Ineffective Altruism: Giving Less When Donations Do More Good

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Abstract: Despite well-meaning intentions, people rarely allocate their charitable donations in the most cost-effective way possible. The manner in which cost-effectiveness information is presented can be a contributing factor. In four studies (N = 2,725), when we inform participants of the cost of a unit of impact (e.g. the cost of a mosquito net), they perversely donate *less* when the cost is *cheaper*. This result arises because people want their donation to have a tangible impact, and when the cost of such an impact is lower, people can achieve it with a smaller donation. A remedy for this inefficiency is to express cost-effectiveness in terms of "units per dollar amount" (e.g. 5 nets provided per $10 donated), thus leaving the cost of providing one tangible item unstated and rendering it less salient as a target donation amount. Across Studies 2 and 3, we demonstrate both the inefficient use of cost-effectiveness information and the effectiveness of this remedy using incentive-compatible donations decisions about providing meals, oral rehydration therapy, deworming medication, and measles vaccines.

Keywords: donations, framing effect, judgment and decision making, targeting, efficiency

Although each charity aims to maximize its own donation revenue, society as a whole is better off if people allocate their donations to the most effective charities (MacAskill 2016; Singer 2016). For example, even among the world's most effective charities, saving a child's life by donating to the least cost-effective of these charities costs 19 times more than by donating to the most cost-effective (GiveWell 2019a).[1] Thus, to the extent that charities compete for donations (Filiz-Ozbay and Uler 2018; MacAskill 2014; Reinstein 2011), society will be better off if more donation dollars go to relatively cost-effective charities. However, despite the importance of cost-effectiveness, little is known about how to influence donors to maximize the societal impact of their donation dollars. Instead, marketing science and related disciplines have focused overwhelmingly on understanding and prescribing how a given charity can maximize donation revenue, with little regard for the charity's effectiveness (Allen, Eilert, and Peloza 2017; Anik, Norton, and Ariely 2014; Bendapudi, Singh, and Bendapudi 1996; Cryder, Botti, and Simonyan 2016; Goswami and Urminsky 2016; LaTour and Manrai 1989; Small and Cryder 2016; Small and Loewenstein 2003; Small and Simonsohn 2008; Sudhir, Roy, and Cherian 2016; White and Peloza 2009).

To support consumer demand for guidance in allocating donations efficiently, organizations are starting to make transparent quantitative estimates of the social impact of donations. For example, GiveWell provides donors with information about the cost-effectiveness of donations to different charities, including estimates of cost per mosquito net, cost per life saved, cost per deworming dosage, and much more (GiveWell 2019b). This "cost per unit" information is prevalent not only as a means of comparing across charities, but also in the marketing materials of individual charities themselves. For example, World Vision and Heifer International present

[1] In this analysis, GiveWell measures cost-effectiveness in terms of the cost of saving a life under 5 years old, or an outcome "as good".

donors with gift catalogues which list the costs of various forms of charitable aid, such as providing a family with a goat or a pig (Heifer International 2018; World Vision 2018).

In this paper, we test how cost-effectiveness information influences the efficiency of donation decisions, which we operationalize as the difference between total donations when a unit of charitable impact is relatively cheap and when a unit of charitable impact (of the same quality) is relatively expensive. We find that people donate *inefficiently* when information is expressed in its typical "cost per unit" frame, but that this inefficient behavior can be remedied by reframing the same information in terms of the units of impact funded by a given dollar amount ("units per dollar amount").

EXISTING RESEARCH ON (IN)EFFICIENT DONATING

Past research presents a complex picture about whether donors are concerned about efficiency when donating. On the one hand, people donate more in the presence of matching incentives (Anik, Norton, and Ariely 2014; Karlan and List 2007) and are averse to donating to charities with high overhead costs (Gneezy, Keenan, and Gneezy 2014). On the other hand, research suggests systematic psychological barriers to efficient donating in terms of which charities and beneficiaries people choose as recipients of their donations (Berman et al. 2018; Cryder, Botti, and Simonyan 2016) and how much they give (Caviola et al. 2014; Loewenstein and Small 2007; Slovic 2007). Moreover, donors tend to be insensitive to the scope of prosocial incentives (Arora and Henderson 2007; Jung et al. 2017) so we might expect similar scope insensitivity to cost-effectiveness information. Overall, while existing research is ambivalent about the potential of cost-effectiveness information to make donations more efficient, the present paper demonstrates a way in which cost-effectiveness information can perversely cause *inefficient* donating.

HYPOTHESES

Although cost-effectiveness information is intended to help people donate more efficiently, it could instead facilitate *inefficient* donating. This unfortunate behavior could arise from donors' desire to see a tangible impact from their donations (Cryder, Loewenstein, and Scheines 2013; Gneezy, Keenan, and Gneezy 2014; Kogut and Ritov 2005). Given that cost-effectiveness information is typically expressed in terms of the "cost per unit" (e.g. $2 per mosquito net), the minimum required donation to achieve a tangible impact is made salient as a potential target donation amount. Unfortunately, the resultant targeting behavior can lead to suboptimal choices. To see how, consider a charity that provides mosquito nets for malaria prevention. When told that the cost of a mosquito net is $2.00, a donor who targets providing one mosquito net will donate $2.00. If instead told that the cost of a mosquito net is $1.00, then that person will donate only $1.00. Consequently, this person perversely donates *less* when the marginal dollar buys *more* impact.

This behavior is analogous to cab drivers with a daily income target working fewer hours on days when their hourly wage is higher (Camerer et al. 1997), and in fact, such income targeting is particularly acute when the wages are being paid to a charity (Exley and Terry 2017). People may be particularly prone to targeting behavior in prosocial contexts, perhaps because the failure to make a prosocial contribution that meets a salient threshold can threaten people's self-image (Gneezy et al. 2012). In sum, this research suggests that donors are indeed likely to use "cost per unit" information to target the minimum donation that provides a tangible impact, and consequently donate inefficiently.

Hypothesis 1: When cost-effectiveness information is framed as "cost per unit," people will donate less when donations are more cost-effective.

The same information that leads to inefficient donations when framed as "cost per unit" can nonetheless be presented in a way that can mitigate this inefficiency. Specifically, instead of framing cost-effectiveness information in terms of "cost per unit" (e.g. $2 per mosquito net), the same information can be framed in terms of "units per dollar amount" (e.g. 5 nets per $10). The framing manipulation is analogous to research on biased perceptions of commonly used efficiency metrics such as "megabits per second" and "miles per gallon." This research shows that these biases can be mitigated by reframing the efficiency ratios with "time" or "gallons" as the numerator (De Langhe and Puntoni 2015; Larrick and Soll 2008). However, despite the similarity of the interventions, the psychology driving the abovementioned effect is distinct from the psychology driving the effect of cost-effectiveness framing on donation decisions. Specifically, the abovementioned effects are driven by the "absolute heuristic," in which people assume that larger absolute changes in efficiency metrics imply larger changes in the outcome of interest. In contrast, the inefficiency that results from "cost per unit" framing is due to the salience of the cost of a single unit of charitable impact, which creates a natural target donation amount.[2] Reframing information in terms of "units per dollar amount" alleviates the inefficiency by making the cost of a single unit less salient. For example, if the cost-effectiveness of a mosquito net charity was framed in terms of "units per dollar amount" (i.e., 5 nets for $10, or 10 nets for $10) then the exact cost of a net would be less salient than if the same information was framed in terms of "cost per unit" (i.e., $2 per net, or $1 per net). Although it is not difficult to transform one frame into the other, people tend to process information in the way that it is presented to them, and rarely re-frame it pro-actively (Kahneman 2011; Slovic 1972). Consequently, when information is framed

[2] It is worth noting that larger absolute increases in the "units per dollar amount" metric *always* imply larger absolute increases in the marginal impact of a dollar donated. However, this relationship does not necessarily hold for the "cost per unit" frame. Thus, the "absolute heuristic," which drives the miles per gallon illusion, would also cause additional bias in the "cost per unit" frame.

as "units per dollar amount," we predict that people will be less likely to donate the amount required to fund a tangible unit, and the inefficient donation pattern will be eliminated.

Hypothesis 2: When cost-effectiveness information is framed as "units per dollar amount," the inefficient tendency of people to donate less when donations are more cost-effective will be eliminated.

THE PRESENT RESEARCH

In what follows, we present four studies exploring how people respond to cost-effectiveness information in charity appeals. In Study 1A, we found that when people learn the cost of a mosquito net for a malaria prevention charity, they report that they would donate *less* when the cost is *cheaper*. In Study 1B, we found that this inefficient pattern still arises when we provide all donors with impact information for the same set of donation amounts, and manipulate only *which* of these donation amounts corresponds to the cost of a net. This result suggests that participants pay particular attention to the dollar amount that corresponds to the cost of a net, and do not merely treat whatever dollar amounts they are shown as anchors (Tversky and Kahneman 1974) or suggested donations (Grice 1975). In Studies 2 and 3, we replicated the result from Study 1A and demonstrated the efficacy of a remedy with incentive-compatible behavior. In Study 2, participants made real donations to a foodbank, and we found that when information is framed as "cost per meal," participants again donate *less* when the cost is *cheaper*. However, when information is instead framed as "meals per dollar," and thus the cost of a meal is rendered less salient, then participants donate more efficiently. In Study 3, we further demonstrated how the "units per dollar amount" frame can remedy the inefficient behavior in the "cost per unit" frame. Participants made incentive-compatible donation decisions to four different types of charitable aid, and we found that the effect is robust both to using different units of charitable impact and also in

the presence of opposing normative and conversational cues about the appropriate donation amount.

In all of our studies, we report all of our measures, manipulations, exclusions, and target sample sizes. We pre-registered all of our studies on AsPredicted.org (see the Appendix for links to pre-registration documents), and we perfectly followed all of our pre-registered analysis plans and exclusion rules. When we report robustness checks or exploratory analyses (in addition to our pre-registered analyses), they are clearly described as such. Additional information about the studies can be found in the Web Appendix, including a full breakdown of how exclusions and attrition account for the final sample size of each study (see Table S3 in Web Appendix F). Finally, we have posted our materials, data, and analyses files online: https://osf.io/y6tvn/?view_only=2b20410e28d74cfb82ca38519cd10eb8.

STUDY 1A

In Study 1A, participants made hypothetical decisions about how much to donate to an anti-malaria charity. To test how donors respond to cost-effectiveness information, we manipulated the cost of a mosquito net between subjects.

Method

Participants. We recruited participants from Amazon's Mechanical Turk (MTurk) for a survey advertised as a "3 minute survey for $0.30." We decided in advance to collect data from 400 participants. In the event of multiple responses from a single MTurk ID or IP address, we pre-registered to include the original response only, resulting in the exclusion of 18 responses and a final sample of 389 (mean age = 37.8, 46.4% female).

Design. All participants were asked to imagine an opportunity to donate to a mosquito net charity, with the only difference between conditions being the cost of providing a mosquito net. Between subjects, we randomly drew the cost of a net from integer numbers of dollars ranging from $1 to $10.

Procedure. The scenario read as follows:

> *Imagine that you are waiting at a train station, and you see a charity fundraiser with a donations bucket. You ask them for a leaflet, and you see that the charity fights malaria in poor countries. Specifically, it provides families with bed nets to protect them from malaria-infected mosquitoes. On the leaflet, there is a section about cost-effectiveness, which says that the bed nets cost on average [$X] to provide.*
>
> *The fundraiser asks you, "Would you like to make a donation? You can donate any amount!"*

At the bottom of the screen, participants responded to the question, “How much, if anything, would you donate?” by entering any amount into a text box. On the next page, we reminded participants of how much they donated and asked them to explain why they decided to donate that amount.

On the final page of the survey, we collected demographic information.

Results

We hypothesized that many participants would target their donation to cover the cost of one mosquito net. Consequently, we predicted a positive correlation between the cost of a mosquito net and the donation amount. We confirmed this positive correlation with a Kendall’s

Tau independence test (τ_b = .13, z = 3.58, p < .001). In other words, people donate *less* when the cost of a mosquito net is lower and the opportunity is more cost-effective. Despite the fact that the donations were hypothetical, meaning that it was costless for participants to report a large donation amount, 25% of participants across conditions chose to donate the exact cost of one net.[3] In contrast, only 3% of participants donated the amount required to fund exactly two nets, and only 1% donated the amount required to fund exactly three nets.

Figure 1 shows that a greater percentage of participants donated each amount from $1 to $10 in the condition in which that amount was *equal to* the cost of a net compared to in the nine other conditions in which that amount was *different from* the cost of a net. In an exploratory analysis, we conducted 10 separate χ^2 tests, one for each integer donation amount between $1 and $10, and found this effect to be significant for all of them (χ^2*s*(1) > 4, *ps* < .05).

[3] When participants who donated the exact cost of a net were asked to justify their decision, the large majority spontaneously reasoned that the donation was the amount necessary to provide a unit of impact. For example, open-ended responses included, “To provide one net for the anti-malaria cause,” “Because that’s how much one bed net would cost,” and “That is the amount that would protect a child. I'd want to protect at least one child.”

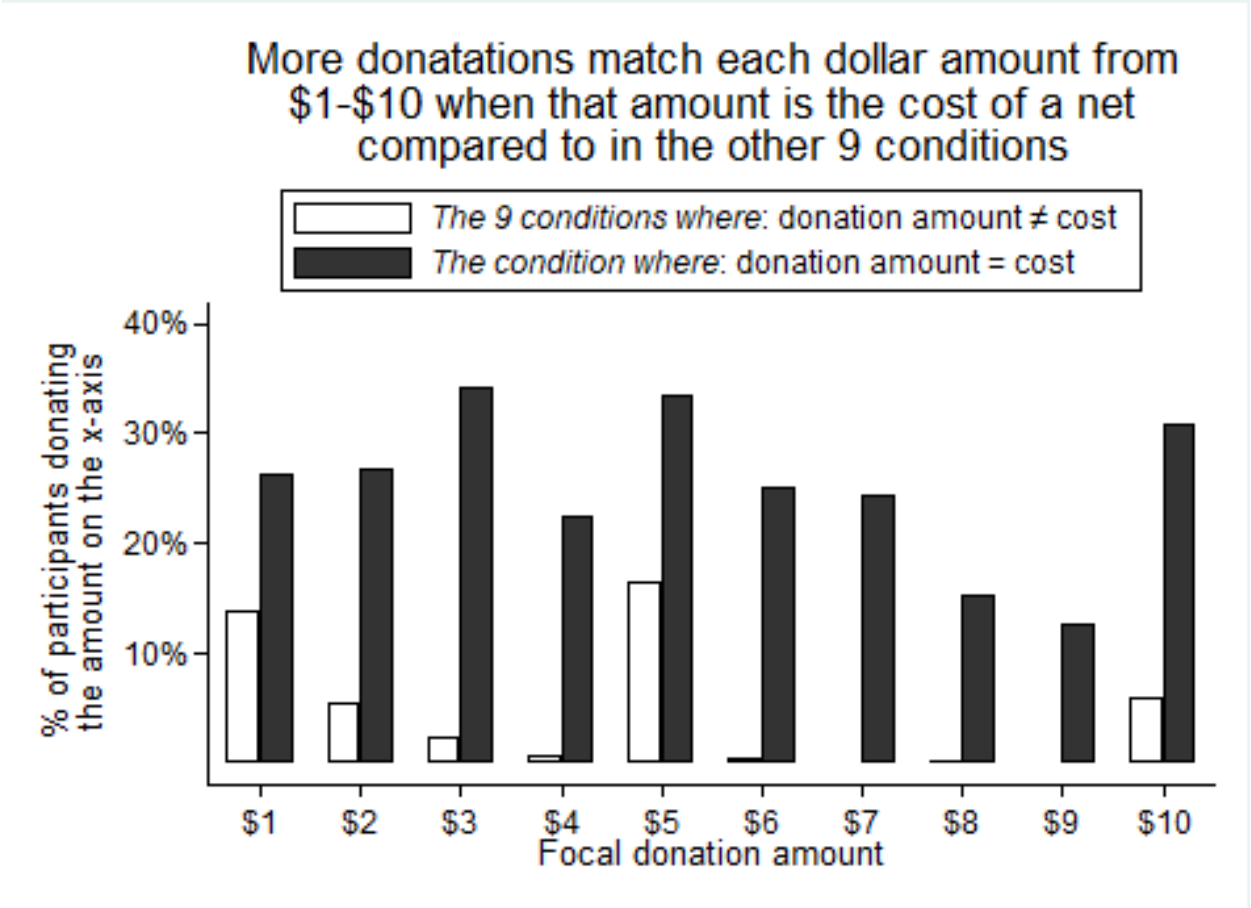

Figure 1: Figure 1 portrays the percentage of participants who donated each integer dollar amount from $1 to $10 in the nine conditions in which the amount was *different from* the cost of a net (white bars) compared to in the condition in which the amount was *equal to* the cost of a net (black bars). For example, the *white* bar above $1 shows that, in the nine conditions in which the cost of a net was *not* $1, *14%* of participants donated $1. Similarly, the *black* bar above $1 shows that, when the cost of a net *was* $1, *26%* of participants donated $1. Overall, each dollar amount constitutes a significantly greater percentage of donations when it is equal to the cost of a net (χ^2*s*(1) > 4, *ps* < .05). While the chart only includes columns corresponding to each cost of a net (ranging from $1-10) participants could give *any* amount, including amounts less than $1 and greater than $10. We portray the full distribution of donations in a histogram in Web Appendix G.

In sum, because donors tend to use "cost per net" information to donate the exact cost of a net, they inefficiently donate less when nets are cheaper. In Study 1B, we show that this inefficient pattern cannot be eliminated simply by displaying the impact of other donation amounts in addition to the cost of a net.

STUDY 1B

While the result in Study 1A is wholly consistent with a *desire* to provide one net, it is also potentially consistent with participants being *anchored* to the cost of a net (Jung, Perfecto, and Nelson 2015; Tversky and Kahneman 1974) or perceiving it as a suggested donation (Grice 1975) purely because of it being the *only* dollar amount displayed. However, these alternative accounts make a testable prediction: The cost of a mosquito net should *not* affect overall donation levels if we present participants in all cost conditions with the impact of the *same* set of possible donation amounts, and instead vary *which* of these displayed donation amounts provides exactly one net. This is because, if each of the displayed donation amounts is equally salient across cost conditions, then anchoring effects should *not* affect overall donation levels. However, if participants have a preference for funding exactly one net, then the cost of doing so will be particularly salient so long as this cost is one of the displayed donation amounts. Thus, we should still observe smaller donations at lower costs.

We designed Study 1B to test these alternative accounts. Participants again made hypothetical decisions about how much to donate to an anti-malaria charity, but this time, cost-effectiveness information was displayed on a table specifying the percentage of the cost of a mosquito net covered by each integer dollar amount from $1 through to $10. Consequently, participants who want to donate the cost of a net would have to actively look up the dollar amount corresponding to 100% of the cost of a net on this table.

Method

Participants. We recruited participants from Amazon's Mechanical Turk (MTurk) for a survey advertised as a "3 minute survey for $0.30." We decided in advance to collect data from 800 participants. In the event of multiple responses from a single MTurk ID or IP address, we pre-registered to include the original response only, resulting in the exclusion of 21 responses. We also pre-registered to exclude participants who did not correctly answer the final comprehension check, resulting in 13 further exclusions and a final sample of 780 (mean age = 37.2, 54.7% female).

Design. All participants were asked to imagine a similar scenario to that in Study 1B, and between subjects, we manipulated the cost of providing a mosquito net as implied by an information table. To avoid setting the various costs of a net either at round numbers (such as $1, $5, or $10) or at amounts that were multiples of each other (such as $3-and-$6 or $4-and-$8) we chose the costs to be $3 and $8.

Procedure. The scenario read as follows:

> *Imagine that you are waiting at a train station, and you see a charity fundraiser with a donations bucket. You ask them for a leaflet, and you see that the charity fights malaria in poor countries. Specifically, it provides families with bed nets to protect them from malaria-infected mosquitoes. On the leaflet, there is a section about cost-effectiveness, which provides the following table* (see Figure 2)*:*

$3 per net condition		**$8 per net condition**	
Dollars donated	*Percentage of bed net cost covered*	*Dollars donated*	*Percentage of bed net cost covered*
$1	*33%*	*$1*	*12.5%*
$2	*67%*	*$2*	*25%*
$3	*100%*	*$3*	*37.5%*
$4	*133%*	*$4*	*50%*
$5	*167%*	*$5*	*62.5%*
$6	*200%*	*$6*	*75%*
$7	*233%*	*$7*	*87.5%*
$8	*267%*	*$8*	*100%*
$9	*300%*	*$9*	*112.5%*
$10	*333%*	*$10*	*125%*

Figure 2: Cost tables in the Study 1B scenario for each cost condition. In the $3 per net condition, the donation amount corresponding to 100% of the cost of a bet net is $3, in the $8 per net condition, this donation amount is $8.

The fundraiser asks you, "Would you like to make a donation? You can donate any amount! Even a donation that covers a portion of the cost of a bed net helps us deliver more nets overall!"

On the same page, we asked two comprehension questions to confirm that participants were correctly interpreting the table and that they understood that even donations of less than the cost of a net would help the charity provide more nets overall (see Web Appendix A). Participants had to answer both of these questions correctly in one attempt to continue with the survey.

On the next page, these participants then saw the whole scenario again and answered the question, “How much, if anything, would you donate?” in a text box. As in Study 1A, we then reminded participants of how much they donated and asked them to explain why they decided to donate that amount.

To preclude the possibility that participants perceived a need to fund at least the cost of a net for their donation to have any functional benefit, they then answered a third comprehension question: “In the scenario, if a person only donated the amount required for half a net, would a family actually receive half of a net?” We pre-registered to exclude participants (n = 13) from the main analysis who answered “Yes” or who failed to answer the question at all.

On the final page of the survey, we collected demographic information.

Results

We hypothesized that, despite the same dollar amounts being displayed across conditions, many participants would target their donation to cover the cost of one mosquito net. Consequently, we predicted lower overall donations in the $3 per net condition (*mean* = $4.13, *median* = $3.00) than in the $8 per net condition (*mean* = $5.48, *median* = $5.00), and we confirmed this prediction with a Wilcoxon rank-sum test (z = - 4.16, p < .001). Thus, participants donated *less* when the cost of a mosquito net was lower and the opportunity was more cost-effective, even though they saw the same dollar amounts in all conditions. Overall, 32% of participants across conditions chose to donate the exact cost of one net (see Figure 3 for histograms of donations by condition).

In sum, the tendency to use cost-effectiveness information to donate the exact cost of a net is not merely due to anchoring on whatever cost is provided (which, in most cases, will naturally be the cost of a single unit of impact). Even when many different cost numbers are provided, the cost of one unit attracts a disproportionate share of donations. Building on this insight, in Studies 2 and 3, we test an intervention that information providers can use to prevent the inefficient pattern observed in Studies 1A and 1B.

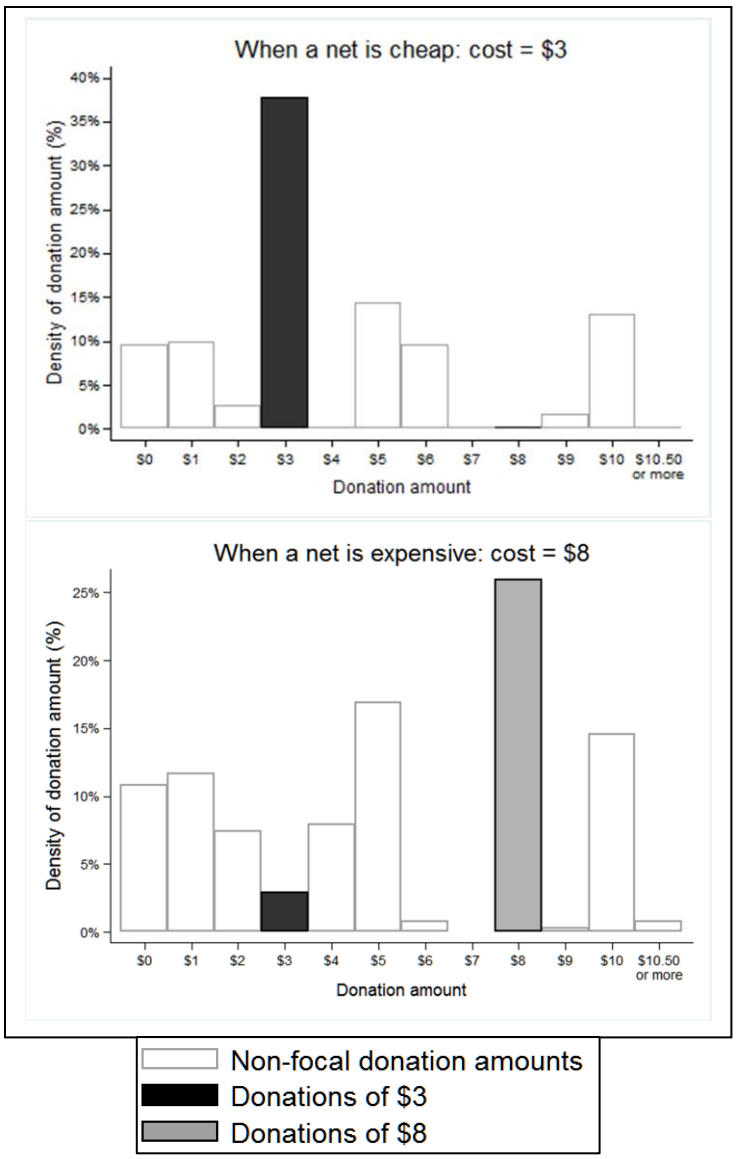

Figure 3: Histograms of donations in Study 1B. When the cost of a net is $3, people disproportionately donate $3 (top histogram) and when the cost is $8, they disproportionately donate $8 (bottom histogram), even though the same dollar amounts are displayed in both conditions. This pattern results in people donating less when the cost is lower.

STUDY 2

In Study 2, we elicited real donations to a foodbank to examine whether the same inefficient pattern observed in Studies 1A and 1B (in which people donate less when the cost is cheaper) persists in an incentive-compatible setting in which we ensure that participants hold the same beliefs about the quality of a unit of impact no matter what its cost. We also investigated a remedy for this inefficient pattern. Specifically, we compared the efficiency of donations when information was framed as "cost per meal," to when this information was instead framed as "meals per dollar." The charity received all of the donations made by participants and the participants received whatever of their endowments they chose not to donate.

Method

Participants. We recruited participants from Amazon's Mechanical Turk (MTurk) for a survey advertised as a "2 minute research survey for $0.20." We decided in advance to collect data from 600 participants. In the event of multiple responses from a single participant, we pre-registered to include the original response only, resulting in the exclusion of 22 participants and a final sample of 587 (mean age = 35.3, 44.0% female).

Design. In a 2 (information frame: cost per meal vs. meals per dollar) × 2 (cost-effectiveness: cheap vs. expensive) mixed design, participants had two separate opportunities to make real donations to a foodbank, each with a 30 cent endowment. Between subjects, participants were randomly assigned to read cost-effectiveness information framed either as "cost per meal" or as "meals per dollar." Table 1 displays the exact wording of the cost-effectiveness information in all conditions. We always referenced the number of meals before the associated dollar amount to control for any order effects (Bagchi and Davis 2012).

Table 1. Study 2 wording of cost-effectiveness information by condition.

		Information Frame Condition	
		Cost per Meal	*Meals per Dollar*
Cost-Effectiveness Condition	*Cheap*	We subsidize this donation decision so that: **Facing Hunger Foodbank can provide a meal for every 5 cents donated**.	We subsidize this donation decision so that: **Facing Hunger Foodbank can provide 20 meals per dollar donated.**
	Expensive	We subsidize this donation decision so that: **Facing Hunger Foodbank can provide a meal for every 10 cents donated.**	We subsidize this donation decision so that: **Facing Hunger Foodbank can provide 10 meals per dollar donated.**

Within subjects, we subsidized each decision by a different amount, such that the cost to participants of providing a given number of meals was always less than the total cost and varied across the two decisions. Each participant made one decision for which the cost of a meal was cheaper (5 cents) and another for which the cost of a meal was more expensive (10 cents). We counterbalanced the order of these decisions between subjects. In addition, we truthfully explained the subsidies to participants. Thus, participants knew that, even though the *cost* of a meal differed across their two donations, the *quality* of the meal was constant.

Procedure. At the beginning of the survey, we explained the procedure to participants. Subsequently, they answered two comprehension questions to confirm that they understood both that the subsidies would influence the cost of meals in each decision differently and that their decisions were real (see Web Appendix B). They had to answer both of these questions correctly to continue with the survey, each within two attempts.

Before participants made their first donation decision, they saw a screen reminding them that they could give away or keep any portion of their 30 cents endowment. To emphasize that they could donate *any* portion of their endowment, we explicitly told participants "Facing Hunger Foodbank can use any donation amount. Every cent helps." On the next page, participants saw the

relevant cost-effectiveness information for their first decision and selected a donation amount from a drop-down menu ranging from 0 to 30 cents in increments of 1 cent. The dependent variable for each decision was the amount that the participant selected. Before their second donation decisions, participants saw an extra screen reminding them that they would see different cost-effectiveness information in their next decision because of the donation subsidy. Then, for a second time, they saw the screen that emphasized that they could donate any amount. After making their second donation decision, participants entered demographic information and exited the survey.

Results

We hypothesized that participants who saw the "cost per meal" frame would target their donation amount to cover the cost of one meal, and consequently would donate inefficiently. Accordingly, participants donated significantly *less* when the cost of a meal was 5 cents (*mean* = 10.5 cents, *median* = 5.5 cents) than when it was 10 cents (*mean* = 11.0 cents, *median* = 10 cents; Wilcoxon signed-rank test z = -2.57, p = .010).[4] However, this inefficient pattern reversed for participants who read cost-effectiveness information framed as "meals per dollar," as the cost of a meal was less salient in this frame. These participants donated significantly *more*, on average, when the cost per meal was 5 cents (*mean* = 11.0 cents, *median* = 10 cents) compared to when it was 10 cents (*mean* = 10.6 cents, *median* = 5 cents; Wilcoxon signed-rank test z = 2.30, p = .022).[5]

The pre-registered regression analysis tested the 2-way information frame × cost-effectiveness interaction and found it to be statistically significant (b = .90, clustered *SE* = .38, p

[4] To test simple effects using a Wilcoxon signed-rank test, we define the dependent variable for each participant to be the difference between donations in the cheap condition and in the expensive condition, within the relevant information frame condition. We then use the Wilcoxon signed-rank test to compare this dependent variable to 0 (see Web Appendix for more details).

[5] Although our theory does not necessarily predict a reversal, manipulating cost-effectiveness across donation opportunities to the same charity made it easy for participants to see whether their second donation was more or less cost-effective than their first, and adjust their donation amount accordingly (Hsee 1996).

= .019, see Table 2 for the full regression analysis).[6] As a robustness check, we also performed a non-parametric, Wilcoxon rank-sum test (which increases statistical power when data are not normally distributed) and found a similar result ($z = 3.45$, $p < .001$).[7] Table S1 and S2 (in Web Appendices D and E) present detailed summary statistics and non-parametric tests for Studies 2 and 3.

Table 2. OLS regression analysis for Study 2 ($N = 587$).

Dependent variable	Donation amount (cents)	Binary measure: Is the donation at least 10 cents? ("yes" = 1, "no" = 0)
Independent variable		
cost-effectiveness (cheap = -.5; expensive = .5)	.01 (.19)	.03 (.01)*
information frame × cost-effectiveness	.90 (.38)*[1]	.12 (.03)***
fixed effects for participant	Yes	Yes
observations	1,174	1,174
R^2	.0004	.0045

Cluster-robust SEs are in parentheses. Cluster: participant.

Both the variable for the main effect of information frame and also the constant term are omitted due to multicollinearity with participant fixed effects.

*$p < .05$, **$p < .01$, *** $p < .001$

[1] Pre-registered test.

These effects are consistent with a desire to fund exactly one meal when explicitly informed of the donation required to do so. The left-hand panels of Figure 4 display donation histograms in the "cost per meal" frame. As these histograms illustrate, whether the cost was 5 cents (top-left panel) or 10 cents (bottom-left panel), a large portion of participants gave exactly

[6] We also pre-registered to replicate this interaction with a between-subjects analysis, using only the first decision made by each participant. However, although the absolute size of the effect was just as large as in the pre-registered, within-subjects analysis, the between-subjects analysis was underpowered, and yielded only directional support for the hypothesis, $b = 1.07$, clustered $SE = 1.83$, $p = .560$.

[7] To test the interaction using a Wilcoxon rank-sum test, we define the dependent variable for each participant to be the difference between donations in the cheap condition and in the expensive condition, and use the Wilcoxon rank-sum test to compare this dependent variable across participants reading different information frames (see Web Appendix for more details).

the cost of one meal. However, this pattern did not emerge when the cost of a meal was obscured, as can be seen in the right-hand panels, which display the donation histograms when cost-effectiveness information was framed as “meals per dollar.”

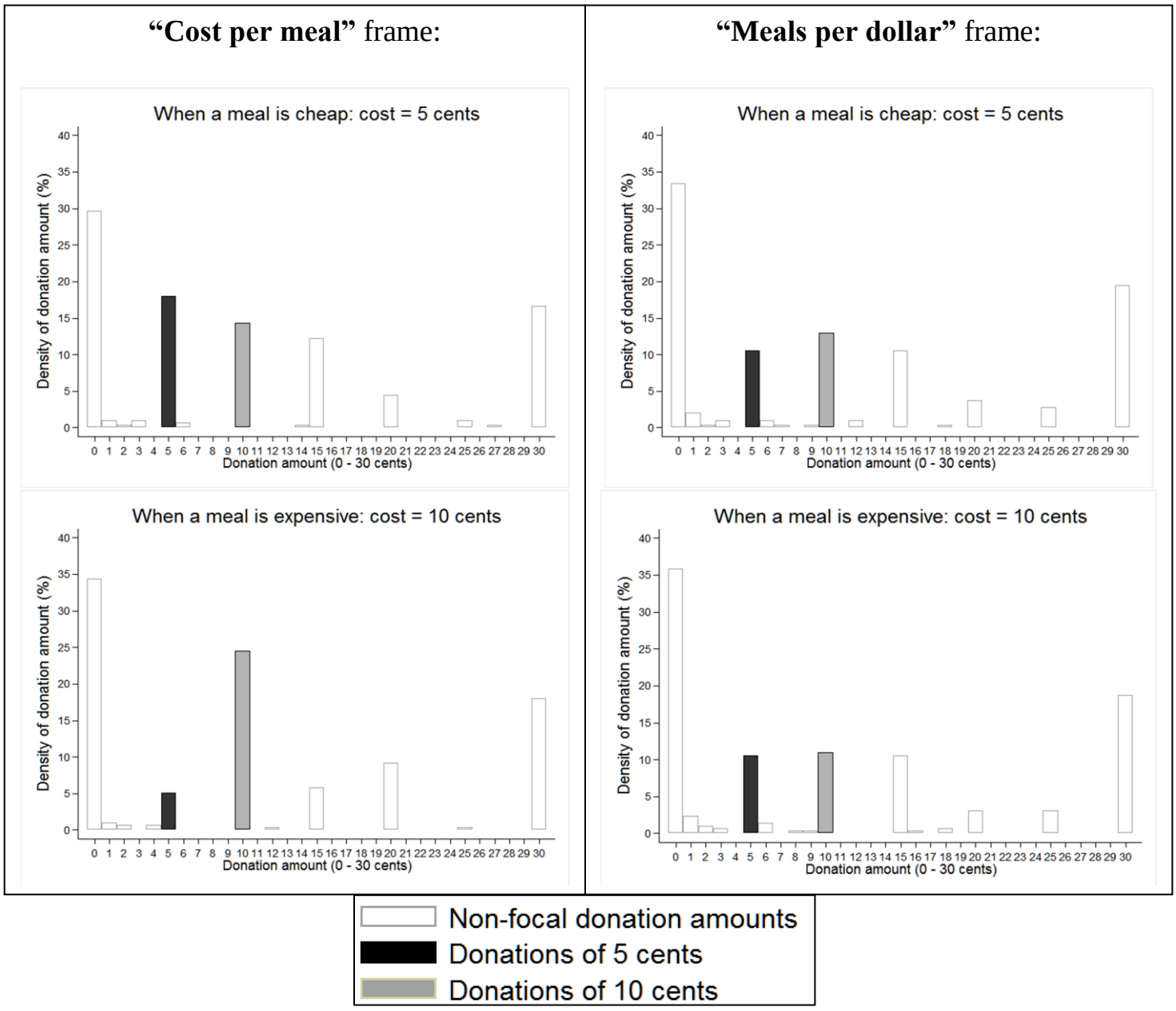

Figure 4: Histograms of donations in Study 2. The left panels show histograms when cost-effectiveness information is framed as "cost per meal" when the cost is cheap (top-left) and expensive (bottom-left). In this information frame, participants' donations track the cost of a meal. Therefore, they give less when the cost is cheaper. The right panels show histograms when information is framed as "meals per dollar." In this information frame, donations no longer track the cost, and so this inefficient pattern is eliminated.

We explored these results further using a binary dependent variable to measure how likely the participants were to make a donation of at least 10 cents (the amount necessary to fund a meal in the expensive condition). If people target a tangible impact, then they will be less inclined to donate at least 10 cents when a donation of just 5 cents is sufficient to fund a meal. However, we expected to observe this pattern only when the cost of a meal was made salient via "cost per meal" information framing. Accordingly, we found an information frame × cost-effectiveness interaction with this binary dependent measure (b = .12, clustered SE = .03, p < .001, see Table 2).

One possible concern with reframing cost-effectiveness information is that it could alter the amount people give overall in addition to the efficiency of their donations, but we find no evidence for reduced donation amounts. Overall, total donations across both cost conditions did not differ in the "cost per meal" frame (*mean* = 21.5 cents, *median* = 15 cents) versus the "meals per dollar" frame (*mean* = 21.6 cents, *median* = 15 cents, Wilcoxon rank-sum test z = -.29, p = .774).[8] Thus, there is no apparent downside to reframing information as "meals per dollar" rather than "cost per meal."

In sum, the results confirm that when information is framed as "cost per meal," participants donate less when a meal is cheaper to provide. However, this inefficient pattern is eliminated when information is framed as "meals per dollar." This result suggests that information providers in general can use "units per dollar" framing instead of "cost per unit framing" to help donors use the information more efficiently – but so far we have only demonstrated this inefficiency in donations to a foodbank. In Study 3, we generalize this result to multiple kinds of aid.

[8] To test for differences in total donations using a Wilcoxon rank-sum test, we define the dependent variable for each participant to be the sum of their donations across the cheap condition and the expensive condition, and use the Wilcoxon rank-sum test to compare this dependent variable between participants reading cost-effectiveness information in different frames (see Web Appendix for more details).

STUDY 3

In Study 3, participants made four incentive-compatible donations decisions to different forms of charitable aid. This design allowed us both to generalize our results to different types of aid, and to bypass the need to vary cost-effectiveness information for the same charity across decisions. We also used a new response format to examine whether the effect in Study 2 is robust to contexts for which there are opposing normative and conversational cues about the appropriate donation amount (Grice 1975).

Method

Participants. We recruited participants from Amazon's Mechanical Turk (MTurk) for a survey advertised as a "5-minute survey for $0.50." We decided in advance to collect data from 1,000 participants. In the event of multiple responses from a single MTurk ID or IP address, we pre-registered to include the original response only, resulting in the exclusion of 46 responses and a final sample of 969 (mean age = 36.7, 53.1% female). Four additional participants made between one and three donation decisions but did not complete the survey. We include these participants in our analyses where possible (as pre-registered), but not in analyses for which a missing observation would be required to calculate the dependent variable.

Design. In a 2 (framing: cost per unit vs. units per dollar) × 2 (cost-effectiveness: cheap vs. expensive) within-subjects design, participants made four donation decisions to different charities specializing in different forms of aid. So that decisions would be made in isolation, we gave participants a separate endowment for each one: $0.30 for providing meals, $0.90 for oral rehydration therapy, $1.20 for deworming medication, and finally $1.80 for measles vaccines. Each of these donation decisions was randomly assigned to a unique cell in the 2 × 2 design. Table

3 displays the exact wording of the cost-effectiveness information in each condition for the foodbank donation.

Table 3. Study 3 wording of cost-effectiveness information for the foodbank donation by condition.

		Information Frame Condition	
		Cost per Unit	*Units per Dollar*
Cost-Effectiveness Condition	*Cheap*	Central Pennsylvania Foodbank can use any donation amount. **On average, every 10 cents you donate covers the cost of one meal.**	Central Pennsylvania Foodbank can use any donation amount. **On average, every dollar you donate covers the cost of 10 meals.**
	Expensive	Central Pennsylvania Foodbank can use any donation amount. **On average, every 15 cents you donate covers the cost of one meal.**	Central Pennsylvania Foodbank can use any donation amount. **On average, every dollar you donate covers the cost of 7 meals.**

As in Study 2, to manipulate cost-effectiveness, we leveraged donation subsidies. We randomly subsidized one decision in each information frame to be cheap, so that a unit cost a third of participants' endowment (e.g. a meal cost $0.10 out of a $0.30 endowment), and we subsidized the other decision to be expensive, so that a unit cost half of participants' endowment (e.g. a meal cost $0.15 out of a $0.30 endowment).

Procedure. At the beginning of the survey, we explained to participants that they would make decisions about splitting an endowment between themselves and each of the four different charities. We motivated participants to take these decisions seriously by entering them into a transparently determined lottery, which demonstrated to participants that for each decision, there was some chance that their endowment would be split between themselves and the target charity as they specified. We tested participants' understanding of these instructions in a comprehension question, which they had to pass to continue with the survey (see Web Appendix C for details of this lottery and the related comprehension question).

Participants then made their four donation decisions. On the screen before each decision, we described the target charity, specified the endowment for that decision, and indicated that participants would see cost-effectiveness information that took into account the researchers' subsidy payments.[9] On the donation screens, participants saw the relevant cost-effectiveness information (see Table 3) and chose their donation amount by moving a slider on a scale where the only points labelled were the end points: 0 and the full endowment (e.g., $0.30). We sought to examine whether the results of Study 2 would be robust to situations in which Gricean norms suggested a preferred donation amount distinct from a unit of charitable impact, so the slider was always initially set at the full endowment as a decoy suggested donation (Goswami and Urminsky 2016). After making their final donation decision, participants entered demographic information and exited the survey.

Results

Because each decision was about a unique type of aid with a unique endowment size, we standardized the dependent variable by calculating the donation as a percentage of the endowment for each decision.

As in Study 2, we hypothesized that participants who saw the "cost per unit" frame would tend to target funding a tangible impact with their donations, and consequently would donate inefficiently. Accordingly, participants donated significantly *less* when the cost per unit was cheap (*mean* = 37.9%, *median* = 33.3%) than when it was expensive (*mean* = 39.2%, *median* = 50.0%; Wilcoxon signed-rank test $z = 3.67$, $p < .001$).[10] However, this inefficient pattern was eliminated

[9] Unlike in Study 2, participants in Study 3 never made two donation decisions to the same target charity, so we did not need to explain that the subsidy amounts differed across decisions.

[10] To test simple effects using a Wilcoxon signed-rank test, we define the dependent variable for each participant to be the difference between the percentage of the endowment donated in the cheap condition and in the expensive

for participants who read information framed as "units per dollar." These participants donated similar amounts when it was cheap (*mean* = 38.7%, *median* = 35.8%) compared to when it was expensive (*mean* = 38.4%, *median* = 37.5%; Wilcoxon signed-rank test $z = 0.43$, $p = .668$).[11] The pre-registered Wilcoxon signed-rank test analyzed the 2-way information frame × cost-effectiveness interaction, and found it to be statistically significant ($z = 3.02$, $p = .003$).[12]

Histograms of participants' donations suggest that, as in Study 2, these effects were driven by participants' desire to fund a meal when explicitly informed of the donation amount required to do so. The left-hand panels of Figure 5 display donation histograms in the "cost per unit" frame. As these histograms illustrate, whether the cost was a third of the endowment (top-left panel) or half of the endowment (bottom-left panel), a large portion of participants gave exactly the cost of a unit. However, this pattern did not emerge when the cost of a unit was less obvious, as can be seen from the right-hand panels, which display the donation histograms when cost-effectiveness information is framed as "units per dollar."

condition, within the relevant information frame condition. We then use the Wilcoxon signed-rank test to compare this dependent variable to 0 (see Web Appendix for more details).

[11] We did not get a reversal most likely because cost-effectiveness information was measured in terms of different units of impact across decisions, and so participants could not tell whether their later donations were more cost-effective than their early donations. They thus donated similar amounts across the cheap and expensive "units per dollar" conditions (Hsee 1996).

[12] To test the interaction using a Wilcoxon signed-rank test, we calculate (for each participant) the difference between donations in the cheap condition and the expensive condition *within* each information frame, then we define the dependent variable as the *difference* between the resulting numbers *across* information frames. Finally, we use the Wilcoxon signed-rank test to compare this dependent variable to zero (see Web Appendix for more details).

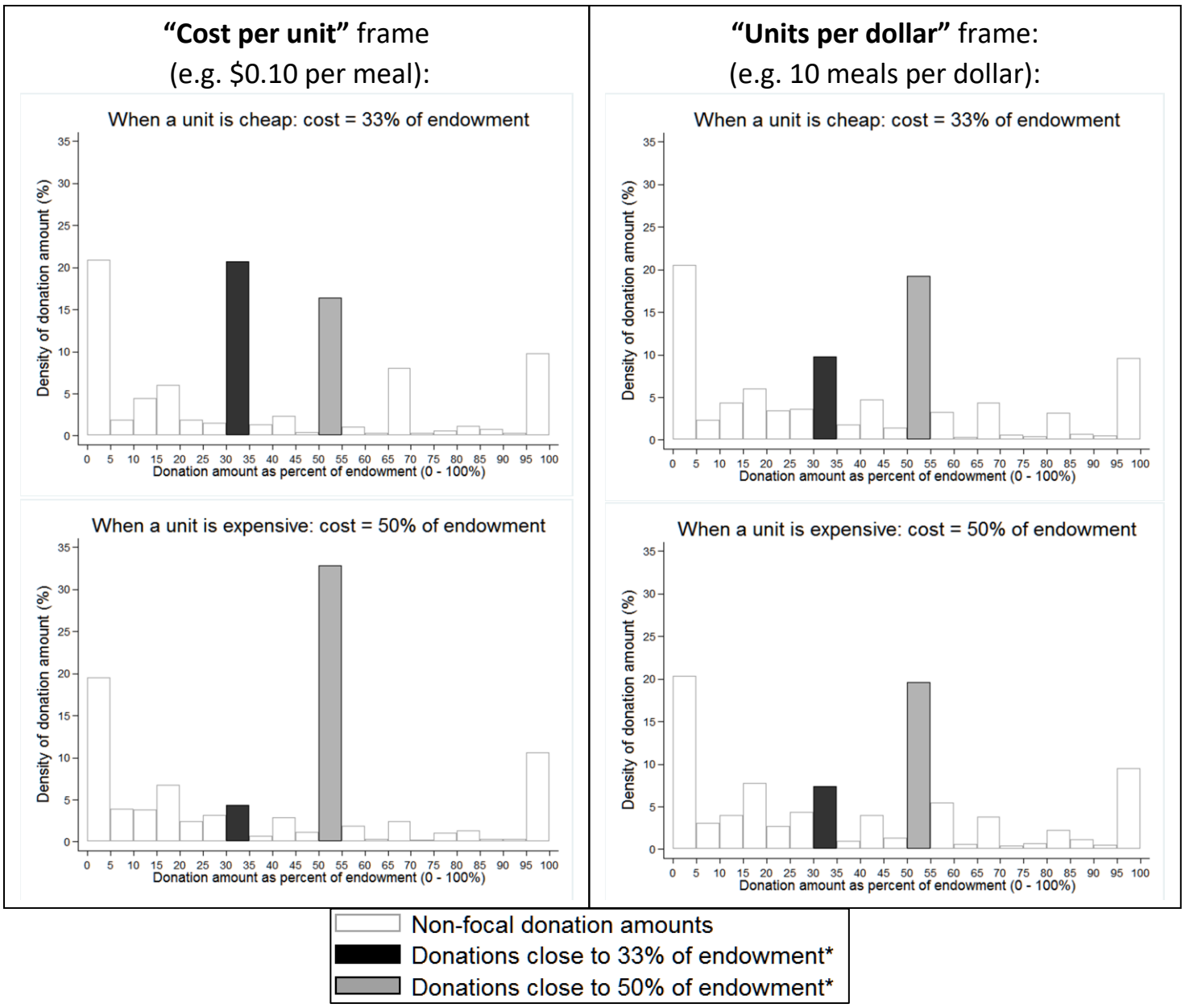

Figure 5: Histograms of donations as percentages of participants' endowments in Study 3. The left panels show histograms when information is framed as "cost per unit" (e.g. $0.10 per meal) when the cost is cheap (top-left) and expensive (bottom-left). In this information frame, participants' donations track the cost of a unit. Therefore, they give less when the cost is cheaper. The right panels make the same comparison when information is framed as "units per dollar," e.g. 10 meals per dollar. In this information frame, donations no longer track the cost of a unit, and so this inefficient pattern is eliminated.

*The black bar shows donation amounts of at least 30% and less than 35% of the endowment (close to 33% of endowment), the grey bar shows donation amounts of at least 50% and less than 55% (close to 50% of endowment).

The other pre-registered analysis was a regression using a binary dependent variable to measure how likely the participants were to make a donation of at least half of their endowment (the amount necessary to fund a unit in the expensive condition) – see Table 4 for details of the regression. If people target a tangible impact, then they will be less inclined to donate at least half of their endowment when a donation of just a third of their endowment is sufficient to fund such an impact. However, we expected to observe this pattern only when the cost of a unit was made salient in the "cost per unit" information frame. Indeed, the information frame × cost-effectiveness interaction supported this prediction (b = .11, clustered SE = .02, p < .001).

Table 4. OLS regression analysis for Study 3 (N = 973)[1].

Dependent variable	Donation amount (as % of endowment)	Binary measure: Is the donation at least half of the endowment? ("yes" = 1, "no" = 0)
Independent variable		
information frame ("units per dollar" = -.5; "cost per unit" =.5)	–.03 (.48)	.02 (.01)*
cost-effectiveness (cheap = -.5; expensive = .5)	.52 (.44)	.07 (.01)***
information frame × cost-effectiveness	1.67 (.86)	.11 (.02)***[2]
constant	38.57 (.90)***	.44 (.01)***
fixed effects for participant	No	No
observations	3,885	3,885
R^2	.0003	.0085

Cluster-robust SEs are in parentheses. Cluster: participant.

Both the variable for the main effect of information frame and also the constant term are omitted due to multicollinearity with participant fixed effects.

*p < .05, **p < .01, *** p < .001

[1] Includes observations from participants who did not complete the study, as pre-registered.

[2] Pre-registered test.

As in Study 2, the framing manipulation did not affect total donations. Specifically, averaged across cost conditions, donations as a percentage of the endowment did not differ in the "cost per unit" frame (*mean* = 38.6%, *median* = 41.7%) versus the "units per dollar" frame (*mean*

= 38.6%, *median* = 40.3%, Wilcoxon signed-rank test z = - .03, p = .973).[13] Thus, there is no apparent downside to altering the information frame to encourage greater efficiency.

In sum, the results confirm that across multiple types of aid, when information is framed as "cost per unit," participants donate less when the cost is lower. However, organizations providing cost-effectiveness information can help donors avoid such inefficient donating by framing information instead as "units per dollar."

GENERAL DISCUSSION

The cost-effectiveness of charities is highly variable, and consequently, helping donors to choose more effective donation recipients could yield a large societal benefit, be it saving more lives, improving educational opportunities, or increasing incomes. To this end, advocates of efficient donating provide donors with transparent, quantitative estimates of the social impact of donations. But, does this cost-effectiveness information always help efforts to channel donations toward more cost-effective opportunities? This paper provides evidence that the framing of this information is crucial to determining its influence. In four studies, when the cost of a unit of charitable impact (e.g. the cost of a mosquito net) is made explicit, people donate *less* when their donations can do more good. This pattern is consistent with a desire to make a tangible impact, and consequently, a tendency to donate only the amount required to do so. Thus, when faced with "cost per unit" information that suggests a cost-effective donation opportunity, we recommend that donors decide how much to give without fixating on the cost. However, we recognize that donors may not be receptive to this message, and so we offer a more practical solution based on

[13] To test the effect of the information frame on total donations using a Wilcoxon signed-rank test, we calculate (for each participant) the average of donations in the cheap condition and the expensive condition *within* each information frame, then we define the dependent variable as the difference between the resulting numbers *across* information frames. Finally, we use the Wilcoxon signed-rank test to compare this dependent variable to zero (see Web Appendix for more details).

the evidence of Studies 2 and 3. Specifically, when the cost of a tangible impact is made less salient by instead framing the information in terms of "units per dollar amount," we eliminate the inefficient pattern of donations.

Importantly, we detect no evidence of greater willingness to donate when faced with information framed as "cost per unit" over "units per dollar amount." This null result suggests that reframing cost-effectiveness information can remedy inefficient donating without reducing overall donation amounts. In contrast, some previous research is ambivalent about the societal benefit of interventions designed to encourage rational donating. For example, people donate more to help identifiable victims than to alleviate suffering on a much greater statistical scale (Small & Loewenstein, 2003) but when they are trained to recognize this bias, they reduce their donations to identifiable victims *without* increasing their donations to statistical victims (Small, Loewenstein, and Slovic 2007). Moreover, people are more inclined to use cost-effectiveness information to choose between donation recipients when the causes that these potential recipients advocate are *less* diverse (Berman et al. 2018). Unfortunately, providing donors with a less diverse range of options presents a similar drawback: reducing the likelihood of a donor finding a cause sufficiently compelling to donate to at all. In contrast, we find here that the inefficient donation pattern in the "cost per unit" frame can be remedied by using the "units per dollar amount" frame, with no apparent cost in terms of overall donations.

While society as a whole would be better off if cost-effectiveness information were *always* framed in terms of "units per dollar amount" rather than *always* framed in terms of "cost per unit," certain charities might still raise more revenue from the latter frame. For example, if the cost of a unit of impact was towards the higher range of what the majority of the donor base was willing to provide, then framing information as "cost per unit" might be the best way to elicit the highest

donations. The implications of such a strategy for society as a whole are unclear. On the one hand, donations to this charity may cannibalize donations to other charities with lower costs (Filiz-Ozbay and Uler 2018; MacAskill 2014; Reinstein 2011), particularly if people who make large donations to this charity feel morally licensed to pass up future donation opportunities to more efficient charities (Khan and Dhar 2006). In this case, the use of "cost per unit" information could be detrimental to society as a whole, even if it increases revenue for the charity that uses it. On the other hand, if people do *not* view donations to different charities as substitutes, then there may be no negative consequences to other charities or to society as a whole (Lange and Stocking 2012; Scharf, Smith, and Wilhelm 2017). More research is needed to determine in what circumstances each of these possibilities is most likely.

In sum, while a more efficient use of existing charitable donations could yield large societal benefits, marketing science has largely overlooked this opportunity and has instead focused on helping individual charities increase their revenue. Correcting this imbalance would not only benefit society, but is also important from the perspective of the donor. If donors care about the impact of their donations, then research that prioritizes maximizing charity revenues over helping donors allocate their donations efficiently is analogous to financial decision-making research that prioritizes investment funds' profits over improving consumers' portfolio allocation decisions: it prioritizes the objectives of marketers while neglecting those of consumers. In filling this gap, we show that the "cost per unit" information provided by advocates of efficient donating has an unintended consequence of facilitating inefficient targeting behavior. Yet, this inefficient behavior can be alleviated. We demonstrate a simple and useful remedy: framing cost-effectiveness in terms of "units per dollar amount." This alternative framing mitigates the perverse effects of impact targeting and can ultimately allow donations to do more good.

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APPENDIX

Links to pre-registration forms

Study 1A: http://aspredicted.org/blind.php?x=4ck2jq

Study 1B: http://aspredicted.org/blind.php?x=9wp86t

Study 2: http://aspredicted.org/blind.php?x=ui5v2r

Study 3: http://aspredicted.org/blind.php?x=ra5758

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Table A1. Table of Contents of the Web Appendix.

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WEB APPENDIX FOR

"INEFFECTIVE ALTRUISM: GIVING LESS WHEN DONATIONS DO MORE GOOD"

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Web Appendix A: Study 1B – Additional Details

Comprehension checks. On the page on which participants read the scenario about the anti-malaria charity, we asked them two comprehension questions. Firstly, in the $3 per net condition [$8 per net condition], we asked, *"How much do you have to donate in order to cover 67% [25%] of the cost of a bed net?"* Participants entered their answer into a text box, and the correct answer in both conditions was $2 (importantly, we ensured that the answer did not differ across conditions). Secondly, to ensure that participants understood that any donation amount was useful, we then asked, *"Would donating this amount mean that a family actually receives 67% [25%] of a bed net, or would it just contribute to the overall cost of providing many bed nets?"* From two options, participants had to select that *"It would contribute to the overall cost of providing many bed nets*." Only participants who answered both questions correctly in one attempt were able to continue with the survey. Out of a total of 899 participants who attempted these comprehension checks, 33 and 85 participants failed the first and second comprehension check respectively, with 106 failing at least one of them. We collected no further data from these participants.

On the page after we collected the dependent variable, participants answered a third comprehension question, *"In the scenario, if a person only donated the amount required for half a net, would a family actually receive half of a net?"* Participants could respond "Yes" or "No," and the correct answer was "No." 12 out of 792 participants answered "Yes" and 1 additional participant who indicated a donation amount did not attempt this final comprehension check. As pre-registered, we manually excluded these 13 participants from the main analysis.

Web Appendix B: Study 2 – Additional Details

Comprehension checks. Before participants made their donation decisions, we asked them two questions to ensure that they had understood the instructions. For the first question, we told participants, *"You will make two decisions, and we will give you 30 cents for each decision."* They then had to complete the sentence beginning *"In each decision:"* with one of four options. The correct answer was, *"you will decide how much to donate to Facing Hunger Foodbank. You will keep however much you choose NOT to donate."*

For the second question, participants had to complete the sentence beginning *"The information on what Facing Hunger Foodbank can do with your donations will change for each decision because:"* with one of four options. The correct option was *"the University of Pennsylvania will subsidize your donations by a different percentage in each decision."*

For each of these questions, if participants answered correctly, they were reminded of the instructions and could then move on with the survey. If they answered incorrectly on their first attempt, we also reminded them of the instructions, and then gave them another opportunity to answer correctly. If participants answered either question incorrectly a second time, they were prevented from continuing with the survey. 18 out of 638 and 25 out of 616 participants who attempted the first and second comprehension questions respectively failed to answer correctly after two attempts, and we collected no further data from them. A total of 8 participants dropped out of the study during the comprehension checks.

Pre-registered exclusions. In the event of multiple responses from a single participant, we pre-registered to include the original response only. However, we did not think to specify in the pre-registration whether we would define a duplicate response as one either with the same IP address as a previous response, or instead with the same MTurk ID as a previous response. So, to be consistent with Studies 1A, 1B, and 3, we report analyses excluding all responses with *either* the same IP address *or* MTurk ID as a previous response, resulting in the exclusion of 22 responses. The significance of our results does not change when we instead exclude duplicate responses on the basis of IP address or MTurk ID alone.

Web Appendix C: Study 3 – Additional Details

Comprehension checks. Before participants made their donation decisions, we asked them a question to ensure that they understood that their decisions had some chance of being enacted. Specifically, they had to complete the sentence beginning *"In this study, you will:"* with one of four options. The correct answer was, *"Make 4 decisions about how to split potential bonus payments between yourself and a different charity in each decision."* Participants had one opportunity to answer this question. If they answered correctly, they could move on with the survey. However, 168 out of 1,145 participants who attempted the comprehension check answered incorrectly. These participants were prevented from continuing with the survey, and we collected no further data from them.

Determining which donation decisions were enacted. To ensure that participants took their decisions seriously, we informed them that there would be some chance that each decision would be enacted. Moreover, we transparently randomized which decisions would be chosen so that participants could verify that for each decision they made, there really was a chance that they would receive a bonus equal to the portion of the endowment that they chose not to donate and that the remainder would go to the charity. To implement this transparent randomization, we randomly assigned each participant a lottery number between 1 and 69, and used this lottery number to determine which of participants' four donation decisions would be enacted, if any. Specifically, we informed participants that we would enact their first donation decision if their lottery number was drawn as the first white ball in the upcoming Powerball draw later that week. Similarly, we would enact their second donation decision if their lottery number was drawn as the second white ball in the upcoming Powerball draw, their third decision if their number was drawn as the third white ball in the upcoming Powerball draw, and their fourth decision if their number was drawn as the fourth white ball in the upcoming Powerball draw. This way, if participants' lottery numbers came up in the Powerball, they could verify that they received the bonus money that they allocated to themselves for the relevant donation decision.

Web Appendix D: Table S1 – Summary Statistics for Studies 2 and 3

Table S1 below displays details summary statistics by study and type of aid. Results for each type of aid in Study 3 should be interpreted with caution due to the greater statistical noise inherent in between-subjects data with fewer observations.

Table S1. Study 2 & 3 means, standard deviations, and medians by study and type of aid.

	Cost per unit		Units per dollar	
	Cheap	**Expensive**	**Cheap**	**Expensive**
Study 2 - meals for a foodbank				
Mean donation in cents (SD)	10.53 (10.65)	10.99 (10.96)	11.04 (11.34)	10.60 (11.40)
Median donation in cents	5.5	10	10	5
% of participants donating at least 10 cents	49.3%	58.2%	50.9%	47.4%
Study 3 - meals for a foodbank				
Mean donation as % of endowment (SD)	42.94 (30.42)	45.20 (30.36)	42.01 (32.90)	39.16 (30.56)
Median donation as % of endowment	33.3	50.0	33.3	33.3
Mean donation in cents (SD)	12.88 (9.13)	13.56 (9.11)	12.6 (9.87)	11.75 (9.17)
Median donation in cents	10	15	10	10
% of participants donating at least 50% of endowment	45.2%	62.8%	48.8%	46.5%
Study 3 - rehydration treatment				
Mean donation as % of endowment (SD)	37.80 (32.40)	40.00 (30.77)	39.47 (29.10)	36.84 (31.76)
Median donation as % of endowment	33.3	50.0	39.4	33.3
Mean donation in cents (SD)	34.02 (29.16)	36.00 (27.7)	35.53 (26.19)	33.15 (28.59)
Median donation in cents	30	45	35.5	30
% of participants donating at least 50% of endowment	35.6%	54.3%	41.7%	41.8%
Study 3 - deworming treatment				
Mean donation as % of endowment (SD)	37.64 (29.57)	35.61 (29.74)	36.18 (30.11)	40.01 (31.19)
Median donation as % of endowment	33.3	33.3	33.3	41.7
Mean donation in cents (SD)	45.17 (35.48)	42.74 (35.68)	43.41 (36.13)	48.01 (37.43)
Median donation in cents	40	40	40	50
% of participants donating at least 50% of endowment	40.6%	42.0%	38.5%	44.7%
Study 3 - measles vaccines				
Mean donation as % of endowment (SD)	33.24 (28.51)	35.92 (30.49)	37.27 (30.59)	37.71 (30.01)
Median donation as % of endowment	33.3	43.6	33.3	44.4
Mean donation in cents (SD)	59.84 (51.32)	64.65 (54.88)	67.09 (55.07)	67.88 (54.01)
Median donation in cents	60	78.5	60	80
% of participants donating at least 50% of endowment	33.5%	45.5%	39.7%	43.4%
Study 3 overall				
Mean donation as % of endowment (SD)	37.88 (30.39)	39.23 (30.55)	38.74 (30.76)	38.42 (30.88)
Median donation as % of endowment	33.3	50.0	35.8	37.5
% of participants donating at least 50% of endowment	38.7%	51.2%	42.2%	44.1%

Note: In Study 2, the endowment for each donation opportunity was $0.30. In Study 3, the endowment was $0.30 for meals, $0.90 for rehydration; $1.20 for deworming; $1.80 for measles.

Web Appendix E: Table S2 – Non-parametric Tests for Studies 2 and 3

Table S2. Non-parametric tests for Study 2 and Study 3.

Study 2

	Simple effect in "cost per meal" condition (n = 294)	**Simple effect in "meals per dollar" condition (n = 293)**	**Moderation by information frame (N = 587)**	**Total donations by information frame (N = 587)**
Dependent variable (DV)	Measure of efficient donating[2]	Measure of efficient donating[2]	Measure of efficient donating[2]	Sum of donation amounts across cheap and expensive conditions
Test type	Wilcoxon Signed-Rank	Wilcoxon Signed-Rank	Wilcoxon Rank-Sum	Wilcoxon Rank-Sum
Test-statistic	z = -2.57*	z = 2.30*	z = 3.45***	z = 0.29
Interpretation	When information is framed as "cost per meal", participants give *less* when donations do more good	When information is framed as "meals per dollar", participants give *more* when donations do more good	Donations are more efficient in the "meals per dollar" frame	No evidence that the information frame influences total donation amounts

Study 3

	Simple effect in "cost per unit" condition (N = 971)	**Simple effect in "units per dollar" condition (N = 969)**	**Moderation by information frame (N = 969)**	**Average donations by information frame (N = 969)**
Dependent variable (DV)	Measure of efficient donating in the "cost per unit" condition[3]	Measure of efficient donating in the "units per dollar" condition[4]	Measure of how much more efficiently participants donate in the "units per dollar" condition than in the "cost per unit" condition[5]	Measure of average donations in "cost per unit" condition minus in "units per dollar" condition[6]
Test type	Wilcoxon Signed-Rank	Wilcoxon Signed-Rank	Wilcoxon Signed-Rank	Wilcoxon Signed-Rank
Test-statistic	z = -3.67***	z = .43	z = 3.02**[1]	z = -0.03
Interpretation	When information is framed as "cost per unit", participants give *less* when donations do more good	When information is framed as "units per dollar", participants' donations do not depend on cost-effectiveness	Donations are more efficient in the "units per dollar" frame	No evidence that the information frame influences average donation amounts

*p < .05, **p < .01, *** p < .001

[1] Pre-registered test.

[2] Donation in cheap condition minus donation in expensive condition.

[3] % endowment donated in cheap "cost per unit" condition minus in expensive "cost per unit" condition.

[4] % endowment donated in cheap "units per dollar" condition minus in expensive "units per dollar" condition.

[5] Measure of efficient donating in "units per dollar" condition minus measure of efficient donating in "cost per unit" condition.

[6] Average of % endowment donated in cheap "cost per unit" condition and in expensive "cost per unit" condition, minus average of % endowment donated in cheap "units per dollar" condition and in expensive "units per dollar" condition. We average rather than sum across cost-effectiveness conditions for ease of interpreting the dependent variable as a percentage of participants' endowment for a given donation. The p-value obtained by averaging is identical to that obtained by summing.

Web Appendix F: Table S3 – Exclusions, Attrition, and Reported Sample Sizes

Table S3 provides an overview of the pre-registered exclusion rules, attrition, and reported sample sizes for Studies 1A, 1B, 2, and 3.

Table S3. Total responses, attrition, pre-registered exclusions, and reported sample sizes.

			Attrition						
Study	**Target Sample Size**	**Total responses**	**Dropped out before the first question in the survey[1,2]**	**Shared an MTurk ID, lab ID, or IP address with a previous response**	**Dropped out during comprehension checks**	**Automatically excluded for failing a comprehension check**	**Dropped out after the comprehension check(s) but before providing any DV observations**	**Manually excluded for failing a comprehension check[4]**	**Observations (participants) used in the main analysis**
1A	400	409	2	18	NA	NA	NA	NA	389 (389)
1B	800	938	18	21	0	106	NA	13	780 (780)
2	600	690	30	22	8	43	0	NA	1,174 (587)
3	1,000	1,249	58	46	NA[3]	168	4	NA	3,885 (973)[5]

Note. All manual exclusions (from shared MTurk ID or IP Addresses or other idiosyncratic exclusions) were applied as preregistered. All of the studies were conducted on MTurk, and so deviations of the total number of responses from the target sample size were due to MTurk software and outside of our control.

[1] The first question in the survey was the reported donation in Study 1A and a comprehension check in Studies 1B, 2, and 3.

[2] These figures include participants who were automatically screened out of the surveys due to participation in previous studies.

[3] Participants had just one attempt in which to complete the comprehension check in Study 3, and so they could not drop out after their first attempt but before passing.

[4] This figure includes participants who did not attempt the comprehension check.

[5] The number in parentheses includes all participants who provided at least one observation.

Web Appendix G: Figure S1 – Histogram of Donations in Study 1A

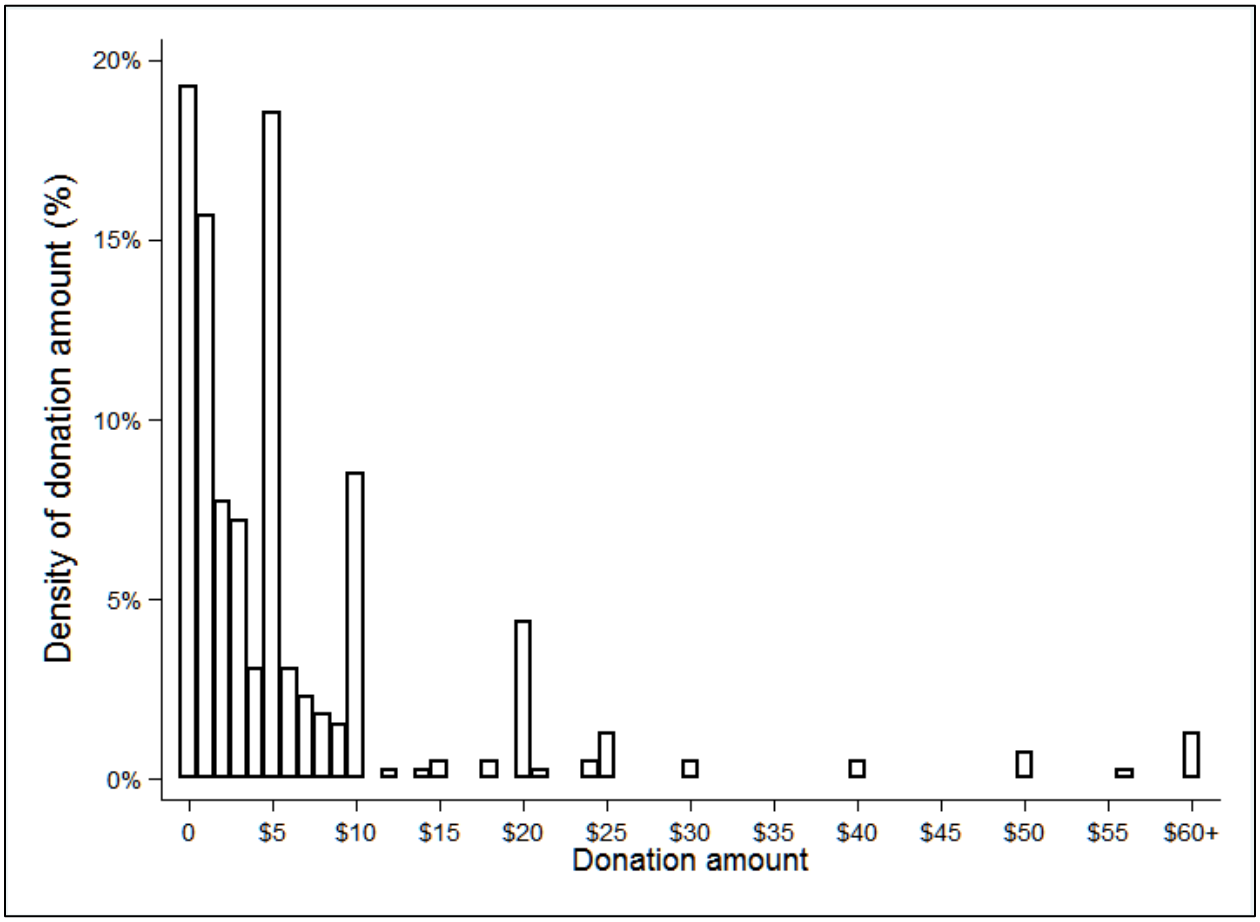

Figure S1: Histogram of hypothetical donations in Study 1A. The bar at "$60+" contains four donations of $100, and one of $500. The modal donation is $0, the modal non-zero donation is $5, the median donation is $4, and the mean donation is $7.85. 89% of donations are of $10 or less.