A Simple, Unified Model of Charitable Fundraising (And Related Activities)

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ABSTRACT

We propose a simple, unified explanation for a number of unique features of charitable fundraising, including campaigns with goals and donation levels. We assume that charities have to spend resources to increase donors' marginal utility of giving and show that an inherent conflict arises – charities want to expend more effort and elicit more donations than donors. We argue that this conflict explains the unique features of fundraising. Campaign goals and donation levels can both be thought of as ways for a charity to commit to eliciting a specific level of donations. Our model also provides a novel explanation for why parents frequently split bequests equally and why people avoid becoming too close to those they are in a position to help, whether the objects of help are subordinates, street beggars, or even students.

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I.   Introduction

Charitable fundraising has a number of unique features. Chief among these unique features are explicit campaigns with stated goals beyond which efforts will be reduced substantially – for-profit firms do not generally state explicit sales goals after which they intend to stop – and donation levels. Any successful theory of charitable fundraising must provide a unified explanation for these features and do so accounting for the substantial resources charities spend on fundraising. Ideally, the model should shed light on phenomena observed in related activities where individuals or organizations are eliciting help, such as bequests and common "pan-handling."

We provide a unified explanation for these phenomena, starting from the assumption that charities, or recipients more generally, must expend resources on donors, or helpers, to elicit their support. We model these activities in a reduced form manner, as increasing the donor's marginal utility of helping the charity.[2] We show that an inherent conflict arises, with charities wanting more help than donors want to provide and argue that this conflict explains the unique features of fundraising.

There is an obvious conflict between helpers and recipients insofar as recipients want helpers to provide all the help they can, while helpers generally do not. More interestingly, when recipients have to exert effort to elicit donations, the recipient wants to exert effort to the point where the net benefit of additional effort – the value of the help obtained from additional effort less the cost of the effort – is zero. A helper who cares about the recipient wants the recipient to exert effort only up to the point where the increase in net help from an increase in effort equals the opportunity cost of the help. Thus, recipients want to spend more resources generating help and obtain more help than helpers want.

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[2] This approach can capture the case where the charity's effort helps it to identify the donor's interests, so that donations can be targeted to the activities that provide the most utility to the donor.

This helper-recipient conflict means that recipients want to commit to exerting more effort eliciting help than helpers want and that helpers want to commit to providing less help than recipients desire. Campaign goals can address this conflict by committing charities to raising a particular amount of money. Donation levels can be thought of in a similar way – amounts that the charity wants to commit to eliciting. In other contexts, parents often split bequests equally among children, which we can explain as an effort to reduce rent-seeking by their children (Light and McGarry [Forthcoming] and Bernheim and Severinov [2003] discuss the equal division of estates). Similarly, people avoid becoming too close to those they are in a position to help, whether the objects of help are subordinates, street beggars, or even students.

A wide-range of unconnected explanations have been proposed for some of the phenomena analyzed here, although no unified explanations exist. Andreoni [1998]; Marx and Matthews [2000]; Duffy, Ochs, and Vesterlund [2004] study the role of indivisibilities, which can help explain the existence of campaigns. In principle, indivisibilities could explain campaign goals, although that is not the intention of these papers.[3] Moreover, while such indivisibilities are surely important sometimes, analysts indicate that fundraising goals are determined by charities' ability to raise money as much as or more than by their needs, and that this is becoming increasingly true over time.[4] Moreover, large capital campaigns typically combine a large number of projects that are only loosely connected. While indivisibilities operate at the level of the

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[3] Andreoni [1998] focuses on campaigns and understanding why they contain silent phases. A silent phase could emerge in the present model, as the charity works with donors to determine the amount that might be raised.
[4] Suggesting a shift in educational fundraising away from projects with non-convexities, Smith [1993] explains that capital campaigns, which originated to fund campus construction during the 1950s and 1960s, are now more focused on increasing endowments. In discussing how to set a fundraising goal, McGoldrick [1993] points to, "the priority needs of the university, the identified potential of prospective donors, the institution's past experience in development, and the effectiveness of your campaign plan (p. 156)." Thus, while the needs of the organization are important, the goal is substantially determined by the organization's ability to raise funds.

individual component projects they are frequently small relative to the total fundraising goals. Harbaugh [1997] studies how charities can increase donations by using giving categories.

The idea that conflicts can emerge between donors and recipients dates back at least to Buchanan's [1975] Samaritan's dilemma (see related work by Lindbeck and Weibull [1988]; Bruce and Waldman [1990]; and Coate [1995]). The present approach differs from this one in at least two ways. The Samaritan's dilemma emphasizes conflicts between the donor and recipient over some other behavior, such as work effort or saving. Our approach is novel in that we identify a conflict that arises in the fundraising process itself, in the amount that the charity manipulates the donor's preferences, not because of another decision made by the recipient. Also, in the Samaritan's problem, helpers have an incentive to commit to a certain level of giving, but recipients do not – they want to take actions that generate sunk costs for themselves. Most, but not all, of the commitment mechanisms we observe in fundraising, including fundraising goals and specified donation levels, are taken by recipients.

The next section develops a simple model to illustrate helper-recipient conflict. Section III discusses applications to charitable fundraising. Section IV discusses three extensions and other applications. Section V concludes.

II.   Model

A helper, who we will refer to as female, obtains utility from her own consumption, from the net benefit received by the recipient of her help, and from a costly effort taken by the recipient. Formally, the helper's utility is,

$$U = \ln(c) + v(h - e, e),$$

where c denotes consumption of a composite commodity; h denotes the amount of help provided; and e denotes the effort of the recipient. The term $h - e$ gives the net help received by the recipient. The helper is assumed to care about the recipient, $v_1 \geq 0$. We

assume that the recipient's effort raises the helper's marginal utility of helping the recipient, so $v_{12} \geq 0$. The helper's budget constraint is $I \geq c + h$, where I denotes income.

The model's properties are particularly easily seen in the special case where

$$U = \ln(c) + \alpha \ln(\min\{h - e, e\}).$$

In this case, the helper feels altruism of $\alpha > 0$ to help the recipient. Net help and the recipient's effort are perfect complements. The solution is particularly easy because at an optimum, $h = 2e$. While we focus on this model, similar results can be obtained in more general models.

II. A. Recipient's Optimum

We begin by assuming that the recipient moves first choosing e and then the helper chooses h and c. To solve this model, we first characterize the helper's choice of h taking e as constant, and then use this solution to obtain the recipient's optimal choice of e. The Lagrangian for the helper's maximization problem is

$$L = \ln(c) + \alpha \ln(\min\{h - e, e\}) + \lambda[I - c - h],$$

where the helper takes e as given. The first order conditions for the helper's maximization problem are:

$$\frac{\partial L}{\partial c} = \frac{1}{c} - \lambda = 0$$

$$\frac{\partial L}{\partial h} = \frac{\alpha}{h - e} - \lambda = 0 \text{ if } e \geq h - e.$$

Two conditions characterize help. First is the condition that $h \leq 2e$. The first order conditions can be rearranged to obtain that $h \leq \tilde{h}$, where $\tilde{h} \equiv \frac{\alpha}{1 + \alpha} I + \frac{1}{1 + \alpha} e$. These conditions imply

$$h = \begin{cases} 2e & \text{if } 2e < \tilde{h} \\ \tilde{h} = \frac{\alpha}{1 + \alpha} I + \frac{1}{1 + \alpha} e & \text{if } 2e \geq \tilde{h} \end{cases} \qquad (*)$$

4

or $h = \min\left\{\dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e, 2e\right\}$.

The recipient chooses e to maximize net help, $h\text{-}e$, taking the helper's optimal h as given. So long as $2e < \dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e$, $\dfrac{dh}{de} = 2$ and $\dfrac{d(h-e)}{de} = 1$, so increases in the recipient's effort increase net help. Once $\dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e \geq 2e$, $\dfrac{dh}{de} = \dfrac{1}{1+\alpha} < 1$ and

$\dfrac{d(h-e)}{de} = \dfrac{-\alpha}{1+\alpha} < 0$, so increases in the recipient's effort reduce net help. The recipient sets e, at the point where $2e = \dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e$, so that further increases in effort do not generate increases in net help. The solution implies $h = \dfrac{2\alpha}{1+2\alpha}I$ and $e = \dfrac{\alpha}{1+2\alpha}I$.

This solution is illustrated in figure 1. The kinked solid line

$h = \min\left\{\dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e, 2e\right\}$ gives the recipient's help as a function of e. The net help received by the recipient is the vertical distance $\min\left\{\dfrac{\alpha}{1+\alpha}I + \dfrac{1}{1+\alpha}e, 2e\right\} - e$, which is

maximized when $e = \dfrac{\alpha}{1+2\alpha}I$, which is shown as the recipient's optimum in figure 1.

II.B. Helper's Optimum

This section considers the values of h and e that are optimal from the helper's perspective. This outcome can be thought of arising from the helper choosing values for h and e and making a binding, take-it-or-leave-it offer to the recipient, in which the recipient takes effort of e in exchange for help of h.[5] Using the condition that $e \geq h - e$, the Lagrangian for the helper's maximization problem is

$$L = \ln(c) + \alpha \ln(h - e) + \lambda[I - c - h] + \mu[2e - h].$$

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[5] This outcome can also be thought of arising from the helper committing not to give more help than some level, h, with the recipient choosing its optial effort taking the helper's maximum help as given.

The first order conditions for the solution to the helper's problem are

$$\frac{\partial L}{\partial c} = \frac{1}{c} - \lambda = 0$$

$$\frac{\partial L}{\partial h} = \frac{\alpha}{h - e} - \lambda - \mu = 0$$

$$\frac{\partial L}{\partial e} = -\frac{1}{h - e} + 2\mu = 0.$$

These can be manipulated to obtain $h = \frac{\alpha}{1 + \alpha} I$ and $e = \frac{1}{2}\frac{\alpha}{1 + \alpha} I$. This point is shown as

the helper's optimum in figure 1.

Intuitively, the helper chooses to help the recipient until her marginal utility of

consumption equals $\frac{v_1}{2} = \frac{\alpha}{2(h - e)}$, her marginal from providing additional help taking as

given that half of any additional help is spent by the recipient taking higher effort. This

solution differs from the one above in that when the recipient moved first, the helper took

the recipient's effort as given.

II.C. Implications

When the helper chooses both h and e, she offers less help and chooses to have

the recipient exert less effort than when the recipient chooses e. Consider a situation in

which the helper and recipient are at the helper's optimum. While the helper prefers not

to have e changed, if the recipient increases e, h-e falls, raising the helper's marginal

utility from helping the recipient, and inducing the helper to increase h. The fact that the

helper will increase help beyond her optimum if the recipient increases effort represents

the helper-recipient conflict.[6]

Given this conflict, the helper has an incentive to preempt the recipient by

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[6] Another way of thinking of helper-recipient conflict would be to view helpers as having an optimal level of help, at which they obtain some surplus. In this case recipients can increase help by refusing to take help beneath some slightly higher amount. We are not aware of such commitments and this mechanism would not explain campaign goals, where only the campaign goal is specified, but not individual contributions.

committing not to give help above her optimum and the recipient has an incentive to commit to exerting effort up to its optimum. Thus, it is not surprising that commitment is common in fundraising.

To the extent that recipients can set these commitment levels freely, one expects them to set them at their own optimal levels. On the other hand, helpers may commit not to exceed a given level of help or may limit the amount of effort to which they expose themselves (for instance by avoiding contact with the recpient). We expect that the equilibrium levels of effort and help reflect a compromise between helpers and recipients.

III. Application to Fundraising

As discussed, charitable fundraising provides an important case in which organizations take costly efforts to elicit donations from those who are in a position to help them. According to Bradley, Jansen, and Silverman's well-publicized [2003] study, charities spent $36 billion in 1999 on fundraising, or 18% of the $195 billion raised. Major gift fundraising involves a time-consuming, long-term process of identifying and cultivating prospective donors.[7] Smaller donations are solicited largely by mail or by telephone and are generally more costly per dollar raised (Dunlop [1993]). In both cases, fundraisers spend considerable resources to raise prospective donors' marginal utility of giving, both by building a sense of awareness and appreciation on the part of the donor and, in the case of major donors, by learning about the donor to tailor the giving opportunity to their interests.

Fundraisers are also aware of some tension in the solicitation process. It is common for fundraisers to ask for larger donations than are expected in order to increase donations. Louden [1993] writes,

> A fundraising maxim – which appears to work in practice – holds that in a
> personal call, the prospect is likely to give at least 50 percent of what was

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[7] This process was pioneered by G. T. "Buck" Smith and David Dunlop, both affiliated with Cornell University (Dunlop [1993] discusses principles; Smith [1993] discusses methods).

asked 75 percent of the time. In the case of a phone request, the prospective donor will give at least 25 percent of the amount solicited 50 percent of the time. Direct mail results are typically far lower; a good response means 2 to 10 percent of those asked make small gifts (p. 77).

Duronio and Loessin [1991] describe "state of the art" fundraising at a private research university. At this institution, donors are systematically asked to make larger gifts than they are expected to make. In order to identify the optimal strategy, "A sample of prospects with the highest ratings will receive letters asking for $2,500 gifts, rather than $1000 gifts. Staff members will analyze results for this sample to see if prospects with similar ratings gave higher gifts when asked for the higher amounts (p. 25)." While these practices are most extreme at lower giving levels (at least in percentage terms), in discussing soliciting major gifts Sturtevant [1997] writes, "When you are seeking leadership or sacrificial gifts [gifts that are large enough to involve a sacrifice on the part of the donor] you can expect some price resistance. You should avoid the temptation to react by trying a lower amount or asking the prospect to define what seems reasonable.... One reason is that I have found things have a way of changing over time (p. 109)." Thus, fundraisers are aware of a conflict between themselves and donors, and tailor their strategies accordingly.

Goals are a common in fundraising. These goals can be thought of as commitments to exert fundraising effort over a defined time period until a pre-specified level of help is received. Fundraisers see campaigns with goals as energizing donors and volunteers. Smith [1993] writes, "Campaigns challenge donors to make larger commitments than would happen in the ordinary course (p. 172)." Donor levels and the associated rewards can also be thought of as preset packages of effort and help, designed to increase help (see Broce [1986] and Greenfield [1999]).

Three other aspects of charitable fundraising are broadly consistent with our analysis. First, although costs are taken as common knowledge in the model, a fundraiser would want to understate fundraising costs. Indeed concerns have been raised with the

accuracy of charities' reports of fundraising costs to the Internal Revenue Service (Brostek [2002]). Bradley, Jansen, and Silverman [2003] find that fundraising costs are four times charities' filings.

It is also interesting that while the Association of Fundraising Professionals [2002] permits members' compensation to depend on performance, members are not allowed to "accept compensation that is based on a percentage of charitable contributions (pp. 22)." An explicit link might make the marginal costs of fundraising more apparent, exacerbating helper-recipient conflict.

As discussed above, helpers have an incentive to commit not to exceed some level of help. If this commitment is available at some fixed cost, the largest helpers would be the ones to do so. Some of the largest donors to charity establish foundations with formal application procedures and giving practices (Broce [1986]). These may be thought of as costly commitment mechanisms.[8]

IV. Extensions and Additional Applications

This section considers three extensions to the model and additional applications. The first extension allows the recipient's effort to directly affect the helper's utility. The second considers the choice between multiple forms of effort. The third explores the importance of altruism on the part of the helper for the recipient.

IV.A. A Direct Effect of the Recipient's Effort on the Helper's Utility

So far the recipient's effort only affects the helper's marginal utility of providing help. In many cases the recipient's effort will be a direct source of utility or disutility for the helper. The contacts and activities a charity arranges for donors may well generate utility for donors. Alternatively, a recipient may use guilt, which generates disutility for the helper, to elicit help.

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[8] To some extent foundations' guidelines may be intended to restrict the discretion of their administrators, but these policies are common even while the founder of the foundation remains active.

In the case of families, elderly parents help their children by providing bequests, and children exert effort to care for their parents in part to affect their parent's desire to leave them a bequest. For instance, the time the child spends caring for the parent may help the parent get to know the child better and care more about him, increasing the bequest. (See Bernheim, Schleifer, and Summers [1985] for an incentive model of this process.) In this case, the effort of the recipient children affects the helper parent's utility directly in addition to their parent's desire to provide help in the form of bequests. Of course, children can also use methods like guilt, which generate disutility for their parents, to increase their parents' desire to leave bequests.

Relationships where one person can help another are common, and potential recipients often take actions to generate help. Thus, superiors are in a position to help their subordinates, and subordinates often take efforts to ingratiate themselves to their superiors. Similarly, street beggars spend time and energy generating sympathy. These activities may generate utility or disutility for the helper.

To capture these cases, we allow the recipient's effort to have a direct effect on the helper's utility. We modify the recipient's utility function to be

$$U = \ln(c) + \alpha \ln(\min\{h - e, e\}) + \gamma \ln(e).$$

If $\gamma > 0$ then the helper receives a direct benefit from the recipient's effort. While if $\gamma < 0$ the helper receives disutility from the recipient's effort.

The Lagrangian for the helper's optimization problem is,

$$L = \ln(c) + \alpha \ln(h - e) + \gamma \ln(e) + \lambda[I - c - h] + \mu[2e - h].$$

The first order conditions for the helper's optimum are

$$\frac{\partial L}{\partial c} = \frac{1}{c} - \lambda = 0$$

$$\frac{\partial L}{\partial h} = \frac{\alpha}{h - e} - \lambda - \mu = 0$$

$$\frac{\partial L}{\partial e} = -\frac{1}{h-e} + \frac{\gamma}{e} + 2\mu = 0.$$

When the helper derives utility directly from e ($\gamma > 0$), the helper may want $e > h/2$. If the

constraint that $e \geq h - e$ does bind, $h = \frac{\alpha+\gamma}{1+\alpha+\gamma}I$ and $e = \frac{(\alpha+\gamma)/2}{(1+\alpha+\gamma)}I$. If the constraint

does not bind, $\mu = 0$, so $h = \frac{\alpha+\gamma}{1+\alpha+\gamma}I$ and $e = \frac{\gamma}{1+\alpha+\gamma}I$. The unconstrained solution

holds when $\gamma \geq \alpha$. The helper's optimum is given by

$$h = \frac{\alpha+\gamma}{1+\alpha+\gamma}I \text{ and } e = \begin{cases} \frac{(\alpha+\gamma)/2}{(1+\alpha+\gamma)}I & \text{if } \gamma < \alpha \\ \frac{\gamma}{(1+\alpha+\gamma)}I & \text{if } \gamma \geq \alpha \end{cases}.$$

The fact that the recipient's effort directly affects the helper's utility does not

affect the recipient's optimum. As γ increases, the helper receives utility directly from the

recipient's effort and therefore wants the recipient to take a higher level of effort. When

$\gamma \in (0, \alpha)$, the conflict between the recipient and helper is attenuated, but remains. Only

when $\gamma = \alpha$ is there no helper-recipient conflict in that the helper's optimum and the

recipient's optimum coincide. When $\gamma > \alpha$, the conflict switches, with the helper

wanting higher values of e than the recipient.

When $\gamma < 0$, the recipient's effort produces disutility for the helper. As γ

decreases, the helper-recipient conflict is exacerbated, with the helper wanting the

recipient to lower e, but the recipient's optimum remaining fixed.

In the context of bequests, to the extent that children rely on guilt to obtain a

larger share of the bequest, parents have a particularly strong incentive to commit to a

division of the estate. Our results indicate that even if the parent values their child's

effort – as when the child's effort is caring for her parent – the parent may still want to

commit to a division of the estate to avoid excessive effort by children.[9]

Similarly, people have an incentive to avoid getting too close to people who they are in a position to help. This is particularly true if contact generates disutility, but holds in a range even if contact generates utility.

In the case of charities, public broadcasters frequently rely on on-air campaigns to elicit help from viewers or listeners, and these campaigns presumably produce disutility (relative to standard programming). Consistent with this fact, our model implies that public broadcasters have a strong incentive to announce campaign goals or the length of the campaign.

IV.B. Multiple forms of Effort by the Recipient

Recipients have many ways of affecting the helper's utility of providing help. For instance, they may rely on guilt or build caring. This section extends the model, allowing the recipient to choose between two types of effort to influence the helper's utility of helping.

With two types of effort, e_1 and e_2, the helper's utility function becomes

$$U = \ln(c) + \alpha \ln\left(\min\{h - e_1 - e_2, \beta_1 e_1 + \beta_2 e_2\}\right) + \gamma_1 e_1 + \gamma_2 e_2.$$

Here β_i gives the effectiveness of each form of effort in influencing the helper's utility of helping, with a high β_i indicating a particularly effective form of effort; γ_i gives the direct utility effect of effort i. Without loss of generality, we normalize the cost of both efforts to the recipient to be the same (β_i and γ_i can be rescaled to adjust for differences in cost). As above, we assume that the cost of effort is linear, which means that the helper will generally use only one type of effort.

The recipient prefers whichever type of effort is more effective in that it produces the most help at the lowest cost. The Lagrangian for the helper's utility maximization

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[9] The model implies that parents should commit to some pre-set division of the estate, with equal division

problem is

$$L = \ln(c) + \alpha \ln(h - e_1 - e_2) + \gamma_1 e_1 + \gamma_2 e_2 + \lambda[I - c - h] + \mu[\beta_1 e_1 + \beta_2 e_2 - h + e_1 + e_2].$$

From the first order conditions, it is possible to show that the helper prefers effort 1 to

effort 2 if $\gamma_1 + \mu\beta_1 > \gamma_2 + \mu\beta_2$. Helpers care about effectiveness and the direct effect of

effort on their utility. Thus, if the two types of effort are equally effective, the recipient

prefers the one that produces more direct utility. Interestingly, the helper may prefer the

effort that produces less utility (or even disutility) provided that it is sufficiently

effective.

As indicated, we expect the equilibrium effort and help to lie between the helper's

optimum and recipient's optimum. If so, recipients have an incentive to rely on the

methods that are best for their helpers. Methods that produce utility for the helper reduce

fundraising conflict in that the helper's optimal effort and help increase as his utility from

the effort increases. To the extent that recipients rely on methods that directly produce

disutility, such as guilt, it must be because these methods are particularly effective. We

speculate that recipients with few competitors, such as children or religions, may be

better able to obtain their own optimum and may be more willing to use guilt.

IV.C. A Model without Altruism

For-profit organizations rely heavily on advertising as a way to induce people to

purchase a product or take other actions they desire. While these forms of preference

manipulation are common, the incentive for commitment arises only when the helper

cares about the recipient's net revenue. To illustrate this point, we modify our utility

function to be

$$U = \ln(c) + \alpha \ln(\min\{h, e\}).$$

One may think of h as representing purchases of the advertised good and e as

representing advertising effort, which complements h. Again c represents consumption of

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being most common probably because it is a bright line.

13

a composite of goods (other than the advertised good). The advertiser chooses e and the consumer sets h and c.

The consumer sets h according to, $h = \min\left(\dfrac{\alpha}{1+\alpha}I, e\right)$. The consumer's utility is maximized when $e = \dfrac{\alpha}{1+\alpha}I$. The advertiser optimally sets e at the consumer's optimal level, so there is no conflict between the helper and recipient. This simple modification illustrates that helper-recipient conflict is special to the case in which the helper (or customer) is altruistic toward the recipient (or firm) in the sense that he cares about the recipient's net revenue.

V. Conclusion

Charitable fundraising has a number of unique features, including explicit campaigns with explicit goals and donation levels. We propose a simple, unified explanation for these and other facts. We assume that charities spend resources to increase donors' marginal utility of helping the charity. We show that charities want to exert more effort to elicit donations than donors want them to.

This helper-recipient conflict means that recipients want to commit to exerting more effort eliciting help than helpers want and that helpers want to commit to providing less help than recipients desire. Campaign goals can address this conflict by committing charities to raising a particular amount of money. Our model also provides an explanation for donation levels, which can be thought of in a similar way – amounts that the charity wants to commit to eliciting – and other features of charitable fundraising. In other contexts, parents often split bequests equally among children, which we can explain as an effort to reduce rent-seeking by their children. Similarly, people avoid becoming too close to those they are in a position to help, whether the objects of help are subordinates, street beggars, or even students.

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Figure 1. Help as a function of the recipient's effort.

$$\tilde{h} = \frac{\alpha I}{1+\alpha} + \frac{e}{1+\alpha}$$

$h = 2e$

$h = e$

$\frac{2\alpha I}{1+2\alpha}$

$\frac{\alpha I}{1+\alpha}$

Recipient's Optimum

Helper's Optimum

h

e

$\frac{\alpha I}{1+\alpha}$ $\frac{\alpha I}{1+2\alpha}$