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Abstract

Charitable giving is sometimes made collectively by a group of people. This form of philanthropy, called group giving, is gaining popularity in practice, but little has been studied in literature. Accordingly, a laboratory experiment is conducted to examine how group giving reacts to different rebate subsidies that are awarded based on the collective giving level of a group. The results show that group giving is particulary effective in boosting a giving rate in a stepwise rebate scheme. A stepwise rebate seems to encourage major contributors to contribute even more so that a rebate threshold is crossed for sure. In contrast, group giving slightly drives down a giving rate in a proportional rebate scheme. These results provide useful information for charitable organizations to develop a new intervention to increase charitable giving. This study also supplements the existing literature by providing empirical results on group giving.

Keywords: donation, laboratory experiment, group behavior, rebate scheme, electricity
C91, C91, D91, Q48

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1. Introduction

Most societies depend on philanthropic organizations to provide essential social services as a way of redistribution of wealth. Since charitable practices

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are strongly affected by social structures, including religious traditions and tax and social welfare systems, the magnitude of charitable giving varies widely among countries. For example, according to Charities Aid Foundation (2016), the United States ranks first for charitable giving by individuals as a percentage of its gross domestic product (GDP) with 1.44% in 2014. The country's individual giving rate, however, has been stagnant for over forty years (Lilly Family School of Philanthropy, 2015). Japan, in contrast, has a weak culture of philanthropy (Onishi, 2007) and individual giving is only 0.12% of its GDP in 2014 (Charities Aid Foundation, 2016). Yet, the interest in charitable giving is increasing as the number of non-profit corporations has doubled in the past 10 years (Cabinet Office, Government of Japan, 2017). It appears that many countries face the same problem of how to increase giving rates.

In the past few decades, researchers across different disciplines have studied what motivates people to donate to charity. One of the motivations to make donations is the reduced costs of making donations. As a way to reduce costs of donations, various types of subsidies have been studied, such as tax deductions (e.g., Steinberg, 1990; Auten et al., 2002; Peloza and Steel, 2005), matching gifts (e.g., Meier, 2007; Karlan et al., 2011), and rebates (e.g., Eckel and Grossman, 2003; Davis et al., 2005; Eckel and Grossman, 2006). While different subsidies work differently, these studies consistently show that subsidization increases giving rates. However, these studies consider only individual and corporate giving. In reality, donations are also made collectively by a group of people. For example, a group of like-minded friends, colleagues and acquaintances may pool their money to support collectively chosen purposes. This form of philanthropy, often called group or collective giving, allows participants to feel a sense of making a bigger impact and thus is gaining popularity (Radley and Kennedy, 1995). Indeed, many forms of philanthropy, such as alumni giving, congregational giving and workplace giving, can be considered as a donation from a group of current and/or prospective donors. Although group giving is becoming popular in practice, little has been studied in literature.

While it is not clear whether subsidization works differently between group and individual giving, previous research provides some hints. It has been shown that one's giving decision can be positively influenced by others' giving decisions (e.g., Krebs, 1970; Muehleman et al., 1976; Schwartz-Shea and Simmons, 1995). The positive influence may be partly explained by constraints of norms (e.g., Kropf and Knack, 2003; Smith and McSweeney, 2007) and reputation (e.g., Andreoni and Petrie, 2004). These studies may suggest a potential of group giving to increase giving rates. In contrast, research on public goods games may suggest a limitation of subsidization in group giving. When we consider such a subsidy in group giving that is awarded based on the collective contribution of donors and shared among them, the subsidy resembles a public good. In a public goods game, various opportunistic behaviors have been observed, such as free riding and diminishing contributions in a repeated game setting (e.g., Marwell and Ames, 1979; Andreoni, 1988; Ledyard, 1995; Fischbacher and Gächter, 2010). These may suggest that the subsidy has only a limited impact on increasing giving rates in group giving. Yet, care must be taken because even though the way the subsidy is awarded and shared in group giving is similar to the way a public good is built and shared, people's behaviors in charitable giving and a public goods game can be essentially different. In many public goods games, players expect direct benefits from investment, such as enjoying cleaner energy and using a new community facility. In contrast, charitable giving is "a donation of money to an organization that benefits others beyond one's own family" (Bekkers and Wiepking, 2011) and "there is no implied reciprocity or tangible reward for the donor" (Radley and Kennedy, 1995). That is, a donor may receive a subsidy, which happens to take a form of a public good, as a byproduct of his "selfless" action to donate to charity. In our laboratory experiment, a subject was told before the experiment that he was going to make a donation to a real charity using his endowment. Therefore, opportunistic behaviors may be less significant in our group giving setting. Summing up, our brief review of literature finds mixing effects of subsidization in group giving, whose true impact has not yet been elucidated fully.

This study is aimed at contributing to the growing need to find interventions to promote charitable giving. Given the gap in literature on group giving and its increasing popularity in practice, we focus on group giving as a potential way to increase giving rates and study how donors, as a group, can be motivated to donate more. Specifically, we conducted a laboratory experiment to examine how individual giving behaviors are affected by subsidies awarded based on the collective giving level of a group. We tested different subsidy schemes and found both positive and negative influences on giving rates. The results provide useful information for charitable organizations to develop a new intervention to increase charitable giving. This study also supplements the existing literature by providing empirical results and insights regarding group giving.

The following sections are organized as follows: Section 2 discusses two subsidy schemes tested in our laboratory experiment; Section 3 explains the experiment design; results are shown and discussed in Section 4; and concluding remarks are provided in Section 5.

2. Subsidy Schemes

In order to examine the response of group giving to different subsidy schemes, we consider two types of rebates; a proportional rebate that is proportional to a level of contribution and a stepwise rebate that is fixed between two consecutive thresholds and increases when the higher threshold is crossed. We apply these rebate schemes to individual and group giving in a repeated (multi-period) setting. Subsidy schemes have sometimes been discussed in threshold public goods games to determine how to redistribute the excess contribution beyond a provision point (e.g., Marks and Croson, 1998; Rondeau et al., 1999; Specer et al., 2009), but theoretical discussions are sparse in general. Nonetheless, we can construct a simple model to represent one's utility in a proportional rebate scheme as a rebate is a continuous function of his contribution. On the other hand, one's utility is complicated in a stepwise rebate scheme as a rebate is now a step (discontinuous) function of his contribution. Below we first discuss the base model with no rebate, which is then modified to incorporate proportional and stepwise rebates. The purpose of this section is not to develop a new mathematical model nor extending existing models. Rather, we focus on deriving some insights from basic mathematical models, which are then compared to the experimental results in Section 4. For detailed discussions on mathematical models of charitable giving, see, for example, Andreoni (1989) and DellaVigna et al. (2012).

2.1. Base Model

Our base model is defined as the following game. A player set is $N = \{1, 2, \cdots, n\}$. Player i, $i \in N$, has an amount of money, M, as an initial endowment. Player i allocates part of his endowment, $x_i \in [0, M]$, as his contribution to a charity. This x_i is player i's strategy. Let $u_i(X)$ be i's utility from total donation where $X = \sum_{i \in N} x_i$. This means that we suppose the utility from donation depends on the total amount of contribution of all players[1]. We assume that $u_i(X)$ is a differentiable increasing concave function and use the notation $X_{-i} = \sum_{j \neq i} x_j$ also. U_i is i's payoff from donation and money. Then, under a quasi linear assumption of the utility of donation,

$$U_i(X_{-i}, x_i) = u_i(X) + M - x_i. \tag{1}$$

For given other players' strategies $x_{-i} = (x_1, x_2, \cdots, x_{i-1}, x_{i+1}, \cdots, x_n)$, player i can solve the following payoff maximization problem:

$$\max_{0 \leq x_i \leq M} U_i(X_{-i}, x_i), \tag{2}$$

Eq.(2) always has a unique optimal solution x_i^* for given X_{-i}. Assuming that x_i^* is an interior solution, the Nash equilibrium is an n-tuple of strategies $x^* = (x_1^*, x_2^*, \cdots, x_n^*)$ that, for all $i \in N$, satisfies

$$\frac{\partial u_i(X_{-i} + x_i)}{\partial x_i} = 1. \tag{3}$$

2.2. Proportional Rebate Scheme

The base model is now extended to incorporate a proportional rebate in both individual and group giving. First, in individual giving, player i receives a rebate in proportion to his contribution, x_i. Let α be a rebate rate. Then, the payoff function in Eq.(1) is modified as

$$U_i(X_{-i}, x_i) = u_i(X_{-i} + x_i) + M - x_i + \alpha x_i. \tag{4}$$

The Nash equilibrium is an n-tuple of strategies x^* that, for all $i \in N$, satisfies

$$\frac{\partial u_i(X_{-i} + x_i)}{\partial x_i} = 1 - \alpha. \tag{5}$$

Next, in group giving, the size of a rebate is determined by the total contribution of all players, $X_{-i} + x_i$, and the rebate is shared evenly among all players. Let β be a rebate rate for each player. Then, player i's payoff function becomes

$$U_i(X_{-i}, x_i) = u_i(X_{-i} + x_i) + M - x_i + \beta X. \tag{6}$$

The Nash equilibrium is an n-tuple of strategies x^* that, for all $i \in N$, satisfies

$$\frac{\partial u_i(X_{-i} + x_i)}{\partial x_i} = 1 - \beta. \tag{7}$$

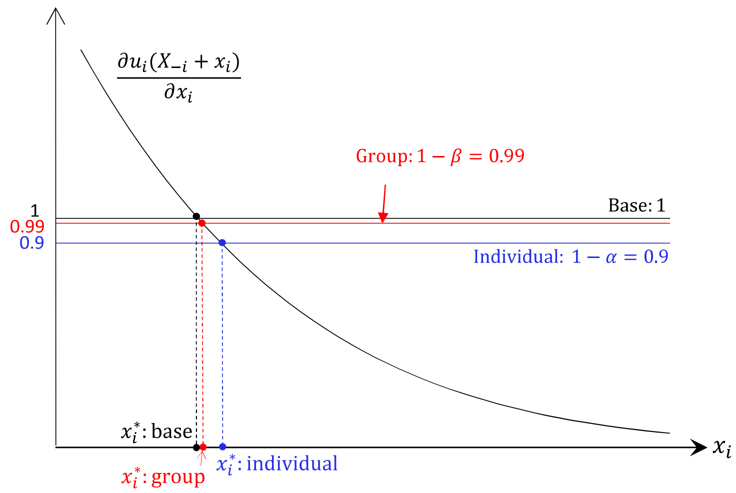

Figure 1: Optimal Contribution in the Proportional Rebate Scheme

Note: This figure compares player i's theoretically optimal contribution levels in the base model (x_i^*:base), individual proportional rebate scheme (x_i^*:individual), and group proportional rebate scheme (x_i^*:group). $u_i(X_{-i}+x_i)$ is player i's utility from the sum of his contribution (x_i) and others' contribution (X_{-i}). $\alpha = 0.1$ and $\beta = 0.01$ are the rebate rates in the individual and group proportional rebate schemes, respectively.

Figure 1 compares player i's optimal amount of contributions in the base model (Eq.(3)) and the proportional rebate schemes (Eq.(5) and Eq.(7)). $\alpha = 0.1$ and $\beta = 0.01$ are chosen so that the magnitudes of rebates are the same in both rebate schemes, assuming $n = 10$. Proportional rebates indeed increase the optimal contribution, but the effect is smaller in group giving than in individual giving.

2.3. Stepwise Rebate Scheme

A model for the individual stepwise rebate scheme is first formulated, which is then modified for the group stepwise rebate scheme. In the individual stepwise rebate scheme, the size of a rebate for player i is a step function of his contribution, x_i. For simplicity, we assume that a total of m thresholds are

[1]As Andreoni and Petrie (2004) state, one may care about others' contribution and use them as reference points for decisions. This may mean that player i's utility from donation is determined by not only his contribution but also the contribution of other players.

evenly spaced over $[0, M]$ with separation distance τ (i.e., $m\tau = M$ for some m) and that a rebate rate is r per threshold. That is, he receives no rebate if $0 \leq x_i < \tau$, rebate $k\tau$ if $k\tau \leq x_i < (k+1)\tau$ for $k \in \{1, 2, \cdots, m-1\}$, and rebate mr if $x_i = m\tau = M$. As in the proportional rebate schemes, his payoff function, U_i, is given by $U_i(X_{-i}, x_i) = u_i(X_{-i} + x_i) + M - x_i +$ (his rebate), and he solves the following payoff maximization problem:

$$\max \Bigg\{ \max_{0 \leq x_i < \tau} [u_i(X_{-i} + x_i) - x_i], \max_{\tau \leq x_i < 2\tau} [u_i(X_{-i} + x_i) - x_i + r],$$
$$\max_{2\tau \leq x_i < 3\tau} [u_i(X_{-i} + x_i) - x_i + 2r], \cdots, \max_{k\tau \leq x_i < (k+1)\tau} [u_i(X_{-i} + x_i) - x_i + kr], \cdots,$$
$$\max_{(m-1)\tau \leq x_i < m\tau} [u_i(X_{-i} + x_i) - x_i + (m-1)r], u_i(X_{-i} + m\tau) - m\tau + mr \Bigg\}. \quad (8)$$

Here M does not matter to solve the maximization problem. Note that maximization problems within the outer maximization in Eq.(8) are defined over right-open intervals, that is, $[0, \tau)$, $[\tau, 2\tau)$, $\cdots$, and $[(m-1)\tau, m\tau)$. In an open interval, an optimal solution may not be found. To get around this issue, consider the following problem:

$$\max \Bigg\{ \max_{0 \leq x_i \leq \tau} [u_i(X_{-i} + x_i) - x_i], \max_{\tau \leq x_i \leq 2\tau} [u_i(X_{-i} + x_i) - x_i + r],$$
$$\max_{2\tau \leq x_i \leq 3\tau} [u_i(X_{-i} + x_i) - x_i + 2r], \cdots, \max_{k\tau \leq x_i \leq (k+1)\tau} [u_i(X_{-i} + x_i) - x_i + kr], \cdots,$$
$$\max_{(m-1)\tau \leq x_i \leq m\tau} [u_i(X_{-i} + x_i) - x_i + (m-1)r], u_i(X_{-i} + m\tau) - m\tau + mr \Bigg\}, \quad (9)$$

which is identical to Eq.(8) except that inner maximization problems are defined over closed intervals, that is, $[0, \tau]$, $[\tau, 2\tau]$, $\cdots$, and $[(m-1)\tau, m\tau]$. Eq.(9) has an optimal solution for each closed interval and we can pick up a solution that maximizes the payoff among the solutions for all the intervals. Indeed, it can be shown that Eq.(8) and Eq.(9) are practically the same. Consider two consecutive inner maximization problems in Eq.(9), with the first and second problems defined over $[(k-1)\tau, k\tau]$ and $[k\tau, (k+1)\tau]$, respectively, for $k \in \{1, 2, \cdots, m\}$. Note that their ranges overlap at the kth threshold, where player i's payoff is $u_i(X_{-i} + k\tau) - k\tau + (k-1)l$ in the first problem and $u_i(X_{-i} + k\tau) - k\tau + kl$ in the second problem. Clearly, his payoff is larger in the second problem than in the first problem. Then, since Eq.(9) never attains its global maximum at any of the right endpoints of the inner maximization problems, excluding these endpoints does not affect the optimal solution. Therefore, Eq.(8) and Eq.(9) are practically the same and thus, an optimal solution exists in Eq.(8). Unlike in the proportional rebate scheme, however, it is difficult to derive the optimal solution.

Next, in group giving, player i faces a problem similar to Eq.(8). For given X_{-i}, he solves the following payoff maximization problem:

$$\max \Bigg\{ \max_{0 \le x_i + X_{-i} < n\tau} [u_i(X_{-i}+x_i) - x_i], \max_{n\tau \le x_i + X_{-i} < 2n\tau} [u_i(X_{-i}+x_i) - x_i + r'/n], \max_{2n\tau \le x_i + X_{-i} < 3n\tau} [u_i(X_{-i}+x_i) - x_i + 2r'/n], \cdots, \max_{kn\tau \le x_i + X_{-i} < (k+1)n\tau} [u_i(X_{-i}+x_i) - x_i + kr'/n], \cdots, \max_{(m-1)n\tau \le x_i + X_{-i} < mn\tau} [u_i(X_{-i}+x_i) - x_i + (m-1)r'/n], u_i(mn\tau) - (mn\tau - X_{-i}) + mr'/n \Bigg\}, \quad (10)$$

where n is the number of players and r' is a rebate rate per group per threshold. Assuming that a rebate is shared evenly among players in group giving, player i receives rebate $\frac{kr'}{n}$ for a total contribution of all players, $X_{-i} + x_i$, that satisfies $kn\tau \le X_{-i} + x_i < (k+1)n\tau$. As in individual giving, it can be shown that an optimal solution exists for Eq.(10). However, it is challenging again to actually derive the solution.

Although we cannot show optimal solutions in the stepwise rebate schemes, we can still derive some properties about player i's utility, $u_i(\cdot)$, from the mathematical models. First, in individual giving, suppose that $\epsilon > 0$ is a sufficiently small and his contribution x_i is in one of small intervals defined as $k\tau - \epsilon < x_i < k\tau$ for $k \in \{1, 2, \cdots, m\}$. Then we suppose, for x_i in such intervals, player i is better off increasing his contribution from the current level x_i to the close threshold, $k\tau$, and receiving a larger rebate. That is, $U_i(X_{-i}, x_i) = u_i(X_{-i}+x_i) + M - x_i + (k-1)r < U_i(X_{-i}, k\tau) = u_i(X_{-i}+k\tau) + M - k\tau + kr$, or equivalently, $k\tau - x_i - r < u_i(X_{-i}+k\tau) - u_i(X_{-i}+x_i)$. This means that the optimal solution, x_i^*, never falls in open intervals $(k\tau - \epsilon, k\tau)$. Given that $x_i^* = k\tau$ is the corner solution, this property is summarized as follows:

$$\text{There is } \epsilon > 0 \text{ such that, for any } x_i, x_i \in (k\tau - \epsilon, k\tau) \text{ for some } k, \quad k\tau - x_i - r < u_i(X_{-i}+k\tau) - u_i(X_{-i}+x_i) \quad (11)$$

Eq.(11) says that a small increment in contribution, $k\tau - x_i$, induces an increment in utility, $u_i(X_{-i}+k\tau) - u_i(X_{-i}+x_i)$, that is larger than the net increase in cost, $k\tau - x_i - r$, after receiving a rebate. In other words, there is a small interval near each threshold in which it is optimal to bump up contribution to the close threshold. This upward *jump* effect in contribution is consistent with our experimental results explained later. Thus we can assume that individual utility function satisfies this effect.

We can show a similar property in group giving. Suppose now that $\epsilon > 0$ is a sufficiently small and the total contribution of all players $X_{-i} + x_i$ is in one of small intervals defined as $kn\tau - \epsilon < X_{-i} + x_i < kn\tau$ for $k \in \{1, 2, \cdots, m\}$. Then, there is such $\epsilon > 0$ that for given X_{-i}, player i is better off bumping up his contribution just enough to reach the close threshold, $kn\tau$, and receiving a larger rebate. That is, $U_i(X_{-i}, x_i) = u_i(X_{-i}+x_i) - x_i + \frac{(k-1)r'}{n} < U_i(X_{-i}, kn\tau - X_{-i}) = u_i(kn\tau) - (kn\tau - X_{-i}) + \frac{kr'}{n}$, or equivalently, $kn\tau - X_{-i} - x_i - \frac{r'}{n} < u_i(kn\tau) - u_i(X_{-i}+x_i)$. Then, given that $x_i^* = kn\tau$ is the corner solution, this property is summarized as follows:

There is $\epsilon > 0$ such that, for any x_i and X_{-i}, $x_i + X_{-i} \in (kn\tau - \epsilon, kn\tau)$ for some k,

$$kn\tau - X_{-i} - x_i - r'/n < u_i(kn\tau) - u_i(X_{-i}+x_i) \tag{12}$$

Since $r'/n = r$ in our experiment and $kn\tau - X_{-i}$ is close to $k\tau$, Eq.(12) is very similar to Eq.(11). Therefore, these upward jump effects should be theoretically similar to each other. However, our experimental results show very different effects between individual and group giving. It seems that imputing $k\tau$ in individual giving is much easier than imputing $kn\tau - X_{-i}$ in group giving because this imputing requires that i should know X_{-i}.

In summary, the mathematical models provide the insight that proportional rebates may work better in individual giving than in group giving and that there may be upward jump effects in the stepwise rebate schemes. However, no insights are derived into the effectiveness of stepwise rebates or the difference in effectiveness between proportional and stepwise rebates. We turn to a laboratory experiment to examine these points.

3. Experimental Design

In order to examine the effectiveness of group giving, we conducted a laboratory experiment and compared group and individual giving in no rebate, proportional rebate, and stepwise rebate schemes. Since group giving with no

Table 1: Treatments

Treatment	Conditions: Rebate Scheme	Conditions: Giving Type	Number of Sessions	Total Number of Subjects
1	No rebate	Individual	3	30
N/A	No rebate	Group	N/A	N/A
2	Proportional	Individual	5	50
3	Proportional	Group	6	60
4	Stepwise	Individual	6	60
5	Stepwise	Group	6	60

Note: This table summarizes the different treatments tested in our laboratory experiment. Each session consisted of 10 subjects. At the beginning of the experiment, subjects were randomly assigned to one of the sessions.

rebate in our experiment design is essentially equivalent to individual giving with no rebate, we tested total five treatments shown in Table 1.

Each session consisted of 10 identical allocation decision problems under one of the five treatments. In Treatment 1, a subject received an endowment of 100 points and was required to split the points between a charity and himself in each period. We call the former *personal points* and the latter, *social points*, hereafter. In each period, a subject's cumulative personal and social points, as well as the cumulative group social points (i.e., the social points accumulated by all group members), were shown to him before and after making a decision. After 10 periods, a subject's payoff and donation to a charity were calculated from his total personal and social points, respectively, with a conversion rate of 100 points = 100 Japanese yen (JPY, around 0.93 USD). Treatment 1 served as the baseline. In Treatments 2-5, a subject also received rebate opportunities: in Treatment 2, a subject received a rebate equivalent to 10% of his social points; in Treatment 3, a subject received a rebate equivalent to 1% of group social points; in Treatment 4, a subject received 10 rebate points for every his 100 social points; and in Treatment 5, a subject received 10 rebate points for every 1,000 group social points[2]. These

[2]We choose these rebate rates so that the magnitudes of rebates are the same in Treatments 2-5 as much as possible, assuming a homogenous group of subjects in group giving. For example, suppose that a subject's social points are 100 points. Then, he receives the following rebates: $100 \times 10\% = 10$ points in Treatment 2; 100×10 subjects $\times 1\% = 10$ points in Treatment 3; 10 points for his 100 social points in Treatment 4; and 10 points

rebate points were added to individual personal points. Note that the rebate rates for the stepwise rebate schemes are chosen so that the proportional and stepwise rebate schemes have the same rebates at thresholds. However, if social points fall between two thresholds, a subject receives a smaller rebate in the stepwise rebate schemes (Treatments 4 and 5) than in the proportional rebate schemes (Treatments 2 and 3). Therefore, strictly speaking, a subject receives a slightly smaller rebate, on average, in the stepwise rebate scheme. Although this is a limitation, we rather stay with these simple rebate rates so that subjects can easily calculate rebates during the experiment.

The data were obtained from the laboratory experiments conducted at Waseda University, Japan, from December 2014 to May 2015. The subject population was composed of 260 undergraduate students from various majors. All subjects were recruited in an identical manner by an advertizement posted on the university website, with a promise of compensation contingent on performance for participation in a forty-minute computer-controlled experiment. The general experiment design followed standard procedure. Communication between subjects, cell phone use, and note taking were strictly prohibited. Instructions were read aloud with copies on all desks, and questions were answered. Specifically, a subject was told that although the actual payment would take place after the experiment, he would receive 1,000 JPY and use the money to make a donation to the Japanese Red Cross Society during the experiment. Then, a subject completed 10 identical allocation decision problems explained above. A subject also completed a questionnaire containing demographic and background questions. After the session, a subject wrote a receipt for getting 1,000 JPY. An experimenter calculated a subject's earning and donation, handed him a receipt for his donation and a cash payment equivalent to 1,000 JPY+(rebate)-(donation), and recorded his name if he chose to receive acknowledgment for donation. Later the donations were totaled and sent to the Japanese Red Cross Society with the information of those subjects who chose to receive acknowledgement.

4. Results

Our experiment reveals contrasting results regarding the effectiveness of group giving in different rebate schemes. Subjects' allocation decisions to

for 10×10 subjects = 1000 group social points in Treatment 5.

Table 2: Total Social Points Per Subject

	Mean	Ratio to Treatment 1
Treatment 1: No rebate, individual	59 points	–
Treatment 2: Proportional, individual	204 points	3.5
Treatment 3: Proportional, group	140 points	2.4
Treatment 4: Stepwise, individual	104 points	1.8
Treatment 5: Stepwise, group	178 points	3.0

Note: This table shows the mean social points per subject per 10 periods in each treatment. The maximum possible value is 1,000 points.

social points are illustrated in Figure 2 and summarized in Table 2. On the whole, social points are high when rebates are offered (Treatments 2-5), as compared with no rebates (Treatment 1). In the proportional rebate schemes, our experimental results confirm the diminished rebate effect in group giving relative to individual giving, or a *negative* group effect, shown in the mathematical models in Subsection 2.3. In contrast, our experimental results find a *positive* group effect in the stepwise rebate schemes, where no mathematical solutions are perviously derived. That is, the rebate effect is larger in group giving than in individual giving in the stepwise rebate schemes. Moreover, this positive group effect in the stepwise rebate scheme seems to be strong. As mentioned in Section 3, rebate rates are set slightly lower in the stepwise rebate schemes than in the proportional rebate schemes. Nonetheless, a subject in group giving contributes more in the stepwise rebate scheme (Treatment 5) than in the proportional rebate scheme (Treatment 3). In the following subsections, we first examine the statistical significance of the effect of each rebate scheme and then explore possible causes to explain the contrasting group effects in the proportional and stepwise rebate schemes.

4.1. Rebate Effects

When rebates are offered, social points are 1.8 to 3.5 times as high as when no rebates are offered (Table 2). In order to examine whether these rebate effects are statistically significant, we estimate the treatment effects by an ordinary least squared (OLS) regression:

$$Y_{i,t} = \alpha EXP2_{i,t} + \beta EXP3_{i,t} + \gamma EXP4_{i,t} + \delta EXP5_{i,t} + \epsilon_{i,t}, \qquad (13)$$

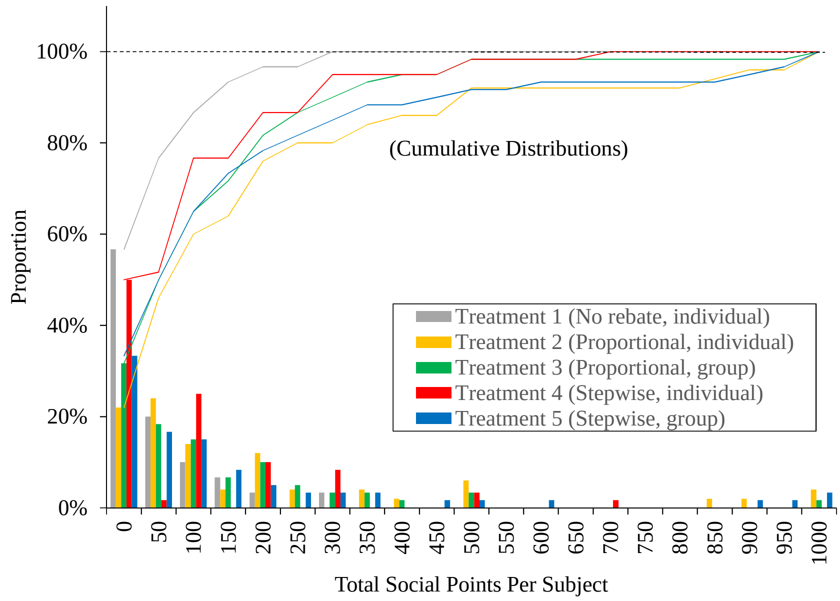

Figure 2: Distributions of Individual Social Points

where $Y_{i,t}$ is the social points of subject i in period t; $EXP2_{i,t}$, $EXP3_{i,t}$, $EXP4_{i,t}$, and $EXP5_{i,t}$ equal to one if subject i is in Treatments 2, 3, 4, and 5, respectively; and $\epsilon_{i,t}$ is an error term. The regression result is provided in Column (1) of Table 3. One thing to note is that the presence of outliers can bias the result of the OLS regression. The distributions of individual social points in Figure 2 show that some subjects in Treatments 2-5 allocated all or almost all of their points to social points, indicating the presence of potential outliers. Therefore, we use the Grubbs' test for detecting outliers. The test finds that indeed there are some outliers in Treatments 2-5[3]. To obtain better estimates, we use a least absolute deviation (LAD) regression. The LAD regression method attempts to dampen the influence of outlying cases in order to provide a better fit to the majority of the data. The result of the LAD regression is provided in Column (2) of Table 3.

Overall, the result confirms the effectiveness of rebates in increasing so-

[3]The Grubbs' test indicates the following outliers: 529, 890, 910, 1000, and 1000 in Treatment 2; 1000 in Treatment 3; 700 in Treatment 4; and 600, 900, 999, 1000, and 1000 in Treatment 5.

Table 3: Rebate Effects on Social Points

Regressor	(1) OLS	(2) LAD
Treatment 2 (Proportional, individual)	144.69**	14.86**
	(1.821)	(0.480)
Treatment 3 (Proportional, group)	81.38**	10.72**
	(1.763)	(0.466)
Treatment 4 (Stepwise, individual)	45.02**	-6.15
	(1.763)	(0.466)
Treatment 5 (Stepwise, group)	119.25**	10.92**
	(1.763)	(0.466)
Constant	115.98**	41.01**
	(2.056)	(0.542)
Observations	2,600	2,600

Note: The table summarizes the estimation results for the effect of rebates on social point allocation. The dependent variable is a subject's social points in each period. Standard errors in parentheses are clustered at the individual level to adjust for serial correlation. Individual coefficients are statistically significant at the **5% level or *10% level.

cial points. The social points in all but the individual stepwise rebate scheme (Treatment 4) are statistically higher than the social points in the no-rebate scheme (Treatment 1). Moreover, it is confirmed that the positive and negative group effects found in Table 2 are also statistically significant. In the proportional rebate schemes, social points are statistically lower in group giving (Treatment 3) than in individual giving (Treatment 2). In contrast, in the stepwise rebate schemes, social points are statistically higher in group giving (Treatment 5) than in individual giving (Treatment 4).

4.2. Jump Effects

In this subsection, we examine how thresholds affect a subject's allocation decision to social points in the stepwise rebate schemes. Figure 3 shows the cumulative distributions of subjects' social points in 10 periods in Treatments 4 and 5. As discussed in Subsection 2.3, the mathematical models show upward jump effects in both individual (Eq.(11)) and group (Eq.(12)) giving. However, a jump effect is observed only in individual giving (Treatment 4) in Figure 3. In Treatment 5, social points relatively evenly spread. Perhaps, a subject in group giving may not be able to impute others' contributions accurately and choose his contribution that is just sufficient to reach a threshold. In contrast, the graph for Treatment 4 suddenly increases, or jumps upward, just before thresholds. Moreover, notice that the graph is fairly flat after crossing each threshold. This indicates that there may be not only upward but also *downward* jumps. That is, if a subject's social points originally fall between two thresholds, he seems to adjust his social points to a higher threshold (upward jump) or a lower threshold (downward jump). These upward and downward jump effects offset with each other, which may be partly responsible for the insignificant rebate effect in Treatment 4 in the LAD regression in Table 3.

Compared to Treatments 3 and 4 in Table 3, a rebate effect in Treatment 5 seems to be strong. Since a jump effect is not significant in Treatment 5, there must be other factors that especially effective in the group stepwise rebate scheme. In the next subsection, we explore this point.

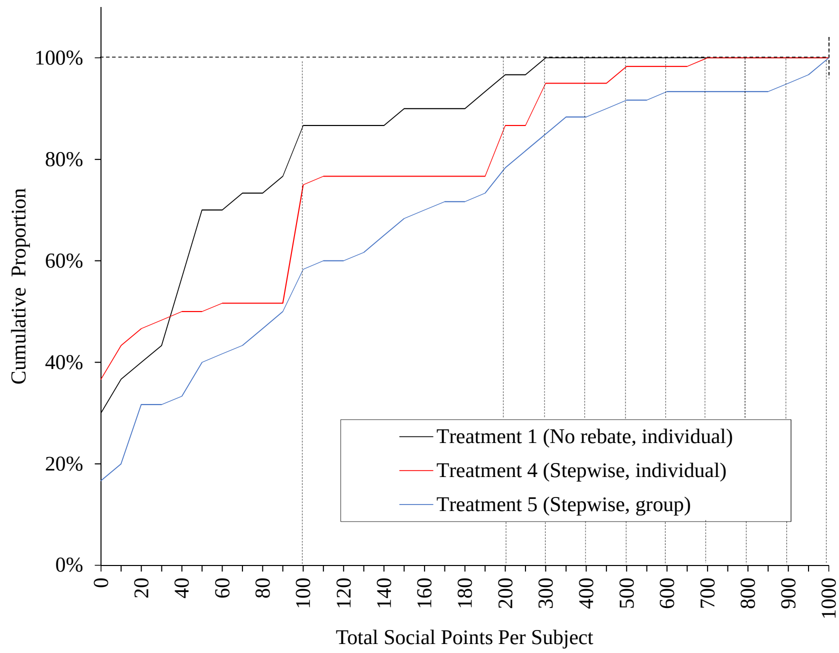

Figure 3: Cumulative Distributions of Individual Social Points in the Stepwise Rebate Schemes

Note: This figure compares social point distributions in Treatments 4 and 5. In Treatment 4, many subjects match their contribution with thresholds, whereas no such effect is found in Treatment 5.

4.3. Effects of Relative Contribution

Now we explore possible causes behind the positive and negative group effects mentioned in Subsection 4.1. In each period, a subject was shown cumulative group social points before and after making an allocation decision. This means that a subject could estimate his relative contribution toward group social points when making a decision. Knowing such relative contribution may affect a subject's decision. For example, a subject may reduce his social points if he feels unfairness when he contributes more than the others do, and vice versa. Then, in order to capture a subject's relative contribution toward group social points, we construct a variable, $Contribution_{i,t-1} = \frac{C_{i,t-1}}{1/9\sum_{j\neq i} C_{j,t-1}}$, where $C_{i,t-1}$ is subject i's cumulative social points in period $t-1$. The interpretation is that when $Contribution_{i,t-1} > 1(< 1)$, subject i had contributed to group social points more (less) than the average of the others up until period $t-1$. The regression result in Table 4 shows how the variable affects a subject's social point allocation in period t. It is found that the variable has a *positive* impact in both Treatments 3 and 5. That is, when a subject's relative contribution in the previous period increases, he allocates more social points in the current period. Moreover, this effect is much larger in Treatment 5 than in Treatment 3. We may interpret this strong positive effect in Treatment 5 as follows: if a subject is eager to cross a threshold, he is likely to have contributed a lot up until now; and if the others have not contributed very much, he needs to contribute more in the current period in order to get closer to the threshold. If this is the case, the impact of $Contribution_{i,t-1}$ can be even larger when a threshold is about to be crossed. In other words, if a threshold is within the reach, a subject who has contributed a lot is likely to contribute even more to make sure that the threshold is crossed in the current period. In order to examine this, we include an interaction term between $Contribution_{i,t-1}$ and $Threshold$, where $Threshold$ equals one if a threshold is crossed in period t, in the regression for Treatment 5 in Table 4. The interaction term indeed has a positive impact on social points. Although the design of rewards is different, Lacetera and Macis (2010) find a similar threshold effect in a blood donation rewards program.

The contrasting group effects between the proportional and stepwise rebate schemes may be partly explained by the the regression results in Table 4. In Treatment 3, the impact of $Contribution_{i,t-1}$ on social points is positive but small. That is, a subject is not likely to increase contribution

Table 4: Rebate Effects on Social Points

	Treatment 3 (Proportional, Group)		Treatment 5 (Stepwise, Group)	
Regressor	OLS	LAD	OLS	LAD
Contribution	1.41**	3.51**	70.79**	76.85**
	(0.041)	(0.020)	(0.274)	(0.090)
*Contribution*Threshold*	–	–	40.17**	55.52**
			(0.817)	(0.256)
Constant	101.47**	70.65**	36.70**	39.92**
	(3.716)	(1.326)	(2.996)	(0.986)
Observations	600	600	600	600

Note: The table summarizes the estimation results for the effect of a subject's relative contribution toward group social points on his allocation decision in group giving. The dependent variable is a subject's social points in each period. Standard errors in parentheses are clustered at the individual level to adjust for serial correlation. Individual coefficients are statistically significant at the **5% level or *10% level.

significantly when others do not contributed much. In the group proportional rebate scheme, a subject can always receive a rebate in proportion to group social points. Therefore, he may be tempted to ride free on others' contribution efforts as often observed in a public goods game. This may partly explain the negative group effect in the proportional rebate scheme. On the other hand, the impact of $Contribution_{i,t-1}$ on social points is large in the group stepwise rebate scheme. A subject cannot receive a rebate if group social points are even one point lower than a threshold in the end. Therefore, major contributors tend to contribute more to avoid wasting their contribution. Moreover, this tendency is amplified near thresholds, shown by the interaction term $Contribution * Threshold$. These combined effect of thresholds may be one of the courses behind the strong positive group effect in the stepwise rebate scheme.

5. Conclusion

Given the potential and growing popularity of group giving and the lack of corresponding academic research, we tested the effectiveness of group giving in the proportional and stepwise rebate schemes in a laboratory experiment. Our results show that a stepwise rebate scheme may especially work well to motivate donation in group giving. This result may provide useful information to charitable organizations. As Gneez and List (2013) point out, charitable organizations tend to be stuck in their conventional, often not the most efficient, fundraising methods. Indeed, subsidization for group giving seems not to have been used yet in practice. However, with recent technological advancements, building a new fundraising framework has become easier. For example, given that most top charities and non-profit organizations already use social media to connect with donors (Advanced Marketing Research Class, 2014), they may ask for donation from a group of donors on social media and use a group rebate subsidization to promote donation. Cloud-funding is another new tool to raise money online and is expected to be effective for charitable organizations (Thorpe, 2013). Incorporating a group rebate subsidization into a cloud-funding framework is another possible application of our results.

It may not be intuitive, but an energy saving program can be also a potential application of our results. Energy saving is similar to charitable giving in the sense that one gives up the utility that he should originally enjoy (e.g., keeping a comfortable room temperature) in order to achieve the public benefit (i.e., conserving natural resources). An energy company calls for energy saving efforts from its customers in order to reduce peak demand because if peak demand constantly exceeds the maximum supply level, the company has to acquire additional, usually very expensive, energy sources. In other words, if customers, as a group, can reduce peak demand to a certain level or lower (i.e., a threshold), the company can avoid large investments. Then, a part of the saved money can be returned to costumers as rebates. Therefore, our stepwise rebate scheme seems to fit well to energy saving programs. Current energy saving reward programs are normally designed for individuals. Given our results, however, a bigger energy saving may be achieved if a reward program incorporates a group rebate subsidization scheme.

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