Do Beliefs About Peers Matter for Donation Matching? Experiments in the Field and Laboratory*

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June 24, 2015

Working Paper

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Abstract

Donation matching in charitable giving does not always improve donation outcomes. This may occur because individuals believe peers will exhaust the matching funds. We develop a theory about how beliefs about peers generosity affect own likelihood of donation. We test our theory in field and laboratory experiments using novel “threshold match” treatments. Results show that donation is more likely when donors have higher beliefs about being pivotal to securing matching money. One “threshold match” treatment more than doubles the donation rate in the field and laboratory relative to no match, suggesting that accounting for beliefs about peers may benefit fundraisers.

Keywords: Charitable Giving, Field Experiment, Matching

JEL Codes: JEL C93, D64, H41
1 Introduction

Charitable contributions in the United States totaled 335 billion dollars in 2013, with the average US household giving $2,974 (GivingUSA, 2013). Annually, total charitable giving has been about 2% of US GDP since the turn of the century (Karlan, List and Shafir, 2011). Fundraisers have begun to embrace the use of randomized field experiments to find the best practices for attracting donors. A popular fundraising institution is to offer matching funds (e.g., an anonymous donor will match each dollar given with an additional dollar up to $10,000). Recent field experiments in charitable giving find that donation matching yields varied success in terms of response rate and contribution amounts. Some find that the match improves one or both of these outcomes, while others find no effect or even negative impacts on these outcomes.\(^1\)

Among the proposed explanations for the inconsistent effectiveness of donation matching, little attention has been given to the factor of donor beliefs about the actions of other donors (henceforth, “beliefs about peers”).\(^2\) Yet it is highly plausible that these beliefs would impact the effectiveness of the match. In non-matching contexts, previous evidence suggests that beliefs about others’ contributions are correlated with own contributions in the provision of public goods in the lab and field (Croson, 2007; Fischbacher and Gächter, 2010; Fehr and Leibbrandt, 2011; Croson and Shang, 2013),\(^3\) and that information about

\(^{1}\)See, for example, Karlan and List (2007); Meier (2007); Rondeau and List (2008); Eckel and Grossman (2008); Huck and Rasul (2011); Karlan et al. (2011); Gneezy, Keenan and Gneezy (2014).

\(^{2}\)To our knowledge, there is no empirical work that examines the importance of such beliefs when a match is available to the donor. This is with good reason. First, beliefs are not observable, and it is unnatural and potentially infeasible to elicit beliefs from donors in the field. Second, in empirical settings it is difficult to disentangle the effect of beliefs from other factors that may be driving contribution behavior. For example, it is plausible that a matching commitment serves as a signal that enhances the credibility of the charity to donors (Vesterlund, 2003). In this case, the matching treatment would potentially confound the role of donor beliefs about peers with the role of signalling.

\(^{3}\)We note that important differences exist between public goods games in the lab and charitable giving decisions in the field, including the decision-making environment and the beneficiaries of contributions. Moreover, unlike donation matching funds, linear public goods experiment matching funds in the lab generally cannot be exhausted.
others’ donations can affect own donations (Shang and Croson, 2009; Smith, Windmeijer and Wright, 2014). Donation matching introduces a new channel through which beliefs about peers may matter. A potential donor may care about securing matching money for the charity, but may believe that others’ donations will exhaust the matching money. In this case, the potential donor’s low probability belief that her donation will trigger matching money could make her unlikely to donate. This line of thinking suggests that if the match could be structured so as to increase the potential donor’s subjective probability of triggering matching money, then she would be more likely to give.

Using experiments in the field and laboratory, we empirically investigate the hypothesis that donors will be more likely to donate as their belief of being pivotal to securing matching money rises. We use a novel donation matching treatment, where donors are placed in groups of 10 and offered a (flat) matching amount of $50 if a threshold number of donations is received (e.g., if at least 3 people donate, then the charity receives $50 extra). We call this matching structure the “threshold match.” In both the field and laboratory we induce variation in donors’ beliefs of being pivotal by varying across treatments the threshold number of donations required to secure the matching money.

In our field experiment, we conduct a direct mail campaign targeted to-
ward alumni of a non-profit educational program. We use a between subjects design to compare the performance of the threshold match treatments, with thresholds of 1, 2, and 3 donors, to a control and a traditional dollar-for-dollar match resembling Rondeau and List (2008). Relative to control, we find an economically substantial and statistically significant effect of the “3 out of 10” threshold match treatment. Specifically, the response rate in this treatment (3.7 percent) is more than twice that of the control (1.6 percent). The literature’s explanations for donor behavior under a match cannot explain this treatment effect, but a model that incorporates beliefs about peers has explanatory power.

To provide an additional test of this beliefs explanation, we conduct a within subjects laboratory experiment that replicates the incentives of the field experiment, but that also elicits donor beliefs about peers. We view our field experiment as identifying a treatment effect of practical interest. And our laboratory experiment as testing the mechanism underlying the effect of interest and the robustness of the treatment effect. In the laboratory, subjects are still in groups of 10 with a matching bonus of $50, but we test a wider range of threshold matches, with thresholds of 1, 3, 5, 7, and 10. Our laboratory results provide further support for the beliefs explanation, as higher donation rates are associated with higher elicited probabilities of being pivotal to the match. Moreover, the treatment effects observed in the field are replicated in the laboratory. In particular, the 3 out of 10 threshold match treatment has the highest donation rate, and it more than doubles the donation rate of the control.

We view the primary contributions of our work as follows. First, we add to the charitable giving literature by providing a novel beliefs-based explanation for donor behavior when a match is available. Second, we demonstrate that this explanation is consistent with empirical results from experiments that we conduct in the field and laboratory. Our results suggest that donors may refrain from donating because they believe that matching funds will be exhausted by other donors. In this sense, beliefs about peers appear to be an

\footnote{See Kessler (2013) for a similar pairing of experiments in the laboratory and field.}
important factor in the decision to give when a donation match is available. Third, and of particular importance to practitioners, we document a threshold match treatment effect that is large relative to treatment effects observed in the donation matching literature. Notably, the treatment driving this large effect can be conducted even with relatively small amounts of matching money. We view our results as indicative that charitable organizations may achieve better donation outcomes by structuring matching money in more innovative ways than a traditional dollar-for-dollar match.\footnote{In the field experiment we find that a traditional dollar-for-dollar match has a contribution rate of 2.34\% while our threshold match with a threshold of 3 has a contribution rate of 3.68\%. While this is a large increase in terms of economic significance, estimate imprecision precludes a finding of statistical significance.}

The remainder of this paper proceeds as follows. Section 2 develops a motivating theoretical model that shows how contribution behavior may depend on donor beliefs about peers. Section 3 discusses the design and results of the field experiment, while Section 4 discusses the design and results of the laboratory experiment. Section 5 evaluates alternative explanations for our results, and Section 6 concludes.

## 2 Theoretical Model

This section presents a general theoretical model for the decision to give charitably when a donation match is available. With simplifying assumptions, the model illustrates how our experimental treatments permit inference about donor beliefs.

Begin by letting $N$ denote the number of agents (potential donors) in a group. Each agent is endowed with wealth $w_i$, which can be split between charitable contributions $b_i$ or consumed privately as numeraire $y_i$. Denote the sum of charitable contributions across the $N$ agents as $B = \sum_{i=1}^{N} b_i$. A donation match $M$ is available and is a function of the vector of individual contributions: $M = \psi(b_1, b_2, ..., b_N)$. Total contributions $G$ is equal to the sum of individual contributions $B$ and the donation match $M$.

Consistent with Andreoni’s impure altruism model (Andreoni, 1990), agent
i may derive utility from consumption of the numeraire \( y_i \), from the charitable contribution \( b_i \) ("warm glow"), and from the total contributions \( G \). To allow for a more general model, utility flows over the sum of all contributions \( B \) and/or the donation match amount \( M \) can be considered.\(^9\)

With choice sets and preferences established, the next step is to characterize optimal behavior for individual agents given their beliefs about other agents. One possibility for the final step of closing the model involves invoking assumptions of rational expectations, for which each agent’s beliefs about the actions of other agents turns out to be accurate. Intuitively, the plausibility of accuracy of beliefs may vary by context. For example, in one-shot games for which agents have not accumulated information about their peers, the rational expectations assumption may be less plausible, and may be relaxed in favor of an alternative assumption that closes the model.\(^{10}\)

We apply simplifying assumptions to the general theoretical framework described above to generate a model of individual optimization motivating the idea that donor beliefs about peers can play an important role in the decision to donate.\(^{11}\) A key component of the model is a specified threshold for donations that, if achieved, produces an amount of matching money given to the charity. Under certain assumptions, variation in the threshold permits inference about

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\(^9\) Utility flows over these dimensions are less established in the literature, but still plausible. It is not clear that donors view donations from peers as a perfect substitute for donation matching money that goes to the charity - a condition that is implied by specifying utility over \( G \) but not \( M \) or \( B \). For example, Karlan and List (2007) suggest that donors may perceive the matching donor as fictional. Taken literally, this suggests a utility function that contains \( B \) - the total contributions excluding the matching donor - but not \( G \) or \( M \).

\(^{10}\) Relaxing the rational expectations assumption that beliefs coincide with actions is a key part of level-K models (Crawford and Iriberri, 2007) and the noisy introspection model of Goeree and Holt (2004).

\(^{11}\) We present a model without rational expectations here because the empirical evidence from both the lab and field indicates that subject beliefs are generally not consistent with peer actions. In the lab only, 30% of the sample have beliefs that correctly guess the true realized number of givers (allowing for an error of plus or minus 1 person). We do not elicit beliefs in the field, but donation rates being below 4% in every treatment implies that the donor is most likely to be pivotal in the threshold \( 1 \) (T1) treatment. But this treatment actually has the lowest donation rate of any treatment with matching money, suggesting that donor beliefs are not consistent with peer actions. For a rational expectations quantal response equilibrium model where contribution probabilities depend on beliefs about the behavior of other donors, see Goeree and Holt (2005).
donor beliefs. This corresponds directly to the design of threshold match treatments in our lab and field experiments.

We specify a particular functional form for how the vector of contribution decisions \((b_1, b_2, ..., b_N)\) maps to a corresponding donation match \(M\). Let \(T\) be an integer between 1 and \(N\) (inclusive) that represents a threshold. If at least \(T\) agents in the group choose to donate, then a fixed matching amount of \(b_M\) is provided to the charity by a matching donor. Because this particular functional form only requires knowing whether each agent donated (and not the amount), we restrict the giving decision to be binary.\(^{12}\) Specifically, the agent may choose to set \(b_i\) equal to a fixed contribution amount \(\bar{b}\), or to 0 by not contributing.

From the perspective of the individual donor, the number of other donors who will choose to contribute is a random variable; denote this by \(k\). The individual donor has a subjective belief distribution regarding the value of \(k\) that will be realized. Parameterize this distribution by letting \(p_j\) denote the subjective probability that the realized number of donors \(k\) is equal to exactly \(j\) donors, where \(j\) ranges from 0 to \(N - 1\). These subjective probabilities must sum to one: \(\sum_{j=0}^{N-1} p_j = 1\).

The individual agent derives utility from three things: consumption of the numeraire good, warm glow from giving (Andreoni, 1990), and matching money obtained by the charity.\(^{13}\) Numeraire consumption is represented by linear utility. Warm glow from giving is represented by the term \(\gamma_i f(\bar{b})\) if

\(^{12}\)The binary decision simplifies the intuition of the model while also aligning it more closely with the empirical results of our experiments, which focus on the binary decision of whether to contribute. Additionally, certain matching mechanisms currently used by practitioners take the form of “If we get \(T\) more donors” rather than conditioning the match on attaining a given amount of money.

\(^{13}\)Note that in this model, there is no utility derived from the total level of the public good. This is for two reasons. First, including this factor would complicate the intuition of the model but not change the conclusion that beliefs about peers are important (in fact, it would make this point even more strongly). To see this, note that one would have to integrate over the belief distribution regarding the amounts contributed by others. This would add terms to the inequality governing the decision to give, but not remove the term that includes \(p_{T-1}\). The second reason is based on suggestive evidence from the contingent valuation method (CVM) literature that public good contributors are insensitive to the scope of the public good provided; see Karlan and List (2007) for a discussion.
the agent decides to give, and 0 otherwise. Matching money obtained by the charity yields a utility flow of $\theta g(b_M)$ if the threshold is actually triggered, and 0 otherwise.\textsuperscript{14} With additional assumptions of additively separable utility flows and risk-neutral preferences, the decision to donate, characterized by comparing the expected utility of contributing and the expected utility of keeping, is described by the two expressions listed below.\textsuperscript{15}

The expected utility of contributing is given by:

$$EU_{contribute} = Pr(k \geq T - 1) \times [(w_i - \bar{\theta}b) + \gamma_i f(\bar{\theta}) + \theta g(b_M)]$$

$$+ Pr(k < T - 1) \times [(w_i - \bar{\theta}b) + \gamma_i f(\bar{\theta})]$$

$$= w_i - \bar{\theta}b + \gamma_i f(\bar{\theta}) + \sum_{j=T-1}^{N-1} p_j \times \theta g(b_M)$$

while the expected utility of keeping is given by:

$$EU_{keep} = Pr(k \geq T) \times [w_i + \theta g(b_M)] + Pr(k < T) \times [w_i]$$

$$= w_i + \sum_{j=T}^{N-1} p_j \times \theta g(b_M)$$

A decision to contribute occurs if $EU_{contribute} > EU_{keep}$, which reduces to:

$$p_{T-1} \times \theta g(b_M) + \gamma_i f(\bar{\theta}) > \bar{\theta}$$

The right-hand side of the inequality is interpreted as the certain loss in utility from contributing, since a contributor loses $\bar{\theta}$ units of numeraire consumption. The left-hand side of the inequality is interpreted as the expected

\textsuperscript{14}In this binary decision model, these utility flows could simply be parameterized as constants. However, this notation is chosen to maintain consistency with the model of Landry, Lange, List, Price and Rupp (2006), which involves a continuous decision of what amount to contribute.

\textsuperscript{15}We assume risk neutrality here for expositional convenience, but our result holds for all risk types. See the Appendix for a proof.
gain in utility from contributing. With probability $p_{T-1}$, the contribution is pivotal and results in a positive utility flow of $\theta g(b_M)$. A contributor also realizes a (certain) warm glow utility flow of $\gamma_i f(\bar{b})$, which guarantees a decision to contribute if it exceeds $\bar{b}$. Because a higher value of $p_{T-1}$ makes the inequality more likely to hold, donor beliefs about the behavior of peers play an important role in the decision to contribute. In other words, if one holds stronger beliefs that other contributions will sum to just below the threshold, then that is associated with an increased likelihood of contributing.

Supposing now that subjective beliefs are single-peaked, we consider a comparative static on the probability of being pivotal by moving the threshold $T$. However, deriving this comparative static requires a modelling decision regarding the effect of the threshold level on the subjective belief distribution. To illustrate this point, consider the (potentially objectionable) assumption that this effect is negligible.\textsuperscript{16} It is helpful to consider this case graphically. Supposing that $T - 1$ is on the left-side of the peak, consider a small increase in $T$. Because the probability mass function is increasing in this region, there is now a greater probability that the individual’s donation will be pivotal. Thus, such a threshold increase results in a greater likelihood of contributing. Consider instead an increase in the threshold $T$ given that $T - 1$ was originally located to the right-side of the peak. By similar reasoning as above, this increase in the threshold reduces the likelihood of contributing. Thus, in the context of this model, observing contribution decisions while holding other factors constant and varying $T$ permits inference about the subjective belief distribution of the agent.

Suppose instead that moving the threshold $T$ results in a different subjective belief distribution. In this case, varying $T$ introduces new probability parameters rather than providing additional information about a single fixed belief distribution. Still, an inference can be made by comparing contribution

\textsuperscript{16}This would be achieved in a model in which the donor believes that others ignore the threshold in making their contribution decisions. Beliefs that others are “naive” in this way is somewhat analogous to the beliefs of level-1 types in a level-k model, which involve other agents making decisions at random and thus being insensitive to parameter changes (Stahl and Wilson, 1994; Nagel, 1995).
rates across the different values of $T$. That is, if a threshold increase results in a higher contribution rate, it can be inferred that donors hold a stronger belief that other contributions will sum to just below the threshold. This is the intuition behind the design of the various threshold-match treatments in both the field and lab experiments (T1, T3, etc.).

3 Field Experiment

The field experiment was conducted in cooperation with a 501(c)3 charitable organization in the United States that operates educational programs for students. This organization traditionally conducts two fundraising appeals per year using direct mail through the United States Postal Service. The first appeal typically occurs in early summer, while the second occurs in early winter. This experiment was conducted during the 2012 summer fundraising window.

The sample of subjects includes 2,567 individuals who attended a program for high-achieving high school students that is operated annually by the organization. This program, which produces approximately one hundred alumni each year, attracts students from a large geographic area encompassing many states. The sample was constructed by including all living individuals who completed the program between the years 1977 and 2007, omitting those individuals who either had no valid mailing address or had opted out of receiving mailings.

3.1 Field Experiment Treatments

In a between-subjects design, individuals were randomly assigned to one of five treatments. Treatments varied language in the fundraising letter about the extent to which an individual’s donation would impact the amount of matching money given to the charity. Aside from one paragraph (approximately two-thirds of the way down the letter) that varied across treatments, the letter was the same for all subjects. The control (C) treatment included standard fundraising language that was similar to language used in previous appeals.
The matching (M) treatment offered a dollar-for-dollar match up to $3,000, noting that the donor had been selected for a group of 600 alumni eligible for the match. The threshold-match (T1, T2, T3) treatments notified the donor that they had been selected for a group of 10 alumni who attended the program in their attendance year, and if a threshold number of these individuals chose to donate, then a matching donor would provide a fixed amount of $50 to the organization. The T1 treatment involved a threshold of 1, while the T2 and T3 treatments featured thresholds of 2 and 3, respectively. Note that the total amount of $3,000 for 600 potential donors chosen in the traditional matching treatment (M) is equivalent to a possible $50 bonus for each group of 10 people in this treatment. A generous benefactor had agreed to provide matching funds in accordance with the rules stated in the letters, thus ensuring that no donors were deceived.

The language for the various treatments is presented below, with italics, bolding, and underlining accurately replicated:

- Control (C): “Your decision to give can make an important, positive impact on [organization name]. The generosity of alumni like you helps ensure that talented young [11-word description of student population served] are able to experience our unique [2 adjectives describing program] education programs. To help support us in these endeavors, please submit your donation by August 31.”

- Matching (M): “Your decision to give can make an important, positive impact on [organization name] - and it can go even further thanks to a commitment of matching donations that we have received. As part of this particular donation program, you are one of 600 randomly selected alumni eligible for a dollar-for-dollar match, up to a total group limit of $3,000. This means that for each of the first $3,000 we receive from your group of 600, we will also receive a matching dollar of support, thus doubling the impact of your donation. To take advantage of this matching opportunity, please submit your donation by August 31.”
• Threshold Match (T1, T2, T3): “Your decision to give can make an important, positive impact on [organization name] – and it can go even further thanks to a commitment of matching donations that we have received. As part of this particular donation program, you have been randomly and anonymously selected for a group of 10 [students] who attended [program name] in your year. From your group of 10, if at least (1 person chooses; 2 people choose; 3 people choose) to make a donation of any amount, then the matching donor will provide an additional $50 of support, thus increasing the impact of your donation. To take advantage of this matching opportunity, please submit your donation by August 31.”

3.2 Field Experiment Randomization and Constraints

In order to prevent deception and to improve the ability to make inference, certain constraints were incorporated into the randomization routine that assigned treatments. Recall that the threshold-match letters informed donors that they had been randomly and anonymously selected for a group of 10 students from their attendance year. To prevent deception, the randomization was programmed to meet this constraint.\(^\text{17}\) A further concern was achieving balance across treatment cells in previous giving history, which would be expected to predict future giving behavior (Meer, 2013).\(^\text{18}\) We balanced on an indicator variable (warm4) that takes the value of 1 if the individual had donated at least once in the 4 years prior to the start of the experiment. The balance of this variable across treatments was also programmed to hold within attendance years at the program, to reduce the correlation of age and cohort variables to treatment. Finally, the amount of available matching funds was

\(^{17}\)Ex-ante the randomization always truly assigned a group of 10 people from each cohort attendance year for T1/T2/T3 and 600 people for the dollar-for-dollar match (M). However, a few letters were returned, so that ex-post some groups had fewer than the originally reported number of people. People attended between 1977 and 2007 and the cohort sizes are between 70 and 101 people.

\(^{18}\)While ex-post adjustments can be made for imbalance, it is more efficient to achieve ex-ante balance (Bruhn and McKenzie, 2009).
limited, so it was not feasible to assign equal numbers of individuals to each treatment. Balance was achieved on all pre-experiment attributes with the exception of cohort year, which was slightly higher in the Control, but which we correct for in our regression analysis with the inclusion of cohort level fixed effects. A balance table on pre-experiment attributes is available in the Appendix.\textsuperscript{19}

### 3.3 Field Experiment Results

Table 1 summarizes the response to the fundraising appeal within the fundraising window, which lasted just over two months.\textsuperscript{20} The first row of Table 1 shows that contribution rates vary across treatments, in a range from approximately 1.6 to 3.7 percent. The number of contributions is low enough (relative to the variation in individual donation amounts) that the mean contribution conditional on giving is sensitive to outliers. To better characterize the response distribution, the 10th, 50th and 90th percentiles (conditional on giving) are provided. These data suggest that the response distributions of the various treatments exhibit significant overlap, as the median is the same across all treatments.\textsuperscript{21}

\textsuperscript{19}One may worry that subjects in the experiment may have colluded with each other. This is unlikely, as the subjects attended the program between 1977 and 2007 and currently are very geographically spread out (residing in over 81 different countries/states). Also the timing of donations is very similar across all the treatments (results available from authors upon request).

\textsuperscript{20}Use of this outcome measure maintains consistency with Karlan and List (2007); Karlan et al. (2011). Donations received after the fundraising window also comprise important information. We observe no meaningful change in outcomes when the end of the window is extended by one month.

\textsuperscript{21}Indeed, this intuition is formalized by the results of a non-parametric Kruskal-Wallis equality-of-population test. Neither this test nor pairwise Wilcoxon rank-sum tests can reject the null hypothesis that the amount distribution conditional on giving is the same across treatments. However, this does not imply that treatments have no effect on the amount given conditional on giving. For example, it is possible that a treatment both increases the amount given conditional on giving and increases the propensity to give for a particular type of individual. If this type is inclined to give small amounts, this counteracts the positive impact on amount given, and the observed amount distribution could remain unchanged. For more discussion of this selection effect, see Karlan and List (2007).
Table 1: Field Experiment: Summary Statistics By Treatment

<table>
<thead>
<tr>
<th>Variables of Interest</th>
<th>C</th>
<th>M</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution Rate (0 to 100)</td>
<td>1.59</td>
<td>2.34</td>
<td>2.00</td>
<td>2.35</td>
<td>3.68</td>
</tr>
<tr>
<td>Mean Contribution, conditional on giving</td>
<td>255.59</td>
<td>158.93</td>
<td>182.14</td>
<td>113.75</td>
<td>320.45</td>
</tr>
<tr>
<td>Dollars raised per letter, excluding match</td>
<td>4.06</td>
<td>3.71</td>
<td>3.92</td>
<td>2.21</td>
<td>11.79</td>
</tr>
<tr>
<td>Dollars raised per letter, including match</td>
<td>4.06</td>
<td>7.43</td>
<td>4.75</td>
<td>2.21</td>
<td>11.79</td>
</tr>
<tr>
<td>Count of Contributions</td>
<td>17</td>
<td>14</td>
<td>6</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Observations</td>
<td>1,071</td>
<td>599</td>
<td>300</td>
<td>298</td>
<td>299</td>
</tr>
<tr>
<td>Amount Percentile 10, conditional on giving</td>
<td>25</td>
<td>50</td>
<td>25</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Amount Median, conditional on giving</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Amount Percentile 90, conditional on giving</td>
<td>1,000</td>
<td>250</td>
<td>700</td>
<td>250</td>
<td>500</td>
</tr>
</tbody>
</table>

With small contribution counts, amount outliers, and overlapping amount distributions, there is little hope of precisely estimating any type of treatment effect on donation amount. Thus, we focus on the binary decision of whether one contributes. Table 2 presents least squares regressions with the binary outcome variable of whether the donor contributed during the fundraising window. The first column presents a simple linear model with dummy variables for the treatments and a control for previous giving history. The second column presents the same simple model but clusters standard errors at the cohort level. The third column adds in cohort level fixed effects. Last the fourth column weights observations by the inverse of the sampling probability.\(^\text{22}\) Across the four specifications, the only treatment with a statistically significant effect on donation rates as compared to the control was the Threshold Match 3 (T3) treatment. The coefficients on T3 range between 1.945 to 2.008 per-

\(^{22}\)The average cohort year had 86 observations (min: 70, max: 101). In each cohort year, 20 alumni were assigned to M, 10 were assigned to each treatment of T1/T2/T3, and the remaining alumni were assigned to C. Thus in years with more observations an individual is more likely to be assigned to the control. For example if the 1997 cohort had 80 individuals then probability of being assigned to T1/T2/T3 is \(\frac{10}{80}\), M is \(\frac{20}{80}\), and control is \(\frac{50}{80}\). Whereas if the 2004 cohort had 100 individuals then probability of being assigned to T1/T2/T3 is \(\frac{10}{100}\), M is \(\frac{20}{100}\), and control is \(\frac{50}{100}\). We adjust for this sampling by presenting results which have been weighted by the inverse of the sampling probability alongside the un-weighted results.
Percentage points, illustrating that the Threshold Match 3 (T3) treatment more than doubled the contribution rate as compared with the mean of 1.59% in the control group. These results are significant at the 5-10% level. In terms of percent change, the T3 treatment effect (131 percent increase) is large relative to extensive margin treatment effects observed in the donation matching literature, which tend to range from slightly negative values to as large as 31 percent.

Table 2: Field Experiment Dependent Variable Probability of Donation (0 to 100)

<table>
<thead>
<tr>
<th></th>
<th>Simple</th>
<th>Simple + Cohort FE</th>
<th>Cohort FE + Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match (M)</td>
<td>0.850</td>
<td>0.850</td>
<td>0.731</td>
</tr>
<tr>
<td></td>
<td>(0.697)</td>
<td>(0.809)</td>
<td>(0.829)</td>
</tr>
<tr>
<td>Threshold Match 1 (T1)</td>
<td>0.438</td>
<td>0.438</td>
<td>0.378</td>
</tr>
<tr>
<td></td>
<td>(0.893)</td>
<td>(0.976)</td>
<td>(0.975)</td>
</tr>
<tr>
<td>Threshold Match 2 (T2)</td>
<td>0.673</td>
<td>0.673</td>
<td>0.609</td>
</tr>
<tr>
<td></td>
<td>(0.895)</td>
<td>(0.891)</td>
<td>(0.923)</td>
</tr>
<tr>
<td>Threshold Match 3 (T3)</td>
<td>2.008**</td>
<td>2.008*</td>
<td>1.949*</td>
</tr>
<tr>
<td></td>
<td>(0.894)</td>
<td>(1.040)</td>
<td>(1.051)</td>
</tr>
<tr>
<td>warm4</td>
<td>15.398***</td>
<td>15.398***</td>
<td>15.283***</td>
</tr>
<tr>
<td></td>
<td>(0.870)</td>
<td>(2.058)</td>
<td>(2.114)</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.109</td>
<td>0.109</td>
<td>0.107</td>
</tr>
<tr>
<td>N</td>
<td>2,567</td>
<td>2,567</td>
<td>2,567</td>
</tr>
</tbody>
</table>

Notes: All coefficients are multiplied by 100 for ease of readability. Standard errors are clustered at the cohort level in columns 2-4 (there are 30 cohorts). In column 4, the observations are weighted to account for the constraints on randomization. Legend: * p < 0.10; ** p < 0.05; *** p < 0.01.

Results from a probit specification are similar. Results using other indicator variables of previous giving in the last year (warm1), 2 years (warm2), 3 years (warm3) or five years (warm5) are also similar and are presented in the Appendix.

See, for example, Karlan and List (2007); Meier (2007); Rondeau and List (2008); Eckel and Grossman (2008); Huck and Rasul (2011); Karlan et al. (2011); Gneezy et al. (2014). Gneezy et al. (2014) find a non-matching treatment effect of similar magnitude to the T3 treatment effect. In their experimental treatment, a lead donor contributed $10,000 to cover all overhead costs associated with raising donations for a non-profit campaign.
None of the treatments besides T3 are found to be significantly different from control. It is worth noting, however, that estimates for each of these other treatments are all positive and potentially economically important, with contribution rate increases ranging from 21 percent to 53 percent relative to the control mean. Estimate imprecision prevents statements of statistical significance at conventional levels for these treatments. Moreover, although the T3 treatment yields substantially larger donation rates than any other matching treatment (M, T1, T2), it is not statistically significantly different from these treatments. For example, the traditional dollar-for-dollar match (M) has substantially lower point estimates (between 0.731-0.850) compared to the T3 coefficients (between 1.945-2.008), but pairwise tests do not find a statistically significance difference. We interpret this result as suggestive, though not conclusive, evidence that structuring matching money in more innovative ways than a dollar-for-dollar match can lead to substantial improvements in donor outcomes.\textsuperscript{25}

3.4 Beliefs, Actions, and Rational Expectations

Empirical contribution rates across the various treatments range from 1.6 to 3.7 percent. With rates this low, it is difficult to explain the effectiveness of the T3 treatment with a rational expectations model. Given the empirical contribution rates, the individual donor is most likely to be pivotal in the T1 treatment. Yet, contribution rates were monotonically increasing as the donation threshold was raised. These results, together with the fairly sensible idea that donors likely do not have precise knowledge about the contribution behavior of their peers, suggest that to accurately understand giving outcomes in this context, the assumption of beliefs being consistent with actions should be relaxed. This contrasts with a number of models of giving behavior in the literature that impose rational expectations to draw conclusions (e.g., Andreoni (1989, 1990); Landry et al. (2006); Karlan and List (2007)).

\textsuperscript{25}We note that the large effect from the innovative overhead treatment in Gneezy et al. (2014) is consistent with our proposition, with the caveat that the overhead sponsorship is an unconditional gift, whereas matching money is a conditional gift.
4 Laboratory Experiment

A novel explanation involving beliefs about donations by peers is successful in explaining the treatment effect in the field experiment. However, there are two shortcomings of the field experiment that prevent a cleaner test of the beliefs story. First, donor beliefs about peers are not observed or elicited in the field. Second, the donation threshold varies across a small range, from 1 to 3 out of 10 donors.

These drawbacks motivate a laboratory experiment that replicates the incentives of the field experiment, but allows resolution of the shortcomings discussed above. To address the first concern, this experiment elicits potential donors’ beliefs about their peers. This provides a more controlled, supplemental test of the explanation that beliefs about peers are an important factor in the decision to give charitably. To address the second concern, the laboratory experiment extends the range of thresholds by considering thresholds of 1, 3, 5, 7, and 10 donors. With five different thresholds spread almost uniformly throughout this range, one can consider the experimental treatments as tracing out portions of the threshold-to-donation-rate relationship that the field experiment does not explore.\textsuperscript{26} This experiment also provides a robustness check of two results from the field experiment: (1) substantial variation in donation rate across thresholds, and (2) the superior performance of the 3 out of 10 treatment relative to control.

4.1 Laboratory Design and Procedures

Between the field experiment discussed earlier and this laboratory experiment, many of the general decision properties remain, such as the number of people in each group, the charitable giving nature of each person’s decision, and certain treatments governing the rules for how individual decisions translate

\textsuperscript{26}We did not explore all other possible threshold values (2, 4, 6, 8, 9) due to time constraints for each experimental session, and because we expected that they would yield limited insights beyond those offered by the threshold values that we did explore. Also, it was infeasible to replicate the field experiment’s dollar-for-dollar match treatment, which involved 600 potential donors.
into matching money that will be given to the charity. However, a number of variables change between the two experiments, such as the subject pool, charity, method of solicitation, between vs. within subject design, and the physical location where the donation decision is made.

Subjects in this laboratory experiment were recruited from the student population at Tufts University. At the beginning of each session, the experiment administrator announced the instructions of the experiment, then directed subjects to complete a short quiz that tested their understanding of the experiment.\footnote{Each session lasted about one hour and average earnings were approximately $18.75. The experiment was conducted using zTree (Fischbacher, 2007).} Each session lasted about one hour and average earnings were approximately $18.75. The experiment was conducted using zTree (Fischbacher, 2007).

Each session involved 10 participants and consisted of a donation stage followed by a belief elicitation stage. Each stage consisted of six periods, and each period corresponded to one of six treatments. The laboratory experiment is a within subject design, which allows us to observe variation in beliefs and donations decisions across treatments for each subject. This is intended to control for subject-specific effects that might correlate with beliefs but also affect the decision to donate. Additionally, because subjects see all the thresholds, there is no signalling value in the threshold level about the quality of the charity. In total, ten sessions were conducted, thus yielding a sample size of 100 subjects. Each subject participated in each of the following six treatments:

- (C) Control: Binary decision to give $0 or $5, no donation match available
- (T1) Threshold Match 1: Binary decision to give $0 or $5, with a flat $50 matching donation if at least 1 out of the 10 subjects donated
- (T3) Threshold Match 3: Identical to T1 but with a threshold of 3 subject donations
- (T5) Threshold Match 5: Identical to T1 but with a threshold of 5 subject donations

\footnote{Full instructions and screenshots are available in the Appendix.}
• (T7) Threshold Match 7: Identical to T1 but with a threshold of 7 subject donations

• (T10) Threshold Match 10: Identical to T1 but with a threshold of 10 subject donations

Each treatment involved a single binary donation decision for each subject, with the non-profit organization *Citizen Schools Massachusetts* serving as the charity.\(^\text{28}\) A decision to “Donate” meant that the subject donated $5 to the charity, and a decision to “Keep” meant that the subject donated nothing.\(^\text{29}\) Donations were made from the subject’s endowment, which was $16. Importantly, subjects knew that in the donation stage, only one period was randomly selected for payment (and donations) to occur. For the randomly selected period, subjects received payments as follows: $16 if the subject chose “Keep” in the selected period (thus keeping their full endowment), and $11 if the subject chose “Donate” (with the remaining $5 going to the charity). For the threshold match treatments, subjects were informed that if the number of subjects who donated in the randomly selected period met or exceeded the threshold, then an anonymous matching donor would give an additional $50 to the charity. This amount was thus consistent with the $50 matching offer provided in the field experiment.

Across sessions, the ordering of treatments within a stage was randomly rotated, so as to avoid complications from order effects.\(^\text{30}\) To prevent learning effects that might confound treatment effects, subjects did not receive any information regarding the decisions made by their peers until the conclusion of the session, after all decisions had been made.

\(^{28}\) *Citizen Schools Massachusetts* is a 501(c)3 charitable organization dedicated to expanding the learning day for middle school children in low-income communities. Like the charity in the field experiment, it is an organization focused on educational outcomes.

\(^{29}\) Subjects had the option of filling out a self-addressed envelope before making any decisions, so that a personal receipt for any potential donations could be mailed.

\(^{30}\) Within a given session, the same ordering of treatments was maintained between the donation and belief elicitation stages. For example, if the first period of the donation stage featured the T1 treatment, then beliefs about donation decisions in the T1 treatment were elicited in the first period of the belief elicitation stage.
After the donation stage had concluded, subjects began the belief elicitation stage. For each period in the donation stage, subjects were asked to report on their beliefs regarding the actions of their peers. This was done via the quadratic scoring rule (Selten, 1998) via an elicitation method used in previous experiments (Moore and Healy, 2008; Eil and Rao, 2011). Each subject was asked to assign a probability \( p_j \) to each possible outcome of the number of other donors \( (j = 0, 1, 2, ..., 9) \). The probabilities across those outcomes were required to add up to one (Manski and Neri, 2013). Depending on the accuracy of their guesses, subjects could earn up to an additional $10 for the beliefs stage of the experiment using the following equation:

\[
5 \times \left[ 2 - \sum_{j=0}^{9} \left( 1 \{ \text{actual number of peer donations} = j \} - p_j \right)^2 \right]
\]

Only one of the elicitation stage periods was randomly selected for payment. The selection rule was as follows: omit as a candidate the period chosen for payment in the donation stage, and choose equally likely among the remaining periods. This was done to avoid the potential for subjects to hedge across their donation and belief elicitation decisions.\(^{32}\)

\(^{31}\)The quadratic scoring rule is incentive-compatible under risk neutral preferences, and consistent with prior literature, our subjects were told that they would maximize expected earnings by telling the truth. See Holt and Smith (2013) for a lottery menu elicitation method that is incentive compatible regardless of risk preferences.

\(^{32}\)For example, suppose that the threshold is 3 and a subject (accurately) believes that their peers will give either 1 or 2 donations, with 70% probability on the 2 donation outcome. Suppose also that the subject derives utility from the threshold being achieved. Then, a risk-averse subject may hedge by choosing to donate in the donation stage (which pays off in utility terms if 2 of their peers donated), but then put disproportionate weight on the outcome 1 in the belief elicitation stage (which pays off in monetary terms if 1 of their peers donated). If both decisions are selected for payment, then the subject has guaranteed a (utility and money) payoff by hedging, but has not truthfully revealed their guess in the belief elicitation stage. By using the period-omission process described above, this incentive to hedge is eliminated. See Blanco, Engelmann, Koch and Normann (2010) for discussion of the extent of hedging problems in belief elicitation experiments.
4.2 Laboratory Results

Figure 1 displays the contribution rate by treatment. The Threshold Match 3 (T3) treatment has the highest contribution rate, with half of subjects choosing to donate in this treatment. The control (C) has the lowest contribution rate, with just under 25% of subjects donating. In column 1 of Table 3, we report the results from a simple linear regression predicting the likelihood of donation by treatment. Treatment T3 increases the likelihood of donating by 26 percentage points above the mean of 24% in the control (C). That represents a doubling of the likelihood of donation. In Table 3, we report both the results for the full 100 subject sample and for the sub-sample of subjects who vary their donation choices across treatments; that is, we exclude those subjects who always donated or never donated. In column 2 of Table 3 we concentrate on only those subjects with variation across treatments to find that T3 increases the likelihood of donation by 42.62 percentage points over the mean of 16.39% in the control, representing a 260% increase. T3 is statistically significantly different from C and T1 in the models in column 1 and 2, but is not statistically significantly different from T5/T7/T10.

The variation in donations across treatments is fully accounted for by a proper subset of the full sample of subjects. This is demonstrated in the Appendix, which presents a histogram of the proportion of subjects who made a given number of “Donate” decisions across all 6 treatments. The subset of subjects who show variation across treatments is interesting, because it is more analogous than the full sample of laboratory subjects to the field experiment subjects who are actually responsible for driving the treatment effect. Said differently, any potential donor population can be divided into those who will never donate, those who will always donate, and those whose donation decision depends on the treatment. The final group accounts for the observed treatment effect in the field experiment, and we seek to understand whether beliefs about peers drive donation behavior in that population.

For the column 1 specification, the test that the coefficient on T3 is equal to T1 yields \( F(1, 99) = 4.16 \) with \( \text{Prob} > F = 0.044 \), and for column 2, \( F(1, 60) = 4.25 \) with \( \text{Prob} > F = 0.0436 \). One may be worried about order effects in our experiment. First, we randomly assigned the order of the treatments, and there is no strong correlation between order and the giving decision. Second, if we restrict the analysis to only the first decision made by participants, we can show that the all the treatments except T1 perform better than the control, however these results are too noisy to say which treatment performs best. Also they do not control for time invariant individual level heterogeneity, which is exactly why we ran a within subjects experiment.
Figure 1: Lab Experiment Contribution Rate by Treatment
Note: This figure show the contribution rate by treatment in the lab experiment.

Certain findings from the field experiment are robust to the changes of conducting the experiment in the laboratory. There is substantial variation in donation rate across thresholds, and Threshold Match 3 (T3) is the top-performing treatment.\(^{35}\) We also observe an increasing monotonicity in donation rates across the control, T1, and T3 treatments.

The laboratory experiment explores the relationship between donation rate and treatment using threshold values larger than those used in the field experiment. While both experiments find an increasing donation rate when the threshold value is less than 3, the laboratory results demonstrate generally decreasing donation rates above the threshold value of 3. This inverted U shape is consistent with previous work that finds contributions are highest with a mid-level threshold (Anik et al., 2014; Isaac et al., 1989).\(^{36}\) However the es-

\(^{35}\)Interestingly, this result holds even though the level of donation rates is much higher in the laboratory setting than it is in the field. A threshold of 1 yields a donation rate of 2.0% in the field experiment and 39% in the laboratory experiment. Similarly, a threshold of 3 yields a donation rate of 3.7% in the field experiment and 50% in the laboratory.

\(^{36}\)This overall pattern is also consistent with the quantal response equilibrium theoretical model presented in Goeree and Holt (2005).
Table 3: Lab Experiment Dependent Variable: Probability of Donation (0 to 100)

<table>
<thead>
<tr>
<th>Pivotal Belief Level</th>
<th>With Control</th>
<th>With Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full</td>
<td>Variation</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>T1</td>
<td>15.00***</td>
<td>24.59***</td>
</tr>
<tr>
<td></td>
<td>(5.50)</td>
<td>(8.80)</td>
</tr>
<tr>
<td>T3</td>
<td>26.00***</td>
<td>42.62***</td>
</tr>
<tr>
<td></td>
<td>(5.77)</td>
<td>(8.73)</td>
</tr>
<tr>
<td>T5</td>
<td>19.00***</td>
<td>31.15***</td>
</tr>
<tr>
<td></td>
<td>(5.57)</td>
<td>(8.76)</td>
</tr>
<tr>
<td>T7</td>
<td>21.00***</td>
<td>34.43***</td>
</tr>
<tr>
<td></td>
<td>(5.48)</td>
<td>(8.51)</td>
</tr>
<tr>
<td>T10</td>
<td>18.00***</td>
<td>29.51***</td>
</tr>
<tr>
<td></td>
<td>(4.79)</td>
<td>(7.45)</td>
</tr>
<tr>
<td>Constant</td>
<td>24.00***</td>
<td>16.39***</td>
</tr>
<tr>
<td></td>
<td>(3.29)</td>
<td>(4.87)</td>
</tr>
<tr>
<td>R2</td>
<td>0.53</td>
<td>0.28</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.43</td>
<td>0.12</td>
</tr>
<tr>
<td>N</td>
<td>600</td>
<td>366</td>
</tr>
<tr>
<td>Subjects</td>
<td>100</td>
<td>61</td>
</tr>
</tbody>
</table>

Notes: All coefficients are multiplied by 100 for ease of readability. All models include subject fixed effects, and standard errors are clustered at the subject level. Legend: * p < 0.10; ** p < 0.05; *** p < 0.01

Estimates are too noisy to allow any strong conclusions, as the T3 treatment is not statistically different from the T5, T7, and T10 treatments in donation rate.

The inverted U shape in Figure 1 is consistent with a beliefs explanation. The increasing portion is consistent with the story that subjects may not believe they are pivotal when there is a low threshold because they expect other donors to achieve the threshold. This amounts to a free riding explanation when the threshold is low, such as in T1. The eventual decreasing pattern as the threshold rises is also consistent with a beliefs story. That is, subjects may believe that with such demanding thresholds, their peers are not likely to donate enough to make their own contribution pivotal (e.g., with T10). Considering the increasing and decreasing portions together, the beliefs story amounts to an explanation of free riding when the threshold is low and belief
Figure 2: Average Beliefs By Treatment
Note: This figure shows the average probability placed on 0, 1, 2, ..., up to 9 other persons in the group donating. This is the average of the reported probabilities for all 100 subjects in all 6 treatments.

that the matching money is a “pipe dream” when the threshold is high. This intuitive explanation and the results observed in the laboratory suggest that in the field experiment donation rates would eventually have declined if the threshold had been raised even further.

To test if beliefs are driving heterogeneity in contribution rates across thresholds, we need to examine the reported beliefs from the laboratory experiment. Collectively, the lab subjects tend to report single-peaked probability distributions as pictured in Figure 2.\footnote{Only 6 individuals in our sample of 100 never report single-peaked belief distributions. Of 600 total elicited belief distributions, 83\% are single peaked.} Figure 2 reports the average reported beliefs of 0 up to 9 other people giving in each treatment. As the threshold moves from 1 to 5 people, there tends to be a shifting of the highest (modal) probability mass toward a larger number of givers. However, under the very
high thresholds (T7 and T10) people put a large amount of mass on 0 other
givers, consistent with the idea that reaching the threshold is a “pipe dream”
when the threshold is very high.

On average, the lab subjects do a good job predicting the true number of
realized peer donors. We can compute the expected number of peer donors as
\[ \sum_{j=0}^{9} p_j \] and compare that to the actual realized number of peer donors in
each treatment (as shown in Table 7 of the Appendix). Although collectively
the realized number of peer donors is close to the expected number, this masks
the fact that individually the subjects often report a expected number of peer
donors that is 7 donors too high or 7 donors too low. In fact, individually,
subjects only report an expected number of peer donors within 1 too high or
1 too low about 70% of the time.

The subjective probability of being pivotal to the match is the reported
probability that \( T-1 \) other subjects give in each treatment (e.g., for a thresh-
old of 3, it is the reported probability that 2 other subjects give). Our theo-
etical model predicts that as \( p_{T-1} \) rises, the likelihood of donation also rises.
Figure 3 shows the relationship between the probability an individual puts
on being pivotal and the donation rate. The figure reveals an upward sloping
pattern: higher probabilities of being pivotal trend with higher donation rates.

Figure 3 does not account for differences driven by treatment or by in-
dividual attributes (e.g., optimism). So, in columns 3 and 4 of Table 3, we
report the results from linear models which include the probability that \( T-1 \)
others donate as an explanatory variable while including individual fixed ef-
fects and treatment fixed effects. Note that we do not randomly assign beliefs,
but rather we randomly assign treatments which influence beliefs. So we can-
not say that changes in beliefs cause changes in donations, but rather that
changes in beliefs are associated with different donation rates, consistent with
our theoretical model.

Recall a subject only has beliefs about being pivotal if there is a threshold
match, so the regression analysis in columns 3 and 4 of Table 3 only applies
to the five threshold match treatments and excludes the control. In column 3,
we find that a one percentage point increase in the likelihood of being pivotal
(beliefs that T-1 others give) is associated with a positive and statistically significant 0.22 percentage point increase in the likelihood of donation. This rises to an associated increase of 0.43 percentage points when we only concentrate on those subjects with some variation in donations across threshold match treatments (column 4). This implies that a 10 percentage point increase in belief of being pivotal would be associated with a 2.2 to 4.3 percentage point increase in the likelihood of donation. As beliefs about being pivotal rise, so does the likelihood of donation even controlling for time invariant attributes about the individual. Our field results were consistent with a theory that changes in beliefs about being pivotal drive changes in contribution rates, and now we have lab evidence that this is indeed part of the mechanism at work.

For comparison purposes we provide the same models in column 3 and 4 but without beliefs in the Appendix. Also, for comparison purposes, we describe the results for only the first period since one may be worried about order effects in our experiment. If we restrict the analysis to only the first decisions made by participants, we can show that the coefficient on pivotal beliefs is still positive but insignificant. However, these results do not control for time invariant individual level heterogeneity, which is exactly why we ran a within subjects experiment.
As a robustness check we can show that pivotal beliefs ($p_{T-1}$) matter above and beyond the total likelihood of reaching the threshold without own donation ($\sum_{j=T}^{9} p_{j,j}$). If we include the total likelihood of reaching the threshold without own donation ($\sum_{j=T}^{9} p_{j,j}$) as a control variable we find that the coefficient on pivotal beliefs is not only still positive and significant, but also it doubles (from 0.22 to 0.48 using the full sample, and from 0.43 to 0.78 using only those with variation; see columns 5 and 6 of Table 9 in the Appendix). As an additional robustness check, for those subjects with single peaked beliefs we can identify if that peak (or modal belief) is on $T - 1$ peer donors. If we use a dummy variable taking the value one when the highest peak is on $T - 1$ other donors as our measure of beliefs about being pivotal, we find that it has a positive and significant relationship with the likelihood of giving (see columns 7 and 8 of Table 9 in the Appendix).

In the field we found that different threshold match treatments (T1/T2/T3) had different effects on the contribution rate with T3 doubling the contribution rate from 1.6% to 3.6%. Our theoretical model implies that the effectiveness of T3 is attributable to changes in the beliefs about being pivotal in this treatment. Now using data from our lab study we have shown that once again that T3 is highly effective in increasing the contribution rate, but moreover that pivotal beliefs do indeed influence giving behavior. Higher beliefs about being pivotal, in any treatment, are associated with a higher likelihood of donation.

5 Alternative Explanations

In this section, we show that the literature’s existing explanations for donor behavior under a match have no explanatory power for our results. However,

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39For example if the threshold were 5, then it might matter what the collective probability mass on 5, 6, 7, 8, and 9 other donors was, rather than the probability that only 4 people give. One way to think of this is that a person wants to donate if they think the threshold will be met without them, and they want to keep their money if they think the threshold won’t be met without them. So that this person wants to be on the “winning” side regardless of whether that is threshold met or threshold not met.

40For example if the threshold were 5, then is the largest probability mass on $p_4$. 

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an explanation involving beliefs about peers does explain what we observe in the field and the laboratory.

Table 4: Predictions of Various Explanations Regarding Treatment Effect of T3

<table>
<thead>
<tr>
<th>#</th>
<th>Explanation</th>
<th>Treatment Effect of T3 (relative to Control)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price effect</td>
<td>0</td>
<td>price of giving unaffected</td>
</tr>
<tr>
<td>2</td>
<td>Public good level effect</td>
<td>-</td>
<td>(potentially) increase in G</td>
</tr>
<tr>
<td>3</td>
<td>Signalling</td>
<td>0</td>
<td>excluded by design</td>
</tr>
<tr>
<td>4</td>
<td>Fictitious donor</td>
<td>0, -</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Donor will give anyway</td>
<td>0, -</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Warm glow</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Beliefs about peers</td>
<td>+</td>
<td>(with certain beliefs)</td>
</tr>
</tbody>
</table>

+ indicates a prediction of increase in response rate.
- indicates a prediction of decrease in response rate.
0 indicates a prediction of no change in response rate.

Karlan and List (2007) summarize six explanations that have been proposed for how matching might (or might not) affect donation decisions. The first is related to price effects because a dollar-for-dollar match can be interpreted as lowering the price of giving. Second, matching may reduce the marginal utility of contributing by increasing the level of the public good that is provided, thereby resulting in decreased donations. Third is Vesterlund’s (2003) signalling explanation: a matching commitment may provide information to donors that the charity is of high quality.41 Fourth is the idea that donors may discount the matching opportunity as fictitious, which could perhaps even harm the charity’s efforts via a negative reputation effect. The fifth explanation is that donors believe that the matching donor exists but will give the full matching gift regardless of what other donations are received. The sixth involves the impure altruism model of Andreoni (1989, 1990), extended

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41Interestingly, Rondeau and List (2008) find in their Sierra Club experiment that an unconditional “challenge” gift is more effective at raising funds than a conditional matching commitment. Still, it is plausible that even conditional matching gifts provide a signal to donors.
to large pools of donors or a large size of the charity (Ribar and Wilhelm 2004, Andreoni 2006). In these cases, giving behavior is determined only by “warm glow” utility from giving, so contribution behavior is insensitive to the matching grant.

We consider these explanations in the context of our experimental results in the field and laboratory; Table 4 provides a summary. Do any of these explanations predict the observed large, positive, and statistically significant treatment effect of T3 relative to control? The traditional price effect story does not because the T3 treatment does not change the price of giving. The second explanation - that matching money reduces the marginal utility of giving by increasing the level of the public good - inaccurately predicts a reduction in giving. Third, our experimental design rules out signalling as an explanation. Quality signalling cannot explain the T3 treatment effect in our field experiment, because solicited donors were alumni who had experienced the quality of the educational program personally. Moreover, the matching amount of $50 is unlikely to be interpreted as a strong signal of quality. An alternative story is urgency signalling, i.e., the match could indicate that “now” is a particularly important time to give (Karlan and List, 2007). However, there is no supporting language in the field study letter to indicate that donations in the current window are any more important than in previous donation appeals. Moreover, in the lab experiment, all subjects face a choice of giving to the same charity both with and without a match, so there is no signalling value in the match about the quality of the charity. Fourth is the possibility that donors perceive the matching opportunity as fictitious, and fifth is the explanation that donors believe that matching funds will be given regardless of their actions. Neither of these can accommodate the increased contribution rate in the T3 treatment. Sixth, the theory of warm glow giving also fails to explain the difference, given its prediction of donor insensitivity to matching funds.

42A price effect changes the rate at which each dollar contributed translates into dollars received by the charity. That is, it is a marginal effect that applies to each dollar donated. In contrast, the match in treatment T3 involves a discontinuous effect that applies to the first dollar donated, but only if a sufficient number of other donors have donated.
We do not interpret our results as a rejection of these explanations in general.⁴³ Rather, we interpret our results as identifying the importance of beliefs about peers, and we suggest that this factor may have explanatory power for donation behavior under more general forms of donation matching. For example, with a dollar-for-dollar match, a donor may believe that peers will exhaust the match, yielding less incentive to contribute relative to the scenario in which the donor believes her donation will secure matching money.⁴⁴

One potential concern is whether the treatment effects observed in the field experiment generalize to other donor populations. We provide a check on this concern by observing the treatment effect of the dollar-for-dollar match (M). This treatment is similar to those used in previously executed designs in the literature on a wide variety of populations. Treatment M’s 1:1 dollar-for-dollar matching rate is consistent with the designs of Karlan and List (2007) and Karlan et al. (2011), while the $3,000 of matching money offered to 600 people is similar to, but slightly more generous than, the $2,500 matching dollars offered to 750 donors in Rondeau and List (2008).⁴⁵ Our dollar-for-dollar match had a contribution rate of 2.34% which is quite close to those found by previous similar designs (Karlan and List, 2007; Rondeau and List, 2008). Thus, this check provides no evidence to suggest that this population varies from other populations in ways that would affect generalizability.

6 Conclusion

This paper lays out a theoretical model describing an important role for beliefs about peers when a donation match is available. The model predicts that higher beliefs of being pivotal to securing matching funds are associated with

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⁴³For example, signalling remains a highly plausible explanation for the efficacy of large dollar-for-dollar matching funds, regardless of its inability to explain our results.

⁴⁴Multiple explanations may play a role here. Even if a donor believes that peers will exhaust the match, the donor may still see the match as a signal of quality or urgency.

⁴⁵However, the Rondeau and List (2008) design included a money-back refund if a specified threshold was not achieved. The other donation matches found in the field experiment literature do not inform the donor of the number of other donors who qualify for the match. Thus, donors are left to form their own beliefs about this variable.
a higher likelihood of donation. We test the prediction using experiments in both the field and laboratory. Taken together, our experimental results suggest that: (1) higher beliefs of being pivotal to securing matching funds are indeed associated with higher donation rates, and (2) improvements in donation rates can be realized by structuring donation matches in innovative ways.

The results of our experiments hold interesting implications for fundraising practitioners. The most effective treatment in increasing donation rates - in both the field and laboratory - is a novel fundraising mechanism that offers a flat $50 of matching money if at least 3 out of 10 potential donors choose to donate. This treatment more than doubles the rate of donation relative to control in both the field and laboratory. This treatment also yields a donation rate that is substantially greater than a traditional dollar-for-dollar match in the field, though estimate imprecision prevents a finding of statistical significance. We interpret these results as support for the notion that dollar-for-dollar matching may not be the best use of matching funds.

At this point, these results can say little about effects of the studied treatments on long-run giving outcomes. The decision to give charitably may have an important dynamic component (Landry, Lange, List, Price and Rupp, 2010). For example, donors may set annual goals for their giving. In this case, increased giving during one appeal window may be accounted for by lowering giving in a later appeal. Along these lines, Meier (2007) presents a finding that matching may undermine the willingness to give charitably in the long run. Additionally, our results cannot speak to the ideal amount of information disclosure during a matching campaign. This experiment did not test how disclosing information about the total size of the donor pool, or other's previous or current donations (Shang and Croson, 2009; Croson and Shang,

46Our experiment uses groups of 10 people and a bonus of $50, to find that T3 doubles the contribution rate versus the control. This doubling may not hold if we changed either group size or bonus size, but believe this is an excellent path for future research. However, the exciting thing is that the doubling effect of the T3 treatment versus control holds for both the field with a very low base rate giving (1.6%) as well as the lab with the higher base rate of 24%. Larger groups have a more difficult time providing threshold public goods(Bagnoli and McKee, 1991), so it is likely the magnitude of our results might decrease with groups larger than 10.
2013) would affect the contributions. We have shown that beliefs about peers matter, and intuitively these beliefs could be influenced by the information revealed so this is an important area for future research.

We have shown that beliefs about peers donations are likely to be an important determinant in charitable donation decisions when a donation match is available. We have also shown that in our field experiment and lab experiment a threshold match calling for a bonus when 3 out of 10 people give is the most effective at raising contribution rates. This threshold match mechanism is more effective than a traditional dollar-for-dollar matching regime in the field. Beliefs about peers explain the effectiveness of this mechanism, and further study of beliefs about others may be insightful for both academics and practitioners.
References


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