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 the two intrinsic motivations for giving: warm glow and pure altruism. In particular, we implemented a within-subject experimental design with three treatments: (i) one, T1, where the recipient is the experimenters, which measures altruistic feelings towards the experimenters, (ii) the Crumpler and Grossman (2008) design, T2, in which the recipient is a charity, and the dictator's donation crowds out one-for-one a donation by the experimenters, which aims at measuring warm glow giving, (iii) a third one, T3, with a charity recipient and no crowding out, which elicits both types of altruism. We use T1 to assess to what extent altruistic feelings towards the experimenters are a potential confound for measuring warm glow in T2. We find giving in T1 not to be significantly different from T2, suggesting that the Crumpler and Grossman design provides an upper bound estimate of warm glow giving. We provide a lower bound estimate based on the behavior of subjects whose warm glow giving in T2 is not confounded, that is, those who do not display altruistic feelings towards the experimenters in T1. We use these two estimates to quantify the portion of giving in T3 due to pure altruism and find it to be between 20% and 26% of endowment. We also 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.

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 highlighted that warm glow encompasses the signaling benefits of altruistic actions, including concerns for self image, social image and esteem (Glazer and Konrad, 1996, Benabou and Tirole, 2006, Ellingsen and Johannesson, 2008, Andreoni and Bernheim, 2009).

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 in order 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, 2009) 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.

This paper makes two contributions to the literature that is concerned with understanding and measuring the motives for charitable giving. First, we propose a novel test for detecting warm glow giving that is not based on crowding out. 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. We design an experiment in which participants are asked to make a series of dictator allocation decisions, being aware that at the end of the experiment only one of the decisions will be selected at random to determine payoffs. If the warm

[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.

glow of acting generously derives, for instance, from the benefit of self-signalling, as in Benabou and Tirole (2006), then the fact that the donation may not be implemented does not erase the signalling 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 the decision 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.

Our second contribution is to provide clean measures of warm glow and pure altruism as motives that drive charitable giving. To this end, we build upon the experimental test of warm glow giving developed by Crumpler and Grossman (2008) [CG henceforth]. They implemented a modified dictator game in which dictators could choose the recipient from a list of charities. 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." (pg. 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. Besides replicating the warm glow treatment of CG (we refer to it as T2), we introduced a condition in which the recipient is the experimenter. In this treatment, subjects may decide to share some of the endowment with the experimenter either because of purely altruistic or warm glow feelings toward him 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).[2] 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 the warm glow treatment 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, this condition (we refer to it as T1) allows us to identify those subjects who may have altruistic feelings toward the experimenters that CG refer to in the quote. Measuring the extent of altruism toward the experimenter is of interest not only in the experimental design developed by CG, but more generally in all designs in which a subject's action has an impact on the total amount that is paid by the experimenter (Harisson and Johnson, 2006).

We find that a sizeable share of subjects is indeed of this type and that average giving in T1 is no different than giving in T2, suggesting that the abovementioned confounding effect is potentially serious. Consequently, giving in the CG treatment provides an upper bound estimate of warm glow. 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 this treatment in the first decision we estimate a lower bound of 22% and an upper bound of 28% of endowment.

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. We then use the bounds of warm glow giving described above to quantify giving due to purely altruistic motivation. We find that in our experiment pure altruism accounts for a donation in the range of 20% and 26% of endowment.[3]

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

[2] Konow (2010) refers to the pure altruism and warm glow motives as unconditional altruism, whereas altruistic motives that are based on social norms, such as reciprocity, are classified as conditional altruism.

[3] Related papers that have been concerned with decomposing altruistic behavior into warm glow and pure altruism are Palfrey and Prisbey (1997) and Goeree et al. (2002) who do so in the context of modified public goods games, and Tonin and Vlassopoulos (2009) who focus on effort donated in a workplace setting.

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 Appendix). 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. 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 that after all decisions are made the monitor will randomly select one of the three decision sheets and use only that 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 hour.

[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 which is not the focus of this paper. They were given an opportunity to receive £10 instead of having the selected decision implemented. This option was not announced beforehand.

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 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.
- 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.

The order in which the three conditions were presented varied session by session. In total, 13 sessions were conducted, so 5 out of 6 unique orders were implemented twice and one was implemented three times.[8]

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, 68 provided the correct answers 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.[9] 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.[10] The number of participants

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

[8] Subjects underwent the three conditions in a randomized order with complete counterbalancing. This required 3!=6 unique orders.

[9] Of the 68 participants providing the correct answer regarding the amount the charity receives, all but 5 answer correctly the questions about the personal payment, while making a mistake regarding the experimenter contribution to the charity. Of these, 15 participants indicate that the experimenter will pay the charity £10. The others indicate that the experimenter will pay 4 instead of 6 or vice versa in at least one question.

[10] 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.

answering correctly to questions regarding T1 and T3 and at least understanding crowding out for T2 is 196 (82% of the original sample).[11]

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 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.[12]

3 A Test of Warm Glow Giving

3.1 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 $x + g = w$. Preferences are represented, as in Konow (2010), by the following utility function:

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

where G is a public good the individual cares about and is given by the sum of his own contribution, g, and contributions by others, $\bar{g}$, so that $G = g + \bar{g}$. The utility function in (1) embeds both a concern for own consumption as well as the two types of altruism that are of interest here. Warm

[11] 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 an hypothetical allocation. They find that 76% answer the questions correctly.

[12] 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%).

glow is captured by the concave function, $\gamma(\cdot)$, which represents the enjoyment the agent receives when contributing. Pure altruism is captured by the last term in the utility function, the concave function $\phi(\cdot)$, which implies that the agent is concerned about the total quantity of a public good, G, that is provided. We assume that all functions are continuous and differentiable.

Suppose that the individual is an expected utility maximizer and decides how to allocate w two consecutive times, knowing that at the end only one of the two allocations will be selected at random to be implemented. Each allocation has equal probability to be selected. Note that the components of utility concerning own consumption and pure altruism are enjoyed only if a decision is implemented, as they depend on the implied allocation of resources. However, the warm glow component (or at least part of it) may 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. Moreover, warm glow felt in each period may depend not only on the donation in that period, but also on (a fraction of) the donation in the previous period. 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. Thus, from the decision-maker's perspective the two allocation decisions are interrelated, as far as the warm glow component of preferences is concerned, even though he knows that only one will be implemented.

Consequently, utility in the first period is given by

$$U_1 = \gamma(g_1) + \frac{1}{2}\left[c(x_1) + \phi(G_1)\right], \tag{2}$$

while utility in the second period is given by

$$U_2 = \gamma(g_2 + \lambda g_1) + \frac{1}{2}\left[c(x_2) + \phi(G_2)\right], \tag{3}$$

where $\lambda \in [0, 1]$, $G_i = g_i + \bar{g}_i$, $i = 1, 2$. We will assume that $\bar{g}_1 = \bar{g}_2 = \bar{g}$.

It follows directly that if there is no warm glow component in the utility function, i.e. if $\gamma(\cdot) \equiv 0$, then the decision in period 1 does not have an impact on utility in period 2 and, given that the individual is facing an identical problem in each period, we expect that $g_1^* = g_2^*$. So, if the individual is solely a pure altruist, then the period in which the decision is taken does not matter for his donation, as each decision is essentially treated as if it were the only decision made. However, if there is a warm glow component in the preferences and the impact of donating is lasting, then a donation made in the first period reduces the marginal utility of giving in the second period, so we expect that $g_1^* > g_2^*$.[13] This "temporary satiation" in warm glow giving should lead to a declining trend in donations.[14] In what follows, we investigate whether such a trend is apparent in our experimental data.

3.2 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 average giving in each treatment differs across the three positions, (we refer to them as DA, DB and DC). As figure 1 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 3. The significant difference between the first decision and the last 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.

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%).[15]

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 acquisition of information regarding the relative worthiness of the recipients. For instance, it is likely that subjects consider

[13] If the individual takes into account the impact of giving in a given period on decisions in later periods, then the problem is more complex. We show in Appendix A that for λ small enough it is still the case that $g_1^* > g_2^*$.

[14] Given that, as mentioned in the introduction, warm glow encompasses the self-signaling benefits of altruistic actions, it is worth mentioning here the paper by Kaya (2009). She studies repeated signaling games in which the informed player's type is persistent and the history of actions is perfectly observable. She then characterizes the least costly separating equilibria and shows under which conditions signaling takes place only in the first period, an extreme case of the declining trend discussed here.

[15] 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.

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.

3.3 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 that individuals are expected utility maximizers and in the absence of other confounding factors, 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 "temporary 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 how the amount of giving due to warm glow in DA is not equivalent to the amount of warm glow giving that would be observed if this were the only decision a subject had to make. The reason is immediately evident when looking at (2) and (3): 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.[16] 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 be observed if this were the only decision a subject had to make.

4 Quantifying the Intrinsic Motivations for Giving

4.1 Assessing the Confounding Effect of Altruistic Feelings toward the Experimenter

In their experiment aimed at measuring the magnitude of warm glow giving, CG find that participants donate on average 20% of their endowment and that approximately 57% of participants make a donation. As underlined by the authors, altruistic motivation 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.

In light of the evidence of declining trends in giving presented above, table 4 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 4 and figure 2, 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 nonparametric tests reported in table 4 confirm that there is no statistically significant difference in giving between T1 and T2. This suggests that concerns towards the experimenter are potentially a serious confounding factor for the interpretation of giving in T2.

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

[16] 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.

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. In what follows we use information on the behavior in T1 to provide a lower bound. In Appendix B we provide a more formal characterization of the identification region, drawing on Manski (2007).

4.2 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 and to impute a value for them using the amount of giving by subjects for whom we do have a good 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 clean 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".[17]

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.[18] 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).

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

[17] Note that subtracting giving in T1 from giving in T2 is not a good way to measure warm glow for the reciprocals. That would remove the components of donations 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.

[18] In particular, we estimate mean giving and the associated standard errors reported in table 6 by running a weighted OLS regression of giving in T2 on a constant. The weight for subjects giving nothing in T2 is 1, the weight for reciprocals is 0 and the weight for unreciprocals is 1+(number of reciprocal givers/number of unreciprocal givers).

4.3 Measuring Pure Altruism

Since 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 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 prior to T2 when T2 is the last decision (i.e. the sum of giving in T1 and T3) is £6.13, while average giving prior to 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.

5 Concluding Remarks

This paper is concerned with detecting and quantifying the two intrinsic motivations for giving: warm glow and pure altruism. We find them both to be operating which indicates that behavior of donors is consistent with the model of impure altruism (Andreoni 1990). 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. 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% to 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 goods games.

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APPENDIX A

The individual maximization problem is

$$\max_{g_1,g_2} \quad U(x_1,g_1,G_1,x_2,g_2,G_2) = \gamma(g_1) + \frac{1}{2}\left[c(x_1) + \phi(G_1)\right] + \gamma(g_2 + \lambda g_1) + \frac{1}{2}\left[c(x_2) + \phi(G_2)\right] + \gamma(\lambda g_2),$$

then, the FOCs are given by:

$$(4) \qquad g_1 : \gamma'(g_1) + \lambda\gamma'(g_2 + \lambda g_1) = \frac{1}{2}\left[c'(w - g_1) - \phi'(g_1)\right]$$

$$(5) \qquad g_2 : \gamma'(g_2 + \lambda g_1) + \lambda\gamma'(\lambda g_2) = \frac{1}{2}\left[c'(w - g_2) - \phi'(g_2)\right]$$

Note that when either $\lambda = 0$ or $\lambda = 1$ the two FOCs are identical so it follows that $g_1 = g_2$. By implicitly differentiating (5) w.r.t. g_1 we obtain:

$$\frac{dg_2}{dg_1} = -\frac{\lambda\gamma''(g_2 + \lambda g_1)}{\gamma''(g_2 + \lambda g_1) + \lambda^2\gamma''(\lambda g_2) + \frac{1}{2}\left[c''(w - g_2) + \phi''(g_2)\right]} < 0,$$

while implicitly differentiating (4) w.r.t. λ we obtain:

$$\frac{dg_1}{d\lambda} = -\frac{\gamma'(g_2 + \lambda g_1) + \lambda^2\gamma''(g_2 + \lambda g_1)}{\gamma''(g_1) + \lambda^2\gamma''(g_2 + \lambda g_1) + \frac{1}{2}\left[c''(w - g_1) + \phi''(g_1)\right]},$$

with $\frac{dg_1}{d\lambda}\mid_{\lambda=0} = \frac{-\gamma'(g_2)}{\gamma''(g_1) + \frac{1}{2}\left[c''(w-g_1) + \phi''(g_1)\right]} > 0$.

Combining the fact that $g_1 = g_2$ if $\lambda = 0$ with the fact that $\frac{dg_1}{d\lambda} > 0$ in a neighborhood of 0 and that $\frac{dg_2}{dg_1} < 0$, it follows that $g_1 > g_2$ when λ is small enough.

APPENDIX B

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

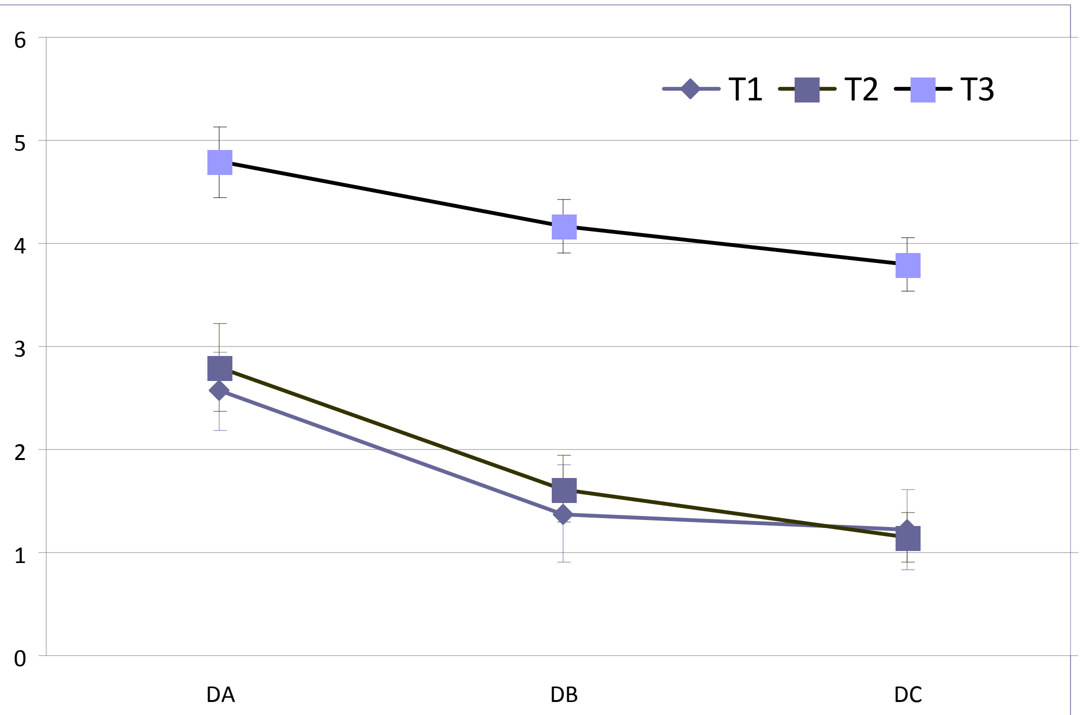
$$\begin{aligned} E[g_w|z=3] &\leq E[g_2|z=3] \\ E[g_w|z=2] &\leq E[g_w|z=3]\,. \end{aligned}$$

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

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

FIGURES, TABLES, AND INSTRUCTIONS

Figure 1: Trends in giving



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

Figure 2: Comparison of giving in T1 and T2

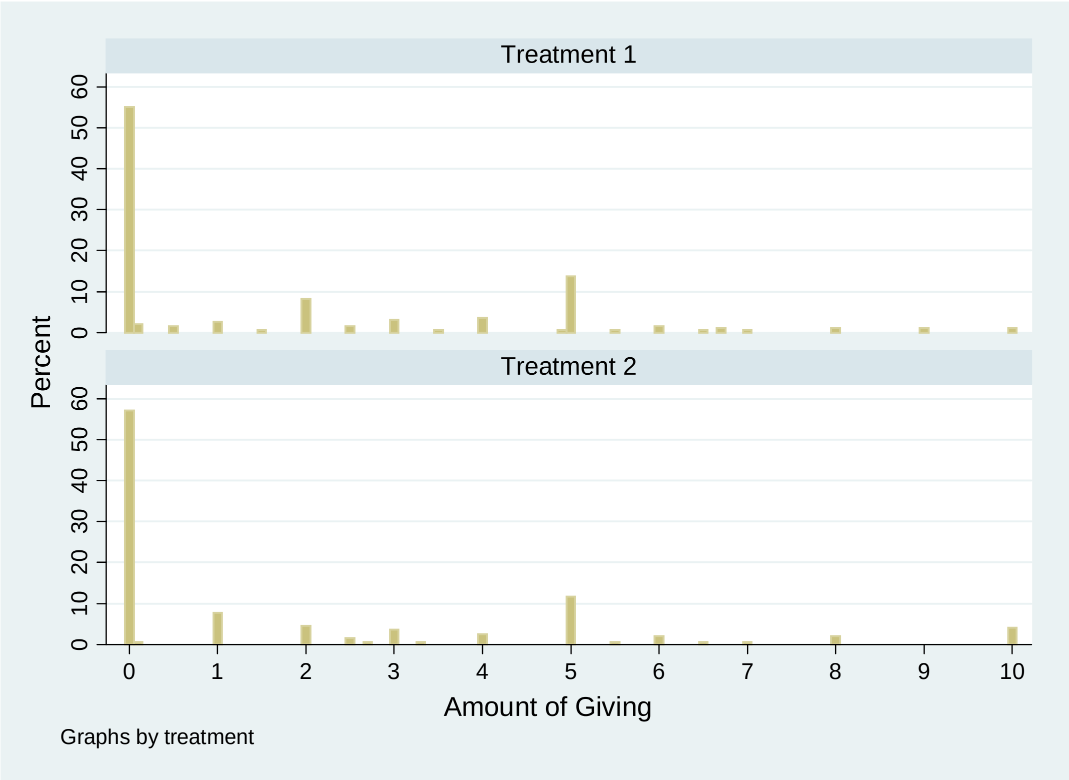
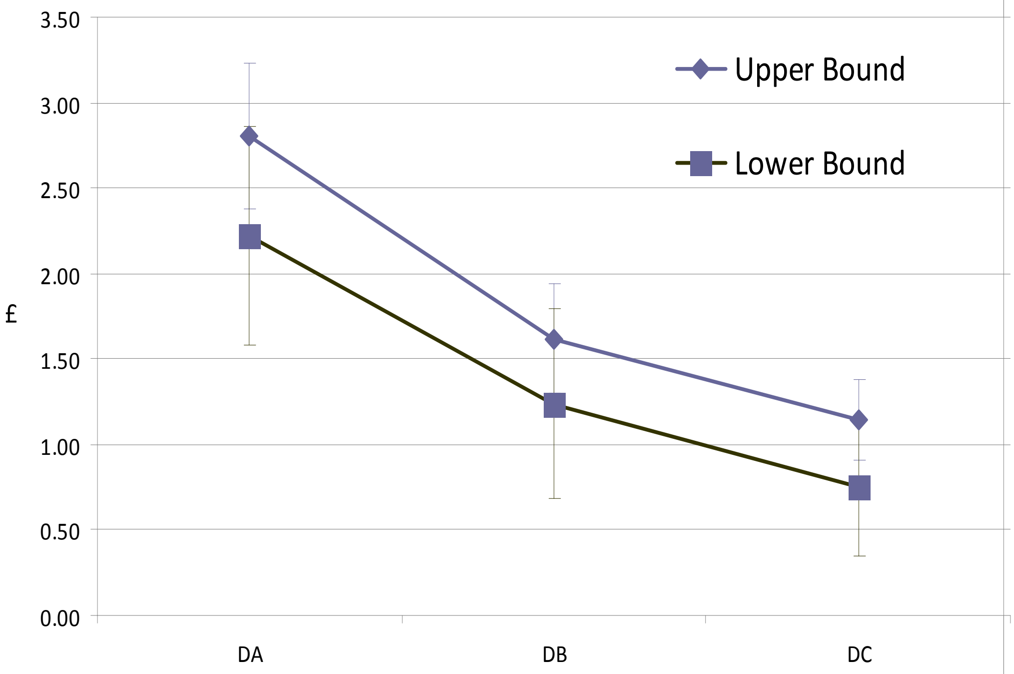


Figure 3: Upper and Lower Bounds of Warm Glow Motivation for Giving



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

Table 1: Summary - Procedures Questions

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

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[1]	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[2]	6.1	2.8	6.6	2.6	7.0	3.1
No Choice[3]	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.

Notes:

1: NSPCC stands for National Society for the Prevention of Cruelty to Children.

2: RSPCA stands for Royal Society for the Prevention of Cruelty to Animals.

3: 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.

Table 3: 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, 3rd position in which a given treatment is undertaken within the sequence of decisions.

Table 4: 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

Proportion of Givers

	T1			T2			Test (p-values)		
	%	se	N	%	se	N	z-test	Pearson chi2	Fisher's exact
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 stands for Wilcoxon-Mann-Whitney test. KS stands for 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.

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
s.e.	0.42	0.32	0.24	0.20
Lower Bound	2.22	1.24	0.75	1.38
s.e.	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.

INSTRUCTIONS T1

You have **£10** to be divided between yourself and the experimenters. You must decide how much of the **£10** to keep for yourself and how much to pass to the experimenters. You may elect to keep it all for yourself and pass nothing to the experimenters, keep nothing for yourself and pass it all to the experimenters, or keep some for yourself and pass the remainder to the experimenters. *NOTE: the amount you elect to keep for yourself, plus the amount you elect to pass to the experimenters must sum to £10.*

Once you have made your decision please fold these sheets. You will then be asked to place them in a box that the monitor will bring around. If this decision is implemented the amount you decide to keep will be placed in an envelope marked with your code number. You may pick up your envelope as you exit the room.

****

INSTRUCTIONS T2

You have **£10** to be divided between yourself and a charity of your choosing. You must decide how much of the **£10** to keep for yourself and how much to pass to your selected charity. You may elect to keep it all for yourself and pass nothing to the charity, keep nothing for yourself and pass it all to the charity, or keep some for yourself and pass the remainder to the charity. *NOTE: the amount you elect to keep for yourself, plus the amount you elect to pass to the charity must sum to £10.*

You will indicate your charity of choice by placing an X in the box next to that charity on the DECISION SHEET. You must select one and only one charity.

PLEASE NOTE:

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.

IN TOTAL YOUR SELECTED CHARITY WILL RECEIVE NEITHER MORE NOR LESS THAN £10.

****

INSTRUCTIONS T3

You have **£10** to be divided between yourself and a charity of your choosing. You must decide how much of the **£10** to keep for yourself and how much to pass to your selected charity. You may elect to keep it all for yourself and pass nothing to the charity, keep nothing for yourself and pass it all to the charity, or keep some for yourself and pass the remainder to the charity. *NOTE: the amount you elect to keep for yourself, plus the amount you elect to pass to the charity must sum to £10.*

[common for T2 and T3]

Payment to charity: At the end of the experiment, the experimenters will calculate the total donations to each charity and will make out cheques for these amounts. The monitor will place the cheques in addressed and stamped envelopes. The monitor and the experimenters will go together to the nearest mailbox and drop the envelopes in the mailbox. Anyone who wishes to join is welcome.

[Example of quiz]

***Here are some examples of allocation decisions and associated outcomes*:**

Your Decision		**Outcomes**	
Keep for Self	Pass to Experimenters	Payment to You	Payment to Experimenters
£10	£0	£10	£0
£8	£2	£8	£2
£2	£8	£2	£8
£0	£10	£0	£10

To check your understanding of the instructions, please answer the following questions before making your decision:

a) Of her £10, Sarah passes £4 to the experimenters.
A. How much will Sarah be paid? £_______________
B. How much will the experimenters receive? £_______________

b) Of her £10, Sarah passes £6 to the experimenters.
A. How much will Sarah be paid? £_______________
B. How much will the experimenters receive? £_______________

DECISION SHEET

Of your **£10**, how much do you wish to keep for yourself, and how much do you wish to pass to the experimenters?

Keep for Self: £ __________
(Increments of 10p)

Pass to Experimenters: £ __________
(Increments of 10p)

Total: £ 10