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Abstract

We examine how taxes impact giving to charity and how this relationship is affected by the degree of wasteful government spending. In our model, government collects a flat-rate tax on income net of charitable donations and redistributes part of the tax revenue. The rest of the tax revenue is wasted. The model predicts that (i) a higher tax rate increases charitable donations, (ii) a higher rate of waste increases (decreases) donations when the elasticity of marginal utility is low (high), and (iii) the marginal effect of the tax rate on donations is always larger than the marginal effect of the rate of waste on donations. We test these predictions using a laboratory experiment with actual donations to charities. We find that the tax rate on average has a weak and insignificant effect on giving. The degree of waste, however, has a large, negative and highly significant effect on giving, with the relationship being moderated by the elasticity of marginal utility. We discuss potential policy implications of our findings.

JEL Classifications: C93, D64, H21
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1. Introduction

Recent polls conducted in the US show that people believe that part of the tax revenue is wasted by the government. According to a 2014 Gallup Poll, Americans estimate that the federal government wastes 51% of each tax dollar.[1] Similarly, according to a HuffPost/YouGov poll conducted in 2013, 69% of Americans think that most of the federal budget deficit could be eliminated by cutting "waste and fraud," where examples of wasteful government spending include salaries and perks for government employees, foreign aid, and military spending.[2]

In this paper we study how taxation affects giving in the presence of a redistributive government that wastes part of the tax revenue. A sizable literature studies the effect of a tax rate on charitable donations and argues that an increase in the tax rate decreases both the price of giving and the income of donors, creating an ambiguous net effect. When part of the tax revenue is wasted (instead of being redistributed back), both the price of giving and the net income of individuals depend not only on the tax rate but also on the degree of waste. To examine how taxes impact giving and how this relationship is affected by the wastefulness of government spending, we provide a theoretical model and conduct a laboratory experiment.

In our model, a public good is provided through private contributions by individuals. The government's role is to collect a flat-rate tax on income net of contributions to the public good and to redistribute the tax revenue. During redistribution, part of the collected tax revenue is wasted (e.g., government spends this money on things that the individuals do not value). Our theoretical model can isolate the effects of the tax rate and wasteful government spending on giving. Consistent with previous theoretical and empirical literature, our model predicts that under innocuous conditions the substitution effect dominates the income effect and, hence, there is a positive relationship between donations and the tax rate. The novelty of our paper is to study the relationship between the level of waste and donations to charities. We find that the substitution effect generated by a higher tax rate is larger than the substitution effect generated by a higher

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[1] See http://www.gallup.com/poll/176102/americans-say-federal-gov-wastes-cents-dollar.aspx. The estimated rate of waste differs across Republicans and Democrats, with Republicans estimating 59 cents and Democrats estimating 42 cents per dollar. In this paper in order to isolate the effect of waste on giving we consider a simple model with individuals being homogenous with respect to their perceptions.

[2] See http://www.huffingtonpost.com/2013/03/18/wasteful-spending-poll_n_2886081.html. Based on the survey responses the article argues that "for many, waste is indeed defined as 'money spent on some government program I don't like'." Note that these perceptions may exogenously change over time depending on government actions or even through simple debates (e.g., discussions of wasteful government spending during elections may heighten individuals' perception about waste).

level of waste, while the income effects are similar. Therefore, the marginal effect of the tax rate on donations is always larger than the marginal effect of the rate of waste on donations. Furthermore, our model shows that the income effect may dominate the substitution effect when the rate of waste increases depending on the elasticity of marginal utility with respect to consumption. In addition, we show that when the economy is large enough, the substitution effect due to a change in the degree of waste approaches zero independent of the elasticity of marginal utility. Therefore, in large economies, the income effect always dominates the substitution effect when the degree of waste increases, leading to a negative relationship between the rate of waste and donations.

We test our model using a laboratory experiment with actual donations to charities. As opposed to naturally occurring data, our controlled environment shuts down the possibility of differences in belief about how tax revenue is used, changes in income over time, as well as other potential confounds which one usually needs to control for when estimating the impact of taxes on charitable donations (see, for example, Andreoni and Payne, 2013). In our experiment, participants earn income, part of which they can donate to a charity. Participants choose their donation amount knowing that a flat-rate tax would be applied on their remaining income, and part of the collected tax revenue would go back to the experimenter, with the remaining part evenly redistributed among the participants within their group. By changing the level of taxes and how much of the tax revenue is wasted (i.e., money received neither by charities nor by participants), we are able to isolate and test the impact of the tax rate and wasteful tax revenue spending on giving in a controlled setting.

Our results show that the tax rate on average has a weak and insignificant effect on giving. The degree of waste, however, has a large, negative and highly significant effect on giving. Consistent with the theoretical predictions, we find that the relationship between giving and waste is moderated by the elasticity of marginal utility. Moreover, as predicted, the marginal effect of the tax rate on donations is statistically significantly larger than the marginal effect of the rate of waste on donations. Also, we document substantial heterogeneity in how individuals respond to changes in the tax rate and the degree of waste.

Our study has important policy implications. First, we find that on average the relationship between the tax rate and donations is weak, suggesting that higher taxes may not change charitable giving (in environments where income loss from taxation is very salient). Second, the degree of waste plays a large role in giving decisions. Our experiment shows that even when the number of people in a given group is very small, the average effect of wasteful government spending on giving is negative. Our theory predicts that for larger economies the effect of wasteful government spending would be even more negative. Increasing the efficiency of how tax revenues are used, as well as providing individuals with better information on public services financed by tax revenues could make a big difference in generating additional charitable giving. Third, tax rates might endogenously affect perception about wasteful government spending. For example, if higher taxes imply higher perception about waste, then we may actually see a decrease – not increase – in charitable donations as taxes increase. Empirical studies estimating price and income elasticities of giving would benefit by controlling for the confounding effect of perception about wasteful government spending.

We discuss related literature in Section 2. In Section 3 we present a theoretical model and develop testable hypotheses. In Section 4 we discuss our experimental design and procedures. Section 5 provides our results and Section 6 concludes.

2. Literature Review

In the United States, individual donations constitute one of the major sources of revenue for many charities. Since most charitable donations are tax deductible, a higher tax rate affects charitable giving in two major ways. On the one hand, because of deduction benefits, higher taxes decrease the price of giving, which leads to a positive effect on giving (the substitution effect). On the other hand, higher taxes reduce after-tax net income, which has a negative effect (the income effect). The empirical literature provides mixed findings on the magnitude of the net effect (Clotfelter, 1985, 1990; Randolph, 1995; Auten et al., 2002; Bakija and Heim, 2011; Hungerman and Ottoni-Wilhelm, 2016).

Earlier empirical studies using cross-sectional data argue that a tax cut leads to a decrease in charitable giving. In particular, Clotfelter (1985, 1990) estimates the price elasticity to be greater than one in absolute value while income elasticity to be less than one. Using panel data, Randolph (1995) finds that charitable giving is relatively insensitive to price changes, suggesting that permanent changes in the price of giving have a small effect on voluntary contributions. In contrast, Auten et al. (2002) find substantial permanent price elasticity using a different estimation technique. More recently, Bakija and Heim (2011) find the price elasticity greater than one in absolute value, while Hungerman and Ottoni-Wilhelm (2016) report a price elasticity of 0.2.

Observational data suffers from problems such as omitted variables and endogeneity biases and, therefore, the estimates of price and income elasticities are very sensitive to the estimation techniques. While, in general, the substitution effect of a tax rate increase is expected to dominate the income effect, the magnitude of the net effect of taxation on charitable donations is still not clearly understood (Andreoni, 2006; List, 2011; Vesterlund, 2016).

A theoretical foundation for the impact of taxation on charitable giving has been provided by Warr (1982) and Bergstrom et al. (1986). These papers show that purely redistributive taxation (that does not change the set of contributors) should have no effect on total public goods provision.[3] Uler (2009) extends the standard model by assuming that charitable donations to the public good are tax deductible and, therefore, redistribution takes place over income net of contributions. The model demonstrates that, under a general class of utility functions, the substitution effect dominates the income effect. Hence, charitable giving increases when the tax rate increases. To the best of our knowledge, however, none of the theoretical models has addressed the case of wasteful government spending (i.e., the case when part of the tax revenue is wasted).

Besides empirical and theoretical work, a number of experimental studies have analyzed how price and income affect individuals giving. Most experimental studies find that, as predicted by economic theory, giving decreases in price (Andreoni and Vesterlund, 2001; Andreoni and Miller, 2002).[4] For example, Eckel and Grossman (2003) conduct a laboratory experiment in which participants choose how much to contribute to a charity under different rebate and match rates and find that contributions decrease in price.[5] Eckel and Grossman (2008) replicate their laboratory findings in a natural field setting. Similarly, Karlan and List (2007) find a negative relationship between price and giving for some range of prices.[6] Experimental evidence about the relationship between income and giving is mixed. Eckel and Grossman (2003, 2008), Eckel et al. (2007) and Rey-Biel et al. (2015) find a positive relationship between income and giving, while

[3] This result would not hold if individuals also have warm-glow motives (Andreoni, 1990). Impure altruism model explains why crowding out is not complete when government provides public funds to charities. Interestingly, Hungerman (2014) shows that when individuals hide income, this creates a deadweight loss and this leads to a surprising finding: warm-glow implies more crowding out in a setting where individuals can evade taxes.

[4] Andreoni and Vesterlund (2001) focus on gender differences in altruism and show that men are more price sensitive. Andreoni and Miller (2002) show that the preferences for altruism can be explained by rational models.

[5] They also find that participants are sensitive to how a subsidy is framed. Other studies comparing subsidy types include Davis et al. (2005), Davis and Millner (2005), Eckel and Grossman (2006a, 2006b), and Blumenthal et al. (2012).

[6] They find that offering to match contributions ($1:$1) increases individual giving. However, further lowering the price by offering larger match ratios ($3:$1 and $2:$1) has no additional impact on giving.

other studies find a negative relationship (Erkal et al., 2011) or no significant relationship at all (Andreoni and Vesterlund, 2001; Buckley and Croson, 2006).[7]

Perhaps the most related study to ours is by Uler (2011), examining how taxes impact individual contributions within a laboratory public goods setting. However, field experiments testing economic theories demonstrate that the results of laboratory experiments may not translate into real world decisions (Levitt and List, 2007). In the public goods game experiments, donations have monetary benefits to each participant, while charitable contributions in the field have no direct personal monetary gain. Most importantly, however, our study differs from previous work by examining how wasteful government spending impacts individual giving.

In order to isolate the direct effects of tax rate and wasteful government spending on giving, our experimental study controls for two important confounds that are difficult to control for when using naturally occurring data. First, wasteful government spending may provoke tax evasion which might in turn affect charitable donations. Barone and Mocetti (2011) find that the attitude towards paying taxes is better when resources are spent more efficiently, and Alm et al. (2016) show that corruption results in higher levels of tax evasion. Our experimental design eliminates tax evasion as a potential confound by automatically taxing all participants in the experiment. Second, there is a possibility of tax rates affecting labor supply decisions; see Saez et al. (2012) for a survey of this literature. Our experimental design eliminates this confound by assigning income to participants prior to the knowledge that part of this income will be taxed.

3. The Theoretical Model and Hypotheses

3.1. The Model

We consider an environment with one private good, one pure public good, and $n > 1$ agents. The public good is provided privately through charitable contributions. Each agent i has an exogenous endowment of y_i units of private good, and decides to contribute g_i to the public good. One unit of public good can be produced by one unit of private good. Therefore, the level of public good provision is equal to the total giving, i.e., $G = \sum_{i=1}^{n} g_i$. The total amount of endowment in the economy is denoted by $Y = \sum_{i=1}^{n} y_i$.

[7] In a survey paper on empirical findings, Auten et al. (2000) argues that the relationship between income and donations is U-shaped.

The government collects a flat-rate tax t, $0 \leq t \leq 1$, on income net of contributions to the public good and redistributes a fraction of the tax revenue equally.[8] During redistribution, part of the collected tax revenue w, $0 \leq w \leq 1$, is wasted.[9] Therefore, individual i's private consumption c_i, after contributing to the public good, paying his/her taxes and receiving refund from the government, is given by

$$c_i = (1-t)(y_i - g_i) + (1-w)\frac{t\sum_{j=1}^{n}(y_j - g_j)}{n}. \quad (1)$$

The preferences of individuals are represented by an additively separable utility function $u(c_i) + v(G)$, where $u(.)$ and $v(.)$ are strictly increasing, strictly concave, twice continuously differentiable functions and satisfy the Inada conditions. Finally, in order to simplify the analysis, we assume everyone contributes in the equilibrium. Note that this latter assumption is reasonable as long as the ex-ante wealth inequality is not very large (Bergstrom et al., 1986; Uler, 2009).[10]

Each individual chooses their contribution level by taking other individuals' contributions as given. If everyone contributes in the equilibrium, the first order condition for an individual i simplifies to:

$$u'(c_i)\left(1 - \left(1 - \frac{1-w}{n}\right)t\right) = v'(G). \quad (2)$$

Since the right hand side of this equation is the same for each individual, we can infer that in equilibrium all agents consume the same amount of the private good. Note that this implies that the "distribution neutrality" result of Bergstrom et al. (1986) holds in this model as well: total

[8] Two comments: First, we focus on the redistributive role of the government and assume the tax revenue is being redistributed. Since redistribution is a special form of a public good, it is not difficult to generalize the model to any public good provision as long as the government provides a *different* public good than the charity. The only difference is that this time our results will condition on the utility over the public good provided by the government (instead of on the consumption utility). Second, we also investigate the case where government and the charity provide the *same* public good (i.e., Andreoni, 1993; Bolton and Katok, 1998; Eckel et al., 2005; Li et al., 2011). We find that, if the government uses tax revenue to provide the same public good as the charity (or to provide a grant to the charitable organization), then higher tax rate always leads to lower donations to charities when the level of waste is fixed and higher rate of waste by the government always leads to higher donations to charities when the tax rate is fixed. Note that the reason this case always generates a negative relationship between tax rate and donations (and a positive relationship between waste and donations) is because governmental provision and charitable provision are substitutes. While this case is also interesting, in this paper we choose to present the case where government and the charity provides different public goods. Therefore, donations are expected to increase with the tax rate which is consistent with the empirical literature in this particular context.

[9] One can think of the waste as government funding programs that the individuals do not care for, or alternatively, it could be considered as inefficient spending.

[10] Our results on the effect of the tax rate and the degree of waste on giving do not depend on this assumption. Proofs dropping this assumption are available upon request.

public goods provision does not depend on the initial income distribution.[11] The first order condition simplifies to:

$$u'\left((1-wt)\left(\frac{Y-G}{n}\right)\right)\left(1-\left(1-\frac{1-w}{n}\right)t\right)=v'(G), \tag{3}$$

This condition is intuitive. Each agent chooses the level of contribution that would equalize the marginal benefit of contributing to the marginal cost of an additional unit of contribution. Note that the equilibrium is uniquely determined.[12]

The first question we would like to answer is what happens to contributions when the tax rate increases for a given degree of waste. From equation (3) we see that higher taxes have two opposing effects on the equilibrium level of contributions: (i) a higher tax rate implies a lower price of giving which has a positive effect on contributions (the substitution effect), (ii) a higher tax rate implies a lower ex-post consumption, which has a negative effect on contributions (the income effect). In order to solve for the net effect of taxes on giving, we differentiate equation (3) with respect to the tax rate t and then solve for $\frac{\partial G}{\partial t}$:

$$\frac{\partial G}{\partial t}=-\frac{u''(b)w\left(\frac{Y-G}{n}\right)(1-at)+u'(b)a}{v''(G)+u''(b)\left(\frac{1-wt}{n}\right)(1-at)}, \tag{4}$$

where $a=1-\frac{1-w}{n}$ and $b=(1-wt)\left(\frac{Y-G}{n}\right)$. Since the denominator is always negative, the sign of the numerator determines the sign of the partial derivative of G with respect to t. Our first result, generalizing the findings of Bergstrom et al. (1986) and Uler (2009), follows:

Theorem 1: For a given degree of waste $0<w<1$, if $u(x)$ satisfies $-\frac{u''(x)x}{u'(x)}\leq 1$, then the total public good provision G is a strictly increasing function of the tax rate t.[13]

While Uler (2009) shows that in the interior equilibrium, total public good provision G is a strictly increasing function of the tax rate t independent of the curvature of the consumption

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[11] Similar to Bergstrom et al. (1986), this result holds only when the set of contributors do not change as the initial income distribution changes. If the set of contributors change when initial income distribution changes, then the model would predict higher contributions when income inequality increases. Hence, similar to Bergstrom et al. (1986) and Uler (2009) there is a trade-off between contributions and (initial) income equality.

[12] This can be seen by using equation (3) and the fact that each individual consume the same amount of the private good.

[13] Note that if $w=1$, total public goods provision would still be a strictly increasing function of the tax rate, if $-\frac{u''(x)x}{u'(x)}<1$.

utility, Theorem 1 shows that curvature becomes important when there is waste.[14] Theorem 1 states that when $w > 0$, whether individuals increase their donations when the tax rate increases depends on the *elasticity of the marginal utility function* with respect to consumption, given by $-\frac{u''(x)x}{u'(x)}$.[15] Note that in environments that involve risk, the same coefficient is also referred to as the *relative risk aversion coefficient*. See Appendix A for a proof of Theorem 1.

Corollary 1: If the agents' consumption preferences are defined by the *Constant Relative Risk Aversion* (CRRA) utility function $u = \frac{x^{(1-\theta)}}{(1-\theta)}$ for $\theta \neq 1$ and $u = \ln(x)$ for $\theta = 1$, then Theorem 1 implies that, for a given degree of waste and for $\theta \leq 1$, public good provision strictly increases when the tax rate increases.

The conditions provided in Theorem 1 and Corollary 1 are very mild. Therefore, one would expect substitution effect to dominate the income effect in the context of donations and the tax rate.

Next, we analyze the relationship between the degree of waste and donations while fixing the tax rate. From equation (3) we see that a higher degree of waste has two opposing effects on the equilibrium level of contributions: (i) a higher degree of waste implies a lower price of giving which has a positive effect on contributions (the substitution effect), (ii) a higher degree of waste implies a lower ex-post consumption which has a negative effect on contributions (the income effect). These opposing effects are very similar to the ones with the tax rate. In fact, the income effects of changing t and w are similar. However, note that the effect of a small change in the tax rate on the price of giving is given by $\left(1 - \frac{1-w}{n}\right)$, whereas the effect of a small change in the rate of waste on the price of giving is given by $\frac{t}{n}$. Since $\left(1 - \frac{1-w}{n}\right)$ is always greater than $\frac{t}{n}$, the substitution effect in the case of waste is not as strong as the substitution effect in the case of tax rate t. Therefore, the condition we derived in Theorem 1 will not hold here. A formal argument for this intuition is stated in Theorem 4.

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[14] When $w = 0$ there is only the substitution effect, and hence the effect of taxes on giving becomes trivial, and does not require any additional assumptions on the utility function.

[15] Note that $\frac{u''(x)x}{u'(x)} = \frac{\frac{du'(x)}{dx}x}{u'(x)} = \frac{\frac{du'(x)}{u'(x)}}{\frac{dx}{x}}$. It can also be interpreted as the sensitivity of the marginal rate of substitution between private consumption and public good consumption to price changes: the derivative of marginal rate of substitution with respect to the price of private consumption (see Mirrlees, 1971).

In order to solve for the net effect of w on giving, we differentiate equation (3) with respect to w and then solve for $\frac{\partial G}{\partial w}$:

$$\frac{\partial G}{\partial w} = -\frac{u''(b)t\left(\frac{Y-G}{n}\right)(1-at)+u'(b)\frac{t}{n}}{v''(G)+u''(b)\left(\frac{1-wt}{n}\right)(1-at)}. \tag{5}$$

Since the denominator in equation (5) is always negative, the sign of the numerator determines the sign of the partial derivative of G with respect to w. Theorem 2 gives sufficient conditions for the substitution effect to dominate the income effect. Appendix A provides a proof.

Theorem 2: For a given tax rate $0 < t \leq 1$, if $u(x)$ satisfies $-\frac{u''(x)x}{u'(x)} \leq \frac{1}{n}$, then the total public good provision G is a strictly increasing function of the degree of waste w.

There are two important observations to make. First, Theorem 2 provides a stronger condition relative to Theorem 1, and, therefore, the condition may not hold. Second, the sufficient condition depends not only on the shape of the utility function but also on the number of people in the economy n. As n increases it becomes harder for this condition to hold.[16] In fact, for large economies (when $n \to \infty$), this condition will not hold for any consumption utility with diminishing marginal returns. This important result suggests that the income effect may dominate the substitution effect and lead to a negative relationship between the rate of waste and donations to the public good even when the substitution effect dominates the income effect for a tax rate change. The intuition for why the income effect may dominate the substitution effect when the rate of waste changes is that, for large economies, collected taxes have very little direct price incentives for individuals. In fact, as $n \to \infty$, the direct benefit from a price change converges to zero, which also implies that the substitution effect converges to zero. But even for a small number of agents it is not hard to see that the condition in Theorem 2 can be violated. Corollary 2 shows a very standard utility function that demonstrates this possibility.

Corollary 2: If the agents' consumption preferences are defined by the CRRA utility function $u = \frac{x^{(1-\theta)}}{(1-\theta)}$ for $\theta \neq 1$ and $u = \ln(x)$ for $\theta = 1$, then Theorem 2 implies that giving strictly increases when the degree of waste increases if $\theta \leq \frac{1}{n}$. Note that for any $\theta > 0.5$, this condition will not be satisfied for any number of agents.

[16] In the experiment, we have three people in one group. Note that if this condition does not hold for $n = 3$, then we do not expect it to hold with $n > 3$. In fact, our data suggest that this condition does not hold for $n = 3$.

While Theorem 2 and Corollary 2 are very useful in providing the sufficient conditions for a positive relationship between donations and the rate of waste, they do not inform us when to expect a definite negative relationship between donations and the rate of waste. Theorem 3 derives a sufficient condition for donations to decrease in the degree of waste under the CRRA utility function. Proofs are available in Appendix A.

Theorem 3: If the agents' consumption preferences are defined by the CRRA utility function, giving strictly decreases when the degree of waste increases if $\theta > \frac{(1-wt)}{(1-at)n}$.[17]

Note that the condition in Theorem 3 is automatically satisfied for any positive θ in very large economies. Corollary 3 shows that if individuals have logarithmic consumption utility, then charitable donations increase when the tax rate increases and they decrease when the degree of waste increases *independent* of the size of the economy.

Corollary 3: If the agents' consumption preferences are given by $\ln(c) + v(G)$, where $\theta = 1$, our model predicts: (i) for a given w, public good provision increases when t increases, (ii) for a given t, public good provision decreases when w increases.

Note that (i) is true because the sufficient condition in Theorem 1 is satisfied, and (ii) comes from Theorem 3 since $\frac{(1-wt)}{(1-at)n} < 1$ for any $n \geq 2$.

Finally, Theorem 4 summarizes the comparison between the impacts of a tax change on donations versus a change in the degree of waste on donations and shows that the marginal effect of increasing the tax rate on giving is larger than the marginal effect of increasing the degree of waste on giving.

Theorem 4: If $u(x)$ satisfies $-\frac{u''(x)x}{u'(x)} \leq n$, then $\frac{\partial G}{\partial t} > \frac{\partial G}{\partial w}$ at any levels of tax and waste.

Note that the sufficient condition in Theorem 4 is very weak and should be satisfied given any standard utility function. We could even argue that for most standard utility functions the sufficient condition in Theorem 1 is satisfied. However, the sufficient conditions in Theorems 2 and 3 may or may not be satisfied.

[17] Note that $\frac{(1-wt)}{(1-at)n} \geq \frac{1}{n}$ for any $0 \leq w \leq 1$. When $w = 1$, $\frac{(1-wt)}{(1-at)n} = \frac{1}{n}$.

3.2. Hypotheses

Next we derive three testable hypotheses. First, assuming elasticity of marginal utility is less than or equal to 1, we conjecture that individual donations should increase when the tax rate increases:[18]

Hypothesis 1: For a given waste w, individual donations increase when the tax rate t increases.

However, donations may increase or decrease when the degree of waste increases depending on the elasticity of marginal utility. [19]

Hypothesis 2: The relationship between giving and w depends on the elasticity of marginal utility.

Finally, we suggest a way of testing the model that does not rely on the elasticity of marginal utility coefficient. Based on Theorem 4, we provide the following hypothesis.

Hypothesis 3: The marginal effect of the tax rate on giving is greater than the marginal effect of the degree of waste on giving for any $0 < t < 1$ and $0 < w < 1$.

By conducting an experiment with real donations, we have the needed control to test these hypotheses and we also can examine the net effect of the degree of waste on charitable donations.

4. Experimental Design and Procedures

The data come from an experiment conducted at the University of Michigan. In the Harrison and List (2004) taxonomy, our experiment is a 'framed field experiment' where participants have a chance to donate to actual charities. A total of 204 students participated in 12 experimental sessions.[20] Each session lasted one hour and fifteen minutes, on average, and had either 12 or 18 participants. The experiment proceeded in four parts and it was programmed using z-tree software (Fischbacher, 2007). The currency used in all parts of the experiment was U.S. dollars. Upon completion of the experiment, earnings from all parts of the experiment were added

[18] The main reason for making this assumption is to be consistent with the large empirical literature on taxes and donations which suggest a positive relationship. In addition, in our experiment, only 7 people did not satisfy this condition, according to our calculations based on our risk elicitation task in the experiment, which was used to approximate the elasticity of marginal utility coefficient. However, this assumption is not crucial for the theory or the data analysis.

[19] In Section 5.2, we also allow for heterogeneity and analyze whether individuals with different elasticity of marginal utility behave differently. We will use a risk elicitation task to approximate these elasticity coefficients and hypothesize that "If the relative risk aversion coefficient is not large, then donations will increase when w increases. If the relative risk aversion coefficent is large, then donations will decrease when w increases.

[20] These were mostly undergraduate students recruited by using the ORSEE software.

to a participation payment of $5. Participants received their payments in private and in cash, ranging from $15.50 to $57.75.

At the beginning of each part of the experiment, all participants were given written instructions, see Appendix B, and an experimenter read the instructions aloud. In part 1, participants took a 20-minute cognitive test containing 10 multiple-choice questions. The questions were drawn from a Graduate Record Examination (GRE) test preparation book (Seltzer, 2009). All were of moderate to high difficulty. Participants were told that they would gain one point for each correct answer and zero for an incorrect answer. Participants were also informed that upon completion of part 1, they will receive earnings which *may* depend on their relative performance in the test.[21]

In part 2, participants were randomly and anonymously matched into groups consisting of 3 participants. We chose $n = 3$ for three important reasons. First, it allows us to minimize mistakes/errors of experimental participants by creating the simplest possible environment for them while still keeping it rich enough to incorporate all the important factors that might influence their behavior. Second, it provides a very strong test for the theory. For larger values of n, it would not be possible to see whether the model makes the correct prediction regarding the impact of the curvature of the utility function on the relationship between donations and the degree of waste. Finally, $n = 3$ creates the hardest possible public good environment to observe a negative relationship between donations and the degree of waste.[22]

Each group was randomly assigned to a different charity and participants in a given group could simultaneously donate any amount to this charity, ranging from $0 to the amount earned in part 1 with increments of 5 cents.[23] In the *Equal* treatment, all members of the group received $30. In the *Unequal* treatment, participants who scored the best in part 1 received $45, participants in the middle received $30, and participants who scored the worst received $15. While the *Equal* treatment provides a simple environment to test our predictions, the *Unequal* treatment provides a relatively more realistic set-up to study our questions. It is important to stress that the focus of our

[21] Specifically, participants were told that the amount earned "may be the same for everyone in this room or each participant's earnings may depend on their relative performance in the test." We used this language to facilitate comparison between our two treatments: *Equal* versus *Unequal*.
[22] As we will show in Section 5, the estimated net effect of the degree of waste on giving is negative. If the net effect was instead positive, then one might argue that the net effect could have changed in a larger group of people. But since the net effect is negative, what we observe here serves as a lower bound for a larger economy.
[23] We used the following charities: American Cancer Society, American Red Cross, Doctors Without Borders, Feeding America, Food for Poor, and Save the Children.

study is to look at the effects of different tax rates and degrees of waste on giving, but we will also be able to study how different initial income distributions might be affecting giving decisions.[24]

After learning their earned income, all participants made their donations simultaneously. Participants knew that we would apply a tax (which was either 0%, 25%, 50%, or 75%) on each participant's remaining income and collect the corresponding amount of money. They also knew that we would evenly redistribute a share of the collected money among the participants within the same group, while part of the collected money (which was either 0%, 50%, or 100%) would be returned back to the experimenter. To avoid negative framings, we did not use the word "waste" in the experiment.[25] In our experiment, individual donations were anonymous.

Participants were asked to make 10 donation decisions under different combinations of the tax rate and the redistribution rate, as shown in Table 1. In addition Tables C1 and C2, in Appendix C, give reader an idea of how contributions would look like under specific utility functions. At the very end of the experiment, the computer randomly implemented one decision for payment and applied the appropriate tax rate and the redistribution (waste) rate to compute the final income for each participant. Then the experimenter sent the check to each charity with the total amount donated to that charity.[26]

In order to minimize calculation mistakes, participants were provided with a pre-programmed "calculator". A participant could enter the tax rate, redistribution rate and the possible donation decisions by themselves and the other participants in their groups. The calculator would then show the group donation, pre-tax income, tax payment, after-tax income, redistribution amount and the final income of the participant. Participants could use the calculator as many times as they like.

In part 3, we elicited participants' risk preferences in order to capture the curvature of their consumption utility which we use as an approximation for their elasticity of marginal utility. In a series of 15 binary choices, as shown in Table 2, participants were asked to choose between a risky option A ($9.0 or $1.0 with 50% chance each) and a safe option B (increasing monotonically from

[24] If the set of contributors do not change across the Equal and Unequal treatments, then our model would predict that the level of public goods provision should be the same across treatments (distribution-neutrality result). Otherwise, the model predicts higher total contributions under the Unequal treatment.
[25] Instead of using the word "waste" we chose to use "redistribution rate" since it is more natural and it was easier to explain to participants.
[26] Participants were told that they could receive confirmation that we actually sent the check to the charity. Specifically, we said: "If you want to get a confirmation about your donation, please include your e-mail address in the sign out sheet and we will have the charity automatically email you the total amount of donation by your group."

$0.5 to $7.5). One of the 15 choices was randomly selected to be paid out at the end of the experiment.[27] Information collected in part 3 allows us to test our Hypothesis 2 in a controlled manner, since our elasticity condition capturing the curvature of the utility function, $-\frac{u''(x)x}{u'(x)}$, corresponds to the relative risk aversion coefficient in our risk elicitation task.[28] As the curvature of the consumption utility increases, we expect individuals to choose a higher number of safe options. Therefore, by using the average relative risk aversion coefficient elicited from the data, we can test our Hypothesis 2: If individuals are not very risk-averse, then, for a given tax rate t, higher w leads to higher donations; however, for highly risk-averse individuals, higher w leads to lower donations.

Finally, it is important to control for social preferences. In part 4, each participant was randomly matched with another participant. Participants were asked to choose one of the four options ($2.00; $2.00), ($1.75; $3.00), ($2.25; $1.00) and ($2.00; $1.75), where first entry corresponds to their own payoff and the second entry corresponds to their paired participants payoff. After both participants made their decisions, the computer randomly determined whose decision to implement, and the earnings of both participants were determined accordingly.

At the end of the experiment, participants filled out a demographic questionnaire. Finally, after the computer displayed outcomes from all parts of the experiment and calculated individual earnings, participants received their payments in private.

5. Results

5.1. The Average Giving

Table 3 shows the average giving and the fraction of participants giving $0 by treatment. The left panel corresponds to the *Equal* treatment in which all participants received $30 and could donate part of this income to a charity. The right panel corresponds to the *Unequal* treatment in which participants received $45, $30, or $15. Recall that the total amount of income is fixed across *Equal* and *Unequal* treatments ($30+$30+$30 versus $45+$30+$15). The only difference is the level of income a participant receives. On average, when there is no tax (i.e., $t = 0\%$) participants donate $3.69 to a given charity in the *Equal* treatment and $3.83 in the *Unequal* treatment. The

[27] The parameters in this task were carefully designed in order to elicit a wide range of risk preferences.

[28] If agents have CRRA consumption utility functions, then $-\frac{u''(x)x}{u'(x)} = \theta$

difference is not statistically significant (Wilcoxon rank-sum, p-value = 0.70). The case of $t = 0\%$ is only for comparison purposes. When examining the effect of taxes and waste on giving, we only consider the case of $t > 0\%$ since when $t = 0\%$ waste is no longer a consideration for participants.[29]

We begin by examining how giving changes when t changes. In the *Equal* treatment, when participants know that there is no waste (i.e., $w = 0\%$), giving slightly increases from \$3.97 when $t = 25\%$ to \$4.06 when $t = 50\%$ and it increases to \$4.18 when $t = 75\%$. However, none of these differences are significant based on pair-wise Wilcoxon signed-rank test. Looking at the effect of higher taxes on giving at $w = 50\%$ and $w = 100\%$, we see first a decrease in giving and then an increase. While the first decrease at $w = 50\%$ is significant at the 0.05 level, none of the other cases are significant. Pooling across all levels of waste, the left panel of Figure 1 shows no significant relationship between the average giving and the tax rate t in the *Equal* treatment (none of the pair-wise comparisons are significant at the conventional statistical levels).

Similar response to changes in the tax rate is observed when examining the *Unequal* treatment. When participants know that there is no waste (i.e., $w = 0\%$), giving slightly increases from \$4.75 when $t = 25\%$ to \$4.90 when $t = 50\%$ and it decreases to \$4.57 when $t = 75\%$. However, these differences are not significant based on pair-wise Wilcoxon signed-rank test. Similarly, for waste levels of $w = 50\%$ and $w = 100\%$, there is no monotonic relationship between the tax rate and giving. The right panel of Figure 1 shows that the line representing the relationship between the average giving and the tax rate in the *Unequal* treatment is virtually flat, suggesting no significant correlation (none of the pair-wise comparisons are significant at the conventional statistical levels).

Next, we examine how giving changes in w. In the *Equal* treatment, when participants know that instead of $w = 0\%$ the degree of waste is $w = 50\%$, giving significantly decreases from \$3.97 to \$3.02 when $t = 25\%$ (Wilcoxon signed-rank test, p-value < 0.01), from \$4.06 to \$2.53 when $t = 50\%$ (Wilcoxon signed-rank test, p-value < 0.01), and from \$4.18 to \$2.85 when $t = 75\%$ (Wilcoxon signed-rank test, p-value < 0.01). When participants know that instead of $w = 50\%$ the degree of waste is $w = 100\%$, giving further decreases from \$3.02 to \$2.06 when $t =$

[29] Imposing an assumption that $w = 0\%$ when $t = 0\%$ is very restrictive and it may not be an accurate description of how participants perceive the case of $t = 0\%$. However, we also redid our analysis by imposing this assumption and the results did not change. These additional estimations are available upon request.

25% (Wilcoxon signed-rank test, p-value < 0.01), from \$2.53 to \$2.04 when $t = 50\%$ (Wilcoxon signed-rank test, p-value < 0.01), and from \$2.85 to \$2.58 when $t = 75\%$ (Wilcoxon signed-rank test, p-value = 0.06). Pooling across all tax rates, the left panel of Figure 2 shows a clear negative and significant relationship between average giving and the degree of waste w in the *Equal* treatment (all pair-wise comparisons are significant at the 0.01 level).

Similar response to changes in waste is observed when examining the *Unequal* treatment. When participants know that instead of $w = 0\%$ the degree of waste is $w = 50\%$, giving significantly decreases from \$4.75 to \$3.58 when $t = 25\%$ (Wilcoxon signed-rank test, p-value < 0.01), from \$4.90 to \$3.67 when $t = 50\%$ (Wilcoxon signed-rank test, p-value < 0.01), and from \$4.57 to \$3.48 when $t = 75\%$ (Wilcoxon signed-rank test, p-value < 0.01). When participants know that instead of $w = 50\%$ the degree of waste is $w = 100\%$, giving further decreases from \$3.58 to \$2.83 when $t = 25\%$ (Wilcoxon signed-rank test, p-value < 0.01), from \$3.67 to \$2.85 when $t = 50\%$ (Wilcoxon signed-rank test, p-value < 0.01), but it increases (although not significantly) from \$3.48 to \$4.25 when $t = 75\%$ (Wilcoxon signed-rank test, p-value = 0.12). The right panel of Figure 2 shows that there is a clear negative and significant relationship between average giving and the degree of waste in the *Unequal* treatment (all pair-wise comparisons are significant at the 0.01 level).

To summarize, nonparametric tests show that, contrary to Hypothesis 1, giving does not change significantly when the tax rate changes. There are two competing explanations for why we did not find support for Hypothesis 1. First, it is possible that the elasticity of marginal utility is greater than 1 for our subject population.[30] Second, the elasticity of marginal utility is less than 1 but income loss is very salient for the subjects and, therefore, subjects weigh the income effect more heavily than predicted by a rational model. Independent of which explanation is correct, by providing a comparative analysis, we can provide a strong test of our model. Given that donations are not responsive of the tax rate, our model predicts that donations should decrease as the rate of waste increases. More formally, the theory predicts that the marginal effect of the tax rate on giving is greater than the marginal effect of the degree of waste on giving for any $0 < t < 1$ and $0 < w < 1$ (see Theorem 4 and Hypothesis 3). Consistent with Hypothesis 3, this is exactly what we see in the data: while the effect of the tax rate on giving is small and not significant, there is a

[30] However, we later rule out this explanation based on our risk elicitation task that is used to approximate elasticity of marginal utility coefficients (assuming one can approximate elasticities with relative risk aversion coefficients).

strong negative relationship between the degree of waste and giving. Note that, our data is also consistent with Hypothesis 2, but nonparametric tests are not helpful in testing Hypothesis 2 directly. Instead, we provide a direct test of Hypothesis 2 in Section 5.2.

To check the robustness of our findings, we also provide a regression analysis.[31] Table 4 reports Tobit regressions with standard errors clustered at the participant level.[32] The dependent variable is *giving*. Regression (1) uses the data from the *Equal* treatment, and the independent variables are the tax rate t and the rate of waste w.[33] Consistent with the non-parametric tests, the coefficient on t is not significant (p-value = 0.68), suggesting that there is no relationship between giving and the tax rate. Also, consistent with the non-parametric tests, the coefficient on w is negative and highly significant (p-value < 0.01), suggesting that giving decreases in the degree of waste. Regression (2) uses the data from the *Unequal* treatment, and the independent variables are the tax rate t, the rate of waste w, and *Income* (to control for the different income levels that participants earned in part 1 of the experiment). As in the *Equal* treatment (regression 1), the coefficient on t is not significant (p-value = 0.96). Also, as in the *Equal* treatment, the coefficient on w is negative and highly significant (p-value < 0.01). Pooling the data together, as shown in regression (3) in Table 4, corroborates this result. Another support for Hypothesis 3 comes from a simple Wald test which we conduct based on the estimation results presented in Table 4. We find that the coefficient on t is significantly higher than the coefficient on w (p-values in all specifications are less than 0.01). Additional robustness checks are provided in Appendix D (see Table D1). This leads us to our first result.

Result 1: In the *Equal* and *Unequal* treatments, giving significantly decreases when the degree of waste w increases, but it does not change when the tax rate t increases.

Regression (3) of Table 4 also gives us an opportunity to see how initial income inequality affects the level of contributions. Consistent with the distribution-neutrality theorem of Bergstrom et al. (1986), we find that the coefficient of the dummy variable *Unequal* is not significant, suggesting that initial income distribution does not matter for giving decisions. However, it

[31] 7 participants (3 in the *Equal* and 4 in the *Unequal* treatment) failed to submit their answers in part 1 on time in the earlier sessions (and thus received a score of zero in part 1). Our results are robust to inclusion or exclusion of these 7 participants, and are available upon request from the authors.
[32] We choose to present Tobit regression analysis since roughly half of the participants give \$0. Our qualitative results are robust to using other specifications such as OLS.
[33] We exclude the data for $t = 0\%$ because for this part of the data it is not clear how to interpret w. However, qualitative results are very similar when we assume that $w = 0\%$ for $t = 0\%$ and include this data in estimation of Table 4.

important to note that while the theory makes correct qualitative prediction at the group level, it does not predict the levels of individual giving. While the model predicts that the high income individuals (who received \$45) should contribute more than the middle income individuals (who received \$30) and the middle income individuals should contribute more the low income individuals (who received \$15), our regression analysis shows that this does not hold in the data. Although the *Income* coefficient in regressions (2) and (3) is positive, it is not significant. Also, see the additional analysis in Appendix D (see Table D2 and Table D3). However, this result is not that surprising given that many other studies find that the high income individuals under-contribute while the low income individuals over-contribute (Chan et al., 1996, 1999; Uler, 2011; Maurice et al., 2013).

5.2. The Curvature of the Utility Function

Recall that one of the theoretical predictions of our model is that the relationship between giving and the degree of waste depends on the curvature of the utility function (or more formally the elasticity of the marginal utility).[34] In particular, Theorem 2 predicts that if the elasticity of marginal utility is less than or equal to 1/3, then giving is an increasing function of the degree of waste. Theorem 3 states that if individuals have CRRA preferences and the relative risk aversion coefficient satisfies $\theta > \frac{(1-wt)}{(1-at)n}$, then giving should decrease when the degree of waste increases.[35]

To elicit the curvature of the utility function, we used a series of 15 binary lottery choices, as shown in Table 2. The relative degree of risk aversion, and thus the degree of curvature of the consumption utility, is determined by the number of safe choices. Risk-averse participants should choose 7 or more safe choices, while risk-neutral or risk-seeking participants should choose 6 safe choices or less.[36]

We find that the average number of safe choices is 7.20 with a standard deviation of 1.84. Assuming a CRRA utility function, seven safe choices corresponds to a relative risk aversion coefficient θ to be in a range between 0.26 and 0.50 and eight corresponds to the relative risk aversion coefficient θ to be in a range between 0.50 and 0.74. As an example, a CRRA utility

[34] The relationship between giving and the tax rate also changes sign with the degree of relative risk aversion, but only for extremely high (not observed in practice) risk aversion degrees.
[35] When the parameters of the experiment are used, that threshold varies between 0.33 and 0.67 depending on the rate of waste and tax.
[36] If an agent picks 6 safe choices we cannot identify whether he is risk-neutral or whether he is slightly risk-averse.

function with a relative risk aversion parameter $\theta = 0.5$ would be consistent with observing 7 or 8 safe choices in the risk elicitation task and it would also be consistent with decreasing donations as the degree of waste decreases.

Next, we examine whether individuals with different risk preferences behave differently as t and w changes. While our theory does not directly address heterogeneity, under the assumption that individuals expect other individuals to be similar to them, we can rely on the current model to derive approximate predictions regarding their giving behavior.[37] We conjecture that individuals who are risk averse would on average decrease their giving, while individuals who are not risk averse would on average increase their giving.

To see if our conjecture is valid, we split our sample into two broad categories based on whether participants are risk-averse or not, and estimate the response of giving to changes in t and w separately for each category.[38] Table 5 reports the same regressions as in Table 4, splitting our data based on whether participants are risk-averse (regressions 1, 2, and 3) or not (regressions 4, 5, and 6).[39] Regressions (1), (2) and (3) replicate our estimation results reported in Table 4, implying that for risk-averse participants giving decreases in the rate of waste w. Regressions (4), (5) and (6), however, show that the magnitude and the significance of this relationship are greatly reduced when we use risk-neutral and risk-seeking participants. These results are consistent with the interpretation that risk aversion (measuring the curvature of the utility function) moderates the effect of the degree of waste on giving. This leads us to our second result.

Result 2: The relationship between giving and the degree of waste w is moderated by the curvature in the consumption utility.

Recall that our model predicts that when w increases, more risk-averse participants should decrease their giving and less risk-averse participants should increase their giving, but risk aversion should not play a role in the relationship between giving and the tax rate t. Our data

[37] For example, there is a large literature in psychology and recently economics that individuals demonstrate a false consensus bias which implies even when actual preferences are heterogeneous, individuals may not realize that and they may be considering a relatively homogeneous environment. See Selten and Ockenfels (1998) and Charness and Grosskopf (2001) for a review of this literature.

[38] When we say "not risk averse", we simply mean this participant has chosen at most 6 safe choices. There is still a possibility that this participant is slightly risk-averse. Note that our theory predicts individuals with slight degree of risk aversion would behave in the same way as individuals who are risk-neutral or risk loving and, therefore, it makes sense to place these participants into the same group.

[39] One participant in our experiment has missing data after part 2 due to health reasons. Therefore, when we add variables from part 3, 4, and questionnaires to the regression analysis, this participant gets automatically dropped from the regression analysis.

provide partial support for the theory since it is mainly risk-averse individuals who decrease their giving when w increases.[40] In Appendix D, we provide additional robustness checks (see Table D4).

In Section 5.4, we provide an alternative test of the model at the individual level allowing for heterogeneity among subjects. Our analysis in Section 5.4 does not depend on the risk elicitation task or the elasticity of marginal utility coefficients. Before we explain the test, we first provide some evidence of heterogeneity in Section 5.3.

5.3. Individual Giving in Response to Changes in t and w

Although we find that, on average, giving decreases in the degree of waste and it does not change in the tax rate, there is substantial heterogeneity when examining individual behavior. Table 6 shows how different participants change their giving in response to changes in t and w. We categorize each individual by two dimensions: (i) how they respond to changes in t and (ii) how they respond to changes in w. We combine the data from the *Equal* and *Unequal* treatments. In Appendix D, we show that our results are similar when splitting the data by each treatment (see Table D5 and Table D6).

Table 6 shows that there are three main types of individuals that account for more than half of all observations (112/204). First, there are 56 participants who always give \$0 disregarding t and w. Second, there are 38 participants who weakly decrease their giving in response to increase of t and w. Third, there are 18 participants who always give the same amount independent of t and w. Summing over each category, we see that most common types of individuals are those who decrease their giving when w increases (75 participants), those who always give \$0 (56 participants), and those who decrease their giving when t increases (49 participants). This leads us to our third result.

Result 3: There is substantial heterogeneity in how individuals respond to changes in t and w. The most common types of individuals are those who (i) donate less when the degree of waste increases, (ii) donate less when the tax rate increases, and (iii) always give \$0.

[40] In Section 6 we highlight some behavioral factors that might explain the discrepancy between theoretical predictions and behavior.

5.4. Additional Support for the Model

In this section, based on Theorem 4, we provide an alternative way of testing the model that does not rely on the relative risk aversion coefficients and does not depend on the assumption of elasticity being less than 1 as assumed in Hypothesis 1.[41] The difference from our previous analysis regarding Hypothesis 3 is that here we test the model at the individual level. If we assume that participants believe others to have similar preferences, then we can provide additional hypotheses for our model at the individual level:

Hypothesis 4: Individuals who decrease their giving when the tax rate increases should also decrease their giving when the degree of waste increases.

Hypothesis 5: Individuals who increase their giving when the tax rate increases, may increase or decrease their giving when the degree of waste increases.

Note that these two hypotheses are consistent with our individual data analysis reported in Table 6. Not including the participants with inconsistent choices, we see that out of 41 participants who consistently decrease their giving when the tax rate increases, 38 of them also decrease their giving when the degree of waste increases. However, among 24 participants who increase their giving when the tax rate increases, only 13 participants consistently increase their giving when the degree of waste increases, while 11 participants consistently decrease their giving when the degree of waste increases.

5.5. Determinants of Giving

In this section we examine the determinants of giving. Table 7 reports the Tobit regressions, in which the dependent variable is *giving*, and the independent variables are the variables used in the estimation of Table 4 and Table 5. For comparison purposes, regression (1) in Table 7 is the same as regression (3) in Table 4.

Regression (2) in Table 7 uses two additional explanatory variables *Egalitarian* and *Generous* (these variables correspond to the distributional choices participants made in part 4 of our experiment). Note that the estimated coefficients on w and t in regression (2) are fairly similar to those in regression (1). In addition, we find that participants who are classified as *Generous* give

[41] It is possible that the elasticity of consumption utility coefficient may not be well captured by the relative risk aversion coefficient if agents are not expected utility maximizers or if the risk elicitation task used in the study does not correctly capture risk preferences.

more to charity (p-value < 0.01). Regression (3) adds other variables which we elicited at the end of the experiment using a survey. The positive and significant coefficient on *Female* suggests that on average women give more than men (p-value < 0.01). Finally, regression (4) adds an additional control for the participant's score in part 1. Importantly, none of these controls changes our main qualitative results.

6. Discussion and Conclusions

We provide a theoretical model and conduct a laboratory experiment with actual charitable donations to study how taxes impact individual giving. The theory shows that the relationship between charitable giving and the tax rate is positive. However, donations may increase or decrease when the rate of waste increases depending on the elasticity of marginal utility. In addition, the model predicts that the marginal effect of the tax rate on giving is greater than the marginal effect of the degree of waste on giving. Our experimental results show that changes in the tax rate t have a weak and insignificant effect on giving. Consistent with the theoretical predictions, the degree of waste w has a negative and highly significant effect on giving, and the relationship between giving and w is moderated by the elasticity of marginal utility. Moreover, the data provide strong qualitative support for the model regarding the differential effects of tax rate and waste on donations.

An interesting question emerging from our experimental findings is why individuals have a strong negative reaction to an increase in the degree of waste, while they have a weak reaction to an increase in the tax rate. After all, both higher tax rates and higher waste decrease the price of giving, creating a positive substitution effect. Our model is capable of explaining the differential effects of the tax rate and rate of waste, since it demonstrates that tax rate and waste create different effects on prices (opportunity cost of giving). The effect of an increase in the tax rate on the price of giving is significantly stronger than the effect of an increase in the rate of waste on the price of giving, as we show in Section 3. We further show in Section 3 that income effects created by tax rate changes and level of waste changes are similar. Therefore, while the substitution effect offsets the income effect when the tax rate increases, the substitution effect is not strong enough to offset the income effect when the degree of waste increases. Of course, there may also be other behavioral factors not considered in the model that reinforce our results. Income losses may be very salient for the subjects, which would imply the income effect to be more heavily weighted in subjects' decisions. Or, participants may experience negative feelings, such as anger, since the experimenter is "wasting" money they rightfully earned in the experiment, which may then lead to lower altruism towards charitable causes.[42] In summary, our experimental design is capable of providing strong qualitative evidence for the model as well as highlighting additional behavioral motives that arise in experiments.

Since our results imply that the average effect of "waste" on donations is negative on large economies, we conjecture that policies decreasing the transaction costs related to taxation are likely to increase charitable donations. Similarly, donations are likely to increase if individuals perceive tax revenue to be spent on services they value rather than things they do not care for. Silverman et al. (2014) argue that individuals evade taxes less if they are given a legitimate explanation for being taxed. Similarly, our results suggest that it might be worthwhile to make an effort to convince individuals that their taxes are being efficiently used for public services. Finally, our results imply that empirical studies estimating price and income elasticities of giving would benefit by controlling for the confounding effect of perception about wasteful government spending since perceptions regarding waste might exogenously or endogenously change over time.

[42] In addition, negative emotions towards taxation could explain why we do not see a positive effect of the tax rate on giving as predicted by the model.

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Table 1: Donation decisions in the experiment

Decision line	Tax rate, t	Waste, w
1	0%	N/A
2	25%	0%
3	50%	0%
4	75%	0%
5	25%	50%
6	50%	50%
7	75%	50%
8	25%	100%
9	50%	100%
10	75%	100%

Participants choose how much to donate given the tax rate and the waste rate.

Table 2: Elicitation of risk preferences

Choice	Option A (risky option)	Option B (safe option)
1	$9.00 or $1.00 with 50% chance	$0.50 for sure
2	$9.00 or $1.00 with 50% chance	$1.00 for sure
3	$9.00 or $1.00 with 50% chance	$1.50 for sure
4	$9.00 or $1.00 with 50% chance	$2.00 for sure
5	$9.00 or $1.00 with 50% chance	$2.50 for sure
6	$9.00 or $1.00 with 50% chance	$3.00 for sure
7	$9.00 or $1.00 with 50% chance	$3.50 for sure
8	$9.00 or $1.00 with 50% chance	$4.00 for sure
9	$9.00 or $1.00 with 50% chance	$4.50 for sure
10	$9.00 or $1.00 with 50% chance	$5.00 for sure
11	$9.00 or $1.00 with 50% chance	$5.50 for sure
12	$9.00 or $1.00 with 50% chance	$6.00 for sure
13	$9.00 or $1.00 with 50% chance	$6.50 for sure
14	$9.00 or $1.00 with 50% chance	$7.00 for sure
15	$9.00 or $1.00 with 50% chance	$7.50 for sure

Participants choose between a risky Option A ($9.0 or $1.00 with 50% chance each) or a safe Option B (a certain amount for sure).

Table 3: Giving by treatment

Treatment		*Equal*		*Unequal*	
Tax rate, t	Waste, w	Average giving	Fraction of $0	Average giving	Fraction of $0
0%	N/A	$3.69 (0.52)	0.50	$3.83 (0.64)	0.50
25%	0%	$3.97 (0.57)	0.46	$4.75 (0.65)	0.39
50%	0%	$4.06 (0.55)	0.44	$4.90 (0.66)	0.39
75%	0%	$4.18 (0.59)	0.46	$4.57 (0.66)	0.39
25%	50%	$3.02 (0.44)	0.47	$3.58 (0.51)	0.43
50%	50%	$2.53 (0.39)	0.50	$3.67 (0.60)	0.46
75%	50%	$2.85 (0.54)	0.52	$3.48 (0.61)	0.50
25%	100%	$2.06 (0.38)	0.61	$2.83 (0.54)	0.56
50%	100%	$2.04 (0.45)	0.67	$2.85 (0.58)	0.58
75%	100%	$2.58 (0.60)	0.70	$4.25 (0.93)	0.61

Standard error of the mean is in parentheses.

Table 4: Tobit regression of giving

Treatment	*Equal*	*Unequal*	*Pooled*
Dependent variable, *giving*	(1)	(2)	(3)
t	-0.46	-0.07	-0.27
[tax rate]	(1.11)	(1.23)	(0.85)
w	-4.26***	-3.92***	-4.13***
[degree of waste]	(1.05)	(1.12)	(0.79)
Income		0.02	0.03
[income = $15, $30, $45]		(0.08)	(0.08)
Unequal			1.66
[1 if the *Unequal* treatment]			(1.33)
Constant	1.47	0.95	-0.30
[constant term]	(1.22)	(2.49)	(2.79)
Observations	810	1026	1836
Clusters	90	114	204

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table 5: Giving and the curvature of the utility function

	Risk-averse participants			Risk-neutral/seeking participants		
Treatment	*Equal*	*Unequal*	*Pooled*	*Equal*	*Unequal*	*Pooled*
Dependent variable, *giving*	(1)	(2)	(3)	(4)	(5)	(6)
t	-0.93	-1.98	-1.59	-0.29	4.00	1.85
[tax rate]	(1.29)	(1.15)	(0.86)	(1.90)	(2.76)	(1.77)
w	-5.81***	-5.05***	-5.40***	-2.46*	-1.56	-2.09
[degree of waste]	(1.60)	(1.41)	(1.08)	(1.16)	(1.91)	(1.15)
Income		0.08	0.08		-0.10	-0.07
[income = $15, $30, $45]		(0.11)	(0.11)		(0.13)	(0.12)
Unequal			1.00			3.06
[1 if the *Unequal* treatment]			(1.70)			(2.16)
Constant	3.13*	1.09	0.27	-0.20	0.92	-0.87
[constant term]	(1.46)	(3.09)	(3.65)	(2.03)	(4.46)	(4.41)
Observations	450	675	1125	351	351	702
Clusters	50	75	125	39	39	78

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table 6: Individual giving in response to changes in t and w

Giving response to changes in the tax rate t	Giving response to changes in the degree of waste w: Zero giving	Constant	Decreasing	Increasing	Other	Total
Zero giving	56	0	0	0	0	56
Constant	0	18	13	2	0	33
Decreasing	0	1	38	2	8	49
Increasing	0	0	11	13	6	30
Other	0	0	13	0	23	36
Total	56	19	75	17	37	204

Each number in the table indicates the number of participants that fall into one of the categories. For example, there are 38 participants whose giving decreases in t and in w.

Table 7: The determinants of giving

Dependent variable, *giving*	(1)	(2)	(3)	(4)
t	-0.27	-0.33	-0.25	-0.27
[tax rate]	(0.85)	(0.85)	(0.84)	(0.86)
w	-4.13***	-4.14***	-4.08***	-4.16***
[degree of waste]	(0.79)	(0.79)	(0.76)	(0.78)
Income	0.03	-0.02	-0.01	-0.02
[income = $15, $30, $45]	(0.08)	(0.07)	(0.07)	(0.09)
Unequal	1.66	1.60	1.83	1.43
[1 if the *Unequal* treatment]	(1.33)	(1.27)	(1.17)	(1.16)
Egalitarian		2.76	1.81	1.83
[1 if ($2.00; $2.00)]		(1.82)	(1.68)	(1.70)
Generous		7.71**	7.92**	7.86**
[1 if ($1.75; $3.00)]		(2.78)	(2.41)	(2.45)
Hardwork			-0.53	-0.52
[how hard you worked in part 1]			(0.28)	(0.27)
Female			3.89**	3.89**
[1 if female]			(1.41)	(1.40)
Family income			0.13	0.22
[family income]			(0.32)	(0.32)
Right-wing			0.78	0.71
[right-wing political view]			(0.54)	(0.56)
Unnecessary			-3.63	-3.04
[1 if taxes are annoying and unnecessary]			(2.27)	(2.30)
Necessary			0.13	1.53
[1 if taxes are necessary and do not bother]			(2.60)	(2.68)
Reputation			0.01	-0.11
[importance of own reputation]			(0.39)	(0.40)
Church			0.72	0.61
[giving to church]			(0.39)	(0.39)
Charity			0.44	0.5
[giving to charities]			(0.50)	(0.51)
Familiar			0.30	0.28
[knowledge of charity]			(0.24)	(0.24)
American			-0.41	-0.34
[1 if a United States citizen]			(1.56)	(1.58)
Part 1				0.13
[part 1 score]				(0.35)
Constant	-0.30	-1.84	-7.43	-7.45
[constant term]	(2.79)	(3.06)	(5.46)	(5.40)
Observations	1836	1827	1827	1764
Clusters	204	203	203	196

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Figure 1: Average giving in response to changes in t by treatment

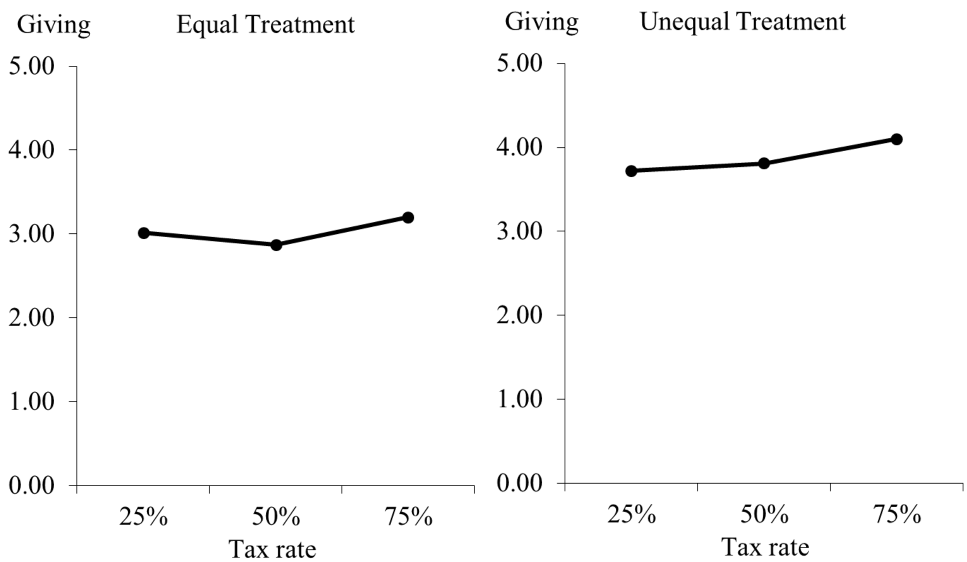
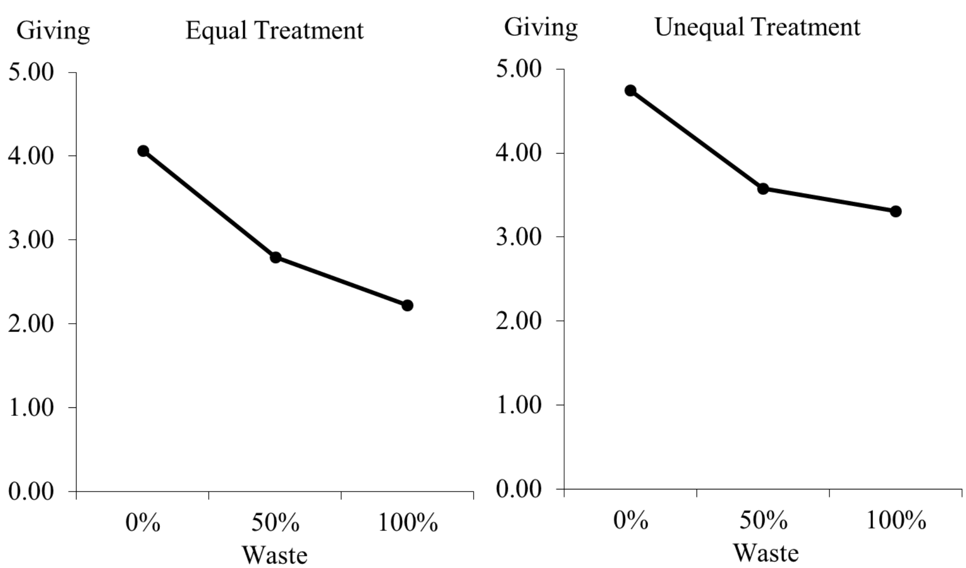


Figure 2: Average giving in response to changes in w by treatment



Appendix A (For Online Publication) – Proofs for Section 3

We start by writing the maximization problem of an agent i:

$$\max_{c_i, g_i} u(c_i) + v(G)$$

s.t. $c_i = (1-t)(y_i - g_i) + (1-w)\frac{t\sum_{j=1}^{n}(y_j - g_j)}{n}$ and $g_i \geq 0$.

Assuming an interior solution, the first order condition is

$$u'\left((1-t)(y_i - g_i) + (1-w)\frac{t\sum_{j=1}^{n}(y_j - g_j)}{n}\right)\left(1 - \left(1 - \frac{1-w}{n}\right)t\right) = v'(G).$$

Since this equation holds for all agents, in equilibrium, the following should hold:

$$y_i - g_i = y_k - g_k = \frac{Y-G}{n}.$$

Therefore, the FOC simplifies to:

$$u'\left((1-wt)\left(\frac{Y-G}{n}\right)\right)\left(1 - \left(1 - \frac{1-w}{n}\right)t\right) = v'(G).$$

Proof for Theorem 1: Totally differentiating the FOC with respect to the tax rate t, and then solving for $\frac{\partial G}{\partial t}$, we get

$$\frac{\partial G}{\partial t} = -\frac{u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)a}{v''(G) + u''(b)\left(\frac{1-wt}{n}\right)(1-at)},$$

where $a = 1 - \frac{1-w}{n}$ and $b = (1-wt)\left(\frac{Y-G}{n}\right)$. Since the denominator is always negative, the sign of the numerator determines the sign of the partial derivative of G with respect to t.

If $w = 0$, the numerator simplifies to $u'(b)a$ and it is easy to see that it is always positive and therefore, we do not need any additional assumptions about the consumption utility.

Now assume $0 < w < 1$. Note that $a = 1 - \frac{1-w}{n} = \frac{n-1+w}{n} > w$. Hence,

$$u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)a >$$

$$> u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)w =$$

$$= w\left(u''(b)\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\right).$$

Since $(1-at) < (1-wt)$, we can show that

$$u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)a > \ w\big(u''(b)b + u'(b)\big).$$

This implies that if $u''(b)b + u'(b)$ is nonnegative, $u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)a$ has to be positive. In other words, for the numerator to be positive, we need $-\frac{u''(x)x}{u'(x)} \leq 1$.

Finally, if $w = 1$, total public goods provision is still a strictly increasing function of the tax rate if $-\frac{u''(x)x}{u'(x)} < 1$. For the extreme case of $w = 1$ and $-\frac{u''(x)x}{u'(x)} = 1$, public goods provision does not change with the tax rate.

Proof for Theorem 2: Totally differentiating the FOC with respect to the rate of waste, and then solving for $\frac{\partial G}{\partial w}$, we get

$$\frac{\partial G}{\partial w} = -\frac{u''(b)t\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\frac{t}{n}}{v''(G) + u''(b)\left(\frac{1-wt}{n}\right)(1-at)}.$$

where $a = 1 - \frac{1-w}{n}$ and $b = (1-wt)\left(\frac{Y-G}{n}\right)$. Since the denominator is always negative, the sign of the numerator determines the sign of the partial derivative of G with respect to w.

When $t = 0$, waste does not matter, so we consider $0 < t \leq 1$. Since $(1-at) < (1-wt)$ and $u''(b) < 0$, we get

$$u''(b)t\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\frac{t}{n} >$$
$$> u''(b)t\left(\frac{Y-G}{n}\right)(1-wt) + u'(b)\frac{t}{n} =$$
$$= t\left(u''(b)b + u'(b)\frac{1}{n}\right).$$

This implies that if $u''(b)b + u'(b)\frac{1}{n}$ is nonnegative, then $u''(b)t\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\frac{t}{n} > 0$. Therefore, the condition needed is $-\frac{u''(x)x}{u'(x)} \leq \frac{1}{n}$.

Proof for Theorem 3: Assume the agents' consumption preferences are defined by the CRRA utility function $u = \frac{x^{(1-\theta)}}{(1-\theta)}$ for $\theta \neq 1$ and $u = \ln(x)$ for $\theta = 1$. Then the elasticity of marginal utility is given by θ. We need to find the condition for donations to strictly decrease when the degree of waste increases. In other words, we need the condition that makes $u''(b)t\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\frac{t}{n} < 0$. Substituting $u = \frac{x^{(1-\theta)}}{(1-\theta)}$ in the previous equation, we get

$$-\theta b^{-\theta-1}t\left(\frac{Y-G}{n}\right)(1-at) + b^{-\theta}\frac{t}{n} < 0.$$

Rearranging, this equation simplifies to

$$\theta > \frac{(1-wt)}{(1-at)n}.$$

It is important to note that $\frac{(1-wt)}{(1-at)n} > \frac{1}{n}$ for $w < 1$, since $(1 - at) < (1 - wt)$. However, for $w = 1$, $\frac{(1-wt)}{(1-at)n} = \frac{1}{n}$.

Proof for Theorem 4: We provide a proof by contradiction. Suppose $\frac{\partial G}{\partial w} > \frac{\partial G}{\partial t}$. Then the following needs to hold:

$$u''(b)w\left(\frac{Y-G}{n}\right)(1-at) + u'(b)a <$$

$$< u''(b)t\left(\frac{Y-G}{n}\right)(1-at) + u'(b)\frac{t}{n}.$$

Rearranging,

$$u'(b)(a - \frac{t}{n}) < u''(b)\left(\frac{Y-G}{n}\right)(1-at)(t-w).$$

We can immediately see that if $t \geq w$, then the previous inequality cannot hold. Instead, let's assume $t < w$. Rearranging one more time, we get

$$\frac{a-\frac{t}{n}}{w-t} < -\frac{u''(b)\left(\frac{Y-G}{n}\right)(1-at)}{u'(b)}.$$

Note that $n < \frac{a-\frac{t}{n}}{w-t}$ and $-\frac{u''(b)\left(\frac{Y-G}{n}\right)(1-at)}{u'(b)} < -\frac{u''(b)b}{u'(b)}$. However, we assumed that $-\frac{u''(b)b}{u'(b)} \leq n$. Hence, we arrive at a contradiction. If $-\frac{u''(b)b}{u'(b)} \leq n$, then $\frac{\partial G}{\partial t} > \frac{\partial G}{\partial w}$.

Appendix B (For Online Publication) – Instructions for the *Unequal* Treatment

Instructions

Thank you for agreeing to participate in this experiment. Your participation is voluntary. In this experiment we want to see the choices that people make. You will be making choices on your own and in private. So it is very important that you remain silent and do not look at other people's choices. If you have any questions, please raise your hand.

The experiment will proceed in four parts. At the beginning of each part you will receive detailed instructions for that part. The earnings that you make will depend on your decisions in each part.

In Part 1, you will take a 20-minute cognitive test containing 10 questions. Upon completion of Part 1 you will earn a certain amount of money. This amount may be the same for everyone in this room or each participant's earnings may depend on their relative performance in the test.

In Part 2, you will be asked to make a series of choices in decision problems. Depending on your choices and chance, you may lose part of the money you earn in Part 1. Your decisions in Part 2 will not affect your earnings from Part 3 and Part 4.

In Part 3, you will be asked to make another series of choices in decision problems. How much money you receive in Part 3 will depend partly on chance and partly on the choices you make.

In Part 4, you will be asked to make one last choice in a decision problem. Again, your decisions from preceding Part 2 and Part 3 will not affect your earnings in Part 4.

In addition, upon completion of the experiment, you will receive a show-up reward of $5. This is yours to keep regardless of the decisions you make in the experiment. After you complete the experiment, you will be asked to fill out a questionnaire while you wait to be paid.

Your computer has been assigned an ID number that you will be informed of. Your decisions and payoffs from the experiment will be recorded with that ID number. At no time your name will be linked to that ID number. At the end of the experiment, you will be paid in private. Your decisions and payoff will not be revealed to anyone during or after the experiment.

Please turn off your cell phones now to avoid any interruption during the experiment.

Part 1 – Cognitive Test

You will now take a 20-minute cognitive test containing 10 questions. You may use the margins of this booklet to work out your answer if needed. You may ONLY use pencil and paper provided. No other aids are permitted. All questions have the following format:

Who is the current President of the United States?

A. Mitt Romney
B. Bill Clinton
C. Barack Obama
D. George W. Bush
E. David Cameron

To correctly answer this example question, you would select C. You will **gain** one point for each **correct** answer and zero for an **incorrect** answer. Try to get as many points as you can. Upon completion of Part 1 you will earn a certain amount of money. This amount may be the same for everyone in this room or each participant's earnings may depend on their relative performance in the test.

You will have 20 minutes to work on the test. You may not be able to finish all the questions in this time.

Part 2 – Donation to a Charity

In Part 2 of the experiment you will be **randomly and anonymously matched** into a group which consists of **3 participants**. Based on the performance on the cognitive test in Part 1, all participants in your group will be ranked, and the **highest ranked participant will earn $45**, the **middle ranked participant will earn $30**, and the **lowest ranked participant will earn $15**. Then, each participant in your group (including you) will have an opportunity to donate **to the same charity**. However, **each group will be randomly assigned to a different charity**.

When Part 2 starts, the name of the charity that your group is assigned to will be given to you on the computer screen. You can donate any amount to this charity from **$0** to the **amount earned** with increments of 5 cents. **The amount you donate will be deducted from the amount you earned**. We will write a check in the total amount that you as well as the other participants in your group chose to donate and send it to the charity (If you want to get a confirmation about your donation, please include your e-mail address in the sign out sheet and we will have the charity automatically email you the total amount of donation by your group).

Here are several examples:

- The numbers in this example are only for demonstration purposes.
- Suppose you have earned $30 upon completion of Part 1.
- If you donate $0 and 0 cents to the charity then your remaining income is $30.
- If you donate $15 and 45 cents to the charity then your remaining income is $14 and 55 cents.
- If you donate $30 to the charity then your remaining income is $0.

You and the other members of your group will make donations simultaneously. You will learn your group's total donation to the charity only at the very end of the experiment.

After all three participants in your group make their donations, we will apply a **tax rate of x%** (which can be either 0%, 25%, 50%, or 75%) on each participant's **remaining income** and collect the corresponding amount of money. Then we will **evenly redistribute y%** (which can be either 0%, 50%, or 100%) of the collected money among the participants of your group (including you).

Here is an example:

- The numbers in this example are only for demonstration purposes.
- Assume that the tax rate is 25% and the redistribution rate is 50%.
- Next, assume that based on the performance on the cognitive test in Part 1, participant 1 was ranked 3rd earning $15, participant 2 was ranked 2nd earning $30, and participant 3 was ranked 1st earning $45 (see column 2 in the table below).
- Also, assume that participant 1 donated $10 to the charity, participant 2 donated $0, and participant 3 donated $20 (see column 3 in the table below).
- Therefore, we will send a check for $30 ($10 + $0 + $20) to the charity.
- Then, on each participant's remaining pre-tax income (see column 4), we will apply a tax rate of 25% (see column 5), collecting $1.25 from participant 1, $7.5 from participant 2, and $6.25 from participant 3 ($1.25 + $7.5 + $6.25, for a total $15). So, after tax participant 1 will have $3.75 remaining (since participant 1 donated $10 and there was a tax of 25% on the remaining $5, leaving participant 1 with $3.75). Similarly, participant 2's and 3's remaining after-tax income will be $22.5 and $18.75, respectively (see column 6).
- Then, 50% of the total amount of $15, collected as taxes from all three participants, will be evenly redistributed among the three participants. Therefore, each participant will receive a redistribution amount of $2.5 (0.5×$15 divided by 3).
- So, the **final income** of each participant (see column 8) will be the sum of the **after-tax income** (see column 6) and the **redistribution amount** (see column 7). In this example only 50% of the collected taxes were redistributed back. **The amount that has not been redistributed goes back to the experimenter, and not to the charity.**

Table 1

(tax rate = 25% and redistribution rate = 50%)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Participant	Initial income	Charity donation	Pre-tax income, (2) - (3)	Tax, (4)×25%	After-tax income, (4) - (5)	Redistribution amount, 0.5×Total(5)/3	Final income, (6) + (7)
1	$15	$10	$5	$1.25	$3.75	$2.5	$6.25
2	$30	$0	$30	$7.5	$22.5	$2.5	$25
3	$45	$20	$25	$6.25	$18.75	$2.5	$21.25
Total	$90	$30	$60	$15	$45	$7.5	$52.5

We will ask you to make 10 decisions of how much you would like to donate to the assigned charity under different combinations of the **tax rate** and the **redistribution rate**. Specifically, on your computer screen you will see a table with 10 lines (also as shown below). In each line you will state how much you would like to donate to the charity. You should think of each line as a separate decision you need to make. However, **only one line will be the 'line that counts' and will be implemented.**

When tax rate is 0%, no tax will be collected. Therefore, your final income is simply equal to your pre-tax income (initial income – donations to charity). When tax rate is not 0%, your final income may be **lower** or **higher** than your pre-tax income depending on the tax rate, redistribution rate and the donation decisions of group members.

Table 2

Decision Line	Tax rate	Redistribution rate	How much would you like to donate to the charity?
1	0%	N/A	
2	25%	100%	
3	50%	100%	
4	75%	100%	
5	25%	50%	
6	50%	50%	
7	75%	50%	
8	25%	0%	
9	50%	0%	
10	75%	0%	

To facilitate your decisions, we will provide a "**calculator**". You may use the calculator to see your final income for any potential donation plans you have in mind before actually making the donation decision. To use the calculator, first enter the **tax rate**, **redistribution rate** and the **possible donation decisions** by you and the other participants in your group. The calculator will then fill in the numbers in Table 1 for you. You can use the calculator as many times as you like.

At the end of the experiment, the computer will randomly draw one line for payment. We will implement the choices of each participant made in that line and will send the contributed amount to the charity. Also, we will apply the appropriate tax rate and the redistribution rate to compute final income for each participant. You will learn which line was drawn, your earnings corresponding to that line and your group's total donation to the charity at the very end of the experiment.

Your decisions in Part 2 do not have any effect on your earnings in Part 3 or Part 4.

An Understanding Check: (All participants need to pass this before the decision making part of the experiment)

1. Suppose you contribute $15 to your group's assigned charity, and the other group members contributed $5 and $10. How much money will the experimenter send to this charity on behalf of your group? Answer: $30
2. Suppose you have earned $30 upon completion of Part 1. Suppose you contribute $10 to your group's assigned charity, what is your pre-tax income? Answer: $20
3. Suppose you have earned $30 upon completion of Part 1. Suppose you contribute $10 to your group's assigned charity, and the tax rate is 50%, what is your after-tax income? Answer: $10
4. Suppose the total amount of taxes collected from your group is $30 and the redistribution rate is 50%, then how much money will you get back? Answer: $5
5. If your after-tax income is $10 and if you also receive $5 back from the redistribution of tax revenue, what is your final income? Answer: $15

Part 3 – 15 Decision Problems

In Part 3 of the experiment, you will be asked to make choices in 15 decision problems. How much money you receive will depend partly on chance and partly on the choices you make.

On your computer screen you will see a table with 15 lines (as shown below). In each line you will state whether you prefer **Option A** or **Option B**. Option A always offers a 50% chance to get $9 and a 50% chance to get $1, while Option B always offers a certain amount for sure (between $0.50 and $7.50, depending on the line). You should think of each line as a separate decision you need to make. **However, only one line will be the 'line that counts' and will be paid out.**

At the end of the experiment, for each participant, the computer will randomly draw one line for payment. Your earnings for the selected line depend on which option you chose: If you chose A in that line, then the computer will randomly choose either $9 or $1 with equal chances as your payment. If you chose B in that line, then you will receive for sure the exact amount that is specified by Option B in that line.

Your decisions in Part 3 do not have any effect on your earnings in Part 4. The actual earnings for this part will be determined at the end of Part 4.

Table 1

Decision Line	Option A		Option B	Choose A or B
1	$9.00 with 50% chance	$1.00 with 50% chance	$0.50 for sure	
2	$9.00 with 50% chance	$1.00 with 50% chance	$1.00 for sure	
3	$9.00 with 50% chance	$1.00 with 50% chance	$1.50 for sure	
4	$9.00 with 50% chance	$1.00 with 50% chance	$2.00 for sure	
5	$9.00 with 50% chance	$1.00 with 50% chance	$2.50 for sure	
6	$9.00 with 50% chance	$1.00 with 50% chance	$3.00 for sure	
7	$9.00 with 50% chance	$1.00 with 50% chance	$3.50 for sure	
8	$9.00 with 50% chance	$1.00 with 50% chance	$4.00 for sure	
9	$9.00 with 50% chance	$1.00 with 50% chance	$4.50 for sure	
10	$9.00 with 50% chance	$1.00 with 50% chance	$5.00 for sure	
11	$9.00 with 50% chance	$1.00 with 50% chance	$5.50 for sure	
12	$9.00 with 50% chance	$1.00 with 50% chance	$6.00 for sure	
13	$9.00 with 50% chance	$1.00 with 50% chance	$6.50 for sure	
14	$9.00 with 50% chance	$1.00 with 50% chance	$7.00 for sure	
15	$9.00 with 50% chance	$1.00 with 50% chance	$7.50 for sure	

Part 4 – One Decision Problem

In Part 4 of the experiment, you will be randomly matched with another participant in this room. Nobody will ever learn whom they were matched with. You will be asked to choose between the following four options:

Option 1: You will receive $2.00 and your paired participant will receive $2.00.
Option 2: You will receive $1.75 and your paired participant will receive $3.00.
Option 3: You will receive $2.25 and your paired participant will receive $1.00.
Option 4: You will receive $2.00 and your paired participant will receive $1.75.

Similarly your paired participant will decide between these four options.

After you and the other participant make your decisions, the computer will also randomly determine whose decision to implement. If the computer chooses your decision to implement, then the earnings to you and the other participant will be determined according to your choice. If the computer chooses the other participant decision to implement, then the earnings will determined according to the other participant choice.

The actual earnings for this part will be determined after everyone makes their decisions.

Part 5 – Questionnaire

1. How hard did you work in the first part of the experiment in a scale from 1 to 10 where 1 indicates little work and 10 indicates extremely hard work.

2. What is your gender?
   a) male
   b) female

3. What is your age in years?

4. What is your major?

5. Family income:
   a) less than 50,000
   b) between 50,000 and 75,000
   c) between 75,000 and 100,000
   d) between 100,000 and 150,000
   e) between 150,000 and 200,000
   f) more than 200,000

6. What proportion of your own income comes from your own work?

a) less than 20%
b) between 20% and 50%
c) between 50% and 70%
d) more than 70%

7. What is the importance of religion in your life?
a) extremely important
b) very important
c) important
d) somewhat important
e) not very important
f) not important at all

8. In political matters, people talk of "the left" and "the right." How would you place your views on this scale, generally speaking?
a) extreme left
b) left
c) left-center
d) center
e) right-center
f) right
g) extreme right

9. How would you place your views on this: “Hard work doesn´t bring success - it´s more a matter of luck and connections”
a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

10. Which of the following statements do you agree with the most?
a) Income taxes are annoying and mostly unnecessary
b) Income taxes are annoying but necessary
c) Income taxes are necessary and do not bother me

11. How would you place your views on this: “It is very annoying if the tax revenues are used for things I do not care for.”
a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

12. How would you place your views on this: “It is the government’s job to ensure that everyone is provided for.”
a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

13. If the government had a choice between reducing taxes or spending more on social programs like health care, social security, and unemployment benefits, which do you think it should do?

a) Reduce taxes
b) Spend more on social programs

14. How would you place your views on this: "I often consider what others will think of me before I make a decision in my life."

a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

15. Do you agree with the following statement: "I regularly give to religious organizations."

a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

16. Do you agree with the following statement: "I regularly give to charities (excluding religious organizations)."

a) I completely agree
b) I agree most of the times
c) I agree
d) I am indifferent
e) I disagree
f) I disagree most of the times
g) I completely disagree

17. How well do you know the charity assigned for your group in Part 2? Please rate it in a 1 to 10 scale where 1 indicates little information and 10 indicates a perfect knowledge about this organization.

18. Are you a United States citizen?

a) Yes
b) No

Appendix C (For Online Publication) – Supplement to Theoretical Predictions

Here, we provide theoretical predictions for our experiment under the following utility functional form: $\frac{c_i^{1-\theta}}{1-\theta} + a\frac{G^{1-\theta}}{1-\theta}$. The predictions rely on the assumption that everyone is a contributor. If this assumption does not hold, quantitative results change but the qualitative results on the effect of the tax rate and the degree of waste do not change. Table C1 shows the predictions when the public goods utility is weighted at a = 1/2, while Table C2 shows the predictions when a = 1/4.

Table C1: Theoretical predictions under specific utility functions with a = 1/2

Tax rate, t	Waste, w	$\theta = 1$ (Cobb-Douglas)	$\theta = 3/4$	$\theta = 1/2$	$\theta = 1/4$
0%	0%	4.29	3.50	2.31	0.61
25%	0%	5.00	4.33	3.21	1.24
50%	0%	6.00	5.55	4.74	2.86
75%	0%	7.50	7.50	7.50	7.50
25%	50%	4.67	4.09	3.13	1.33
50%	50%	5.29	5.07	4.66	3.57
75%	50%	6.52	7.02	8.11	11.91
25%	100%	4.29	3.81	3.00	1.41
50%	100%	4.29	4.29	4.29	4.29
75%	100%	4.29	5.21	7.50	17.14
Maximum possible donation level for a given preference structure for $0 \leq t \leq 1$ and $0 \leq w \leq 1$		10.00	30.00	30.00	30.00

Table C2: Theoretical predictions under specific utility functions with a = 1/4

Tax rate, t	Waste, w	$\theta = 1$ (Cobb-Douglas)	$\theta = 3/4$	$\theta = 1/2$	$\theta = 1/4$
0%	0%	2.31	1.50	0.61	0.04
25%	0%	2.73	1.88	0.87	0.08
50%	0%	3.33	2.48	1.34	0.20
75%	0%	4.29	3.50	2.31	0.61
25%	50%	2.53	1.77	0.85	0.09
50%	50%	2.90	2.24	1.32	0.25
75%	50%	3.66	3.25	2.54	1.19
25%	100%	2.31	1.64	0.81	0.09
50%	100%	2.31	1.86	1.20	0.31
75%	100%	2.31	2.31	2.31	2.31
Maximum possible donation level for a given preference structure for $0 \leq t \leq 1$ and $0 \leq w \leq 1$		6.00	30.00	30.00	30.00

Appendix D (For Online Publication) – Additional Estimations

Table D1 provides robustness checks related to the discussion in Section 5.1 and Table 4. For convenience, regression (1) in Table D1 replicates the estimation results reported in Table 4. Regression (2) adds an additional interaction term $t \times w$. Regression (3) further adds interaction terms $w \times Unequal$, $t \times Unequal$ and $t \times w \times Unequal$. Note that upon adding these controls, the qualitative results originally reported in regression (1) do not change. Giving significantly decreases in the degree of waste w, but it does not change in the tax rate t.

Table D1: Tobit regression of giving

Treatment	*Pooled*	*Pooled*	*Pooled*
Dependent variable, *giving*	(1)	(1)	(2)
t	-0.27	-0.76	0.06
[tax rate]	(0.85)	(0.79)	(1.37)
w	-4.13***	-4.64***	-3.95**
[degree of waste]	(0.79)	(0.94)	(1.33)
Income	0.03	0.03	0.03
[income = $15, $30, $45]	(0.08)	(0.08)	(0.08)
Unequal	1.66	1.66	1.88
[1 if the *Unequal* treatment]	(1.33)	(1.33)	(1.56)
$t \times w$		1.03	-1.57
[interaction term]		(1.84)	(2.88)
$t \times$ *Unequal*			-1.43
[interaction term]			(1.66)
$w \times$ *Unequal*			-1.19
[interaction term]			(1.77)
$t \times w \times$ *Unequal*			4.51
[interaction term]			(3.78)
Constant	-0.30	-0.05	-0.17
[constant term]	(2.79)	(2.76)	(2.76)
Observations	1836	1836	1836
Clusters	204	204	204

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table D2 provides further robustness checks related to the discussion in Section 5.1 and Table 4. Here, we focus separately on each income group (i.e., participants who received $15, $30, or $45) in the *Unequal* treatment. Consistent with our previous results, regressions (2) and (3) show that giving of middle income individuals (who received $30) and high income individuals (who received $45) significantly decreases in the degree of waste w, but it does not change in the tax rate t. Regression (1) also shows that giving of low income individuals (who received $15) decreases (although not significantly) when w increases.

Table D2: Tobit regression of giving

Treatment	*Unequal*	*Unequal*	*Unequal*
Income	$15	$30	$45
Dependent variable, *giving*	(1)	(1)	(2)
t	0.11	-2.07	-3.94
[tax rate]	(1.01)	(1.27)	(3.21)
w	-0.77	-7.22***	-10.56*
[degree of waste]	(0.81)	(1.99)	(4.30)
$t \times w$	-3.17	5.26	11.07
[interaction term]	(1.83)	(3.16)	(7.53)
Constant	2.29*	4.52***	-1.68
[constant term]	(1.06)	(1.33)	(3.72)
Observations	342	342	342
Clusters	38	38	38

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table D3 provides robustness checks related to the discussion in Section 5.1 and Table 4. Here, we examine if there is any non-monotonic relationship between giving and income in the *Unequal* treatment. Recall that in Table 4 and Table D1 the *Income* coefficient is not significant. It is possible, however, that there is a non-monotonic relationship between giving and income. To examine this, we provide pairwise comparisons of different income individuals. For example, regression (1) uses the data from individuals with low income (who received $15) and middle income (who received $30). As we can see, the *Income* coefficient is not significant. The same is true for regressions (2) and (3).

Table D3: Tobit regression of giving

Treatment	*Unequal*	*Unequal*	*Unequal*
Income	$15 and $30	$15 and $45	$30 and $45
Dependent variable, *giving*	(1)	(1)	(2)
t	-0.71	-0.80	-3.05*
[tax rate]	(0.81)	(1.41)	(1.46)
w	-3.51***	-3.91*	-9.08***
[degree of waste]	(1.00)	(1.70)	(2.20)
Income	0.10	0.01	-0.10
[income = $15, or $30, or $45]	(0.10)	(0.08)	(0.19)
$t \times w$	0.27	1.00	8.22*
[interaction term]	(1.79)	(3.47)	(3.77)
Constant	0.91	0.42	6.17
[constant term]	(2.33)	(2.70)	(7.05)
Observations	684	684	684
Clusters	76	76	76

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table D4 provides robustness checks related to the discussion in Section 5.2 and Table 5. Instead of estimating separate regressions for risk-averse and risk-neutral/seeking individuals, we construct a dummy variable *Risk-averse* for individuals with 7 or more safe choices. We also include the interaction terms. The coefficient on w is still significant at the 0.01 level in the *Equal* treatment (regression 1), however its magnitude is substantially lower. On the other hand, in the *Unequal* treatment (regression 2) and pooled data (regression 3), the significance on w completely disappears. Importantly, in the pooled regression (3), the w×*Risk-averse* is significant at 0.05 level, suggesting that risk aversion mediates the relationship between giving and w.

Table D4: Giving and the curvature of the utility function

Treatment	*Equal*	*Unequal*	*Pooled*
Dependent variable, *giving*	(1)	(2)	(3)
t	-0.34	4.00	1.86
[tax rate]	(1.99)	(2.64)	(1.74)
w	-2.59*	-1.38	-2.03
[degree of waste]	(1.26)	(1.83)	(1.15)
Income		-0.08	-0.07
[income = $15, $30, $45]		(0.13)	(0.12)
Unequal			3.01
[1 if the *Unequal* treatment]			(2.07)
Risk-averse	3.70	0.22	1.11
[1 if risk-averse]	(2.35)	(5.29)	(5.60)
t × *Risk-averse*	-0.53	-6.06*	-3.48
[interaction term]	(2.39)	(2.93)	(1.97)
w × *Risk-averse*	-3.08	-3.83	-3.43*
[interaction term]	(1.95)	(2.24)	(1.51)
Income × *Risk-averse*		0.16	0.15
[interaction term]		(0.17)	(0.17)
Unequal × *Risk-averse*			-2.00
[interaction term]			(2.64)
Constant	-0.49	0.80	-0.86
[constant term]	(1.99)	(4.25)	(4.31)
Observations	801	1026	1827
Clusters	89	114	203

Note: * indicates statistical significance at 0.05, ** at 0.01, and *** at 0.001 level. Standard errors in parentheses are clustered at the participant level.

Table D5 and Table D6 provide robustness checks related to the discussion in Section 5.3 and Table 6. As in Table 6, we categorize each individual by two dimensions: (1) how they respond to changes in t and (2) how they respond to changes in w. However unlike in Table 6, we split the data by the *Equal* and *Unequal* treatment. Table D5 and Table D6 show that in both treatments there are three main types of individuals that account for more than half of all observations: (1) participants who always give \$0 disregarding t and w, (2) participants who weakly decrease their giving in response to increase of t and w, (3) participants who do not change their giving in t and w.

Table D5: Individual giving response in the *Equal* treatment

Giving response to changes in the tax rate t	Giving response to changes in the degree of waste w					
	Zero giving	Constant	Decreasing	Increasing	Other	Total
Zero giving	26	0	0	0	0	26
Constant	0	7	4	1	0	12
Decreasing	0	0	17	1	3	21
Increasing	0	0	4	6	4	14
Other	0	0	7	0	10	17
Total	26	7	32	8	17	90

Each number in the table indicates the number of participants that fall into one of the categories. For example, there are 17 participants whose giving decreases in t and in w.

Table D6: Individual giving response in the *Unequal* treatment

Giving response to changes in the tax rate t	Giving response to changes in the degree of waste w					
	Zero giving	Constant	Decreasing	Increasing	Other	Total
Zero giving	30	0	0	0	0	30
Constant	0	11	9	1	0	21
Decreasing	0	1	21	1	5	28
Increasing	0	0	7	7	2	16
Other	0	0	6	0	13	19
Total	30	12	43	9	20	114

Each number in the table indicates the number of participants that fall into one of the categories. For example, there are 21 participants whose giving decreases in t and in w.