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An experimental investigation of intrinsic motivations for giving

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Abstract This paper presents results from a modified dictator experiment aimed at distinguishing and quantifying intrinsic motivations for giving. We employ an experimental design with three treatments that vary the recipient (experimenter, charity) and amount passed (fixed, varying). We find giving to the experimenter not to be significantly different from giving to a charity, when the amount the subject donates crowds out the amount donated by the experimenter such that the charity always receives a fixed amount. This result suggests that the latter treatment, first used by Crumpler and Grossman (J Public Econ 92(5–6):1011–1021, 2008), does not provide a clean test of warm glow motivation. We then propose a new method of detecting warm glow motivation based on the idea that in a random-lottery incentive (RLI) scheme, such as the one we employ, warm glow accumulates and this may lead to satiation, whereas purely altruistic motivation does not. We also provide bounds on the magnitudes of warm glow and pure altruism as motives that drive giving in our experiment.

Keywords Dictator game · Warm glow · Pure altruism · Charitable giving · Random Lottery Incentive Scheme

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1 Introduction

What motivates people to act generously, for instance, by making donations to charities? Besides extrinsic motives such as tax breaks, thank-you gifts, and various material rewards deriving from, for example, developing a reputation for being generous, there are intrinsic motives for giving. In particular, the literature has focused on a distinction between two types of intrinsic motivation: pure altruism and warm glow (Andreoni 1989, 1990). The crucial distinction is that people motivated by pure altruism care about the total amount of public good that is provided, for instance, because others' well-being enters directly their utility function (Becker 1974), while people motivated by warm glow care about their own individual donation, which acquires properties of a private good. Of course, the two motives may be also operating simultaneously. Recently, various papers have argued that warm glow encompasses the signaling benefits of altruistic actions, including concerns for self image, social image, and esteem (Benabou and Tirole 2006; Ellingsen and Johannesson 2008, 2011; Andreoni and Bernheim 2009; Grossman 2010).

Besides the need to obtain a cleaner picture of the motives for giving the interest in the distinction between warm glow and pure altruism stems from the fact that it has implications for the evaluation of a long standing idea in public finance, the so-called crowding out hypothesis: the possibility that private giving in support of charitable causes may be crowded out by public spending. As purely altruistic motivation is subject to crowding out while warm glow is not, empirical studies in the field and the lab have sought to estimate the extent of crowding out to provide evidence of the relative importance of warm glow and pure altruism.[1] Field studies have usually found little evidence of crowding out, however, interpretation of such findings may be difficult. For instance, a recent investigation using a panel of charities (Andreoni and Payne 2011) finds that crowding out is primarily due to reduced effort in fund-raising by charities. In laboratory experiments, on the other hand, crowding out is typically found to be significant (e.g., Eckel et al. 2005).

This paper makes two main contributions to the literature that is concerned with understanding and measuring the motives for charitable giving. First, we demonstrate that the experimental design developed by Crumpler and Grossman (2008) [CG henceforth] does not offer a clean test of warm glow due to the presence of strong altruistic feelings toward the experimenter. This finding has implications for all designs in which a subject's action has an impact on the total amount that is paid by the experimenter (Harrison and Johnson 2006). Our second contribution is to offer an alternative and novel test for detecting warm glow giving that is not based on crowding out. Also, under reasonable assumptions, we can provide bounds on the magnitudes of warm glow and pure altruism as motives that drive charitable giving.

1 Andreoni (2006) and Vesterlund (2006) offer excellent surveys of both theoretical and empirical aspects of the crowding out hypothesis and more generally of the economics of philanthropy and charitable giving.

Our starting point is the CG design which entails a modified dictator game in which dictators could choose the recipient from a list of charities.[2] The chosen charity received a fixed amount from the experimenter and any amount the dictator decided to pass on to the charity crowded out one-for-one the experimenter's contribution. This substitution removes the incentive to give for someone who is a pure altruist toward the charity, that is, someone who is exclusively concerned about the total amount that goes to the charity regardless of the identity of the giver. On the other hand, for a warm glow giver who derives utility from the act of giving per se, the incentive to give is still active. CG find that subjects in their experiment gave an average of 20 % of their endowment and attribute this to the warm glow motive for giving. Note, however, that other interpretations for this finding cannot be ruled out. As the authors themselves acknowledge:

> [. . .] it is possible that participants are making contributions because they have some altruistic feelings for the experimenter. By giving to the charity, the subject is reducing the financial burden on the experimenter. (p. 1014)

Our experimental design allows us to assess how serious this confounding factor is. In particular, in our experiment subjects make three decisions of how to allocate an endowment of £10. We introduce a condition in which the recipient is the experimenter (we refer to it as T1), besides replicating the warm glow treatment of CG (we refer to it as T2). In T1, subjects may decide to share some of the endowment with the experimenter either because of purely altruistic or warm glow feelings or because they want to be kind to someone who has already been kind to them, that is, because of a concern for fairness or reciprocity (Rabin 1993; Fehr and Gachter 2000). Note that in terms of the impact of the subject's decision on the final allocations for the subject and the experimenter, this condition is identical to the warm glow treatment implemented by CG, where the subject's giving reduces the experimenter's costs by the same rate. For example, if in T2 a subject gives £5, then he or she receives £5 and reduces the experimenter's cost by £5, that is, the subject in effect gives back to the experimenter £5 out of the £10 that were handed out as an endowment.

Thus, T1 allows us to identify those subjects who may have altruistic feelings toward the experimenters that CG refer to in the quote. We find that a sizeable share of subjects is indeed of this type and we fail to reject the null that average giving in T1 is equal to T2, suggesting that the above-mentioned confounding effect is potentially serious. In the third condition that we implemented (we refer to it as T3), the recipient was again a charity of the subject's choice only this time the amount passed on to the charity was not fixed but was determined by what the subject donated, if anything. In this third condition, both types of motives, warm glow and pure altruism, are operating while altruistic feelings toward the experimenter are not induced.

In our experiment participants are exposed to these three treatments in random order, being aware that at the end of the experiment only one of the decisions will be selected at random to determine payoffs. We use the probabilistic implementation of the decisions in our design to perform a new test of detecting warm glow motivation.

[2] Eckel and Grossman (1996) was the first paper to introduce a real charity as recipient in a dictator experiment.

The idea behind our test is that purely altruistic motivation is by definition conditional on the donation being actually implemented, while for warm glow motivation this is not necessarily the case. If the warm glow of acting generously derives, for instance, from the benefit of self-signaling, as in Benabou and Tirole (2006), then the fact that the donation may not be implemented does not erase the signaling benefit of a donation, which implies that warm glow may accumulate by spilling-over across treatments. This, instead, is not the case with purely altruistic motivation. Consequently, if there is a warm glow component in the utility function, then the position in which a given treatment is taken within the sequence of decisions matters, as a subject's warm glow gratification may be more satiated when a decision is taken later in the experiment. Indeed, we find average giving to be higher in decisions taken earlier in the experiment, thus providing evidence of warm glow as a motive that drives giving. We also discuss the implications of our findings for the interpretation of other experiments that use a probabilistic implementation of a sequence of choices.

Finally, our design enables us to offer a lower bound estimate of warm glow giving—clean of any confounding altruistic concerns for the experimenters—by examining the behavior of those subjects who did not display any altruistic behavior in T1. For subjects undergoing T3 in the first decision we estimate that giving due to warm glow is between 22 and 28 % of endowment. We can also quantify giving due to purely altruistic motivation and we find that pure altruism accounts for a donation in the range of 20 and 26 % of endowment.[3] Thus, we find the two intrinsic motivations for giving to be roughly equally important in our experiment.

The structure of the rest of the paper is as follows. Section 2 presents the experiment. Section 3 assesses the impact of altruism toward the experimenter; Sect. 4 introduces our test of warm glow giving, while Sect. 5 provides bounds for warm glow and pure altruism in our experiment. The last section concludes.

2 The experiment

2.1 Procedures

All sessions of the experiment were conducted at the University of Southampton in the fall of 2009. A total of 251 subjects of diverse academic backgrounds (excluding economics and psychology) participated in 13 experimental sessions. In each experimental session an equal number of male and female subjects was invited. Sessions took place in large classrooms, where participants, ranging between 15 and 25, sat at isolated desks to guarantee their privacy. At the beginning of the experiment, an information sheet with some general instructions regarding the experiment was read aloud (see Supplementary Material). After collecting the participation consent form, we distributed envelopes containing a £5 show up fee and a 5-digit personal code number that subjects would use to identify their decisions throughout the experiment.

[3] Related papers that have been concerned with decomposing altruistic behavior into warm glow and pure altruism are Palfrey and Prisbrey (1997) and Goeree et al. (2002) who do so in the context of modified public goods games, and Tonin and Vlassopoulos (2010) who focus on effort donated in a workplace setting.

This ensured subjects' anonymity when making their decisions and collecting their earnings.

In each session, a monitor was randomly selected among the participants to verify that the experimenters followed the protocol.[4] After the selection of the monitor, participants were informed that they will be asked to make three separate decisions about how to allocate £10 by receiving sequentially three decision sheets (A, B, and C) and after all decisions are made, the monitor will randomly select one of the three decision sheets and use only one decision sheet to determine payments. The selection procedure was explained in detail.[5] Participants then received the instruction and decision sheet for each decision sequentially. To check for understanding of the instructions, before making each decision participants had to respond to two questions about hypothetical allocation decisions.[6] At the end, participants completed a short questionnaire while we prepared the payment for each subject and wrote the cheques to the charities. A session lasted approximately 1 h.

2.2 Treatments

In the experiment participants were asked to decide how to allocate £10 in three different conditions:

- In condition T1, the £10 had to be divided between the participants and the experimenter.[7] In this treatment the following types of motivations may induce giving: pure altruism toward the experimenter, warm glow derived from giving to the experimenter, or reciprocity toward the experimenter.
- In condition T2, the £10 had to be divided between the participants and a charity of their own choosing selected from a list of ten. The participants were informed that "the experimenters will pay your selected charity a top-up (the difference between £10 and what you choose to pass) so that in total the charity receives £10" and that "in total your selected charity will receive neither more nor less than £10". This condition corresponds to the one implemented in CG. Giving in this treatment may be motivated by warm glow derived from giving to the charity. In addition, purely altruistic motivation and reciprocity toward the experimenters may also play a role.
- In the last condition, T3, the £10 had to be divided between the participants and a charity of their own choosing selected from the same list of ten charities as in T2.

[4] To ensure the credibility of donations to the charities, we informed subjects that at the end of each session the monitor would accompany one of the experimenters to the nearest mailbox to drop the envelopes with the cheques and that they could join in, if they wished.

[5] After all decisions were made the monitor drew from an envelope containing cards with the numbers 1, 2, and 3 printed on them. The code number of each participant ended in either 1, 2, or 3. Decision A (B) [C] was implemented for participants having a code number ending in the first (second) [third] number the monitor drew.

[6] After the three allocation decisions had been made, participants were asked to make a final decision. They were given an opportunity to receive £10 instead of having the selected decision implemented. This option was not announced beforehand. We find that almost a quarter of subjects choose to opt out, while around one third opt out from a positive donation. In Tonin and Vlassopoulos (2013), we argue that these patterns of opting out provide evidence of giving motivated by self-image concerns.

[7] We used a neutral language in the experimental instructions (see Supplementary Material).

In this treatment two motivations operate: pure altruism and warm glow feelings derived from giving to the charity.

Subjects underwent the three conditions in a randomized order. In total, 13 sessions were conducted, with 5 out of 6 unique orders implemented twice and one implemented three times.

2.3 Descriptive statistics

We first discuss how subjects performed in the questions checking comprehension of the treatments. Out of the 238 subjects who made decisions in the experiment (13 subjects acted as monitors), 133 answered all questions testing understanding of the treatments correctly. Most mistakes occurred in T2, where 98 subjects did not provide the correct answers. Of these 98 subjects, 63 provided the correct answers to T1 and T3, and in T2 they answered correctly the question regarding the amount the charity received, therefore they did understand that the charity would receive £10 regardless of the individual decision of how much to pass.[8] Considering that all these subjects understand the crowding out and the fact that the experimenters are contributing to the charity, we conduct the analysis including them.[9] To summarize, the sample we use consists of participants answering correctly to questions regarding T1 and T3 and at least understanding crowding out for T2. This amounts to 196 subjects (82 % of the original sample).[10]

The questionnaire also included some questions regarding the experimental protocol reported in Table 1. The answers suggest that subjects considered that their anonymity was preserved, that the money collected would indeed be sent to charity, and that the instructions were clear and easy to follow. Moreover, they indicate that they consider the recipients of donations to the charity as deserving of support. Finally, participants indicate that at the moment of taking their decisions they did understand that only one would be implemented.

In Table 2, we summarize the choice of charities and the average donation to each charity. Choosing a charity in T3 without passing anything is inconsequential, therefore we report both for the sample as a whole and for the subsample of those actually donating something in T3. The choice of charities across treatments is very

[8] The quiz involved hypothetical donations of £4 and £6, see the Supplementary Material for details. All of these 63 subjects made a mistake in reporting the experimenters' contribution, while only four made a mistake in reporting the amounts the subject received. All mistakes concerning the amounts the subject received and 75 % of mistakes regarding the experimenters' contribution consisted in indicating that the experimenters will pay/subject will receive £4 instead of £6 or vice versa in at least one question. The remaining 25 % of mistakes regarding the experimenters' contribution involved the indication that the experimenters will pay the charity £10. We believe that these mistakes do not reflect a serious misunderstanding, but are rather due to sloppiness or to the consideration that, at the end of the experiment, the experimenters will indeed pay £10 to the charity, part of it on the subject's behalf and part as a top-up.

[9] We also conducted the analysis using the smaller sample of 133 subjects who answered all questions correctly. The results (available upon request) are very similar.

[10] In most of their sessions, CG test understanding through a two question quiz on the same form used to make allocation decisions. The questions are about personal payments and the amount received by the charity for a hypothetical allocation. They find that 76 % answer the questions correctly.

Table 1 Summary—procedures questions

	All $N = 238$	Sample used $N = 196$
1. The procedures followed in this experiment preserved your anonymity	4.68 (.76)	4.72 (.74)
2. The money you passed to the Charity will be sent to the charity	4.50 (.92)	4.53 (.86)
3. The instructions for the experiment were clear and easy to follow	4.39 (.85)	4.39 (.85)
4. The recipients of donations to the Charity are deserving of support	4.67 (.79)	4.66 (.80)
5. When I took my decisions I understood that only one would be implemented	4.68 (.84)	4.70 (.81)

Means (Standard deviations) are reported
Answers range between 1 (Strongly Disagree) and 5 (Strongly Agree)

Table 2 Summary—donations to charities

	T2		T3 all		T3 donors	
Name of charity	%	Average £	%	Average £	%	Average £
Amnesty International	7.7	2.4	6.6	3.0	5.1	4.9
British Red Cross	5.6	0.5	7.1	4.0	6.3	5.6
Cancer Research UK	32.1	2.1	28.0	4.2	27.0	5.4
Greenpeace UK	5.1	0.9	7.1	4.5	8.2	4.9
Help the Aged	2.6	1.3	3.6	5.6	3.8	6.6
MSF (Doctors Without Borders)	15.3	1.9	14.0	4.4	15.0	5.1
The National Trust	2.6	1.6	1.5	4.7	1.9	4.7
NSPCC[a]	13.8	1.7	15.0	5.3	17.0	5.7
Oxfam GB	7.7	1.4	9.2	4.5	8.9	5.8
RSPCA[b]	6.1	2.8	6.6	2.6	7.0	3.1
No Choice[c]	1.5	1.7	1.0	0.0	0.0	...
Total		1.8		4.2		5.3

"%" indicates the % of partipants choosing the charity; "average £" indicates the average donation. The number of participants in "T2" and "T3 all" is 196, while in "T3 donors" it is 158
[a]NSPCC stands for National Society for the Prevention of Cruelty to Children[b] RSPCA stands for Royal Society for the Prevention of Cruelty to Animals.[c] In T2, 3 participants did not choose any charity, 1 of them passed £5. In T3, 2 participants did not choose, but none passed anything

similar: 70 % of individuals choose exactly the same charity in both treatments (71 % for the whole sample, 68 % for those making a donation in T3). Cancer Research UK is by far the most popular, followed by Doctors without Borders and National Society for the Prevention of Cruelty to Children.[11]

[11] Despite a different list of charities, there are strong similarities with the distribution of choices reported in CG. There the American Cancer Society was the most popular choice (27 %), followed by Doctors without Borders (15 %) and Feed the Children (14 %).

3 Assessing the confounding effect of altruistic feelings toward the experimenter

In their experiment aimed at measuring the magnitude of warm glow giving, CG found that participants donate on average 20 % of their endowment and approximately 57 % of participants make a donation. As underlined by the authors, altruistic motivations toward the experimenter is a potentially confounding factor behind this result. To assess whether this is the case we compare the patterns of giving in T1 and T2. Notice that giving in T1 is potentially due to a mixture of reciprocal motives toward the experimenters, purely altruistic concerns toward the experimenters and warm glow motivation.

Table 3 reports results separately for each of the three positions within the sequence in which T1 and T2 have been taken as well as for the sample as a whole. What is evident in Table 3 and Fig. 1, which presents the frequency of giving in T1 and T2, is the remarkable degree of similarity in giving across the two treatments. The parametric and non-parametric tests reported in Table 3 confirm that there is no statistically significant difference in giving between T1 and T2. Note that this is true when we focus on the between-subject aspect of the design, that is, subjects' choice in the first position, where subjects could not be reacting specifically to contrasts between the three treatments. This suggests that concerns toward the experimenter are a serious confounding factor for the interpretation of giving in T2. It also suggests that an alternative experimental demand effect, subjects expecting that the experimenter wants them to give more when a charity is involved as a recipient, is not operating.

Some anecdotal evidence corroborating this can be derived from the responses to the questionnaire administered at the end of the experiment. We asked par-

Table 3 Comparison of giving T1–T2

	T1			T2			Test (*p* values)		
	Mean	SD	*N*	Mean	SD	*N*	*t* test	WMW	KS
DA	2.57	2.82	68	2.80	3.29	60	0.66	0.80	0.98
DB	1.38	2.21	68	1.62	2.71	71	0.57	0.75	1.00
DC	1.22	2.06	60	1.14	1.90	65	0.82	0.57	0.97
All	1.74	2.46	196	1.82	2.75	196	0.76	0.86	1.00
	T1			T2			Test (*p* values)		
	Proportion	SE	*N*	Proportion	SE	*N*	*z* test	Pearson chi^2	Fisher's exact
Proportion of givers									
DA	0.54	0.06	68	0.55	0.06	60	0.95	0.95	1.00
DB	0.37	0.06	68	0.39	0.06	71	0.75	0.75	0.86
DC	0.43	0.06	60	0.35	0.06	65	0.36	0.36	0.46
All	0.45	0.04	196	0.43	0.04	196	0.68	0.68	0.76

WMW Wilcoxon–Mann–Whitney test, *KS* Kolmogorov–Smirnov test.
DA, DB, and DC are the 1st, 2nd, 3rd position in which a given treatment is undertaken within the sequence of decisions

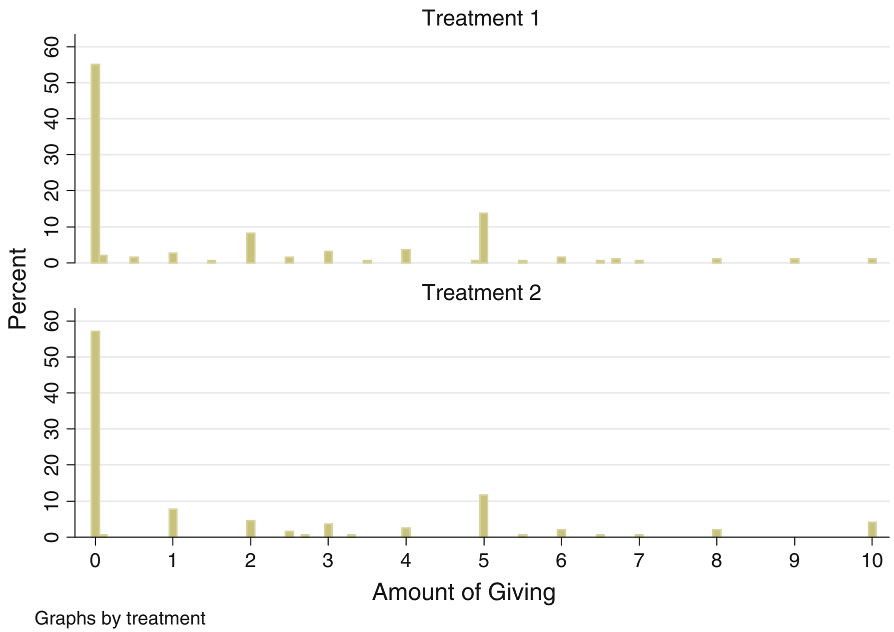

Fig. 1 Comparison of giving in T1 and T2

ticipants open-ended questions about their motives for giving in each of the treatments. One participant motivated the decision to give £5 in T2 by saying " I felt that asking for all of £10 would cost experimenters and therefore the university too much (£20 in total)." Another one giving £4 in T2 wrote " I wanted to help the uni save some money, they spent enough for these experiments." These examples suggest that indeed motivation other than warm glow is present in T2.

To summarize, giving in T2 represents an upper bound on warm glow giving, as additional reasons for giving may be present. Therefore, the fact that people give in T2 cannot be taken as evidence of warm glow motivation in charitable giving. In what follows, we provide a novel test of warm glow giving that is not based on crowding out.

4 A test of warm glow giving

4.1 Preliminaries

To illustrate the reasoning behind our test of warm glow motivation consider an individual who is endowed with wealth w and can allocate this between consumption of a private good, x, and a contribution to a public good, g, so that $x + g = w$. This individual faces the same sequence of decisions as in our experimental design. We will refer to the three positions in the sequence as DA, DB, and DC. Suppose that we are in an environment in which people are motivated solely by pure altruism, so that preferences for a single- allocation decision are represented by the following utility function

$$U(x, g) = c(x) + \phi(g + \bar{g}), \tag{1}$$

where the purely altruistic component of the utility function depends on the total amount of public good provided, given by the sum of own contribution, g, and contributions by others, $\bar{g}$. Both $c(\cdot)$ and $\phi(\cdot)$ are concave functions. In what follows, we study the decision of how much to contribute in a given treatment in each of the three positions in the sequence. A purely altruistic individual chooses his contribution when a given treatment is the last decision by solving the following maximization problem, where we replaced x by using the budget constraint:

$$\max_{g_{DC}} \frac{1}{3} \left[c(w - g_{DC}) + \phi(g_{DC} + \bar{g}_{DC})\right].$$

This gives the f.o.c.[12]

$$c'(w - g_{DC}) = \phi'(g_{DC} + \bar{g}_{DC}). \tag{2}$$

When facing the very same treatment as the second choice, an individual motivated solely by pure altruism maximizes

$$\max_{g_{DB}} \frac{1}{3} \left[c(w - g_{DB}) + \phi(g_{DB} + \bar{g}_{DB})\right] + V_{DB},$$

where V_{DB} is the continuation value. This clearly does not depend on g_{DB}, as a purely altruistic individual only cares about final allocations and only one of the three choices will be randomly selected to be implemented. So, the f.o.c. is

$$c'(w - g_{DB}) = \phi'(g_{DB} + \bar{g}_{DB}). \tag{3}$$

Finally, an individual facing the same treatment in the first period maximizes

$$\max_{g_{DA}} \frac{1}{3} \left[c(w - g_{DA}) + \phi(g_{DA} + \bar{g}_{DA})\right] + V_{DA},$$

where, as above, V_{DA} is the continuation value and does not depend on g_{DA}. The f.o.c. is

$$c'(w - g_{DA}) = \phi'(g_{DA} + \bar{g}_{DA}). \tag{4}$$

By comparing (2), (3), and (4), it is evident that for somebody motivated solely by pure altruism, whether a given treatment is the first, the second, or the last in the sequence

[12] For expositional simplicity we focus here on interior solutions.

is immaterial. Notice that this is true even if the purely altruistic component of utility is different in the three treatments. Indeed, there is no reason to believe that £5 given to the experimenters have the same utility value as £5 given to a charity. So, we can formulate the following proposition

Proposition 1 *If giving is motivated solely by purely altruistic motivation, then the donation in a given treatment is the same regardless of the position in which the treatment is undertaken.*

This, however, may not be the case if there is also a warm glow component in the utility function. In particular, the components of utility concerning own consumption and pure altruism are by definition enjoyed only if a decision is implemented, as they depend on the actual allocation of resources. So, whether I give £5 or £1 in T3 does not matter from a purely altruistic perspective as far as that decision is not implemented, because the charity will not receive anything anyway and, therefore, the amount of public good is unchanged, as is, of course, private consumption. The warm glow component (or at least part of it) may however be enjoyed regardless of whether the decision will be carried out or not, because, for instance, the individual benefits from upholding the self-image or identity of being a kind person. For instance, if I give £5 to a charity in T3, I may feel more generous compared to the case in which I give £1 in the same treatment, even if the decision is actually not implemented. After all, I demonstrated that I was willing to give a considerable amount and it was not my decision but Nature's decision not to implement that allocation.

So, even though only one of the three decisions will be implemented, the three allocation decisions may be interrelated when there is a warm glow component in preferences. In particular, warm glow felt in each period may depend not only on the donation in that period but also on the donations in the previous periods. In the self-signaling example mentioned above this would capture the notion that the evaluation of own type in a given period does not depend only on the action in that period but also on actions in previous periods. If the warm glow component in the utility function is concave, this implies a reduction in the marginal utility of giving arising from warm glow in decisions that come later in the sequence. For instance, when deciding how much to give in a particular treatment an additional pound may provide quite a strong additional utility in terms of self-image if the decision is the first in the sequence. However, if the same decision is the third in the sequence and I have, for example, already given a considerable amount in the first two decisions, then I may not need to prove much further to myself that I am a generous type and, therefore, the marginal utility of donating a pound will be lower. This " satiation" in warm glow giving leads to a declining trend in donations. This intuition is formalized in Appendix 1. In what follows, we investigate whether such a trend is apparent in our experimental data.

4.2 Results

Recall that in our experiment we randomized the order in which we presented the subjects with the three allocation decisions. Here, we examine whether aver-

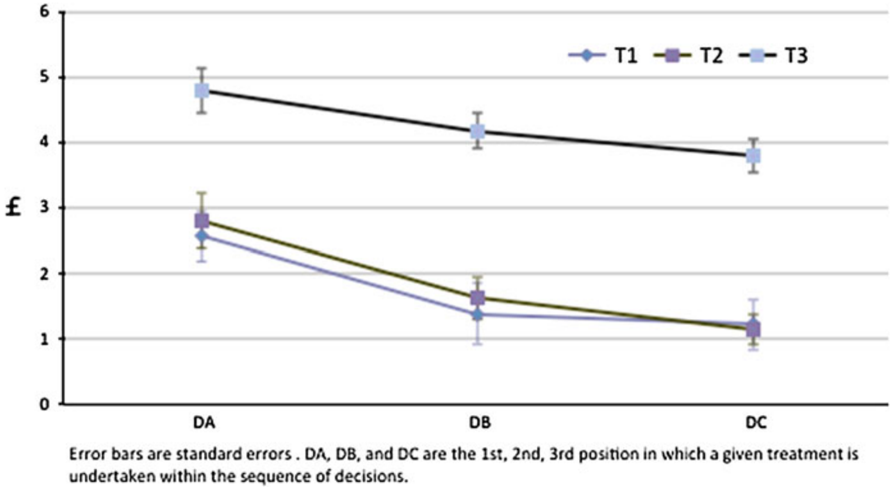

Fig. 2 Trends in giving

age giving in each treatment differs across the three positions. As Fig. 2 shows, a decline in donations is evident for all treatments. The decline is more pronounced between the first (DA) and second decision (DB) than between the second and third (DC) decision. The decline is also more pronounced for T1 and T2 than for T3. This picture is confirmed when we perform tests of differences in giving using both a t-test and non-parametric tests that are reported in Table 4. The significant difference between the first and the last decision, and the Jonckheere-Terpstra test support the presence of an overall trend. The second and the third decisions do not differ in a statistically significant way, while in the case of T3 the difference between the first and second decisions is only marginally significant.[13]

We have argued above that a decline in donations can be attributed to satiation of warm glow motivation and is not related to purely altruistic motivation as the latter operates only if a treatment is implemented. This implies that we can use the drop in giving across decisions to provide a lower bound for warm glow motivation in each treatment. Thus, in the case of T2 the drop in donation between the first and the last decision suggests that at least £1.66 out of the £2.80 that are given in the first occasion are due to warm glow (59 %). The figure is smaller in the case of T1 (£1.34, 52 %) and even smaller for T3 (£0.99, 21 %).[14]

An alternative explanation for the decline in giving that we observe could be that subjects' decision to give in later stages of the experiment is influenced by the gradual

13 Reinstein (2010) also finds an overall negative trend in giving over time. In his design one out of six decisions is randomly selected for implementation.

14 This does not imply that warm glow motivation is smaller in T3 than in T2 and T1, but that the experimental design allows us to find a " more binding" lower bound for T1 and T2 than for T3. The reason behind this is that T3 in DB and DC is preceded by T1 and T2, where donations are relatively small, while T1 and T2 are preceded also by T3, where donations are much higher, thus, the warm glow is more satiated.

Table 4 Trends in giving

	T1			T2			T3		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
DA	2.57	2.82	68	2.80	3.29	60	4.79	3.18	68
DB	1.38	2.21	68	1.62	2.71	71	4.17	3.54	57
DC	1.22	2.06	60	1.14	1.90	65	3.80	3.31	71
DC–DA	−1.34			−1.66			−0.99		
(DC–DA)/DA	−52 %			−59 %			−21 %		
Pairwise test	*t* test	WMW	KS	*t* test	WMW	KS	*t* test	WMW	KS
DA vs DB	0.004	0.005	0.009	0.013	0.014	0.007	0.151	0.086	0.085
DB vs DC	0.341	0.411	0.339	0.122	0.262	0.364	0.271	0.336	0.358
DA vs DC	0.001	0.008	0.001	0.000	0.002	0.006	0.037	0.033	0.081
	Jonckheere–Terpstra			Jonckheere–Terpstra			Jonckheere–Terpstra		
Overall trend	0.007			0.002			0.032		

One-sided exact pvalues are reported for the tests. For the Jonckheere-Terpstra test for T3 the pvalue is asymptotic

WMW stands for Wilcoxon-Mann-Whitney test. KS stands for Kolmogorov-Smirnov test.

DA, DB, and DC are the 1st, 2nd, and 3rd position in which a given treatment is undertaken within the sequence of decisions

acquisition of information regarding the relative worthiness of the recipients. For instance, it is likely that subjects consider the experimenters a less worthy cause as compared to charities. If this is true, then a subject may be less inclined to give to the experimenters at a later stage of the experiment when it has been revealed to them that charities are also potential recipients. This may account for the decline in giving for T1. However, such an explanation does not account for why giving in T2 and T3 is also declining, as, if anything, we would expect giving to charities to increase in later stages when it is revealed that the experimenters are the alternative but less worthy recipients.

4.3 Discussion

Experimental designs in which subjects are exposed to different treatments and in which only one of the treatments is randomly selected to be implemented are very common. These random-lottery incentive (RLI) schemes are convenient in that they allow for within-subject analysis. The commonly held assumption is that, provided individuals are expected utility maximizers, these incentive schemes allow to observe, for each treatment, the same response as if the treatment would have been the only one a subject faced (see Bardsley et al. 2010, pp. 264–284 for an extensive discussion and Cubitt et al. 1998). What we show here is that if the treatments elicit some components of the utility function that are not conditional on implementation, in our case the warm glow of giving, then responses incentivized under a RLI scheme will not be the same as responses to each treatment taken in isolation, even if individuals are expected utility maximizers. The declining trend in donations analyzed above provides evidence of this cross-treatment spillover. This may happen in other contexts and it should be taken into account to avoid confounding it with other behavioral traits. For instance, in many repeated public goods experiments we observe declining contributions over time, and this has been attributed to strategic and learning effects (Ledyard 1995). However, if warm glow is part of the motivation behind contributions, then at least part of the declining trend could be due to the satiation highlighted here.

The use of RLI schemes has also implications from a measurement perspective. In the context of the current experiment, it is worth noticing that the amount of giving due to warm glow in DA is not equivalent to the amount of warm glow giving that would have been observed if this were the only decision a subject had to make. The reason is that the cost of giving in a given decision, i.e., the foregone utility deriving from private consumption, is paid only if that decision is actually implemented and thus it is multiplied by the probability of implementation, while the part of the benefit of giving that is not conditional on implementation, namely the warm glow component of the utility function, is enjoyed regardless of implementation. Due to this, warm glow observed in a design with RLI should be greater than warm glow in a design where the decision is implemented for sure. Also, notice that this feature does not depend on the other components of the experiment being related to giving at all.[15] On the other hand, the amount of giving due to pure altruism is not affected by the probabilistic implementation. Thus, purely altruistic giving elicited in this experiment corresponds to the one that would have been observed if this were the only decision a subject had to make.

5 Quantifying the intrinsic motivations for giving

5.1 A lower bound estimate of warm glow giving

Our experimental design allows us to determine for which subjects the amount of giving in T2 does not represent a clean measure of warm glow. We can also impute a value of warm glow for these subjects using the amount of giving of subjects for whom we do have a better measure. Specifically, of the 84 subjects who give something in T2, 24 do not give any money in T1. These subjects do not display any altruistic feelings toward the experimenters, therefore, giving in T2 represents a good measure of their warm glow. With a slight abuse of terminology, we will refer to these participants as “ unreciprocals”. We are then left with 60 subjects for whom giving in T2 may be confounded by reciprocity or purely altruistic feelings toward the experimenter. We will refer to these participants, giving positively in both T1 and T2, as “ reciprocals”. Note that subtracting giving in T1 from giving in T2 is not a good way to measure warm glow for the reciprocals. That would not only remove the components of donations

15 An additional reason for the non-equivalence between giving in DA and giving in a single decision is that a participant may take into account the effect that giving in DA will have on giving in subsequent decisions.

Table 5 Comparison of reciprocals and unreciprocals

		All	DA	DB	DC
Giving in T1					
Unreciprocals	Mean	0.00	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00
	N	24	7	8	9
Reciprocals	Mean	3.91	5.12	3.33	2.67
	SD	2.38	2.18	1.88	2.50
	N	60	25	20	15
Giving in T2					
Unreciprocals	Mean	3.38	4.04	3.14	2.12
	SD	3.19	3.47	3.34	2.33
	N	24	12	7	5
Reciprocals	Mean	4.61	5.70	4.43	3.54
	SD	2.42	2.22	2.77	1.66
	N	60	21	21	18
Giving in T3					
Unreciprocals	Mean	3.33	4.80	3.28	2.65
	SD	3.44	3.70	3.95	2.94
	N	24	5	9	10
Reciprocals	Mean	5.56	5.43	5.99	5.31
	SD	2.92	3.11	2.91	2.90
	N	60	14	19	27

DA, DB, and DC are the 1st, 2nd, 3rd position in which a given treatment is undertaken within the sequence of decisions

Table 6 Warm glow

	DA	DB	DC	All
Upper bound	2.80	1.62	1.14	1.82
SE	0.42	0.32	0.24	0.20
Lower bound	2.22	1.24	0.75	1.38
SE	0.64	0.56	0.41	0.32
N	60	71	65	196

DA, DB, and DC are the 1st, 2nd, 3rd position within the sequence of decisions.

in T2 due to reciprocity and pure altruism toward the experimenter, but it would also remove the component of donation in T1 that is due to warm glow. The declining trend for T1 documented in the previous section suggests that warm glow giving is indeed present also in T1.

The next step is to use giving in T2 by unreciprocals to impute the unobserved warm glow giving by reciprocals and then calculate an average giving due to warm glow for the whole sample. The results of this procedure are reported for each decision separately in Table 6. In particular, we estimate mean giving and the associated standard errors reported in Table 6 by running for each position in the sequence a weighted OLS regression of giving in T2 on a constant. The weight for subjects giving nothing in T2

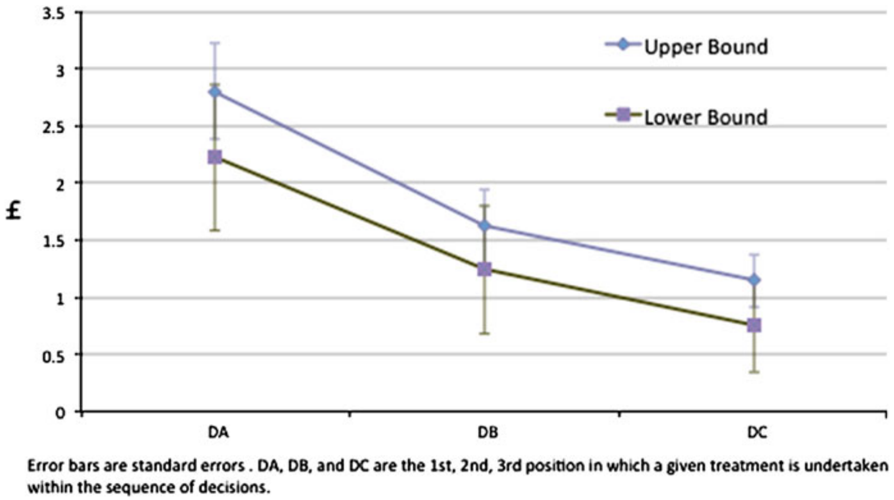

Fig. 3 Upper and lower bounds of warm glow motivation for giving

is 1, the weight for reciprocals is 0 and the weight for unreciprocals is 1+(number of reciprocal givers/number of unreciprocal givers). Average giving due to warm glow is £2.22 in DA and £1.38 for the sample as a whole. We consider this to be a lower bound estimate of warm glow because it is based on the subgroup of givers, the unreciprocals and those who do not give anything, who are on average less generous. To see this note that average giving in T2 and T3 for unreciprocals is lower than for reciprocals (see Table 5). Thus, the assumption we make to identify a lower bound for warm glow giving is that reciprocals' warm glow motive is at least as big as for unreciprocals.[16] In Appendix 2, we provide a more formal characterization of the identification region, drawing on Manski (2007).

To summarize, we are able to bound the extent of warm glow giving both from above and from below (see Fig. 3; Table 6). In the first decision, for instance, the lower bound is 22 % of endowment, while the upper bound is 28 %.

5.2 Measuring pure altruism

Under the assumption that giving in T3 is driven by a combination of warm glow and pure altruism, we next work out a range of giving due to pure altruism by subtracting from average giving in T3 the estimates for warm glow giving derived above. For DA average giving in T3 is 48 %, therefore, the lower bound for pure altruism is 20 % of

[16] One may argue that incentives for reciprocation could be stronger in T2 than in T1. This feeling could be driven by the fact that in T2 the experimenters have acted pro-socially by offering to pay £10 to a charity in the status quo. However, if such an effect is present, it is of second order importance. To see this, note that a subject who is not altruistic would not derive any additional utility from the donation made by the experimenters and therefore would not have any reason to reciprocate. Any reciprocity is thus mediated through the increase in utility due to altruistic feelings. Considering that subject we label as "unreciprocals" do not reciprocate a £10 direct gift, the impact of an additional £10 indirect gift is likely to be negligible.

endowment and the upper bound is 26 % of endowment. Thus, in the first decision the amounts donated due to pure altruism and to warm glow are roughly equivalent. The relative importance of pure altruism should increase in subsequent decisions, as warm glow is fading away, while the expectation is that the purely altruistic component should remain constant across decisions.

Notice, however, that measuring pure altruism by subtracting giving in T2 from T3 is not possible for subsequent positions in the decision sequence. This is because warm glow giving embedded in T2 when T2 is, for instance, the last decision is different from warm glow giving embedded in T3, when T3 is the last decision. To see why, notice that average giving before T2 when T2 is the last decision (i.e., the sum of giving in T1 and T3) is £6.13, while average giving before T3 when T3 is the last decision (i.e., the sum of giving in T1 and T2) is only £4.66. Thus, the warm glow component of the utility function should be more " satisfied" in the former case than in the latter and thus subtracting the estimated warm glow from T3 in the second or last position would overstate the actual degree of pure altruism.

6 Concluding remarks

This paper is concerned with detecting and quantifying the two intrinsic motivations for giving: warm glow and pure altruism. From a quantitative perspective, our experimental design allows us to decompose giving into its two components. In particular, we find that in the first-allocation decision, giving due to warm glow and giving due to pure altruism are roughly equivalent. While the precise relative strengths of the two components found in our experiment may not generalize to other settings, our results indicate that warm glow motivation in charitable giving is non- negligible and, therefore, that the model of impure altruism developed by Andreoni (1990) is relevant when thinking about charitable giving.

How do these measures compare to those in a one-shot situation? We would expect warm glow to be lower in a one-shot situation. This is because, as argued above, in a design with probabilistic implementation the amount donated due to warm glow motivation depends on the probability of implementation as the cost of giving is contingent on implementation, while the enjoyment due to warm glow is not necessarily so. In particular, the lower the probability of a given decision being actually implemented, the higher should be the magnitude of warm glow. This may explain why in the one-shot experiment of CG they find an upper bound of warm glow that is 20 % of endowment while we find it to be 28 % for the first decision. On the other hand, our measure of giving due to pure altruism (20– 26 % of endowment) does not depend on the probability of implementation and, therefore, should correspond to the one-shot case.

From a methodological viewpoint, our finding of a decreasing trend in giving prompts a cautionary note on the use of random-lottery incentive (RLI) schemes. If an experimental treatment elicits some components of preferences that are not conditional on implementation, in our case the warm glow benefits of giving, then behavior under a RLI scheme will not be the same as behavior induced by the same treatment when taken in isolation, even if individuals are expected utility maximizers. An important avenue for future research would be to assess how important this concern may be for the interpretation of findings of experimental studies that have used this scheme to measure social preferences, for instance, by running multiple-round public good games.

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Appendix 1

Here, we add to (1) a warm glow component represented by the concave function $\gamma(\cdot)$. This captures the enjoyment the agent receives when contributing. Thus, preferences for a single allocation decision are represented by the following utility function:

$$U(x, g) = c(x) + \gamma(g) + \phi(g + \bar{g}). \tag{5}$$

In what follows, we study the decision of how much to contribute in a given treatment when this is faced in each of the three positions in the sequence. To simplify the exposition, we will look at treatment 1 (T1) and indicate the donations in the three positions as g_{T1}^{DA}, g_{T1}^{DB}, and g_{T1}^{DC}. When T1 is the last decision, an individual chooses his contribution by solving the following maximization problem, where we replaced x using the budget constraint:

$$\max_{g_{T1}^{DC}} \gamma\left(g_{T1}^{DC} + \lambda g_{T2} + \rho g_{T3}\right) + \frac{1}{3}\left[c\left(w - g_{T1}^{DC}\right) + \phi\left(g_{T1}^{DC} + \bar{g}_{T1}^{DC}\right)\right]. \tag{6}$$

This characterization of the utility function captures the two properties of warm glow discussed in Sect. 4.1, namely that the warm glow component of utility is enjoyed even if a given allocation is not implemented and that, as a result, warm glow felt in each period may depend not only on the donation in that period but also on the donations in the previous periods. These two notions are captured by the fact that $\gamma(\cdot)$ is not multiplied by the probability of being implemented and that its argument is a weighted sum of the donation in the current treatment and donations in the previous two treatments, indicated as g_{T2} and g_{T3}, with the weights given by $\lambda \geq 0$ and $\rho \geq 0$. We thus allow each treatment to have a different weight in the warm glow component of the utility function. After all, if I give £5 to a charity I may feel more generous than if I give £5 to the experimenters. Notice that the weights are specific to each treatment and not to a particular position in the sequence. Notice also that if warm glow does not accumulate, i.e., if $\lambda = 0$ and $\rho = 0$, then Proposition 1 holds and we would expect donations in a given treatment to be the same regardless of the position in which the treatment is undertaken.

The f.o.c. is then given by

$$\gamma'\left(g_{T1}^{DC} + \lambda g_{T2} + \rho g_{T3}\right) = \frac{1}{3}\left[c'\left(w - g_{T1}^{DC}\right) - \phi'\left(g_{T1}^{DC} + \bar{g}_{T1}^{DC}\right)\right]. \tag{7}$$

When facing the same treatment as the second choice, the maximization problem is given by

$$\max_{g_{T1}^{DB}} \gamma\left(g_{T1}^{DB}+\lambda g_{T2}\right)+\frac{1}{3}\left[c\left(w-g_{T1}^{DB}\right)+\phi\left(g_{T1}^{DB}+\bar{g}_{T1}^{DB}\right)\right]+V_{DB}, \tag{8}$$

where V_{DB} is the continuation value and, without loss of generality, we assume that T2 was the first decision in the sequence, so that λg_{T2} appears in the warm glow function. Different from the case of a purely altruistic individual discussed in Sect. 4.1, now the continuation value does depend on g_{T1}^{DB}, as the donation in this period has an impact on the warm glow component in the following period. If the individual does not take this fact into account, than the f.o.c. is

$$\gamma'\left(g_{T1}^{DB}+\lambda g_{T2}\right)=\frac{1}{3}\left[c'\left(w-g_{T1}^{DB}\right)-\phi'\left(g_{T1}^{DB}+\bar{g}_{T1}^{DB}\right)\right]. \tag{9}$$

Comparing (7) and (9), it follows immediately from the concavity of $\gamma(\cdot)$ that, as far as $\rho g_{T3}>0$, then the optimal donation in T1 is greater when T1 is undertaken in the second position in the sequence, than when it is undertaken in the third position in the sequence, so $g_{T1}^{DB}>g_{T1}^{DC}$.

If the individual takes into account the impact of a given donation on subsequent choices, then the f.o.c. is

$$\begin{aligned}&\gamma'\left(g_{T1}^{DB}+\lambda g_{T2}\right)+E_{DB}\gamma'\left(g_{T1}^{DB}+\lambda g_{T2}+\rho g_{T3}\right)\\&=\frac{1}{3}\left[c'\left(w-g_{T1}^{DB}\right)-\phi'\left(g_{T1}^{DB}+\bar{g}_{T1}^{DB}\right)\right],\end{aligned} \tag{10}$$

where E_{DB} indicates expectations when in position DB, as donation in the third period, when T3 will be undertaken, is unknown. Because of the envelope theorem, we do not need to take into account the impact of g_{T1}^{DB} on g_{T3}. Notice that compared to (9), in (10) there is an additional marginal benefit of a donation. So, also when the impact of a given donation on subsequent choices is taken into account, the optimal donation in T1 is greater when T1 is undertaken in the second position in the sequence, than when it is undertaken in the third position in the sequence, i.e., $g_{T1}^{DB}>g_{T1}^{DC}$.

Now, we look at the decision in the first position. An individual facing T1 in the first period maximizes

$$\max_{g_{T1}^{DA}} \gamma\left(g_{T1}^{DA}\right)+\frac{1}{3}\left[c\left(w-g_{T1}^{DA}\right)+\phi\left(g_{T1}^{DA}+\bar{g}_{T1}^{DA}\right)\right]+V_{DA}, \tag{11}$$

when the individual does not take the impact of the current choice on subsequent choices into account, the f.o.c. is

$$\gamma'\left(g_{T1}^{DA}\right)=\frac{1}{3}\left[c'\left(w-g_{T1}^{DA}\right)-\phi'\left(g_{T1}^{DA}+\bar{g}_{T1}^{DA}\right)\right]. \tag{12}$$

By comparing (12) to (9), it is evident that as far as $\lambda g_{T2} > 0$, then the donation in T1 when undertaken in the second position is less than the donation in T1 when undertaken in the first position, thus $g_{T1}^{DA} > g_{T1}^{DB}$. By comparing (12) to (7), it is also evident that $g_{T1}^{DA} > g_{T1}^{DC}$.

When the individual does take into account the impact of the current choice on subsequent choices, the f.o.c. is

$$\gamma'\left(g_{T1}^{DA}\right) + E_{DA}\gamma'\left(g_{T1}^{DA} + \lambda g_{T2}\right) + E_{DA}\gamma'\left(g_{T1}^{DA} + \lambda g_{T2} + \rho g_{T3}\right)$$
$$= \frac{1}{3}\left[c'\left(w - g_{T1}^{DA}\right) - \phi'\left(g_{T1}^{DA} + \bar{g}_{T1}^{DA}\right)\right]. \quad (13)$$

Without loss of generality, we assume that T2 is the second decision in the sequence and T3 is the last one. By comparing (13) to (7), it is evident that even when the individual does take into account the impact of the current choice on subsequent choices $g_{T1}^{DA} > g_{T1}^{DC}$. The comparison with (10) is more complex, as the expectation operator refers to two different positions in the sequence. However, as it is clearly the case that $\gamma'(g_{T1}) > \gamma'(g_{T1} + \lambda g_{T2})$, then it follows that $g_{T1}^{DA} > g_{T1}^{DB}$ if $E_{DA}\gamma'\left(g_{T1}^{DA} + \lambda g_{T2}\right) + E_{DA}\gamma'\left(g_{T1}^{DA} + \lambda g_{T2} + \rho g_{T3}\right) > E_{DB}\gamma'\left(g_{T1}^{DB} + \lambda g_{T2} + \rho g_{T3}\right)$.

Thus, we have shown how a declining trend in donation arises if giving is motivated by warm glow and the warm glow felt in each period depends not only on the donation in that period but also on the donations in the previous periods. Notice that, as in Sect. 4.1, the above analysis holds even if the purely altruistic component of utility, $\phi(\cdot)$, is different in the three treatments.

Appendix 2

This section draws on Manski (2007). Indicate donation in T2 as g_2, while donation due to warm glow giving is g_w. There are three exhaustive and mutually exclusive groups in our population, identified by the variable z: non-givers in T2 ($z = 1$), unreciprocals ($z = 2$), and reciprocals ($z = 3$). We are interested in mean donation due to warm glow motives, i.e., $E[g_w]$. By the Law of Iterated Expectations

$$E[g_w] = E[g_w|z=1]\,P(z=1) + E[g_w|z=2]\,P(z=2) + E[g_w|z=3]\,P(z=3),$$

where $P(z = i)$ is the probability that z equals $i = 1, 2, 3$. The sampling process asymptotically reveals $P(z)$ and $E[g_w|z = i]$ for $i = 1, 2$, as in this case $E[g_w|z = i] = E[g_2|z = i]$. However, $E[g_w|z = 3]$ is not revealed. Our identifying assumptions are

$$E[g_w|z = 3] \le E[g_2|z = 3]$$
$$E[g_w|z = 2] \le E[g_w|z = 3].$$

Hence, the identification region for $E[g_w]$, indicated as $H\{E[g_w]\}$, is given by

$$H\{E[g_w]\} = [E[g_2|z=1]\,P(z=1) + E[g_2|z=2]\,[P(z=2)+P(z=3)]\,,\,E[g_2]]\,.$$

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