponds to positive giving in *GITA*). Figure 1 depicts contribution levels by period.

[5] In case a participant did not answer the questions correctly, a help screen explained the correct answers in detail.

Table 2 Summary statistics of GIVE, GIVE*, TAKE and GITA

Statistic	First period				All 10 periods (means)			
	GIVE	GIVE*	TAKE	GITA	GIVE	GIVE*	TAKE	GITA
Mean decision	11.75	6.25	−11.39	3.53	7.71	4.84	−15.56	−0.77
	(4.59)	(2.73)	(3.94)	(3.54)	(5.26)	(2.69)	(2.37)	(3.37)
Mean contribution	11.75	14.25	8.61	11.53	7.71	12.84	4.44	7.23
	(4.59)	(2.73)	(3.94)	(3.54)	(5.26)	(2.69)	(2.37)	(3.37)
% of decisions MaxSelf	11.11	12.50	36.36	20.00	33.89	25.25	52.73	45.25
% of decisions > 0	88.89	87.50	–	65.00	66.11	74.75	–	41.50
% of contribution > 8	69.44	87.50	54.54	65.00	45.28	74.75	24.32	41.50

Standard deviations for group level data in parentheses

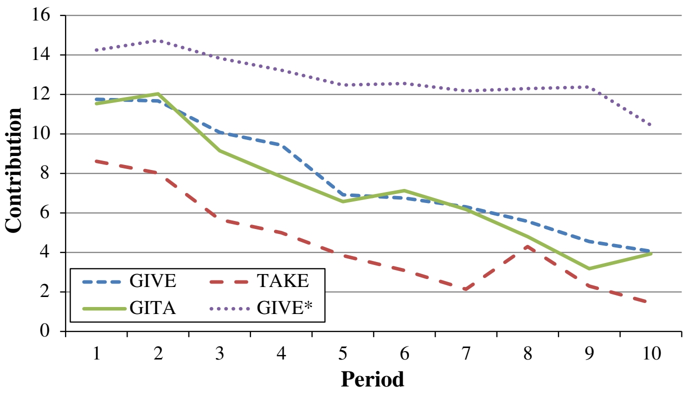

Fig. 1 Average contributions over all periods, by treatment

Across all periods, in *GIVE*, each agent contributed 7.71 tokens on average, resulting in a public good provision level of $4 \times 7.71 = 30.84$ tokens. Contributions are substantially smaller in *TAKE* with 4.44 tokens.

The differences between the treatments are confirmed by a series of tests (based on group contributions averaged across all periods) as well as by a series of linear regression models that we report in Table 3.[6] Taking the average of all periods, the *TAKE* treatment leads to fewer contributions than *GIVE* (3.3 tokens, statistically significant at the 5 or 10 % level, depending on the specification in Table 3). This difference between *GIVE* and *TAKE* is confirmed by Welch's t-tests based on group

[6] Column (I) takes a most conservative approach by taking the group average of contributions across all periods as dependent variable. Columns (II) and (III) control for interdependencies of decisions across periods by including individual random effects and clustering standard errors at the group level. The results are stable to using different specifications like group average of contributions per period as dependent variable or a linear time trend.

Table 3 Linear regression of contribution levels of all four treatments

	Dependent variable: contribution level		
	(I) OLS estimation one observation per group, mean over all ten periods	(II) Random-effects estimation standard errors clustered at group level	(III) Random-effects estimation standard errors clustered at group level
GITA	−0.481	−0.481	−0.552
	(1.615)	(1.964)	(2.083)
GIVE*	5.124***	5.124***	3.728**
	(1.615)	(1.865)	(1.868)
TAKE	−3.270**	−3.270*	−3.745**
	(1.579)	(1.814)	(1.842)
Period 6-10		−3.528***	−4.522***
		(0.394)	(0.741)
Period 6-10_GITA			−0.142
			(1.181)
Period 6-10_GIVE*			2.792***
			(0.980)
Period 6-10_TAKE			0.949
			(0.884)
Constant	7.711***	9.475***	9.972***
	(1.172)	(1.084)	(1.649)
Observations	40	1600	1600
Individuals	(160)	160	160
Groups	(40)	40	40

GIVE is the baseline. Standard errors in parentheses, significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

averages across all periods ($p = 0.0557$) and first period individual contribution levels ($p = 0.0615$).[7]

Overall, we replicate Andreoni (1995)'s finding:

Result 1 *The final provision level of the public good is significantly smaller when agents take from an existing public account (TAKE) than in a pure giving frame (GIVE).*

Our experiment therefore confirms the difference between behavior in giving versus taking treatments even if a neutral frame is used in the instructions.

[7] This difference is also found using a Mann–Whitney test based on first period individual contribution levels ($p = 0.07$), but does not show up when comparing group averages across all periods ($p = 0.27$). Using the Welch t test appears, however, more appropriate: a Shapiro–Wilk W test cannot reject the hypothesis of normality for both distributions and a Levene's test shows that the variances of the samples of *GIVE* and *TAKE* are not equal ($p = 0.014$). In this case, Ruxton (2006) and Fagerland and Sandvik (2009) advise using the Welch's t test for unequal variances instead of the Mann–Whitney test as it performs better than the Mann–Whitney test in terms of controlling Type I errors.

Moving to the intermediate treatment *GITA* where giving and taking options coexist, we find contributions to be significantly larger than in *TAKE* (7.23 versus 4.44, 5 % level of significance based on comparison of coefficients in Table 3, two-sided Mann–Whitney test: $p = 0.04$), while they are almost identical as in *GIVE* (7.23 vs. 7.71, two-sided Mann–Whitney test $p = 0.87$, see also Table 3).

Importantly, the average contribution in *GITA* was 7.23 tokens, and thereby almost indistinguishable from the one in *GIVE*. This is particularly surprising as taking was possible, and the range of final contribution levels was identical to the one in *GIVE* and *TAKE*. We report:

Result 2 *Starting with an intermediate endowment of the public account and allowing for giving and taking (GITA) leads to an almost identical provision of the public good as in a pure giving game (GIVE) and a significantly greater final provision of the public good compared to the taking game (TAKE).*

Result 2 provides a potential caveat to findings by Andreoni (1995): reversing the public good giving game to a taking game in *TAKE* may reduce the contribution levels only because of the one-sided nature of the action space that does not allow for giving. Result 2 therefore indicates that taking options do not necessarily lead to less cooperative behavior on average than a pure giving frame. While *GITA* and *GIVE* are strikingly similar when considering the average contribution decisions, differences in the distributions of contribution decisions exist: Table 2 shows that across all 10 periods more people in *GITA* behaved in the most selfish way than in *GIVE* (34 % versus 45 %). As such, the almost identical average contribution implies that those who contributed, contributed more in *GITA* than those in *GIVE*.

The treatments *GIVE, GITA*, and *TAKE* were designed to keep the set of outcomes and thereby the range of possible contribution levels identical. As such, they differ both in the giving as well in the taking domain, but they do not impose a constraint on the amount that can be contributed. We therefore finally consider how a pure extension of the action space into the taking domain affects behavior: comparing *GITA* and *GIVE** we find a significantly lower provision level when taking options are introduced without changing the giving domain (contributions of 7.23 tokens versus contributions of 12.84 tokens). This difference is significant (1 percent level of significance in Table 3, two-sided Mann–Whitney test $p = 0.001$). The result may not look surprising as *GITA* and *GIVE** are identical in the giving domain, both with respect to the action space and the resulting effects on private and public account. As such, some agents who give zero in *GIVE** can be expected to take in *GITA*. In order to identify the impact of taking options on individual behavior, we compare the percentage of individuals who give a strictly positive amount (see Table 2). Concentrating on period 1 decisions, 87.5 percent give in *GIVE** and 88.9 percent in *GIVE*, while only 65 percent give a positive amount in the first period in *GITA*. The differences between individual decisions in *GIVE** and *GITA* as well as *GIVE* and *GITA* are both significant at the 5 percent level based on Fisher exact tests. The differences are even more pronounced when averaging across all 10 periods (41.5 percent in *GITA* vs. 74.8 percent in *GIVE**).

Result 3 *Fewer agents give a positive amount if the action space allows for giving and taking (GITA* vs. *GIVE* and GITA vs. GIVE).*

Random effects Probit regressions for the probability of positive giving in Table 4 confirm this finding. The estimated coefficients for *GITA* are negative and statistically significant (baseline *GIVE*), while the coefficients for *GIVE** are not significantly different from zero. Result 3 thereby extends the findings by List (2007) and Bardsley (2008) from dictator games to public good games: not all subjects who take when taking is allowed pool at zero contributions when the action set allows for giving only.

We note that positive giving in both *GIVE** and *GITA* coincides with contributions larger than 8. Interestingly, the corresponding levels in *GIVE* are very similar to those in *GITA* (see Table 2) and significantly smaller than when enforcing such contribution levels in *GIVE**. That is, if one allows for smaller contribution levels (in both *GIVE* and *GITA*), individual contributions fall.

We finally consider the percentage of agents who choose the most selfish option (see Table 2). In *TAKE*, 36.4 percent of agents take out the maximum amount in period 1, while fewer agents choose the most selfish action in *GITA* (20.0 percent, difference significant at the 10 percent level based on Fisher exact test), *GIVE** (12.5 percent, at 5 percent level) and in *GIVE* (11.1 percent, at 1 percent level). Introducing a taking option and reducing giving options therefore appears to make subjects less hesitant to behave in the most selfish manner.

Table 4 Probit Regression of Giving a Positive Amount in GIVE, GIVE* and GITA

Independent variables	Dependent variable: binary variable on whether a positive amount was given (yes = 1)	
	(IV) All 10 periods	(V) All 10 periods
GITA	−1.005***	−1.141***
	(0.305)	(0.349)
GIVE*	0.347	0.395
	(0.310)	(0.354)
Period 6-10		−1.043***
		(0.106)
Constant	0.686	0.1304
	(0.225)	(0.267)
Observations	1160	1160
Individuals	116	116
Groups	29	29

Random effects Probit estimation; GIVE is the baseline. Standard errors in parentheses, significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4 Concluding discussion

In this article, we replicate Andreoni (1995)'s finding that subjects behave less cooperatively in a taking frame than in a giving frame. By considering an intermediate treatment which allowed for giving and taking, we find that the existence of taking options does not necessarily make agents behave more selfishly: on average, they generate public good contribution levels similar to the pure giving treatment. The percentage of subjects who behave in the most selfish way increased while the remaining people became more cooperative. When options to give are kept identical and the action space is just extended to the taking domain, we also identify a larger share of agents choosing the most selfish action and fewer agents giving positive amounts to the public good.

Taking jointly, our results allow insights into the motives of giving. Giving in public good games is often interpreted as a sense for efficiency, conditional cooperation or agents gaining a warm glow from giving (Andreoni 1990). Cox et al. (2013) already show that a whole class of social preference theories (e.g., Fehr and Schmidt 1999; Cox and Sadiraj 2007) predict identical allocation in the *GIVE* and the *TAKE* treatment. This prediction is not consistent with our replication of Andreoni (1995)'s findings. Conversely, our result that a pure extension of the action space to the taking domain decreases the percentage of players who contribute positive amounts is not consistent with a strict version of warm glow that agents receive from contributing a positive amount. Instead, taking less than possible may already be seen as doing good, i.e. subjects appear to evaluate their action relative to the available set of actions (see also List 2007; Bardsley 2008).

For a better understanding of how to overcome social dilemmas, we therefore consider it worthwhile to further study the heterogeneity in the reaction of subjects to taking options and to investigate which institutions at the same time induce (some) agents to provide public goods and restrain others from exploiting them.

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