Charitable Giving When Altruism and Similarity are Linked

Julio J. Rotemberg*

Very Preliminary: October 1, 2011

Abstract

This paper presents a model in which anonymous charitable donations are rationalized by two human tendencies drawn from the psychology literature. The first is people's disproportionate disposition to help those they agree with while the second is the dependence of peoples' self-esteem on the extent to which they perceive that others agree with them. Government spending crowds out the charity that ensues from these forces only modestly. Moreover, people's donations tend to rise when others donate. In some equilibria of the model, poor people give little because they expect donations to come mainly from richer individuals. In others, donations by poor individuals constitute a large fraction of donations and this raises the incentive for poor people to donate. The model also provides a ready interpretation for situations in which the number of charities rises while total donations are stagnant.

*Harvard Business School, Soldiers Field, Boston, MA 02163, jrotemberg@hbs.edu.

As shown by Sugden (1982) and Andreoni (1988), the idea that charitable contributions are caused by altruism towards the recipients of these contributions is inconsistent with a number of observations about actual charities. This includes, in particular, the fact that individuals do not react to a charities receipt of additional funds by curtailing their own donations significantly. In this paper I show that the properties of charitable contributions are easier to rationalize if one considers social preferences with the properties assumed by Rotemberg (2009).

Rotemberg (2009) stresses that the empirical psychology literature has shown that humans tend to have two properties. The first is that they are happier when they learn that there is more agreement with their point of view. The second is that they have warmer feelings towards, and are more willing to help, individuals whom they perceive as sharing their beliefs or, more generally, individuals who are more similar to themselves. Rotemberg (2009) captures these properties in a utility function and shows that, in combination, they can explain why people vote.

Charitable contributions are similar to voting in that they allow people to signal what they like. People who think a particular charitable cause is worthwhile can signal this attitude to others by contributing just like voting for a candidate can signal the belief that a candidate is suitability for office. The parallel is in some ways even closer in the sense that both charitable contributions and voting involve the expression of beliefs about how resources ought to be distributed to others. These beliefs are often held quite passionately and it may be particularly important for people to find ways to make other people who share these beliefs feel good about themselves. In the current context, it should lead people who believe in a charitable cause to gain (vicarious) utility from contributing to this cause because they would expect the happiness of other believers in the cause to rise when they learn that there are more people like them.

Consistent with Andreoni (1990), my result hinges on the supposition that individual utility does not depend only on the public good that is provided by the charity. The extra utility of giving (or “warm glow” to use Andreoni’s (1990) phrase) is modeled explicitly as depending on the utility received by others, however.[1] The size of this particular benefit from contributions depends on an individual's assessment of the number of people who agree with him. If this number is larger, more people gain from learning that an additional person agrees with them, so the vicarious benefits from donating rise. This fits broadly with the empirical evidence suggesting that, all else equal, people are more likely to contribute to a cause if they expect the cause to have many other supporters.

Democratic voting systems tend to gain legitimacy from treating all individuals equally, so that wealthier individuals are rarely given additional votes in an overt manner. In the case of charitable contributions, on the other hand, rich people are generally expected to make larger contributions than poorer ones. The standard public goods model of Bergstrom, Blume and Varian (1986) predicts this if preferences do not vary by income. If both the rich and the poor contribute positively, they must have the same marginal utility for both the private and the public good, so that richer people must give more. If, instead, the marginal utility of private consumption is lower for rich people, which seems like the more plausible case, only rich individuals contribute.

In my alternative model, the rich have a related reason to contribute more, namely that their income makes them willing to pay a higher price to signal that there is an additional altruist around. One novel implication of the model, on the other hand, is that the contributions of poorer individuals tend to be subject to multiple equilibria. Equilibria where poor individuals do not contribute at all tend to coexist with equilibria in which their donations constitute the bulk of total contributions. The intuition for this multiplicity is the following. When only rich people contribute, all individual donations are high so the cost of signaling that there is an additional altruists is high as well. This tends to deter contributions form poorer individuals. By contrast, if the bulk of contributions is made by poor individuals, the typical contribution is small. The cost of signaling that there is an additional altruists can thus be low enough that poor individuals wish to make contributions.

[1] Andreoni (1990) refers to the warm glow as an "egoistic" force, in part to contrast this with the altruism implicit in charitable contributions. Whether the vicarious utility that individuals receive from the payoffs of others, should be called rewards to the ego or nor, is not a question I pursue here.

One attractive aspect of this multiplicity of equilibria is that it may help explain why the fraction of contributors to charity varies greatly across countries. According to a recent Gallup survey, 73% of individuals in the United Kingdom donated money to an organization while only 31% of individuals in France did so.[2] This variability may well be due to sources other than multiple equilibria, though it is worth noting that it is unlikely to be due exclusively to France having a more extensive welfare state. In Denmark, where public welfare provision is also substantial, 67% of individuals contributed to charity according to the same Gallup poll.

This paper is far from the first to suggest that gifts and charitable contributions are related to signaling. However, the important signaling papers of Glazer and Konrad (1996), Bénabou and Tirole (2006) and Ellingsen and Johannessson (2011) suppose that the individual is signaling in a way that makes his own contributions visible. Particularly in the case of large contributions, many contributions are visible to others. My emphasis, by contrast, is on contributions whose total is visible to others but whose constituent individual contributions are not. Perhaps the best example of such anonymous contributions are those made using SMS messages. After the Haiti earthquake of 2010, for example, several organizations set up phone numbers such that dialers to these numbers that texted "HAITI'" would transfer either $5 or more commonly $10 from their account to those of the organization seeking to provide relief. The funds raised in this manner were not insubstantial. The American Red Cross apparently raised $29 million in this way.

Individuals may be able to remember their own contributions, so this still leaves the possibility that they are signaling to their future selves as in Bénabou and Tirole (2006). In their model, this is valuable to individuals because they would like to believe themselves to be generous. This still leaves open the question of what form of "genuine generosity" it is that people would like to believe themselves to be in possession of. The model in this paper is an attempt at answering this question.

The paper proceeds as follows. The next section summarizes the public goods approach

[2]See Charities Aid foundation (2010).

to charity, not only to recapitulate its weaknesses but also to lay the foundations for the behavioral assumptions that I add in Section 2. That section shows that these assumptions ensure that government spending causes a smaller crowding out than in the public goods case and that people respond to news of more contributions by increasing their own donations. Section 3 starts the analysis of the case where people also differ in income and tastes. Section 4 presents equilibria in which the two types I consider contribute to distinct charities. Section 5 looks at equilibria where, instead, only one of these types makes positive contributions. The following section studies the inference problem faced by individuals when individuals of both types contribute to indistinguishable charities while section 7 presents the resulting equilibria. As a way to understand the relationship between increases in the number of charities and changes in total contributions, section 8 compares outcomes with indistinguishable charities to outcomes where these cater to different types of donors. Section 9 concludes.

1 Background: The standard public goods case

There are N individuals and these belong to one of two groups. Those who belong to the subset A sympathize with the recipients of a charity while the rest are selfish. All individuals have pre-tax income I, pay taxes of t and can spend their after-tax income on either privately consumed goods or on charity. The individual expenditures on the former by individual i are denoted by x_i while those on the latter are denoted by g_i. Individual i's budget constraint is thus

$$x_i + g_i = I - t. \tag{1}$$

The taxes t are used to support the charity, so that the total funds received by the charity equal

$$G = tN + \sum_j g_j \equiv G_{-i} + g_i, \tag{2}$$

where the second equality serves to define G_{-i}, the amount received by the charity from all sources other than i's voluntary contributions.

The utility function of selfish individuals just depends on their private consumption so that they set $x_i = I - t$. Altruists, on the other hand, have material payoffs that depend on G, as in the standard public goods analysis of charitable contributions of Bergstrom, Blume and Varian (1986). For simplicity, I consider a particular functional form that relates material payoffs P_i to x_i and G, namely

$$P_i = \log(x_i) + v \log(G). \tag{3}$$

Preferences with this functional form have been used before in the literature, particularly by Andreoni (1990). Using (1) and (2), these payoffs can be written as

$$P_i = \log(I - t - g_i) + v \log(G_{-i} + g_i) \tag{4}$$

If individuals maximized P_i, as in the standard analysis, the first order condition for an optimum with strictly positive g_i are

$$-\frac{1}{I - t - g_i} + \frac{v}{G_{-i} + g_i} = 0, \tag{5}$$

which gives

$$g_i = \frac{v(I - t) - G_{-i}}{1 + v} \tag{6}$$

At a symmetric equilibrium, all altruistic individuals set their g_i equal to the common value g. If there are m members of A, G equals $(gm + tN)$. Using the first order condition (5), this symmetric equilibrium satisfies

$$g = \frac{vI - (v + N)t}{v + m}. \tag{7}$$

Total private giving to charity equals mg so that, using (7), the total received by the charity's recipients equals

$$G = \frac{mvI + (N - m)t}{v + m}. \tag{8}$$

When $m = N$ so that everyone is an altruist, an increase in t has no effect on G. This is Warr's (1982) neutrality result and follows from the ability of altruistic individuals to reestablish the conditions equating the marginal utility of spending on private and public goods by fully offsetting the government's transfers to charity. When $m < N$, the taxation of people who do not contribute voluntarily increases the total funds available to the charity as in Bergstrom, Blume and Varian (1986). The total increase in G is smaller than the increase in nonvoluntary contributions $(N-m)t$, however. The reason is that voluntary contributors respond by curtailing their own contributions by even more than the tax that is levied on them.

As shown in (7), altruists also reduce their own contribution g when the number of altruists m is higher. As far as an altruistic individual i is concerned, the only effect of adding additional altruists is to increase G_{-i}. Equation (6) then implies that g_i falls. As emphasized by Sugden (1982), this effect is likely to be substantial. If one supposes that the slope of individual giving with respect to after tax income is between .02 and .04 percent, which seems realistic, v is also between .02 and .04. A one dollar increase in the charity's resources from other sources should then lead individual i to reduce his own contribution by $1/(1+v)$, that is between 96 and 98 cents. This unappealing result comes about because a one dollar increase in G_{-i} is seen by someone who is altruistic towards the charity's recipients as equivalent to having received a dollar of income and having spent that dollar of income on the charity. The person's reaction, then, is to reduce his gifts to charity so that the total increase in the charity's resources are between .02 and .04.

2 Adding self-esteem and altruism for contributors to the standard model

The first modification introduced in this section is that the utility function of the m altruists now also depends on their expectation of the number of people who share their altruism. For this to affect charitable contributions, it is important that people do not know m in advance, so that they use the observed level of G_{-i} to make inferences about m.

For an individual i belonging to A, let D_i represent his individualistic payoffs, *i.e.*, the payoffs that do not depend on the payoffs of others. Since the number of people who agree with this individual equals $m-1$, we have

$$D_i = P_i + wE_i(m-1), \tag{9}$$

where E_i is the operator that takes expectations based on i's information. The linearity of D_i in $E_i(m-1)$ turns out to be very convenient in the case of multiple types studied below.

In addition, the utility of members of A depends on the payoffs of other members. Letting the parameter a capture the intensity of this altruism for other altruists, we have

$$U_i = D_i + aE_i\left(\sum_{j\neq i, j\in A} D_j\right) \tag{10}$$

Since altruists expect other altruists to be identical, altruist i each expects all others to have the same private consumption x_j and the same expectation regarding $(m-1)$, $E_j(m-1)$. Using (3), (9) in (10), the utility of altruist i is thus

$$U_i = \log(x_i) + E_i(m-1)\log(x_j) + v(1+aE_i(m-1))\log(G) + \tilde{w}E_i(m-1)(1+aE_i(E_j(m-1))) \tag{11}$$

I focus on symmetric Nash equilibria. At such equilibria, individuals know the total resources of the charity G, the tax rate t and the population N. While people do not observe individual contributions directly, they all anticipate that other altruists make contributions equal to a common value g. As a result, any altruist i's belief concerning m satisfies

$$E_i(m-1) = \frac{G_{-i} - tN}{g}. \tag{12}$$

By the same token, i's expectation of $E_j(m-1)$ when j is any altruist different from i is

$$E_i(E_j(m-1)) = \frac{G_{-i} + g_i - g - tN}{g}. \tag{13}$$

This differs from $E_i(m-1)$ because i realizes that he can affect G_{-j} by changing g_i. Using (12) and (13) in (11), the utility of altruist i conditional on G_{-i} is

$$\begin{aligned} U_i &= \log(x_i) + E_i(m-1)\log(I-g) + v\left(1 + a\frac{G_{-i}-tN}{g}\right)\log(G_{-i}+g_i) \\ &\quad + w\left\{\frac{G_{-i}-tN}{g}\left[1 + a\left(1 + \frac{G_{-i}+g_i-g-tN}{g}\right)\right]\right\} \end{aligned} \tag{14}$$

Using (1) to substitute for x_i in this equation, the first order condition for an optimal (interior) level of g_i is

$$-\frac{1}{I-t-g_i}+\frac{v}{G_{-i}+g_i}\left(1+a\frac{G_{-i}-tN}{g}\right)+\frac{wa(G_{-i}-tN)}{g^2}=0. \tag{15}$$

As required by the second order conditions, the derivative of this equation with respect to g_i is negative. Its derivative with respect to G_{-i} is

$$-\frac{v}{(G_{-i}+g_i)^2}\left(1+a\frac{G_{-i}-tN}{g}\right)+\left\{\frac{va}{g(G_{-i}+g_i)}+\frac{wa}{g^2}\right\}. \tag{16}$$

In the standard case considered in the previous section, the parameters a and w are zero, so this expression is negative. As discussed above, it follows that g_i falls when G_{-i} rises. At the opposite extreme, when a and w are positive while v is negligible, so that the predominant source of donations is the desire to raise the self-esteem of people who share one's altruism, (16) is positive so that g_i rises with G_{-i}. The reason is that an increase in G_{-i} signals that there are more members of A so that increases in g_i raise the self-esteem of more people.

To understand in more detail the conditions under which an increase in G_{-i} raises g_i, it is worth computing the symmetric equilibrium. At such an equilibrium, each individual contribution g_i must equal the common belief about the contributions of others g. Therefore, $g_i = g = (G_{-i} - tN)/(m-1)$. Using this in (15), this equilibrium satisfies

$$F \equiv \frac{-1}{I-t-g}+v\frac{1+a(m-1)}{gm+tN}+w\frac{a(m-1)}{g}=0 \tag{17}$$

This equilibrium condition simplifies further when $t=0$. Equation (17) implies that, in this case.

$$g=\frac{\psi}{1+\psi}I \qquad \text{where} \qquad \psi = v\left(a+\frac{1-a}{m}\right)+(m-1)aw \tag{18}$$

As in the standard analysis discussed earlier, increases in m, the number of contributors to public goods, lower individual contributions when $w=0$. This is true even if $a>0$ so that an increase in other's donations signals to all altruists that they should obtain a larger vicarious utility gain from an increase in G. Nonetheless, because even a constant g leads G

to rise when m rises and because (9) assumes a diminishing marginal utility for G, the net effect an increase in m is a decline in g when w is zero. The direct effect of an increase in w on g is positive, since ψ is rising in w while g is rising in ψ.

The more interesting result is that, for sufficiently large w relative to v, g is also rising in m. Since g is strictly increasing in ψ and depends on m only through ψ, g rises in m if and only if $d\psi/dm$ is positive. Therefore, g rises with m if and only if

$$\frac{d\psi}{dm} = -\frac{v(1-a)}{m^2} + wa > 0 \qquad \text{or} \qquad w > \frac{1-a}{a}\frac{v}{m^2} \tag{19}$$

Notice that this condition turns out to be easier to meet as m and a grow. A reduction in a implies that altruists care less about the self-esteem of other altruists, so that it pushes in the same direction as a reduction in w. An increase in m, by contrast, raises the number of people whose self-esteem is affected by increasing g_i and thus acts in a way that is similar to an increase in w. The role of m in this model might be appear problematic because (18) implies that g becomes arbitrarily close to I, so that people give almost all their income to charity, as m rises without bound. It is important to stress, however, that the analysis has been conducted for a fixed population N, and m cannot be larger than this. Moreover, the parameter w may well depend on N itself. If, for example, self-esteem depends on the fraction of individuals that share one's views rather than on their absolute number, w would be inversely proportional to N. In that case, ψ would not rise with the total population N, though it would still be increasing in m for given N if (19) were satisfied.

Interestingly, condition (19) also ensures that g_i is increasing in G_{-i}. To see this, it suffices to notice that, when $t = 0$, the expression in (16) equals $1/g^2$ times the leftmost expression (19). Since a positive value of the expression in (16) leads g_i to be increasing in G_{-i}, the conclusion follows.

Three different field experiments suggest that increases in m and G_{-i} raise g_i. The most directly applicable is Frey and Meier (2004). They experiment with providing information to students in Zurich about past contributions. When they provide data that past participation in contributions was extensive, individual are more likely to contribute than when such information is absent. The contribution rate falls further if they provide information suggesting that past participation was low. Similarly, List and Lucking-Reiley (2002) show that contributions rise when more "seed money" is available for the purchase of a university computer. Finally, Shang and Croson (2009) manipulate how public radio volunteers respond to incoming calls wishing to make a donation. They find that these donors make larger contributions if they are told that someone else has given more.

This observed complementarity between donations and expectations of other's donations contradicts the standard model described earlier (which implies that these variables are substitutes). It also contradicts the version of Andreoni's (1990) "warm glow" model where the benefits of donations are "purely egoistic" in that individuals derive utility only from their own donations and not from G. The reason is that, in this case, G_{-i} should exert no influence on g_i. As demonstrated by Romano and Yildirim (2001), a "mixed" model where i's utility depends on both his own donation g_i and on total donations G need no be inconsistent with a positive response of g_i to G_{-i}. What is necessary for this to be the case, however, is that second partial derivatives satisfy certain properties. In the case where private goods are separable, what is needed is that the derivative of utility with respect to g_i (the "warm glow effect") be larger when total donations are higher. It is not immediately apparent when utility functions should be expected to have this property, however, so that the current paper can be seen as an attempt to providing a psychological foundation for this feature.

I now study the extent to which an increase in taxes t that is matched by increased government expenditures on G leads to declines in individual contributions. Differentiating the equilibrium condition (17), we have

$$\frac{dg}{dt} = -\frac{dF/dt}{dF/dg} \qquad \text{where} \left[\begin{array}{rcl} -\frac{dF}{dt} & = & \frac{1}{(I-t-g)^2} + \frac{v(1+a(m-1))N}{(mG+tN)^2} \\ -\frac{dF}{dg} & = & \frac{1}{(I-t-g)^2} + \frac{v(1+a(m-1))n}{(mG+tN)^2} + \frac{wa(m-1)}{g^2} \end{array} \right. \tag{20}$$

Both $-dF/dt$ and $-dF/dg$ are positive. When $w = 0$ so that self-esteem considerations are absent, the former is strictly larger than the latter because N exceeds m. Thus a one dollar increase in taxes leads contributors to lower their contributions by more than one dollar. This result also obtained when both a and w were zero, so this shows that altruism among members of A is not sufficient to overturn this result. If, however, w and a are both positive, it becomes possible for dF/dg to exceed dF/dt so that dg/dt is smaller than one in absolute value.

For given w, a and n, the absolute value of dg/dt shrinks together with v. For illustrative purposes it is thus useful to study the limit where v is negligible. At that point, (17) simplifies so that the equilibrium value of g is given by

$$g = \frac{wa(m-1)}{1 + wa(m-1)}(I - t). \tag{21}$$

A one dollar increase in t thus has the same effect on the contributions of members of A as a one dollar reduction in I. If contributions rise by 2 to 4 cents with a one dollar increase in their income, this reduction in contributions is negligible. Total crowding out is smaller still since a one dollar increase in taxes raises total revenue by N dollars of which only $m * dg/dI$ are crowded out. If the fraction of contributors m/N is 70 percent, total crowding out is between 1.5 and 3 cents per dollar.

A rich empirical literature has sought to determine the extent to which government transfers to charities crowd out private donations. The estimates range widely, though relatively few studies find the nearly complete crowd out predicted by the model when w is set to zero. What we just established is that much lower levels of crowding out, even the negligible crowd-out found by Ribar and Wilhelm (2002), can be rationalized if one is willing to reduce v and increase w.

3 A model with two types

From now on, I let the population contain two types of individuals H and L, where these types can potentially differ in their income, in the fraction of altruists within each type, and in the tastes of the altruists of each type. As a result, the voluntary contributions of altruists of type H, g^H will generally differ in equilibrium from g^L, the voluntary contributions of altruists of type L.

Let the N_H individuals who belong to the set H have a income I^H while the N^L individuals who belong to set L have income I^L with $I^H \geq I^L$. I allow the tastes of altruists of type H to differ from those of altruists of type L, though I mostly study special cases in which the tastes are the same.

Instead of being given by (3), the material payoffs of an altruist of type τ are now given by

$$P_i^\tau = \log(x_i) + v^\tau \log(G) \qquad\qquad r = H, L. \tag{22}$$

Similarly, equation (9) for total individualistic payoffs is replaced by

$$D_i^\tau = P_i^\tau + w^{\tau\tau} E_i^\tau(m^\tau - 1) + w^{\tau\omega} E^\tau(m^\omega) \qquad \tau, \omega = H, L;\ \omega \neq \tau \tag{23}$$

so that the self-esteem of an altruist of type τ can depend differentially on their expectations of the number of altruists of type H and the number of altruists of type L. Lastly, equation (10) for overall utility is replaced by

$$U_i^\tau = D_i^\tau + a^{\tau\tau} E_i^\tau \left(\sum_{j \neq i, j \in A} D_j^\tau \right) + a^{\tau\omega} E_i^\tau \left(\sum_{j \in A} D_j^\omega \right), \qquad \tau, \omega = H, L; \qquad \tau \neq \omega \tag{24}$$

so that an altruist of type τ can care differentially for altruists of types H and L.

The maximization of U_i^τ can be simplified somewhat by noting that individual i expects all the altruists of the same type to choose the same level of x, x_j^τ. Using (22), and (23) in (24), we obtain

$$\begin{aligned}
U_i^\tau = {} & \log(x_i^\tau) + \Big[v^\tau (1 + a^{\tau\tau} E_i^\tau(m^\tau - 1)) + v^\omega a^{\tau\omega} E_i^\tau(m^\omega) \Big] \log(G) + \\
& \Big\{ (a^{\tau\tau} \log(x_j^\tau) + w^{\tau\tau}) E_i^\tau(m^\tau - 1) + (a^{\tau\omega} \log(x_j^\omega) + w^{\tau\omega}) E_i^\tau(m^\omega) \Big\} + \\
& E_i^\tau \Big((m^\tau - 1) a^{\tau\tau} [w^{\tau\tau} E_j^\tau(m^\tau - 1) + w^{\tau\omega} E_j^\tau(m^\omega)] + m^\omega a^{\tau\omega} [w^{\omega\tau} E_j^\omega(m^\tau) + w^{\omega\omega} E_j^\omega(m^\omega - 1)] \Big), \\
& \tau, \omega = H, L; \tau \neq \omega, j \neq i
\end{aligned} \tag{25}$$

The terms inside curly brackets depend exclusively on factors that are outside i's control. It is thus helpful to define $\tilde{U}_i^\tau$ as being equal to U_i^τ after subtracting the terms in curly brackets.

If H and L have the same tastes, both v^H and v^L should equal a common value v, $a^{\tau\tau}$ and $w^{\tau\tau}$ should be independent of τ and both $a^{\tau\omega}$ and $w^{\tau\omega}$ for $\tau \neq \omega$ should not depend on whether H equals τ or ω. in an even more special case, individuals do not pay attention to the question of whether another person is of type H or L so that $a^{\tau\omega}$ and $w^{\tau\omega}$ equal $a^{\tau\tau}$ and $w^{\tau\tau}$ respectively. Given Byrne's (1961) evidence that a very wide range of attitudes predicts attraction, as well the extensive evidence that people tend to be more attached to people who are similar to themselves in a variety of ways, it seems reasonable to suppose that people of type τ care more about people of type τ than they care about people of the other type.[3] The differential caring for one's own type then implies that $a^{\tau\tau} > a^{\tau\omega}$ and $w^{\tau\tau} > w^{\tau\omega}$ when $\tau \neq \omega$.

I consider Nash equilibria in which individuals pick their own contributions while knowing both the total receipts of the charities that receive donations and the equilibrium contributions of the two altruistic types. Differentiating (25) with respect to g_i^L and g_i^H respectively while taking into account that g_i^τ equals $I^\tau - x_i^\tau$, the benefit of increasing contributions slightly for altruists of the two types are

$$\frac{d\tilde{U}_i^\tau}{dg_i^\tau} = \frac{-1}{I^\tau - g_i^\tau} + \frac{v^\tau}{G} + a^{\tau\tau} E_i^\tau(m^\tau - 1)\left[\frac{v^\tau}{G} + w^{\tau\tau}\frac{dE_j^\tau(m^\tau)}{dg_i^\tau} + w^{\tau\omega}\frac{dE_j^\tau(m^\omega)}{dg_i^\tau}\right],$$
$$+ a^{\tau\omega} E_i^\tau(m^\omega)\left[\frac{v^\omega}{G} + w^{\omega\tau}\frac{dE_j^\omega(m^\tau)}{dg_i^\tau} + w^{\omega\omega}\frac{dE_j^\omega(m^\omega)}{dg_i^\tau}\right] \qquad \tau,\omega = H, L,\ \tau \neq \omega,\ \ j \neq i. \tag{26}$$

It turns out that several different kinds of equilibria are possible. I start with the simplest kind, namely those where altruists of type H make contributions to charities that are observably distinct from those that receive contributions from altruists of type L. After studying the conditions under which such separating equilibria are possible, I turn my attention to two other sorts of equilibria. In the first, altruists of type H make positive contributions while altruists of type L make zero contributions while in the second, both make positive contributions to indistinguishable charities.

[3]See McPherson *et al.* (2001) for a recent survey of papers showing the the correlations between similarity and attachment.

4 Equilibria with contributions to distinct charities

This section studies the conditions under which equilibria exist in which altruists of type H contribute to different charities than altruists of type L. Charities are then distinguished by type, and I let G^τ denote the total contribution to charities that cater to individuals of type τ. At a Nash equilibrium, each agent i knows the total amount contributed to charity τ other than by himself, and I denote this by G^τ_{-i}. At a separating Nash equilibrium, altruists of type τ each contribute g^τ to the charity of type τ, so that the expectations held by altruist i of type τ must satisfy

$$E_i^\tau(m^\tau - 1) = \frac{G^\tau_{-i}}{g^\tau} \qquad E_i^\tau(m^\omega) = \frac{G^\omega}{g^\omega} \qquad \tau, \omega = L, H \qquad \tau \neq \omega \tag{27}$$

Each type of altruist can in principle contribute to either type of charity. At a separating equilibrium, however, he is expected to contribute only to his own so that dg_i^τ in (26) raises only G^τ. Using (27), these equations imply that the benefits of increasing g_i^τ slightly are given by

$$-\frac{1}{I^\tau - g_i^\tau} + \frac{v^\tau}{G} + a^{\tau\tau}\frac{G^\tau_{-i}}{g^\tau}\left(\frac{v^\tau}{G} + \frac{w^{\tau\tau}}{g^\tau}\right) + a^{\tau\omega}\frac{G^\omega}{g^\omega}\left(\frac{v^\omega}{G} + \frac{w^{\omega\tau}}{g^\tau}\right)$$

These expressions are obviously decreasing in g_i^τ so that they must be zero if the individuals are optimizing with respect to their contributions to their own charity under the assumption that every other altruist of type τ contributes g^τ to their charity. At a symmetric separating equilibrium, g_i^τ must equal g^τ so G^τ_{-i}/g^τ must equal $m^\tau - 1$ if i of type τ. Setting the above equations to zero, the following conditions are necessary for a separating equilibrium

$$-\frac{1}{I^\tau - g^\tau} + \left[\frac{v^\tau(1 + a^{\tau\tau}(m^\tau - 1)) + v^\omega a^{\tau\omega} m^\omega}{m^\tau g^\tau + m^\omega g^\omega} + \frac{a^{\tau\tau}(m^\tau - 1)w^{\tau\tau} + a^{\tau\omega} m^\omega w^{\omega\tau}}{g^\tau}\right] = 0. \tag{28}$$
$$\tau, \omega = H, L; \quad \tau \neq \omega$$

We have immediately

Proposition 1. *There exists a pair of values g^L and g^H with $0 < g^\tau < I^\tau$ that solve* (28).

Proof. For fixed $g^\omega > 0$, the limit of the left hand side of (28) when g^τ goes to zero from above is plus infinity while the limit when it goes to I^τ from below is minus infinity. There is thus a zero between 0 and I^τ for every positive g^ω. □

This establishes that one can find a pair of values g^L and g^H that satisfy these necessary conditions for a separating equilibrium. For this pair to be an actual equilibrium, altruists of type τ must not wish to contribute to the charity that receives funds from altruists of type ω where $\omega \neq \tau$. Since these altruists are indifferent to a small change in G^τ that is financed by an offsetting change in x_i^τ, one can be certain that altruists of type τ do not wish to contribute to charity ω if they are unwilling to reduce G^τ by dg_i while raising G^ω by the same amount. According to (27), this deviation would raise all other individual's estimate of m^ω by dg_i/g^ω while lowering their estimate of m^τ by dg_i/g^τ. As a result, (25) implies that these deviations would raise the utility of altruists of type L and H respectively if and only if

$$a^{LL}(m^L - 1)\left(\frac{w^{LH}}{g^H} - \frac{w^{LL}}{g^L}\right) + a^{LH}m^H\left(\frac{w^{HH}}{g^H} - \frac{w^{HL}}{g^L}\right) > 0 \tag{29}$$

$$a^{HH}(m^H - 1)\left(\frac{w^{HL}}{g^L} - \frac{w^{HH}}{g^H}\right) + a^{HL}m^L\left(\frac{w^{LL}}{g^L} - \frac{w^{LH}}{g^H}\right) > 0. \tag{30}$$

This leads to two conclusions.

Proposition 2. *If $v^L = v^H$ $a^{LL} = a^{LH} = a^{HL} = a^{HH}$ and $w^{LL} = w^{LH} = w^{HL} = w^{HH}$ while $I^H > I^L$, no separating equilibrium exists.*

Proof. Setting $a \equiv a^{LL} = a^{LH} = a^{HL} = a^{HH}$ and $w \equiv w^{LL} = w^{LH} = w^{HL} = w^{HH}$, (30) implies that a separating equilibrium exists only if $g^L \geq g^H$. On the other hand, inspection of (28) under the conditions of the proposition implies that the terms in square brackets are independent of the value of τ so that, given that $I^H > I^L$, $g^H > g^L$ □

Proposition 3. *As long as $m^\tau > 1$ while I^τ, a^{HH}, a^{LL}, w^{HH} and w^{LL} are strictly greater than zero, a separating equilibrium exists if a^{LH}, a^{HL}, w^{LH} and w^{HL} are low enough.*

Proof. Even if a^{LH}, a^{HL}, w^{LH} and w^{HL} were all set to zero, the values of g^L and g^H that solve (28) are strictly positive if $m^\tau > 1$ while I^τ, a^{HH}, a^{LL}, w^{HH} and w^{LL} are positive. At the same time, the positive terms of (29) and (30) are arbitrarily small for arbitrarily low values of a^{LH}, a^{HL}, w^{LH} and w^{HL} so that, for these values, both inequalities are violated. □

Together, these propositions establish that situations where all altruists care identically about each other are inconsistent with the existence of separate charities that cater to the two types. If, on the other hand, people of type τ have more altruism for people of their own type, or have self esteem that is more dependent on the attitudes of people of their own type, type-specific charities are more likely to arise.

One special case that is particularly simple and revealing involves the limit when v^L and v^H go to zero while $a^{HL} = a^{LH} = w^{HL} = w^{LH} = 0$. Proposition 3 implies that a separating equilibrium exists while (28) implies that it satisfies

$$g^\tau = \frac{a^{\tau\tau} w^{\tau\tau} (m^\tau - 1) I^\tau}{1 + a^{\tau\tau} w^{\tau\tau} (m^\tau - 1)}.$$

,

This shows that, as one might expect, contributions rise with altruism $a^{\tau\tau}$, the effect of agreement on self-esteem $w^{\tau\tau}$, and the number of altruists of type τ, m^τ. It also shows that, if all types have the same tastes (as defined by $a^{\tau\tau}$ and $w^{\tau\tau}$) and their altruists are equally numerous, the type whose I^τ is higher also has higher private consumption $I^\tau - g^\tau$. The reason for this is that increases in I^τ raise individual contributions g^τ and this raises the "price" of signaling that there is one additional individual of type τ. This prompts a substitution away from contributions towards private consumption.

5 Equilibria where only one type makes charitable contributions

I demonstrate in this section that equilibria of this type exist for a broad range of parameters, including parameters that ensure that (29) and (30) are negative, so that separating equilibria with $g^L > 0$ and $g^H > 0$ exist. If only type τ makes positive contributions and one continues to suppose that both the total level of contributions G and the equilibrium value of g^τ are known, then the number m^τ of altruists of type τ becomes revealed as well. For concreteness, suppose that the the type that makes positive contributions in equilibrium is H. For equilibria of this type to exist, the altruists of type L must not wish to deviate by making positive contributions themselves.

In principle, deviations by altruists of type L can take one of two forms. They can either contribute to a charity that is already used by altruists of type H, and thereby increase G as well as people's expectation of m^H, or they can contribute to a new charity that they label to be specifically for individuals of type L. Assuming the latter is possible, it raises the difficult question of how people's expectations of m^L change in response to such a contribution.

It is possible to imagine plausible conditions under which this expectation does not change. One such case is where people who observe positive contribution to an alternative charity assume that, regardless of their total size, these contributions came form a single individual while, at the same time, their prior distribution of m^L assigned zero weight to the possibility that $m^L = 0$. The posterior distribution of m^L would then be equal to the prior one. What is interesting about this special case is that the individual who is deviating is conveying his type correctly, as in the suggestion by Cho and Kreps (1987), and yet the more relevant equilibrium inference, which concerns the total number of altruists of type L, does not change. [4] In any event, we have the following.

Proposition 4. *Suppose that $a^{HL} = a^{LH} + w^{HL} = w^{LH} = 0$ while $a^{\tau\tau} > 0$ and $w^{\tau\tau} > 0$. Then, an equilibrium with $g^L = 0$ exists as long as v^L is sufficiently small and beliefs about m^L do not change when there is a contribution to an alternative charity.*

Proof. If g^L were equal to zero, the analysis leading to (18) would imply that

$$g^H = \frac{\hat{\psi}_0^H}{1+\hat{\psi}_0^H} I^H \qquad \text{where} \qquad \hat{\psi}_0^H = v^H \left(a^{HH} + \frac{1-a^{HH}}{m^H} \right) + (m^H - 1) a^{HH} w^{HH}$$

This level of contribution is an equilibrium for all altruists of type H as long as no altruist of type L deviates by making a contribution.

If an altruist of type L were to contribute to a charity that was already being used by altruists of type H, the increase in the perceived number of altruist of type H would not

[4] At the same time, this is a special case and it is equally possible to imagine cases where the demonstration by one individual that $m^L \geq 1$ affects the expectation of m^L. Indeed, I consider below the case where the prior distribution of m^τ is uniformly distributed between 0 and N^τ. In this case, evidence that $m^\tau \geq 1$ raises the expected value of m^τ from $N^\tau/2$ to $(N^\tau + 1)/2$.

have either direct or indirect effects on his well-being. Therefore the deviators gain would be

$$\frac{-1}{I^L} + \frac{v^L(1 + a^{LL}(\bar{m}^L - 1))(1 + \hat{\psi}_0^H)}{m^H \hat{\psi}_0^H I^H},$$

where $\bar{m}^L$ is the expectation m^L held by an individual whose only information is that he knows himself to be an altruist of type L. If this altruist contributed to a new charity, and people's expectation regarding the m^L were unaffected, the gain would be exactly the same. Since $\hat{\psi}_0^H$ is strictly larger than zero even in the limit when v^H and v^L go to zero, this expression is negative for small enough v^L. $\square$

The conditions of this proposition ensure that (29) and (30) are negative so that a separating equilibrium does indeed coexist with these equilibria in which only one type contributes. At the same time, the assumption that $a^{HL} = a^{LH} + w^{HL} = w^{LH} = 0$ implies that the gains to people of type L from contributing to a charity of type H are low because people of type L gain do not gain self esteem from knowing more people of type H are altruistic nor to they obtain any vicarious benefits from the increase in the self esteem of altruists of type H. More generally, these benefits are positive. Nonetheless, this incentive is often not sufficient to induce people of type L to contribute to a charity that is only receiving donations from altruists of type H. In particular:

Proposition 5. *If*

$$\frac{I^L}{I^H} < \frac{1}{\tilde{\psi}_0^L} \frac{\tilde{\psi}_0^H}{1 + \tilde{\psi}_0^H} \tag{31}$$

where

$$\tilde{\psi}_0^H = \frac{v^H(1 + (m^H - 1)a^{HH}) + \hat{m}^L a^{LH}}{m^H} + (m^H - 1)a^{HH}w^{HH} + \hat{m}^L a^{LH} w^{LH}$$
$$\tilde{\psi}_0^L = \frac{v^L(1 + (\bar{m}^L - 1)a^{LL}) + m^H v^H a^{LH}}{m^H} + (\bar{m}^L - 1)a^{LL}w^{LH} + m^H a^{LH} w^{HH}$$

and $\hat{m}^L$ represents the ex ante *expectation of m^L, there exists an equilibrium with $g^L = 0$ and $g^H > 0$.*

Proof. If no altruist of type L contributes, total contributions equal $m^H g^H$ and the value of m^H is revealed by the total level of contributions. The result is that the expectation of m^L held by people of type H equals $\hat{m}^L$ while that held by altruists of type L is $\bar{m}^L$. The analysis leading to equation (28) then implies that all altruists of type H set their g_i^H equal to $\tilde{\psi}^H I^H/(1+\tilde{\psi}^H)$.

Now consider the incentives of altruists of type L to make contributions to the H charity. Given that people's estimate that m^H equals G^H/g^H, $dE_j(m_H)/dg_i^L$ equals $1/g^H$. Using this in (26) implies that the altruist of type L loses from increasing $\hat{g}_i^H$ if (31) holds. □

In the standard public goods case the a's or the w's are zero, so that condition (31) implies that I^L must be equal to at least $(v^H/v^L)m^H I^H/(v^H+m^H)$. Since $(I^H - g^H)$ equals $m^H I^H/(v^H+m^H)$, this says that I^L must equal at least the private consumption of altruists of type H if v^H equals v^L. In practice, of course, many individuals with relatively low incomes give to charity even when their income is much smaller than the private consumption of donors whose income is higher. In the standard public goods analysis, this would be possible only if these lower income individuals cared more for G than their richer counterparts, so that $v^L > v^H$. As already discussed above, this condition is not necessary for the more general preferences considered here. Still, there is still a minimum level of I^L such that, for lower levels of income, there exists an equilibrium with $g^L = 0$.

6 Expectations of m^τ when both types contribute to indistinguishable charities

This section computes the expected values of the two m's for individuals of types L and H. This calculation is carried out neglecting integer constraints and under the assumption that every individual's prior distribution for m^τ is uniformly distributed between 0 and N^τ. Conditional on being an altruist of type τ, an individual's prior distribution for m^τ is thus uniform between 1 and N^τ so that it has a mean of $1 + (N^\tau - 1)/2$. As long as the origin of the y-axis is interpreted to start at 1, the top left plot of Figure 1 gives the range of all possible values of m^L and m^H for an individual of type L. All the combinations inside this box satisfy $1 \leq m^L \leq N^L$ and $0 \leq m^H \leq N^H$ and are equally likely *ex ante*.

Total contributions by others, G_i^τ, limit the possible ranges of m^H, m^L, or both. To see this, focus first on an individual i of type L. This individual knows that at a symmetric equilibrium

$$g^H m^H + g^L(m^L - 1) = G_{-i}^L, \tag{32}$$

If $G_{-i}^L < N^H g^H$, this individual perceives that the maximum possible value for m^H is smaller than N^H. If this inequality is reversed, this individual cannot rule out the possibility that m^H is equal to N^H. In this case, his perception regarding the minimum value of m^L is that it is strictly larger than one (because even if $m^H = N^H$ other individuals of type L must be making voluntary contributions). Similarly, if $G_{-i}^L < (N^L - 1)g^L$, i views the maximum possible value of m^L to be lower than N_L. If, instead, this latter inequality is reversed, m^L can equal N^L while the minimum value of m^H is above zero. This gives rise to three qualitative different kinds of outcomes.

First, suppose that G_{-i}^L is smaller than the minimum of $(N^L - 1)g^L$ and $N^H g^H$. Individual i then perceives that m^L can be between 1 and $1 + G_{-i}^L/g^L$, while m^H can be between 0 and G_{-i}^L/g^H. This situation is depicted in the second quadrant of Figure 1. Given that all the values inside the box bordered by $m^H = N^H$ and $m^L = N^L$ were equally likely *ex ante*, and that the individuals knows that (32) must hold, all the outcomes on the line between $\{1, 1 + G_{-i}^L/g^L$ and $\{G_{-i}^L/g^H, 0\}$ are equally likely *ex post*. As a result, the posterior distribution of m^H is uniformly distributed between 0 and G_{-i}^L/g^H while that of m^L is uniformly distributed between 1 and $1 + G_{-i}^L/g^L$.

The second type of outcome arises when $(N^L - 1)g^L$ is smaller than G_{-i}^L, which is in turn smaller than $N^H g^H$. Aside from satisfying (32), the feasible m's must remain inside the box that satisfies $1 \leq m^L \leq N^L$ and $0 \leq m^H \leq N^H$. The result is that, in the third panel of Figure 1, the m combinations that an altruist of type L sees as possible after observing G_{-i}^L lie on the line between the points $\{(G_{-i}^L - (N^L - 1)g^L)/g^H, N_L\}$ and $\{G_{-i}^L/g^H, 0\}$. Since all these combinations are equally likely, the posterior distribution of

m^H is uniformly distributed between $(G^L_{-i} - (N^L - 1)g^L)/g^H$ and G^L_{-i}/g^H while m^L remains uniformly distributed between 1 and N^L. As a result,small changes in G^L_{-i} have no effect on the posterior distribution of m^L. While this result was derived under special assumptions, there is a simple intuition that is associated with it and that should be valid more generally. This is that G^L_{-i} contains very little information about the range of the possible values of m^L if N^L and g^L are small enough that the level of contributions is consistent with both $m^L = 0$ and $m^L = N^L$. One obtains the same qualitative outcome, except with G^L_{-i} having no information about m^H if G^L_{-i} is larger than $N^H g^H$ while being smaller than $(N^L - 1)g^L$.

The leaves the last qualitative outcome, which arises when G^L_{-i} is larger than both $N^H g^H$ and $(N^L - 1)g^L$. The result is depicted in the last panel of Figure 1. The m's that are consistent with i's information lie once again at the intersection of the line between $\{0, 1 + G^L_{-i}/g^L$ and $\{G^L_{-i}/g^H, 0\}$ and the subset of the plane given by $1 \leq m^L \leq N^L$ and $0 \leq m^H \leq N^H$. These combinations of m are all equally likely so that m^H is uniform between $(G^L_{-i} - (N^L - 1)g^L)/g^H$ and N^H while m^L is uniform between $(G^L_{-i} - N^H g^H)/g^L$ and N^L.

Using (32), it is apparent that whether G^L_{-i} is greater than or smaller than $N^H g^H$ hinges on the relationship between g^L/g^H and $(N^H - m^H)/(m^L - 1)$ while the question of whether G^L_{-i} is greater or smaller than $(N^L - 1)g^L$ hinges on the relationship between g^L/g^H and $m^H/(N^L - m^L)$. If, in particular, g^L/g^H is smaller than both these critical values, we are in the third quadrant of Figure 1. If g^L/g^H is smaller than $(N^H - m^H)/(m^L - 1)$ and larger than $m^H/(N^L - m^L)$, we are in the second quadrant while if it is smaller than the latter and larger than the former we are in the fourth. The expectations held by altruist i of type L concerning m^L and m^H thus satisfy:

$$\begin{array}{llll}
\frac{g^L}{g^H} \leq \min\left(\frac{N^H - m^H}{m^L - 1}, \frac{m^H}{N^L - m^L}\right): & E^L_i(m^L - 1) = \frac{N^L - 1}{2}, & & E^L_i(m^H) = \frac{2G^L_{-i} - (N^L - 1)g^L}{2g^H} \\
\frac{m^H}{N^L - m^L} \leq \frac{g^L}{g^H} \leq \frac{N^H - m^H}{m^L - 1}: & E^L_i(m^L - 1) = \frac{G^L_{-i}}{2g^L}, & & E^L_i(m^H) = \frac{G^L_{-i}}{2g^H} \\
\frac{N^H - m^H}{m^L - 1} \leq \frac{g^L}{g^H} \leq \frac{m^H}{N^L - m^L}: & E^L_i(m^L - 1) = \frac{N^L - 1}{2} + \frac{G^L_{-i} - N^H g^H}{2g^L}, & & E^L_i(m^H) = \frac{N^H}{2} + \frac{G^L_{-i} - (N^L - 1)g^L}{2g^H} \\
\frac{g^L}{g^H} \geq \max\left(\frac{N^H - m^H}{m^L - 1}, \frac{m^H}{N^L - m^L}\right): & E^L_i(m^L - 1) = \frac{2G^L_{-i} - N^H g^H}{2g^L}, & & E^L_i(m^H) = \frac{N^H}{2}
\end{array} \tag{33}$$

The analysis for an altruist of type H is quite similar, though not identical. One obvious difference is that, if the equilibrium value of g^H differs from that of g^L, the equilibrium value of G^H_{-i} differs from that G^L_{-i}. A related difference is that al an altruist of type H realizes that m^H equals at least 1, whereas an altruist of type L does not know this. The result is that, for H, the qualitative outcome depends on whether G^H_{-i} is greater or less than $N^L g^L$ and $(N^H - 1)g^H$. Still, an analysis along the lines of the one above establishes that this altruist's expectations of m^L and m^H satisfy

$$\begin{array}{llll}
\frac{g^L}{g^H} \leq \min\left(\frac{N^H-m^H}{m^L}, \frac{m^H-1}{N^L-m^L}\right): & E_i^H(m^L) = \frac{N^L}{2}, & & E_i^H(m^H-1) = \frac{2G^H_{-i}-N^L g^L}{2g^H} \\
\frac{m^H-1}{N^L-m^L} \leq \frac{g^L}{g^H} \leq \frac{N^H-m^H}{m^L}: & E_i^H(m^L) = \frac{G^H_{-i}}{2g^L}, & & E_i^H(m^H-1) = \frac{G^H_{-i}}{2g^H} \\
\frac{N^H-m^H}{m^L} \leq \frac{g^L}{g^H} \leq \frac{m^H-1}{N^L-m^L}: & E_i^H(m^L) = \frac{N^L}{2} + \frac{G^H_{-i}-(N^H-1)g^H}{2g^L}, & & E_i^H(m^H-1) = \frac{N^H-1}{2} + \frac{G^H_{-i}-N^L g^L}{2g^H} \\
\frac{g^L}{g^H} \geq \max\left(\frac{N^H-m^H}{m^L}, \frac{m^H-1}{N^L-m^L}\right): & E_i^H(m^L) = \frac{2G^H_{-i}-N^H g^H}{2g^L}, & & E_i^H(m^H-1) = \frac{N^H-1}{2}
\end{array} \tag{34}$$

As in the earlier one type analysis, the equilibrium depends on the way other people's perceptions of m change when an individual changes his own contribution. Regardless of whether an individual i is of type L or H, an increase in his own contribution g_i by one dollar raises the G_j^τ of all other agents by one dollar. At the boundary values of (33) and (34), the change in the perceived values of m^H and m^L is different for altruists of the two types. However, the effect is the same in the interior of these regions. To see this, differentiate (33) and (34), which yields

$$\begin{array}{lll}
\frac{g^L}{g^H} < \min\left(\frac{N^H-m^H}{m^L}, \frac{m^H-1}{N^L-m^L}\right): & \frac{dE_j^\tau(m^L)}{dg_i^\omega} = 0, & \frac{dE_j^\tau(m^H)}{dg_i^\omega} = \frac{1}{g^H} \\
\frac{m^H}{N^L-m^L} < \frac{g^L}{g^H} < \frac{N^H-m^H}{m^L}: & \frac{dE_j^\tau(m^L)}{dg_i^\omega} = \frac{1}{2g^L}, & \frac{dE_j^\tau(m^H)}{dg_i^\omega} = \frac{1}{2g^H} \\
\frac{N^H-m^H}{m^L-1} < \frac{g^L}{g^H} < \frac{m^H-1}{N^L-m^L}: & \frac{dE_j^\tau(m^L)}{dg_i^\omega} = \frac{1}{2g^L}, & \frac{dE_j^\tau(m^H)}{dg_i^\omega} = \frac{1}{2g^H} \\
\frac{g^L}{g^H} > \max\left(\frac{N^H-m^H}{m^L-1}, \frac{m^H}{N^L-m^L}\right): & \frac{dE_j^\tau(m^L)}{dg_i^\omega} = \frac{1}{g^L}, & \frac{dE_j^\tau(m^H)}{dg_i^\omega} = 0,
\end{array} \tag{35}$$

for τ and ω equal to H or L, where j must differ from i when $\omega = \tau$.

One notable aspect of (35) is that the second and third lines are identical. Thus, the derivatives of beliefs about the m's with respect to total contributions when g^L/g^H takes on "intermediate" values does not depend on whether $m^H/(N^L - m^L)$ is smaller than or greater than $(N^H - m^H)/m^L$. The former is in fact larger than the latter if

$$m^H m^L < (N^H - m^H)(N^L - m^L) \qquad \text{or} \qquad \frac{m^H}{N^H} + \frac{m^L}{N^L} < 1 \tag{36}$$

With m^H/N^H and m^L/N^L having a standard uniform distribution and both N^L and N^H fixed, this inequality is satisfied for one half of all possible realizations of m^H and m^L. Because the case where this inequality holds is so similar to the case where it does not, I carry out the analysis only for one case, namely the case where it holds.

7 Equilibria with heterogeneous gifts to an indistinguishable set of charities

In this section, I demonstrate equilibria in which the two types donate positive amounts to charities that are indistinguishable from one another, so that they can be treated as being the same. it turns out that equilibria with different values of g^L can coexist for certain parameters and income levels. The reason is that, as demonstrated by (35), small changes in the volume of charitable contributions are interpreted differently for different values of g^L.

As the ratio g^L/g^H is raised above zero, it goes from being smaller than both $(N^H - m^H)/m^L$ and $m^H/(N^L - m^L)$ to being greater than these terms. When this ratio is larger than both, we find ourselves in the case described in the last line of (35). As discussed above, whether intermediate values of g^L/g^H lead to the second or third line of (35) depends on whether $(N^H - m^H)/m^L$ is larger than $m^H/(N^L - m^L)$ or not. I focus on the case where it is. It is then possible for g^L/g^H to be strictly between $m^H/(N^L - m^L)$ and $(N^H - m^H)/m^L$ so that G is smaller than both $N^L g^L$ and $N^H g^H$ and it is apparent to everyone that there exist non-contributors of both types.

Agent's expectations then obey the second lines of (33), (34), and (35). Using these expectations in (26) we obtain the private gains from increasing these contributions slightly. These are

$$\frac{d\tilde{U}_i^\tau}{dg_i^\tau} = -\frac{1}{I^\tau - g_i^\tau} + \frac{v^\tau}{G} + a^{\tau\tau}\frac{G_{-i}^\tau}{2g^\tau}\left[\frac{v^\tau}{G} + \frac{w^{\tau\tau}}{2g^\tau} + \frac{w^{\tau\omega}}{2g^\omega}\right] + a^{\tau\omega}\frac{G_{-i}^\tau}{2g^\omega}\left[\frac{v^\omega}{G} + \frac{w^{\omega\tau}}{2g^\tau} + \frac{w^{\omega\omega}}{2g^\omega}\right] \tag{37}$$

We then have:

Proposition 6. *Let* $r_0 = m^H/(N^L - m^L)$, $r_1 = (N^H - m^H)/m^L$ *and suppose that* $r_0 < r_1$ *Let*

$$\psi_M^L(r) = \frac{v^L}{m^H + m^L r} + \frac{m^H + (m^L - 1)r}{2}\left\{\frac{a^{LL}}{r}\left(\frac{v^L}{m^H + m^L r} + \frac{w^{LH}}{2} + \frac{w^{LL}}{2r}\right)\right.$$
$$\left. + a^{LH}\left(\frac{v^H}{m^H + m^L r} + \frac{w^{HH}}{2} + \frac{w^{HL}}{2r}\right)\right\}$$
$$\psi_M^H(r) = \frac{v^H}{m^H + m^L r} + \frac{m^H + m^L r - 1}{2}\left\{\frac{a^{HL}}{r}\left(\frac{v^L}{m^H + m^L r} + \frac{w^{LH}}{2} + \frac{w^{LL}}{2r}\right)\right.$$
$$\left. + a^{HH}\left(\frac{v^H}{m^H + m^L r} + \frac{w^{HH}}{2} + \frac{w^{HL}}{2r}\right)\right\}.$$

An equilibrium with $g^L/g^H = r$ *exists as long as* $r_0 < r < r_1$ *and* I^L/I^H *satisfies*

$$\frac{I^L}{I^H} = \frac{\psi_M^H(r)}{1 + \psi_M^H(r)}\left[r + \frac{1}{\psi_M^L(r)}\right] \tag{38}$$

At this equilibrium,

$$g^H = \frac{\psi_M^H(r)}{1 + \psi_M^H(r)} I^H \tag{39}$$

Proof. If g^L were exogenous, one could obtain the equilibrium level of g^H by taking (37) for $\tau = H$ and equating it to zero after substituting g^H for g_i^H and $g^H(m^H - 1) + g^L m^L$ for G_{-i}^H. The result is that g^H must satisfy (39).

For altruists of type L to find it optimal to set g_i^L equals to r times this value of g^H, it must be the case that the expression in (37) for $\tau = L$ is zero at this point. This requires that

$$-\frac{-1}{I^L - rg^H} + \frac{\psi_M^L(r)}{g^H} = 0,$$

which is satisfied when I^L satisfies (38). □

Proposition 6 gives the value of I^L that ensures an equilibrium ratio of g^L/g^H equal to r. It can equally well be interpreted as saying that an equilibrium with both altruists of type L and of type H contributing to the same charity exists as long as

$$\frac{\psi_M^H(r_0)}{1 + \psi_M^H(r_0)}\left[r_0 + \frac{1}{\psi_M^L(r_0)}\right] < \frac{I^L}{I^H} < \frac{\psi_M^H(r_1)}{1 + \psi_M^H(r_1)}\left[r_1 + \frac{1}{\psi_M^L(r_1)}\right].$$

The method of equilibrium construction in Proposition 6 can also be used for the case where $(N^H - m^H)/(m^H - 1)$ is smaller than $(m^L - 1)/(N^L - m^L)$ and g^L/g^H is between these two values. The method then allows one to determine values of I^L/I^H that yield an equilibrium for values of g^L/g^H between $(N^H - m^H)/(m^L - 1)$ and $(m^H - 1)/(N^L - m^L)$.

I now demonstrate that a pooling equilibrium of the kind described in Proposition 6 can arise even when there also exists an equilibrium in which one of the two types does not contribute to charity. To do this, it is necessary to show that I^L/IH can satisfy (38) for an r between r_0 and r_1 while also satisfying (31). These equations would be incompatible if $\psi^\tau_M(r)$ were equal to $\tilde{\psi}$, both of whom are measures of the marginal benefit of giving an additional g^H dollars to charity. There are reasons, however, for $\psi^L_M(r)$ for $r > r_0$ to exceed $\tilde{\psi}^L_M$. The first of these is that, once r exceeds r_0, additional donations raise people's estimates of m^L, and this is more valuable to altruists of type L if a^{LL} exceeds a^{LH} and w^{LL} exceeds w^{LH}. The second is that, if r is lower than one, the cost of signaling that there is an additional altruist in the population can be lower when r exceeds r_0. This cost equals $(1/2g^H)(1+1/r)$ whereas it equals $1/g^H$ when r is smaller than r_0 (including when $r = 0$).

To illustrate the importance of these forces, I now focus on a special case. Consider first the case where every altruist cares about every other altruist equally. We then have

Proposition 7. *Suppose that* $a = a^{HH} = a^{HL} = a^{LL} = a^{LH}$ *and* $w = w^{HH} = w^{HL} = w^{LL} = w^{LH}$ *and that both* v^L *and* v^H *are negligible. For a fixed realization of* m^H *and* m^L*, and as long as* $awm^H < 2$*, one can find values of* N^L *and* N^H *large enough that* I^L/I^H *satisfies both* (31) *and* (38) *for an* $r > 0$.

Proof. Given the uniform distribution of m^L, $\hat{m}^L$ equals $N^L/2$ while $\bar{m}^L$ equals $(N^L + 1)/2$. Using the assumed properties of the a's, the w's and the v's, condition (31) then becomes

$$\frac{I^L}{I^H} < \frac{m^H + N^L/2 - 1}{m^H + (N^L - 1)/2} \frac{1}{1 + aw(m^H + N^L/2 - 1)} \equiv R(N^L),$$

where note is taken that R depends on N^L. Using the properties of a, w and v in the definitions of ψ^τ_M given in Proposition 6, we obtain

$$\psi^L_M(r) = \frac{aw(m^H + (m^L - 1)r)}{4} \left(1 - \frac{1}{r}\right)^2 \qquad \psi^H_M(r) = \frac{aw(m^H - 1 + m^L r)}{4} \left(1 - \frac{1}{r}\right)^2$$

Now consider the variable $\theta(r)$ given by

$$\theta(r) = \frac{\psi_M^H(r)}{1+\psi_M^H(r)}\left[r + \frac{1}{\psi_M^L(r)}\right]$$

The limit of $\theta(r)$ as r goes to zero is zero while its limit as r becomes unboundedly large is infinite. Thus, r's can be found such that $\theta(r) < R$. For given N^L, the resulting r might be below r_0, however. Raising N^L lowers r_0 but also lowers R, thereby requiring yet another reduction in r. What can be shown, however, is that when N^L is large, the I^L/I^H that is consistent with r_0 is below R. To see this, let $r = r_0$, which yields

$$\psi_M^L(r_0) = \frac{aw}{4}\left(m^H + (m^L - 1)\frac{m^H}{N^L - m^L}\right)\left(1 - \frac{N^L - m^L}{m^H}\right)^2$$
$$\psi_M^H(r_0) = \frac{aw}{4}\left(m^H - 1 + m^L\frac{m^H}{N^L - m^L}\right)\left(1 - \frac{1}{r}\right)^2$$

The limit of

$$\frac{\psi_M^H(r_0)}{1+\psi_M^H(r_0)}\frac{r_0}{R(N^L)}$$

for large N^L is then $awm^H/2$, while the limit of

$$\frac{\psi_M^H(r_0)}{1+\psi_M^H(r_0)}\frac{1}{\psi_M^L(r_0)R(N^L)}$$

is zero. The limit of $\theta(r_0)/R$ is thus smaller than one as long as $awm^H < 2$. For an r near this r_0 to be an equilibrium for an I^L/I^H below R, it must also be the case that this r_0 is below r_1. For any r_0, this can be achieved by raising N^H. □

The reason high values of N^L help bring about these multiple equilibria is that they lead the observed value of G together with low values of g^L to be inconsistent with the possibility that all N^L individuals of type L have made contributions. Such a low g^L implies that the price of signaling that there is an additional altruist is low, and this induces contributions from altruists of type L even if their income I^L is quite low. This low level of income would lead altruists of type L not to contribute if only people of type H were expected to contribute. Altruists of type L would be deterred from contributing because the price of signaling that there is an additional altruist equals g^H in this alternative setting, and this is higher.

I now turn to the case where g^L/g^H is greater than the maximum of $(N^H - m^H)/(m^L - 1)$ and $m^H/(N^L - m^L)$. This maximum can be expected to be small if N^L is large relative to N^H. The reason is that the mean value of the numerator of both these expressions is $N^H/2$ while that of the denominator is near $N^L/2$. It follows that the fourth line of (35) is often relevant even for fairly small values of g^L/g^H when N^L is large relative to N^H.

Using these expectations in (26) the individual gains from increasing g_i^L and g_i^H slightly are

$$\frac{d\tilde{U}_i^L}{dg_i^L} = -\frac{1}{I^L - g_i^L} + \frac{v^L}{G} + a^{LL}\frac{2G_{-i}^L - N^H g^H}{2g^L}\left(\frac{v^L}{G} + \frac{w^{LL}}{g^L}\right) + a^{LH}\frac{N^H}{2}\left(\frac{v^H}{G} + \frac{w^{HL}}{g^L}\right)$$
$$\frac{d\tilde{U}_i^H}{dg_i^H} = -\frac{1}{I^H - g_i^H} + \frac{v^H}{G} + a^{hL}\frac{2G_{-i}^H - N^H g^H}{2g^L}\left(\frac{v^L}{G} + \frac{w^{LL}}{g^L}\right) + a^{HH}\frac{N^H}{2}\left(\frac{v^H}{G} + \frac{w^{HL}}{g^L}\right)$$

The steps used to prove Proposition 6 then imply that

Proposition 8. *An equilibrium with* $g^L/g^H = r > \max((N^H - m^H)/(m^L - 1), m^H/(N^L - m^L))$ *exists if* I^L/I^H *satisfies*

$$\frac{I^L}{I^H} = \frac{\psi_T^H(r)}{1 + \psi_T^H(r)}\left[r + \frac{1}{\psi_T^L(r)}\right] \tag{40}$$

where

$$\begin{aligned}\psi_T^L(r) &= \frac{v^L}{m^H + m^L r} + a^{LL}\frac{2(m^H + (m^L - 1)r) - N^H}{2r}\left(\frac{v^L}{m^H + m^L r} + \frac{w^{LL}}{r}\right)\\ &\quad + a^{LH}\frac{N^H}{2}\left(\frac{v^H}{m^H + m^L r} + \frac{w^{HL}}{r}\right)\\ \psi_T^H(r) &= \frac{v^H}{m^H + m^L r} + a^{HL}\frac{2(m^H + m^L r) - N^H - 1}{2r}\left(\frac{v^L}{m^H + m^L r} + \frac{w^{LL}}{r}\right)\\ &\quad + a^{HH}\frac{N^H - 1}{2}\left(\frac{v^H}{m^H + m^L r} + \frac{w^{HL}}{r}\right).\end{aligned}$$

At this equilibrium,

$$g^H = \frac{\psi_T^H(r)}{1 + \psi_T^H(r)} I^H \tag{41}$$

For completeness, it is worth noting that, for I^L/I^H large enough that (31) is violated, there can also exist equilibria with g^L/g^H smaller than both r_0 and r_1. Using the same approach as before, we have

Proposition 9. *An equilibrium with* $g^L/g^H = r < \min((N^H - m^H)/m^L, (m^H - 1)/(N^L - m^L))$ *exists if* I^L/I^H *satisfies*

$$\frac{I^L}{I^H} = \frac{\psi_B^H(r)}{1+\psi_B^H(r)}\left[r + \frac{1}{\psi_B^L(r)}\right] \tag{42}$$

where

$$\begin{aligned}
\psi_B^L(r) = &\frac{v^L}{m^H + m^L r} + a^{LH}\frac{2(m^H + m^L r) - (N^L+1)r}{2}\left(\frac{v^H}{m^H+m^L r} + w^{HH}\right) + \\
&a^{LL}\frac{N^L - 1}{2}\left(\frac{v^L}{m^H + m^L r} + w^{LH}\right) \\
\psi_B^H(r) = &\frac{v^H}{m^H + m^L r} + a^{HH}\frac{2(m^H + m^L r - 1) - N^L r}{2}\left(\frac{v^H}{m^H+m^L r} + w^{HH}\right) + \\
&a^{HL}\frac{N^L}{2}\left(\frac{v^L}{m^H + m^L r} + w^{LH}\right).
\end{aligned}$$

At this equilibrium,

$$g^H = \frac{\psi_B^H(r)}{1+\psi_B^H(r)}I^H \tag{43}$$

Propositions 6, 8 and 9 allow one to compute the ratios I^L/I^H that lead particular values of g^L/g^H to be equilibria, except for those at the boundaries of the regions in (35). For a particular set of parameters, the results are displayed in Figure 2. This Figure is drawn for N^H, N^L, m^H and m^L equal to 500, 10,000, 100 and 7,000 respectively. In addition, the taste parameters v^τ, $a^{\tau\omega}$ and $w^{\tau\omega}$ for all τ and ω including $\tau = \omega$ equal .05, .0001, and .1 respectively. Altruists thus all have the same tastes and do not care whether another person belongs to H or to L.

Each panel of the figure has three distinct segments, corresponding to the boundaries of the regions in (35). Within each segment, I^L/I^H needs to be higher to rationalize a higher g^L/g^H. As one would expect, relatively higher donations by altruists of type L are possible only if their income is higher as well. As g^L/g^H crosses from being below $m^H/(N^L - m^L)$ to being above, however, the income ratio I^L/I^H that rationalizes this falls. As discussed earlier, increases in G have a larger impact on the perceived number of altruists when g^L/g^H crosses this boundary. This is due to a combination of factors. The first is that type L

altruists now donate enough that it is no longer possible for all of them to be altruists. Therefore, increases in G suggest that there are more of them. At the same time, $g_L/g^H < 1$ so, in effect, the cost of signaling that there is an additional altruist is lower: it falls from g^H to an average of g^H and g^L.

Interestingly, there is a further drop in this cost as g^L/g^H rises from being smaller than $(N^H - m^H)/m^L$ to being above. The reason is that, given that (36) holds, higher values of g^L imply that increases in G no longer affects the posterior probability of m^H. This means that the cost of signaling that there is an additional altruists then falls to g^L from being an average of g^L and g^H. Since g^L is still below g^H, the incentive to donate increases. The result is that there are three equilibria for I^L/I^H between about .58 and .72. The first is the equilibrium with $g^L = 0$ discussed previously. The next has g^L/g^H between the two thresholds in (35), while the last has g^L/g^H above both. Transitions between these equilibria might be interpretable as involving different marketing messages. To leave the equilibrium with $g^L = 0$ and reach the one between thresholds, it may be sufficient to convince altruists of type L that even small donations make a difference. By contrast, to transition to the one with the highest g^L/g^H, it might make sense to limit the minimum donation that the charities accept.

As the second panel of the figure shows, total charity revenue rises as one goes from equilibria with lower values of g^L/g^H to ones with higher ones. This is not only because this increase is associated with an increase in the donations of altruists of type L. Rather, the last panel shows that the donations of altruists of type H rise as well. The reason is that, as already discussed, the equilibria with higher levels of g^L/g^H involve a lower cost of signaling that there is an additional altruist and this affects altruists of type H as well.

One unappealing aspect of the results in Figure 2 is that the equilibrium levels of g^L/g^H in the Figure are much smaller than the corresponding levels of I^L/I^H. Thus, rich people at these equilibria contribute a much larger fraction of their income than poorer people. This follows from the fact that people of the two types see each other as identical, so they must end up with the same level of private consumption. When people of different incomes are considered, this is mostly counterfactual.

In the context of this model, however, it seems more reasonable to suppose that altruists of type H have a particular affinity for altruists of type H, and analogously for altruists of type L. An example of this sort is considered in Figure 3. Most parameters, including $a^{\tau\tau}$ and $w^{\tau\tau}$ for τ equal to L or H are the same as those for Figure 2. The four values that are different are those for $a^{\tau\omega}$ and $w^{\tau\omega}$ in the cases where τ differs from ω. To make tastes identical in a certain sense, I set $a^{HL} = a^{LH}$ while $w^{HL} = w^{LH}$ and, these equal one twentieth of a^{HH} and w^{HH} respectively.

The Figure ignores the positive values of g^L/g^H below $m^H/(N^L - m^L)$ because these cannot be equilibria unless I^L/I^H exceeds .49. On the other hand, it shows that equilibria with higher values of g^L/g^H emerge when I^L/I^H is quite low. Most interestingly, many of the equilibrium values of g^L/g^H are comparable to those of I^L/I^H with there being an equilibrium in which they are identical when I^L/I^H equals about .056. This occurs for two reasons. First, the altruists of type H, who are relatively rich, are no longer so concerned about the welfare of the poorer altruists of type L, and this significantly reduces their contributions relative to those in Figure 2. Second, because the altruists of type L are so much more numerous, the incentive to signal altruism remains quite strong for members of L. The result is that there are equilibria where people with lower income devote a higher percentage of their income to charity. It follows immediately that the private consumption of contributors of type H exceeds that of contributors of type L.

8 Comparing separating and pooling equilibria

The analysis of section 7 shows that equilibria with donations to indistinguishable charities exist as long as income ratios are within certain implicitly defined bounds. On the other hand, Proposition 1 and the rest of the analysis of Section 4 shows that the existence of equilibria with donations to distinct charities does not depend on income levels. Rather, it just requires that the inequalities in (29) and (30) be violated, which requires that people care more about altruists of their own type than about altruists of the other type. Since the conditions for existence are different, one would expect both types of equilibria co-exist for certain parameters, and this section confirms this by showing some examples. Secondly, I consider the question whether equilibria with indistinguishable charities raise more or less total revenue than more equilibria with distinct charities. This represents a step towards studying whether it is desirable to have distinct charities targeted to different donor populations in cases where the beneficiaries are the same.

Consider first an extreme case of the situation studied in Proposition 3, namely the case where both types care only about the altruism of people of their own type. We then have

Proposition 10. *Suppose that $a^{\tau\omega} = w^{\tau\omega} = 0$ when τ differs from ω, that $v^H = v^L = 0$ and that the tastes of the two types are identical so that $a^{\tau\tau} = a$ and $w^{\tau\tau} = w$ for both values of τ. Then, at every equilibrium in which individuals have access only to indistinguishable charities, no type expects that their donation would be smaller if they had access to distinct charities and at least one type expects that they would be larger.*

Proof. Equation (28) implies that contributions at separating equilibria satisfy

$$\frac{g^\tau}{I^\tau - g^\tau} = (m^\tau - 1)aw \qquad\qquad \tau = H, L. \tag{44}$$

When charities are indistinguishable, (26) implies that the conditions for altruists of type τ not to wish to increase their contributions take the form

$$\frac{1}{I^\tau - g^\tau} \geq awE_i^\tau(m^\tau - 1)\frac{dE_j^\tau(m^\tau)}{dg_i^\tau} \tag{45}$$

For interior equilibria, these have to hold as equalities, and otherwise $g^\tau = 0$. If g^L/g^H is either smaller or larger than the two threshold values, $dE_j^\tau(m^\tau)/dg_i^\tau$ equals 0 for one type and $1/g^\tau$ for the other. The type for which it equals zero contributes nothing, and therefore expects that it would contribute more if distinct charities were available. The type for which it equals $1/g^\tau$ satisfies

$$\frac{g^\tau}{I^\tau - g^\tau} = awE_i^\tau(m^\tau - 1),$$

so that it expects its contributions to be the same as in (44).

If g^L/g^H is between the two threshold values, $dE_j^\tau(m^\tau)/dg_i^\tau$ equals $1/2g^\tau$ so that contributions satisfy

$$\frac{g^\tau}{I^\tau - g^\tau} = \frac{aw}{2} E_i^\tau(m^\tau - 1).$$

Since the left hand side is increasing in g^τ, both types expect that their g^τ would be larger is (44) held. $\square$

The intuition behind this proposition is simple: if people gain utility only from signaling to altruists of their own type, contributing to a joint charity is relatively unattractive because some of the signal is "wasted" by giving utility to altruists of the other type. Given the strength of this intuition, it is worth proving that there are examples where contributions are larger when the charities are indistinguishable.

To demonstrate this, I consider an example where both N^H and N^L equal 900, where m^H and m^L equal 500 and 300 respectively. Altruists of type L care only about altruists of type L with a^{LL} and w^{LL} equal to .1 and .08 respectively while a^{LH} and w^{LH} equal zero. Similarly, the self esteem of altruists of type H depends only on the number of other altruists of type H that they perceive so that w^{HH} equals .05 and w^{HL} equals zero. On the other hand, altruists of type H care equally about altruists of type H and L so that both a^{HH} and a^{HL} equal .001.

Equilibria with g^L/g^H above $m^H/(N^L - m^L)$ are displayed in Figure 4.[5] This example differs from those in Figures 2 and 3 in that the highest levels of total contributions relative to I^H occur for income ratios I^L/I^H that lead g^L/g^H to be between the two thresholds. Focusing only on thus middle region, Figure 5 combines the first two panels of Figure 4 to plot total contributions as a function of I^L/I^H. It also plots the levels of total contributions that, for these income ratios, result from the solution to (28). These are equilibria if agents have access to charities that are distinguishable by type because, at these points, the inequalities (29) and (30) are violated.

The Figure shows that, for I^L/I^H between .039 and .0406, the equilibrium with indis-

[5]Those with lower g^L/g^H require substantially larger levels of I^L/I^H.

tinguishable charities collects more donations. Part of what lies behind this example is that people of type H like to make people of type L happy so they tend to contribute more to charities that L also contributes to. That is not all, however, because this force also tends to make equilibria with distinct charities infeasible, and these are viable in this example. One possible contributor to the finding that distinct charities collect less revenue is presented in the second panel in Figure 5. What this Figure shows is that people's expectation of m^L is high relative to the actual level of m^L at the points where the equilibrium with indistinguishable charities raises more donations. This high level of donations might thus be due to a mistake by people of type H, who would donate less if they had the information about m^L that is revealed by equilibria with distinct charities.

The coexistence of an increased number of charities together with a relatively stagnant level of total donations can be rationalized in another way. I now show, in particular, that it follows if people start out by caring for all altruists equally but then become more parochial so they care only about people of their own type.

Let v represent both v^H and v^L while a and w represent the initial values of $a^{\tau\omega}$ and $a^{\tau\omega}$ respectively where τ and ω can be equal to one another. For simplicity, suppose further that $I^L = I^H = I$. Since the two types are initially undistinguishable and identical, they both give g in equilibrium. Total donations G then reveal $m^H + m^L$ accurately. The model of section 2 applies and, with $t = 0$ (17) implies that individual donations are given by

$$\frac{1}{I-g} = \frac{1}{g}\left(\frac{v(1+a(m^H+m^L-1))}{m^H+m^L} + (m^H+m^L-1)aw\right). \tag{46}$$

Now suppose people become parochial so that, while $a^{\tau\omega}$ and $w^{\tau\omega}$ continue to equal a and w respectively when τ is equal to ω, they equal zero when the two indices are different. Since (29) and (30) are now violated, there is an equilibrium with distinct charities. Since m^τ equals G^τ/g^τ at this equilibrium, both m^H and m^L are revealed. Equation (28) thus implies that the two contributions satisfy

$$\frac{1}{I-g^\tau} = \frac{1}{g\tau}\left(\frac{v(1+a(m^\tau-1))}{m^H+m^L} + (m^\tau-1)aw\right). \tag{47}$$

Comparison of (46) and (47) immediately implies that the g that solves the former is larger than the g^{τ}'s that solve the latter. As one would suspect given that each person now cares about fewer people, contributions are smaller as people become more parochial. the number of charities can rise, however, because (29) and (30) stop being satisfied.

9 Conclusions

This paper has shown that two assumptions grounded in evidence from psychology can help explain some aspects of charitable giving. Most particularly, the combination of letting altruism be larger towards like-minded people and having self-esteem depend on the number of people that agree with oneself is consistent with small reductions in one's own giving in response to larger giving by others. Indeed, there are parameters for which the model predicts that an individual will increase his own giving when others give more. The model is also able to explain why certain charities attract contributions from people with different income levels even if one does not assume that the underlying other regarding preferences differ by income class. In particular, the model does not require poor people to be extremely generous relative to rich people (or rich people to be extremely selfish relative to poor ones) in order to have both make contributions at the same time.

Having said this, it is important to stress that the paper has not set out to explain all known puzzles concerning charitable contributions. As it stands, for example, the model seems unlikely to provide a meaningful account of situations in which people split their charitable contributions among a number of different charities. The reason is that, as in models where charitable giving is due exclusively to altruism towards recipients, the model predicts that the marginal utility of giving is independent of the size of the gift. This suggests that people should concentrate their gifts on charities that gives the highest marginal utility of giving. If several charities provide this same maximal level, the allocation among them is a matter of indifference.

To provide a more determinate explanation of people who contribute to multiple charities, the model would have to be modified. One possibility along these lines is to try to model people's desire to "hedge their bets" when making contributions. An extreme case of this is when when corporations make campaign contributions to opposing parties in an election. To capture this phenomenon, one would have to take into account people's uncertainty regarding charities and people's fear of regretting their contribution. This is consistent with one important aspect of charities, namely that measuring their effectiveness is difficult and, partly for this reason, they find themselves frequently embroiled in scandal. When a scandal erupts, contributors can be expected to regret contributions. A contributor that spreads his gifts across charities increases the odds of regretting one of his gifts but reduces the size of each potential regret. Aversion to large regrets would thus incline individuals to spreading out their donations.

10 References

Andreoni, James, "Privately Provided Public Goods in a Large Economy: The Limits of Altruism," *Journal of Public Economics,* 35, February 1988, 57–73.

— "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving," *Economic Journal,* 100, June 1990, 464–77.

Bénabou, Roland and Jean Tirole, "Incentives and prosocial behavior," *American Economic Review,* 96, December 2006, 1652–78.

Bergstrom, Theodore C., Lawrence E. Blume, and Hal R. Varian, "On the Private Provision of Public Goods," *Journal of Public Economics,* 29, February 1986, 25–49.

Byrne, Donn, "Interpersonal attraction and attitude similarity," *The Journal of Abnormal and Social Psychology,* 62, May 1961, 713–715.

Charities Aid Foundation, *The World Giving Index*, 2010.

Cho, In-Koo, and David M.Kreps, "Signaling Games and Stable Equilibria," *Quarterly Journal of Economics,* 102, May 1987, 179–221.

Ellingsen, Tore and Magnus Johannesson, "Conspicuous generosity," *Journal of public Economics,* 95, 2011, 1131–43.

Frey, Bruno S. and Stephan Meier, "Social Comparisons and Pro-social Behavior" Testing 'Conditional Cooperation" in a Field Experiment," *American Economic Review,* 94, December 2004, 1717–22.

Glazer, Amihai and Kai A. Konrad, "A signaling explanation for charity," *American Economic Review,* 86, September 1996, 1019–28.

List, John A. and David Lucking-Reiley, "The Effects of Seed Money and Refunds on Charitable Giving: Experimental Evidence from a University Capital Campaign." *Journal of Political Economy,* 110, 2002, 215–33.

McPherson, Miller, Lynn Smith-Lovin, and James M. Cook, "Birds of a Feather: Homophily in Social Networks," *Annual Review of Sociology,* 27, 2001, 415–44.

Randolph, William C., "Dynamic Income, Progressive Taxes, and the Timing of Charitable Contributions," *Journal of Political Economy,* 103, August 1995, 709-38.

Ribar, David C. and Mark O. Wilhelm, "Altruistic and Joy-of-Giving Motivations in Charitable Behavior," *Journal of Political Economy,* 110, April 2002, 425–57.

Romano, Richard and Huseyin Yildirim, "Why Charities Announce Donations: A positive Perspective," *Journal of public Economics,* 82, 2001, 423–47.

Rotemberg, Julio J., "Attitude-Dependent Altruism, Turnout and Voting," *Public Choice,* 140. July 2009, 223–44.

Saez, Emmanuel, "The optimal treatment of tax expenditures," *Journal of Public Economics,* 88, 2004, 2657-84.

Shang, Jen and Rachel Croson, "Field Experiments in Charitable Contribution: The Impact of Social Influence on the Voluntary Provision of Public Goods," *Economic Journal* 119, October 2009, 1422–39.

Sugden, Robert, "On the economics of philanthropy," *Economic Journal,* 92, June 1982, 341–50.

Warr, Peter G., "Pareto Optimal Redistribution and Private Charity," *Journal of Public Economics,* 19, October 1982, 131–8.

Figure 1: Inferences about m^L and m^H for different parameters

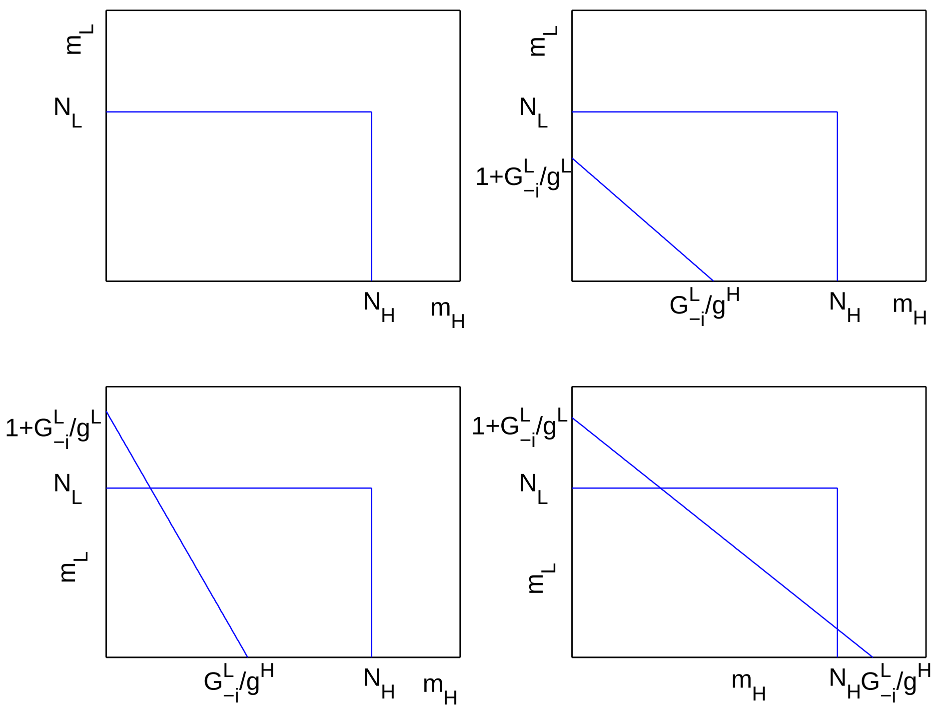

Figure 2: Contributions to indistinguishable charities in an example where altruists do not distinguish between H and L

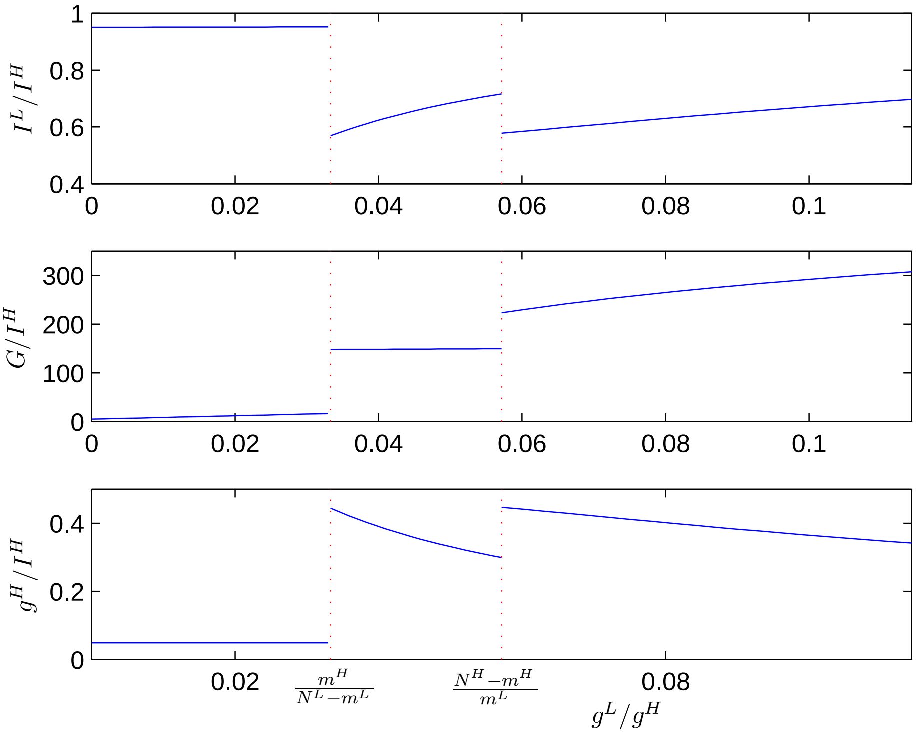

Figure 3: Contributions to indistinguishable charities in an example where altruists distinguish between H and L

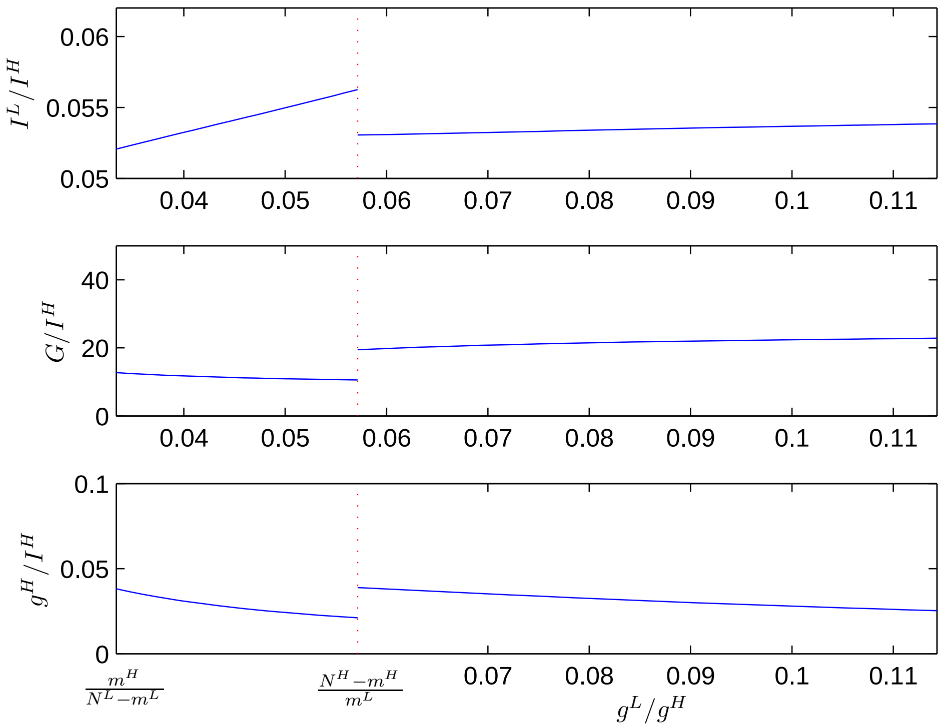

Figure 4: Contributions to indistinguishable charities in an example with asymmetric tastes

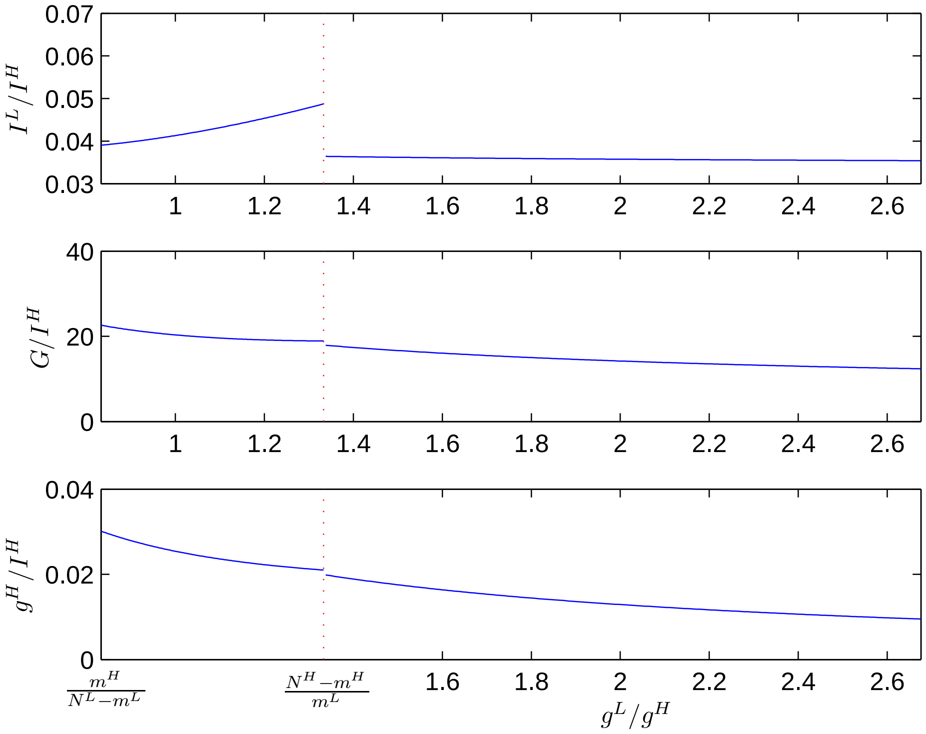

Figure 5: Distinct versus indistinguishable charities in an example with asymmetric tastes