Charitable Giving, Inequality and Taxes *

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Abstract

The impact of redistributive policies on charitable contributions is still not entirely understood. While a higher level of redistributive taxation decreases the price of voluntary giving, it also decreases the after-tax income of the wealthy agents. The aim of this paper is to examine the relationship between the level of charitable giving and the level of redistribution. This paper provides a controlled laboratory experiment that distinguishes the impact of pre-tax income inequality and the tax rate on voluntary giving. The experimental findings show that while the participants decrease their voluntary contributions as the pre-tax income distribution becomes more equal, they increase their contributions with taxation. These findings have important implications for government policies regarding charitable organizations.

Keywords: Charitable Giving, Public Goods, Voluntary Contributions, Efficient Private Provision, Laboratory Experiment

JEL Classification: C72, C92, D30, H41

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1 Introduction

In the United States, voluntary contributions constitute one of the major sources of revenue for many charities. The Giving USA Foundation estimates that voluntary contributions reached almost $300 billion in 2006. This paper asks,"how much do economic factors such as the degree of income redistribution influence individuals when they decide on their contributions?" In particular, the paper examines the relationship between redistributive taxation and voluntary giving through a controlled laboratory experiment. In addition, the experimental design allows us to isolate the impacts of both taxation and pre-tax income inequality on charitable contributions.

Taxation affects charitable giving in two ways: through its effect on the after-tax net income and through its effect on the price of giving. To investigate the net impact of taxation on charitable contributions, earlier empirical studies use cross-sectional data, and estimate price elasticity to be greater than one in absolute value while income elasticity is estimated to be less than one (Clotfelter, 1985, 1990). This implies that a tax cut leads to a decrease in charitable giving. However, Randolph (1995) argues that charitable giving is relatively insensitive to changes in its price. Utilizing a panel data, he finds that permanent changes in the price of giving have a small effect on voluntary contributions. In contrast, Auten *et al.* (2002) use a different estimation technique and find a substantial permanent price elasticity. Since it is difficult to make strong inferences using the naturally occurring data, the net effect of a tax change on contributions is still not clearly understood (Peloza and Steel (2005), Andreoni (2006), Vesterlund (2006)).

A theoretical foundation on the impact of taxation on tax-deductible charitable giving has been provided by Uler (2008). Uler considers redistributive taxation that depends on income net of contributions to the public good: the government collects a flat-rate tax (γ) on income net of contributions, and then redistributes the tax revenue equally. Uler argues that the price of charitable giving decreases with the degree of redistribution, and this has a positive effect on the total amount of giving (substitution effect). However, redistribution leads to lower consumption for the contributors and therefore has a negative effect on contributions

to charity (income effect). The theoretical model developed in that paper demonstrates that, under a general class of utility functions, the substitution effect dominates the income effect. Hence, charitable giving increases with the tax rate.

The findings of Uler suggest that the impact of ex-post income equality (taxation) on charitable contributions is different from the impact of ex-ante (pre-tax) income equality. In addition, in a joint production context, Ray and Ueda (1996) show that production increases with the degree of egalitarianism embodied in the social welfare function. In his seminal work, Olson (1965) makes an argument in favor of ex-ante income inequality, suggesting that higher levels of public goods will be achieved with higher levels of inequality. While Warr (1983) shows that the wealth distribution among the set of contributors does not matter for the amount of public good provision, Bergstrom, Blume and Varian (1986) demonstrate that increasing inequality by transferring income from a non-contributor to a contributor increases public good provision. Itaya *et al.* (1997) argue that creating a wealthy individual (a sole provider of the public good) by increasing income inequality can also raise welfare.[1]

This paper asks whether charitable giving can be raised with redistributive taxation in accordance with the theoretical predictions.[2] In particular, I expect that while pre-tax equality has a negative impact on the charity contributions, charitable contributions strictly increase with taxation. This paper provides an experimental analysis of these theoretical predictions. Throughout the paper I assume that agents do not have utility from own contributions. Although warm-glow may play a role in individuals' contribution decisions (as Andreoni (1989, 1990) demonstrates), I disregard that here in order to focus on the effects of redistribution.[3]

In the experiment, redistribution is enforced in the following way: each individual receives a transfer if her *net income* (income net of contributions) is lower than the average net income of all the group members and makes a transfer if her net income is higher than the average net income of all the group members. The experimental design varies two dimensions. The

[1] In addition, if inequality is not too high, increasing income inequality can bring Pareto improvements (Cornes and Sandler, 2000; Olszewski and Rosenthal, 2003).

[2] In this paper, the theoretical predictions rely on Bergstrom *et al.* (1986) and Uler (2008).

[3] In fact, later in the paper we will see that experimental data is not consistent with warm-glow motives.

first one is the initial wealth distribution. In the "equal treatment" each subject has the same initial income, whereas in the "unequal treatment" they receive different amounts. By comparing the contributions under equal and unequal treatments one can see the impact of the initial wealth distribution on the level of public goods provision. In addition, the level of redistribution varies from "no sharing" to "moderate sharing" and then finally to "high sharing." The high sharing treatment tests whether contributions can be raised close to the efficient levels. The moderate sharing treatment tests whether subjects are sensitive to the level of redistribution.

I find that the experimental data supports the theoretical predictions. The main findings of the experiment can be summarized as follows. Ex-ante (pre-tax) income equality has a *negative* impact on both the contributions and the payoffs of the subjects. In contrast, I find a *positive* relationship between the contributions and the tax rate under a heterogeneous wealth distribution as well as a homogeneous wealth distribution. Voluntary giving increases sharply as soon as taxes are introduced, and declines sharply as soon as taxes are removed. Even at a quantitative level, contributions move towards to the theoretical predictions in later rounds of the experiment. Indeed, by the last period individual contributions are quite consistent with the predicted levels.

A paper that is closely related to this one is Falkinger, Fehr, Gachter and Winter-Ebmer (2000). Falkinger *et al.* test the tax-subsidy mechanism that is proposed by Falkinger (1996), which introduces a mechanism to efficiently provide public goods.[4] The following incentive scheme is proposed: each individual receives a subsidy if her contribution is greater than the mean contribution and pays a tax if her contribution is lower than the mean contribution. The mean contribution is defined as either the average contribution of the whole population or the average contribution of the income class to which the individual belongs. Falkinger *et al.* conduct a series of experiments with *homogeneously* endowed subjects, and show that this mechanism generates intended outcomes very successfully. They find that implementing the mechanism shifts contributions immediately toward an efficient level of provision. Note that this tax-subsidy mechanism uses a non-standard taxation scheme; it either does not

[4]For a detailed survey on incentive-compatible mechanisms for pure public goods, see Chen (2004).

generate transfers between different income classes (if the tax-subsidy is within the income class to which the individual belongs), or if it does then the transfers are generally from poorer income classes to higher income classes. Instead, this paper examines redistributive taxation that depends on income net of contributions to the public good: a flat-rate tax (γ) on net income is collected, and then the tax revenue is redistributed equally.[5]

In summary, I show that tax policies have an impact on (tax-deductible) charitable giving. The results of the experiment support the theoretical findings of Uler (2008) and suggest that (tax-deductible) charitable giving is increasing in the degree of tax rate. Hence, redistributive policies that impose tax-cuts may have detrimental effects on voluntary giving.[6]

The rest of the paper is organized as follows. Section 2 summarizes the related literature. Section 3 introduces the experimental design and Section 4 reports the findings. Section 5 concludes.

2 Related Experimental Literature

The main aim of this paper is to see whether redistributive taxation increases charitable contributions, since this has never been tested before.[7] In addition, I provide a comparison between the impact of ex-ante and ex-post inequality on voluntary giving. In this section, I first report the experimental studies that investigate the effect of price and income on giving behavior. Next, I briefly discuss the experimental literature on the relationship between public goods provision and ex-ante inequality.

Andreoni and Vesterlund (2001) and Andreoni and Miller (2002) investigate contribution decisions in a modified dictator game where both the initial allocation and the price of giving are varied. They derive demand curves of individuals for altruism. Andreoni and Vesterlund

[5]With a homogenous wealth distribution, the transfer mechanism introduced in this paper is mathematically equivalent to this tax-subsidy mechanism. However, given a heterogeneous wealth distribution these mechanisms work differently.

[6]In this paper, I do not consider the impact of tax rate on effort choice. See Uler (2008) for a discussion on when tax-cuts may have a positive effect on charitable giving.

[7]It is not possible to see the impact of redistributive taxation on charitable giving by using Falkinger's mechanism.

focus on the gender differences in altruism and show that men are more price sensitive. Andreoni and Miller show that the preferences for altruism can be explained by rational models. Eckel and Grossman (2003) conduct an experiment where a dictator decides how much to contribute to a real charity. They found that subjects are sensitive to how a subsidy is framed, i.e., a matching grant raises more funding compared to a tax subsidy. They also show that contributions increase in income and decrease in price. Karlan and List (2007) look at the effect of price changes on charitable contributions by conducting a natural field experiment. They found that offering to match contributions increases the revenue and the probability that an individual contributes. But, larger match ratios ($3:$1 and $2:$1) compared to smaller match ratios had no additional impact. Note that I study the impact of redistributive taxation on voluntary giving. In other words, I examine the net impact of price and income changes on contributions.

There is a large literature on the impact of ex-ante inequality on public goods provision. Buckley and Croson (2006) provides an excellent summary of studies on inequality and voluntary giving. Among these papers two of them are very related to this paper. The theoretical model of Bergstrom, Blume and Varian (1986) is tested in a laboratory experiment by Chan *et al.* (1996). Chan *et al.* find that the model predicts the direction of the change in the contributions relatively well, i.e., total contributions to the public good increase with the degree of ex-ante inequality. However, the model fails to predict the magnitude of individual contributions when the inequality level is high. Chan *et al.* (1999) examine the effects of income inequality on the provision of public goods with incomplete information and communication. They show that voluntary giving is higher under income inequality. Both of these papers consider a non-linear public good, as in this paper. On the other hand, in a linear public goods game, Isaac and Walker (1988) and Anderson et al. (2004) find that public good provision decreases with asymmetric incomes. Anderson et al. (2004) provide inequality by imposing different show-up fees among subjects. In threshold public goods setting, Rapoport and Suleiman (1993) find that heterogeneously endowed groups provided less than homogeneously endowed groups. Buckley and Croson (2006) show that inequality

aversion models do not predict behavior well in a laboratory experiment: individuals with low incomes contribute a higher percentage of their income to the public good than individuals with high income, hence exacerbating the income inequalities.

3 Experimental Design

The experiments took place at the Center for Experimental Social Science (C.E.S.S.) at New York University in April and September 2006. There were a total of 188 participants. The experiment lasted for approximately 1.5 hours. On average subjects earned $25 including a $5 show-up fee. Subjects earned laboratory currency (tokens) which is then converted into cash at the end of the session (1 token = 0.25 US Cents). After reading the instructions, subjects answered practice questions in order to make sure the instructions were clear, and they were able to compute their earnings.[8]

Based on Uler (2008), there is one private good and one public good. The public good is provided through voluntary contributions. Each subject i has an exogenous endowment, w_i, and decides how much to contribute to the public good, g_i. The level of public good provision is equal to the total giving, $G = \sum_{i=1}^{n} g_i$, where n is the total number of agents. Let $g_{-i} = (g_1, ..., g_{i-1}, g_{i+1}, ..., g_n)$ denotes the vector of contributions by all individuals except i.

The experimenter collects a flat-rate tax, γ, on income net of contributions, and then redistributes the tax revenue equally. Hence private income of each subject i, y_i, is equal to

$$y_i = (1-\gamma)(w_i - g_i) + \frac{\gamma \sum_{j=1}^{n}(w_j - g_j)}{n}.$$

Equivalently, each subject makes or receives a transfer depending on their income level net of their voluntary contributions. More formally, the transfer that they will receive or make is determined by

$$t(w_{i,}g_i, g_{-i}) = \gamma[(w_i - g_i) - \frac{1}{n}\sum_{j=1}^{n}(w_j - g_j)] \quad (1)$$

[8] A summary of the instructions were read aloud to all subjects in order to create common knowledge of the mechanism.

with $0 \leq \gamma \leq 1$ determining the degree of redistribution. For example, $\gamma = 1$ enforces perfect ex-post equality across agents. As γ decreases, the amount of redistribution decreases (i.e., there are no transfers when $\gamma = 0$). The budget constraint for individual i is:

$$y_i + g_i + t(w_{i,}g_i, g_{-i}) = w_i$$

An important observation is $\sum_{i=1}^{n} t(w_{i,}g_i, g_{-i}) = 0$. Agents with net income higher than the average net income make a transfer, while agents with net income lower than the average net income receive a transfer. In other words, the budget is balanced.

The experimental design is based on the public goods experiment of Falkinger *et al.* (2000). As in that experiment, subjects were randomly matched into groups of 4 in the first period and stayed in the same group throughout the experiment, which allows us to collect independent observations. Each subject received a fixed amount of income, w_i, in the beginning of each period and knew the income distribution. A key feature of the design is that it allows for non-trivial income distributions.

Subjects were told that their payoffs each period is the sum of their earnings from the group project and the private project.[9] Their income from the group project is simply the sum of contributions of all members in their group to the group project:

$$\text{Income from Group Project} = v(G) = \sum_{i=1}^{4} g_i$$

Their income from the private project is calculated according to the following formula,

$$\text{Income from Private Project} = u(y_i) = 5y_i - 0.05y_i^2$$

where $y_i = w_i - g_i - t(w_{i,}g_i, g_{-i})$ is the contributions to the private project (endowment net of contributions and transfer).[10] Subjects were provided with a payoff table that lists the

[9] In the experiment, a neutral framing is used.

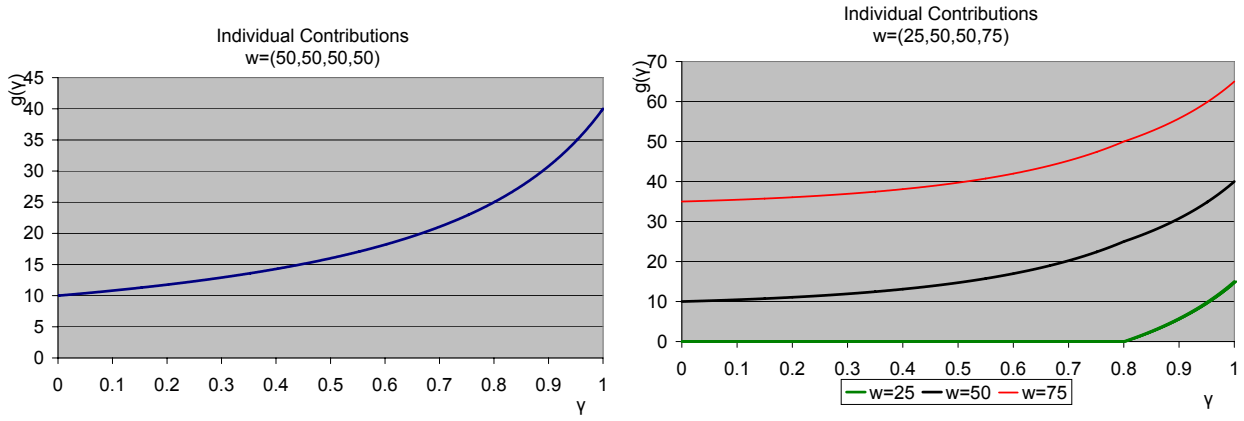
[10] Note that, under this payoff function, it is also possible to get a negative relationship between the tax rate and total contributions when initial income distribution is very unequal. Although it might be interesting to see whether total contributions decrease with taxation under extreme initial inequality, in this paper I focus

private income level corresponding to each level of private contribution.

In the experiment, I vary both the initial income distribution and the level of tax. I impose two different initial income distributions: Equal (W1) and Unequal (W2). In the "Equal Treatment" all members of the group get 50 tokens. In the "Unequal Treatment" one subject gets 25 tokens, two subjects get 50 tokens and one subject gets 75 tokens. Hence, for all groups the total income is fixed at 200 tokens.

There are three different levels of redistribution. In the "Control Treatment (C)," there is no redistribution; whereas in the "Sharing Treatments (T1 and T2)," the tax rate is positive. In the experiment, subjects go through both control and sharing treatments, which are 20 periods each. However, only after the first treatment is over, do they know what will happen in the second part of the experiment. The advantage of the *within-subject design* is to control for individual characteristics. The disadvantage of within-subject design is that the order of treatments may affect the results.[11] In order to control for this possibility, the order of the treatments are reversed in every other session. In addition, the experimental design also allows us to make a *between-subject comparison* in order to test if subjects are sensitive to the redistribution parameter.

Figure 1: Theoretical predictions under equal and unequal income



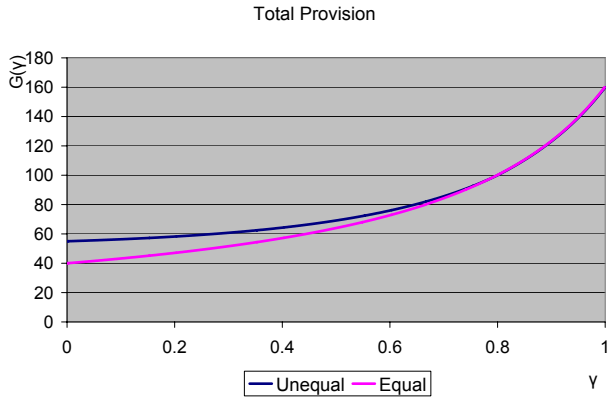
Assuming individuals are payoff-maximizers, the theoretical predictions are demonstrated

on the general cases where tax rate increases contributions, and leave that for future research.

[11]Nalbantian and Schotter (1997) demonstrate that previous history affects group performance.

in Figure 1 and Figure 2.[12] Figure 1 shows the individual contributions at the equal and unequal treatments. We see that transfers affect the equilibrium contributions positively. Figure 2 shows the total provision under both equal and unequal treatments. Equality of the initial income distribution negatively affects equilibrium contributions. For any value of γ, total provision is larger under the unequal treatment than under the equal treatment.

Figure 2: Total provision



I set $\gamma = 0$ in the control treatment, $\gamma = 0.7$ in the T1 treatment, and $\gamma = 0.9$ in the T2 treatment.[13] It can be seen in Figure 1 that at these values equilibrium predictions are quite different from each other. Note that $\gamma = 1$ creates perfect equality. I pick $\gamma = 0.9$ on purpose since when $\gamma = 1$, there will be a continuum of equilibria and consequently problems of equilibrium selection.

Table 1 summarizes the experimental design. I conducted 2 sessions with equal income distribution where γ was changed from 0 to 0.9 (W1CT2) and 2 sessions where γ was changed from 0.9 to 0 (W1T2C). There were 2 sessions with unequal income distribution where γ was changed from 0 to 0.9 (W2CT2) and 2 sessions where the order of treatments was reversed (W2T2C). Similarly, there were 2 sessions with unequal income distribution where γ was changed from 0 to 0.7 (W2CT1) and 2 more sessions where the order of the treatments was

[12] One may argue that the model does not capture preferences of inequality aversion. If individuals are inequality averse, then theoretical predictions will change. However, our data is not consistent with inequality aversion preferences as well (also see Buckley and Croson (2006)). See Derin and Uler (2007) for an empirical study on this issue.

[13] A slightly different wording is used in the experiment. See Appendix for details.

reversed (W2T1C). Note that in total there were 8 groups in every within-subject treatment except W2CT1, where there were 7 groups.

Table 1: Experimental Design

Within-Subject Treatments	Wealth Distribution	γ	Number of Sessions	Groups	Group Size
W1CT2	(50,50,50,50)	0 and 0.9	2	1-8	4
W1T2C	(50,50,50,50)	0.9 and 0	2	9-16	4
W2CT2	(25,50,50,75)	0 and 0.9	2	17-24	4
W2T2C	(25,50,50,75)	0.9 and 0	2	25-32	4
W2CT1	(25,50,50,75)	0 and 0.7	2	33-39	4
W2T1C	(25,50,50,75)	0.7 and 0	2	40-47	4

Table 2 shows the theoretical predictions. Note that the efficient amount of public good provision is 160, and $\gamma = 0.9$ tests if contributions can be raised close to the efficient level. In addition, $\gamma = 0.7$ tests whether the tax rate matters. Another important role of $\gamma = 0.7$ is to see how individuals behave when theory predicts that their after-tax income is not equal, and therefore there is redistribution. Under the unequal income distribution and $\gamma = 0.7$, contributors have higher net incomes in the equilibrium.[14] Consequently, theory predicts that there are income transfers in the equilibrium. Note that, in the equal treatment, equilibrium contributions increase due to the threat of redistribution. There is no redistribution when there is no income heterogeneity. Therefore, I do not conduct an experiment where agents are homogeneously endowed and $\gamma = 0.7$.

The main hypotheses are the following:

Hypothesis 1. Public good provision strictly increases with redistribution (γ).

Hypothesis 2. Each income class increases their contributions with redistribution (γ).[15]

Hypothesis 3. Total contributions increase with initial income inequality for $\gamma = 0$, and do not change for $\gamma = 0.9$.

[14]Note that contributors enjoy the same net income (see Bergstrom et al. (1986), Uler (2008)).
[15]This holds weakly for the low income class and strictly for the others.

Table 2: Theoretical Predictions

Wealth Distribution	γ	Individual Contributions	Total Contribution	Individual Payoff	Total Payoff
(50,50,50,50)	0	(10,10,10,10)	40	(160,160,160,160)	640
(50,50,50,50)	0.9	(33,33,33,33)	132	(203,203,203,203)	810
(25,50,50,75)	0	(0,10,10,35)	55	(149,175,175,175)	674
(25,50,50,75)	0.7	(0,19,19,44)	82	(183,187,187,187)	744
(25,50,50,75)	0.9	(8,33,33,58)	132	(203,203,203,203)	810

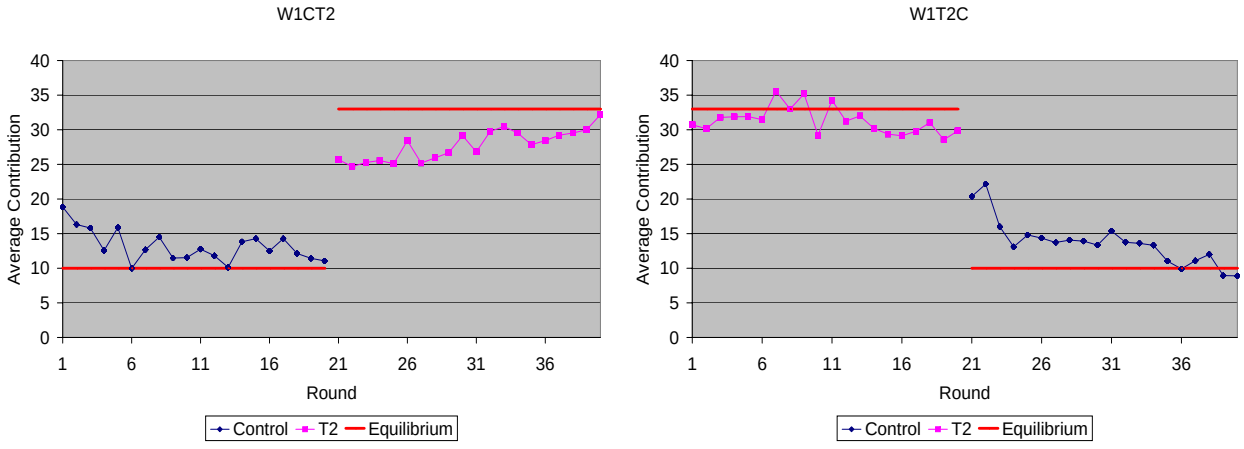
The experimental data and findings are presented in the next section.

4 Results

4.1 Data

Figure 3 shows the average contributions in the treatments W1CT2 and W1T2C. 32 subjects (in groups 1-8) played the control treatment first and then the sharing treatment ($\gamma = 0.9$), illustrated in Figure 3 (left-hand side). The order of the treatments was reversed for the other 32 participants (groups 9-16), which is illustrated on the right hand-side of Figure 3.

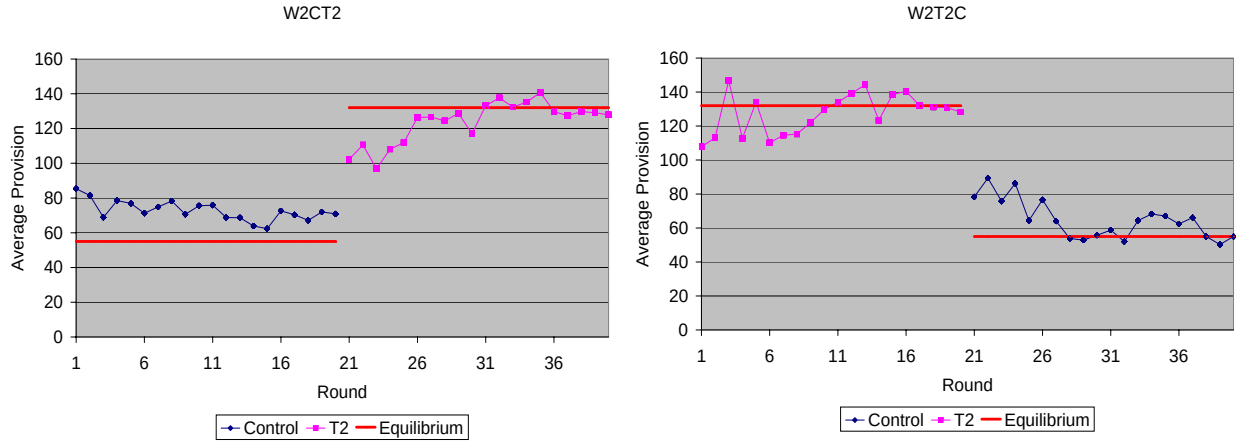
Figure 3: Average contributions for W1CT2 and W1T2C



In the control treatment, contributions start at a much higher level than the equilibrium

prediction but decline later in that treatment. This behavior is consistent with previous experiments on public goods provision (see Ledyard, 1995). In the sharing treatment, we see some order effect: previous free riding experience affects the contributions in the sharing treatment.[16] If the sharing treatment is the first treatment, we see that agents contribute at the equilibrium level, whereas if it is followed after the control treatment, we see the contributions begin below the equilibrium prediction. However, they increase over time, and by the last period the mean contribution gets very close to the equilibrium prediction. This suggests that implementing a between-subjects design would only lead to stronger support for the theory.

Figure 4: Average public good provision for W2CT2 and W2T2C



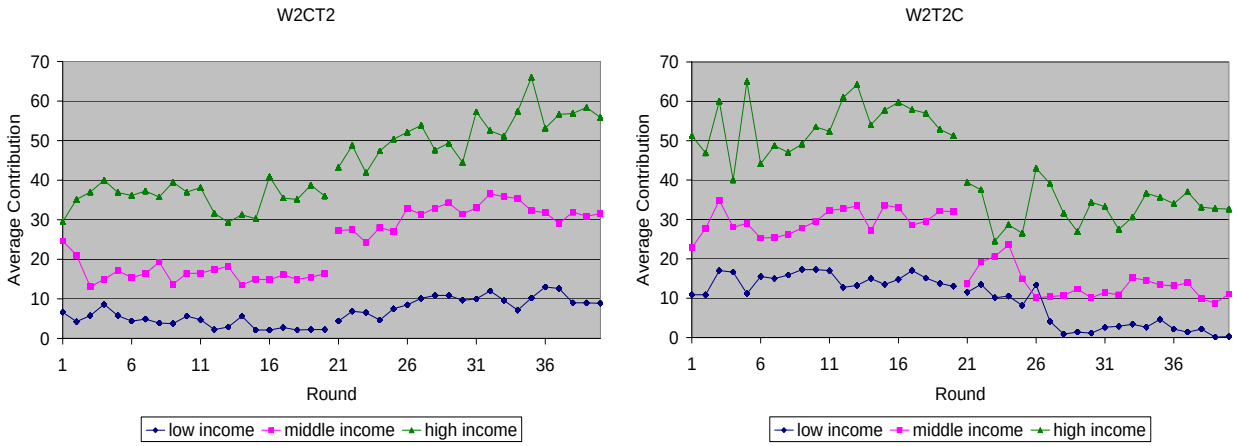
Next I examine voluntary giving when the income distribution is unequal. The left-hand side of Figure 4 shows the average public good provision of 8 groups (groups 17-24) who participated in sessions with unequal income distribution where γ was changed from 0 to 0.9. The right-hand side shows the average public good provision of 8 groups (groups 25-32) who played the sharing treatment, $\gamma = 0.9$, followed by the control treatment. The total public good provision seems to be largely consistent with the equilibrium prediction in the sharing treatment and much higher than contributions when there is no redistribution.

One obvious question is does each income class increase their contributions in the T2

[16]When the first 5 periods are eliminated, order effect disappears.

treatment. Figure 5 shows that there are huge differences between the control and the sharing treatments for each income class. Each income class contributes more when there is redistribution.

Figure 5: Average contributions of each income class in W2CT2 and W2T2C



Now I investigate the public good contributions when the degree of redistribution is lower. 15 groups participated in experiments with $\gamma = 0$ and $\gamma = 0.7$. 7 groups (groups 33-39) played the control treatment first and the other 8 groups (groups 40-47) played the sharing treatment first. Figure 6 shows the average provision. Clearly, the sharing treatment has a huge impact on voluntary contributions. Although contributions start at a much higher level than the theoretical prediction, over time they get very close to the predicted level.

Finally, I look at average contributions of each income class for treatments W2CT1 and W2T1C. In Figure 7, we see that each income class contributes more when there is redistribution, similar to Figure 5.

4.2 Data Analysis

I start by testing *Hypothesis 1*. Table 3 presents the average provision of each group over all periods and over the last 10 periods under both the control and the sharing treatments.[17]

[17]I found that there is no order effect, i.e., one cannot reject the hypothesis that average public good provision is same for groups that take the same treatment in a different order, except for $\gamma = 0.9$ treatment under

Figure 6: Average public good provision for W2CT1 and W2T1C

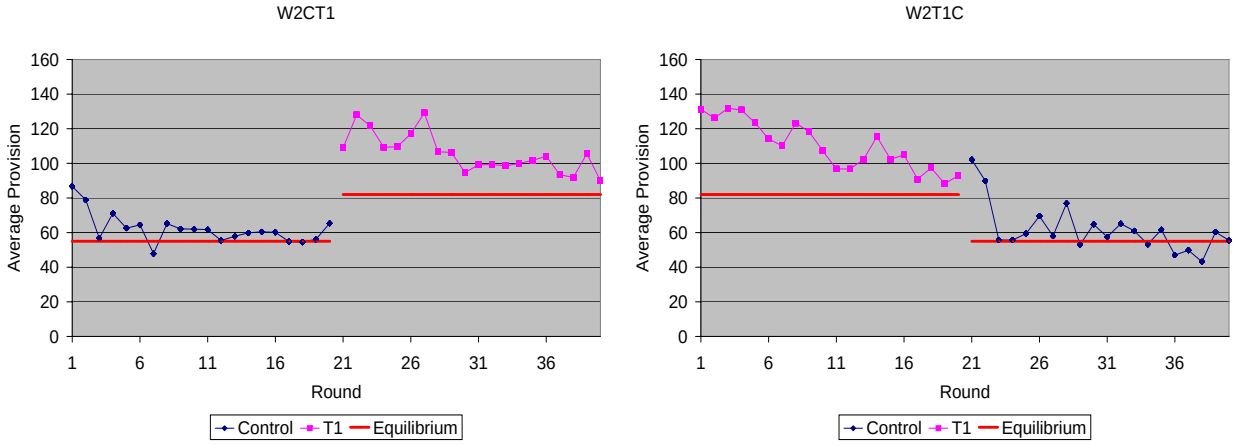
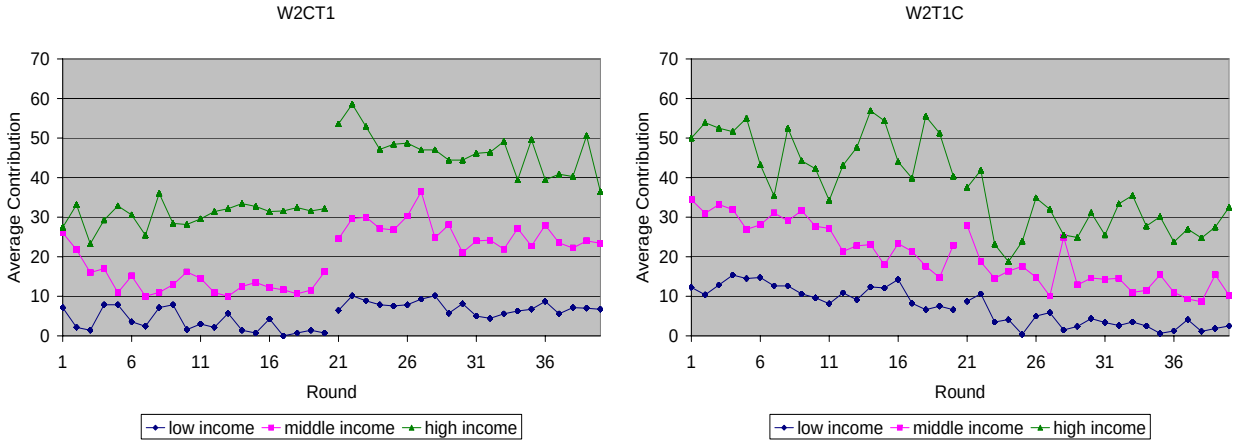


Figure 7: Average contributions of each income class in W2CT1 and W2T1C



It can be seen that each group increased their contributions in the sharing treatment. Averages over periods are used in the statistical analysis since they give us independent observations. In order to test whether contributions are higher in the presence of redistribution, Wilcoxon *matched-pairs* sign-rank tests are performed (qualitative results do not depend on this choice).[18] Contributions are significantly higher in the sharing treatments compared to the control treatments. For all pairwise comparisons p-value is less than 0.01 (both for all periods and last 10 periods).[19]

Table 3: Average provision of each group in each treatment

W1				W2				W2			
All		Last 10		All		Last 10		All		Last 10	
Control	T2	Control	T2	Control	T1	Control	T1	Control	T2	Control	T2
71.2	117.4	66.7	123.2	60.0	111.0	49.5	88.1	56.3	133.7	57.3	129.9
78.4	118.5	76.0	122.1	58.8	118.4	53.9	92.6	78.3	158.5	77.0	167.7
54.0	94.0	48.5	107.0	65.1	107.9	49.6	107.4	81.2	103.6	76.5	113.2
54.7	130.6	60.3	131.1	66.4	93.4	69.0	87.3	85.9	114.6	84.5	124.7
51.1	92.6	45.5	91.0	57.4	108.3	60.3	107.5	63.3	122.5	63.2	155.8
39.2	126.1	36.1	120.4	55.5	90.0	54.1	96.9	57.3	147.8	57.3	163.1
43.5	115.3	40.0	139.5	72.3	111.5	73.9	108.8	102.3	126.1	93.0	126.2
30.1	94.4	24.3	105.8	54.0	139.5	41.7	120.8	57.3	83.8	45.2	77.9
31.9	136.4	26.1	129.4	57.8	113.3	50.9	106.6	49.1	124.6	46.3	128.4
39.9	141.1	27.5	147.8	80.2	140.6	64.4	125.8	71.6	137.3	61.4	138.1
54.1	114.5	34.9	113.7	64.5	75.8	58.4	74.9	81.3	128.6	81.8	134.3
61.7	133.1	50.0	128.0	43.0	109.4	41.9	74.2	72.8	130.5	68.8	144.7
51.2	119.6	50.7	113.1	50.7	99.6	48.9	96.5	59.9	122.1	54.7	122.7
52.3	138.2	47.6	126.3	82.7	119.2	72.3	92.6	46.6	120.9	38.9	133.5
86.0	124.1	73.2	125.3	62.9	84.4	64.8	98.8	77.2	130.6	65.1	137.5
61.0	95.3	67.3	93.7	-	-	-	-	60.2	124.9	62.3	134.5
Mean Provision											
53.7	118.2	48.4	119.8	62.1	108.1	56.9	98.6	68.8	125.6	64.6	133.3

Performing a between-subjects comparison among T1 ($\gamma = 0.7$) and T2 ($\gamma = 0.9$) reveals that the degree of redistribution matters. Under T2 the contributions are systematically higher than under T1 (Wilcoxon rank-sum test for *independent samples*, $p < 0.01$ for all periods and p=0.000 for the last 10 periods). Since independent samples are compared, one may be skeptical saying that the difference may be due to individual characteristics.

equal income distribution. If the first 5 rounds are eliminated, then order effect in the "Equal Treatment" also disappears.

[18] I've performed different statistical tests while testing all hypothesis, including regression analysis. Results continue to hold.

[19] All reported p-values are for a double-sided test.

However, under the control treatment, one cannot reject the null hypothesis that the mean contributions of the two independent samples come from the same distribution (p=0.29 for all periods and p=0.14 for last 10 periods). In other words, the mean contributions for groups 17-32 are not significantly different than the mean contributions for groups 33-47 in the control treatment, while the mean contributions in the T2 treatment for groups 17-32 are significantly higher than the mean contributions in the T1 treatment for groups 33-47. Moreover, the mean contributions in the T1 treatment are systematically higher than the mean contributions in the pooled control treatment (p=0.000). Therefore, the data supports Hypothesis 1: contributions are increasing in the degree of redistribution.

Next I check whether both middle and high income classes increase their contributions with γ. Note that the model predicts that low income class do not contribute both at $\gamma = 0$ and $\gamma = 0.7$, but contributes a positive amount at $\gamma = 0.9$. In Table 4 and Table 5, the contributions of each income class are presented both for all periods and for last 10 periods.[20] For each income class, Wilcoxon tests show that contributions in the sharing treatments (T1 and T2) are systematically higher than the contributions in the control treatment (p-values are less than 0.01 for all pair-wise comparisons).

I test whether contributions in the T1 treatment are systematically lower than the contributions in the T2 treatment. Although one cannot reject the null hypothesis that the contributions are the same in the T1 and the T2 treatments when all periods are considered, one can show that contributions in the T1 treatment are systematically lower than the contributions in the T2 treatment for each income class if the first 10 periods are eliminated (p-values are 0.09, 0.005 and 0.03 for low, middle and high income classes respectively). I check if the above result is due to individual characteristics by comparing how two independent samples contributed in the control treatment. One cannot reject the null hypothesis that the contributions of two independent samples in the control treatment are equal for each income class (p-values are 0.88, 0.42, 0.23 for low, middle and high income classes respectively). Hence, *Hypothesis 2* is also supported by the data except for low income individuals under T1. Although the model predicts that low income class shouldn't change

[20]Since in a group there are two people with an endowment of 50, I take an average of their contributions.

Table 4: Contributions of each income class under control and T1 treatments

Endowment=25				Endowment=50				Endowment=75			
All		Last 10		All		Last 10		All		Last 10	
Control	T1	Control	T1	Control	T1	Control	T1	Control	T1	Control	T1
3.5	5.3	3.0	2.7	15.6	23.5	10.5	19.7	25.3	58.8	25.5	46.0
5.7	22.5	2.0	21.4	12.0	26.4	12.5	15.7	29.3	43.2	26.9	39.9
8.0	15.5	5.5	10.5	8.0	36.8	4.6	37.2	41.0	18.8	35.0	22.5
2.5	1.6	2.5	1.7	12.3	18.0	12.0	17.1	39.3	55.8	42.5	51.5
0.0	0.0	0.0	0.0	9.4	21.4	9.2	22.1	38.5	65.6	42.0	63.4
0.0	3.4	0.0	5.9	15.9	29.4	14.5	30.5	23.7	27.9	25.1	30.0
4.6	2.6	1.1	2.0	25.0	26.6	23.5	26.7	17.7	55.8	25.9	53.5
4.1	25.0	4.7	25.0	12.5	36.3	6.0	23.6	25.0	41.9	25.0	48.7
5.0	5.0	1.5	5.5	14.4	19.3	12.2	17.6	24.0	69.8	25.0	66.0
3.4	8.5	1.0	7.3	24.2	32.4	19.7	28.1	28.3	67.4	24.1	62.4
2.0	3.9	0.4	2.0	18.6	28.3	16.0	28.8	25.4	15.2	26.1	15.3
0.0	4.5	0.0	5.0	7.4	27.0	6.0	15.6	28.3	51.0	29.9	38.0
0.8	12.5	0.0	12.5	10.0	15.7	12.0	14.1	30.0	55.8	25.0	55.9
6.7	15.0	4.4	11.1	20.7	32.4	15.9	22.3	34.6	39.5	36.1	37.0
6.2	14.3	6.8	8.3	9.9	15.7	9.5	20.0	37.0	38.8	39.0	50.5
Mean contributions											
3.5	9.3	2.2	8	14.4	25.9	12.3	22.6	29.8	47	30.2	45.4

Table 5: Contributions of each income class under control and T2 treatments

Endowment=25				Endowment=50				Endowment=75			
All		Last 10		All		Last 10		All		Last 10	
Control	T2	Control	T2	Control	T2	Control	T2	Control	T2	Control	T2
0.0	8.5	0.0	9.7	10.6	36.7	11.2	34.7	35.0	51.8	35.0	50.8
4.3	12.0	3.0	12.9	20.0	38.1	19.5	39.9	34.0	70.4	35.0	75.0
3.0	2.8	2.7	3.0	19.2	20.9	18.2	20.9	39.9	59.0	37.4	68.5
11.8	21.6	10.9	18.6	17.1	28.3	17.3	29.9	40.1	36.5	39.1	46.4
3.4	7.2	0.5	14.2	11.7	37.2	11.4	47.6	36.5	40.9	40.0	46.5
3.4	15.2	1.0	17.7	14.3	36.7	15.7	40.6	25.3	59.1	25.0	64.2
0.0	0.4	0.0	0.1	30.5	36.1	27.3	35.3	41.3	53.6	38.5	55.5
7.4	5.0	5.2	5.0	8.8	16.1	6.3	13.9	32.5	46.5	27.5	45.2
0.0	6.0	0.0	3.9	10.9	31.2	10.7	30.2	27.3	56.4	25.0	64.2
8.3	18.9	1.9	17.0	9.8	30.7	4.8	32.3	43.8	57.0	50.0	56.5
1.8	16.0	0.0	9.6	19.5	33.0	19.8	35.8	40.6	46.6	42.2	53.1
6.6	17.9	0.0	19.4	17.0	30.1	18.1	32.1	32.3	52.4	32.6	61.2
3.0	7.6	1.0	9.2	8.5	28.0	8.1	29.1	40.0	58.6	37.6	55.3
3.5	18.0	1.6	22.6	10.8	29.0	10.0	30.7	21.6	44.9	17.3	49.6
5.6	12.9	3.9	11.1	18.1	35.5	12.2	38.9	35.4	46.7	36.8	48.7
10.1	19.9	9.3	23.3	12.5	19.0	14.0	22.7	25.0	67.1	25.0	65.9
Mean contributions											
4.5	11.8	2.6	12.3	15	30.4	14	32.1	34.4	53	34	56.7

their contributions between control and T1 treatments, data reveals that they increase their contributions as well.[21]

I will now look at the impact of initial income inequality in order to examine *Hypothesis 3*. Note that, moving from W1 to W2, the theoretical model predicts no change in contributions when $\gamma = 0.9$ and an increase in contributions when $\gamma = 0$. The intuition behind this result is that when γ is small, contributions can be increased by creating inequality between initial endowments; however, as γ gets larger, initial inequality will not have any impact on contributions. Therefore, inequality should have no effect on voluntary contributions in the T2 treatment, and a positive effect in the control treatment. In order to check the model's predictions, I fix γ and compare the effect of increased inequality. This will be a between-subjects comparison.[22] I use independent group averages over all periods as observations. In particular, I compare the first column of Table 3 with the ninth column, and the second column with the tenth column. I find that increasing inequality does not decrease public good contributions: as predicted by the theory, when there is no sharing, a two-sample Wilcoxon rank-sum (Mann-Whitney) test rejects the equality of the two groups of observations (p=0.01); when there is sharing a two-sample Wilcoxon rank-sum (Mann-Whitney) test cannot reject the equality of two groups of observations (p=0.25). If first 10 periods are eliminated, the mean provision in the T2 treatment is significantly higher when there is inequality as well (p=0.02). Therefore, inequality has a positive effect even if theory predicts no change in the T2 treatment. Moreover, heterogeneity which is along income lines does not seem to impair group cohesiveness.

Although increasing inequality can be seen as a useful policy tool, there are some subtleties. Increasing inequality in income distribution may increase total welfare but it does not necessarily bring about a Pareto improvement. When there is no redistribution, increasing inequality makes the agents with low income worse off than before (see Table 2). In fact, in the control treatment, average payoff in the equal treatment was 162.5 tokens; however,

[21] Contributions in the T1 treatment are systematically higher than the contributions in the control treatment (p-values are 0.005, 0.001 and 0.006 for low, middle and high income classes, respectively).

[22] Given γ, I compare the public good contributions of groups that have different initial income distributions. Therefore in the below analysis I eliminate the subjects that enter T1 treatments.

average payoff of low income participants was 146.3 tokens in the unequal treatment. The difference is statistically significant (p=0.000).

So far we have seen that redistribution increases the contributions to the public good. Next step in my analysis is to check whether contributions are consistent with the point predictions. For equal income distribution, the average provision is 53.7 in the control treatment and 118.2 in the sharing treatment (see Table 6 below).

Table 6: Observed versus predicted

		All 20	Last 10	Last	Predicted
Equal	Control	53.7	48.4	39.9	40
	T2	118.2	119.8	124.1	132
Unequal	Control	65.5	60.9	61.5	55
	T1	108.1	98.6	91.5	82
	T2	125.6	133.3	128.1	132

A Wilcoxon signed-rank test confirms that the mean group contributions are systematically higher than the equilibrium prediction of 40 in the control treatment ($p < 0.01$) and significantly lower than the equilibrium prediction of 132 in the sharing treatment ($p < 0.01$). However, Figure 3 indicates that contributions are declining over the periods for the control treatment and increasing for the sharing treatment. Therefore, I also look at the average provision in the last period. The mean provision is now 39.9 and 124.1 for control and sharing treatments respectively. In the last period, average group contributions in the control treatment are not systematically different than the equilibrium prediction at any standard confidence levels. Average group contributions in the sharing treatment are not systematically different from the equilibrium prediction at the 15% significance level ($p = 0.19$).

Under the unequal income distribution, the average provision for all periods in the control treatment is 65.5. Average group contributions are systematically higher than the predicted value of 55 ($p < 0.01$). Average contributions in the control treatment are not significantly different than the predicted value in the last round ($p = 0.14$). Similarly, in the T1 treatment, contributions are systematically above the equilibrium prediction. However, they decline

towards the equilibrium prediction over time. In the last period, one cannot reject the null hypothesis that the contributions are equal to 82 at the 10% significance level (p=0.13). The average provision in T2 is 125.6 over all periods. Wilcoxon signed rank test reveals that contributions are not systematically above or below the predicted value of 132 at a 5% significance level (p=0.08). The data is highly consistent with the equilibrium prediction if the first 10 periods are eliminated ($p = 0.7$); The group contributions in the last period are not systematically different than the equilibrium prediction as well ($p = 0.4$).

Table 7 compares the observed and predicted contribution levels for each income class. On average, the low income class contributes 4 in the control treatment, 9.3 in the T1 treatment and 11.8 in the T2 treatment. These contributions are significantly higher than the equilibrium predictions of 0, 0 and 8, respectively (Wilcoxon signed rank tests, $p < 0.01$). Individuals with low incomes contribute systematically higher than 0 even in the last period in the control and T1 treatments. In the last period of the T2 treatment, the contributions of low income individuals are not systematically different from 8 ($p = 0.11$). Similarly, the middle income class contributes systematically higher than the predicted amount in the control and T1 treatments over all periods. However, in the last period, contributions are not systematically different than the equilibrium levels in both treatments (p=0.14 in the control treatment and p=0.23 in the T1 treatment). In the T2 treatment, middle class contributes on average 30.4 tokens, and contributions are not systematically different than the equilibrium prediction of 33 (p=0.31). Finally, the high income class contributes 32.2 tokens in the control treatment. Contributions of the high income class over all periods are systematically below the equilibrium prediction of 35 (p=0.04). In the last period they contribute 33.4 on average; contributions are not systematically different from 35 (p=0.39). Contributions in the T1 treatment are highly consistent with equilibrium prediction. In the treatment T2, the mean contributions of the high income class are not systematically different than 58 if the first 10 rounds are eliminated (p=0.47).[23]

To summarize, the low income class over-contributes in all treatments (except the last period in the T2 treatment). The middle income class over-contributes in the control and

[23]Mean contributions are not significantly different than 58 in the last period as well (p=0.29).

Table 7: Observed versus predicted for each income class

		All 20	Last 10	Last	Predicted
Low	Control	4	2.4	1.5	0
	T1	9.3	8	6.7	0
	T2	11.8	12.3	10.9	8
Middle	Control	14.7	13.2	13.4	10
	T1	25.9	22.6	23.2	19
	T2	30.4	32.1	31.8	33
High	Control	32.2	32.2	33.4	35
	T1	47	45.4	38.5	44
	T2	53	56.7	53.6	58

T1 treatments (except the last period). The high income class under-contributes in the control treatment (except the last period). Nevertheless, in all treatments contributions move towards the predicted level.[24]

5 Conclusion

In the United States, policy makers search for ways to prevent free riding and increase charitable giving to efficient levels. Empirical studies examining the effect of tax policies on charitable giving have generated mixed results due to the sensitivity of the estimates to the different estimation techniques and identification problems. This paper provides experimental findings on how changes in the degree of redistribution affect voluntary contributions. In addition, the experimental design allows us to test the effect of pre-tax income inequality on charitable contributions. I find that charitable giving increases with the degree of pre-tax income inequality. In contrast, charitable contributions increase with the tax rate in

[24]Note that individuals do not seem to be inequality averse; the low income class over-contributes and the high income class under-contributes. This increases the income inequality further. Another interesting observation is that, if individuals have a warm-glow motive of giving, or in other words, if they are impure altruists, I expect individuals to increase their contributions relative to the baseline predictions (Andreoni, 1989 and 1990). However, there is no systematic increase from the equilibrium predictions of the model in the sharing treatment.

accordance with the theoretical predictions.

While the broad finding of the paper supports a more egalitarian tax system, there are some limitations. When effort is endogeneously determined, individuals may choose to work less and earn lower income under a more egalitarian tax rate. As Uler (2008) shows this may decrease the total welfare. However, higher tax rates does not necessarily imply that total income will fall. In contrast with the traditional view that argues redistribution is detrimental to investment and growth, recent literature provides evidence on the fact that redistribution may also have a positive impact on growth (i.e., Saint Paul Verdier (1993, 1996), Easterly and Rebelo (1993a, 1993b), Galor and Zeira (1993), Sala-i Martin (1996), Perotti (1996). If redistribution does not decrease the total income, then higher levels of taxation will increase the social well being.

Appendix

In the experiment, for simplicity, the sharing rule is given as

$$\text{Transfer} = (\text{ Net income of subject } i \text{ - Average net income of others }) * \beta$$

where β was set to 0.5 or 0.7 in the sharing treatments. Note that this sharing rule is mathematically equivalent to the sharing rule presented in the paper:

$$\begin{aligned} t_i &= \beta[(w_i - g_i) - \frac{1}{n-1}\sum_{j \neq i}(w_j - g_j)] \\ &= \gamma[(w_i - g_i) - \frac{1}{n}\sum_{j=1}^{n}(w_j - g_j)] \end{aligned}$$

where $\gamma = \frac{n}{n-1}\beta$. Hence γ is equal to 0.67 and 0.93, respectively.

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