The Social Cost of Randomization*

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Abstract

Many social programs are allocated through lotteries. In this paper we ask whether potential recipients support or oppose such allocation of financial benefits, by allowing them to reward or punish an allocator conditional on her choice of allocation mechanism: direct allocation to one recipient vs. randomization among potential recipients. We find that recipients on average *support* randomization when all potential recipients have equal endowments. However, when there is expected inequality between the potential recipients, the relatively poorer recipients on average *oppose* randomization. We therefore identify a social cost associated with random allocation which is borne by the relatively poorer recipients.

JEL codes: C91, D03, D61. **Keywords**: Random Assignment, Lotteries, Randomized Experiments, Fairness, Dictator Game, Laboratory Experiment, Allocative Efficiency, Social Choice.

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1 Introduction

Individuals, organizations, and governments frequently make allocation decisions not only for themselves, but also for others: parents allocate food to their children, NGOs distribute aid to the poor, governments allocate unemployment benefits and healthcare to their citizens. But according to what criteria should scarce resources be distributed among potential recipients? This question lies at the heart of social choice theory, and has been the subject of intense debate for centuries (Rawls 1971; Sen 1970; Bentham 1879; Arrow 1963; Harsanyi 1955). A common answer is randomization: when no detailed information is available about potential recipients, it is standardly argued that lotteries should be the method of choice (Eckhoff 1989; Katta and Sethuraman 2006). Furthermore, random allocation of benefits is thought to be permissible, and even preferred, when resources are scarce and not everyone can get the benefit (Lockwood and Anscombe 1983; Lilford and Jackson 1995; Toroyan et al. 2000).

Historical examples include the casting of lots to determine membership in the Athenian Council of 500 in the 4th and 5th centuries B.C. (Eckhoff 1989); an instruction to assign land ownership by lot in the Book of Numbers (Silverman and Chalmers 2001); a Viking custom to divide land among heirs or other claimants by lot; a Danish law to this effect that still exists today for cases when the estate of a deceased person is administered by a court (Eckhoff 1989); an 1842 court ruling which held that lots should have been drawn on a sinking boat to determine which passengers should be thrown overboard to ease the load on the sinking vessel (United States v. Holmes); and military drafts held in Britain, Austria-Hungary, the United States, and other countries (Silverman and Chalmers 2001; MacAtasney 1998; Fienberg 1971; Rosenblatt and Filliben 1971). Contemporary examples of the use of randomization include the U.S. "Green Card" lottery, in which the US Department of State makes available 50,000 permanent resident visas every year[1]; and several instances of random allocation of social housing, such as the CHA Waitlist Lottery administered by the Chicago Housing Authority[2]. In addition, randomization serves a crucial

[1] See e.g. http://www.usa-green-card.com/, accessed on October 18, 2015.
[2] See e.g. http://www.thechawaitlist.org/, accessed on October 18, 2015.

function in science and medicine: it is the backbone of the Randomized Controlled Trial (RCT), where it ensures that the treatment and control groups are statistically identical, and thus allows attributing any differences in behavior or welfare outcomes to an intervention. It is due to this feature that RCTs are widely regarded as the gold standard for clinical trials (Sacks et al. 1982) and, more recently, the evaluation of social programs in both developed and developing countries (Fisher 1925; Newman et al. 1994; Harrison and List 2004; Duflo and Kremer 2005; Thomas 2010).

Thus, random allocation of benefits and burdens has often been thought to be acceptable when resources are scarce, such that only some potential recipients can benefit. The purpose of this paper is to determine whether this also holds for *potential recipients* – i.e., do potential recipients support randomization as an allocation mechanism? This question is important: if randomization is not supported by potential recipients, allocating scarce resources through lotteries might imply social costs that have to be taking into account in the choice of allocation mechanism.

The perceived fairness of randomization has only been considered in a handful of studies, all of which are survey-based. Hillis and Wortman (1976) provide survey evidence showing that randomization for scientific purposes is perceived to be permissible when the study is scientifically necessary; however, these authors also find that scarce resources are not regarded as a sufficient justification for randomization. Innes (1979) found that college students reported high perceived moral justifiability of randomization of juvenile offenders into institutionalization vs. family therapy. Erez (1985) surveyed prison inmates about their opinions regarding four different selection criteria for special beneficial programs: need; merit; first come, first served; and random assignment. Need was perceived as the fairest allocation criterion, and randomization as the least fair. Similarly, Johnson et al. (1991) found that people generally deem randomization to be unacceptable in clinical trials when one treatment is better than the other; even when expert opinion about which treatment is better is split 80% vs. 20%, only 3% of respondents find randomization acceptable. However, randomization is deemed more acceptable when the treatment is not a life-saving intervention. These findings echo Gary Burtless' (1995) claim that "except among philosophers and research scientists, random assignment is often thought to be an unethical way to ration public resources."

Surprisingly, we know of no study that has gone beyond using surveys and tested whether potential recipients support or oppose randomization in an incentive compatible way. When self-interest plays a role, people's principles of fairness might differ from the claims they are willing to make regarding these principles (Konow 2000), and the purpose of the present study is thus to fill this gap. We set up experimental groups of three participants, in which one allocator decides how to allocate an indivisible prize of CHF 5 to one of two potential recipients. The allocator can choose between allocating the prize directly to one of the two potential recipients, or to let the computer randomize with equal probabilities. We then ask whether the potential recipients support or oppose the different allocation mechanisms by allowing them to either reward or punish the allocator conditional on her allocation choice. Importantly, we elicit this information in an incentive-compatible manner, as rewards and punishments of the allocator are costly to the potential recipients. In addition, we ask whether differences in endowments between potential recipients affect their reward/punishment behavior; for instance, when one potential recipient is relatively poorer than the other, we might expect that random allocation is punished more by the relatively poorer recipient. Finally, we test whether uncertainty about the distribution of endowments between the potential recipients affects their behavior; for instance, we might expect that uncertainty about initial endowments makes randomization more acceptable.

We find that the potential recipients' support for randomization depends on the distribution of their endowments. When recipients have equal endowments, they *support* randomization, in the sense that they choose, on average, to incur a cost to *reward* the allocator for randomizing. In contrast, when recipients have unequal endowments, the relatively poorer recipients on average *oppose* randomization, in the sense that are willing to incur a non-negligible cost to punish the allocator for randomizing, while the relatively richer recipients neither reward nor punish randomization on average. Thus, if there is expected inequality between potential recipients, an allocator who chooses to randomize imposes a *social cost* on the recipients – especially the least privileged ones – that manifests itself in the recipients' willingness to pay to punish the allocator. This social cost is primarily borne by the relatively poorer recipients, who are willing to give up 4.4% of the prize being allocated to punish the allocator for choosing that allocation method, regardless of whether or not they end up being the recipient of the prize.

Recipients' aversion to randomization therefore has implications for the allocation of social programs and for the value of targeting: investing resources into finding deserving recipients may be justified because the least privileged potential recipient are willing to give up a significant share of a financial benefit to signal opposition to the benefit being randomly allocated.

The remainder of the paper is organized as follows: Section 2 outlines the experimental setup; Section 3 reports the econometric approach and results; Section 4 concludes.

2 Design and Procedures

2.1 Participants

We recruited 105 healthy participants from the subject pool at the University of Zürich. Their mean age was 22.08 ± 3.31 (mean $\pm$ S.D.). We excluded students of economics and psychology. All participants gave written informed consent and were remunerated according to the outcomes of the tasks described below. There was no show-up fee. An experimental session lasted 2 hours.

2.2 Session Structure

The experiment was conducted in three sessions with 36, 36, and 33 participants, respectively. Participants were seated at networked computers in the behavioral laboratory of the Department of Economics at the University of Zürich. Each participant was randomly assigned the role of Allocator or Recipient at the beginning of the session and kept this role for the entire session. The sessions were divided into two parts: the main experiment and the belief elicitation. In the main experiment, participants completed a task in groups of three, where two participants were assigned the roles of potential recipients and the remaining participant was assigned the role of the allocator. All participants knew their own role (allocator or recipient), but did not know the identities of the other players in their group. Allocators received a starting endowment of CHF 32[3]; recipients received varying endowments depending on the condition (see details below). In the belief elicitation part of the experiment, participants were incentivized to estimate the behavior of the other participants during the main experiment (details about the incentive scheme are described in Section 2.5).

At the end of the experiment, all participants filled out a socioeconomic questionnaire and were paid.

2.3 Block Structure and Conditions

After being given detailed instructions on the task and correctly answering test questions that probed understanding of the task, participants performed two blocks of the allocation task. Each block consisted of six trials, and each trial corresponded to a different condition. The conditions differed in terms of the distribution of endowments between the two potential recipients and the information revealed to all three participants about this distribution. The six types of conditions were: Equal Certain, Richer Certain, Poorer Certain, Equal Uncertain, Richer Uncertain, and Poorer Uncertain. In all "Certain" conditions, the exact endowments of the two potential recipients were revealed to all three participants. In all "Uncertain" conditions, the participants were informed only about an interval from which the endowment of Recipient A would be drawn, and an interval from which the endowment of Recipient B would be drawn. Within these intervals, initial endowments were drawn at random using a uniform probability distribution. The participants were not informed about the probability distribution of their incomes within the intervals, but the midpoints of the intervals were always equal to the endowments in the corresponding "Certain" condition. In the second block of the experiment the

[3]At the time of the experiment, CHF 1.00 was equivalent to approximately USD 0.97.

six conditions were repeated with the modification that all endowments and interval midpoints were increased by CHF 10, while the length of the intervals remained the same in the "Uncertain" conditions. We refer to the first block as the Low Endowment block and to the second block as the High Endowment block.

In the "Equal Certain" condition, Recipient A and Recipient B received equal endowments. These endowments were CHF 15 in the low endowment block and CHF 25 in the high endowment block. In the "Richer Certain" condition, Recipient A received a higher endowment than Recipient B. In the low endowment block, Recipient A was endowed with CHF 20, while Recipient B was endowed with CHF 10; in the high endowment block Recipient A was endowed with CHF 30, and Recipient B with CHF 20. In the "Poorer Certain" condition, these roles were reversed: either Recipient A was endowed with CHF 10 while Recipient B was endowed with CHF 20, or Recipient A was endowed with CHF 20 while Recipient B was endowed with CHF 30. Note that in the "Richer Certain" and "Poorer Certain" conditions the average endowment was equal to the endowment given to both recipients in the "Equal Certain" condition. Note also that the relatively poorer recipient was given the same endowment in the high endowment block as the relatively richer recipient was given in the low endowment block. This allows us to control for income effects.

In the "Equal Uncertain" condition, the two recipients received equal endowments *in expectation*: in the low endowment block, both endowments were drawn from the interval CHF [7.50 - 22.50], and in the high endowment block, both endowments were drawn from the interval CHF [17.50 - 32.50]. In the "Richer Uncertain" condition, Recipient A was given a higher endowment than Recipient B *in expectation:* in the low endowment block, Recipient A's endowment was drawn from the interval CHF [12.50 - 27.50] while Recipient B's endowment was drawn from the interval CHF [2.50 - 17.50]; in the high endowment block, Recipient A's endowment was drawn from the interval CHF [22.50 - 37.50] while Recipient B's endowment was drawn from the interval CHF [12.50 - 27.50]. In the "Poorer Uncertain" condition, these roles were again reversed as described above. Note that the intervals from which Recipient A and Recipient

B's endowments were drawn overlapped in the "Richer Uncertain" and "Poorer Uncertain" conditions. Thus, all participants were genuinely uncertain as to which recipient would be given the relatively lower endowment.

Figure 1 gives an overview over the six conditions and the two blocks.

Within each block, each participant played one trial in each of the six conditions presented in Figure 1. Thus, each recipient assumed the "Equal Certain", "Richer Certain", "Poorer Certain", "Equal Uncertain", "Richer Uncertain", and "Poorer Uncertain" roles exactly once within each block. The sequence of conditions (the order in which recipients experienced the different conditions) was perfectly counterbalanced between recipients A and B. Specifically, for each sequence experienced by a recipient in the role of Recipient A, there existed a participant in the role of Recipient B who experienced the exact same sequence and vice versa[4].

After each group of three participants (two recipients and one allocator) had played six trials, corresponding to all six conditions in the low endowment block, groups were randomly re-assigned, and the second block, where participants played six trials corresponding to all six conditions in the high endowment block, began. Each participant played a total of two blocks and no participants who had played together in the first block met each other again in the second block.

2.4 Trial Structure

Each trial was structured as follows. At the beginning of the trial, all three members of a group were informed about the endowments of the two recipients; thus, all participants had the same information about the distribution of endowments, whether this information was exact or with uncertainty. In particular,

[4]For example, if a recipient in the role of Recipient A experienced the conditions in the following order (Sequence 1): "Equal Certain", "Richer Certain", "Poorer Certain", "Equal Uncertain", "Richer Uncertain", "Poorer Uncertain", there is by construction a recipient in the role of Recipient B who experienced the conditions in the following order (Sequence 2): "Equal Certain", "Poorer Certain", "Richer Certain", "Equal Uncertain", "Poorer Uncertain", "Richer Uncertain". The perfect counterbalance means that for each of such pairs of recipients A and B there exist another pair in which Recipient A experienced Sequence 2 and Recipient B experienced Sequence 1.

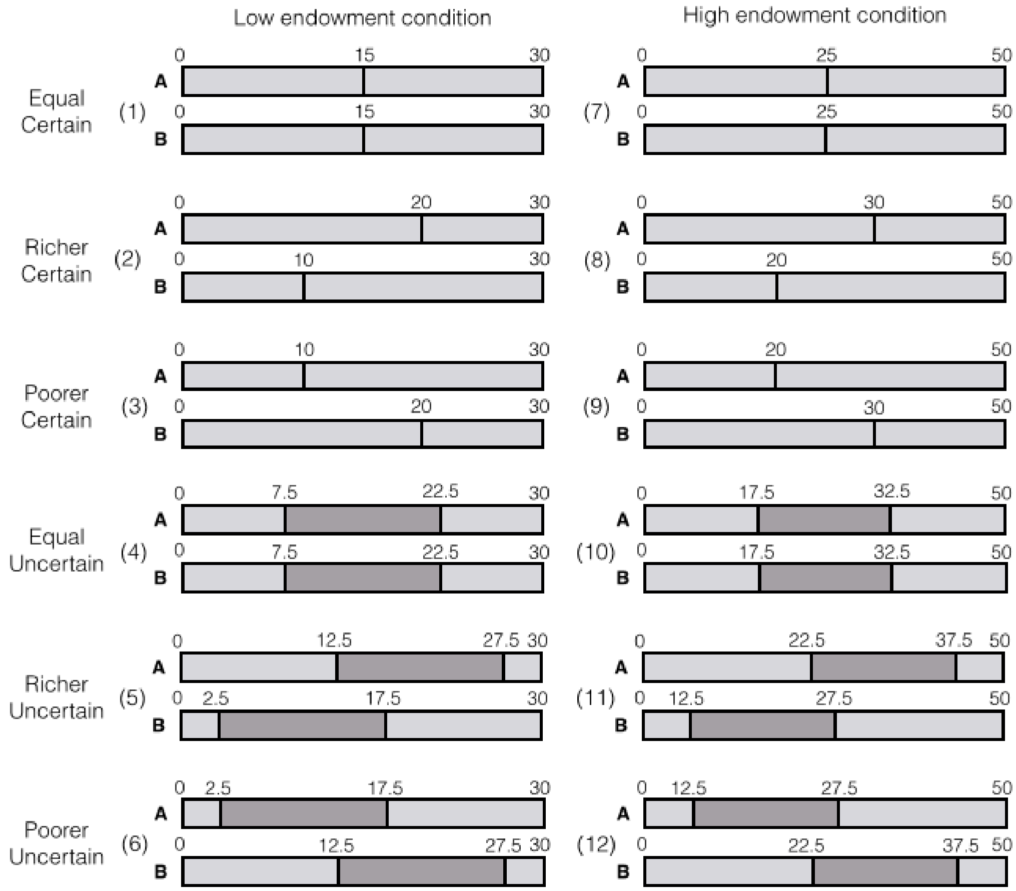

Figure 1: Overview Over the Six Experimental Conditions and the Two Blocks.

Notes: Each participant completed two blocks of the task, consisting of six trials each. The two blocks differed by the magnitude of the initial endowments, which were increased by CHF 10 in Block 2 (high endowment block) relative to Block 1 (low endowment block). Within each block, the two recipients were either given equal endowments (Conditions 1, 4, 7, 10) or unequal endowments (Conditions 2, 3, 5, 6, 8, 9, 11, 12) in expectation; in the latter case, this resulted in a relatively poorer and a relatively richer potential recipient. In addition, initial endowments were either known with certainty (Conditions 1-3, 7-10), or with some degree of uncertainty (Conditions 4-6, 10-12). Under uncertainty, initial endowments were randomly and uniformly distributed in an interval of ± CHF 7.50 around the endowments in the Certain conditions. All members of each group (i.e. both recipients and the allocator) knew about the relative endowments of the two potential recipients in each group. The figure shows the information given to the participants about the endowments of Recipients A and B in each experimental condition. For each condition the top bar indicates the endowment of Recipient A, while the bottom bar indicates the endowment of Recipient B. In conditions 1-3 and 7-9 the exact endowments are indicated by black vertical lines in the interior of the bar. In conditions 4-6 and 10-12 the start and endpoints of the endowment intervals are indicated by black vertical lines and the interval itself is filled with a darker grey shade.

each recipient was informed about her own endowment and the endowment of the other recipient, and the allocator was informed about the endowments of each recipient. In addition, information about the recipients' endowments was presented as common knowledge; every participants was made aware that all participants were given the same information about recipients' endowments.

The allocators then faced a decision of how to allocate an indivisible prize of CHF 5 between the two recipients. In doing so, allocators had three options: they could allocate the prize directly to Recipient A, they could allocate the prize directly to Recipient B, or they could let the computer randomize to whom to allocate. If the allocator chose to let the computer randomize, the ex ante probability distribution was 50/50 and both the allocator and the recipients were informed about this probability distribution[5].

Recipients A and B had the option of punishing or rewarding the allocators for their choices. We elicited recipient reward/punishment behavior using the strategy method, i.e. in each trial recipients made a reward/punishment decision for each possible choice of the allocator (*Give to me*, *Give to other,* or *Randomize*) before knowing the decision of the allocator[6]. In particular, each recipient was given a reward/punishment budget of CHF 8 on top of their endowment. From this budget they could spend CHF $x \in [0, 8]$ on rewarding or punishing the allocator conditional on her allocation choice, and the amount that was not spent rewarding or punishing the allocator, CHF $8 - x$, was payed out to the recipient. The reward/punishment technology was $1:2$, i.e. for each CHF a recipient spent rewarding the allocator, CHF 2 were added to the allocator's income; for each CHF a recipient spent punishing the allocator, CHF 2 were subtracted from the allocators' income. Allocators knew that recipients had this reward/punishment opportunity and were informed about the reward/punishment technology.

Note that we used neutral language: rather than the terms "reward" and "punish", participants were told that they could "increase or decrease the in-

[5] An example screen of what the allocators saw in the experiment before making their allocation decisions is presented in Appendix Figure A.1.

[6] An example screen of what the potential recipients saw in the experiment before making their reward/punishment decisions is presented in Appendix Figure A.2.

come of the allocator". Note also that the recipient labels "A" and "B" were only presented to the allocator. Recipients were never informed whether they were referred to as "Recipient A" or "Recipient B"; they were only informed about being "a recipient" and references to the other recipient were phrased as "the other recipient" to both recipients. This design rules out label effects in recipient behavior. Potential label effects in allocator behavior (e.g. preferential treatment of Recipient A because recipients were listed alphabetically when allocators made their allocation decisions) are discussed in Section 3.2.

Across the six conditions and two blocks, the allocator made a total of twelve allocation decisions (6 conditions $\times$ 2 blocks), while the recipients made a total of 36 contingent reward/punishment decisions (6 conditions $\times$ 2 blocks $\times$ 3 choices). Neither the allocator nor the recipients were informed of the decisions of the other group members within each trial; this information was not revealed until the very end of the experiment. Together, the lack of information about the behavior of others and the reassignment without replacement between blocks, rule out reputation effects, as well as strategically changing ones own behavior when learning about the behavior of others.

2.5 Estimates of Others' Preferences

In the belief elicitation part of the experiment, all participants repeated the same tasks as above, except they were now asked to estimate the average choices of *all* participants in the first part of the experiment. Specifically, the allocators were asked to estimate the average reward or punishment from all recipients for all possible allocation choices in each condition, while the recipients were asked to estimate the average reward or punishment of all *other* recipients for all possible allocation choices in each condition.

Each participant estimated the reward/punishment response of both Recipient A and Recipient B for all possible allocation choices in each condition in the low endowment block. Each participant thus made 36 estimates in total (6 conditions $\times$ 2 participants $\times$ 3 choices). To incentivize the participants to give their best estimate of the others' choices, they were initially rewarded with CHF 1 for each estimate they made; for every CHF the estimate deviated from the actual reward/punishment mean realized within each condition in the first part of the experiment, CHF 0.10 were subtracted from this amount.

2.6 Payment

At the end of the experiment, one trial from each block was chosen at random and paid out to all participants; thus, the allocator received their initial endowment of CHF 32 plus or minus the aggregate reward or punishment from the recipients for the specific allocation choice in that trial. Conversely, the recipients received their initial endowment plus the CHF 8 reward/punishment budget, minus the money spent out of this budget on rewarding or punishing the allocator in the randomly chosen trial. In addition, one of the potential recipients received the CHF 5 prize based on the allocator's choice in the randomly chosen trial. Finally, all participants received the payment from the belief elicitation part of the experiment, as described above.

3 Results

Our experiment offers three unique ways to assess participants' support for, or opposition to, possible allocation mechanisms: we observe how recipients reward or punish allocators for their choices; we observe how allocators decide to allocate a scarce resource; and we observe how allocators' decisions are informed by their beliefs about recipients' rewards and punishments for different allocation choices. Our main interest is the behavior of the recipients, but we shall touch upon the behavior and beliefs of the allocators for a short discussion about efficiency and suggested allocator preferences.

3.1 Recipient Behavior

Recipients were given the opportunity to respond to the different choices of the allocator by rewarding or punishing the allocator conditional on those choices. Throughout the analysis we will consider a recipient's reward for a specific allocation choice as an indication that the recipient *supported* that choice. Similarly, we consider a punishment for a specific allocation choice as an indication that the recipient *opposed* that choice. This interpretation allows us to avoid assumptions about the functional form of the utility function of the recipients. Instead, we assume only that no recipient punished the allocators for an allocation choice she supported, and no recipient rewarded the allocator for an allocation choice she opposed. Since purely selfish recipients can experience positive or negative utility without being willing to incur a cost to signal this, our interpretations of "support" and "opposition" are conservative measures of positive and negative utility, respectively.

We generate a linear reward/punishment variable (*Reward*) where rewards are coded as positive, punishments are coded as negative, and the unit of measurement is Swiss Francs (CHF). Subsequently we will refer to this linear variable as "*Reward*", with an upper case R, while we will refer to only the positive domain of this variable as "reward", with a lower case r. We will interpret a positive average *Reward* for a specific allocation choice as average *support* for that choice, and a negative average *Reward* as average *opposition*. We pool recipients A and B, since these are identical in expectation, and study instead the behavior of different recipient "types" defined by the recipients' relative position in the endowment distribution: whether they were equal in expectation (*Equal*), whether they were relatively poor in expectation (*Poor*), or whether they were relatively rich in expectation (*Rich*).

From each recipient's point of view, the possible choices of the allocators were (i) to allocate directly to that recipient (*Give to Me*), (ii) to allocate directly to the other recipient (*Give to Other*), or (iii) to randomize between the two potential recipients (*Randomize*). As described in Section 2.4, the experiment was designed to rule out strategic behavior by maintaining anonymity throughout the experiment and by not revealing any information about behavior of the other participants before the very end of the experiment. Furthermore, rewarding and punishing allocators was costly to the recipients, and thus a recipient who wanted to maximize her own payoff should neither reward nor punish the allocators regardless of their allocation choice. Across recipients, we do indeed find that the median response to each allocator choice was to neither reward nor punish the allocator (see Appendix Table A.1). However, only 22 recipients (31.4%) *never* rewarded nor punished the allocator across all 36 choices. The remaining 48 recipients (68.6%) changed their reward/punishment behavior *at least* once during the experiment. Thus, the majority of recipients were at some point during the experiment willing to incur a cost to signal their support/opposition toward the choices of the allocator.

Figure 2 presents simple summary statistics of recipients' *Reward* for the different allocator choices across the low endowment/high endowment and certainty/uncertainty conditions. The dark gray bars show recipients' average response to direct allocation to themselves, the medium grey bars show recipients' average response to direct allocation to the other recipient, and the light grey bars show recipients' average response to randomization.

The first two bars in each panel reveal that all recipient types, on average, rewarded the allocator for direct allocation to themselves, and punished the allocator for direct allocation to the other recipient. As argued above, this behavior is inconsistent with payoff maximization, as a payoff maximizing recipient should never be willing to incur a cost to reward or punish the allocator when there is no teaching element involved (which is the case here). Instead, this behavior reveals that, on average, all recipient types were willing to incur a cost to reciprocate.

In the positive domain (when the prize was allocated directly to themselves), recipients rewarded the allocator with almost the same amount regardless of initial endowment: the equal recipients rewarded the allocator with CHF 0.90, the relatively poorer recipients rewarded the allocator with CHF 0.98, and the relatively richer recipients rewarded the allocator with CHF 1.01. In the negative domain (when the prize was allocated directly to the other recipient), equal recipients punished the allocator with CHF -0.68, the relatively poorer recipient punished the allocator with CHF -0.97, while the relatively poorer recipient punished the allocator with CHF -0.29. The relatively poorer recipients thus punished direct allocation to the relatively richer recipients more than three times as much as the relatively richer recipients punished direct allocation to the relatively poorer recipients. This difference can potentially signal prefer-

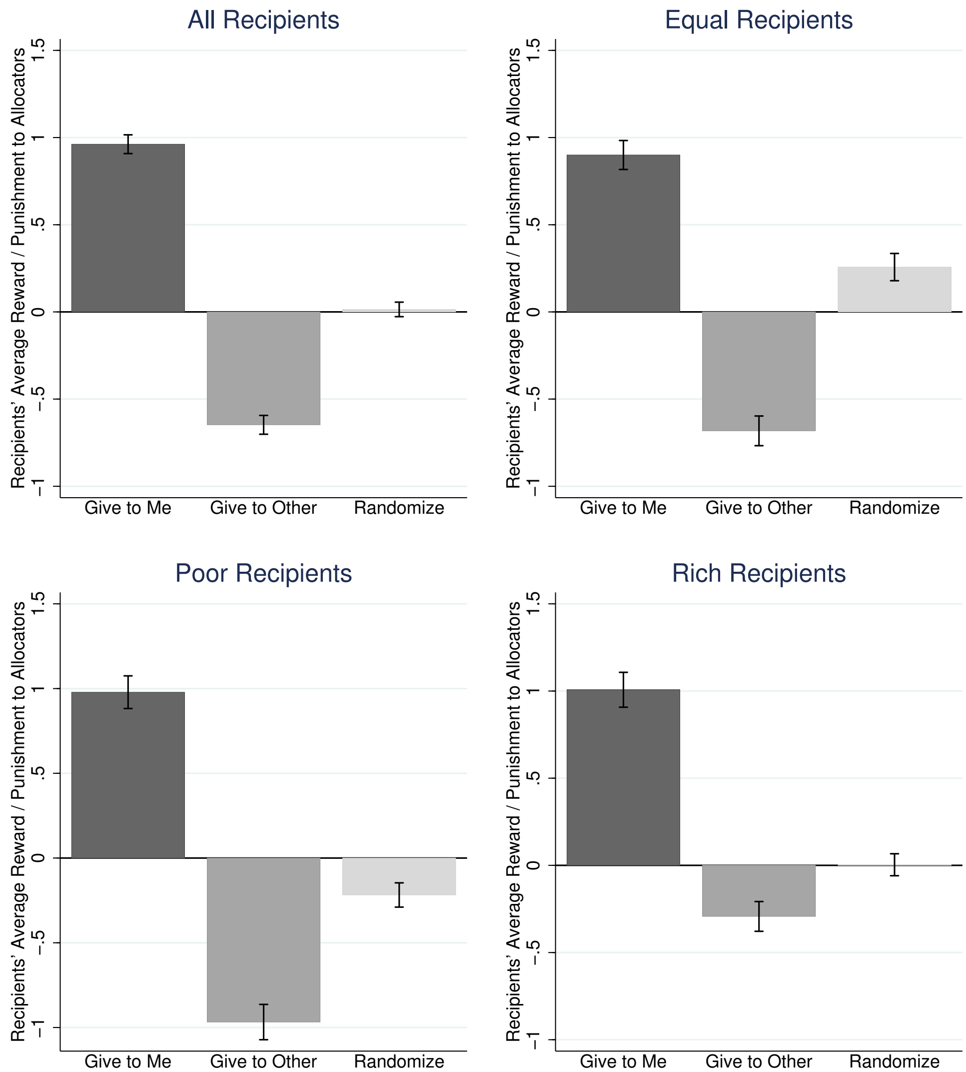

Figure 2: Recipients' Average Reward/Punishment to the Allocators Conditional on the Allocators' Choices

Notes: Dark gray bars show recipients' average *Reward* to the allocators for direct allocation to themselves, medium gray bars show recipients' average *Reward* to the allocators for direct allocation to the other recipient, and light gray bars show recipients' average *Reward* to the allocators for randomization. The top left panel shows the average *Reward* of all recipients across all conditions. The top right panel shows the average *Reward* of all recipients across the equal endowment conditions. The bottom panel shows the average *Reward* of all the relatively poorer recipients (left panel) and of all the relatively richer recipients (right panel) across the unequal endowment conditions. Error bars are naïve standard errors, calcualted as $\frac{S.D.}{\sqrt{N}}$.

ences for fairness or equality, i.e. when recipients were relatively poorer, they found direct allocation to the relatively richer recipient more unfair than they found direct allocation to the relatively poorer recipient when they were relatively richer. However, the fact that even the relatively richer recipients on average punished direct allocation to the relatively poorer recipient reveals that preferences for fairness or equality cannot fully explain recipients' behavior.

These average punishments are particularly interesting because they are highly inefficient, in that they are subtracted once from the endowment of the recipient and twice from the endowment of the recipient, while rewards are welfare increasing. The behavior of the recipients thus does not seem to display a concern for efficiency, which has previously been found to be as strong a motivator for allocation decisions as concerns for equality in certain populations (Fisman et al. 2015).

The third bar in the first diagram shows that, on average across all conditions, potential recipients neither rewarded nor punished the allocator for choosing to randomize. However, the next three diagrams reveal there are interesting differences in the average response to randomization between the three recipient types: on average, recipients with equal endowments *rewarded* the allocator for randomizing with CHF 0.26, the relatively poorer recipients *punished* the allocator for randomizing with CHF -0.22, and the relatively richer recipients neither rewarded nor punished the allocator for randomizing with an average of CHF 0.00. Thus, even though the relatively richer recipients were given higher endowments than recipients with equal endowments, they gave up *less* money to reward the allocator for choosing to randomize – i.e. when there was inequality between potential recipients, the relatively richer recipients supported randomization less than did recipients in conditions with equality between all potential recipients. A similar argument can be made for the relatively poorer recipients: even though they were given lower endowments than the recipients with equal endowments, they gave up *more* money to punish the allocator for choosing to randomize than did recipients with equal endowments. Thus, when there was inequality between the potential recipients, both the relatively poorer and the relatively richer recipients supported randomization less than when all recipients were given equal endowments.

Table 1 assesses whether these differences are statistically significant. We estimate the following equation separately for each possible allocation choice (*Give to Me*, *Give to Other*, and *Randomize*):

$$Reward_{ic} = \beta_0 + \beta_1 Poor_{ic} + \beta_2 Rich_{ic} + \alpha_i + \varepsilon_{ic}. \tag{1}$$

$Reward_{ic}$ is the linear reward/punishment variable presented above, $Poor_{ic}$ is an indicator that the recipient assumed the role of the relatively poorer recipient, while $Rich_{ic}$ is an indicator that the recipient assumed the role of the relatively richer recipient. The omitted category is recipients with equal endowments. The interpretation of coefficient β_0 is thus the average *Reward* for recipients with equal endowments, while coefficients β_1 and β_2 capture the difference in average *Reward* between the recipients with equal endowments and the relatively poorer and the relatively richer recipients, respectively. α_i captures individual level fixed effects, ε_{ic} is an error term clustered at the participant level, i is a participant index and c is a condition index, $i \in [1, 70]$ and $c \in \left\{ \text{(Certain, Uncertain)} \times \begin{pmatrix} \text{High endowment} \\ \text{Low endowment} \end{pmatrix} \right\}$. Linear combinations of coefficients are reported in the lower panel of the table, along with corresponding standard errors. The interpretation of the linear combination of β_0 and β_1 is the average *Reward* chosen by the relatively poorer recipients, and the linear combination of β_0 and β_2 is the average *Reward* chosen by the relatively richer recipients. Furthermore, the F-statistic and the corresponding p-value from a Wald test of equality between β_1 and β_2 is reported in the lower panel of the table.

Column (1) confirms that all three recipient types, on average, significantly rewarded the allocator for direct allocation to themselves, and that the differences between the average rewards of CHF 0.90 (*Equal*), CHF 0.98 (*Poor*) and CHF 1.01 (*Rich*) are not statistically different from each other. Column (2) confirms that all three recipient types, on average, significantly punished the allocator for direct allocation to the other recipient, and that average punishment from the relatively poorer recipient (CHF -0.97) is statistically different

Table 1: Effect of the Recipient's Relative Endowment on Her Reward/Punishment to the Allocator

	Dependent variable: *Reward*		
	(1) Give to Me	(2) Give to Other	(3) Randomize
Poor	0.08	-0.29**	-0.47***
	(0.09)	(0.11)	(0.12)
Rich	0.11	0.39**	-0.25**
	(0.10)	(0.15)	(0.11)
Constant	0.90***	-0.68***	0.26***
	(0.05)	(0.06)	(0.07)
Mean of dep. variable	0.96	-0.65	0.01
Poor + Constant	0.98***	-0.97***	-0.22***
(s.e.)	(0.06)	(0.10)	(0.05)
Rich + Constant	1.01***	-0.29**	0.00
(s.e.)	(0.07)	(0.12)	(0.05)
F-stat: Poor = Rich	0.06	10.16	9.87
p-value	0.80	0.00***	0.00***
Observations	840	840	840

Notes: Effect of the recipient't relative endowment on her reward/punishment to the allocator. The constant term captures recipients' average *Reward* when endowments are equal. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the participant level. A linear combination of β_1 and β_0, capturing the average *Reward* from the relatively poorer recipients, and a linear combination of β_2 and β_0, capturing the average *Reward* from the relatively richer recipients', as well as F-statistics and corresponding p-values from Wald tests for coefficient equality between β_1 and β_2, are reported in the lower panel of the regression table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

from the average punishment from relatively richer recipient (CHF -0.29). Furthermore, the average punishment from recipients with equal endowments (CHF -0.68) is is almost the exact midpoint of the average punishments from the relatively poorer and the relatively richer recipients, while still being statistically different from both averages. Column (3) reveals that the average responses to randomization from both recipients with equal endowments (CHF 0.26) and the relatively poorer recipients (CHF -0.22) were statistically different zero, while they were also statistically different from each other. The average response to randomization from the relatively richer recipients (CHF 0.00) was not statistically different from zero, but it differed significantly from the average responses of both the equal recipients and the relatively poorer recipients. Thus, all relevant differences discussed in relation to Figure 2 are statistically significant.

In sum, we find that, on average, recipients *rewarded* randomization at a cost to themselves when there was equality in endowments between potential recipients; *punished* randomization at a cost to themselves when they were relatively poor compared to other potential recipients; and neither rewarded nor punished randomization when they were relatively rich compared to other potential recipients.

Recipient Behavior from the Perspective of the Allocator

We now ask how recipient behavior looks from the perspective of the allocator. Taken together, the above results imply that an allocator who chose to randomize between equal recipients could expect to be rewarded for this choice. On the other hand, an allocator who chose to randomize between unequal recipients could expect to be punished for that same choice. Figure 3 shows the allocators' expected net *Reward* (the sum of rewards/punishments from the two recipients not taking into account the 1:2 reward/punishment technology) for each allocation choice across the equal endowment conditions and across the unequal endowment conditions, respectively.

In the equal endowment conditions, allocators' maximized their expected net *Reward* by choosing to randomize, but they also received a positive expected net *Reward* when allocating directly to either Recipient A or Recipient B. In

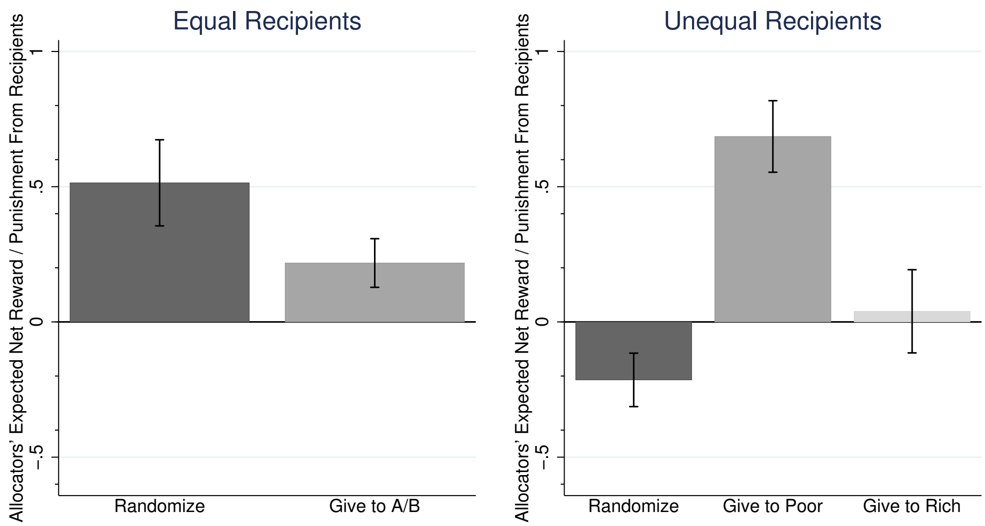

Figure 3: Allocators' Expected Net *Reward* for Each Possible Allocation Choice

Notes: Dark gray bars show allocators' expected net *Reward*, defined as the sum of rewards and punishments from both recipients within a given trial, when they chose to randomize between the two recipients in the equal endowment conditions (left panel) and in the unequal endowments conditions (right panel). Medium gray bars show allocators' expected net *Reward* when they chose to allocate directly to either Recipient A or Recipient B in the equal endowments conditions (left panel) or to the relatively poorer recipient in the unequal endowment conditions (right panel). The light grey bar (right panel) shows allocators' expected net *Reward* when they chose to allocate directly to the relatively richer recipient in the unequal endowment conditions. Error bars are naïve standard errors, calculated as $\frac{S.D.}{\sqrt{N}}$.

the unequal wealth condition, allocators maximized their expected net *Reward* by allocating directly to the relatively poorer recipient. But here they received a negative expected net *Reward* when they chose to randomize, and a small but positive expected net *Reward* when they chose to allocate directly to the relatively richer recipient.

Table 2 assesses whether these differences are statistically significant. In column (1) we estimate the following equation for the equal endowment conditions:

$$Reward_{gc} = \beta_0 + \beta_1 Give\ to\ A/B_{gc} + \alpha_g + \varepsilon_{gc}, \tag{2}$$

where *Reward* is the same variable as used in the previous regressions and *Give to A/B* is an indicator that the allocator chose to allocate directly to either Recipient A or Recipient B. c is a condition index, g is an index at the group level that identifies which two recipients were paired with which allocator in each trial. α captures group level fixed effects, and ε is an error term clustered at the group level, since random assignment to conditions happened at this level.

In column (2) we estimate a similar equation for the unequal endowment conditions:

$$Reward_{gc} = \beta_0 + \beta_1 Give\ to\ Poor_{gc} + \beta_2 Give\ to\ Rich_{gc} + \alpha_g + \varepsilon_{gc}, \tag{3}$$

where *Give to Poor* is an indicator that the allocator chose to allocate directly to the relatively poorer recipient, and *Give to Rich* is an indicator that the allocator chose to allocate directly to the relatively richer recipient. Everything else is as in Equation 2. In both columns (1) and (2), the interpretation of the coefficient β_0 is thus allocators' expected net *Reward* for randomization. In column (1) the interpretation of coefficient β_1 is the increase/decrease in expected net *Reward* when allocators chose to allocate directly to either Recipient A or Recipient B in the equal endowment conditions. In column (2) the interpretation of coefficients β_1 and β_2 is the increase/decrease in expected net *Reward* when allocators chose to allocate directly to the relatively poorer recipient or the relatively richer recipient, respectively, in the unequal endowment conditions. Linear combinations of coefficients β_0 and β_1 are reported in the lower panel of the table in both columns. In column (1) this linear combination captures allocators' expected net *Reward* for direct allocation to either Recipient A or Recipient B in the equal endowment conditions. In column (2) this linear combination captures allocators' expected net *Reward* for direct allocation to the relatively poorer recipient in the unequal endowment conditions. In column (2) a linear combination of β_1 and β_2, capturing allocators' expected *Reward* for direct allocation to the relatively richer recipient, as well as the F-statistic and corresponding p-value from a Wald test of equality between β_1 and β_2 are also reported in the lower panel of the table.

Table 2 shows that when an allocator chose to randomize between potential recipients who had equal endowments in expectation, they could indeed expect a significantly positive net *Reward* of CHF 0.51 – or more than 10% of the prize being allocated. However, even though this expected net *Reward* is more than twice as large as the expected net *Reward* for direct allocation to either Recipient A or Recipient B, CHF 0.22, these two values are not significantly different from each other.

Table 2 also shows that an allocator who chose to randomize between potential recipients who had unequal endowments in expectation could expect a significantly negative net *Reward* of CHF -0.21 – or 4.2% of the prize being allocated. This net *Reward* is not significantly different from what they could expect if they chose to allocate directly to the relatively richer recipient, CHF 0.04. However, it is significantly lower than their expected net *Reward* for allocating directly to the relatively poorer recipient, CHF 0.69. Thus, an allocator who chose to randomize between unequal recipients was awarded CHF 0.90 (CHF 0.69 – (-0.21)) less in expectation than an allocator who chose to allocate directly to the relatively poorer recipient. This difference amounted to an expected payoff difference of CHF 1.80 due to the 1:2 reward/punishment technology.

Table 2: Allocators' Expected Net *Reward* for Each Possible Allocation Choice

	Dependent variable: Net *Reward*	
	(1) Equal Conditions	(2) Unequal Conditions
Give to A/B	−0.30	
	(0.19)	
Give to Poor		0.90***
		(0.17)
Give to Rich		0.25
		(0.22)
Constant	0.51***	−0.21**
	(0.09)	(0.10)
Mean of dep. variable	0.37	0.17
Give to A/B + Constant	0.22**	
(s.e.)	(0.09)	
Give to Poor + Constant		0.69***
(s.e.)		(0.11)
Give to Rich + Constant		0.04
(s.e.)		(0.14)
F-stat: Give to Poor = Give to Rich		8.00
p-value		0.01***
Observations	280	840

Notes: Allocators' expected net *Reward* for each possible allocation choice. The constant term captures allocators' net *Reward* for randomization. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the group level. In column (1) the linear combination of β_1 and β_0 captures allocators' expected net *Reward* for direct allocation to either Recipient A or Recipient B in the equal endowment conditions. In column (2) the linear combination of β_1 and β_0 captures allocators' expected net *Reward* for direct allocation to the relatively poorer recipient in the unequal endowment conditions, and the linear combination of β_2 and β_0 captures allocators' expected net *Reward* for direct allocation to the relatively richer recipient in the unequal endowment conditions. The F-statistics and corresponding p-values for a Wald test of coefficient equality between β_1 and β_2 in the unequal endowment conditions are also reported in the lower panel of the table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Robustness

Effects of Uncertainty on Recipient Behavior. Does uncertainty about the distribution of endowments affect recipients' reactions to different allocations? The results reported above average over the Certain/Uncertain conditions; however, we might expect recipients to reward the allocators more/punish the allocators less when there is uncertainty about the exact distribution of endowments. To test this hypothesis, we estimated Equation 1 with an indicator that participants (both allocators and recipients) had uncertainty about the distribution of recipients' endowments, and interactions between this variable and whether the recipient was relatively poorer or relatively richer, respectively. Estimation results are reported in Appendix Table A.3. We find that no recipient type behaved significantly differently in trials in which there was uncertainty about the distribution of the recipients' endowments. Most importantly, we find no increase in recipients' *Reward* for randomization when there was uncertainty about the distribution of endowments. The argument that lotteries should be the method of choice when no detailed information is available about potential recipients (Katta and Sethuraman 2006; Eckhoff 1989) thus does not seem to be supported by the behavior of potential recipients.

Effects of Absolute Endowments on Recipient Behavior. A potential concern with the findings reported above is that there could be income effects. In expectation, relatively poorer recipients were endowed with CHF 10/20 (low endowment/high endowment block), relatively richer recipients were endowed with CHF 20/30, and recipients with equal wealth were endowed with CHF 15/25. Thus, if a decreasing marginal utility of endowments affected recipients' willingness to incur costs to signal their support/opposition toward different allocator choices, we would not be able to directly compare average behavior across the three recipient types.

To test for this confound, we estimate Equation 1 with an indicator for the high endowment conditions and interaction terms between the high endowment conditions and whether the recipient assumed the role of the relatively poorer or the relatively richer recipient, respectively. Estimation results are presented in Appendix Table A.2. We find that neither the indicator for the high endowment conditions, nor any of the interaction terms, are statistically significant. This result suggests that none of the recipient types significantly changed their reward/punishment behavior when we introduced the uniform increase in recipients' endowments. Specifically, the relatively poorer recipients did not change their behavior in the high endowment conditions to match that of the relatively richer recipients in the low endowment conditions, even though those two recipient types were given the same absolute endowment of CHF 20. This lack of differential response indicates that recipients' reward/punishment behavior was driven by whether they were *relatively* poorer or richer than the other recipient, and not whether they were poor or rich in *absolute* terms. We therefore conclude that differences in absolute endowments cannot account for the differences in reward/punishment behavior between the three recipient types.

Summary of Recipient Behavior

We find that potential recipients on average *rewarded* the allocator for choosing to randomize when there was equality in endowments between all potential recipients. Under the assumption that no recipient chose to reward an allocation method she opposed, this finding implies that the potential recipients on average *supported* randomization as an allocation method when there was equality between all potential recipients.

However, we find that the potential recipients on average *punished* the allocator for choosing to randomize when there was inequality in their endowments. Under the assumption that no recipient chose to punish an allocation method she supported, this finding implies that the potential recipients on average *opposed* randomization as an allocation method when there was inequality between the potential recipients. Since opposition is a conservative measure of disutility, we thus find that randomization was associated with an average *disutility* among potential recipients when these had unequal endowments. We refer to the aggregate disutility as "the social cost of randomization". This social cost is primarily primarily borne by the relatively poorer recipients, who are willing to give up 4.4% of the prize being allocated in order to punish the allocator for choosing that allocation method, regardless of whether or not they end up being the recipient of the prize.

3.2 Allocator Behavior

We now turn to the behavior of the allocators and ask: do they allocate so as to maximize their expected net *Reward* given recipients' reward/punishment behavior? This question is particularly interesting because all participants were randomized into being either allocators or potential recipients. Thus, we can assume that support for, or opposition to, randomization as an allocation method was identical between allocators and potential recipients in expectation at the outset, and any differences in support/opposition between the allocators and the potential recipients can thus be attributed to the participant's role in the allocation process.

We begin by presenting simple summary statistics for allocator behavior in Figure 4 and Table 3. The left panel in Figure 4 and the first column in Table 3 show the proportion of trials in which allocators chose to randomize, allocate directly to Recipient A, or allocate directly to Recipient B, respectively, in the equal endowment conditions (direct allocation to recipients A and B is pooled in Table 3 as Figure 4 reveals that allocators do not treat these differently). The right panel in Figure 4 and the second column in Table 3 show the proportion of trials in which allocators chose to randomize, allocate directly to the relatively poorer recipient, or allocate directly to the relatively richer recipient, respectively, in the unequal endowment conditions. The lower panel of Table 3 shows the t-statstics and corresponding p-values of t-tests comparing the different proportions to each other within the equal endowment conditions and the unequal endowment conditions, respectively. All proportions average over the high endowment/low endowment and certain/uncertain conditions.

When recipients had equal endowments in expectation, the modal allocator choice, chosen in 69% of trials, was to randomize between the two potential recipients. In fact, 19 out of 35 allocators (54.3%) randomized in *all* trials in which recipients had equal endowments, and every single allocator randomized in *at least* one trial in which recipients had equal endowments. Even allocators

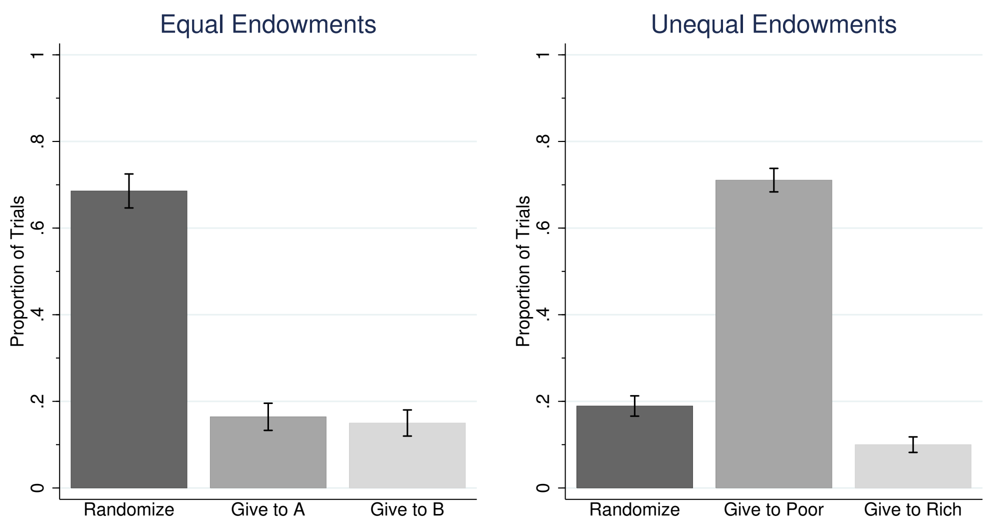

Figure 4: Proportions of Trials in Which Allocators Chose to Randomize or to Allocate Directly to One of the Two Potential Recipients

Notes: Dark gray bars show the proportion of trials in which allocators chose to randomize in the equal endowment conditionss (left panel) and in the unequal endowmenet conditions (right panel). Medium gray bars show the proportion of trials in which allocators chose to allocate directly to Recipient A in the equal endowment conditions (left panel), or to the relatively poorer recipient in the unequal endowment conditions (right panel). Light gray bars show the proportion of trials in which allocators chose to allocate directly to Recipient B in the equal endowment conditions (left panel), or to the relatively richer recipient in the unequal endowment conditions (right panel). Error bars are naïve standard errors, calculated as $\sqrt{\frac{p(1-p)}{N}}$.

Table 3: Proportions of Trials in Which Allocators Chose to Randomize or to Allocate Directly to One of the Two Potential Recipients

	(1) Equal Endowments	(2) Unequal Endowments
Randomize	0.69	0.19
	(0.05)	(0.05)
Give to A/B	0.31	
	(0.00)	
Give to Poor		0.71
		(0.00)
Give to Rich		0.10
		(0.00)
t-stat: Randomize = Give to A/B	4.72	
p-value	0.00***	
t-stat: Randomize = Give to Poor		−10.99
p-value		0.00***
t-stat: Randomize = Give to Rich		2.81
p-value		0.01***
t-stat: Give to Poor = Give to Rich		15.42
p-value		0.00***

Notes: Proportions of trials in which allocators chose to randomize, or allocate directly to one of the two potential recipients in the equal endowment conditions; or randomize, allocate directly to the relatively poorer recipient, or allocate directly to the relatively richer recipient in the unequal endowment conditions. Naïve standard errors, calculated as $\sqrt{\frac{p(1-p)}{N}}$, are reported in parentheses. t-statistics from t-tests comparing the different proportions to each other are reported in the lower panel of the tabel together with corresponding p-values.

who chose to allocate directly to either Recipient A or Recipient B seem to have "randomized" between the two potential recipients, as they allocated directly to Recipient A in 16% of trials and directly to Recipient B in 15% of trials. Thus, there seems to be no label effect in allocator behavior.

Since the potential recipients on average rewarded randomization when they had equal endowments, the allocators' choices were a relatively good match of recipients' behavior in the equal endowment conditions. This leads to a high allocator "efficiency" of 82.4%, calculated as the average net *Reward* obtained by the allocators as a fraction of the average net *Reward* the allocators could have obtained, if they had all chosen the net *Reward* maximizing strategy ($\frac{0.69 \cdot 0.51 + 0.31 \cdot 0.22}{0.51} \cdot 100\% = 82.4\%$).

When recipients had unequal endowments in expectation, the modal allocator choice, chosen in 71% of trials, was to allocate directly to the relatively poorer recipient. In fact, 15 out of 35 allocators (42.9%) allocated to the relatively poorer recipient in *all* trials in which recipients had unequal endowments. Allocators also randomized in a substantial proportion of trials, 19%. Since the potential recipients on average punished the allocator for randomizing when they had unequal endowments, this proportion is surprisingly large. The same holds for the proportion of trials in which the allocators chose to allocate directly to the relatively richer recipient, 10%. When there was inequality between the potential recipients, the allocators' choices therefore did not match the behavior of the recipients very well; in this case the allocator "efficiency" only amounts to 65.8% ($\frac{0.19 \cdot (-0.21) + 0.71 \cdot 0.69 + 0.10 \cdot 0.04}{0.69} \cdot 100\%$).

Thus, a question emerges: given that allocators' expected net *Reward* for randomization is significantly negative when the potential recipients were unequal in expectation, why did 19% of the allocators choose to randomize between them?

Why do Allocators Randomize between Potential Recipients with Unequal Endowments? If the allocators tried to match the preferences of the reward/punishment behavior of the potential recipients, we would expect that all the allocators chose the net *Reward* maximizing allocation strategy. Equivalently, we would expect that no allocator expected to "leave money on the table" with their allocation choice. Since we elicited allocators' beliefs about the behavior of the potential recipients in the end of the experiment, we can directly test whether this is the case.

Table 4 assesses whether the allocators expected to leave money on the table with their allocation choices. We estimate the following equation for both the equal endowment conditions (column 1) and the unequal endowment conditions (column 2):

$$D(\text{Allocator Expected to Leave Money on the Table})_{ic} = \beta' \mathbf{Allocation}_{ic} + \varepsilon_{ic}.$$

D(Allocator Expected to Leave Money on the Table) is an indicator that the allocator believed that she was leaving money on the table in a given trial. **Allocation** is a vector of indicators for the different allocator choices, i.e. **Allocation** = (Randomize, Give to A/B) in the equal endowment conditions and **Allocation** = (Randomize, Give to Poor, Give to Rich) in the unequal endowment conditions. The regressions are run without a constant term, which means that all coefficients can be interpreted directly as proportions[7]. In columns (1) and (2) β_1 captures the proportion of trials in which the allocators chose to randomize despite believing that they were leaving money on the table. In column (1) β_2 captures the proportion of trials in which allocators chose to allocate directly to recipients A or B in the equal wealth condition despite believing that they were leaving money on the table. In column (2) β_2 and β_3 capture the proportions of trials in which allocators chose to allocate directly to the relatively poorer recipient or the relatively richer recipient, respectively, despite believing that they were leaving money on the table. Standard errors

[7]The equation is estimated without correcting for individual level fixed effects, as 22 out of 35 allocators expected to leave money on the table in either *all* or *none* of the trials in which recipients had equal endowments, and 9 out of 35 allocators expected to leave money on the table in either *all* or *none* of the trials in which recipients had unequal endowments. Regressions controlling for individual level fixed effects are thus, in practice, based on the behavior of only the 13 allocators in the equal endowment conditions or the 26 allocators in the unequal endowment conditions who shifted between expecting to leave money on the table and expecting to maximize their net *Reward* at least once across trials. Nevertheless, we report results from regressions controlling for individual level fixed effects in Appendix Table A.5; this does not change the pattern of significance.

are heteroskedasticity-robust and clustered at the participant level.

The first column in Table 4 reveals that the allocators believed that they were leaving money on the table in 40% of trials in which they chose to randomize and in 24% of trials in which they chose to allocate directly to either Recipient A or Recipient B when the recipients had equal endowments in expectation. More interestingly, the second column reveals that the allocators expected to leave money on the table in 60% of the trials in which they chose to randomize when recipients had unequal endowments in expectation. On the other hand, allocators expected to leave money on the table in only 30% of trials in which they chose to allocate directly to the relatively poorer recipient.

The fact that allocators believed that they *were* maximizing their net *Reward* in the majority of trials in which they chose to allocate directly to the relatively poorer recipient does not imply that they were *motivated* by trying to maximize their net *Reward*. However, the fact that allocators believed that they were leaving money on the table in the majority of trials in which they chose to randomize implies that their choice of randomization *cannot* have been motivated by an attempt to maximize their expected net *Reward*. We thus conclude that allocators must have had preferences for randomization over and above what can be explained by their expectations for recipients' reward/punishment behavior.

In sum, we identify a disconnect between allocators choices and what recipients rewarded the allocator for choosing: allocators randomized to a greater extent than was optimal in terms of maximizing their net *Reward*. This disconnect cannot be explained by allocators having systematically wrong beliefs about recipients' reward/punishment behavior, since they choose to randomize despite expecting that this was not their net *Reward* maximizing strategy. Thus, we conclude that allocators had preferences for randomization over and above what can be explained by a motivation to maximize their net *Reward* from the recipients.

Effect of Uncertainty on Allocator Behavior. Given the argument made by Katta and Sethuraman (2006) and Eckhoff (1989), i.e. that lotteries should be the method of choice when no detailed information is available about poten-

Table 4: Proportions of Trials in Which Allocators Believed That They Were Leaving Money on the Table With Their Allocation Choices

	Dependent variable: Dummy for Whether the Allocator Expected to Leave money on table	
	(1) Equal Endowments	(2) Unequal Endowments
Randomize	0.40***	0.60***
	(0.08)	(0.09)
Give to A/B	0.24**	
	(0.09)	
Give to Poor		0.30***
		(0.06)
Give to Rich		0.70***
		(0.13)
Mean of dep. variable	0.36	0.39
F-stat: Randomize = Give to A/B	1.49	
p-value	0.23	
F-stat: Randomize = Give to Poor		8.91
p-value		0.01***
F-stat: Randomize = Give to Rich		0.42
p-value		0.52
F-stat: Give to Poor = Give to Rich		8.32
p-value		0.01***
Observations	70	140

Notes: Proportions of trials in which allocators believed that they were leaving money on the table with their allocation choices. Regressions are run without a constant term. Standard errors are heteroskedasticity-robust and clustered at the participant level. F-statistics and corresponding p-values from Wald tests for coefficient equality between β_1 and β_2 in column (1) and between β_1 and β_2, β_1 and β_3 as well as β_2 and β_3 in column (2) are reported in the lower panel of the table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

tial recipients, we hypothesized that allocators would be more likely to randomize in the unequal endowment conditions when they had uncertainty about the exact distribution of endowments between the potential recipients. In Table 5, we assess how allocators reacted to the introduction of uncertainty. We estimate the following equation separately for the equal endowment conditions (columns 1 and 2) and unequal endowment conditions (columns 3-5):

$$Allocation_{jc} = \beta_0 + \beta_1 Uncertain_{jc} + \alpha_j + \varepsilon_{jc}, \tag{4}$$

where *Allocation* is an indicator that the allocator chose the allocation mechanism $x \in \{\text{Randomize, Give to A/B, Give to Poor, Give to Rich}\}$, and $Uncertain$ is an indicator that there was uncertainty about the exact distribution of the recipients' endowments. The interpretation of coefficient β_0 is thus the proportion of trials in which the allocators chose the allocation mechanism x when they were certain about the distribution of recipients' endowments, and coefficient β_1 captures the increase/decrease in this proportion when uncertainty was introduced. α_j captures individual level fixed effects, ε_{jc} is the random error term, j is a participant index for allocators, and c is a condition index. $j \in [1, 35]$ and $c \in \left\{ \text{(Certain, Uncertain)} \times \begin{pmatrix} \text{High endowments} \\ \text{Low endowments} \end{pmatrix} \right\}$. Standard errors are clustered at the participant level because allocators were randomized into the order of conditions within blocks.

Table 5: Effect of Uncertainty on the Allocators' Probability of Randomizing or Allocating Directly to One of the Two Potential Recipients

	Equal Endowments		Unequal Endowments		
	(1) Randomize	(2) Give to A/B	(3) Randomize	(4) Give to Poor	(5) Give to Rich
Uncertain	0.09	−0.09	0.15***	−0.14**	−0.01
	(0.05)	(0.05)	(0.05)	(0.06)	(0.03)
Constant	0.64***	0.36***	0.11***	0.78***	0.11***
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)
Mean of dep. variable	0.69	0.31	0.19	0.71	0.10
Observations	140	140	280	280	280

Notes: Effect of uncertainty on the allocators' probability of randomizing or allocating directly to one of the two potential recipients. The constant term captures allocators' probability of randomizing or allocating directly to one of the two potential recipients when their endowments were known with certainty. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the participant level. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Table 5 shows that the allocators randomized more frequently when there was uncertainty about the distribution of recipients' endowments. Column (1) shows that this increase in frequency is not statistically significant when uncertainty was introduced in the equal endowment conditions. However, column (3) shows that the increase is highly statistically significant when recipients had unequal endowments: when there was uncertainty about which recipient was poorer, allocators were 15 percentage points more likely to randomize, and 14 percentage points less likely to allocate directly to the recipient who was relatively poorer in expectation. The argument made by Katta and Sethuraman (2006) and Eckhoff (1989) thus seems to be echoed by the allocators as we expected.

We saw in Appendix Table A.3 that the potential recipients did *not* reward randomization more when there was uncertainty about the distribution of their endowments than under certainty. The fact that allocators chose to randomize more frequently when there was uncertainty about the distribution of endowments between the potential recipients thus further supports the proposition that allocators had preferences for randomization over and above what can be explained by the reward/punishment behavior of the potential recipients.

4 Conclusion

The use of randomization to allocate scarce goods is a cheap and expedient allocation method that creates *ex ante* equality between potential recipients. However, it may carry *social* costs if potential recipients experience disutility when this allocation method is used. In this paper we have shown that the social cost of randomization depends on the distribution of endowments between the potential recipients. When potential recipients in our experiment were given identical endowments in expectation, they on average *supported* randomization as an allocation method. At the same time, the majority of participants responsible for allocating an indivisible benefit to one of these potential recipients chose to let a computer randomize to whom to allocate the benefit. The social cost of randomization was therefore low when potential recipients were identical in expectation, which led to a high degree of allocator efficiency.

In contrast, when potential recipients were given unequal endowments in expectation, they *opposed* randomization on average: the relatively poorer potential recipients were willing to incur a significant cost to *punish* an allocator who chose to randomize prior to knowing the *ex post* allocation of the prize. Since this average punishment is a conservative measure of average disutility, we identify a social cost of randomization when there is inequality between potential recipients. At the same time, the relatively poorer recipients were, on average, willing to incur a significant cost to *reward* an allocator who allocated the prize directly to them. This reward more than outweighed the average punishment to the allocator from the relatively richer recipients for the same allocation choice. The allocators thus received a significantly positive expected reward for choosing to allocate directly to the relatively poorer recipient, which suggest that there may be social value in targeting and finding deserving participants when recipients are unequal on observable factors such as wealth.

Given that a desire for equality is a well-documented phenomenon (Dawes et al. 2007; Cruces et al. 2012; **?**), it is not surprising that the majority of allocators chose to direct the prize to the relatively poorer potential recipient when such a recipient existed. What is perhaps more surprising is that a significant proportion of allocators (19%) chose to allocate the prize by randomizing between the two potential recipients when these were unequal in expectation despite facing an expected net punishment from the potential recipients for doing so. In the majority of trials where allocators chose to randomize between unequal potential recipients, the allocators correctly believed that they would have received a *higher* net reward for allocating directly to the relatively poorer recipient. Allocators were thus willing to leave money on the table in order to randomize when there was inequality between potential recipients. We conclude that allocators seem to have had preferences for randomization that were not informed by recipients' reward/punishment behavior (or the allocators' beliefs about this behavior), which suggests that there might be a disconnect in the preferences for randomization between potential recipients of a social program and its allocators.

Our findings imply that policy makers, who have to allocate an indivisible scarce good, will minimize the social cost associated with allocating the good to some recipients while leaving others empty-handed by targeting the good directly to the most disadvantaged potential recipients. If all potential recipients are identical in expectation, such that neither the allocator nor the potential recipients are able to identify who is the most disadvantaged among the potential recipients, random allocation is socially costless and might even bear with it a social benefit.

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A Appendix

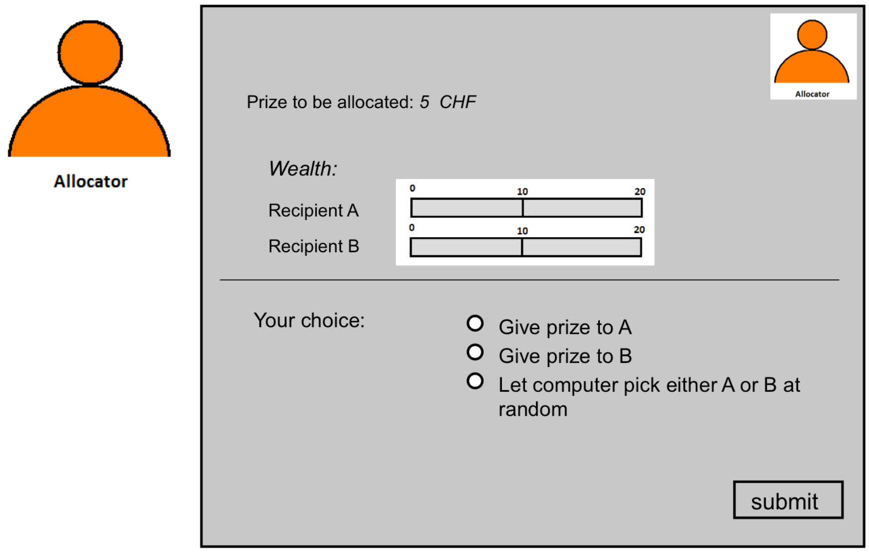

Figure A.1: Example Screen for the Decisions of Allocators

Notes: Example of what the allocators saw in the experiment before they made their allocation decision. This screen has been translated from German.

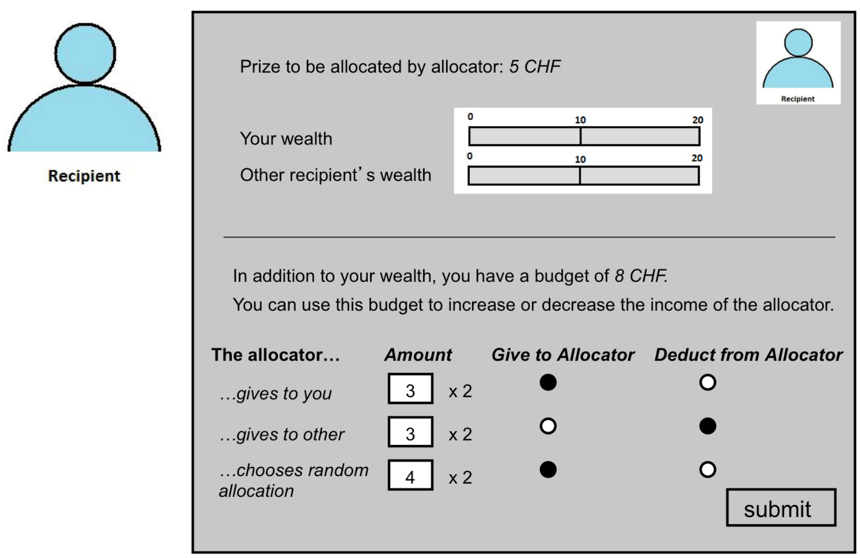

Figure A.2: Example Screen for the Decisions of the Potential Recipients

Notes: Example of what the potential recipients saw in the experiment before they made their reward/punishment decision. This screen has been translated from German.

Table A.1: Proportions of Trials in Which Recipients Awarded CHF 0 to the Allocator

	Dependent variable: Dummy for whether the Recipient Awarded CHF 0 to the Allocator		
	(1) Give to Me	(2) Give to Other	(3) Randomize
Equal	0.53***	0.62***	0.66***
	(0.05)	(0.05)	(0.05)
Poor	0.53***	0.57***	0.69***
	(0.05)	(0.05)	(0.05)
Rich	0.53***	0.66***	0.71***
	(0.05)	(0.05)	(0.05)
Mean of dep. variable	0.53	0.62	0.69
F-stat: Equal = Poor	0.01	3.42	0.47
p-value	0.91	0.07*	0.50
F-stat: Equal = Rich	0.00	1.30	1.88
p-value	1.00	0.26	0.18
F-stat: Poor = Rich	0.01	4.89	0.31
p-value	0.93	0.03**	0.58
Observations	840	840	840

Notes: Proportions of trials in which recipients awarded CHF 0 to the allocator. ”Equal” is an indicator that the recipients had equal wealth, ”Poor” and ”Rich” are indicators that the recipient was relatively poor or relatively rich, respectively. Regressions are run without a constant term such that all coefficients directly capture proportions of trials. Standard errors are heteroskedasticity-robust and clustered at the participant level. F-statistics and corresponding p-values from Wald tests of coefficient equality between β_1 and β_2, β_1 and β_3, as well as β_2 and β_3 are reported in the lower panel of the table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Table A.2: Effects of Recipients' Absolute Endowments on Their Reward/Punishment Behavior

	Dependent variable: *Reward*		
	(1) Give to Me	(2) Give to Other	(3) Randomize
Poor	0.01	−0.36***	−0.49***
	(0.11)	(0.13)	(0.16)
Rich	−0.03	0.34**	−0.25**
	(0.13)	(0.16)	(0.12)
High endowment	−0.21**	0.02	−0.03
	(0.08)	(0.08)	(0.08)
Poor x High endowment	0.13	0.14	0.04
	(0.12)	(0.12)	(0.15)
Rich x High endowment	0.27	0.09	−0.01
	(0.17)	(0.10)	(0.16)
Constant	1.01***	−0.69***	0.27***
	(0.07)	(0.08)	(0.08)
Mean of dep. variable	0.96	−0.65	0.01
F-stat: High Endowment	2.64	1.85	0.12
p-value	0.06*	0.15	0.95
Observations	840	840	840

Notes: Effects of recipients' absolute endowments on their reward/punishment behavior. The constant term captures recipients' average reward/punishment behavior in the equal wealth condition with low endowments. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the participant level. F-statistics and corresponding p-values from a Wald test of joint significance of β_3, β_4 and β_5 for each regression are reported below the table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Table A.3: Effects of Uncertainty on Recipients' Reward/Punishment Behavior

	Dependent variable: *Reward*		
	(1) Give to Me	(2) Give to Other	(3) Randomize
Poor	0.10	−0.24*	−0.42***
	(0.10)	(0.13)	(0.13)
Rich	0.08	0.44**	−0.18*
	(0.16)	(0.20)	(0.10)
Uncertain	0.04	0.01	0.04
	(0.08)	(0.08)	(0.12)
Poor x Uncertain	−0.04	−0.10	−0.11
	(0.13)	(0.12)	(0.20)
Rich x Uncertain	0.06	−0.09	−0.15
	(0.17)	(0.14)	(0.15)
Constant	0.88***	−0.69***	0.24***
	(0.07)	(0.08)	(0.07)
Mean of dep. variable	0.96	−0.65	0.01
F-stat: Uncertain	0.45	0.53	1.39
p-value	0.72	0.66	0.25
Observations	840	840	840

Notes: Effects of uncertainty on recipients' reward/punishment behavior. The constant term captures recipients' average reward/punishment behavior in the equal wealth condition when participants have certainty about the distribution of recipients' endowments. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the participant level. F-statistics and corresponding p-values from a Wald test of joint significance of β_3, β_4 and β_5 for each regression are reported below the table. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Table A.4: Effect of Recipients' Absolute Wealth on Allocators' Probability of Randomizing or Allocating Directly to one of the Two Potential Recipients

	Equal Endowments		Unequal Endowments		
	(1) Randomize	(2) Give to A/B	(3) Randomize	(4) Give to Poor	(5) Give to Rich
High endowment	−0.14***	0.14***	−0.05	−0.01	0.06
	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
Constant	0.76***	0.24***	0.21***	0.71***	0.07***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Mean of dep. variable	0.69	0.31	0.19	0.71	0.10
Observations	140	140	280	280	280

Notes: Effect of recipients' absolute wealth on allocators' probability of randomizing or allocating directly to one of the two potential recipients. The constant term captures allocators' probability of allocating as indicated in the column head in the low endowment condition. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the group level. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.

Table A.5: Proportions of Trials in Which Allocators Believed that They Were Leaving Money on the Table

	Dependent variable: Dummy for Whether the Allocator Expected to Leave Money on the Table	
	(1) Equal Endowments	(2) Unequal Endowments
Give to A/B	−0.60	
	(0.37)	
Give to Poor		0.38**
		(0.15)
Give to Rich		0.13
		(0.26)
Constant	0.50***	0.32***
	(0.09)	(0.12)
Mean of dep. variable	0.36	0.61
F-stat: Give to poor = Give to rich		1.36
p-value		0.25
Observations	70	140

Notes: Proportions of trials in which allocators believed that they were leaving money on the table. Regressions control for individual level fixed effects; standard errors are heteroskedasticity-robust and clustered at the participant level. F-statistics and corresponding p-values from a Wald test of coefficient equality between β_1 and β_2 in the unequal wealth condition is reported below the table in column (2). * Significant at the 10% confidence level, ** Significant at the 5% confidence level, *** Significant at the 1% confidence level.