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Masked Heroes: endogenous anonymity in charitable giving

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Keywords: Altruism, Charitable Giving, Signalling, Anonymity
JEL Classification: D64, C72

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Masked Heroes: endogenous anonymity in charitable giving*

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Abstract

Previous work on anonymous donations has looked almost exclusively at exogenous anonymity. This study considers endogenous anonymity, approaching it from two angles. We present stylised facts of anonymous giving, drawn from large dataset of donations on behalf of runners in the London Marathon, finding that not only are anonymous donations quite likely to be larger than public ones, but that those who follow an anonymous donation donate around 4% more than had the same donation been made publicly. Our main contribution is to explain this phenomenon through a signalling model, where foregoing prestige through anonymity signals the charity's quality.

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1 Introduction

Mainonides' eight degrees of charity tells us that *"There are eight degrees of tzedaka (charity), each greater than the next...(the sixth) is one who knows to whom he gives, but the recipient does not know his benefactor. The greatest sages used to walk about in secret and put coins in the doors of the poor"*. This paper is concerned with why people may choose to make large donations anonymously. Although rare, this phenomenon clearly occurs in practice; from the sages described by Maimonides to more recent examples; such as that made to the RAF's campaign to restore a Vulcan Bomber (BBC (2010)), and the anonymous donation of $200million to Baylor University in Texas (the largest donation in the University's history) (Scoggins (2010)).

When and why people choose to give anonymously has not been addressed by existing literature on charitable giving. Those papers which do look at anonymity have looked almost exclusively at the effect of exogenous anonymity on donations. The consensus of this literature is that the less social pressure an individual is under (the more anonymous they are), the less likely they are to donate, and the less they will donate (conditional on donating). Neither does existing theory offer a clear reason why an individual would choose anonymity rather than simply not donating. Large donors, such as George Soros & libertarian billionaires the Koch brothers have made large donations both anonymously and publicly (Mayer (2010)) - this cannot be explained by a preference for anonymity.

In this paper we investigate the circumstances of anonymous donations in a large dataset of over 70,000 donations made through the Virgin Money Giving website to fundraisers running in the 2010 London Marathon. We find that 'extreme' donations (particularly large, or particularly small) are more likely to be made anonymously than moderately sized ones. We find that early donations are more likely to be anonymous than are later ones, particularly for the first donation to a fundraising page. Importantly, we find that donations following a large anonymous donation are larger than those following a large public donation. This finding is the basis of a two-stage signalling model in which agents informed about some measure of charity quality choose to donate anonymously in order to signal to later, uninformed donors, that the charity is of high quality.

When the amount donated is revealed without the identity of the donor, the act of donating anonymously may act as a signal. Taking the case of well-known philanthropist George Soros, we may consider that for some causes, publishing his identity being known informs others that the donation is an informed one, implying information about the charity's quality. However, someone observing the donation is not just gaining information about the charity but also about the donor. If the observer believes that donating to charity is good, their estimation of the donor will increase; if the donor values this estimation they benefice from making such a large donation, independently of the charity's quality. In instances where an individual donor is not known as an authority on charity quality, an anonymous donation may be more informative about quality than if their identity was revealed. Knowing this to be the case, a donor who wishes to see the charity succeed, and the public good provided, may choose to conceal their identity. In this case, choosing to donate anonymously acts as a costly signal of charity quality.

The main contribution of this paper is to present some "stylised facts" of anonymity in charitable giving, and to seek to explain what we observe with a simple signalling model, where motivated agents may wish to conceal their identity in order to inform others of the charity's quality and hence to prompt larger donations.

The next section will review the relevant literature on anonymity and signalling in charitable giving, and will identify the positioning of our work within this. Section 3 presents our "stylised facts" of anonymity in giving, drawn from a large dataset of over 70,000 donations made on behalf of runners in the 2010 London Marathon, identifying that very large donations are more likely to be made anonymously than very small donations, and that large anonymous donations are followed by larger donations than are large public donations. In section 4 we present a simple model of anonymity in charitable giving, in which informed donors motivated by the provision of a public good as well as their own donation, trade off social rewards (from donating publicly) with increased donations by others as a result of anonymity. Finally, we present our conclusions.

2 Previous Work

Much of the previous literature on anonymity and altruism, with the notable exception of Andreoni & Petrie (2004), has been concerned with the effect of *exogenous* anonymity on whether and how much people give. A number of experiments in both the lab (e.g, Andreoni & Petrie (2004)) and the field (see Alpizar et al (2008), List & Lucking Reiley (2002), Soetevent (2005) and Landry et al (2005)) have looked at the effect of anonymity on donation, and generally conclude that anonymity reduces donations to a public good.

Although Hugh-Jones & Reinstein (2012), provide reasons why a group or institution might choose anonymity (in order to elicit more honest signals of participant 'types' by credibly withdrawing the threat of punishment), they do not offer an explanation as to either why fundraisers should allow some donors to opt into anonymity, or why anybody would choose to do so.

In this paper, we are interested in the case where donors endogenously choose to give anonymously. This is investigated by Andreoni & Petrie (2004) who, in addition to their experimental work on exogenously altered levels of scrutiny, allow donors to select into anonymity. Although they observe a rise in contributions to the public good in this treatment, it is not significant (p=0.12) and is driven (almost) entirely by a rise in revealed donations .

[0]Under the information -and- photos treatment the average donation to the revealed public good was 48% of endowment (9.6 tokens) in only 21 of 1600 observations were

There are a number of possible explanations for why anonymity might lead to reduced donations. Harbaugh (1998a,b), proposes and tests a model whereby donors are motivated by the prestige they receive from having their donations announced if they are above a certain level. Glazer & Konrad (1996), and Hawkes & Bird (2002), provide alternative mechanisms for the delivery of prestige through charitable giving (peers or partners, respectively). These models suggest that larger donors should have the most to gain from choosing to donate publicly, and so would be less likely to donate anonymously.

Individuals may choose their donation to conform to a social norm. Bernheim (1994), presents a model of conformity whereby individuals donate similar amounts in order to signal that they are of the same "type" as other donors to the same cause. If all donors wish to conform with the community (the mean), and the utility gained from conformity decreases with deviation from the mean, we might expect conformity-driven anonymity to be decreasing as donation size approaches the mean, and for conformity-motivated donations rarely to be much larger than the mean. Overall, the benefits from donating publicly in terms of signalling generosity appear to be increasing in the amount donated, and so previous work seems to predict that larger donors would be less likely to donate anonymously.

If there is uncertainty about the quality of the charity, and different information is available to different donors, there is an opportunity for signalling.

amounts above this donated anonymously.

Under a binary public good (i.e. one that is either provided or is not), as in List (2002), an agent who knows the charity's quality has an incentive to donate, signalling to others that the charity is worth donating to, only if the expected (social) return to provision is greater than the cost.

Potters et al (2005) present a model of endogenous *sequencing*, in which players in a public good game choose the order in which they make their donation, with one agent being informed about the return to the public good (analogous to the quality of a charity), and the other not. They find that in the 81% of cases, players elect to move sequentially (with the informed agent moving first), and that in 85% of these cases, the uninformed agent follows the signal sent by the informed agent. In Potter et al's game, donations are binary (donate/don't donate), and so there is no consideration of the size of donation. However, to support the argument for sequential donations they give the example of famous philanthropist Brooke Astor, whose large donations were often followed by other major donors following her lead; from this it is implicit that signalling donations will typically be large ones. However, rather than "star" donors, we are interested in the use of anonymity as a signalling device.

This poses a question; how are uninformed donors to identify informed ones if their identities are kept secret. Even if the individual donating is not widely known to be informed, the fact of choosing to donate early may signal that they have information. Vesterlund (2003), presents a model in which early donors will engage in costly information search and subsequently signal the charity's quality to others, with the result that net donations are higher with hidden information than had the quality of the charity been common knowledge.

In both Potters et al (2005) and Vesterlund (2003), sequential ordering takes place with informed agents moving first by design. While this may be realistic, it is not a necessary condition - even with random arrival into the community and exogenous drawing of information, Banerjee's (1992) herding model suggests that uninformed agents, arriving with the possibility to invest (donate), will simply not do so, and hence that being the first donor is a signal of both charity quality and information possession.

What is revealed is of importance to signalling models; if it is common knowledge that the first agent is informed (either because of the Banerjee (1992) result or the rules of the game as in Potters et al (2005)), then their identity is not important; i.e. "donating first" maps perfectly onto "being informed". Hence, an anonymous donor may be treated as an informed signaller. We now proceed to present some stylised facts of anonymous giving.

3 Data

We make use of a large dataset of donations made using the Virgin Money Giving service on behalf of fundraisers running in the 2010 London Marathon. Virgin Money Giving (VMG) was set up in 2009, in conjunction with Virgin Money becoming the official sponsor of the London Marathon. This dataset was generated by Smith et al (2012), to whom we are grateful for allowing its use. Although Virgin Money is a profit-making company, VMG is not-for-profit. It charges charities a one-off, set-up fee of £100 and takes two per cent of nominal donations (i.e. gross of tax relief).

Runners in the marathon are able to set up a "fundraising page" on the website, and can then advertise the site to friends and family by word of mouth, email or social networking websites. As a result of this, the majority of donors to a given page will be known to the fundraiser, and so it is reasonable to expect that there will be characteristics shared by donors within a single page.

Users of the site include individuals giving directly to charity but also, primarily, individual fundraisers who are raising money for charities, either by seeking sponsorship for taking part in events such as the London marathon or setting up pages to collect memorial donations or donations in lieu of a wedding gift or birthday present.

Having been invited, donors arrive at a page assigned to a specific fundraiser, where they are able to see information about the runner, the charity for which they are running, and a history of past donations. They can also see the comments left by previous donors (if any), and their identities if they have chosen to reveal them - if not, the amount is revealed, and the donation is labelled as "anonymous". If the page has a fundraising target, this, as well as the progress made so far towards this target, is displayed.

The dataset contains 73584 donations, made to 3984 fundraisers. Donations of more than £1000 and pages to which more than 50 donations are made are excluded as outliers. Table 1 contains summary statistics of donations.

Table 1: **Summary Statistics**

	Mean	**St. Dev**	**Min.**	**1st pctile**	**Med.**	**99th pctile**	**Max**
Public							
No. Donations	15.95	11.16	1	1	14	45	50
Amount	29.64	46.12	1	5	20	200	1000
Page Total	916	691.4	0	60	776.1	3491	9550
Target	1722	1824	1.5	250	1500	6000	100000
N	64596						
Anonymous							
No. Donations	14.93	11.39	1	1	12	45	50
Amount	39.48	75.78	1	5	20	390.5	1000
Page Total	955	771.7	0	50	795.3	3807	9520
Target	1815	2136	1.5	300	1500	6000	100000
N	8988						
All							
No. Donations	15.83	11.2	1	1	14	45	50
Amount	30.84	50.78	1	5	20	250	1000
Page Total	920.7	701.8	0	60	779.8	3519	9550
Target	1733	1866	1.5	250	1500	6000	100000
N	73584						

As table one shows, there is considerable variation in the amount donated by different groups, with anonymous donors donating more, on average, than those who make their donation publicly. However, the amount donated also varies widely within category, with the median anonymous and public donation each being £20. There is considerably also more variation in anonymous donations, which have a higher standard deviation (£75.78 vs. £46.12).

It is notable that the majority (75%) of donations are of round amounts (£10, £20, £50 or £100). While this may reflect individual donors' preferences, it may in part be a result of menu effects on the VMG donation pages, as described by Smith et al (2012). Due to the nature of anonymous donation, it is not possible to identify characteristics of anonymous donors themselves. 8988 donations were made anonymously, 12% of total donations. 27 fundraising pages had all of their donations made anonymously, while 552 had none.

3.1 Anonymity and amount donated

We look first at the relationship between endogenous anonymity and amount donated. In the context of Virgin Money Giving, individuals choose whether to donate, how much to donate and whether to donate anonymously. The latter two decisions; the amount to donate and whether to donate publicly, are made on the same page of the VMG website, and so are plausibly simultaneous; in this case, existing theory and experimental data do not suggest a particular outcome. Figure 1 shows the relationship between amount donated and anonymity in our data.

As shown in Figure 1 small donations are fairly likely to be made anonymously (around 18% of donations at this level are made anonymously), but grow steadily less likely as they approach the mean donation; donations at the mean are the least likely to be anonymous. Donations larger than the mean show the reverse relationship; they are more likely to have been made

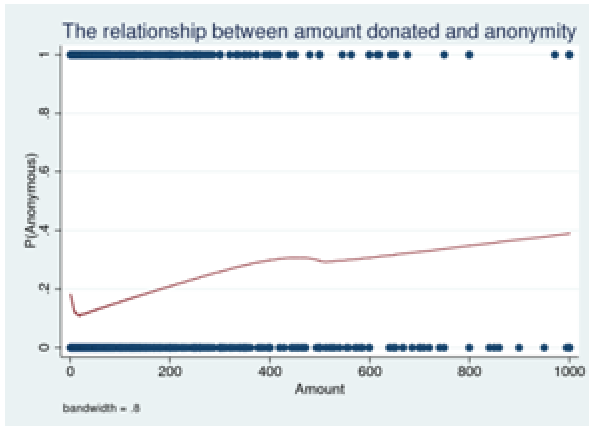


Figure 1: The relationship between amount donated and anonymity

anonymously the larger they become.

Within the existing literature it is difficult to find a model to explain this behaviour. The prestige motive, described by Harbaugh (1998), or the desire to signal one's own affluence (Glazer & Konrad (1996)) suggests that the lower a donation is, the less there is to be gained from making it publicly. If there are levels of donation for which the private reward (in terms of warm glow, for instance), is positive, but the public reward (prestige or similar) is negative, donors may prefer to make the donation anonymously, which is consistent with the negative correlation between amount donated and anonymity as donation size approaches the mean for a given page. It does not, however, explain the positive correlation between above average donations and anonymity.

Other explanations, such as the desire to conform to a social norm (Bernheim (1994)), or inequality aversion (Fehr & Schmidt (1999)), seem more plausible given the overall shape of this relationship. The shallower slope could be interpreted as being consistent with Fehr & Schmidt's kinked inequality aversion curve, suggesting that people dislike being advantaged less than they dislike being disadvantaged. We argue that this model does not apply here, however, as it is concerned with endowments, and not with consumption. An interpretation of charitable giving as giving money to those less fortunate than yourself would predict decreasing anonymity as donations get larger. To the extent that donors to the same page are of roughly the same level of wealth, larger donations are more redistributive, and so should be more utility-yielding under Fehr & Schmidt's model of inequality aversion. Moreover, as a donor's decision about amount and anonymity are made simultaneously, the benefits of donating a smaller amount publicly would seem to exceed those of donating a large amount anonymously under the Fehr & Schmidt (1999) framework - they receive conformity benefits and prestige, and retain income to be used for private consumption. Hence, a different hypothesis must be suggested.

3.2 Estimation

We now estimate a series of models to determine which factors are correlated with anonymity, using a panel with fundraising page as the cross-sectional unit of observation, and a donation's order within a page as the time dimension. So the first donation to a given fundraising page is at time 1, and the second at time 2, regardless of actual time passing between the two points. This formulation makes intuitive sense, as we are considering timings in terms of various players' moves in a game, responding to information provided by previous players. Model 1, below, shows the fixed effects estimate of the relationship between amount donated, place in the order of donation, and anonymity, including time varying controls.

$$Y_{it} = \alpha + \beta_1 D_{it} + \beta_2 \theta_{it} + \phi_i + \epsilon_{it} \tag{1}$$

Where Y_{it} is a binary variable set to 1 if donation t to fundraiser i is anonymous and 0 otherwise, D_{it} is the amount donated by donor t to page i, θ_{it} is the place of the donation within the fundraising page, i, ϕ_i is a page specific fixed effect, and ϵ_{it} is an i.i.d. error term. Model (2) estimates the same relationship, with the addition of a squared term on amount donated, while model (3) contains a set of place in order dummies. Results from these regressions, shown in Table 2 are consistent with figure 1, showing that anonymity is decreasing in probability as the amount donated increases, but that at some point this relationship switches. It also shows that early donations are more likely to be made anonymously.

Figure 1 suggests more clearly a functional form for the relationship between anonymity and donation amount; that it changes sign at the mean. We define a binary variable, L, to equal 1 when the amount donated is above the mean for that page, and 0 else, and estimate;

$$Y_{it} = \alpha + \beta_1 D_{it} L_{it} + \beta_2 D_{it} + \beta_3 \theta_{it} + \phi_i + \epsilon_{it} \tag{2}$$

Model (4) estimates this same model, while Model (5) interacts L and the amount donated.

Table 2 - Linear probability model: whether donation is anonymous

	(1)	(2)	(3)	(4)	(5)
Log amount	0.009***	-0.127***	-0.126***	0.003	-0.026***
	(0.002)	(0.008)	(0.008)	(0.003)	(0.003)
Place in order	-0.008***	-0.007***	-0.005***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log amount squared		0.021***	0.020***		
		(0.001)	(0.001)		
First donation			0.048***	0.051***	0.048***
			(0.006)	(0.006)	(0.006)
Large donation				0.012**	-0.207***
				(0.004)	(0.014)
Large donation squared					0.066***
					(0.004)
Constant	0.107***	0.314***	0.308***	0.116***	0.191***
	(0.006)	(0.013)	(0.013)	(0.007)	(0.009)

Standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.10

These results show that larger donations may be more likely to be made anonymously than smaller ones. More specifically, we find that although donations above the mean are initially less likely to have been made anonymously, the rate of anonymity among these donors increases more steeply than the fall in anonymity below the mean. We also find that early donors are more likely to give anonymously than are later ones. As shown in models 3-5, there is a large (around five percentage points), tendency for first donors to donate anonymously. These results are robust to the use of logistic regression (found in the appendices).

The relationship this describes is arguably similar to that described by a conformity type story of charitable giving, in which individuals experience negative social returns from donating above the mean, and so conceal their identities. However, as argued above, we believe that a different model is needed to explain the data.

3.3 Signalling

If donors are altruistic their choice of donation strategy will be in part determined by a desire to influence subsequent donors. That early donors can influence the behaviour of later ones is consistent with the findings of Vesterlund (2003), Potters et al (2005) and List & Lucking-Reiley (2002). The question of how anonymity influences future donors is an empirical one. To answer this, we follow the strategy adopted by Smith et al (2012) in attempting to determine the effect of a large anonymous donation on subsequent donations within that page.

Our identification strategy is therefore to focus on a narrow window, in which we can reasonably assume that the exact timing of a large donation is random (i.e. that a large donation is as likely to have been the 14th donation as it is to have been the 15th). Exploiting this assumption, we investigate the size of donations following an anonymous donation relative to the size of those that came before, and how this differs from the response to a revealed donation of the same size. Hence, we estimate;

$$\frac{1}{n}\sum_{s=1}^{n} lnD_{t+s} - \frac{1}{n}\sum_{s=1}^{n} lnD_{t-s} = \alpha + \beta_1 ln(D_t) + \beta_2 ln(D_t)(Y_t) + \theta_t + u_t \quad (3)$$

Where D_t is a donation of D at place t in the order of donations,Y_t is a binary variable for anonymity set to 1 if the donation is anonymous or 0 else, and n is the size of the bandwidth used. Analysis using the full sample of donations shows no significant effect of anonymity on subsequent donations for any bandwidth. However, we are interested in the specific effect of "large" donations on subsequent donations, as intuitively these are more visible to subsequent donors and hence more likely to have an effect (these are also the donations which we believe are unexplained by existing literature). Following Smith et al (2012), we define a large donation as one above 60 (twice the sample mean). By limiting our analysis to these plausibly visible individuals, the results are altered significantly (as in models 6-9). Table 3 shows the results of estimating this model for a number of bandwidths

(BW) of 2, 4, 5 and 10. Model (10), in the far right hand column, makes use of the entire sample of donations, and shows a substantial (5%) increase in donations following a donation that is both large and anonymous.

Table 3 - The effects of anonymous large donations on subsequent donors

Bandwidth	3	4	5	10	5
	(6)	(7)	(8)	(9)	(10)
Ln(Amount)	0.030	-0.007	-0.005	-0.007	-0.007**
	(0.022)	(0.017)	(0.016)	(0.013)	(0.002)
Anonymous	0.028	0.043*	0.041*	0.035*	-0.004
	(0.026)	(0.020)	(0.019)	(0.016)	(0.006)
Timing	0.001*	0.001**	0.001*	0.000	0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Large					0.165*
					(0.074)
Large & Anonymous					0.047**
					(0.019)
Constant	-0.196	-0.032	-0.036	-0.020	-0.778***
	(0.104)	(0.082)	(0.076)	(0.064)	(0.096)

Standard errors in parentheses, *** $p < 0.01, **p < 0.05, *p < 0.10$

For large anonymous donations, the effect on donors in a locality of three or more is both consistently positive and statistically significant. This finding, that large anonymous donations lead to larger subsequent donations, is interesting and perhaps counter-intuitive.

Interestingly, small anonymous donations appear to have no impact on subsequent donations, while donations following a donation which is both large and anonymous are around 5% larger than those before. If we limit our analysis to only the first large donation to a given fundraising page, the effect declines to an insignificant 2.5% increase in donation size among followers. However, the comparative scarcity of observations in this case is a likely cause for the loss of significance.

In this section we have presented evidence from over 70,000 donations, which shows that there is a correlation between the likelihood of donating anonymously and the difference from the average donation. We find that large anonymous donations appear to induce subsequent donations to be larger than if they had been made publicly. Given that these results are (to the best of our knowledge) unique in the literature, in the next section we present a signalling model consistent with their implications.

4 Model

In our data we observe two trends of interest; first, donation size and anonymity are correlated. Second, that large anonymous donations appear to elicit greater subsequent donations than do revealed donations of the same size. Before proceeding to formal modelling, it is worth sketching our narrative in simple terms. We show how, without anonymity, information asymmetry can lead to low levels of donations and inefficient outcomes. When anonymity is available, outcomes may be improved through signalling.

Our narrative is one of information transmission, where the quality of the charity is only known by some of the population. The quality of the charity, together with the donations received will determine the benefit of the public good. We suggest that individuals without information will view actions taken by individuals with information as a signal of the charity's quality.

Starting with a world where anonymity is not possible, when an individual makes a donation, they receive some benefit from the public good (from warm glow and/or their receipt from the good itself), and some 'prestige' in the form of social recognition. The return on contributions to the public good (the quality of the charity), is known to some donors, but not to others. Informed donors can signal charity quality through the size of their donation - foregoing private consumption in order to show that the charity is of high quality.

In our model, individuals will consider two factors when donating to charity; their total benefit from the public good and the prestige received from donating. Thus, any donation made publicly offers only weak information about the quality of the charity, as any signal of this kind is mixed in with the prestige-seeking behaviour of the donor.

If, however, a donor has the choice to donate anonymously, a stronger signal can be sent. Subsequent donors may infer a higher quality from a private donation than from a public one of the same size, as the donor has chosen to forego prestige. They learn more about the quality of the charity than if a donation of the same size had been made publicly.

Our model is a two-stage signalling game with two players; a sender (S) and a receiver (R), who sequentially choose whether to make a donation $d_i \in \{0, D\}, D \in [\underline{d}, \overline{d}]$ to a single charity.[1]. The charity provides a public good, so any donation given to the charity will result in both a direct payoff to the donor and a positive externality to the other player. The charity's quality, the distribution of which is assumed to be common knowledge, is denoted $q \in (\underline{q}, \overline{q})$. The realised value of q is known only to S[2]. Otherwise each player is identical, with utility function:[3]

$$U_i(d_i, d_j; q, \psi) = \begin{cases} qd_i + qd_j - d_i + \psi, & \text{if donation is public} \\ qd_i + qd_j - d_i, & \text{if donation is private} \end{cases} \tag{4}$$

In addition to the benefit from the provision of the public good, a player is assumed to experience (positive) prestige ψ, whenever donating publicly (denoted by $\gamma = 1$). If they choose to donate privately ($\gamma = 0$) the only benefit is the provision of the public good.

[1] $\underline{d}$ is analogous to a 'minimum' donation required to receive prestige. In practice, this will vary from fundraising environment to fundraising environment, but may be considered as similar to the established 'social norm' of a group (for similar intuition on this, see Smith et al (2012)) $\overline{d}$, conversely, is a simplification of the concept of a 'large' donation discussed earlier.

[2] This follows Potters et al (2005), Vesterlund (2003) or Banerjee (1994).

[3] For simplicity we have used an explicit function. This utility function is linear in d_i in this case because even a large donation contributes negligibly to the overall provision of the public good. For a discussion of assumptions required for other utility functions see Peacey Sanders (2013).

This specification is chosen for simplicity. An alternative specification, in which ψ is a function of d_i, is considered in Peacey & Sanders (2013).

In the first stage of the game, S chooses whether and how much to donate. If he chooses to donate he can either donate publicly, or privately.

S chooses a strategy $\sigma_S : \Omega \to \{0, (D, \gamma = 0), (D, \gamma = 1)\}$. Even if the donation is given privately, it is revealed to R and so R knows exactly which strategy player S has chosen. We denote θ_S as the realised strategy played by S.

Since we have a signalling game, we use the Bayesian Nash equilibrium concept. R's beliefs about E[q] will be updated from θ_S, and hence R's strategy will depend on θ_S. We denote R's posterior belief about the distribution of q as μ_R.

We are interested in separating equilibriums, in which S takes different strategies for different values of q.

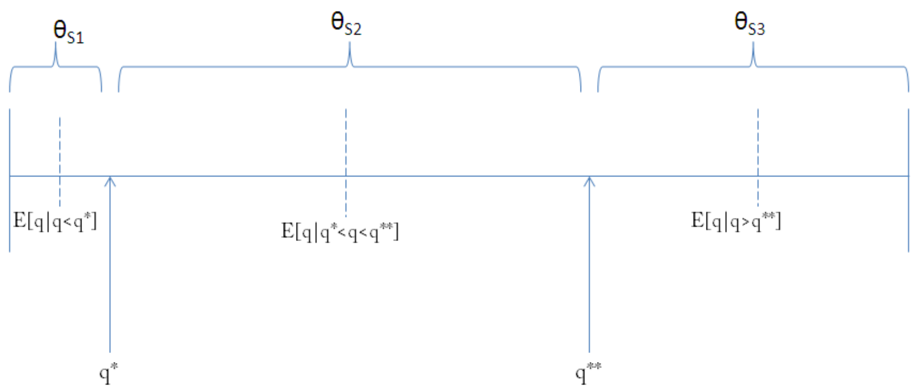
4.1 Equilibrium

There are many possible separating equilibriums, depending on the posterior beliefs that are held by R. We propose a separating equilibrium in which R believes anonymity provides a credible signal of a higher quality.

In this equilibrium, R believes that S will restrict her strategies to one of three. The strategies will be conditional on q, and hence there are two cutoff values for which S's strategy will change: q^* and q^{**}.

$$\mu_R = \begin{cases} \mu_{R0} = q \sim U(\underline{q}, q^*), & \text{if } \theta_S = 0 \\ \mu_{R1} = q \sim U(q^*, q^{**}), & \text{if } \theta_S = (\underline{d}, \gamma = 0) \\ \mu_{R2} = q \sim U(q^{**}, \overline{q}), & \text{if } \theta_S = (\overline{d}, \gamma = 1) \\ \mu_{R3} = q = 0 & \text{otherwise} \end{cases} \tag{5}$$

Given these beliefs, we consider the strategy R chooses. R is unable to signal, and so will never incur the cost of donating anonymously[4]. Thus, R will only choose one of three strategies $\{0, (\underline{d}, \gamma = 0), (\overline{d}, \gamma = 0)\}$. Which of these strategies is chosen (that is, how much R donates), is contingent on his belief about the quality of the charity.



[4]In our sample we observe that only 1.4% of last donations to a page are both large by our definition and anonymous

To show that this is an equilibrium we need to verify R's Incentive Compatability Constraints. For R to donate $\underline{\mathrm{d}}$ she will need to believe:

$$E[q]\underline{\mathrm{d}} - \underline{\mathrm{d}} + \psi > \max\{E[q]\overline{d} - \overline{d} + \psi, 0\} \tag{6}$$

Thus,

$$E[q|q\ U(0, q^*)] = \frac{\underline{\mathrm{q}} + q^*}{2} > \frac{\underline{\mathrm{d}} - \psi}{\underline{\mathrm{d}}} \tag{7}$$

For R to donate $\overline{d}$ she will need to believe q is sufficiently high:

$$E[q]d - d + \psi > max\{E[q]\underline{\mathrm{d}} - \underline{\mathrm{d}} + \psi, 0\} \tag{8}$$

Thus,

$$E[q|q\ U(q^{**}, \overline{q})] = \frac{q^{**} + \overline{q}}{2} > 1 \tag{9}$$

Given R's strategies and beliefs, we need to show the range of values of $q^*, q^{**}, \underline{\mathrm{q}}, \overline{q}$ for which S's signalling strategies are optimal.

For S to make no donation, then

$$0 > max\{q2\underline{\mathrm{d}} - \underline{\mathrm{d}} + \psi, q2\overline{q} - \overline{d}\} \tag{10}$$

Thus,

$$q < \frac{\underline{\mathrm{d}} - \psi}{2\underline{\mathrm{d}}} \tag{11}$$

For S to make a small public donation (i.e, $(\underline{d}, \gamma = 0)$) then

$$q2\underline{\mathrm{d}} - \underline{\mathrm{d}} + \psi > max\{0, q2\overline{d} - \overline{d}\} \tag{12}$$

Thus,

$$\frac{\underline{\mathrm{d}} - \psi}{2\underline{\mathrm{d}}} < q < \frac{\overline{d} - \underline{\mathrm{d}} - \psi}{2(\underline{\mathrm{d}} - \overline{d})} \tag{13}$$

Finally, for S to make a large private donation (i.e,$(\overline{d}, \gamma = 1)$) then

$$q2\overline{d} - \overline{d} > max\{0, q2\underline{\mathrm{d}} - \underline{\mathrm{d}} + \psi\} \tag{14}$$

Thus,

$$q > \frac{\overline{d} - \underline{\mathrm{d}} - \psi}{2(\underline{\mathrm{d}} - \overline{d})} \tag{15}$$

Hence, $q^* = \frac{\underline{\mathrm{d}} - \psi}{2\underline{\mathrm{d}}}$ and $q^{**} = \frac{\overline{d} - \underline{\mathrm{d}} - \psi}{2(\underline{\mathrm{d}} - \overline{d})}$.

The Bayesian Nash Equilibrium we have found is defined below by each player's strategy (equations 16 and 17), and R's beliefs contingent on S's action (equation 18). R's beliefs are common knowledge.

$$\theta_S^* = \begin{cases} 0, & \text{if } q < q^* \\ (\underline{d}, \gamma = 0), & \text{if } q^* < q < q^{**} \\ (\overline{d}, \gamma = 1), & \text{if } q > q^{**} \end{cases} \tag{16}$$

Where q^* and q^{**} are given above.

$$\theta_R^* = \begin{cases} (\underline{\mathrm{d}}, \gamma = 0), & \text{if } \theta_S^* = (\underline{\mathrm{d}}, \gamma = 0) \\ (\overline{d}, \gamma = 0), & \text{if } \theta_S^* = (\overline{d}, \gamma = 1) \\ 0, & \text{otherwise} \end{cases} \tag{17}$$

$$\mu_S = \begin{cases} q \sim U(\underline{\mathrm{q}}, q^*), & \text{if } \theta_S = 0 \\ q \sim U(q^*, q^{**}), & \text{if } \theta_S = (\underline{d}, \gamma = 0) \\ q \sim U(q^{**}, \overline{q}), & \text{if } \theta_S = (\overline{d}, \gamma = 1) \\ 0 & \text{otherwise} \end{cases} \tag{18}$$

As is common among Bayesian Nash Equilibria (BNE), the off equilibrium beliefs can take a number of other values.

While this is just one of many BNE, we show that an equilibrium of this form (where R donates $\overline{d}$) may not exist when there is no choice over anonymity. It is efficient for R to donate if $q > 1$. If the most costly signal that S can send will still not convince R that $q > 1$, then there will be scope for improved outcomes. We suggest that a lack of anonymity will cause market failure when ψ is large relative to $\overline{d}$. We start by considering $\overline{q} < 2$. Thus, ex-ante $E[q] < 1$.

Public donations will work as a signal when:

$$\mu((\overline{d}, \gamma = 1)) = \frac{\overline{d} - \psi + \overline{q}2\overline{d}}{4\overline{d}} > 1 \tag{19}$$

However, the possibility of anonymous donations will work for a larger range of $\overline{q}$:

$$\mu((\overline{d}, \gamma = 0)) = \frac{\frac{1}{2} + \underline{q}}{2} > 1 \tag{20}$$

This model is robust to a more general donation strategy, to differences in psychological factors or information endowments, and to the inclusion of more players - detailed descriptions can be found in Peacey & Sanders (2013).

5 Conclusions and Extensions

Using a large dataset from the natural environment of VMG fundraising pages, we have investigated the characteristics of anonymous donations, and subsequently their effect on other donors. We find that, contrary to our expectations from the literature, large anonymous donations are fairly common. Empirically, our main result is the finding that large anonymous donations induce larger donations from subsequent donors than do public donations of the same size.

Given this result, we produce a signalling model whereby anonymity is used as a costly signal of a charity's quality by an informed donor, which produces results consistent with our empirical findings, which is the main contribution of our paper.

We believe that, conditional on the signal being sent, we have a lower estimate of its effect, because the revealed donations are not a perfect counterfactual; those who do not conceal their identity are necessarily those for whom revelation is optimal, and so may differ to anonymous donors in important characteristics.

The largest difficulty with our empirical result is that we have so little information about anonymous donors. If we were able to gain more detailed information about them, and so track their donations across different communities, we may be able to develop a better counterfactual.

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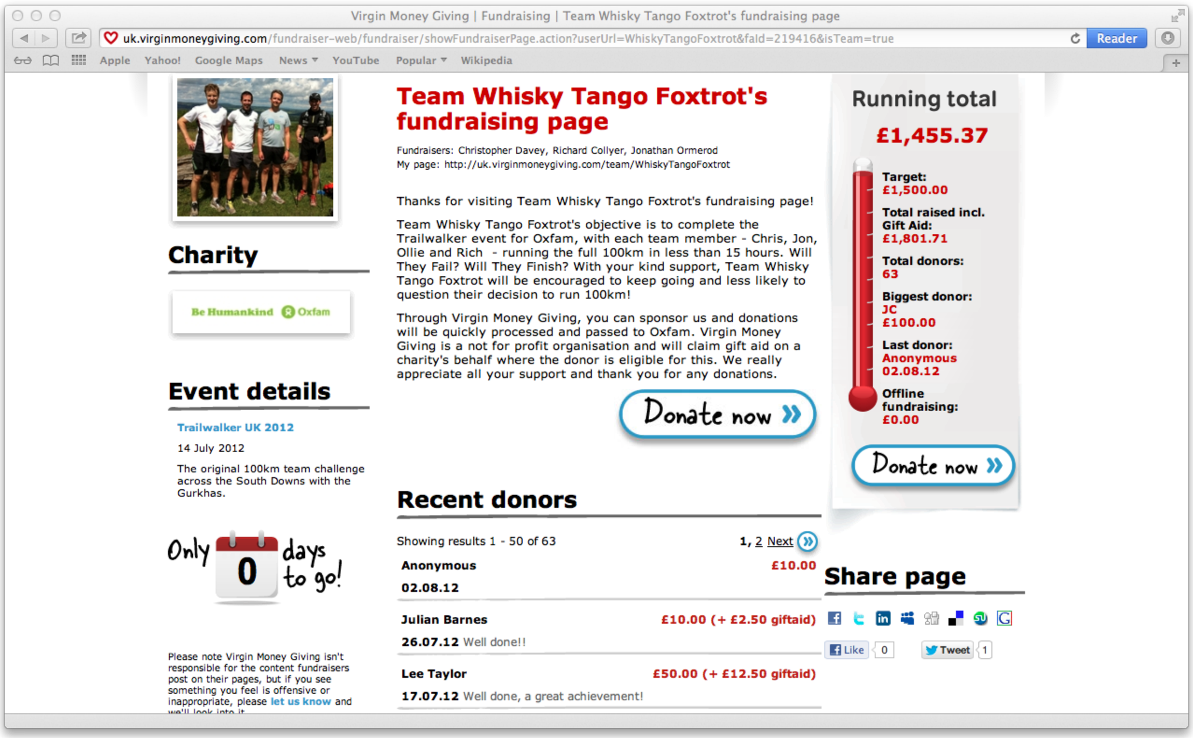
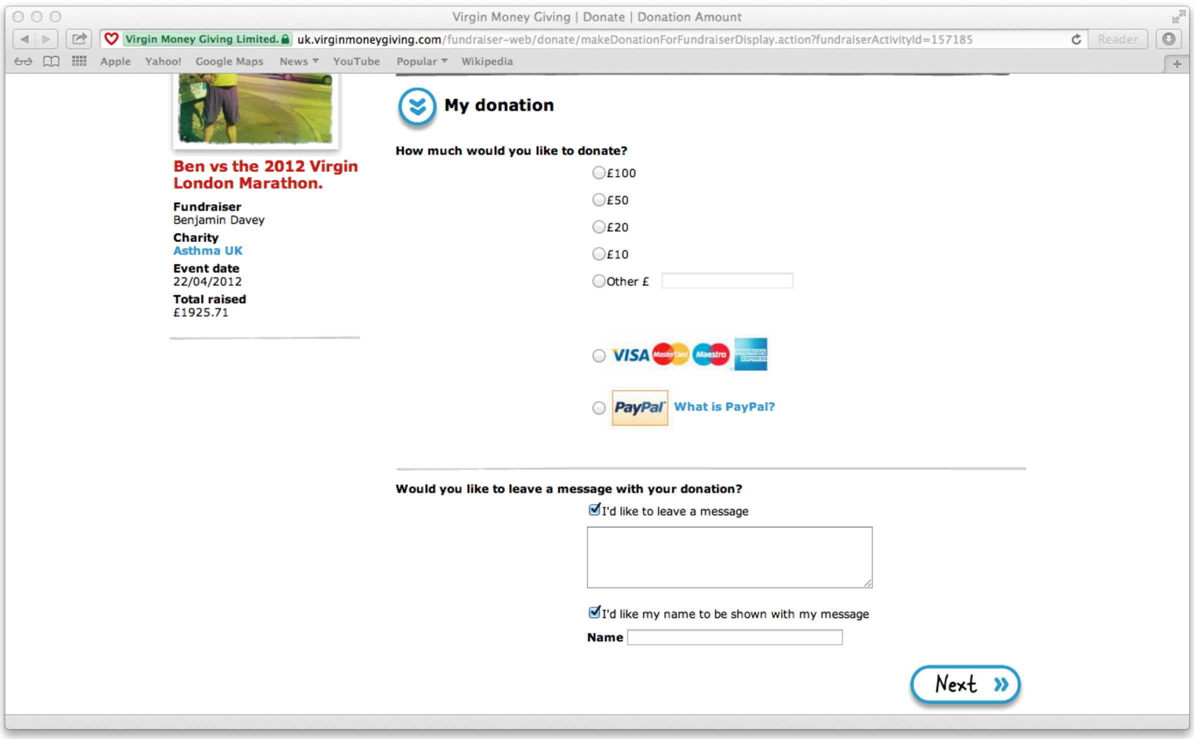
Appendix A: Virgin Money Giving Pages





Appendix B: Robustness of the Model

This appendix extends the simple two player model presented in the main paper. In the primary model, two agents interact and make a choice from one of three donation amounts, and whether to donate anonymously. One agent is informed, and the other not, and both agents extract some utility from both the provision of the public good and from having others know that they have contributed to it. Here, we relax many of these assumptions, and demonstrate that the principle conclusions of our model continue to hold (although they become weaker under many such relaxations). In section A1, we expand the set of donations, while in section A2 we allow the characteristics of donor and their information sets to vary, such that the second player, R, may have some informaton about the charity's quality. In section A3 we allow for ψ to vary between players, and in section A4 we introduce multiple players to the game.

B1: Generalising the donation strategy

In our model, costs and benefits to donations were both linear. This assumption will lead to corner solutions, where if donations occurred they would either be the minimum possible, or the maximum. If, however, donors have diminishing returns to consumption, or the benefit from donating is concave in d_i, then they may choose to donate amounts that are between the minimum and maximum, i.e. $\notin \{\underline{d}, \overline{d}\}$. It is possible to generalise the way in which donations can be given either by allowing a choice over a finite discrete number of donations[5] or by allowing a choice over a continuum of donations.

We consider a finite number of discrete donations; both for simplicity and because a large portion of donations observed in our data are of "round" amounts, making a discrete choice model more plausible.
If players have a possible choice over N discrete donations; $d_i \in \{0, d_0, d_1, d_2...d_N\}$ we propose that there can be a separating equilibrium, in which different signals are sent according to $|N| - 1$ threshold values for q.
The number of pure strategies available to S is $2|d| - 1$ [6], where $|d|$ is the cardinality of the set of donations. However, since anonymity is a dominated action for player 2 (the last player), he will choose one of $|d|$ actions.

B2: Information endowments and player characteristics

Our model assumes that S has perfect knowledge about the quality of the charity. Our model also requires that the sender obtains utility from the receivers' donation. These assumptions (that S has more information than R, and is motivated by the general level of charitable good provision) are consistent with past work in this area; Potters et al (2005) assume that one agent has knowledge of the charity's quality, while Vesterlund (2003), shows that if charity quality is uncertain, some

[5] This can include a strategy which involves a probabilistic mix between donation sizes, essentially creating a continuum of expected donations

[6] This comes from $\{d\} \times \{0, 1\}$ minus one since if donation is zero there is no choice over anonymity.

individuals will engage in costly information search. That S receives utility from R's donation is a standard public good setup. Here we find it useful to think in terms of more and less motivated agents.

Then they have a greater incentive to signal charity quality than do other players, as their return on others' donations is higher. Intuitively, we can also turn to the framework of Vesterlund (2003), and assume that the cost of information gathering is may be lower for more motivated agents, as they are likely to be more closely linked to the charity than are less motivated agents.

We can relax this assumption, so that each player gets a signal about the quality of the charity, with similar results. However, it is clear that signals are only as valuable as the information they can transmit, which is diminished in a case where both players have information. Hence, the less that can be learnt from S, the smaller the power of her signal. This results in a smaller range of values for which a separating equilibrium will occur.

Intuitively, we assume that individuals who care about the charity have a lower cost to gathering information about it and so will be more likely to do so. While it is possible for R (as well as S) be concerned with how much the other player donates (as in our model), the only assumption required on her is that her utility is increasing in q.

B3: Differences in psychological factors

We have so far assumed that the net effect of the psychological factors, ψ, is constant. We can relax this assumption in one of two ways - either by allowing ψ to vary within individual, so that the same person could experience different, non-zero, values of ψ depending the action he takes, or between individuals, such that different people are more or less motivated by psychological factors.

The assumption that ψ is a positive constant suggests that prestige is the dominant psychological factor. When donations are very small, however (i.e. less than the mean) the dominant psychological effect may be (lack of) conformity. We might expect, for this level of donation, ψ to be negative. Hence it is possible that ψ is an increasing function of d_i. When the cost of the signal is negative, i.e. for small d, we might still observe anonymity. In this case, anonymity would not need always to be a response to charity quality. As a signal is only as effective as its cost, the signalling value of anonymity may be weaker for low values of d_i, but may be stronger for higher values, depending on the form of the relationship between d_i and ψ.

For example, consider ψ as any monotonically increasing function of d_i, such that

$$\psi(\underline{\mathrm{d}}) < 0 \text{ and } \psi(\overline{d}) > 0$$

ψ is determined by both the sizes of relevant psychological factors and social norms. There is a donation size x, where these effects will exactly cancel each other out. For example, it could be that x is the current mean donation of the group.

In this case, donations less than x will have a negative net psychological cost (e.g, driven by a lack of conformity), whilst larger donations will have a positive psychological benefits (e.g, driven by aforementioned prestige).

Since there is now no psychological benefit (moreover, there is a loss) to making a minimum donation, R will no longer make minimum donations[7]. Hence, the separating equilibrium we are looking for will simply have one "cut off" value of q. R will either make a large public donation, or choose not to donate at all. The receiver's beliefs will take the following form:

$$\mu_R \begin{cases} \mu_{R0} = q \sim U(\underline{\mathrm{q}}, q^*), & \text{if } \theta_S = 0 \\ \mu_{R1} = q \sim U(q^*, \overline{q}), & \text{if } \theta_S = (\overline{d}, \gamma = 1) \\ \mu_{R2} = q = 0 & \text{otherwise} \end{cases} \tag{21}$$

and the strategies played in equilibrium are given by:

$$\theta_S^* = \begin{cases} 0, & \text{if } q < q^* \\ (\overline{d}, \gamma = 1), & \text{if } q > q^* \end{cases} \tag{22}$$

[7]If there is a range for which ψ increases very rapidly, and a non-large donation gives a high psychological payoff, then there is an equilibrium where a medium donation is used primarily for psychological gain.

$$\theta_R^* = \begin{cases} 0, & \text{if } \theta_S^* = 0 \\ (\overline{d}, \gamma = 0), & \text{if } \theta_S^* = (\overline{d}, \gamma = 1) \\ 0, & \text{otherwise} \end{cases} \tag{23}$$

Where $q^* = \frac{1}{2}$

We note that there are still a multitude of equilibria after relaxing this assumption. In any separating equilibrium, other signals may be sent by S, but they will all be less costly and hence would only imply a smaller q*.

We now consider relaxing the assumption that psychological effects are constant between individuals, i.e. that $\psi_i \neq \psi_j$. If we introduce variation (i.e, individuals each have a private ψ, drawn from a common, known, distribution), signalling power would be reduced. Those who benefited from low cost signals (i.e, who had low draws of ψ) would have lower thresholds for private donations (and a receiver's belief would be higher than the true q). Those who had high cost signals (i.e, who had high draws of ψ) would have higher thresholds for private donations (and receivers' beliefs would be lower than the true q). Of course, on average, the receiver's belief would be correct. A simple model with 'types' of players who vary in their psychological characteristics can be found in Appendix C.

B4: Multiple players

As there are only two players in our model, it is clear that R will have perfect knowledge about S's actions independently of her choice of γ. In this game, we interpret a public donation as a "plaque" which is seen by members of the public. Hence we suggest that the effect of R's contribution on S's prestige is negligible relative to the (large) exogenous population.

There is an obvious way in which we can generalise the game to N players. Player 1 sends a signal which is received by all future players. Each player i after that, acts as both a receiver (of previous player's signals) and a sender (in as much as their donation is informative about those donations which went before, which were informed). Each donor will learn from the previous signals she has received and use this to decide what action to take. This type of information flow would possess similar properties to Banerjee (1992), with the important distinction that a donor's action space is continuous. Since the number of future donors that can be influenced, and perhaps the expectation that the donor is informed, are decreasing in the lateness of a donation, we would expect earlier players to donate larger amounts and more frequently donate anonymously.

Appendix C: Extensions to Model - A world with types

Individuals may differ in both their (psychological) persona[8] and how much they value a given charity[9]. In this extension we model this heterogeneity, by allowing both ψ and q to be individual specific. These parameters are privately known to the individual, and the distribution of each is common knowledge.

Altering either of these parameters has a similar effect - confusion is added about why an individual is donating.

First consider ψ; On the one hand, individuals with a low draw of ψ find it less costly to forego prestige, and thus weaken the signalling value of anonymity. On the other hand, individuals with a large draw of ψ strengthen its value. Thus the values of q^* and q^{**} will depend on the individual's ψ_i . Larger values of ψ_i will result in a lower q^* and a larger q^{**}. Thus individuals with higher ψ_i will be more likely to donate small amounts publicly and less likely to make large anonymous donations. Since ψ_i is privately known, R can only condition his strategy on $E[q|\theta^*_S]$ and not $E[q|\theta^*_S, q_i]$. Hence a larger variance of ψ decreases efficiency.

Second if q is individual specific; e.g, $q_i = q + \epsilon_i$, individuals who have low q_i will find it less worthwhile both to donate and to encourage others to donate. This results in higher values of both $q^*$and q^{**} for lower values of an individual's q_i . As before, a larger variance of q decreases efficiency. If the two characteristics (q and ψ) are jointly distributed we can tell a story containing three types; "Heroes" are motivated primarily by the former, whereas "Villains" are motivated purely by the latter. In addition we suggest the majority of individuals are "Citizens", who are motivated by a combination of the two factors. Furthermore, we suggest that Heroes possess perfect knowledge of the charity quality whereas the other types do not[10].

As donating is costly, for a given utility function there is a minimum

[8] For example, some people may be conditional or unconditional co-operators (Fischbacher et al (2000))

[9] For example, if an individual has personal experience with a disease, she may perceive the value of the charity higher

[10] In this analogy, we note that we do not require the distribution of types to be known

quality of charity at which it is optimal for both Heroes and Citizens to donate. While the Heroes are able to make this choice with the advantage of information, Citizens may decide not to donate ex-ante even when, ex-post, the quality of the charity is high.
As Villains' utility is independent of the charity's quality, they will always donate when the value of the prestige is greater than the cost of donating. Hence simply observing a donation is not sufficient to infer anything about the quality of the charity. However, if Heroes are able to donate anonymously, they are able to send a signal about the quality of the charity. This is because a Villain will never donate anonymously, as she will not be willing to forego prestige. If a Citizen observes an anonymous donation, they know that it must have been made by a Hero, and hence that the charity must be of high quality. The result of this is that on observing an anonymous donation, a Citizen will choose to donate.

Appendix D: Further Empirical Specifications

D1: First Stage Empirics

The tables which follow report logit and probit models of the results contained within Table 2.

Table A1 - Probit model: whether donation is anonymous

	(1)	(2)	(3)	(4)	(5)
Log amount	0.032***	-0.600***	-0.596***	-0.053***	-0.073***
	(0.005)	(0.024)	(0.024)	(0.007)	(0.007)
Place in order (10)	-0.010***	-0.010***	-0.005*	-0.005*	-0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log amount squared		0.096***	0.095***		
		(0.003)	(0.003)		
First Donation			0.223***	0.230***	0.230***
			(0.024)	(0.024)	(0.024)
Large Donation				0.370***	-1.114***
				(0.021)	(0.139)
Large · Log amount					0.315***
					(0.029)
Constant	-1.247***	-0.282***	-0.304***	-1.043***	-0.986***
	(0.018)	(0.039)	(0.039)	(0.022)	(0.022)

standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table A2- Logit model: whether donation is anonymous

	(1)	(2)	(3)	(4)	(5)
Log Amount	0.065***	-1.066***	-1.059***	-0.102***	-0.144***
	(0.010)	(0.041)	(0.041)	(0.014)	(0.014)
Place in order (10)	-0.019***	-0.019***	-0.010*	-0.009*	-0.009*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Logged Amount Squared		0.169***	0.168***		
		(0.006)	(0.006)		
First Donation			0.407***	0.419***	0.419***
			(0.044)	(0.044)	(0.044)
Large Donation				0.686***	-1.968***
				(0.039)	(0.240)
Large · Log amount					0.567***
					(0.050)
Constant	-2.140***	-0.398***	-0.440***	-1.739***	-1.620***
	(0.035)	(0.069)	(0.070)	(0.042)	(0.043)

standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

These results are consistent with those displayed in the body of the paper.

D2: Second Stage Empirics

This section contains robustness checks for our most important empirical finding - that donations made immediately after a large anonymous donation are significantly larger than are those made after a large public donation.

Table A3, below, contains robustness checks for this finding. Regressions 1, 2 and 3 in this table replicate the regressions found in Table 3. Following Smith et al (2012), we perform the same kind of difference in difference analysis as in our second stage regressions, but focus only on the first large donation to a given page. Given Smith et al's (2012) observation that large donations will tend to follow large donations, we consider that a large anonymous donation may simply be the result of following a large donation of one kind or the other, possibly outside of the bandwidths covered by our analyses. Comparing donations made before and after the first *large* donation within a given page, we see results that are similar or larger in the magnitude of effect size to those reported in Table 3. Although these results are not significant, the stability of the point estimate of the effect suggests that the large reduction of statistical power may be at least partially responsible.

Table A3- Difference in difference with first large anonymous donations

	(1)	(2)	(3)	(4)	(5)
Ln(amount)	0.149**	0.077	0.014	0.013	
	(0.048)	(0.044)	(0.042)	(0.045)	
Anonymous	0.023	0.024	0.024	0.119*	
	(0.060)	(0.054)	(0.051)	(0.057)	
Place(10)	0.197	0.275**	0.208*		
	(0.115)	(0.096)	(0.085)		
Distance to Target	0.000*	0.000**	0.000**	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.First Large Anonymous					0.158***
					(0.036)
L.First Large					0.207***
					(0.023)
L.First Donation					0.018
					(0.018)

standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Other columns show results from different specifications, varying the bandwidths of interest and including more controls. These results are broadly in line with those found in table 3, and with the implications of our model.