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TIME-INCONSISTENT CHARITABLE GIVING

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ABSTRACT

We motivate this paper with a puzzle. When we asked subjects to give five dollars to charity today, about 30 percent agree, but when the donation would instead be paid in one week, giving increases by 50 percent. The puzzle is that received models of self-control cannot explain this time-inconsistent charitable giving. This suggests a new approach is needed for intertemporal pro-sociality. We present one solution to the puzzle in a theoretical model and two new experiments. Our explanation relies on the rich dynamics of warm glow, and specifically image concerns, in prosocial behavior.

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1 Introduction

We begin this paper by demonstrating a puzzle. In the first week of a two-week experiment, we ask subject to give \$5 to a worthy charity. Half are asked to decide now to give now, and half are asked to decide now to give the money in a week. If giving is like other consumption, then the effects of both the warm-glow of giving and the cost of the gift should both be evaluated at the time the gift is transacted. But this means the two decisions are identical—if the net utility from giving today is positive, then it remains positive even when discounted one week, with or without hyperbolic discounting. In our experiment, by contrast, we find what we call *time-inconsistent charitable giving*: when today's decision is implemented one week after it is made, giving increases by 50 percent. Understanding this *time-inconsistent charitable giving* is the goal of this paper.

Time inconsistencies are usually explained by models in which elements of the costs and benefits are separated across time. In our motivating experiment above, both the gift (benefit) and the payment (cost) were made at the same time. What was different about the two was the separation between the date of the decision and the date that decision was implemented. To explain the positive effect of delay, it would have to be that a share of the positive utility from giving flows at the time of the decision, while a larger share of the negative utility of paying for the gift flows at the time of the transaction. When discounting is applied more heavily to the costs than to the benefits, time-inconsistent charitable giving can occur.

Notice, at this point we can convert the conditions set out in the prior paragraph into primitives about warm-glow assumed in the behavioral model. Instead, we take this as an opportunity to learn about the process that generates the warm glow, and that would allow, or perhaps force, the giver to consume some of the benefits of giving at the time of the decision to give, but still delay the full cost. The mechanism we posit for this is maintaining a self- or social image (Andreoni & Bernheim, 2009).

It is essential to first understand why models in which individuals only derive utility from *transacting* the gift cannot explain the puzzle. In transacting the gift, both the benefits and costs are assumed to occur in the same period. As a result, preference rankings between giving and not giving cannot change over time.

One fix for this would be to assume different discount rates for the joy of giving and the pain of giving. This will surely create time inconsistencies, but could only be consistent with a model in which people are tempted to *not* give. As we show in follow up studies, time-inconsistent givers show a strong preference for flexibility over commitment. This indicates that temptation is not a dominant explanation for dynamic giving decisions.[1] Moreover, this modeling choice begs the question of why there may be two different discount parameters.

The solution we propose builds on the observation that a charitable contribution is a social interaction. Stated differently, a single act of making a charitable contribution can create a number of opportunities for the donor to collect social utility, which has been known in literature as warm-glow (Andreoni, 1989, 1990). Since both the ask to give and the transaction of giving are social interactions, both offer opportunities for warm-glow to be collected (Andreoni and Payne, 2003; Andreoni and Rao, 2011; Andreoni et al., 2017).

Our model of this phenomenon is built off of the observation that saying yes or no to a request to give, even if is a future gift, can generate an emotional response from the person asked.[2] They may feel guilty saying no or elated to say yes. When there is an audience to witness a decision about giving, these feelings of guilt or pride will likely be stronger the larger the audience. But where do these emotions come from? Think first of self-image. A person with an image of being charitable has just been offered an opportunity to affirm this image. Someone concerned with social image has been offered a similar opportunity. Once a decision to give has been made, the person's self- or social-image can change, bringing immediate positive utility from a decision to give. Transacting the commitment brings utility later, but in our motivating experiment would add nothing to the giver's image. Thus, image concerns add positive utility to saying

[1] See Breman (2011); Saito(2015); and Dreber et al., (2016).

[2] Similar observations are made in Andreoni et al., (2017, 2019); DellaVigna et al., (2012); Exley (2015); Exley and Naecker (2017); and Kessler (2017).

yes to a request to give, and discounting can allow the positive image utility to outweigh the potentially negative utility from actually giving. Thus a person may not give when asked to give today, but will give when asked today to commit to giving in a week. When there is an audience to witness a decision about giving, these feelings of guilt or pride will likely be stronger the larger the audience.

We build a model of dynamic social-image concerns that contains two novel assumptions about the giving experience. First, like anticipation (e.g., Loewenstein, 1987; Elster and Loewenstein, 1992; Bernheim and Thomadsen, 2005; Köszegi, 2010), the warm glow from giving can begin flowing the moment the decision to give has been made and, in particular, because social-image utility can flow as soon as the audience observes the commitment to give. The cost of transacting the gift, however, can be discounted.

While this immediate experience of decision utility in the early period can explain the results of our motivating study, the fifty percent growth in giving from a one week delay seems intuitively (to us) too large of an effect for discounting alone to generate. Thus we also consider a second realistic feature of our study that the pleasures experienced at the time of the giving decision may be re-experienced later when focus is brought to the giving decision, such as when the gift is transacted. Hence, spreading a single giving decision into two distinct social interactions is like giving a person a larger audience, even if the audience is the same people, and even if the audience is simply themselves (as with self-signaling). The combination of both effects makes deciding now to give later strongly preferable to deciding now to give now.

In addition to our motivating experiment, we present two additional experiments to contrast our model with other known models that could bear on time-inconsistent charitable giving. In the first of these two experiments we offer subjects a (probabilistic) commitment device, in the style of Augenblick et al., (2015). We find that a majority of subjects who show time-inconsistent charitable giving do not exhibit a preference for commitment, but rather a preference for flexibility, in contradiction to models of temptation, for instance.

To test broader predictions of our model of dynamic image concerns, our third experiment exogenously varies the information given to the audience, and its size (Ali and Bénabou, 2018). We find that time-inconsistent giving decisions increase when (some) giving decisions are visible to an audience, and that commitment demand increases when commitment choices are subject to an audience. The results are broadly consistent with image concerns, and suggest that these can be an important part of the explanation for time-inconsistent giving.

While a small literature has emerged around the temporal nature of altruistic decisions, we are the first to consider dynamic social interactions as the source of time inconsistent giving behavior.[3] Our model of dynamic social-image concerns builds on a rich literature of static models of social and self-image concerns.[4] Our model opens up many new directions for research on the use dynamic fundraising appeals, anonymity, pledges, and the public announcements of future gifts.

The paper is organized as follows. Next, Section 2 presents motivating experiment on the puzzle of time-inconsistent charitable giving. In Section 3 we develop a theoretical model of dynamic social-image concerns, and review other known possible explanations of our motivating experiment. Section 4 presents our second experiment allowing subjects to choose commitment. Section 5 studies dynamic giving decisions and commitment demand when these decisions are made visible to an audience, providing a test of dynamic image concerns. Section 6 concludes.

2 The Motivating Experiment: Give More Later

2.1 Experimental Design

We designed a simple longitudinal experiment. Subjects came to the laboratory for an experiment designed to last two visits exactly one week apart, to the hour, irrespective

[3]These have focused on the effects of time pressure (Rand et al., 2012; Kessler et al., 2016; Recalde et al., 2018), narrow bracketing (Adena and Huck, 2017), reminders (e.g., Huck and Rasul, 2010) and present-biased discounting (Kovarik, 2009; Breman, 2011; Dreber et al., 2016; Kolle and Wenner, 2018).

[4]Benabou and Tirole, 2006, 2011; Andreoni and Bernheim, 2009; Ariely et al., 2009; Ellingsen et al., 2012; Grossman, 2015; Filiz-Ozbay and Ozbay, 2014; Tonin and Vlassopoulos, 2013; Adena and Huck, 2019, among others.

of their decisions. We compare two treatments. In both treatments subjects see identical presentations about a charity called GiveDirectly, and then are asked if they would give \$5 of their participation fee to the charity. All decisions are made in the first week, and no new decisions are made in second week.

In the first treatment, subjects decide now about donations made today and coming from today's participation fee. We refer to this as the Decide Now to Give Now (NN) treatment. In the second treatment, called the Decide Now to Give Later (NL) treatment, subjects make an identical decision in week 1, but the donation is transacted a week later and is paid from the participation fee from the next week. We observed 179 subjects in the NN treatment and 173 in the NL treatment.[5]

2.2 Results

The results of this experiment are shown in Figure 1. The one-week delay in transacting a charitable gift raises giving from 31% in the Decide Now to Give Now treatment to 45% in the Decide-Now-to-Give-Later treatment—a 50% increase in giving. When deciding today about a donation transacted today, people are significantly less likely to give than when deciding today about a gift to be transacted just one week later (χ^2-test, $p \leq 0.01$).[6]

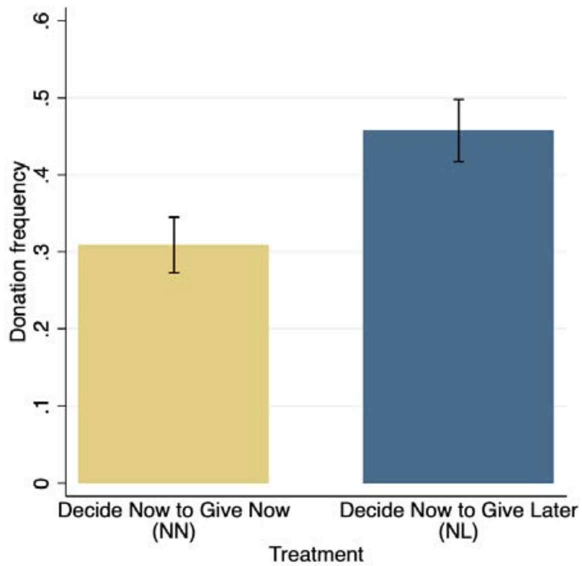
2.3 The Puzzle

The behavior shown in Figure 1 clearly demonstrates that a delay between the decision to give and the giving transaction increases giving. This cannot be explained by a model in

[5]To reduce attrition, the first four out of eight sessions of the NN and NL treatments paid a higher show-up payment in Week 2 of the study, paying \$6 in Week 1 and \$20 in Week 2. The second set of four sessions paid the same show-up of \$15 in both weeks. We observe no significant differences in attrition ($\chi^2 = 0.197$, $p = 0.658$) and donation behavior (32.5% and 29.4%, respectively, $\chi^2 = 0.184$, $p = 0.668$ in NN; and 43.8% and 47.5%, respectively, $\chi^2 = 0.206$, $p = 0.650$, in NL) between these sessions and hence pool them in the analysis.

In NN, 14 subjects (7.8%) failed to complete the study, and in NL the number was 20 (11.5%). The difference in completion rates is not significant across treatments, and subjects do not differ in their observable characteristics. We focus on the analysis of individuals who completed the study, though findings remain unchanged including all subjects. Further details of the design and the instructions for this experiment are found in Appendix B.

[6]In Appendix C, we show the results by gender. Giving by women increases from 30% to 50% with delay, that by men increases from 32% to 39%.



Note: Error bars denote ± 1 S.E.

Figure 1: Giving Decisions in the NN and NL Treatments

which individuals only derive utility from the giving transaction and exhibit (standard) time-consistent discounting.

To demonstrate this, assume households only derive utility when the gift is transacted. An individual is asked to give a set amount to a charity, g, which we normalize to 1 so that $g = 0$ or 1 can be interpreted as both a quantity and an index of giving. If the individual decides to give, he gains value $v \geq 0$, but must pay 1 for the gift.

In the Decide Now to Give Now treatment, the individual decides to give if

$$v > 1. \tag{1}$$

What happens if the giving transaction is delayed by a week, as in the Decide Now to Give Later treatment? Assume that utility from experimental payments is discounted at a rate δ_x while future charitable gifts are discounted at a rate δ_g. An individual who is asked to give later will have utility of giving of $\delta_g v(1) + \delta_x u(-1) = \delta_g v$, and utility of not giving of $\delta_g v(0) + \delta_x u(0) = \delta_x$. Suppose, as is standard, that $\delta_x = \delta_g$. Then the give later decision depends on the benchmark condition (1), and is unaffected by the delay in carrying out the decision. That is, charitable giving is *time-consistent*.

3 Models of Time-Inconsistent Charitable Giving

How can the behavior in Experiment 1 be explained? We consider two explanations. First, individuals may exhibit temptation and/or quasi-hyperbolic discounting that differs for giving and own payments. Breman (2011) documents a similar change in giving to that observed in Experiment 1, with longer time delays, of one and two months, and attributes it to present-bias. However, there is a second explanation that is relevant in the context of giving: (warm-glow) utility from giving may not only be determined by the giving transaction, but also derived from the giving decision.

To understand the importance of these two explanations, we must design a setting that will draw clear distinctions between them. We do this by studying commitment demand in Experiment 2. We consider a within-subjects setting in which subjects are asked to make the same giving decision at two different times, $t = 1$ or $t = 2$, that are one week apart (to the hour). The question asked each week is a request to give \$5 to the charity GiveDirectly at time $t = 2$. Thus saying yes in $t = 2$ is to give now, while saying yes in $t = 1$ is to give later. Notice too that all transactions take place in $t = 2$, while decisions are made both before or concurrent to the transaction. By fixing the date of the transaction and altering the date of the decision, this setting allows a rich set of alternative models.

After the second decision is made one of the two decisions is randomly selected to be carried out in $t = 2$. The degree of randomness, however, is selected by the subject in $t = 1$ in a manner similar to Augenblick et al. (2015). Let p be the probability that the $t = 1$ decision is selected. We restrict p to three values: $p \in \{0.1, 0.5, 0.9\}$. We call p the level of commitment and for clarity will often refer to $p = 0.1$ as *flexibility* (F), $p = 0.5$ as *indifference* (I), and $p = 0.9$ as *commitment* (C), and instead write $p \in \{F, I, C\}$. The choice of p will play a key role in our experiment as the level of commitment chosen will help reveal a subject's true preference for giving.

Table 1 provides an overview of the models we discuss in this section. It outlines their predictions and the results of Experiment 2, testing commitment demand (and thus temptation models), presented in Section 4.

Table 1: Models and Testable Predictions Regarding Probabilistic Commitment

Model	(1) Give More Later	(2) Commitment if Give More Later	(3) Commitment if Always Givers
Giving utility flows only from the giving transaction:			
Benchmark	No	-	**Indifferent**
Temptation to Give:			
Sophisticated	No	-	**Indifferent**
Naïve	No	-	**Indifferent**
Temptation to Keep:			
Sophisticated	**Yes**	Yes	**Yes/Indifferent**
Naïve	**Yes**	Indifferent	**Indifferent**
Kreps:	No	**No**	No
Giving utility flows from the giving decision and transaction:			
Image Concerns	**Yes**	**No**	**Indifferent**
Data	**Yes**	**No**	**Indifferent**

Note: Bold indicates coincidence between test and evidence.

3.1 Temptation

Two recent papers study temptation in the domain of prosocial behavior. Dreber et al. (2016) use a dual-self model assuming *temptation to give*, in which an individual's short-run suffers from self-control problems that make its giving higher than the long-run self prefers. Saito (2015) (see also Noor and Ren, 2011) assumes a *temptation to keep*. To simplify our discussion of these two approaches, assume two discount rates, δ_g on utility from giving, and δ_x on utility from money kept for one's self. Much like in

Jackson and Yariv (2015), this will necessitate time inconsistency. When $\delta_g > \delta_x$, we say people are tempted to give. When $\delta_x > \delta_g$, by contrast, we say the person is tempted to keep. What type of temptation is consistent with the time-inconsistent charitable giving observed above?

A person will decide *not* to give now if $v < 1$, but will decide now to give later if $\delta_g v > \delta_x$, that is, if $v > \delta_x/\delta_g$. For the same person to satisfy both of these conditions requires that $\delta_x/\delta_g < 1$, that is, the donors are tempted to keep.

Individuals who are naïve about their time inconsistency act as though they will execute their long run plans. They can alternatively be assumed to be sophisticated, meaning they understand that temptation will take over and choose commitment to the long-run plan that maximizes current discounted utility. Focusing on those tempted to keep, in our setting sophisticates will choose $p = C$ while naïve players will be indifferent to p.

Naturally, we expect our sample to also include those who care so little for the charity that $g_1 = g_2 = 0$, or who care so much for the charity that $g_1 = g_2 = 1$, regardless of the opportunity to commit. By this model we expect both of these groups to be indifferent to p.

3.2 Utility from the Giving Decision: Image Concerns

A charitable contribution is a social interaction not a market exchange. Stated differently, giving is an experience rather than a consumption item. Hence, a single act of making a charitable contribution can create a number of opportunities for the donor to collect warm-glow utility (Andreoni, 1989, 1990; Ribar and Wilhelm, 2002; Ottoni-Wilhelm et al., 2017). Warm-glow is a "placeholder for more specific individual and social motivations" (Andreoni et al., 2017) to give. An important component of warm glow is social and self image: One's feelings of guilt and price about their generosity are an important driver of giving decisions (e.g., Andreoni et al., 2017; DellaVigna et al., 2012; Exley, 2015; Exley and Naecker, 2017; and Kessler, 2017).

We propose that image utility can be derived when a decision to give is made. We choose this specific form of warm-glow utility, which is also derived at the moment of the giving decision, because it can explain why apparently time-inconsistent givers choose flexibility. Naturally, other components of warm glow could be derived when a decision to give is made. We think that carefully understanding image concerns is important, as they have been shown to matter broadly, and they allow the giving utility not only to flow at various moments, but be magnified by increasing the number of social interactions.

We start from our benchmark model where the only heterogeneity is in v, the utility one gets from the act of giving, and introduce image concerns, building on static models of image concerns, such as Bénabou and Tirole (2006) and Andreoni and Bernheim (2009). We will refer to v as a person's "type." We assume that v is drawn from a continuous distribution $f(v)$ on the interval $v \in [0, \bar{v}]$, where $\bar{v} > 1$.

Imagine an *audience* observes an individual's actions but not their v's, and forms a belief about each individual's type. Image concerns are also known as audience effects as they require that someone, perhaps just the experimenter, the other subjects in the study, or a subject's "impartial spectator," to be viewing the participant's choice.

Definition: Audience. An audience is $n \geq 1$ individuals who make the same observations on a subject, and thus form the same expectation of the subject's "type," which we call μ. The audience can be characterized by their number and belief. For audience j write this as $\mathcal{A}_j = \{n_j : \mu_j\}$ meaning n_j individuals all hold the belief μ_j about a particular individual.

The individual gains more image utility the higher the audience believes v to be. Of course, the individual never observes the audience's belief, so we assume each person forms an accurate expectation of the audience's belief about the subject's own true type.

Next, we formally define the two types of possible signaling. These definitions are based on the assumption that each individual has only one audience (of size n).

Definition: Social-Signaling. A person is engaged in social-signaling if they believe that an *audience of others* is seeing the person's strategy unfold. Based on information the audience holds at any time, the audience forms (or updates) beliefs about the expected value of the person's utility parameter v. Call the person's expectation about the audience's belief μ. A person who cares for social-signaling maximizes a utility function that is increasing in μ.

Definition: Self-Signaling. A person is engaged in self-signaling if they behave as if they are unsure of their own v value, and, importantly, act like their own audience in a social-signaling model (Bénabou and Tirole, 2006).

An important distinction between self- and social-signaling is that the self has the advantage of knowing their own full strategy for $t = 1$ and $t = 2$, while the audience for social-signaling can only condition their beliefs on actions they observe.

Finally, we must define the image function $M(n : \mu)$:

Definition: Image Function $M(n : \mu)$. The function $M(n : \mu)$ maps the audience to a real number M, and has these qualities:

a) *Continuous*: $M(n : \mu)$ is continuous and differentiable w.r.t. μ.

b) *Increasing and concave in μ*: $\partial M/\partial \mu \geq 0$, and $\partial^2 M/\partial \mu^2 \leq 0$.

c) *Magnification by Audience*: Having a larger audience will magnify the effect of any existing audience. Thus, if $M(n_1 : \mu) > 0$, for any $n_2 > n_1 \geq 1$, $M(n_2 : \mu) \geq M(n_1 : \mu)$. In particular, there will be a function $\omega(n)$ such that $M(n : \mu) = \omega(n)M(1 : \mu)$.

d) *Decreasing Marginal Magnification*: $\omega(n)$ has the features $n \geq \omega(n) \geq 1$, $1 \geq \omega'(n) \geq 0$ and $\omega''(n) \leq 0$.

e) *Cardinal*: M is a cardinal measure.

3.2.1 Image Concerns in Experiment 1

Before applying image concerns to probabilistic commitment, we demonstrate how a model of image concerns can generate the time-inconsistent charitable giving puzzle from Experiment 1, as a consequence of the time delay but regardless of discounting.

Imagine first that the only audience is the experimenter. This is the person who observes the individual's decision to give in Experiment 1, at the end of Week 1 and Week

2 (in the NL treatment). How can image concerns explain the time-inconsistent charitable giving puzzle seen in Experiment 1? Recall, the individual's strategy in Experiment 1 is simply $g = 0$ or $g = 1$. We assume the potential donor will form an expectation of the audience's belief about the donor's type v based on their observation of g, which we call $\mu(g)$, where $\mu(1) \geq \mu(0)$. Next, we assume there is an increasing and concave function $M(1 : \mu)$ that translates beliefs into utility. To simplify notation, when there is an audience of one (the experimenter or the self), we will write $M(\mu)$.

There will exist a Perfect Bayesian Equilibrium of this signaling game in which the critical value of v, say $v^* \leq 1$, is such that $g = 0$ if $v < v^*$ and $g = 1$ if $v \geq v^*$. The question to pose is, how does the solution from the NN treatment, v^*_N, compare to the solution for the NL treatment, v^*_L?

First consider NN. Then v^*_N solves these conditions:

$$\begin{aligned} v^*_N + M(\mu_N(1)) =& 1 + M(\mu_N(0)), \qquad (2) \\ \mu_N(0) =& \frac{1}{F(v^*_N)} \int_0^{v^*_N} v f(v) dv, \\ \mu_N(1) =& \frac{1}{1 - F(v^*_N)} \int_{v^*_N}^{\bar{v}} v f(v) dv. \end{aligned}$$

Now consider NL. This treatment resembles NN in that the decision is reported to the experimenter in $t = 1$, but it differs in that the gift is transacted with the experimenter a week later at $t = 2$. Moreover, since the donation is featured in both meetings of the experiment, there is potential for social image utility in both periods. Let v^*_L solve the equations below, which determine the Perfect Bayesian Nash equilibrium in NL:

$$\begin{aligned} \delta v^*_L + M(\mu_L(1)) + \delta\beta M(\mu_L(1)) =& \delta + M(\mu_L(0)) + \delta\beta M(\mu_L(0)), \qquad (3) \\ \mu_L(0) =& \frac{1}{F(v^*_L)} \int_0^{v^*_L} v f(v) dv, \\ \mu_L(1) =& \frac{1}{1 - F(v^*_L)} \int_{v^*_L}^{\bar{v}} v f(v) dv. \end{aligned}$$

The one-week discount factor is $0 \leq \delta \leq 1$, β is a depreciation factor applied to the $t = 1$

image utility in $t = 2$, in particular $0 \leq \beta \leq 1$.

Compare equations (2) and (3). We obtain that $v_L^* < v_N^*$. This difference arises if $\beta = 0$, and it becomes larger as β increases. We hence predict time-inconsistent charitable giving in our motivating experiments that is caused by the delay of time, but not necessarily by temptation or self-control problems. Of course, forms of discounting could be part of the effect, which is why Experiment 2 tests commitment demand.

Notice that this model of social image predicts time inconsistent *choices*, but unlike the other models, does not base the prediction on time inconsistent *preferences*. When the decision maker has full awareness of the audience effects, she will be perfectly happy with a fully contingent plan to decide now to give later and also to say no in one week to a request to "give now." Stated differently, preferences do not change, are not naïve, and are conformable to time-inconsistent charitable giving.[7]

3.2.2 Image Concerns in Probabilistic Commitment

Next, we examine individual behavior when individuals also choose their level of commitment, p. Assume in $t = 1$ the audience (the experimenter) observes the decision to give later, g_1, and $p \in \{C, I, F\}$. From this, the audience forms an expected value of v, and the subject forms a (rational) expectation of this value. Call this $\mu_1(g_1, p)$. In $t = 2$, the individual decides about giving now, g_2, and the subject and the audience updates their beliefs regarding v, which we call $\mu_2(g_1, p, g_2)$. Finally, for ease of presentation and to accentuate the role of social image, we will assume that the one-week discount factor is $\delta = 1$ while allowing future image utility to be depreciated with β. All derivations reported in Appendix A will include $\delta < 1$, with identical qualitative findings.

Given an increasing and concave function M, an individual's expected utility is:

$$U(g_1, p, g_2) = (v - 1)(pg_1 + (1 - p)g_2) + M(\mu(g_1, p)) + \beta M(\mu(g_1, p, g_2))$$

The key to the predictions are the following four lemmas. Formal proofs of each of

[7]See also Andreoni et al., (2019) for a similar finding in the context of fair allocations to two apparently equally deserving others.

these are in Appendix A.

Lemma 1: Assume the population is engaged in social-signaling, but not self-signaling. Further assume that some people in this population prefer to give in exactly one period. These people will prefer to give in $t = 1$ rather than $t = 2$.

This lemma is very intuitive. A person who has chosen a strategy of $s = (0, 1 - p, 1)$ could also have accomplished the same level of consumption and giving by having chosen $s = (1, p, 0)$. The question for this donor is which path for revealing of the full strategy will generate the most social utility. The first strategy will yield $M(0, 1-p) + \beta M(0, 1-p, 1)$ while the otherwise equivalent second strategy will yield $M(1, p) + \beta M(1, p, 0)$. For the strategy $s' = (0, 1 - p)$ the maximum probability of giving is p, while for $s' = (1, p)$ the minimum probability of giving is p. Thus we should anticipate $M(1, p) > M(0, 1-p)$. As long as $M(1, p, 0) = M(0, 1 - p, 1)$, then choosing the unfolding of the full strategy that sends the strongest signal of one's full intentions in $t = 1$ should dominate.

Lemma 2: Assume the population is engaged in social-signaling, but not self-signaling. Then, if in $t = 1$ the audience observes a person choosing $g_1 = 0$ for any p, the audience can conclude that this person also intends to choose $g_2 = 0$ in $t = 2$.

The second lemma follows almost immediately from the first. If this lemma were not true, it would violate Lemma 1. It holds the critical implication that $g_1 = 0$ is sufficient for $g_2 = 0$ as well.

Next consider that some people in this population may prefer to give in both periods. Since there is not a choice of $p = 1$, it will not be until $t = 2$ that these people reveal their full strategies. Define $E(v|g_1, p, g_2)$ the expected v of an individual given the strategy (g_1, p, g_2). We add an extra assumption, which we will relax later:

Assumption 1 (No Counter-Signaling): $E(v|1, p, 1)$ is the same for all p.

This assumption means that in $t = 2$, if the person has chosen to give in both periods, her expected type does not depend on her commitment choice. Thus, a person interested in social image will want to send the strongest signal of v in period $t = 1$ in order to get the highest social image.[8] This means choosing $s' = (1, C)$ since $E(v|1, C) \geq E(v|1, I) \geq E(v|1, F)$.

Lemma 3: If $E(v|1, p, 1)$ is the same for all p and if the individuals cares about social image and wishes to choose $g_1 = g_2 = 1$, the individual will chose strategy $s' = (1, C)$ in $t = 1$.

Again, Lemma 3 naturally flows from social image concerns. It also has a very useful implication for those not choosing $s' = (1, C)$, which we state in Lemma 4:

Lemma 4: If $E(v|1, p, 1)$ is the same for all p, if the individual cares about social image, and if in $t = 1$ the audience sees the strategy $s' = (1, p)$ for any $p \neq C$, then the audience will believe that $g_2 = 0$.

We can now state a proposition for our probabilistic commitment game with social image concerns.

Proposition 1: Assume all individuals care equally about social image, and that $E(v|1, p, 1)$ is the same for all p. Then there exists a Bayesian Perfect equilibrium of the probabilistic commitment game, which is characterized by numbers v^{F0}, v^{I0}, v^{C0}, and v^{C1}, such that $0 \leq v^{F0} \leq v^{I0} \leq v^{C0} \leq v^{C1} \leq 1$ and

a) all individuals with $v < v^{F0}$ choose $s = (0, p, 0)$, for any p;

b) all individuals with $v^{F0} \leq v \leq v^{I0}$ choose $s = (1, F, 0)$;

c) all individuals with $v^{I0} \leq v \leq v^{C0}$ choose $s = (1, I, 0)$;

d) all individuals with $v^{C0} \leq v \leq v^{C1}$ choose $s = (1, C, 0)$;

e) all individuals with $v^{C1} \leq v \leq \bar{v}$ choose $s = (1, C, 1)$.

The formal proof of this is in Appendix A, but given the structure provided thus far, it is rather easy to construct image functions M and probability distribution functions of $f(v)$ that would be consistent with an equilibrium. For instance, suppose that in

[8] For a detailed discussion of counter-signaling, see Feltovich, Harbaugh, and To (2002) for introducing the concept of counter-signaling.

$t = 1$ the whole population of subjects can be apportioned to one of the four pools above (note in $t = 1$, both types in (d) and (e) are in the same pool choosing $(1, C)$). Assuming a form for $f(v)$ then one can identify the five values of v needed to form the edges of the pools. Then to find the image utility M for each pool we note that in equilibrium there will be one type who is indifferent between joining two adjacent pools. For instance there will be a type v^{F0} who is indifferent to joining the pool that does not give and the pool that gives only with probability $p = F$. For this type, $(1+\beta)M(0, p, 0) = 0.1(v^{F0} - 1) + (1+\beta)M(1, 0.1, 0)$. If we assume a value for $M(0, p, 0)$ we can build the value of $M(1, 0.1, 1)$ for $p = F$. Next we know that there will be someone with $v = v^{I0}$ who is just indifferent to pooling with those with lower and those with higher v's. For this person $0.1(v^{I0} - 1) + (1 + \beta)M(1, F, 0) = 0.5(v^{I0} - 1) + (1 + \beta)M(1, I, 0)$. Continuing in this manner, for any assumption of $f(v)$ and β, we construct the M function that will satisfy equilibrium.

Notice that the last of the 4 pools in $t = 1$, at $s' = (1, C)$, will split into two pools in $t = 2$. There will be the "always-give" types with $v \geq 1$ who will give in both periods regardless of the social image. A pool of those with v's near to but below 1 will have an incentive to mimic the true always-give types in order to gather additional social image utility.

3.2.3 About Self-signaling

If individuals in the experiment do not see the experimenter as an audience but instead see only themselves as the audience, then they are solely self-signaling. The main difference between this and the prior case of social signaling is that self-signaling individuals can observe their full strategy in $t = 1$. Since, for instance, $s = (1, 0.9, 0)$ and $s = (0, 0.1, 1)$ both produce a probability of giving of 0.9, they yield the same self-image. To differentiate from commitment probabilities, call probability of giving q. Every three-part strategy reduces to a probability q that they give. Because $q = 0$ when $g_1 = g_2 = 0$ and $q = 1$ when $g_1 = g_2 = 1$, there are five values of q they can choose from $q \in \{0, 0.1, 0.5, 0.9, 1\}$.[9]

[9] See Appendix A for further detail and formal proofs.

3.2.4 About Counter-signaling

By counter-signaling we mean that there exists another equilibrium in which the most generous person in the group—the person with $v = \bar{v}$—can find a way to further signal that she is, in fact, the person with the highest v in the community. The new equilibrium must be so costly to imitate that only those with v at or near $\bar{v}$ could benefit from the strategy. Suppose Assumption 1, that $E(v|1, p, 1)$ is the same for all p, no longer holds. In our game we have two natural "wasteful" signals. Given our lemmas above, choosing a strategy $s = (1, C, 1)$ should always be better than any other way to give $g_1 = g_2 = 1$. But suppose the person at $\bar{v}$ instead chose the strategy $(1, F, 1)$. This changes the donor's $t = 1$ image by an amount $\Delta_1 = M(\mu(1, F)) - M(\mu(1, C)) < 0$. In $t = 2$, the complete strategy is revealed to be $s = (1, F, 1)$. If the audience rewards this with an increase in social image utility of $\Delta_2 = M(\mu(\bar{v})) - M(\mu(1, C, 1)) > 0$ in $t = 2$, then, if $\Delta_2 > \Delta_1$, it is easily shown that there is a probability distribution function $f(v)$ and image function M, that could support this type of equilibria with one or even two new pools formed. We can get equilibria with pools of people choosing the counter-signaling strategies of $s = (1, I, 1)$, of $(1, F, 1)$, or of both $(1, I, 1)$ and $(1, F, 1)$. In each case the individuals in these counter-signaling pools are from the highest v types. An important aspect of counter-signaling is that it is only useful if g_2 is seen by the audience. This will come into play in Experiment 3.[10]

3.3 Kreps Demand For Flexibility

Kreps (1979) shows that, given the future is uncertain, individuals should demand flexibility. Notice that this consideration could not have played a role in our motivating experiment, as commitment demand was not part of the decision. Moreover, both the decision to give now and to give later were made at the same time in Experiment 1, and so there was an equal degree of uncertainty in both decisions. In the framework described at the outset of this section, however, Kreps' intuitions could play some role, and they

[10]See Appendix A for formal proofs.

will be considered in our analysis.

4 Probabilistic Commitment: Experiment 2

Experiment 2 is a direct application of the theoretical setting discussed above. Hence our description of the experiment here focuses primarily on implementation.

4.1 Experimental Design

This is a within-subjects experiment, in which all subjects participated in a two-week (to the hour) study. In contrast to Experiment 1, each individual made two giving decisions in this experiment. Both decisions were about giving $5 to a deserving charity in week 2. The week 1 decision we write as g_1, and the week 2 decision is g_2. Both choices were made knowing that of the two decisions one would be randomly chosen to carry out. The odds of g_1 being chosen were selected by the subject in week 1, immediately after the choice of g_1. This probability p is constrained to be $p \in \{0.1, 0.5, 0.9\}$. All these stages were known to subjects before making any decisions. Instructions are shown in Appendix B.

A total of 183 subjects participated in week 1, and 163 returned for week 2. This attrition was unrelated to decisions to give and commitment choices in week 1 (χ^2-test, p=0.537). We focus the analysis on 163 subjects.[11]

4.2 Results

First we examine within-subject behavior in Experiment 2. We find that 25.2% of the subjects always give, while 38.0% never give. The remainder, 36.8%, make different decisions over time. Of these, 62% (or 22.7% of subjects in the sample) decide now to give later, but not give now. The remainder, 38% (14% of the sample) choose to give now, but do not decide now to give later. Those choosing now to give later, but not now

[11] Details on attrition and behavior are shown in Appendix C.

to give now in $t = 2$ are more numerous than the opposite (McNemar's test, $p = 0.07$), in line with the results of Experiment 1.

Table 2 summarizes the commitment choices of subjects and their give-now decisions, according to their decision to give later. Column (4) shows that, among subjects who decide now to give later, $g_1 = 1$, flexibility is most frequently preferred, by 22.1% of the subjects, while commitment and indifference are both chosen by 12.9% of subjects. This distribution is different from chance (χ^2-test, p=0.056).

Table 2: Distribution of Subjects' Choices in the Probabilistic Commitment Experiment

(1) g_1	(2) Percent of Subjects	(3) Commitment Choice	(4) Percent of Subjects	(5) g_2	(6) Percent of Subjects
$g_1 = 0$	52.1%	C	25.8%	0	18.4%
				1	7.4%
		I	14.1%	0	12.3%
				1	1.8%
		F	12.3%	0	7.4%
				1	4.9%
$g_1 = 1$	47.9%	C	12.9%	0	4.3%
				1	8.6%
		I	12.9%	0	3.7%
				1	9.2%
		F	22.1%	0	14.7%
				1	7.4%

Note: $n = 163$ subjects.

Focusing on individuals who decide now to give later, but do not decide now to give now in $t = 2$, $(g_1, g_2) = (1, 0)$, we observe an even stronger preference for flexibility. The choice pattern $(g_1, p, g_2) = (1, F, 0)$ is observed for 14.7% of subjects. By contrast, 4.3% of subjects who only give later choose to commit, and 3.7% choose indifference. The preference towards flexibility is statistically significant (χ^2-test, p <0.01). As shown in Table 3, the preference towards flexibility is significantly stronger among individuals choosing to give more later, than among individuals showing other dynamic giving paths.

This yields Finding 1.

Finding 1 (Give more later and Commitment): Individuals who choose to give more later exhibit a preference for flexibility.

Table 3: Dynamic giving decisions and commitment demand

	(1)	(2)	(3)
		Commitment Choice	
	Commitment ($p = C$)	Indifference ($p = I$)	Flexibility ($p = F$)
Give More Later	-0.318*	-0.156	0.475***
(give later, not give now)	(0.182)	(0.162)	(0.118)
Always Give	-0.153*	0.024	0.130*
(give later and give now)	(0.083)	(0.114)	(0.075)
Give less later	0.040	-0.226*	0.187
(not give later, give now)	(0.091)	(0.121)	(0.134)
Observations		163	

Note: This table presents the marginal effects (calculated at the means of all variables) from a multinomial probit regression relating patterns of dynamic choice to commitment choice. Give later, not give now is a dummy variable that takes value one if the subject gives in week 1 and not in week 2. Give later and give now is a dummy variable that takes value one if the subject gives in week 1 and week 2. Not give later, give now is a dummy variable that takes value one if the subject does not give in week 1 and but gives in week 2. The omitted category is choosing not to give in week 1 and week 2. Individual characteristics such as gender, ethnicity, whether the subject is a native English speaker, and their score in the Cognitive Reflection Test are included as covariates. Robust standard errors, clustered at the session level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The preference for flexibility is no longer observed among individuals who always give. Instead, these subjects appear to choose levels of commitment with equal likelihood. Strategy $(g_1, p, g_2) = (1, C, 1)$ is preferred by 8.6% of subjects, $(1, I, 1)$ is preferred 9.2%, and $(1, F, 1)$ is preferred by 7.4%. This distribution of choices is not significantly different from chance (χ^2-test, p=0.843). This yields Finding 2.

Finding 2 (Always give and Commitment): Individuals who always give exhibit an equal likelihood of choosing each of the possible levels of commitment.

Looking back to Table 1, the three main variables of interest for explaining the time-inconsistent charitable giving puzzle all point to the model of image concerns. However, not all of the data is perfectly in line with the model. The model of image concerns predicts that we would never observe a strategy that chooses $g_1 = 0$ and $g_2 = 1$. Yet, Table 2 shows us that about 14% of subjects are in this category. The strategy $(0, C, 1)$, that was chosen by 7.4% of subjects, could be consistent with one who is tempted to give and is sophisticated, thus choosing commitment, or self-signaling. Likewise, the strategy $(1, C, 0)$, chosen by 4.3% of the subjects, could be consistent with a sophisticated time-inconsistent subject who is tempted to *not* give. Only the later strategy will produce the time-inconsistent charitable giving puzzle, but its influence on the total effect is negated by the $(0, C, 1)$ subjects, meaning that models of self-control in general will not be able to explain the time-inconsistent charitable-giving effect.

Strategies that choose F are suggested by Kreps as a demand for flexibly in the face of an ambiguous future. First, only 36.4% of our subjects choose flexibility. Of those who do, Kreps suggests that if $E(v) > 1$ for $t = 2$, the most likely strategy would be $(1, F, 1)$. Likewise if $E(v) < 1$, the most likely strategy choice should be $(0, F, 0)$. In fact $(1, F, 1)$ represents only 7.4% of choices and is out numbered by $(1, F, 0)$ at 14.7%.[12] This leads to our next finding.

Finding 3 (Temptation and Uncertainty): Evidence in support of both models of temptation and of demand for flexibility are present in the experiment. However, the predictions of temptation have a net effect opposite to that of the time-inconsistent-charitable-giving effect, and demand for flexibility is too small to be of use in predicting the relatively higher giving when deciding now to give later.

The analysis thus far clearly indicates that, while there is evidence for temptation models among some individuals, these models cannot explain the demand for flexibility of time-inconsistent types. By contrast, the demand for flexibility is consistent with the model of image concerns, though further evidence is needed to ascertain how relevant image concerns are for dynamic behavior. We provide a test of this model, by controlling the size of the audience and the information we allow the audience to know.

[12] See Appendix D where we further examine whether subjects self-reported resolving uncertainty between the week 1 and week 2 sessions of the experiment.

5 Manipulating Social Image: Experiment 3

To directly test image concerns, Experiment 3 repeats Experiment 2, but adds three treatments that each manipulate the audience and the information they use to form social image. All three new treatments add the other subjects in the experimental session as the audience. This is typically between 20 and 23 other individuals. We then vary the part of the strategy we announce to this audience. Treatment Announce 3 (A3) tells the new audience all three elements of each other player's strategy. In $t = 1$ subjects in a given session are told g_1 and p of all subjects present, and then in $t = 2$ are also told g_2. Announce 2 (A2) tells the subjects in a session only the two $t = 1$ choices of g_1 and p. Finally, Announce 1 (A1) reveals one element, g_1 in $t = 1$, and nothing else. We refer to the absence of announcements as Baseline.

5.1 Several Audiences

Notice that announcing giving decisions to other subjects will create two audiences, the experimenter and the other subjects in the session. Next we discuss how our model of image concerns must be adjusted to account for this.

5.1.1 Image Function for Several Audiences

Begin with two audiences, $\mathcal{A}_a = \{n_a : \mu_a\}$ and $\mathcal{A}_b = \{n_b : \mu_b\}$. Intuitively, the aggregation function should have the basic qualities of the image function of a single audience noted above. Let $N(n_a : \mu_a, n_b : \mu_b)$ be the aggregation function for these two audiences. As we note in the definition of M, image utility can be written as $w(n)M(\mu)$. Recall that μ is the expected value of the individual's belief about the audience's beliefs about the individual's v. Following this, we can form the individual's expectation, μ_{ab}, as the weighted average of each audience's expected belief:

$$\mu_{ab} = \frac{n_a}{n_a + n_b}\mu_a + \frac{n_b}{n_a + n_b}\mu_b. \tag{4}$$

Then it is natural to define $N(n_a : \mu_a, n_b : \mu_b)$ as

$$N(n_a : \mu_a, n_b : \mu_b) = \omega(n_a + n_b)M(\mu_{ab}), \tag{5}$$

where $M(\mu_{ab})$ has all of the qualities of the image function of a single audience defined above. The generalization to three or more audiences is straightforward.

In our experiment, n_a will be about 20, while n_b will be 1. Given the concavity of $\omega(n)$ and the concavity of M, the existence of the larger audience will have the effect of greatly dulling the impact of the smaller audience, while the opposite effect will not be true. Inside M, the smaller audience will be weighed approximately by 1/21 while the large audience will be weighted 20/21, making the smaller audience nearly inconsequential to the predictions. Thus, when the two audiences differ, we will provide an analysis for the larger audience for the starkest predictions, knowing the true effects may be tilted slightly in the direction of the Baseline.

5.1.2 Equilibrium Conditions

Earlier we described how to construct the critical values of v that serve to define the different pools in equilibrium. While the full derivation of these is in Appendix A, we write them here in a form that is most useful for understanding the predictions of the announce conditions.

$$v^{F0} = 1 - (1+\beta)w(n)(M(\mu_F) - M(\mu_0))/0.1 \tag{6}$$

$$v^{I0} = 1 - (1+\beta)w(n)(M(\mu_I) - M(\mu_F))/0.4 \tag{7}$$

$$v^{C0} = 1 - w(n)(M(\mu_C) + \beta(M(\mu_{C0}) - (1+\beta)M(\mu_I)))/0.4 \tag{8}$$

$$v^{C1} = 1 - \beta(M(\mu_{C1}) - M(\mu_{C0}))/0.1 \tag{9}$$

where $\mu_0 = E(v|0 \leq v \leq v^{F0}), \mu_F = E(v|v^{F0} \leq v < v^{I0}), \mu_I = E(v|v^{I0} \leq v < v^{C0}), \mu_C = E(v|v^{C0} \leq v \leq \bar{v}), \mu_{C0} = E(v|v^{C0} \leq v < v^{C1})$, and $\mu_{C1} = E(v|v \geq v^{C1})$.

5.2 Predictions for the Announcement Conditions

We discuss predictions on the announcement conditions going from least to most restrictions on the two audiences.

5.2.1 Predictions for Announce 3 (A3)

We begin with Announce 3 under the assumption of only social signaling. Announce 3 simply expands the audience from 1 to n members. As is easily seen, this applies pressure for v^{F0}, v^{I0}, v^{C0}, and v^{C1} to all move lower. This means that, relative to the Baseline, we expect more individuals to agree to giving in Week 1 and 2, increasing the average values for g_1 and g_2.

Next, suppose some people are not engaging in social-signaling in the Baseline, but only self-signaling. Then the self-signaling person would be indifferent to $s = (1, p, 0)$ and $s = (0, 1-p, 1)$. Since the announcements in treatment A3 are clearly adding social-signaling, our predictions for A3 as compared to the Baseline are largely the same, but that we should expect the incidence of $s = (0, 1-p, 1)$ in A3 to decline relative to the Baseline.

We can also say something about counter-signaling. Since we predict a greater number of people choosing $g_1 = g_2 = 1$, the utility of always giving may be diluted. This could in turn give those at the very top of the distribution of v's an incentive to counter-signal: further separate themselves through choosing lower levels of commitment, in A3 relative to the Baseline. Thus we may expect the number of $s = (1, I, 1)$ and $s = (1, F, 1)$ to rise relative to the Baseline.

5.2.2 Predictions for Announce 2 (A2)

Announce 2 is identical to Announce 3 except no information on g_2 is provided. The main effect of this is that unless $v \geq 1$, there is no reason to give in both periods for image reasons, i.e., for anyone to join a pool of $g_1 = g_2 = 1$ givers. This means we can simply define $v_{C1} = 1$ in equations (6) to (9) above.

If the only audience is others, we predict v^{F0}, v^{I0}, and v^{C0} all lower relative to the Baseline, due to the observability of the week 1 gift. This means that we expect a rise in g_1. Since the week 2 gift is not observed, we then also predict a reduction in g_2. As with A3, we also expect a reduction in self-signaling strategies of the sort $s = (0, p, 1)$. Since g_2 is not observed, we expect less counter-signaling relative to A3.

When we combine this audience with the experimenter as audience, then we will get a slight softening of these predictions toward the Baseline predictions, but, we conjecture, the general effects should be in the directions just described.

5.2.3 Predictions for Announce 1 (A1)

Given that the audience in A1 will only see whether $g_1 = 1$ or 0, all subjects will sort into just two pools. The first is for $g_1 = 0$ and the second for $g_1 = 1$. The cutoff value separating them is v^{A1}. Without any signaling value from p or from giving in $t = 2$, any subject with $v < 1$ will have an incentive to attach to any $g_1 = 1$ the minimum level of commitment, $p = F$. However, those for whom $v \geq 1$ will still have an incentive to give in $t = 2$. For these people, the choice of p is irrelevant as it pertains to the new audience.

In the equilibrium we find the value of v^{A1} to solve

$$\omega(n)M(\mu_0) - (v^{A1} - 1)0.1 - \omega(n)M(\mu_{A1}) = 0 \tag{10}$$

Imagine for a minute that $v^{A1} = v^{F0}$ in A3, such that the same number of people choose $g_1 = 0$. Then the first two terms of (10) would be the same as in A3, but clearly $\mu_{A1} > \mu_{F0}$ even if $v^{A1} = v^{F0}$, since those who choose $g_1 = 1$ pool with all higher types. This means that if we start at $v^{A1} = v^{F0}$, then the value of the expression in (10) will be less than zero in value. How must we adjust v^{A1} to return equilibrium?

Differentiating the left hand side of (10) with respect to v^{A1} we find an ambiguous result:

$$
\begin{aligned}
&\frac{\partial}{\partial v^{A1}}\omega(n)M(\mu_0) - (v^{A1} - 1)0.1 - \omega(n)M(\mu_{A1}) \\
&=\omega(n)M'(\mu_0)(v^{A1} - \mu_0)\frac{f(v^{A1})}{F(v^{A1})} \\
&-\omega(n)M'(\mu_{A1})(\mu_{A1} - v^{A1})\frac{f(v^{A1})}{1 - F(v^{A1})} \\
&-0.1.
\end{aligned}
$$

Since $\mu_0 < \mu_{A1}$, by concavity $M'(\mu_0) > M'(\mu_{A1})$. And since $\mu_0 < v_{A1} < \mu_{A1}$ it follows that $(v^{A1} - \mu_0) > (\mu_{A1} - v^{A1})$. This makes the net value of the first two terms positive. However, for the full derivative to be positive the net value of the first two terms must exceed -0.1. While, intuitively, this seems likely, the actual result is unclear. As a result, we cannot compare the effect of A1 on $g_1 = 0$ to the Baseline or to the other conditions. However, we can expect strong reductions in p and g_2 (both conditional on $g_1 = 1$).

Table 4 summarizes the predictions regarding how the Announcement treatments will differ from the Baseline, without announcements. We present our main predictions concerning giving decisions, g_1 and g_2, which are the focus of our tests in Experiment 3. After presenting our main results, we test our additional predictions regarding self-signaling, counter-signaling, and commitment choices.

5.3 Experimental Design

As is clear by now, Experiment 3 extends Experiment 2 with three additional treatments designed to test the predictions of the social image model. These treatments manipulate the information about participants' decisions by announcing subsets of their strategies to the other participants in the experimental session (between 20 and 23 other subjects).[13] In Announce 1, we announce g_1 to all participants in Week 1. In Announce 2, we announce (g_1, p). Announce 3 reveals the full strategy (g_1, p, g_2). The announcement plans were known to all subjects before decisions were made. These sessions were otherwise like

[13]Details are shown in Appendix C.

Table 4: Main Predictions From Image Concerns Model in the Announcement Treatments

	Directions of Change Relative to Baseline	
Outcome:	g_1	g_2
Predictions		
Announce 3	+	+
Announce 2	+	−
Announce 1	?	−
Data		
Announce 3	+ (***)	− (n.s.)
Announce 2	+ (***)	− (n.s.)
Announce 1	− (n.s.)	− (***)

Note: All changes are relative to the Baseline treatment (in which the only audience is the experimenter). "+" denotes an increase. "'−" denotes a decrease. The question mark "?" denotes an ambiguous prediction. Under data, we present the sign of the effects and in parenthesis their statistical significance. n.s. denotes not significant, ***, **, * denotes significant at the 1%, 5% and 10% level, respectively.

those in Experiment 2.

A total of 263 new subjects participated in this experiment. Of these, 244 completed both weeks of the experiment.[14] There were 64, 65, and 59 in Announce 1, 2 and 3, respectively. In addition, 56 participated in a replication of Experiment 2, which is the Baseline treatment in Experiment 3. Since behavior in the new sessions of the Baseline treatment was not significantly different from behavior in Experiment 2,[15] all subjects in Experiment 2 are included in the analysis of Experiment 3 and form part of the Baseline treatment. Detailed instructions of this experiment are shown in Appendix B.

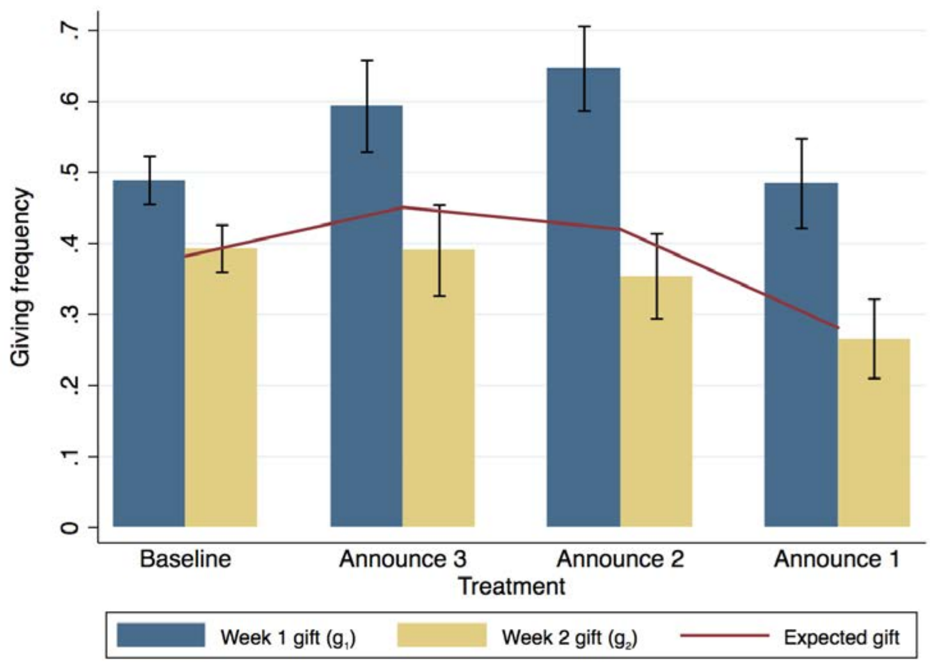
In the empirical analysis, we first examine, g_1 and g_2, which are our primary outcome variables. We acknowledge, however, that g_2 may have been impacted by the information provided at the end of the first week's session regarding the strategies chosen by others (see, e.g., Frey and Meier, 2004; Shang and Croson, 2009).

[14] There are no significant differences in participation in the Week 2 session by treatment (χ^2-test, $p = 0.129$), or by giving decisions and commitment choices within each treatment (χ^2-test, $p > 0.1$ in all treatments). Detailed results are shown in Appendix C.

[15] Donation decisions and commitment decisions in week 1, as well as donation decisions in week 2 did not differ (χ^2-test, $p > 0.1$ in all cases).

5.4 Main Results

Figure 2 shows the results from the three new announcement treatments along with the Baseline treatment. Here we see clear evidence of a continued time-inconsistent charitable giving. In fact, when described relative to give now, the effect appears stronger in the treatments with announcements: give later shows a 24% increase over give now in the Baseline treatment, while there is a 71% increase across the combination of all announcements treatments.[16]



Note: Error bars denote ± 1 S.E.

Figure 2: Giving by Announcements Treatment

Table 5 displays the estimated treatment effects of the announcements treatments on the main outcome variables discussed in the predictions. We also add the expected gift, $E(g) = pg_1 + (1 - p)g_2$, to show the overall effect on giving. We begin with the first column of Table 5 which shows the effects announcements on the Week 1 gift.

[16]The difference in giving decisions over time, which is of 10 percentage points in the Baseline treatment, more than doubles in the treatments with announcements. Using a differences-in-differences regression analysis, we find the difference increases by 12 percentage points in A1 ($p = 0.079$), by 20 percentage points in A2 ($p = 0.007$), and by 11 percentage points in A3 ($p = 0.231$).

Table 5: Treatment Effects in the Announcements Experiment

	(1) Probit Week 1 gift decision g_1	(2) Probit Week 2 gift decision g_2	(3) Linear reg. Expected gift E(g)
Announce 3	0.105***	-0.002	0.079
	(0.036)	(0.105)	(0.084)
Announce 2	0.151***	-0.042	0.041
	(0.045)	(0.087)	(0.067)
Announce 1	0.003	-0.134***	-0.092**
	(0.050)	(0.045)	(0.033)
Constant			0.525***
			(0.079)
Observations	407	407	407
R-squared			0.044

Note: Probit marginal effects (calculated at the means of all variables), and OLS coefficients. The variables Announce 1, Announce 2 and Announce 3 are dummy variables that take value one if the individual was a participant in that treatment, and zero otherwise. The omitted category is the Baseline treatment. Individual characteristics such as gender, ethnicity, whether the subject is a native English speaker, and their score in the Cognitive Reflection Test are included as covariates. Robust standard errors, clustered at the session level, are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

This outcome provides the clearest test of the model, as it is the first decision made by participants. Consistent with the predictions, we find that giving increases in Announce 3 and 2. We do not find an effect of Announce 1.

The second column of Table 5 shows the the effects announcements on the Week 2 gift. We find evidence in line with the predictions in Announce 1 and 2, whereby giving in Week 2 was expected to decrease. The effect in Announce 1 is significant, while that in Announce 2 is only directional. Contrary to our predictions, we do not find an increase in giving in Announce 3. As discussed above, this may be in part due to the fact that announcement decisions in Week 1 may convey information that leads to social influence effects, beyond the social image model.

Finally, we examine the results shown in column (3) of Table 5, which tests the effects of announcements on expected gifts. These are naturally a combination of the effects on

Week 1 and Week 2 decisions. Again, all three coefficients have the expected sign, one of which is significant. These findings indicate that only announcing the initial decision to give, without announcing commitment choices or the final gift, may discourage giving overall. Providing more information can directionally increase giving, though its effects may be weak in magnitude.

Overall, of the 5 treatment effects with clear theoretical predictions discussed in Table 4, 4 were measured with the correct sign, and three of those have significant coefficients. We must, however, acknowledge that multiple (5) hypotheses are tested (List et al., 2016). If we use a Bonferroni correction, on our primary outcome variables, g_1 and g_2, results remain nevertheless unchanged (all p values remain below 0.05). This leads to our last finding:

Finding 4 (Image concerns and audience effects): Exogenously varying the information about intertemporal giving decisions known to others strengthens the time-inconsistent charitable giving puzzle, and these audience effects are broadly consistent with the dynamic model of image concerns.

5.5 Additional Results

Our model of dynamic image concerns makes additional testable predictions for the effects of announcements on behaviors such as self-signaling and counter-signaling. We present the results of testing these predictions in columns (1) and (2) of Table 6. We expect to observe less self-signaling in all treatments, as a new audience has been added with other participants. This implies that, behaviorally, we expect fewer individuals to choose the strategy $(0, p, 1)$. Consistent with the model, column (1) of Table 6 shows that self-signaling is reduced in all treatments, significantly so in Announce 3 and Announce 2.

Next, the predictions of the image model imply that counter-signaling should increase in Announce 3, relative to Baseline, and it should decrease in Announce 2 and Announce 1 relative to Announce 3. To investigate counter-signaling, we test whether individuals

Table 6: Additional Treatment Effects in Experiment 3

	(1)	(2)	(3)	(4)
	Probit regressions		Linear regressions	
	Self-signaling	Counter-signaling	Commitment	Commitment if $g_1 = 1$
	$(0, p, 1)$	$(1, I, 1)$ & $(1, F, 1)$	p	$p * g_1$
Announce 3	-0.084*	0.054	-0.032	0.074*
	(0.049)	(0.040)	(0.027)	(0.036)
Announce 2	-0.085*	0.014	-0.005	0.075*
	(0.050)	(0.037)	(0.035)	(0.040)
Announce 1	-0.064	-0.055*	-0.027	-0.017
	(0.051)	(0.029)	(0.044)	(0.027)
Constant			0.528***	0.307***
			(0.073)	(0.068)
Observations	407	407	407	407
R-squared			0.005	0.048

Note: Probit marginal effects (calculated at the means of all variables) are shown in columns (1)-(2), and OLS coefficients in columns (3)-(4). The variables Announce 1, Announce 2 and Announce 3 are dummy variables that take value one if the individual was a participant in that treatment, and zero otherwise. The omitted category is the Baseline treatment. Individual characteristics such as gender, ethnicity, whether the subject is a native English speaker, and their score in the Cognitive Reflection Test are included as covariates. Robust standard errors, clustered at the session level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

are more or less likely to choose the strategies $(1, I, 1)$ and $(1, F, 1)$. The results are shown in column (2) of Table 6. We find that counter-signaling increases in Announce 3 directionally. It decreases significantly in Announce 1 relative to Announce 3 (χ^2-test, $p < 0.01$), and we find a directional drop in this behavior in Announce 2 relative to Announce 3 (χ^2-test, $p = 0.396$).

Table 6 also explores the treatment effects on the commitment decisions of individuals in Experiment 3. Relative to Baseline, conditional on choosing to give in Week 1 ($g_1 = 1$), individuals should choose higher levels of p in Announce 2 and Announce 3, as these are visible to the audience. By contrast, they should decrease their choice of p in Announce 1. Column (4) of Table 6 provides the results of this test. Consistent with the model, we find that commitment increases in Announce 2 and 3, while it directionally decreases in

Announce 1.[17]

6 Summary and Conclusion

We began this paper with a puzzle. In a between-subjects experiment we found strong evidence of time-inconsistent charitable giving. Giving increased nearly 50 percent simply by adding a week's delay between the *decision* to give and the *transaction* of that gift. The puzzle was validated in two additional within-subjects experiments showing the week-long delay increases giving by 24% to 82%.

The obvious place to look for a resolution of this puzzle is to models of self-control or present bias, or perhaps to models of an uncertain future. We show that strong demand for flexibility among time-inconsistent givers suggests that these models cannot be the only explanation for the puzzle.

We present a new dynamic model of time-consistent social-image signaling that both explains our puzzle and provides a rich set of hypotheses beyond other known models. The contribution is thus theoretical, empirical, and conceptual.

Why do we believe this result is important? Our approach changes the perspective of researchers in a non-trivial way. Rather than thinking of charitable giving as purchasing goods and services for others, our model is asking researchers to view the act of giving as a social interaction with unique social rewards, including social-image. We view social-image utility as a magnification of private concerns of guilt from free riding or the warm-glow from doing your fair share, which themselves may be internalizations of social norms and pressures.

Viewing charitable giving as a social interaction means that our focus changes to the process of giving. Utility can flow at the time the *decision* to give has been made. Thus, warm-glow, in the form of social-image, can begin before the gift is transacted. Execution of the gift at a later date acts the same way expanding the audience can increase social image, further increasing the benefits of separating the decision from the gift. These two

[17] Detailed descriptive statistics of commitment choices in Experiment 3, by treatment, are shown in Appendix C.

effects in combination provide the best model to explain our puzzle of time-inconsistent charitable giving.

This new view provides a more complete picture of motivations surrounding giving, and raises many interesting questions for future research. For instance, it suggests there could be an optimal distance of time between the agreement to give and the ultimate timing of the giving transaction. Other innovations in fundraising that take advantage of this form of preferences can also be studied, such as the potential benefit of taking pledges for future donations (Andreoni & Serra-Garcia, 2018).

In sum, we have introduced a challenging puzzle of time-inconsistent charitable giving. The puzzle requires a solution in which positive utility flows when the decision to give is made, not just when transactions occur. Self- and social-image concerns can imbue the decision to give with such utility. More than any other received model, image concerns provide the best explanation for the data from all three experiments presented.

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Appendix A: Theoretical Framework

A.1. Probabilistic Commitment

We assume that every population consists of some subjects with v close to zero who will choose $g_1 = g_2 = 0$. Set the image utility experienced by these people to $M_0 \leq 0$. Others will be so charitable as to have $v > 1$ and so will always choose $g_1 = g_2 = 1$. To explain time-inconsistent charitable giving in our game of probabilistic commitment, it must be that some people prefer to give in only one of the periods, and in particular must favor giving in $t = 1$.

It is possible that some people will be engaged in self-signaling as well as social-signaling if they see the experimenter as an audience. Here we will assume that everyone is engaged in social-signaling with an audience of $n = 1$, that is, the experimenter. We must acknowledge, however, that some subjects may not see the experimenter as an audience and will be engaged only in self-signaling. For this part if the discussion, we will set these people aside. When, in Experiment 3, we manipulate the audience and surely add significant social-signaling incentives, we will revisit this possibility that in Experiment 2, a small number of subjects are only engaged in self-signaling.

A.2. Definitions of Signaling Preferences

Definition: Social-Signaling. A person is engaged in social-signaling if they believe that an *audience of others* is seeing the person's strategy unfold. Based on information the audience holds at any time, the audience forms (or updates) beliefs about the expected value of the person's utility parameter v. Call the person's excpectation about the audience's belief μ. A person who cares for social-signaling maximizes a utility function that is increasing in μ.

Definition: Self-Signaling. A person is engaged in self-signaling if they behave as if they are unsure of their own v value, and, importantly, act like their own audience in a social-signaling model.

An important distinction between self- and social-signaling is that the self has the advantage of knowing their own full strategy for $t = 1$ and $t = 2$, while the audience for social-signaling can only condition their beliefs on actions they observe.

Definition: Self-and-Social Signaling. A person could have have both self- and social-signaling motives.

Having both motives will mean finding a way to aggegrate social image utility across at least two audiences.

A.3. Analysis of only Social Image Types

Lemma 1: Assume the population is engaged in social-signaling, but not self-signaling. Further assume that some people in this population prefer to give in only one period. These people will prefer to give in $t = 1$ rather than $t = 2$.

Proof: By assumption, the person can choose either $s = (1, p, 0)$ or $s = (0, 1 - p, 1)$ as both stragies will result in the same potential flows of earnings. However, the audience in $t = 1$ must form their first estimate of the donor's v based only on the portion of their strategies revealed in $t = 1$, that is $s' = (g_1, p)$. Suppose first that $s' = (1, p)$. Then the audience's *minimal* belief is that v is at least high enough to give $g = 1$ with probability p. Suppose instead that $s' = (0, 1 - p)$. Now the audience's *maximal* belief is that v is high enough to give $g = 1$ with probability p. Since $E(v|1, p) \geq E(v|0, 1 - p)$, the strategy $(1, p, 0) \succ (0, 1 - p, 1)$.$\|$

Lemma 1 already largely established Lemma 2.

Lemma 2: Assume the population is engaged in social-signaling, but not self-signaling. Then, if in $t = 1$ the audience observes a person choosing $g_1 = 0$ for any p, the audience can conclude that this person also intends to choose $g_2 = 0$ in $t = 2$.

Proof: Suppose not. Then this person chooses $s = (0, p, 1)$. This contradicts Lemma 1.$\|$

Next let's consider that some people in this population may prefer to give both periods. Since there is not a choice of $p = 1$, it will not be until $t = 2$ that these people reveal their full strategies. We add an extra assumption, which we will relax later:

Assumption 1 (No Counter-Signaling): The $E(v|1, p, 1)$ is the same for all p.

This assumptions implies that a person interested in social image will want to send the strongest signal of v in period $t = 1$ in order to get the highest social image. This means choosing $s' = (1, C)$ since $E(v|1, C) \geq E(v|1, I) \geq E(v|1, F)$.

Lemma 3: If $E(v|1, p, 1)$ is the same for all p and if the individuals cares about social image and wishes to choose $g_1 = g_2 = 1$, the individual will chose strategy $s' = (1, C)$ in $t = 1$.

Proof: Since social image utility will be the same in $t = 2$ regardless of p, and the objective is to choose $g_1 = g_2 = 1$ and p to maximize utility, then this is the same as choosing p to maximize social image at $t = 1$. This is achieved by choosing $s' = (1, C)$ in $t - 1$ and $g_2 = 1$ in $t = 2$.

This lends itself naturally to the next lemma:

Lemma 4: If $E(v|1, p, 1)$ is the same for all p, if the individual cares about social image, and if in $t = 1$ the audience sees the strategy $s' = (1, p)$ for any $p \neq C$, then the audience will believe that $g_2 = 0$.

Proof: Suppose not. Then, this will contradict Lemma 3.

We can now state a proposition for our probabilistic commitment game with social image concerns.

Proposition 1: Assume all individuals care equally about social image, and that the $E(v|1, p, 1)$ is the same for all p. Then there exists a Bayesian Perfect equilibrium of the probabilistic commitment game, which is characterized by numbers v^{F0}, v^{I0}, v^{C0}, and v^{C1}, such that $0 \leq v^{F0} \leq v^{I0} \leq v^{C0} \leq v^{C1} \leq 1$ and

a) all individuals with $v < v^{F0}$ choose $s = (0, p, 0)$, for any p;

b) all individuals with $v^{F0} \leq v \leq v^{I0}$ choose $s = (1, F, 0)$;

c) all individuals with $v^{I0} \leq v \leq v^{C0}$ choose $s = (1, I, 0)$;

d) all individuals with $v^{C0} \leq v \leq v^{C1}$ choose $s = (1, C, 0)$;

e) all individuals with $v^{C1} \leq v \leq \bar{v}$ choose $s = (1, C, 1)$.

Proof: Notice that in $t = 1$ there will be at most 4 pools consisting of those choosing the strategy $s' = (g_1, p)$ of $(0, p)$, $(1, F)$, $(1, I)$, and $(1, C)$. Lemma 3 shows that those wishing to give in both $t = 1$ and $t = 2$ would choose $(1, C)$ in $t = 1$. Then in $t = 2$ the pool at $(1, C)$ would be split into two pools by a $v^{C1} < 1$ such that those with $v^{C0} \leq v < v^{C1}$ choose $g_2 = 0$ and those with $v^{C1} \leq v \leq \bar{v}$ choose $g_2 = 1$. We assume that for certain distributions of v and definitions of the image function $M()$, this will indeed be an equilibrium, and then prove the proposition by construction.

Let $f(v)$, $0 \leq v \leq \bar{v}$, be the probability distribution function for v, with density function $F(v) = \int_0^v f(v)dv$. We assume $f(v)$ is continuous, and twice differentiable. Then define the function $a(x, y)$ as the average (that is, expected value) of v conditional on $x \leq v \leq y$:

$$a(x, y) = \frac{1}{F(y) - F(x)} \int_x^y v f(v) dv$$

Then, define the expected value of v within each pool as

$$\begin{aligned}
\mu_0 &= a(0, v^{F0}), \\
\mu_F &= a(v^{F0}, v^{I0}), \\
\mu_I &= a(v^{I0}, v^{C0}), \\
\mu_C &= a(v^{C0}, \bar{v}), \\
\mu_{C0} &= a(v^{C0}, v^{C1}), \text{and} \\
\mu_{C1} &= a(v^{C1}, \bar{v}).
\end{aligned}$$

Next, define the utility of a donor in a given pool at time $t = 1$. We will use $M()$ to indicate the image utility in $t = 1$ and $\delta\beta M()$ as the discounted image utility for $t = 2$, where $0 < \delta\beta \leq 1$. We use δ to represent the one week discount rate, and $0 < \beta \leq 1$ to represent the idea that social image earned in period 1 may only partly carry over to the period 2 decision.

$$U(v|0, p, 0) = M(\mu_0) + \delta\beta M(\mu_0) \tag{11}$$

$$U(v|1, F, 0) = 0.1\delta(v-1) + M(\mu_F) + \delta\beta M(\mu_F) \tag{12}$$

$$U(v|1, I, 0) = 0.5\delta(v-1) + M(\mu_I) + \delta\beta M(\mu_I) \tag{13}$$

$$U(v|1, C, 0) = 0.9\delta(v-1) + M(\mu_C) + \delta\beta M(\mu_{C0}) \tag{14}$$

$$U(v|1, C, 1) = \delta(v-1) + M(\mu_C) + \delta\beta M(\mu_{C1}). \tag{15}$$

Then in equilibrium, the critical values v^{F0}, v^{I0}, v^{C0}, and v^{C1} solve these four equations:

$$U(v^{F0}|0, p, 0) - U(v^{F0}|1, F, 0) = 0 \tag{16}$$

$$U(v^{I0}|1, F, 0) - U(v^{I0}|1, I, 0) = 0 \tag{17}$$

$$U(v^{C0}|1, I, 0) - U(v^{C0}|1, C, 0) = 0 \tag{18}$$

$$U(v^{C1}|1, C, 0) - U(v^{C1}|1, C, 1) = 0 \tag{19}$$

By the assumption that M is increasing, continuous, and concave, this system will have a unique solution where $0 \leq v^{F0} \leq v^{I0} \leq v^{C0} \leq v^{C1} \leq 1$. The final inequality follows from the assumption that all those with $v \geq 1$ will choose $g_1 = g_2 = 1$ as long as $M \geq 0$ and by continuity there will form a pool of "always give" types that includes some points $v < 1$ in the neighborhood of $v = 1$. ‖

A.3.1. Generalization to Counter-signaling

If we weaken the assumption of no counter-signaling, we can potentially get one or even two new types of equilibria that include counter-signaling. By counter-signaling we mean that the highest type person choosing $g_1 = g_2 = 1$ does not employ the strongest signal of $p = C$ in $t = 1$ but instead sends a weaker signal choosing, say $s' = (1, I)$ rather than $(1, C)$, thus pooling with lower type in $t = 1$, such that in $t = 2$ this person can reveal themselves to be (among) the highest types. They can do this if the utility lost in the lower quality signal sent in $t = 1$ can be made up for by those with high enough v such that the social image $M(1, I, 1) > M(1, C, 1)$. In particular, if upon seeing the full strategy of $s = (1, I, 1)$ the social image for this strategy increases just enough such that $U(v|1, I, 1) \geq U(v|1, C, 1)$ if and only if $v = \bar{v}$, and for all others the inequality is reversed. Then we can establish a new equilibrium where the most generous type can further separate from those of lower v. This is shown in Corollary 1 below.

If there is a sufficiently long right tail of the distribution of types, $f(v)$, then it is possible for there to be two counter-signals: $(1, F)$ by the highest group, and $(1, I)$ by the second highest group. This is shown in Corollary 2.

Of course, if there is no social information about g_2, then counter-signaling will not be possible, excluding these strategies as equilibria. This will return when discussing Experiment 3.

Corollary 1: Assume the no-counter-signaling assumption fails, and in particular assume $M(\mu_I) + \beta M(\bar{v}) > M(\mu_C) + \beta M(\mu_{C1})$, but $M(\mu_F) + \beta M(\bar{v}) < M(\mu_C) + \beta M(\mu_{C1})$. Then, there exists a probability distribution function $f(v)$, $0 \leq v \leq \bar{v}$, and a neighborhood of $\bar{v}$, $N_\epsilon(\bar{v})$, such that all j with $v_j \in N_\epsilon(\bar{v})$ choose the strategy $s = (1, I, 1)$. In equilibrium the image function $M(\mu)$ assures us that the individual i with $v_i = \bar{v} - \epsilon^*$ is indifferent to counter-signaling or choosing $s = (1, C, 1)$.

Proof: If these assumptions hold, then a person with $v_i = \bar{v}$ can deviate from the strategy $s = (1, C, 1)$ to the counter-signaling strategy whereby the person pretends to be a lower v type by choosing $s' = (1, I)$ in $t = 1$ such that in $t = 2$ the complete strategy $s = (1, I, 1)$ can be revealed. Since, by Lemma 2 the audience is anticipating that any strategy $s' = (1, I)$ must be completed in $t = 2$ with $s = (1, I, 0)$, the audience must ask who is most likely to profit from this deviation. If the answer is that only individuals at or very near $v_i = \bar{v}$, then this counter-signaling strategy can become an equilibrium. Given continuity, there will be a neighborhood of $\bar{v}$ where all i with v_i in this neighborhood will form a small pool that sends the counter-signal in period 1 and further separates themselves from the other "always give" types.

In particular, let $\mu(\epsilon) = a(\bar{v} - \epsilon, \bar{v})$ be the expected value of v given $v \in N_\epsilon(\bar{v})$. Then, for the equilibrium to exist, we need to find a value of ϵ, say ϵ^*, such that the no-counter-signaling conditions, appropriately modified, hold for $v_i \in N^*_\epsilon(\bar{v})$ but not for those with $v \notin N^*_\epsilon(\bar{v})$. Specifically, $M(\mu_I) + \beta M(\mu\epsilon^*) > M(\mu_C) + \beta M(\mu_{C1})$, but $M(\mu_F) + \beta M(\mu(v^*) < M(\mu_C) + \beta M(\mu_{C1})$. ‖

Corollary 2: Assume $M(\mu_F) + \beta M(\bar{v}) > M(\mu_C) + \beta M(\mu_{C1})$. Then there exist a neighborhood of $\bar{v}$, $N_\epsilon(\bar{v})$, such that all i with $v_i \in N_\epsilon(\bar{v})$ choose the strategy $s = (1, F, 1)$. And, letting $\bar{v}'$ be the lowest element of $N_\epsilon(\bar{v})$, then there exists another neighborhood of $\bar{v}'$ such that all $v_j \in N_\gamma(\bar{v}')$ such that $v_j < \bar{v}'$ the strategy $s = (1, I, 1)$ will be optimal.

Proof: Here we simply follow the logic of Corollary 1, applying the method twice, under the assumption that the distribution of v will actually support the equilibrium. ‖

A.3.2. Analysis of only Self-Signaling types

Assuming people are only self-image signalers is equivalent to assuming that $t = 1$ and $t = 2$ are combined to a single decision. In particular, to a self-signaler the strategies $s = (1, p, 0)$ and $(0, 1 - p, 1)$ are the same. This then reduces the self-signal to choosing a probability with which to give, say q, where now q has five possible values, $q = 0, 0.1, 0.5, 0.9$, or 1. The strategy $q = 0$ results from $s = (0, p, 0)$ and $q = 1$ from $s = (1, p, 1)$. Contrary to the above, now $(1, p, 0)$ and $(0, 1 - p, 1)$ both produce p.

With a model of pure self-signaling the solution is obvious:

Proposition 2: If subject care only about self-signaling there will exist an equilibrium will be characterized by four numbers, $v_{0.1} \leq v_{0.5} \leq v_{0.9} \leq v_1 \leq 1$, such that

a) If $v_i < v_{0.1}$ then i will give with probability $q = 0$.

b) If $v_{0.1} < v_i \leq v_{0.5}$ then i will give with probability $q = 0.1$

c) If $v_{0.5} < v_i \leq v_{0.9}$ then i will give with probability $q = 0.5$

d) If $v_{0.9} < v_i \leq v_1$ then i will give with probability $q = 0.9$

e) If $v_1 < v_i$ then i will give with probability $q = 1$

Proof: This is a subclass of the case considered in Proposition 1. The same tools can be applied to construct this proof.

Appendix B: Instructions and Decision Screens

B.1. Summary of Session Structure

All experiments invited subjects to participate in a 2-week experiment. We refer to Week 1 and Week 2 sessions in what follows. Participation in the two sessions was always required and independent of decisions made in Week 1.

The structure of the Week 1 session was as follows. First there was a Welcome Sheet, shown below. After subjects read the Welcome Sheet, a GiveDirectly Pitch was done. The slides of GiveDirectly were shown on a screen in front of the room, visible to all subjects. The experimenter read the slides. After reading the slides, the instructions were read out loud. For each Experiment, we present the instructions and decision screens shown in Week 1 below. The text in square brackets that follows was not read aloud. All treatment differences are indicated in brackets below.

In Week 2 of Experiment 1, subjects did not receive any additional written instructions. In all treatments, they were first reminded of their donation decision in Week 1 on their computer screens, and then asked to complete several survey questions on their computer. Once everyone had completed the survey, the subjects were called individually to receive their payment.

In Week 2 of Experiments 2 and 3, subjects made their Week 2 donation decision (g_2). At the beginning of the session, subjects were reminded of their Week 1 decisions (g_1 and p). In the treatment Announce 3 sessions, they were reminded that their Week 2 donation would also be announced, following the same procedures as the announcements in Week 1. Once all subjects had made their decisions and completed several survey questions, a volunteer was randomly selected to roll a dice in front of the room, to determine for each subject whether their Week 1 or Week 2 decisions would be implemented, according to their choice of g_1, g_2 and p.

[WELCOME SHEET]

Welcome

Thank you for participating in this experiment. During the experiment you and the other participants are asked to answer a series of questions. Please do not communicate with other participants. If you have any questions please raise your hand and an experimenter will approach you and answer your question in private.

This experiment consists of two parts.

- Part 1: Today we will ask you to answer a series of questionnaires.
- Part 2: A follow up survey that you will be asked to fill out a week from today.

Payment

You receive for the participation in this experiment $30. Please note that in order to obtain you all payments you need to answer both parts of the experiment.

- Today you receive $15 for showing up to the experiment and answering the first part of the experiment. You can collect the $15 from the experimenter after the session is finished.
- The remaining $15 you will receive at the end of the next week's session.

B.2. Experiment 1

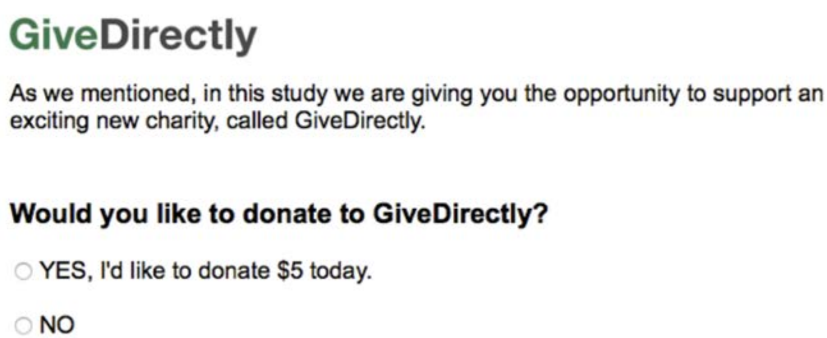
[At the end of the GiveDirectly pitch:]

- [Treatment NN]: We would like to ask you whether you would like to donate $5 of your show up fee for today's session to GiveDirectly. You will be asked to answer this question on your screens in a minute. If you answer "YES, I'd like to donate $5 today," $5 of your show up fee today will be donated. If you say "NO," no donation will be made. Your decisions are final today.

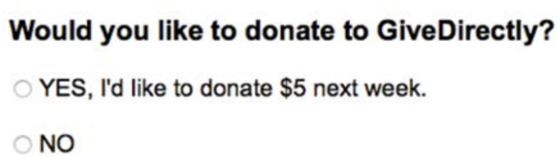
- [Treatment NL]: We would like to ask you whether you would like to donate $5 of your show up fee for next week's session to GiveDirectly. You will be asked to answer this question on your screens in a minute. If you answer "YES, I'd like to donate $5 next week," $5 of your show up fee next week will be donated. If you say NO, no donation will be made. Your decisions are final today.

Decision Screens

NN:



NL:



B.3. Experiments 2 and 3

The instructions of Experiment 3 are shown below. In brackets the additional variations in Treatments Announce 1, Announce 2 and Announce 3 are shown. The instructions for Experiment 2 did not explicitly discuss the indifference option, which was offered on the computer screens only. This discussion was added explicitly in Experiment 3, including the Baseline treatment of Experiment 3, which replicates Experiment 2. The results demonstrate no differences in decisions. The former set of instructions is available upon request.

Your Donation Decision

In this study we will ask you to make two donation decisions, but only one of these two will end up being the decision that counts. One donation decision will be made today. Call this your week-1 donation decision. Your second donation decision will be made next week, when you return to the lab to complete this study. Call this your week-2 donation decision.

Here is how it works.

Week-1 donation decision

Today we will ask you whether you would like to donate \$5 of your show up fee for next week's session to GiveDirectly. You will be asked to answer this question on your screens in a minute. If you answer "YES, I'd like to donate \$5 next week," \$5 of your show up fee next week will be donated. If you say NO, no donation will be made.

Week-2 donation decision

Next week, when you return to the lab to complete this study, you will have the opportunity to renew or revise your donation decision. In particular, next week you will be asked again whether you would like to donate \$5 of your show up fee for next week's session to Give Directly. If you answer "YES, I'd like to donate \$5 today,"

$5 of your show up fee next week will be donated. If you say NO, no donation will be made.

IMPORTANT: Only one of your decisions, either your week-1 or your week-2 donation decision, will be implemented. That is, only one decision will be the decision-that-counts. We will not use both! The most you will ever donate in this study is $5. The least you can donate is $0.

How will we decide whether your week-1 donation decision or your week-2 donation decision is the decision-that-counts?

Next week, after you make your week-2 donation decision, we will ask someone in the room to roll a 10-sided die to determine which decision is the decision-that-counts. All 10 numbers on the die are equally likely. Based on your decision, there will be a 1 in 10 chance or a 9 in 10 chance that the decision-that-counts is your week-1 decision.

Today you will have three options to choose from:

A. Your **week-1 donation decision** will count with a **1 in 10 chance**, and so your week-2 donation decision will count with a 9 in 10 chance.

B. Your **week-1 donation decision** will count with a **9 in 10 chance**, and so your week-2 donation decision will count with a 1 in 10 chance.

C. Your choice between Option A or Option B is determined using a coin flip.

If you chose Option A today, the following will occur. A volunteer will roll a 10-sided die and:

- Your **week-1** donation decision will be the decision-that-counts if number “1” is the outcome of the die roll.
- Your **week-2** donation decision will be the decision-that-counts if numbers “2”, “3”, “4”, “5”, “6”, “7”, “8”, “9” or “10” are the outcome of the die roll.

If you choose Option B today, the following will occur. A volunteer will roll a 10-sided die and:

- Your **week-1** donation decision will be the decision-that-counts if numbers "2", "3", "4", "5", "6", "7", "8", "9" or "10" are the outcome of the die roll.
- Your **week-2** donation decision will be the decision-that-counts if number "1" is the outcome of the die roll.

If you chose Option C today, a volunteer will flip a coin to determine whether your payment will be determined according to Option A or Option B.

- If the outcome of the coin flip is "heads", Option A will be the option assigned to you.
- If the outcome of the coin flip is "tails", Option B will be the option assigned to you.

[Announce 1:

Announcing Decisions

At the end of the session today, after everyone's decisions have been recorded, we will announce your week-1 donation decision to all of the participants in the room today. We will do this two ways.

First, we will use the screen at the front of this room to display the decision of each participant. The screen display may look something like this:

Seat Number	Week-1 Donation Decision
1	Yes, donate $5 next week
2	No
3	Yes, donate $5 next week

. . . and so forth

Next, we will call out seat numbers sequentially, starting at a randomly determined seat number. When we call your seat number, for example seat number 25, please stand up and say “I am at seat 25”. Then, please read the decision you made today listed on the screen, by saying “I chose yes, donate $5 next week”, or “I chose no”. Please remember to stay standing until we are ready to call the next seat number.

As you can see, this means that the other participants in this session will learn your week-1 donation decision.

[Announce 2:

Announcing Decisions

At the end of the session today, after everyone’s decisions have been recorded, we will announce your week-1 donation decision and your choice between Options A, B and C to all of the participants in the room today. We will do this two ways.

First, we will use the screen at the front of this room to display the decision of each participant. The screen display may look something like this:

Seat Number	Week-1 Donation Decision	Option A, B or C?
1	Yes, donate $5 next week	Option A
2	No	Option B
3	Yes, donate $5 next week	Option C

. . . and so forth

Next, we will call out seat numbers sequentially, starting at a randomly determined seat number. When we call your seat number, for example seat number 25, please stand up and say “I am at seat 25”. Then, please read the decision you made today listed on the screen, by saying “I chose yes, donate $5 next week”, or “I chose no”, and thereafter adding “And I chose Option A”, “And I chose Option B” or “And I chose Option C”. Please remember to stay standing until we are ready to call the next seat number.

As you can see, this means that the other participants in this session will learn your week-1 donation decision, and your choice between Option A, B or C.]

[Announce 3:

Announcing Decisions

At the end of the session today, after everyone’s decisions have been recorded, we will announce your week-1 donation decision and your choice between Options A, B and C to all of the participants in the room today. We will do this two ways.

First, we will use the screen at the front of this room to display the decision of each participant. The screen display may look something like this:

Seat Number	Week-1 Donation Decision	Option A, B or C?
1	Yes, donate \$5 next week	Option A
2	No	Option B
3	Yes, donate \$5 next week	Option C

. . . and so forth

Next, we will call out seat numbers sequentially, starting at a randomly determined seat number. When we call your seat number, for example seat number 25, please stand up and say "I am at seat 25". Then, please read the decision you made today listed on the screen, by saying "I chose yes, donate \$5 next week", or "I chose no", and thereafter adding "And I chose Option A", "And I chose Option B" or "And I chose Option C". Please remember to stay standing until we are ready to call the next seat number.

As you can see, this means that the other participants in this session will learn your week-1 donation decision, and your choice between Option A, B or C.

When you return to the lab next week, after everyone's decisions have been recorded, we will announce your week-2 decisions, following the same procedures as described above. We will also remind everyone in the room of your decisions in week 1.]]

In summary:

- Today you make a decision about donating \$5 out of your show-up fee for next week's session to Give Directly. This decision will be carried out next week with a 1 in 10 or a 9 in 10 chance.

- Next week you will be asked again to make a decision about donating \$5 out of your show up fee for next week's session to Give Directly. This decision will be carried out next week with a 9 in 10 or a 1 in 10 chance.

- Only one of these two decisions will be carried out.
- You make both donation decisions before you know which decision will be carried out.
- You decide today whether you would like Option A (your week-1 donation decision to count with a 1 in 10 chance and so your week-2 donation decision will count with a 9 in 10 chance), Option B (your week 1 donation decision to count with a 9 in 10 chance and so your week-2 donation decision will count with a 1 in 10 chance) or Option C (you would like to flip a coin between these two options).
- After you have made your week-2 donation decision, a die will be rolled to determine whether your week-1 or your week-2 donation decision is the decision that counts. If you chose to flip a coin, a coin will be flipped beforehand.
- [Announce: At the end of the session today, [1: your week-1 donation decision [2, 3: and your choice between Options A, B and C]] will be announced to the rest of the participants in the room.
- [Announce: At the end of the session next week, [1, 2: there will be no announcements. [3: your week-2 donation decision will also be announced to the rest of the participants in the room, together with your week-1 decision and your choice between Options A, B and C.]]

Next you will be asked about your donation decision on the screens.

Remember: Your donation decision today could be the decision-that-counts so treat this decision as if it were the decision that will count.

Decision Screens

Week 1 decision:

GiveDirectly

As we mentioned, in this study we are giving you the opportunity to support an exciting new charity, called GiveDirectly.

Would you like to donate to GiveDirectly?

- YES, I'd like to donate $5 next week.
- NO

Commitment decision (on screen following week 1 decision):

As we mentioned, we will also ask you next week about your donation decision. Here you can choose whether you would like your donation decision today to be the decision-that-counts with a 1 in 10 chance or a 9 in 10 chance. You can also say that it doesn't matter to you which option is chosen, in which case we will flip a coin to decide for you.

Please select below what option you would prefer:

- **A:** I definitely want
  my donation decision **today** to count with a **1 in 10 chance**
  (and so my donation decision **next week** to count with a **9 in 10 chance**.)
- **B:** I definitely want
  my donation decision **today** to count with a **9 in 10 chance**
  (and so my donation decision **next week** to count with a **1 in 10 chance**).
- **C:** I truly don't care which option A or B above is chosen.
  Please flip a coin to decide.

Appendix C: Additional Analyses

C.1. Analysis of show-up rates

Table C.1 examines the determinants of the decision to show-up in Week 2, in the NN and NL treatments. We do not find that the treatment, or the decision to give within each treatment, or any individual characteristic is related to show-up in Week 2. Table C.2 provides the same analysis for the Commitment and Announcement Experiments.

C.1. Analysis of Show-up Rates (Experiment 1)

	No-show rate in Week 2	Give (g=1) If no-show	If show-up	*p-value*	N
NN Treatment	7.8%	28.6%	30.9%	*0.856*	179
NL Treatment	11.6%	45.0%	45.8%	*0.949*	173
NL vs. NN show-up rate (p-value χ^2-test)	*0.235*				

C.2. Analysis of Show-up Rates (Experiments 2 and 3)

	Experiment 2	Experiment 3 (Announcements)			
	Probabilistic Commitment	Baseline	Announce 1	Announce 2	Announce 3
No-show rate	10.9%	6.7%	5.9%	3.0%	13.2%
χ^2-test p-value (Announcements)		0.129			
Week 1 Decision	If show-up	If show-up	If show-up	If show-up	If show-up
No + c=0.9	26%	27%	8%	22%	10%
No + c=0.5	14%	16%	22%	8%	24%
No + c=0.1	12%	5%	22%	6%	7%
Yes + c=0.9	13%	13%	23%	15%	15%
Yes + c=0.5	13%	16%	17%	22%	22%
Yes + c=0.1	22%	23%	8%	28%	22%
	If no-show	If no-show	If no-show	If no-show	If no-show
No + c=0.9	35%	50%	0%	50%	22%
No + c=0.5	10%	25%	0%	0%	0%
No + c=0.1	0%	25%	0%	0%	0%
Yes + c=0.9	20%	0%	50%	0%	11%
Yes + c=0.5	10%	0%	50%	0%	44%
Yes + c=0.1	25%	0%	0%	50%	22%
χ^2-test p-value	0.537	0.401	0.352	0.841	0.372

C.2. Gender Differences in Experiment 1

Table C.3. disaggregates the results of Experiment 1 by gender. In the NN and NL treatments the number of male participants is 124 and the number of female participants is 194.

Table C.3. Results by Gender

	Men	Women
NN and NL Treatments		
Decide Now to Give Now (NN): Share of giving	0.323	0.300
	(0.058)	(0.046)
Decide Now to Give Later (NL): Share of giving	0.390	0.500
	(0.064)	(0.051)
NN vs. NL: χ^2-test (p-val)	0.754	0.183

Notes: This table presents the behavior of male and female participants in the NN and NL treatments. The table presents the frequency of each behavior unless otherwise noted. Standard errors are displayed in parentheses for giving rates.

C.3. Session sizes in Experiment 3

The session size in treatments Announce 1, Announce 2 and Announce 3 was as follows. In treatment Announce 1 the size of the Week 1 sessions was 22, 22 and 24, across three sessions. In Announce 2, the size of the sessions was 21, 22 and 24. In Announce 3, the size of the sessions was 21, 23 and 24.

C.4. Commitment Decisions in Experiment 3

Table C.5. provides detailed descriptive statistics of commitment choices in Experiment 3, by treatment.

C.5. Commitment Decisions in Experiment 3

		Treatment			
Week 1 gift, Week 2 gift		Baseline	Announce 1	Announce 2	Announce 3
Dynamically inconsistent (yes, no)	$p = F$	68.8%	72.2%	68.2%	53.3%
	$p = I$	14.6%	27.8%	18.2%	26.7%
	$p = C$	16.7%	0.0%	13.6%	20.0%
	Frequency (N)	48/219	18/64	22/65	15/59
Dynamically inconsistent (no, yes)	$p = F$	29.6%	25.0%	33.3%	0.0%
	$p = I$	14.8%	0.0%	0.0%	66.7%
	$p = C$	55.6%	75.0%	66.7%	33.3%
	Frequency (N)	27/219	4/64	3/65	3/59
Dynamically consistent (yes, yes)	$p = F$	27%	15%	15%	25%
	$p = I$	39%	46%	50%	45%
	$p = C$	34%	38%	35%	30%
	Frequency (N)	59/219	13/64	20/65	20/59
Dynamically consistent (no, no)	$p = F$	18%	14%	15%	19%
	$p = I$	33%	48%	25%	57%
	$p = C$	49%	38%	60%	24%
	Frequency (N)	85/219	29/64	20/65	21/59

D. Uncertainty and Flexibility: Additional Results

In this section we examine additional survey evidence regarding the role of uncertainty in Experiment 2. At the end of the Week 2 session, after all donation decisions had been made, we asked individuals to indicate their level of agreement with the following statements: "Over the last week... (a) I thought about GiveDirectly" (GD thought); (b) I read or did research about GiveDirectly" (GD read); (c) I learned about other charities like GiveDirectly" (Thought others); (d) I thought about whether my financial situation allows me to donate to GiveDirectly" (Thought budget). Answers were provided on a 5-point Likert scale, ranging from strongly disagree to strongly agree. Based on these statements we construct an index, that we label as Resolving Uncertainty index, that measures the extent to which the individual thought and did research about her donation decision. We also elicited the extent to which the search for information about GiveDirectly changed the subject's opinion, through the statement "Over the last week I became more favorable about GiveDirectly." (GD more favorable). We present average responses to each variable in Table D.1. Based on these statements we construct an index, labeled Resolving Uncertainty index, that measures the extent to which the individual thought and did research about her donation decision. A higher value of the index indicates more research and thought was given to the donation decision. We also elicited the extent to which the search for information about GiveDirectly changed the subject's opinion, through the statement "Over the last week I became more favorable about GiveDirectly."

In Table D.2. we examine the relationship between these measures and donation behavior. Naturally, since these measures were elicited after donation decisions have been made, the results should be interpreted with caution. Column (1) of Table D.2. displays the results of a linear regression on the (standardized) Resolving Uncertainty index and giving and commitment decisions. The results indicate that individuals who demanded flexibility report a higher likelihood doing more thinking and research between Week 1 and Week 2, relative to those individuals who are indifferent between commitment and

Table D.1. Self-reported behaviors between Week 1 and Week 2 sessions (Experiment 2)

	GD thought	GD read	Thought others	Thought budget	GD more favorable
Always give					
Flexibility	3.6	2.8	2.9	4.3	3.0
Indifference	3.3	2.1	2.2	2.9	3.1
Commitment	3.4	2.1	2.6	3.1	3.0
Never give					
Flexibility	3.3	2.5	2.8	3.7	2.8
Indifference	3.0	1.9	1.9	3.4	2.3
Commitment	3.5	2.3	2.4	4.3	2.8
Give more later					
Flexibility	3.1	2.3	2.8	3.6	3.0
Indifference	4.0	2.0	2.0	4.0	2.3
Commitment	3.4	2.0	2.1	2.7	2.6
Give less later					
Flexibility	4.4	3.4	3.0	4.4	3.6
Indifference	3.3	2.0	2.3	3.0	2.3
Commitment	3.3	2.7	2.3	4.2	3.1

flexibility. However, those subjects who choose to give more later ($g_1 = 1$ and $g_2 = 0$) and demand flexibility are *less* likely to do research and think about the charity, which speaks against the concern that this type of time-inconsistent individuals demanded flexibility due to uncertainty.

Column (2) of Table D.2. explores the relationship between changes in opinion with regards to GiveDirectly, time inconsistency and demand for flexibility. The results indicate that subjects who chose (No, Yes) and demanded flexibility express becoming significantly more favorable towards GiveDirectly in the week between the first and second session of the experiment. The behavior of these subjects is consistent with Kreps (1979), since they were initially uncertain and cautious, but changed their donation decision, potentially due to their change in opinion about GiveDirectly. By contrast, the behavior of subjects who chose to give more later ($g_1 = 1$ and $g_2 = 0$) and demanded flexibility is again inconsistent with Kreps (1979). These subjects change their decision towards not giving in Week 2, but they do not report becoming *less* favorable towards the charity, since the coefficient for this group is not significant and positive (0.803).

Table D.2. Flexibility and Uncertainty

	(1) Resolving Uncertainty Index	(2) Became more favorable towards charity
Flexibility	0.961*	-0.073
	(0.438)	(0.458)
Give more later X Flexibility	-1.053*	0.803
	(0.531)	(0.571)
Never give X Flexibility	-0.336	0.511
	(0.536)	(0.684)
Give less later X Flexibility	0.444	1.487**
	(0.433)	(0.515)
Commitment	0.192	-0.073
	(0.286)	(0.423)
Give more later X Commitment	-0.732	0.334
	(0.526)	(0.683)
Never give X Commitment	0.564	0.565
	(0.528)	(0.693)
Give less later X Commitment	0.386	0.894
	(0.531)	(0.507)
Give more later	0.462	-0.803
	(0.311)	(0.464)
Never give	-0.137	-0.784
	(0.513)	(0.598)
Give less later	0.042	-0.803*
	(0.473)	(0.420)
Constant	-0.375	0.240
	(0.332)	(0.388)
Observations	163	163
R-squared	0.133	0.094

Note: This table presents the estimate coefficients from an ordinary least squares regression relating choices in the Commitment treatment and self-reported measures of behavior between the Week 1 and Week 2 session. The Resolving Uncertainty index is the sum of the answers to the following statements: Over the last week... (a) I thought about GiveDirectly; (b) I read or did research about GiveDirectly; (c) I learned about other charities like GiveDirectly; (d) I thought about whether my financial situation allows me to donate to GiveDirectly. A value of 1 corresponds to strongly disagree and 5 corresponds to strongly agree. The variable Became more favorable towards charity takes values 1 to 5, reflecting disagreement/agreement with the statement "Over the past week I became more favorable about GiveDirectly". Both dependent variables are standardized. All explanatory variables are dummy variables that take value one if the subject chose the described behavior. Robust standard errors, clustered at the session level, are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$