Public Goods Provision, Inequality and Taxes *

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Abstract

The impact of redistributive policies on voluntary contributions is still not well understood. While a higher level of redistributive taxation decreases the price of voluntary giving, it also changes the income distribution by decreasing income inequality. This paper provides a controlled laboratory experiment to investigate the net impact of the tax rate on public goods provision. 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 privately provided public goods.

Keywords: Voluntary Giving, Public Goods, Redistribution, Taxation

JEL Classification: C72, C92, D30, H20, H41

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1 Introduction

This paper studies situations where private individuals make contributions to public goods, and asks "how much do economic factors, such as income redistribution, influence individuals when they decide on their contributions?" In particular, the paper provides the first controlled experimental study that investigates the relationship between redistributive taxation and public goods provision. In addition, the experimental design allows us to isolate the effects of both taxation and pre-tax income inequality on public goods provision.

Taxation affects tax-deductible voluntary giving in two ways: through its effect on the after-tax net income and through its effect on the price of giving. Redistributive taxation decreases the opportunity cost of tax-deductible giving, and therefore it has a positive impact on contributions (price effect). However, it also changes the income distribution by decreasing income inequality. This exacerbates the free-riding problem (income distribution effect), and has a negative effect on public goods provision (i.e., Olson (1965), Warr (1983), Bergstrom et al. (1986), Itaya et al. (1997), Cornes and Sandler (2000), Olszewski and Rosenthal (2003), Uler (2009)). Prior theoretical research predicts that, under a general class of utility functions, the price effect dominates the income distribution effect. Hence, voluntary contributions to public goods increase with the tax rate (Uler, 2009).[1]

Empirical estimations of the taxation effect have produced ambiguous results (Peloza and Steel (2005), Andreoni (2006), Vesterlund (2006)). While some empirical studies estimate that a tax cut leads to a decrease in charitable giving (Clotfelter, 1985, 1990 and Auten et al., 2002), some argue that charitable giving is relatively insensitive to changes in its price (Randolph (1995)). Given that empirical work is sensitive to estimation techniques and identification strategies, this paper explores the question in a controlled experiment.

The aim of this paper is to study the impact of redistributive taxation on public goods provision. In the experiment, redistributive taxation is enforced in the following way: a flat-rate tax on income net of contributions to the public good is collected, and then the tax

[1] Public goods provision may also be increased through other government subsidies (Andreoni and Bergstrom, 1996). In addition, joint production increases with the degree of egalitarianism embodied in the social welfare function (Ray and Ueda, 1996).

revenue is redistributed equally. To study the effect of taxation on public goods provision the experimental design varies the level of redistribution. The experiment also varies the initial income distributions to check whether the results hold independently of the initial income inequality. This also allows us to separate the impact of ex-ante *equalizing* redistribution on voluntary contributions and to contrast it with the impact of ex-post redistribution (taxation).[2]

The results show that the effects of ex-ante and ex-post equalizing redistribution policies on voluntary contributions and social welfare go in opposite directions. Ex-ante equalizing redistribution 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 the theoretical predictions. Since efficiency in public goods provision can be increased through different redistribution policies (ex-ante versus ex-post redistribution), this paper provides important policy implications. The findings support the use of ex-post equalizing redistributive policies in order to increase efficiency in privately provided public goods, and show that there does not have to be a trade-off between equality and efficiency. However, these results should be interpreted with caution since the paper uses high tax rates and considers a linear redistributive scheme.[3]

There are several experimental studies that investigate the price effect on giving behavior. 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. Eckel and Grossman (2003) conduct an experiment where a dictator decides how much to contribute to a real charity, and show that contributions increase with income and

[2]Taxation is an ex-post redistribution since transfers depend on income net of voluntary contributions. In contrast, an ex-ante equalizing redistribution is to decrease initial income inequalities (redistribution does not take voluntary contributions into account). While ex-ante equalizing redistribution only has an income distribution effect, taxation also has a price effect which works in opposite direction.

[3]In addition, I do not consider the impact of tax rate on effort choice. See Uler (2009) for a discussion on when taxation may have a detrimental effect on voluntary giving.

decrease with price.[4] Karlan and List (2007) look at the effect of price changes on voluntary contributions by conducting a natural field experiment. They found that offering to match contributions increases the revenue and the probability that an individual contributes. In addition, the income distribution effect has also been studied. Chan, Mestelman, Moir and Muller (1996) test the theoretical model of Bergstrom, Blume and Varian (1986) and they find that total contributions to the public good increase with the degree of ex-ante inequality. Chan *et al.* (1999) examine the effects of (ex-ante) income inequality on the provision of public goods with incomplete information and communication.[5]

In contrast to these earlier experimental papers, the innovation in this paper is to study the impact of taxation (ex-post redistribution) on public goods provision.[6] Therefore, there is a real redistribution after voluntary contributions are made, which allows us to examine the *net* impact of price and income distribution effects on contributions under redistributive taxation. Consistent with the earlier literature on (non-linear) public goods, this paper confirms that the ex-ante equalizing redistribution has a negative effect on public goods provision. I find that the impact of ex-post equalizing redistribution on voluntary giving go in the opposite direction. Taxation brings efficiency independently of the initial income distribution.

The rest of the paper is organized as follows. Section 2 introduces the experimental design, Section 3 provides the theoretical predictions and Section 4 reports the findings.

[4]Eckel and Grossman (2008) conduct a natural field experiment and finds consistent results with their laboratory experiments. Other related studies include Eckel and Grossman (2006a, 2006b), Davis et al. (2005) and Davis and Millner (2005).

[5]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.

[6]A related paper is by Falkinger, Fehr, Gachter and Winter-Ebmer (2000). Falkinger et al. (2000) tests an incentive compatible mechanism that is first proposed by Falkinger (1996): 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. Nevertheless, this tax-subsidy mechanism uses a non-standard taxation scheme; it either does not 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 sheds light on the impact of redistributive taxation (which depends on income net of contributions) on the public goods provision.

Section 5 concludes.

2 Experimental Design and Protocol

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

The experimental design is based on the public goods experiment of Falkinger *et al.* (2000).[7] As in that experiment, subjects are randomly matched into groups of 4 in the first period and stay in the same group throughout the experiment. Each subject receives a fixed amount of tokens, w_i, in the beginning of each period and know the token distribution. Subjects know that there are two income generating projects: the group project and the private project. Their payoffs each period is the sum of their earnings from the group project and the private project.[8] Tokens that are contributed to the group project benefit all group members, whereas tokens that go to the private project only have private benefits. Subjects decide how many of their tokens to allocate to the group project.

The innovation in this experiment is that subjects pay a tax on tokens that are left after voluntary contributions to the group project. Then, the tax revenue is distributed equally to the subjects. These private tokens are then invested in the private project. The following explains the design in more detail:

Each subject i decides how much to contribute to the group project, g_i. Their income

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

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

from the group project (public good) is simply the sum of contributions of all members in their group to the group project:

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

The experimenter collects a flat-rate tax, γ, on income net of contributions, and then redistributes the tax revenue equally. Equivalently, 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. More formally, the transfer that they will receive or make is determined by

$$t(w_{i,}g_i, g_{-i}) = \gamma[(w_i - g_i) - \frac{1}{4}\sum_{j=1}^{4}(w_j - g_j)] \quad (1)$$

with $0 \leq \gamma \leq 1$ determining the degree of redistribution.[9] 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 $\gamma = 0$). An important observation is $\sum_{i=1}^{n} t(w_{i,}g_i, g_{-i}) = 0$. The private tokens (endowment net of contributions and transfer) for individual i is given by:

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

where g_{-i} denotes the vector of contributions by all individuals except i. These private tokens are then allocated to the private project, and subject's income from the private project is calculated according to the following formula,[10]

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

[9]Redistribution was framed slightly differently in the experiment. For simplicity, the sharing rule was given as: Transfer = (Net income of subject i - Average net income of others) $*\beta$. Note that this sharing rule is identical to the sharing rule presented in the paper and in Uler (2009) where $\gamma = \frac{n}{n-1}\beta$.

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

Subjects were provided with a payoff table that lists the private income level corresponding to each level of private contribution.[11]

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 ($\gamma = 0$); whereas in the "Sharing Treatments (T1 and T2)," the tax rate is positive ($\gamma = 0.7$ and $\gamma = 0.9$, respectively).[12] In the experiment, subjects go through both control and sharing treatments, which are 20 periods each. However, they learn what will happen in the second part of the experiment only after the first treatment is over. 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.[13] 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.

In the experiment, 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).[14] 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 reversed (W2T1C). In total there were 8 groups in every within-subject treatment except W2CT1, where there

[11]The formula for private project is adopted from Falkinger et al. (2000). This function has the advantage of having a high curvature so that the trade-offs are more clear to the subjects.

[12]Even though these tax rates seem to be large and close to each other, one expects them to generate strong treatment effects, since contributions are an increasing and convex function of γ.

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

[14]Note that the name of the sessions are assigned so that the first two letters correspond to the income distribution (W1 or W2). The letters T1 and T2 correspond to the sharing treatments, and C corresponds to the control treatment.

were 7 groups.

3 Theoretical Predictions

Proposition 1 summarizes the equilibrium level of public goods provision.

Proposition 1: *Suppose individuals are payoff maximizers, then public goods provision, $G(\gamma)$, is given by:*

a. For $W1 = (50, 50, 50, 50)$, $G(\gamma) = \frac{160}{4-3\gamma}$ where each individual contributes $g_i = \frac{40}{4-3\gamma}$,

b. For $W2 = (25, 50, 50, 75)$, $G(\gamma) = \frac{1}{4-\gamma}(100 - 100\gamma + \frac{480}{4-3\gamma})$ for $\gamma < 0.8$ and $G(\gamma) = \frac{160}{4-3\gamma}$ for $\gamma \geq 0.8$, where each individual contributes $g_i = \max\{0, w_i + \frac{\gamma}{1-\gamma}\frac{200-G}{4} - \frac{1}{1-\gamma}(50 - \frac{40}{4-3\gamma})\}$

Proposition 2 shows the relationship between tax rate and total voluntary contributions. It is important to note that when income distribution is equal, there is only the price effect. When income distribution is unequal, both the price and income distribution effects are present. However, the Proposition 2 shows that price effect dominates the income distribution effect.

Proposition 2: *Public goods provision strictly increases with γ for both the equal and unequal income distributions.*

Proposition 2 states that total contributions increase with the tax rate. Consequently, for the equal income distribution each agent increases their contributions with γ. For the unequal income distribution, it can also be shown that the agent with 25 tokens contribute nothing for $\gamma < 0.8$, and then she increases her contributions for $\gamma \geq 0.8$. Agents with 50 and 75 tokens strictly increase their contributions for all γ.

Proposition 3: *For $\gamma < 0.8$ contributions to the public good are higher under unequal income distribution. For $\gamma \geq 0.8$, contributions under different income distributions are equal.*

Proposition 3 shows that inequality weakly increases public goods provision. The intuition behind this result is that creating wealthy individuals decrease free riding problems. More formally, a transfer from a contributor to other contributors that decrease the set of contributors increases the public good provision. Results presented here can easily be verified by sketching and comparing the predicted levels. In addition, Uler (2009) provides proofs for the results presented here for a general class of utility functions.[15]

Table 1 shows the theoretical predictions.[16] 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.[17] 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.[18] 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 $\gamma = 0.7$.

Table 1: 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

Our main hypotheses are presented below:

[15] Uler (2009) does not consider quasilinear preferences.

[16] In the experiment, the sharing rule was given as: Transfer = (Net income of subject i - Average net income of others) $*\beta$ with β equal to 0, 0.5 or 0.7. Note that this sharing rule is identical to the sharing rule presented in the paper with γ equal to 0, 0.667 or 0.933.

[17] 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.

[18] Note that contributors enjoy the same net income (see Bergstrom et al. (1986), Uler (2009)).

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

Hypothesis 2. Each income class increases their contributions with redistribution (γ). This holds weakly for the low income class and strictly for the others.

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

Next, I briefly consider how alternative behavioral models such as fairness (Fehr and Schmidt (1999), and Bolton and Ockenfels (2000)), warm-glow (Andreoni, 1989 and 1990) and altruism (Becker, 1981) would affect the theoretical predictions.[19] The positive relationship between the tax rate and public goods provision continues to hold under all three models (although the rate of increase is now much lower). Similarly, initial income inequality increases contributions under inequality aversion, warm-glow and altruism. However, there are important departures from the quantitative predictions in Table 1. First, (for $\gamma = 0$ and 0.7) the inequality aversion model predicts higher contributions by moderate and high income classes seeking to decrease income inequality than the standard theory.[20] However, for the equal income distribution, inequality aversion predicts the same level of contributions as the standard theory since there is no income inequality to account for. Second, the warm-glow and altruism models predict higher levels of contribution than the predictions

[19]I assume the following functional forms to derive the direction of deviations from the standard theory predictions. For inequality aversion, I use the following utility function:

$$5((1-\gamma)(w_i - g_i) + \gamma\frac{W-G}{n}) - 0.05((1-\gamma)(w_i - g_i) + \gamma\frac{W-G}{n})^2 + \sum g_j + a((w_i - g_i) - \frac{W-G}{n})^2$$

where $0 < a < 1$. The last term is changed to $g_i^{1/b}$, $b > 1$, for the warm glow model and to

$$c\sum_{k\neq i}(5((1-\gamma)(w_k - g_k) + \gamma\frac{W-G}{n}) - 0.05((1-\gamma)(w_k - g_k) + \gamma\frac{W-G}{n})^2 + \sum g_j)$$

with $0 < c < 1$ for the altruism model.

[20]Inequality aversion will not change the theoretical predictions when everyone is a contributor since public goods provision equalizes all incomes. However, when there are noncontributors, the predicted level of public goods provision is higher under inequality aversion (compared to the standard model). In particular, if subjects are inequality averse, we should observe higher contributions by subjects that have income 50 or 75 tokens in order to decrease the income inequality.

of standard theory for any level of tax with the *equal* income distribution. With the unequal income distribution, the altruism model predicts (weakly) strictly higher contributions compared to standard theory predictions for (low) middle and high income classes for any γ. For the unequal income distribution, the warm-glow model also predicts weakly higher contributions compared to standard theory predictions for the low income class for any γ, and strictly higher contributions for middle and high income classes for $\gamma = 0$. However, for $\gamma = 0.7$ and 0.9, the warm-glow model does not make a particular prediction regarding the direction of deviation compared to the standard theory.[21]

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

4 Results

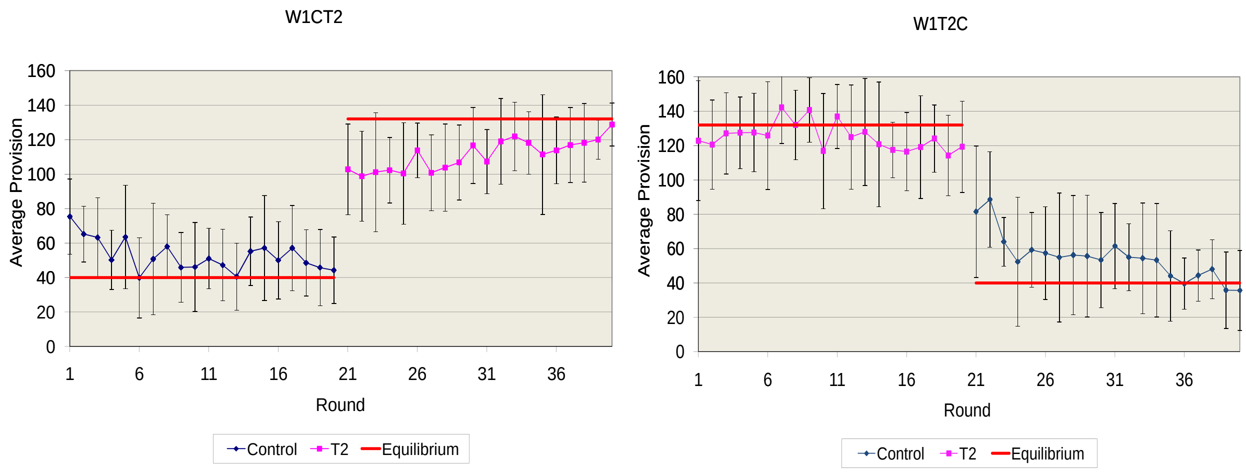
In Section 4.1, I start by examining how taxation affects the average contribution in the equal income distribution. For the equal income distribution, there is only the price effect, which we hypothesize to have a positive effect on contributions. For the unequal income distribution, there are two opposing effects: the price and income distribution effects. Therefore, in Section 4.2 I will examine the net effect of taxation. Section 4.3 only looks at the income distribution effect by comparing ex-ante income distributions. Section 4.4 provides a test of point predictions.

4.1 Equal Income Distribution

Figure 1 shows the average provision and error bars (one standard deviation) under equal income distribution. 32 subjects played the control treatment first and then the sharing treatment ($\gamma = 0.9$), illustrated in Figure 1 (left panel). The order of the treatments was reversed for the other 32 participants, illustrated in the right panel of Figure 1.

[21] The direction of deviation depends on the parameters of the model. High or middle income classes may contribute less than standard theory predictions because low income class may be contributing much higher levels compared to the standard theory and the higher income classes prefer to free ride on this extra level of provision.

Figure 1: Average public goods provision 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; Falkinger et. al., 2000). More importantly, we observe much higher contributions in the sharing treatment.[22]

In order to test whether contributions are higher in the presence of redistribution, the Wilcoxon *matched-pairs* sign-rank test is performed (qualitative results do not depend on this choice).[23] The average provision of each group over all periods are used in the statistical analysis since they give us independent observations. Contributions are significantly higher in the sharing treatment compared to the control treatment ($p - value < 0.001$).[24]

Result 1: *Public good provision strictly increases with redistribution (γ) for equal income distribution.*

[22]We see some order effect in the sharing treatment: previous free riding experience affects the contributions in the sharing treatment. 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. However, in the other treatments of the experiment, I didn't find any order effects. If the first 5 rounds are eliminated, then order effect in the "Equal Treatment" also disappears. This slight order effect does not change the qualitative predictions of this paper.

[23]I have performed different statistical tests while testing all hypothesis, including regression analysis. The results still hold.

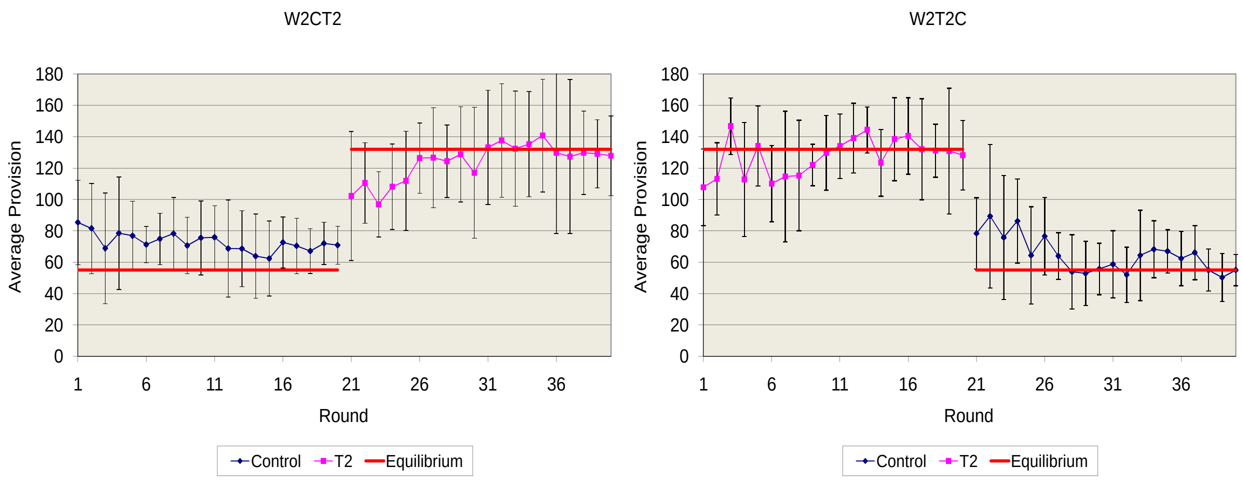
[24]All reported p-values are for a double-sided test.

Next I examine voluntary giving when the income distribution is unequal. I start by investigating the total contribution of the groups, and then I will provide an analysis on average contributions of each income class.

4.2 Unequal Income Distribution

High Tax Treatment

Figure 2: Average public goods provision for W2CT2 and W2T2C



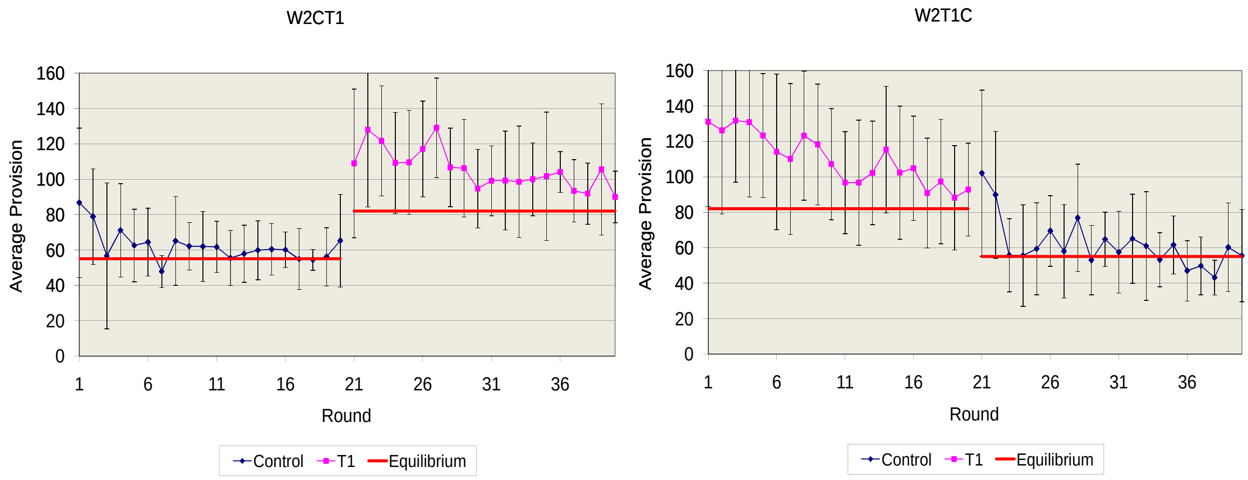
The left panel of Figure 2 shows the average public good provision (total contribution) with unequal income distribution when γ changed from 0 to 0.9. The right panel shows the average public good provision when $\gamma = 0.9$ was followed by the control treatment. In the sharing treatment the total public good provision is largely consistent with the equilibrium prediction and much higher than the level of contributions when there is no redistribution. Wilcoxon *matched-pairs* sign-rank test confirms that contributions are significantly higher when $\gamma = 0.9$ compared to the control treatment ($p - value < 0.001$).[25]

Moderate Tax Treatment

[25] In all nonparametric tests, average provision over periods are used in the statistical analysis since they give us independent observations. If nothing is mentioned, averages are over all 20 periods of a given treatment.

Figure 3 shows the average provision for experiments with $\gamma = 0$ and $\gamma = 0.7$. Although contributions start at a much higher level than the theoretical prediction, over time they get very close to the predicted level. As in the high tax treatment, the sharing treatment has a huge impact on voluntary contributions ($p - value = 0.001$).

Figure 3: Average public goods provision for W2CT1 and W2T1C



Are contributions sensitive to the tax level?

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, $p = 0.006$ for all periods and $p < 0.001$ for the last 10 periods). Since independent samples are compared, one may be skeptical saying that the difference may be due to individual characteristics. 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 ($p = 0.286$ for all periods and $p = 0.144$ for last 10 periods). In other words, while the mean contributions are not significantly different between two independent subject groups under the control treatments, the mean contributions in the T2 treatment are significantly higher than the mean contributions in the T1 treatment. Moreover, the mean contributions in the T1 treatment are systematically higher than the mean contributions in the pooled control treatment ($p < 0.001$). Therefore, the data are consistent with Hypothesis 1.

Result 2: *Public good provision strictly increases with redistribution (γ) for the unequal income distribution.*

Next, I investigate whether each income class increases their contributions with the degree of redistribution.

How does each income class react to taxation?

I first check whether both the middle and high income classes strictly increase their contributions with γ.[26] Note that the model predicts that low income subjects do not contribute both at $\gamma = 0$ and $\gamma = 0.7$, but contribute a positive amount at $\gamma = 0.9$.

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 also test, for each income class, 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 0.089, 0.005 and 0.034 for low, middle and high income classes respectively).

Finally, 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 0.889, 0.418, 0.226 for low, middle and high income classes respectively). Hence, *Hypothesis 2* is also supported by the data except for low income individuals under T1, because the low income class also increased their contributions between the control and T1 treatments.

Result 3: *Each income class strictly increases their contributions with redistribution (γ).*

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

Results 1-3 demonstrate that both the public goods provision and the average contributions of individuals increase with the tax rate (ex-post redistribution). Section 4.3 studies the effect of ex-ante redistribution.

4.3 Initial Income Inequality

This section looks at the impact of initial income inequality in order to examine *Hypothesis 3*. I use a between-subjects comparison.[27] 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. I use independent group averages over all periods as observations.

I find that increasing inequality does not decrease public good contributions: as predicted by the theory, when $\gamma = 0$, a two-sample Wilcoxon rank-sum (Mann-Whitney) test rejects the equality of the two groups of observations ($p = 0.012$); when $\gamma = 0.9$ a two-sample Wilcoxon rank-sum (Mann-Whitney) test cannot reject the equality of two groups of observations ($p = 0.250$).[28].

Result 4: *Total contributions increase with initial income inequality for $\gamma = 0$, and do not change for $\gamma = 0.9$.*

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

[27] 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.

[28] If first 10 periods are eliminated, the mean provision in the T2 treatment is significantly higher when there is inequality as well ($p = 0.020$). 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

inequality makes the agents with low income worse off than before (see Table 1). In fact, in the control treatment, average payoff in the equal treatment was 162.5 tokens; however, average payoff of low income participants was 146.3 tokens in the unequal treatment. The difference is statistically significant ($p < 0.001$).

4.4 Testing Point Predictions

So far we have seen that all qualitative theoretical predictions are consistent with the data. Next step in my analysis is to check whether the same holds for quantitative predictions. This allows us to contrast alternative theoretical models.

Public Goods Provision

For equal income distribution, the average provision is 53.7 in the control treatment and 118.2 in the sharing treatment (see Table 2 below). A Wilcoxon signed-rank test confirms that the mean group contributions are systematically higher than the equilibrium prediction of 40 in the control treatment ($p = 0.004$) and significantly lower than the equilibrium prediction of 132 in the sharing treatment ($p = 0.007$).

Table 2: Public Goods Provision Estimates

		Average	Start point	Asymptote	Predicted
Equal	Control	53.7	85.0 (7.5)	**46.9** (4.5)	40
	T2	118.2	109.4 (8.9)	120.1 (3.7)	132
Unequal	Control	65.5	92.3 (6.1)	59.6 (2.5)	55
	T1	108.1	134.7 (14.1)	102 (3.9)	82
	T2	125.6	99.2 (8.1)	**131.4** (4.6)	132

Robust standard errors are given in parentheses.
The asymptotic estimates in bold are not significantly different than theoretical predictions.

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 ($p < 0.001$).[29] Similarly, in the T1 treatment, contributions are systematically above the equilibrium prediction ($p = 0.001$). 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 (p=0.079).

In addition to the nonparametric tests, I investigate the convergence process through regression analysis by clustering around the groups for robust standard errors.[30] Both initial and long term (asymptotic) estimates for contributions are provided in Table 2. Even though the exact point predictions are not always supported by the data, we see that the asymptotes are always closer to the theoretical predictions than the starting points or the averages.[31]

Result 5: *For the equal income distribution, total contributions are lower than the predicted level for the T2 treatment. For the unequal income distribution, total contributions are higher than the theoretical predictions for the control and T1 treatments. However, total contributions in* ***all*** *treatments move toward the predicted levels.*

Individual contributions under Unequal Income Distribution

Table 3 compares the average and predicted contribution levels for each income class as well as the estimates of the regression analysis. First, I conduct nonparametric tests. On average, the low income class contributes 4 in the control treatment, and 9.3 in the T1 treatment. These contributions are significantly higher than the equilibrium prediction of zero contribution (Wilcoxon signed rank tests, $p < 0.001$). The low income class contributes 11.8 in the T2 treatment which is marginally significantly higher than the predicted level of 8 ($p = 0.056$). Similarly, the middle income class contributes systematically higher than

[29]Contributions of each income class in almost all treatments are closer to the theoretical predictions if the first 10 rounds are eliminated. Results are available upon request.

[30]Based on the convergence analysis of Noussair et al. (1995), I run the following specification:
$provision_i = \alpha(\frac{1}{t}) + \beta(\frac{t-1}{t}) + \epsilon_i$
where i indicates independent groups and t represents the period number. Notice that as t gets larger $(\frac{1}{t})$ approaches zero, and $(\frac{t-1}{t})$ approaches 1. Hence, the constant β gives the asymptotic estimate of provision, and the constant α gives an estimate for the initial provision.

[31]I also test whether the asymptotic contributions are significantly different than then the predicted levels. The p-values are 0.146, 0.006, 0.069, 0.000, 0.897, respectively.

the predicted amount in the control and T1 treatments ($p < 0.01$ for both). In the T2 treatment, middle class contributes on average 30.4 tokens, and contributions are not systematically different than the equilibrium prediction of 33 ($p = 0.313$). Finally, the high income class contributes 32.2 tokens in the control treatment, systematically below the equilibrium prediction of 35 ($p = 0.038$). Contributions in the T1 treatment are highly consistent with equilibrium prediction ($p = 0.495$). In the treatment T2, the mean contributions of the high income class are significantly lower than the predicted 58 ($p = 0.047$). Next, I consider the convergence process. In all treatments contributions move towards the theoretical predictions with the exception of low income class in T2 treatment, and high income class in the control treatment. In addition, I test whether the asymptotic contributions are significantly different than the predicted levels.[32] Result 6 summarizes the findings.

Table 3: Estimates for each income class

		Average	Start point	Asymptote	Predicted
Low	Control	4.0	10.4 (1.8)	2.6 (0.5)	0
	T1	9.3	11.3 (3.0)	8.9 (1.9)	0
	T2	11.8	7.1 (2.5)	12.9 (1.8)	8
Middle	Control	14.7	24.2 (2.7)	12.6 (1.0)	10
	T1	25.9	33.8 (4.9)	24.2 (1.6)	19
	T2	30.4	24.0 (3.0)	**31.8** (1.8)	33
High	Control	32.2	33.6 (3.8)	31.9 (1.4)	35
	T1	47.0	55.8 (7.3)	**45.0** (4.4)	44
	T2	53.0	44.0 (5.6)	**54.9** (2.1)	58

Robust standard errors are given in parentheses.
The asymptotic estimates in bold are not significantly different than theoretical predictions.

Result 6: *The low income class over-contributes in all treatments. The middle income class over-contributes in the control and T1 treatments. The high income class under-contributes*

[32] The p-values are 0.000, 0.000, 0.014, 0.014, 0.006, 0.518, 0.036, 0.817, 0.169, respectively.

in the control treatment. Nevertheless, in the majority of treatments contributions move towards the predicted level.

So far, we have seen that all qualitative predictions of the standard theory are consistent with the data. Moreover, even qualitatively, public goods provision seem to be converging towards the standard theoretical predictions. Nevertheless, it is important to see whether individual's contributions are also close to the predicted levels of the standard theory.

Is there heterogeneity among subjects?

It is possible that average contributions are consistent with the theoretical predictions, yet only a small proportion of subjects are contributing at the equilibrium level. We see that this is not the case. The percent frequency of individuals that deviate from equilibrium predictions by specific amounts under equal (unequal) distribution is shown in the left-panel (right-panel) of Figure 4. Average contribution of each subject over all 20 periods of a treatment is used as an observation.

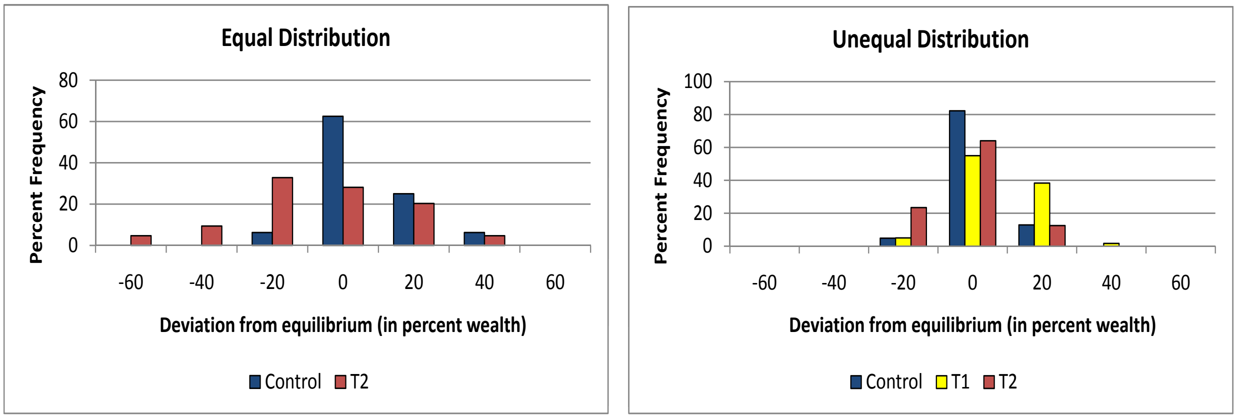
Frequency distributions show some heterogeneity among subjects. In addition, we see that a higher percentage of individuals are exactly consistent with the equilibrium predictions under the control treatment relative to the sharing treatments.[33] One reason might be that the equilibrium is easier to figure out for the control treatment. Consistent with the earlier results, contributions in the control and low sharing treatments are skewed to the right compared to the high sharing treatment. However, in all treatments, a majority of the subjects contribute close to the theoretical predictions.

Result 7: *There is some heterogeneity among subjects. Nevertheless, a majority of subjects contribute within 30% of the theoretical predictions (in percent wealth) in all treatments.*

Next, we ask whether the deviations from the standard theory can be explained by the fairness, warm-glow or altruism models.

[33] Here class 0 allows for 10 percent deviations from the equilibrium in both ways. Other classes are defined in a similar manner.

Figure 4: Percent frequency of individuals consistent with the theoretical predictions



Are non-standard preference models consistent with the observed data?

The inequality aversion models do not seem to be consistent with the data (similar to the earlier findings of Buckley and Croson, 2006).[34] We have seen that the low income class over-contributes and the high income class under-contributes compared to the standard theory predictions (see Result 6). This increases the income inequality even further. In addition, the deviations observed under the equal income distribution cannot be explained by inequality aversion.

Similarly, warm-glow and altruism models cannot consistently explain all the deviations from the standard theory. Under the equal income distribution the warm-glow and altruism models predict higher contributions for any γ (relative to the standard theory). However, observed contributions are not significantly higher than the standard theory predictions under $\gamma = 0$. Moreover, total contributions are significantly lower under $\gamma = 0.9$ (see Result 5). Similarly, for the unequal income distribution and $\gamma = 0$, we expect both the middle and high income classes to contribute significantly higher than the predicted level as well. In contrast, we observe that high income class under-contributes compared to the predicted level by the standard theory.

[34]Buckley and Croson (2006) also show that inequality aversion models do not predict behavior well in a laboratory experiment (in a linear public goods set-up): 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. However, these models may perform well for charitable contributions where contributions do not benefit the contributor directly (Derin-Gure and Uler, 2010).

Result 8: *The deviations in the data from the standard theory predictions cannot be consistently explained by the inequality aversion, warm-glow or altruism models.*

5 Conclusion

Policy makers search for ways to prevent free riding and increase voluntary giving to efficient levels. Empirical studies of the effect of tax policies on voluntary 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.[35] In addition, the experimental design allows us to test the effect of pre-tax income inequality on voluntary contributions. I find that there is a negative relationship between the voluntary giving and ex-ante equalizing redistribution. In contrast, voluntary contributions increase with the tax rate in accordance with the theoretical predictions.

There are several directions for future research. First, the paper only considers a flat-rate tax system. Second, to increase the treatment effects, large tax rates are used in this experiment. Future research should address the robustness of the results with different tax policies and a different set of tax rates.[36]

Third, when effort is endogeneously determined, individuals may choose to work less and earn lower income under a more egalitarian tax rate. As Uler (2009) shows this may decrease the total welfare. However, higher tax rates do not necessarily imply that total income will fall. Recent literature provides evidence on the fact that redistribution may also have a positive impact on growth (i.e., Saint Paul Verdier, 1996; Easterly and Rebelo, 1993a, 1993b; Galor and Zeira, 1993; Sala-i Martin, 1996). If redistribution does not decrease the total income, then higher levels of taxation will increase the social well being. Fourth, in addition

[35]For a general overview of using laboratory experiments in public economics, see Alm and Jacobson (2007).

[36]Another possible robustness check is to see whether taxation has a political connotation which may not be captured in our experimental setting.

to the endogenous reaction of labor markets to the changes in tax rates, recent experimental literature suggests that altruism or willingness to donate to public goods may differ when individuals earn their endowment (Cherry et al., 2002; Hoffman et al., 1994; Oxoby and Spraggon, 2008). Fifth, preferences for redistribution may be influenced by values and beliefs about distributive justice as well as by self-interest (i.e., Eckel, Grossman and Milano, 2007; Erkal, Gangadharan and Nikiforakis, 2009; Konow, 2000; Rey-Biel, Sheremeta and Uler, 2010). People may prefer more redistribution to the poor if they believe that poverty is caused by circumstances beyond individual control. Therefore, this paper provides insights into public goods provision and taxation for the short-run where individuals may not be able to react to the changes in the tax policies immediately and their beliefs on the source of inequality have not yet been affected. An important direction for future research is therefore to endogenize earnings in the experiment to study long-term consequences of taxation on public goods provision.

References

[1] Alm, James and Sarah Jacobson (2007) "Using Laboratory Experiments in Public Economics" National Tax Journal, Vol. LX, No. 1. pp. 129-152.

[2] Anderson, Lisa R., Jennifer M. Mellor and Jeffrey Milyo (2004), "Inequality and Public Good Provision: An Experimental Analysis." Working Paper, College of William and Mary.

[3] Andreoni, James (1989), "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence." The Journal of Political Economy, Vol. 97, No. 6, pp. 1447-1458.

[4] Andreoni, James (1990), "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving" The Economic Journal, 100, 464-477.

[5] Andreoni, James (2006), "Philanthrophy," in S-C. Kolm and J. Mercier Ythier, eds., Handbook of Giving, Reciprocity and Altruism, Amsterdam: North Holland, 2006, page 1201-1269

[6] Andreoni, James and Ted Bergstrom (1996), "Do Government Subsidies Increase the Private Supply of Public Goods?" Public Choice, Springer, vol. 88(3-4), pages 295-308, September.

[7] Andreoni, James and James Miller (2002) "Giving According to GARP: An Experimental Test of the Consistency of Preferences for Altruism." Econometrica, 70 (2):737-753.

[8] Andreoni, James and Lise Vesterlund (2001) "Which is the Fair Sex? Gender Differences in Altruism." Quarterly Journal of Economics, 116 (1): 293-312.

[9] Alesina, A. and Angeletos G. M. (2005) "Fairness and Redistribution." American Economic Review, Vol.95, No.4, 960-980.

[10] Auten, Gerald E., James M. Cilke, and William C. Randolph (1992), "The Effects of Tax Reform on Charitable Contributions." National Tax Journal, 45(3) (September), 267-290.

[11] Auten Gerald E., Holger Sieg and Charles T. Clotfelter (2002), "Charitable Giving, Income and Taxes: An Analysis of Panel Data." The American Economic Review, Vol. 92, No. 1, pp. 371-382.

[12] Bergstrom, T., Blume, L. and Varian H. (1986) "On The Private Provision of Public Goods." Journal of Public Economics, 29, 25-49.

[13] Buckley, Edward and Rachel Croson (2006) "Income and Wealth Heterogeneity in the Voluntary Provision of Linear Public Goods." Journal of Public Economics, 90, 935-955.

[14] Chan, Kenneth S., Stuart Mestelman, Rob Moir and R. Andrew Muller (1996) "The Voluntary Provision of Public Goods under Varying Income Distributions." The Canadian Journal of Economics, Vol. 29, No. 1, 54-69.

[15] Chan, Kenneth S., Mestelman, Stuart, Moir, Rob, Muller, R. Andrew, 1999. Heterogeneity and the voluntary provision of public goods. Experimental Economics 2 (1), 5 –30.

[16] Chen, Y. (2004) "Incentive-Compatible Mechanisms for Public Goods: A Survey of Experimental Research." in C. Plott and V. L. Smith, (eds.), The Handbook of Experimental Economics Results, Amsterdam: Elsevier Press.

[17] Cherry, Todd L., Frykblom, Peter, and Jason F. Shogren (2002), "Hardnose the Dictator", American Economic Review, 92(4): 1218-1221.

[18] Clotfelter, Charles T. (1985), "Federal Tax Policy and Charitable Giving." Chicago: University of Chicago Press.

[19] Clotfelter, Charles T. (1990), "The Impact of Tax Reform on Charitable Giving: A 1989 Perspective," in Do Taxes Matter, J. Slemrod (ed.), MIT Press, 203-235

[20] Cornes, R. and Todd Sandler (2000) "Pareto-Improving Redistribution and Pure Public Goods." German Economic Review, 1 (2): 169-186.

[21] Davis, D. D., Millner, E. L., and R. J.Reilly (2005), "Subsidy schemes and charitable contributions: a closer look." Experimental Economics, 8: 85-106.

[22] Davis, D. D., and E. L Millner (2005), "Rebates and matches and consumer behavior." Southern Economic Journal, 72: 410-421.

[23] Derin, P. and Uler N. (2007) "Inequality Aversion and Public Goods Provision", Working Paper

[24] Easterly, W., Rebelo, S. (1993a) "Fiscal policy and economic growth: An empirical investigation", Journal of Monetary Economics 32, 417-458.

[25] Easterly, W., Rebelo, S. (1993b) "Marginal income tax rates and economic growth in developing countries", European Economic Review 37, 409-417.

[26] Eckel, Catherine C. and Grossman, Philip J., 2003. "Rebate versus matching: does how we subsidize charitable contributions matter?," Journal of Public Economics, Elsevier, vol. 87(3-4), pages 681-701, March.

[27] Eckel, Catherine C., and Philip J. Grossman (2006a), "Do donors care about subsidy type? An experimental study." In D. Davis, and M. Isaac (Eds.), Research in experimental economics, Vol. 11. Experiments investigating fundraising and charitable contributions (pp. 163-182). New York: JAI Press.

[28] Eckel, Catherine C., and Philip J. Grossman (2006b), "Subsidizing charitable giving with rebates or matching: further laboratory evidence." Southern Economic Journal, 72(4): 794-807.

[29] Eckel, Catherine C., and Philip J. Grossman (2008), "Subsidizing charitable contributions: a natural field experiment comparing matching and rebate subsidies." Experimental Economics, 11: 234-252.

[30] Eckel, Catherine C., Philip J. Grossman and Angela Milano (2007), "Is More Information Always Better? An Experimental Study of Charitable Giving and Hurricane Katrina", Southern Economic Journal 2007, 74(2), 388-411

[31] Erkal, Nisvan, Gangadharan , Lata, and Nikos Nikiforakis (2010),"Relative Earnings and Giving in a Real-Effort Experiment", working paper, University of Melbourne

[32] Falkinger, J. (1996) "Efficient Private Provision of Public Goods by Rewarding Deviations from Average." Journal of Public Economics, 62, 413-422.

[33] Falkinger, J., Fehr, E., Gaechter, S. and Winter-Ebmer, R. (2000) "A Simple Mechanism for the Efficient Provision of Public Goods: Experimental Evidence" The American Economic Review, vol. 90, no. 1, pp. 247-264.

[34] Galor, O. and J. Zeira (1993), Income Distribution and Macroeconomics, Review of Economic Studies, 60:35-52.

[35] Hoffman, E., McCabe, K., Shachat, K., and Vernon Smith (1994), “Preference, Property Rights and Anonymity in Bargaining Games.” Games and Economic Behavior, 7: 346-380.

[36] Isaac, R.M. and Walker, J.M. (1988) “Group Size Effects in Public Good Provision: The Voluntary Contributions Mechanism.” The Quarterly Journal of Economics, Vol. 103, No.1, 179-199.

[37] Itaya, J., Meza, D. and Myles, G.D. (1997) “ In Praise of Inequality: public good provision and income distribution.” Economics Letters, 57, 289-296.

[38] Karlan, Dean and John A. List (2007) “Does Price Matter in Charitable Giving? Evidence from a Large-Scale Natural Field Experiment.” American Economic Review, vol. 97(5), pages 1774-1793, December.

[39] Konow, J. (2000) “Fair Shares: Accountability and Cognitive Dissonance in Allocation Decisions” The American Economic Review, Vol. 90, No. 4 (Sep., 2000), pp. 1072-1091.

[40] Ledyard, John (1995) “Public Goods: A Survey of Experimental Research.” in The Handbook of Experimental Economics. Roth and Kagel, eds. Princeton, NJ: Princeton University Press.

[41] Nalbantian, H. and Andrew Schotter (1997) “Productivity under Group Incentives: An Experimental Study”, The American Economic Review, Vol. 87, No. 3, pp. 314-341.

[42] Noussair, C., C. Plott, R. Riezman (1995) “An Experimental Investigation of the Patterns of International Trade”, The American Economic Review, Vol. 85, No. 3, pp.462-491.

[43] Olson Mancur (1965). “The Logic of Collective Action: Public Goods and the Theory of Groups.” Cambridge: Harvard University Press.

[44] Olszewski, W., Rosenthal, H. (2004) “Politically Determined Income Inequality and The Provision of Public Goods.” Journal of Public Economic Theory, 6 (5), 707-735.

[45] Oxoby, Robert J., and John Spraggon (2008), "Mine and yours: Property rights in dictator games." Journal of Economic Behavior and Organization, 65: 703-713.

[46] Peloza John and Piers Steel (2005), "The Price Elasticities of Charitable Contributions: A Meta Analysis." Journal of Public Policy and Marketing, 24 (2), 260-272.

[47] Randolph, William (1995), "Dynamic Income, Progressive Taxes, and the Timing of Charitable Contributions" Journal of Political Economy, 103 (4), 709–738.

[48] Rapoport Amnon and Ramzi Suleiman (1993), "Incremental Contribution in Step-level Public Goods Games with Asymmetric Players." Organizational Behavior and Human Decision Processes, Vol. 55, 171-194.

[49] Ray, D. and Ueda, K. (1996) "Egalitarianism and Incentives." Journal of Economic Theory, vol. 71, issue 2, pages 324-348.

[50] Reece, William (1979), "Charitable Contributions: New Evidence on Household Behavior" American Economic Review, 69, 142-51.

[51] Rey-Biel P., R. Sheremeta, and N. Uler (2010), "Rewarding Effort and/or Luck: A Cross-Cultural Study", working paper.

[52] Saint Paul, G. and T. Verdier (1996) "Inequality, redistribution and growth: A challenge to the conventional political economy approach", European Economic Review, 40, 719-728.

[53] Sala-i-Martin, Xavier (1996), "Transfers, Social Safety Nets, and Economic Growth" , IMF Working Paper No. 96/40 Available at SSRN: http://ssrn.com/abstract=882940

[54] Uler, N. (2009) "Public Goods Provision and Redistributive Taxation", Journal of Public Economics, Elsevier, vol. 93(3-4), pages 440-453, April.

[55] Warr, P. (1983) "The Private Provision of a Public Good is Independent of the Distribution of Income." Economic Letters, 13, 207-211.

[56] Vesterlund, Lise (2006), "Why do People Give?" in Richard Steinberg and Walter W. Powell eds., The Nonprofit Sector, 2nd edition, Yale Press.