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WHY ANNOUNCE LEADERSHIP CONTRIBUTIONS? AN EXPERIMENTAL STUDY OF THE SIGNALING AND RECIPROCITY HYPOTHESES

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Discussion paper

Why Announce Leadership Contributions? An Experimental Study of the Signaling and Reciprocity Hypotheses.*

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Abstract

Why do fundraisers announce initial contributions to their charity? Potential explanations are that these announcements cause future donors to increase their contributions, either because they want to reciprocate the generosity of earlier donors, or because the initial contributions are seen as a signal of the charity's quality. Using experimental methods we investigate these two hypotheses. When only the first donor is informed of the public good's quality, subjects not only copy the initial contribution, but the first donor also correctly anticipates this response. While this result is consistent with both the signaling and the reciprocity explanations, the latter is unlikely to be the driving force. The reason is that announcements have no effect on contribution levels when the quality of the public good is common knowledge. Thus our results provide strong support for the signaling hypothesis. (*JEL* C92, D82, H41)

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1 Introduction

Fundraisers often rely on a sequential solicitation strategy when asking for contributions. For instance, during fund drives potential donors may be informed of past contributions and in particular of major individual contributions. Capital campaigns are typically launched by the announcement of a large "leadership" contribution, and new donors and their pledged amounts are made public throughout the campaign. Churches collect contributions in open baskets, and recurring fundraising campaigns inform donors of previous contributions made in the local community or at the latest charity event.[1] Surprisingly there has been limited empirical research on such sequential strategies. One exception is Silverman, Robertson, Middlebrook, and Drabman (1984). They examine data from a 20-hour national telethon in which three different funding schemes were employed. Their results show that announcing the names of individuals pledging money and the amount of money pledged resulted in greater contributions than when they were not announced.

From a theoretical viewpoint the frequent use of announcements at first seemed puzzling to economists. Comparing a no-announcement contribution game with an announcement game where donors contribute one at a time, Varian (1994) shows that private contributions are largest when donors are uninformed of the contributions made by others. This result, however, relies on the assumption that the donors can commit to giving only once. Relaxing this assumption, predicted contribution levels with and without an announcement are identical. Thus a fundraiser will achieve no additional gain by announcing previous contributions.

Why then do fundraisers appear to be far from indifferent between announcing and not announcing past contributions? A number of alternative explanations have been provided. One is that announcements provide the donors with prestige or the ability to signal their wealth.[2] That is, announcements

[1] Edles (1993) recommends that fundraisers inform future donors of the number of donors and the total amount that they have contributed.

[2] Andreoni (1988, 1990), Harbaugh (1998), Glaeser and Konrad (1996), Olson (1965), and Steinberg (1989).

may effectively add a private benefit to the contribution, thereby increasing the marginal benefit of giving. While compelling, this explanation does not address the commonly held belief that announcements not only increase the leader's contribution, but also increase the future contributions of others. For instance, the chairman of the trustees of Johns Hopkins explains that the reason that the university asks donors for permission to announce their gifts is that "fundamentally we are all followers. If I can get somebody to be the leader, others will follow. I can leverage that gift many times over."[3]

One case in which theory predicts that announcements will affect the contributions of those who follow is when the payoff of the public good is discontinuous. Andreoni (1998) examines the case where a threshold of contributions must be reached to secure provision. In such an environment there may be multiple equilibria, some of which do not result in provision of the public good. Andreoni shows that announcements may allow donors to coordinate on a positive provision outcome. Similarly, if there is a discrete increase in payoffs at the completion of a project, Marx and Matthews (2000) show that sequential provision may result in a positive provision outcome, even when no such equilibrium exists in the simultaneous game. Thus in a threshold environment announcements may increase contributions. Unfortunately this explanation does not help us understand why fundraisers choose to announce contributions when raising funds for a public good without a threshold.[4] Indeed the evidence by Silverman et al. (1984) suggests that announcements also will be successful when provision is strictly increasing in the contribution level. Similarly a recent experiment by List and Lucking-Reiley (2001) demonstrates that large initial contributions will increase future contributions in a non-threshold environment.[5]

[3] The New York Times, February 2, 1997, p. 10.

[4] While fundraisers may combine an announcement strategy with an announced contribution goal for the campaign, these goals are not generally binding and hence the underlying technology of the public good is continuous. See Morelli and Vesterlund (2000) for examples and an examination of the fundraiser's incentive to truncate a continuous production function.

[5] List and Lucking-Reiley (2001) find that increasing the initial contribution from 10% to 67% of the campaign goal produces a nearly six-fold increase in subsequent contributions. While the objective for each solicitation was to provide funds for a computer, the letter made clear that insufficient or excessive funds would be put to alternative use within the organization. Thus provision was increasing with contributions. Consistent with the continuous production technology is the fact that their results are the same when contributions are refunded when they are short of the goal (see Bagnoli and Lipman, 1989, and Pecorino and

In a non-threshold environment a possible explanation for the positive correlation between initial and subsequent contributions is that the initial announcements serve as a signal that reveals information about the quality of the public good. Vesterlund (2001) shows that charities prefer to announce past contributions when there is imperfect information about the good's quality. The reason is that when the initial donor is informed about the charity's quality, then the fundraiser can credibly make this information common knowledge by announcing the level of the first contribution. For high-quality charities, announcements generate contributions that exceed those that arise when past contributions are not announced, and furthermore the contributions exceed the level that results when the charity's quality is common knowledge. Thus announcements not only help high-quality charities to be recognized as being worthwhile, but it also enables them to reduce the traditional free-rider problem.

A second explanation for the effectiveness of announcements in non-threshold environments may be that announcements trigger a social norm of reciprocity. Reciprocity generally refers to a *conditional* obligation, where decisions are made sequentially and actors are informed about previous decisions. In sequential games it has frequently been shown that people tend to be kind to those who have been kind to them and unkind to those who have been unkind.[6] If reciprocity extends to charitable giving then it will cause contributions to be positively correlated with previous contributions. In particular, the information that others have already made a (large) contribution may evoke a social obligation on future donors to reciprocate. Thus fundraisers may have an incentive to publicly announce previous contributions because it allows them to forcefully trigger a reciprocity norm.

The objective of this paper is to examine the role of announcements in a non-threshold environment and in particular to more carefully investigate the reciprocity and signaling hypotheses. We report results from a series of experiments designed to answer two questions: First, in an asymmetric information environment do announcements cause contributions to increase? Second, if con-

Temimi, 2001).

[6] See Fehr and Gächter (2000) for references and an overview of the importance of reciprocity.

tributions are higher with announcements, could this be due to reciprocity rather than signaling? We examine a simple environment, where there are two potential donors. The donors' information is exogenously determined, and charitable contributions correspond to contributions to a linear public good. In two of our treatments the first potential donor, but not the second, is informed of the quality of the public good, and we examine the effect of informing the follower of the leader's contribution. According to the signaling hypothesis, higher contributions are predicted when the leader's contribution is announced. In order to assess whether reciprocity may account for any increase in contributions we conduct two additional treatments to examine the effect of announcements when both donors are fully informed of the quality of the public good. These four treatments allow us to test the predictive force of the signaling hypothesis and also to calibrate the effect of reciprocity considerations.

Our results are broadly consistent with the signaling hypothesis. Followers in the asymmetric-information treatment tend to mimic the leaders' contributions, and leaders anticipate this inference. Thus leaders internalize the best response of subsequent donors, so that the leader's private incentives become aligned with that of the group. As a result announcements cause a substantial increase in contributions. In contrast announcements have a negligible effect on contributions when the quality of the public good is common knowledge. Thus, our results show that announcements are preferred in some environments but not in others, and that reciprocity is unlikely to be the reason why announcements are effective when the charity's quality is not common knowledge.

In the next section of the paper we derive the comparative static predictions of the signaling model and describe how these differ from a model of reciprocity. In section 3 we describe our experimental design, and we present the results of the experiment in section 4. In section 5 we discuss our findings in light of past experimental results and examine the practical implications of our results. Finally section 6 concludes the paper.

2 A Signaling Model of Voluntary Contributions

The signaling hypothesis posits that early contributions may serve as a signal of a charity's quality. The key ideas can be illustrated by means of a simple model in which charitable donations are treated as contributions to a linear public good. This model will serve as the basis for our experiment.

There are two players, Player 1 and Player 2, each with a unit endowment. Each player decides whether to allocate his endowment to a private good ($x_i = 0$) or a public good ($x_i = 1$), where the marginal per capita return from the public good is denoted by m. The payoff functions are:

$$\pi_i = 1 - x_i + m(x_1 + x_2),$$

for $i = 1, 2$, where the value of m is drawn by Nature from a commonly known probability distribution. In this environment a fully efficient outcome (in the sense of joint payoff maximization) requires that no player contributes if $m < \frac{1}{2}$ and both players contribute if $m > \frac{1}{2}$.

We will consider a number of different versions of this contribution game. Consider first the case where the sequence of events is as follows. Nature draws m. Player 1 is informed of the value of m before she chooses her contribution x_1. Player 2 is informed of Player 1's decision, but not of the true value of m. Then, Player 2 chooses his contribution x_2. Finally, payoffs are determined and the game ends.

In this game Player 2 can try to make inferences about the value of m from Player 1's decision, and Player 1 may adjust her contribution decision in anticipation of these inferences. To illustrate how this works assume that $E[m] < 1$, and that $E[m|m > \frac{1}{2}] \geq 1$. That is, on the basis of the prior distribution the expected value of m is below unity, implying that contributing to the public good is privately sub-optimal. However, if the return from the public good is known to exceed $\frac{1}{2}$, then the expected return of the public good exceeds that from the private good, and it is privately optimal to contribute.

Under these assumptions the unique perfect Bayesian equilibrium is for Player 1 to choose $x_1 = 1$ if $m > \frac{1}{2}$ and to choose $x_1 = 0$ if $m < \frac{1}{2}$. Player 2 will follow the choice of Player 1, that is, $x_2 = 1$ if $x_1 = 1$ and $x_2 = 0$ if $x_1 = 0$. In this equilibrium no player contributes if $m < \frac{1}{2}$ and both players contribute if $m > \frac{1}{2}$. Thus a fully efficient outcome is attained for every value of m.[7]

To illustrate the implication of the initial announcement, consider instead the case where Player 2 is not informed of Player 1's choice. Player 2 will now base his decision on the prior distribution of m. Given that $E[m] < 1$, Player 2's dominant strategy is not to contribute ($x_2 = 0$). Player 1 on the other hand will still base her decision on the true value of m, however now she contributes only when $m > 1$. Thus, contributions are inefficient when Player 2 is not informed of 1's decision. The equilibrium contribution levels for the two games are illustrated in Figure 1.

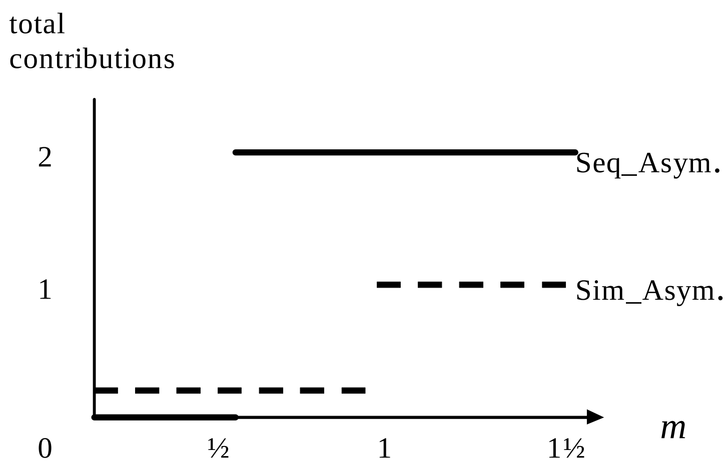

Figure 1. Total Contributions with Asymmetric Information: Sequential vs. Simultaneous Moves

With sequential moves, both players contribute when $m > \frac{1}{2}$, and with simultaneous moves, Player 2 never contributes and Player 1 contributes if $m > 1$. Whether Player 2 is informed about Player 1's move thus has a substantial

[7] The weaker condition that $Pr\{m > 1\} > 0$ ensures that signaling will occur in equilibrium, and it leads to higher contributions (and joint payoffs) than in the case where Player 2 is not informed of Player 1's decision. Signaling will only induce a fully efficient outcome if $E[m|m > \frac{1}{2}] \geq 1$.

impact on the total contribution level. The signaling hypothesis of charitable giving postulates that this increase in contributions is one of the reasons charities publicly announce initial (leadership) contributions. To investigate this hypothesis we will examine experimentally if announcements are effective in raising contributions when only Player 1 is informed of the quality of the public good.

From an empirical perspective, the answer to this question is, ex ante, not obvious. Even if subjects attempt to maximize own-earnings, the issues underlying the signaling equilibrium are subtle and cognitively demanding.[8] The equilibrium conditions require not only that subjects in the role of Player 2 make inferences from others' decisions and behave accordingly, but also that subjects in the role of Player 1 make their decisions in anticipation of these inferences.[9]

Signaling is not the only reason why we might find that announcements increase contributions. Abundant experimental evidence shows that subjects cooperate in environments in which equilibrium (in the standard sense) would predict non-cooperation. Moreover, several experimental studies have suggested that such cooperation is of a reciprocal (i.e., conditional) nature. That is, kind actions are followed by kind actions and unkind actions are repaid with an unkind response.[10] The sequential structure of the present game is therefore prone to reciprocal cooperation, and an increase in contributions may be due to reciprocity rather than signaling. Certainly, if reciprocity leads to a substantial amount of following behavior by Player 2 then a payoff-maximizing Player 1 will be induced to contribute when $m \in (\frac{1}{2}, 1)$.

To assess whether reciprocity considerations might explain why sequential

[8] Earlier signaling experiments suggest that separating equilibrium have less drawing power than pooling equilibria, especially when (perfect Bayesian) pooling and separating equilibria exist simultaneously (Cadsby, Frank, and Maksimovic, 1990, 1998, Cooper, Garvin, and Kagel, 1997a, 1997b). The case for separation is better when it is the unique equilibrium. Even in this case, however, it may take quite some time for play to develop towards separation (see Cooper et al., 1997b).

[9] This anticipation is necessary because Player 1's payoff depends on Player 2's decision. This dependence is one aspect of the model that distinguishes it from the models of informational cascades. For an experimental examination of informational cascades see for example Anderson and Holt (1997).

[10] Although there is wide agreement on the importance of reciprocity, there is less agreement on how to explain or model it. See for example Loewenstein, Thompson, and Bazerman (1989), Bolton (1991), Rabin (1993), Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Falk and Fischbacher (1998), Dufwenberg and Kirchsteiger (1998), and Charness and Rabin (2001).

moves induce higher contributions we also examine the effects of announcements when the value of the public good is common knowledge. Finding a negligible effect of announcements in this environment would suggest that reciprocity cannot account for substantive differences between contributions in the asymmetric sequential and simultaneous conditions. Furthermore, if contributions in the full-information sequential-move case exceed those in the full-information simultaneous-move case the difference gives us a measure of what proportion of the effect in the asymmetric-information environment is due to reciprocity rather than signaling.

We first determine whether announcements increase contributions in an asymmetric-information environment, and subsequently we examine whether a potential increase in contributions may be explained by reciprocity. To address these questions four versions of the basic public goods game are implemented. Two move structures (sequential versus simultaneous) are combined with two information conditions about the public good's return (full versus asymmetric). The next section outlines how these versions of the game were implemented experimentally.

3 Experiment

We examined a two-person public goods environment under four different informational treatments. Specifically we examine treatments where Player 2 is either informed or uninformed of the quality of the public good and/or Player 1's contribution. This 2×2 experimental design is summarized in Table 1.

Table 1: Player 2's Information

		Return from the public good: Observable	Return from the public good: Unobservable
Player 1's contribution:	Observable	Seq_Full	Seq_Asym
	Unobservable	Sim_Full	Sim_Asym

We ran four sessions of each of the four treatments, with 12 subjects in each session, for a total of 192 subjects. Subjects were recruited from a pool of undergraduate students at the University of Nottingham, and randomly assigned to a treatment. No subject participated in more than one session of the experiment.

All sessions used an identical protocol. Upon arrival, subjects were randomly assigned a computer terminal and a role as first- or second mover. Subjects retained their role throughout the session. In total, 24 subjects were observed in each role of each of the four treatments. This allocation of roles was described in a set of written instructions that the experimenter read aloud.[11] As part of the instructional phase, subjects completed a quiz on how to calculate the payoffs of the game. The experimenter checked that all subjects had completed the quiz correctly before continuing with the instructions. Subjects were allowed to ask questions by raising their hand and speaking to the experimenter in private. Subjects were not allowed to communicate with one another throughout the session, except via the decisions they entered on their terminal.

The decision-making phase of the session consisted of 18 rounds. In each round first movers were randomly and anonymously paired with second movers, with the stipulation that no one played another subject twice in a row, and that no pair of subjects would be matched more than three times.[12] Subjects' identities were never revealed to anyone.

In each round the subjects were given the choice between two actions: A or B. Choosing A gave the individual a certain private return of 40 pence. By choosing B both players received a return of 0, 30, or 60 pence. In terms of the model in section 2, choosing A corresponds to not contributing ($x_i = 0$) and B corresponds to contributing ($x_i = 1$). The return from A of 40 pence corresponds to one payoff unit, and the return from B corresponds to either $m = 0$, 0.75 or 1.5 payoff units.

At the beginning of each round first movers were informed of the return from B and were prompted to chose A or B. When all first movers had chosen, second movers were either informed of the return from B (full-information treatment) or told that each of the three values was equally likely (asymmetric-information

[11] Reading the instructions aloud caused the structure of the game to become common information. A copy of the instructions for the experiment can be found in Appendix I.

[12] The matching scheme was randomly generated prior to the experiment and used in all sessions.

treatment). Similarly the second mover was either informed of first mover's choice of A or B (sequential treatment) or not informed (simultaneous treatment). The second mover then made a choice between A and B.[13] At the end of each round, subjects were informed of choices and payoffs in their game, as well as the actual return from B, and they recorded these on a record sheet.

At the end of round 18, subjects were paid their earnings from all 18 rounds in private. All sessions lasted less than an hour and subjects earned an average of £11.52 (with a minimum of £6.90 and a maximum of £13.80).

Assuming that all subjects aim to maximize their own earnings and that this is common knowledge we get the following predictions in each of the four treatments. In the full-information treatments (Seq_Full and Sim_Full) both players choose A when $m = 0$ or 0.75, and both choose B when *m=1.5*. In the Seq_Asym treatment both players choose A when $m = 0$, and both choose B when $m = 0.75$ and 1.5. Finally, in the Sim_Asym treatment the uninformed second mover always chooses A, and the informed first mover chooses B when $m = 1.5$, and A otherwise.

For each session of the experiment a total of 108 joint decisions were made (6 pairs × 18 rounds). The corresponding sequence of 108 values of m was randomly drawn prior to the experiment, with $m = 0$ being observed 34 times, $m = 0.75$ a total of 39 times, and $m = 1.5$ a total of 35 times. This same sequence provided the values of the return from B for all sessions. From this sequence it is easy to determine the predicted contribution and earnings level in each treatment of the experiment. Table 2 summarizes these predictions.

Table 2: Equilibrium Predictions

	x_1	x_2	$x_1 + x_2$	Expected π_1(£)	Expected π_2(£)
Seq_Asym	74	74	148	13.2	13.2
Sim_Asym	35	0	35	8.4	10.7
Seq_Full	35	35	70	11.9	11.9
Sim_Full	35	35	70	11.9	11.9

Table 2 makes clear that announcements are predicted to have an effect only in the asymmetric-information environment and that this is the only case in

[13] Note that all sessions have sequential moves in the sense of priority in time.

which the equilibrium will be Pareto efficient.

4 Results

In our analysis of the data we provide answers to the two questions posed in Section 2. First, do announcements increase contributions in an asymmetric-information environment, and, second, may a potential increase in contributions be due to reciprocity? Since both the signaling and reciprocity hypotheses are consistent with finding that announcements increase contributions in the asymmetric-information treatment an affirmative answer to the first question will not allow us to distinguish between the two hypotheses. If, however, announcements are equally successful when both donors know the value of the good, then it is unlikely that signaling is the explanation for its success in the asymmetric treatment.

4.1 Do Announcements Increase Contributions when there is Asymmetric Information?

The equilibrium prediction is that announcements increase contributions when only the first mover knows the public good's quality. The evidence from the asymmetric-information treatments strongly supports this prediction. As shown in Figure 2 announcements increase individual and total contributions by more than 50%. These differences are statistically significant at conventional levels, even using a conservative test that uses each session as the unit of observation (see Appendix II for details). Thus actual behavior is consistent with the prediction that announcements are effective in an asymmetric-information environment.

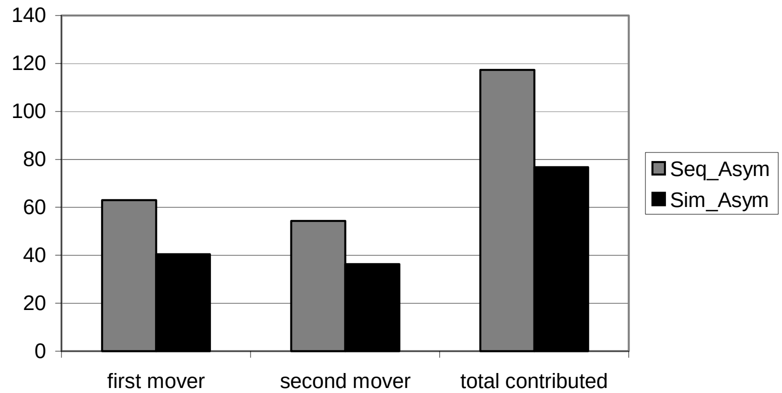

Figure 2: Average Contribution per Session
(second mover uninformed)

What causes this increase in contributions? The answer is twofold. First, our results show that with announcements the second mover is very likely to mimic the decision of the first mover. Second, it appears that the first mover correctly anticipates this response. When the first mover contributes, we observe 80.6% of second movers mimicking her behavior. In contrast, only 7.8% of second movers choose to contribute when the first mover does not contribute. Hence, a contribution by the first mover increases the contribution rate of second movers by 72.8%-points. Although this increase is smaller than that predicted in equilibrium (100%), it is sufficient to make contributions at $m = 0.75$ the payoff-maximizing strategy for the first mover. The reason is that a rational first mover should contribute at $m = 0.75$ if she believes that doing so will increase the probability that the second mover contributes by at least 33.3%-points. The behavior of the first mover suggests that the vast majority of them correctly anticipate the second mover's response. Figure 3 illustrates the first movers' frequency of contribution conditional on m in each of the two treatments.

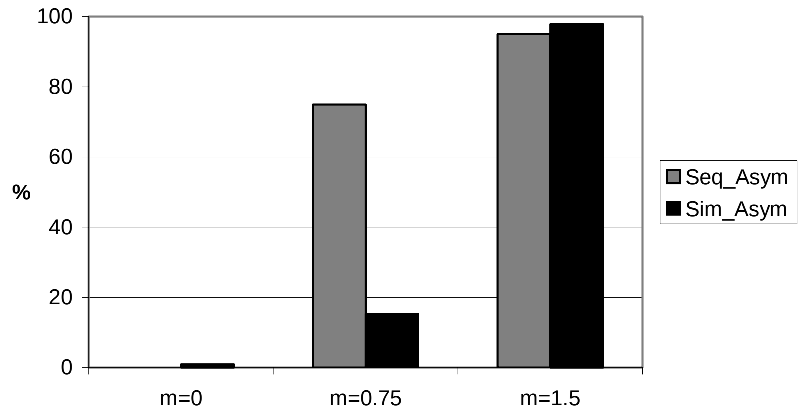

Figure 3: Frequency of Contributions by the First Mover

Independent of announcements first movers almost never contribute when $m = 0$, and they almost always contribute when $m = 1.5$. The primary difference between the two treatments is in first-mover contributions when $m = 0.75$. When the first contribution is announced 75% of first movers contribute when $m = 0.75$; in contrast only 15% contribute in the absence of announcements.

Next we examine the effect of announcements on earnings. Our results show that announcements increase individual earnings by between 15-20%. While substantial this increase is smaller than that predicted. Table 3 summarizes the actual and predicted earnings. Earnings opportunities are not fully exploited in the Seq_Asym treatments. The primary reason is that the second mover occasionally fails to contribute when $m = 0.75$ or 1.5, causing observed earnings to be 91% of the predicted (efficient) level. Earnings in the Sim_Asym treatments also differ from the prediction. While first-mover earnings are larger than predicted, those of the second mover are smaller than predicted. This shortfall arises because the second movers contribute about one third of the time in the simultaneous treatment, with one third of these contributions being made when $m = 0$, i.e., when the public good is worthless. Each such worthless contribution constitutes a loss of 40 pence for second movers, but has no impact on first-mover earnings.

Table 3: Average Earnings (£) per Subject per Session

		First movers	Second movers
Seq_Asym	predicted	13.2	13.2
	observed	11.7	12.3
Sim_Asym	predicted	8.4	10.7
	observed	10.1	10.4

Though joint payoffs are higher than predicted in the simultaneous treatment and lower than predicted in the sequential treatment, our results are still consistent with the comparative static prediction that both players enjoy significantly higher earnings when the initial decision is observed (see Appendix II for details). Combined with the larger overall contributions, both donors and a contribution-maximizing fundraiser would prefer that the initial contributions be announced in an asymmetric-information environment. As shown above the explanation for this success is that second movers mimic the announced decision of the first mover, and that the first mover correctly anticipates this response. There are two reasons why the second mover may choose to mimic the decision of the first mover. It may be that the second mover simply wants to reciprocate the kindness of the first mover, or that he views the first mover's contribution as a signal that the marginal benefit from contributing is positive. To discriminate between these two hypotheses of reciprocity and signaling we examine the effect of announcements when both first and second movers know the quality of the public good.

4.2 Is Reciprocity the Reason that Announcements Increase Contributions?

The announcement of the initial contribution may allow reciprocal subjects to coordinate on contributing when $m = 0.75$. If reciprocity causes contributions to increase with announcements, then we should expect that this also plays a role when the quality of the public good is common knowledge.

In contrast to the asymmetric-information treatment, we find that announcements have a negligible effect in the full-information treatment. Figure 4 illustrates the average contributions by treatment. First movers give more, on average, when contributions are announced, and second movers give more when they are not announced. Neither of these effects is significant (see Appendix II for details). As a result we can reject the hypothesis that overall giving is larger with announcements. Consistent with the equilibrium prediction we see that announcements have little effect in the full-information treatment, suggesting that there is little support for the hypothesis that reciprocity is the driving force behind the success of announcements in the asymmetric-information treatments.

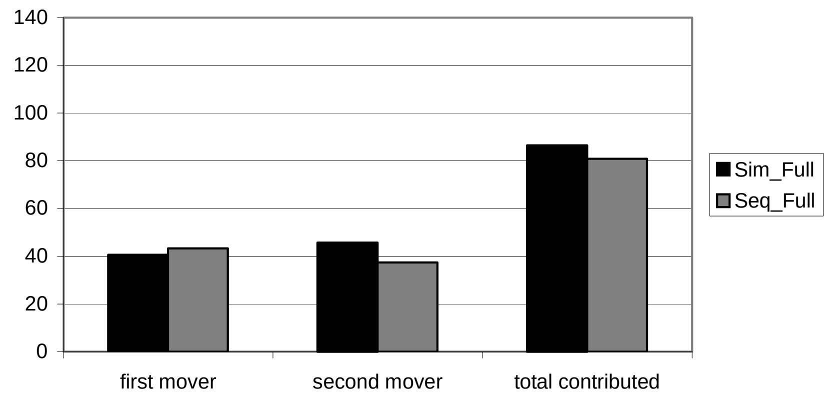

Figure 4: Average Contribution per Session
(full information)

In the asymmetric-information treatment we found a substantial degree of following behavior when the second mover was informed about the choice of the first mover. In the full-information treatment this happens to a much lesser extent. The interesting case is when $m = 0.75$. Conditional on the first mover contributing, the second mover contributes in 33.3% of the cases. If the first mover does not contribute, the second mover does not contribute either. Thus, some degree of reciprocity is present, and by contributing, the first mover can increase the contribution rate of the second mover by 33.3%-points. This is exactly the rate of increase that would make a rational risk-neutral first mover indifferent towards contributing.[14]

[14] These results are remarkably close to those of Clark and Sefton (2001) for a sequential

This raises the question of whether the first mover is affected by the announcement of her contribution. Figure 5 illustrates the first mover's likelihood of contributing conditional on the value of m. Similar to the asymmetric-information treatments (see Figure 3) we see that the first mover generally contributes when the value of m is 1.5 and doesn't contribute when it is 0. The only difference relative to the asymmetric-information treatment is that announcements have a limited effect on contributions when $m = 0.75$. Contributions by the first mover increase when her choice is announced to the second mover (from 16% to 27%) but the increase is not nearly as large as in the asymmetric-information treatment (from 15% to 75%). This should not be surprising in view of the finding that in the full-information treatment there is much less following behavior by the second mover than in the asymmetric-information treatment.

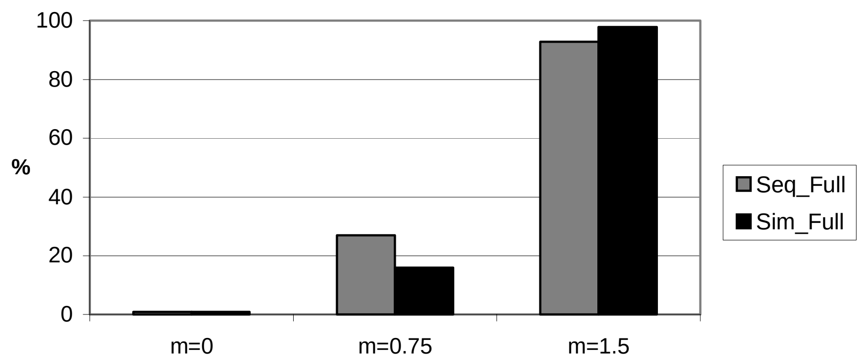

Figure 5: Frequency of Contributions by the First Mover

Interestingly, with $m = 0.75$, the overall contribution rate by the second mover is actually lower when first-mover contributions are announced (9%) than when these are not announced (27%). Thus, when there is full information, announcements have a negative effect on second-mover contributions and a positive

prisoner's dilemma with a payoff structure that is comparable to our full-information game with $m = 0.75$. In their baseline treatment the rate at which the second mover cooperates increases by about 35%, whereas the increase needed to make cooperation a best response for the first-mover is 25%. Clark and Sefton do not study a simultaneous move game to which results can be compared.

effect on first-mover contributions.[15]

The effect of announcements on earnings is also limited. Given the differing contribution patterns of the two donors it is not surprising that announcements decrease first donor earnings while increasing those of the second donor. The overall effect on total earnings is an insignificant decrease of 1% (see Appendix II for details).

In summary, our data show that announcements are ineffective in increasing the overall contribution level when both donors know the value of the public good. This suggests that it is unlikely that the substantial increase in contributions in the asymmetric-information treatment is caused by reciprocity.

5 Discussion

Although we frequently observe fundraisers announcing past contributions, our results suggest that the success of such a strategy depends on the informational environment. While announcements have a negligible effect on contributions in the full-information environment, we find that they cause a substantial increase in contributions in the asymmetric-information environment. This result indicates that announcements are successful because they enable the first mover to signal that the public good is worthwhile.[16] Relative to previous signaling experiments it is striking how quickly subjects behave according to the equilibrium prediction of the game. Previous studies have found that it takes time for strategic play to develop. For example, in the entry limit pricing game of Cooper, Garvin, and Kagel (1997b) play consistently starts off with the first mover choosing her myopic maximum, that is, the choice that would maximize her payoffs if she ignores the effect of her choice on the choice of the second mover. Similarly the second mover typically starts off at the myopic maximum,

[15] Van der Heijden et al. (2001) compare sequential and simultaneous moves in a gift-exchange experiment and find a similar effect. Rather than furthering the overall rate of cooperation, a sequential move structure mainly seemed to affect the strategic positions of the players, putting the first-mover in a weaker position and the second-mover in a stronger one.

[16] Romano and Yildirim (2001) provide an alternative explanation for announcements. In a full-information environment they show that donors, who are sufficiently concerned about the warm-glow of giving, may give more in a sequential game. The results from our full-information treatment rule out the possibility that this explanation is what causes the success of announcement in the asymmetric-information environment.

ignoring the information that is contained in the choice of the first mover. Only with sufficient repetition does play converge to equilibrium.

In our Seq_Asym treatment strategic behavior develops almost immediately. If the first mover anticipates that the second mover will follow her choice she should contribute when the return is 0.75, but if she ignores this response she should not contribute (not contributing is the myopic maximum when $m = 0.75$). Already in the first round we find that first movers contribute at a rate of 75% when they are confronted with a return of $m = 0.75$. Similarly, the myopic maximum for the second mover is not to contribute. We find, however, that conditional on the first mover contributing second movers contribute at a rate of 69% in the first round.

One reason why equilibrium play develops rapidly may be that the equilibrium of the game is unique (see also Cadsby et al., 1990). Note however that uniqueness does not generally secure rapid convergence to equilibrium. For example, the lemons market experiments with cheap talk in Forsythe, Lundholm, and Rietz (1999) are also characterized by a unique (pooling) equilibrium. Yet play shows only a very weak tendency to converge toward the equilibrium. It may be that another reason that signaling works so well in our experiment is that the equilibrium is efficient and results in symmetric payoffs to the players, implying that at equilibrium there is no conflict between own-payoff maximization, efficiency, or equity. Although, as we have seen in section 4.2, other-regarding preferences are insufficient to trigger support for reciprocity in the full-information environment, it may be that these same preferences enhance the behavioral attraction of the signaling equilibrium in the asymmetric-information environment.

Our experimental results support the theoretical prediction that fundraisers prefer to announce past contributions in an asymmetric-information environment. It is interesting to ask whether such an environment could arise endogenously. Theoretically, this question can be addressed by explicitly incorporating information acquisition into the model. For example assume that potential donors, just before donating, are given the private option to purchase a perfectly informative and private signal on the charity's quality. Consider first the symmetric cases where both donors are equally informed. In the event that information is costless both donors will know the value of the charity, and when the cost of information is sufficiently large neither donor becomes informed.[17] In both cases the resulting contributions are Pareto inferior. Of interest is the fact that there are intermediate costs at which only the first mover purchases information. The reason is that the benefit of purchasing information is larger for the first mover than the second. When information costs are between 0.1 and 0.25 the resulting equilibrium is one where the first mover is informed and the second is not.[18] Hence for this intermediate range of costs the asymmetric-information environment will arise endogenously, and as shown experimentally this places the contribution-maximizing fundraiser in a position where she prefers to announce the initial contribution.[19]

The theoretical predictions are that both the fundraiser and the donors will prefer an environment where only the first mover knows the value of the public good. In our experiments, consistent with the first part of this prediction, we see in figure 6 that average contributions in the sequential asymmetric-information treatment are 45% larger than those found in the sequential full-information treatment (this difference is statistically significant at conventional levels of significance, see Appendix II).

[17] In equilibria where the first mover has purchased information the second donor only purchases information when the first contribution is positive.

[18] Let c denote the cost of information. The equilibrium contributions in this endogenously arising asymmetric-information environment is that the leader chooses $x_1 = 0$ if $m = 0$, and chooses $x_1 = 1 - c$ if $m = 0.75$ or 1.5. The follower mimics the leader's choice, that is, $x_2 = 0$ if $x_1 = 0$, and $x_2 = 1$ if $x_1 = 1 - c$. This equilibrium cannot be sustained for costs larger than 0.25 because the first mover would prefer being uninformed and pretending as if she acquired good information.

[19] Vesterlund (2001) presents this result in more detail and shows that this equilibrium can be sustained when the fundraiser is informed of the charity's quality and the announcement decision is endogenous. Furthermore, she shows that the fundraiser has an optimal solicitation ordering when presented when soliciting in a heterogeneous population, thus it will not be possible for a first mover to avoid her leadership role.

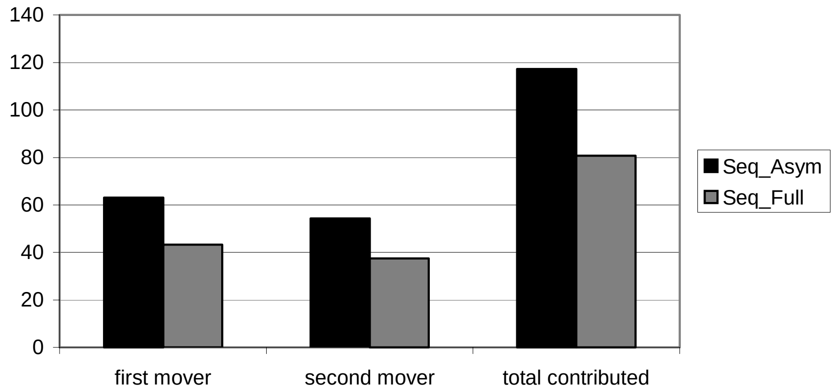

Figure 6: Average Contribution per Session

While our experimental results show that the fundraiser prefers the asymmetric information environment, the results are less clear when comparing the donors' earnings in the two treatments. Earnings for first and second movers are only slightly higher in the asymmetric treatment than in the full information one, and the difference is not significant (see Appendix II). Figures 7 and 8 help us reconcile the increase in contributions with the limited effect on earnings. Although both first and second movers are more likely to contribute when $m = 0.75$ in the asymmetric-information treatment, this increase barely outweighs the missed earnings opportunities when $m = 1.5$. Since some second movers do not mimic the behavior of the first movers, the likelihood of the second mover contributing when $m = 1.5$ is only 76% in the asymmetric-information treatment, whereas it is 97% in the full-information treatment. Thus, in those instances in which the public good has a very high return, the uninformed donor sometimes fails to provide valuable contributions. The result is a limited net effect on average payoffs.

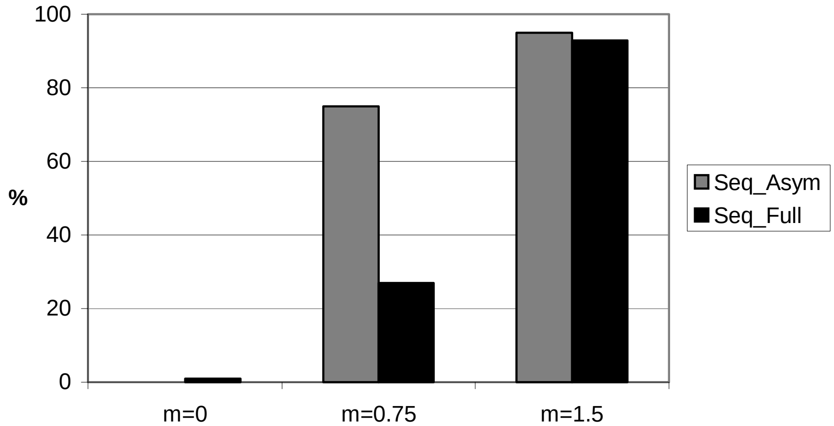

Figure 7: Frequency of Contributions by the First Mover

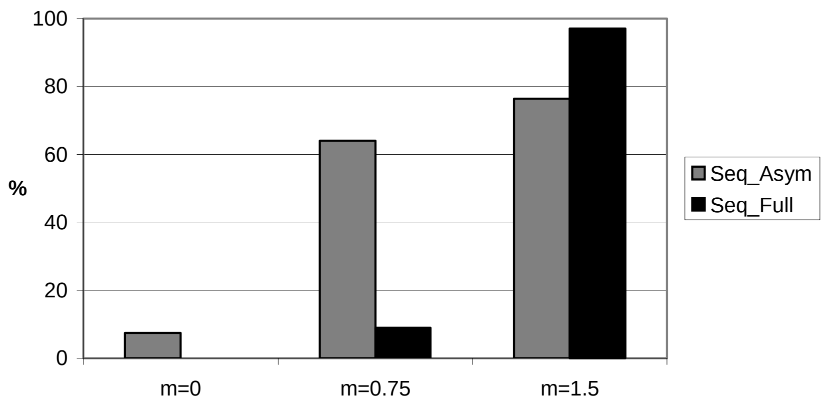

Figure 8: Frequency of Contributions by the Second Mover

6 Conclusion

Equilibrium based on own-earnings maximization offers sharp predictions about contributions in our public-goods environment. It is not the case that every decision by every subject conforms to these predictions, and the theory does not provide an exact description of subjects' behavior. Nonetheless, our experimental results suggest that the prediction is a good approximation, and the changes in contributions across our asymmetric-information treatments are broadly consistent with the predicted comparative statics. When only the first mover is informed, announcements are very effective. When the first contribution is not announced, second movers rarely contribute, and first movers only contribute when their return from the public good exceeds that of the private good. In contrast, announcements cause second movers to copy first-mover decisions, and first movers tend to contribute when it is collectively optimal to do so.

While consistent with the signaling hypothesis, second movers who are motivated by reciprocity are likely to behave in a similar manner. However, our finding that announcements have no effect on contributions in the full-information environment suggests that reciprocity has a limited role in explaining the success of announcements in the asymmetric-information environment.

Much research on public goods has been done within a complete and perfect information environment; our findings should encourage both empirical and theoretical investigations of the role of information in charitable giving. We have focused on environments in which the informational structure is exogenous, but obvious questions arise as to how the informational structure is determined and how it affects giving. While the theoretical prediction is that an asymmetric-information environment may arise endogenously, it is of interest to determine experimentally whether this is the case. Are subjects willing to provide or purchase information? Will they try to manipulate others into thinking that they are informed donors? How will this depend on underlying preference and technology parameters? And how will the endogenous provision of information affect contributions and welfare?

We view the results from our simple environment as promising, and see them as evidence that further experimental research within richer frameworks may be fruitful. Another promising avenue for future work is to examine more carefully the behavior of donors in light of some of the new theoretical work in this area. For example, one of the predictions of the signaling model is that the fundraiser's optimal-solicitation ordering prescribes the wealthiest donors to be the initial donor, thereby forcing them into a leadership role. Once asked, the initial donor has no option but to investigate the quality of the charity - perhaps this is one of the justifications for foundations, and maybe a better understanding of their work will improve our understanding of how uncertainty affects actual giving patterns.

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Appendix I

Instructions

Text in [] was only included in written instructions for the treatment indicated.

[Upon arrival each subject draws a card form a deck consisting of A-6 hearts and A-6 spades. They are seated at terminals labeled with a matching card. This determines their role in the session. When all subjects seated hand out instructions and record sheets.]

[Experimenter announces: "We're now ready to begin the experiment. Thank you all for coming. You should all have a record sheet and a set of instructions. I am going to begin by reading through the instructions aloud"]

Instructions

Introduction

This is an experiment about decision making. There are twelve people in this room participating in the experiment. You must not talk to the other participants or communicate with them in any way during the experiment. If, at any stage, you have any questions raise your hand and a monitor will come to where you are sitting to answer them.

The experiment will consist of eighteen rounds. In each round you will be randomly paired with another participant. Your earnings in each round will depend on the decisions made by you and the person you are paired with for that round. At the end of the experiment you will be paid in private and in cash, based upon your accumulated earnings from all eighteen rounds.

Choices and earnings

In each round you have to choose between two options: A or B. The other person in your pair also has to choose between options A and B.

If you choose A, 40 pence are added to your earnings and 0 pence are added to the earnings of the person with whom you are paired. Likewise, if the person you are paired with chooses A, 40 pence are added to his or her earnings and 0 pence are added to your earnings.

If you choose B, an amount is added both to your earnings and to the earnings of the other person in your pair (irrespective of whether that person chooses A or B). Likewise, if the other person in your pair chooses B, an amount is added both to his or her earnings and to your earnings (irrespective of whether you choose A or B).

The amount that is added to each person's earnings with a choice of B is called the *return from B*. This return is randomly determined by the computer at the beginning of each round, and will vary from round to round. In any round the return is equally likely to be 0 pence, 30 pence, or 60 pence. The return is the same for you and the person with whom you are paired in a round. The return may be different for different pairs of participants.

Procedure and information

Six participants have been allocated the role of 'first mover,' the other six have been allocated the role of 'second mover.' Upon arrival you have drawn a card. If this card is hearts you are a first mover, if the card is spades you are a second mover. Your role will be the same throughout the experiment.

In each round, each first mover will be anonymously and randomly paired with a second mover. This will be done in such a way that you will not be paired with the same person two rounds in a row. Nor will you be paired with the same person more than three times. You will never know the identity of the other person in your pair, nor will that person know your identity.

In the first stage of a round the first mover will enter a choice (A or B). Then, in the second stage, the second mover will enter a choice (A or B). Before making his or her choice the second mover [**sequential:** will] [**simultaneous:** will not] be informed of the first mover's choice. [**full info:** In each round, both the first mover and the second mover will be informed of the exact return from option B (0 pence, 30 pence or 60 pence), before making their choices.] [**partial info:** In each round, the first mover will be informed of the exact return from option B (0 pence, 30 pence or 60 pence) before making his or her choice, but the second mover will not be informed about the return from option B before making his or her choice.]

When all the second movers have made their choices, the result of the round will be shown on your screen. The screen will list the return from option B, the choices made by you and the other person in your pair, and the amounts earned by you and the other person in your pair. You should then record this information on your Record Sheet.

[page break]

Quiz

To make sure everyone understands how earnings are calculated, we are going to ask you to complete a short quiz. Once everyone has completed the quiz correctly we will continue with the instructions. If you finish the quiz early, please be patient. For each question you have to calculate earnings in a round for you and the other person in your pair.

[Experimenter announces: "Now please answer the questions in the quiz by filling in the blanks. In five minutes I'll check each person's answers. If you have a question at any time, just raise your hand."]

Suppose the return from B is 0 pence. What will be your earnings and the earnings of the person you are paired with if …

	your earnings	other's earnings
1. you choose A and the person you are paired with chooses A?	_______	_______
2. you choose A and the person you are paired with chooses B?	_______	_______
3. you choose B and the person you are paired with chooses A?	_______	_______
4. you choose B and the person you are paired with chooses B?	_______	_______

Suppose the return from B is 30 pence. What will be your earnings and the earnings of the person you are paired with if …

	your earnings	other's earnings
5. you choose A and the person you are paired with chooses A?	_______	_______
6. you choose A and the person you are paired with chooses B?	_______	_______
7. you choose B and the person you are paired with chooses A?	_______	_______
8. you choose B and the person you are paired with chooses B?	_______	_______

Suppose the return from B is 60 pence. What will be your earnings and the earnings of the person you are paired with if …

	your earnings	other's earnings
9. you choose A and the person you are paired with chooses A?	_______	_______
10. you choose A and the person you are paired with chooses B?	_______	_______

11. you choose B and the person you are paired with chooses A? _______ _______

12. you choose B and the person you are paired with chooses B? _______ _______

[page break]

[When all subjects have completed quiz correctly, experimenter announces: "Everyone has completed the quiz so I'll continue with the instructions at the top of the third page where it says "summary"."]

Summary

Before we start the experiment let us summarize the rules. The sequence of each round is as follows:

1. Each first mover is randomly paired with a second mover.
2. The return from B is determined: the return is equally likely to be 0 pence, 30 pence or 60 pence.
3. The first mover is informed of the return from B and chooses between A and B.
4. [**full info + sequential:** The second mover is informed of the return from B and the first mover's choice, and chooses between A and B.] [**full info + simultaneous:** The second mover is informed of the return from B, but not the first mover's choice, and chooses between A and B.] [**partial info + sequential:** The second mover is informed of the first mover's choice, but not the return from B, and chooses between A and B.] [**partial info + simultaneous:** The second mover chooses between A and B (not knowing the return from B or the first mover's choice).
5. Both the first mover and the second mover are informed of the results of the round and record them on their Record Sheet.

After round 18 the experiment ends and each participant is paid his or her accumulated earnings, in private and in cash.

[Experimenter announces: "Now, please press the space bar and begin making your decisions. At various times you will have to wait for others to make their decisions. When that happens please be patient. If you have a question at any time, just raise your hand."]

Appendix II

All p-values refer to tests that take an individual session as the unit of observation.

Table A.1: Average Contribution per Session

		x1	x2	x1 + x2
all rounds	seq_full	43.25	37.50	80.75
	seq_asym	63.00	54.25	117.25
	sim_full	40.75	45.75	86.50
	sim_asym	40.50	36.25	76.75
first 9 rounds	seq_full	45.50	40.50	86.00
	seq_asym	62.50	53.00	115.50
	sim_full	48.00	51.50	99.50
	sim_asym	45.50	40.00	85.50
last 9 rounds	seq_full	41.00	34.50	75.50
	seq_asym	63.50	55.50	109.00
	sim_full	33.50	40.00	73.50
	sim_asym	35.50	32.50	68.00

Table A.2: Average Individual Earnings (£) per Session

		earnings for 1	earnings for 2	total earnings
all rounds	seq_full	11.67	12.05	23.72
	seq_asym	11.71	12.30	24.01
	sim_full	12.17	11.84	24.00
	sim_asym	10.07	10.36	20.43
first 9 rounds	seq_full	12.14	12.48	24.62
	seq_asym	11.96	12.59	24.55
	sim_full	12.80	12.57	25.37
	sim_asym	10.49	10.86	21.35
last 9 rounds	seq_full	11.19	11.62	22.82
	seq_asym	11.47	12.00	23.47
	sim_full	11.54	11.11	22.65
	sim_asym	9.66	9.86	19.52

Table A.3: Treatment Effects on Contributions:
p-values for Mann-Whitney U-test (two-sided)

A: First Contribution:

All rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.3429	0.3429
seq_asym		0.0286	0.0286
sim_full			0.8857
First 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.8857	0.6857
seq_asym		0.0286	0.0286
sim_full			0.3429
Last 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.3428	0.2000
seq_asym		0.0286	0.0286
sim_full			0.4857

B: Second Contribution:

All rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.1143	0.8857
seq_asym		0.3429	0.0571
sim_full			0.0571
First 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.1143	0.0571	1.0000
seq_asym		0.8857	0.1143
sim_full			0.0571
Last 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.1142	0.8857
seq_asym		0.0571	0.0286
sim_full			0.2000

C: Total Contribution:

All rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.6857	0.4857
seq_asym		0.0286	0.0286
sim_full			0.0571
First 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.0571	0.8857
seq_asym		0.1143	0.0286
sim_full			0.0286
Last 9 rounds			
	seq_asym	sim_full	sim_asym
seq_full	0.0286	0.6857	0.4857
seq_asym		0.0286	0.0286
sim_full			0.3429

Table A.4: Treatment Effects on Average Earnings per Round:
p-values for Mann-Whitney U-test (two sided)

A: Donor 1's Earnings

	seq_asym	sim_full	sim_asym
All rounds			
seq_full	0.6857	0.1143	0.0286
seq_asym		0.3429	0.0286
sim_full			0.0286
First 9 rounds			
seq_full	0.8857	0.1143	0.1143
seq_asym		0.0571	0.0286
sim_full			0.0286
Last 9 rounds			
seq_full	0.3429	0.1143	0.0286
seq_asym		0.8857	0.0286
sim_full			0.0286

B: Donor 2's Earnings

	seq_asym	sim_full	sim_asym
All rounds			
seq_full	0.8857	0.3429	0.0286
seq_asym		0.0571	0.0286
sim_full			0.0286
First 9 rounds			
seq_full	0.3429	0.3429	0.0571
seq_asym		1.000	0.0286
sim_full			0.0286
Last 9 rounds			
seq_full	0.3429	0.1143	0.0286
seq_asym		0.0286	0.0286
sim_full			0.0286

C: Total Earnings

	seq_asym	sim_full	sim_asym
All rounds			
seq_full	0.6857	0.6857	0.0286
seq_asym		0.8857	0.0286
sim_full			0.0286
First 9 rounds			
seq_full	0.3429	1.0000	0.0571
seq_asym		0.0286	0.0286
sim_full			0.0286
Last 9 rounds			
seq_full	0.2000	0.3429	0.0286
seq_asym		0.2000	0.0286
sim_full			0.0286