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A test of stability in a linear altruism model

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HIGHLIGHTS

- We investigate the stability of the altruism parameters in an experimental Trust game.
- We use the Quantal Response Equilibrium (QRE) to study first mover behavior.
- We study second mover behavior, which can be extrapolated without rationality assumptions.
- Stability implies that altruism parameters are statistically the same, if a subject's allocation to a role is random.
- We test and reject this hypothesis. We also discuss plausible explanations.

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ABSTRACT

Linear altruism predicts the estimated preferences to be independent of the subject's position in the game, if the role allocation is randomly determined, because subjects, in each role, have the same preferences *ex ante*. We test and reject this hypothesis.

1. Introduction

Linear altruism is a functional form used extensively in outcome-based models of social preferences: the underlying assumption is that individuals have a utility over monetary outcome profiles that depends on their and other players' payments. Our objective in this exercise is to investigate the stability of the altruism parameters in the Trust game. We use the Quantal Response Equilibrium (QRE) of McKelvey and Palfrey (1995) to study first mover behavior.[1] As standard in this literature we assume that first mover beliefs are consistent with the observed probability distribution of the actions of second movers. We also study second mover behavior, which can be extrapolated without any rational expectations' assumptions. Behavior in strategic interactions is explained as a Nash equilibrium of the game, where final payoffs are paid in utility units. Linear altruism and other theories of social preferences predict the estimated preferences to be independent of the subject's position in the game, if, in the experiment, the allocation to a role is randomly determined, because subjects, in each role, have the same preferences *ex ante*. Thus, a logical implication of the assumption of stability of preferences is that the estimated altruism

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[1] QRE can be viewed as an extension of standard random utility models of discrete (quantal) choice to strategic settings. Under this process the best response functions become probabilistic. Much recent work has shown that QRE can rationalize behavior in a variety of experimental settings including: Alternating-Offer Bargaining (Goeree and Holt, 2000), Coordination games (Anderson et al., 2001), the Traveler's Dilemma (Capra et al., 1999; Goeree and Holt, 2001), All-Pay and First-Price Auctions (Anderson et al., 1998; Goeree et al., 2002).

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parameters are statistically the same; that is, the weight assigned by the first mover on the second mover's payoff, estimated with the QRE approach, should be statistically indistinguishable from the weight assigned by the second mover to the first mover's payoff. Our results do not find support for this claim. In particular, we show that the representative first mover is less altruistic than the representative second mover in the second approach. We discuss plausible explanations for the discrepancy and caution researchers to accommodate for these possibilities before interpreting agents' behavior in strategic interactions.

2. Experimental design

In the experimental session, the subjects had to play the Trust game for 15 rounds. The number of rounds to come was not communicated to the subjects. In each round, the subjects faced a different participant. With the conclusion of the experimental session, the subjects were privately paid their earnings in cash.

The Trust game is standard. One subject had the role of the first mover and the other subject had the role of the second mover. Let $m \in \{1, 2\}$ index the order of the mover, where $m = 1$ denotes the first mover, and $m = 2$ denotes the second mover. The subjects' roles were determined by random assignment. The first mover was initially given an endowment of 4 quarters and was asked to specify an integer amount of quarters, between zero and 4 inclusive, to transfer to the second mover. Any quarters that were not transferred to the second mover were secured as profit for the first mover. Denote the amount of quarters transferred as $x \in \{0, 1, 2, 3, 4\}$. The amount transferred was multiplied by 4 before reaching the second mover; that is, the second mover received $4x$ quarters for a transfer x. If the first mover transferred 0 quarters, then the game ended. Otherwise, the second mover was asked to allocate $4x$ based on five options. Our experimental design secured that changes in the estimated parameters across movers were not affected by the cardinality of the choice set as both first movers and second movers had five choices to select from. Each option indicated the amount kept by the second mover, which was also the payoff of the second mover, and the corresponding profit of the first mover. The latter was provided in order to safeguard against calculation errors by subjects. The options were structured so as to provide variability in the allocation of $4x$. The first and fifth options were extreme in the sense that in the first option the second mover kept 0 quarters and the first mover got $4x$, whereas in the fifth option the allocation was flipped so that the second mover got $4x$ and the first mover got 0 quarters. The intermediate options were positioned across the two extremes. The second and fourth options distributed $4x$ unevenly, with the first mover getting the bigger portion in the second option, and the second mover getting the bigger portion in the fourth option. Finally, the third option split $4x$ more evenly across the first and second mover compared to the other options.[2] Let $y \in \{1, 2, 3, 4, 5\}$ denote the choice of the second mover. Furthermore, let π_m denote the payoff of mover m in quarters. Given a transfer x and choice y, the second mover's payoff is $\pi_2 = (y - 1) \times x$. On the other hand, the first mover's payoff is $\pi_1 = 4 + 3x - \pi_2$, that is, the first mover earns $4 - x$ from the first stage of the game and $4x - \pi_2$ from the second stage of the game. For example, assume that the first mover transfers 3 quarters to the second mover, so that $x = 3$. The second mover receives $4x = 12$ quarters. Assume that the second mover chooses the third option, so that $y = 3$. The second mover earns $\pi_2 = (y - 1) \times x = (3 - 1) \times 3 = 6$ quarters. The first mover gets the remaining 6 quarters; yet, this is not the payoff of the first mover who, also, secured 1 quarter in the first stage of the game. Therefore, the first mover's profit is $\pi_1 = 3x + 4 - \pi_2 = 3 \times 3 + 4 - 6 = 7$ quarters. Had the second mover chosen the second option instead, so that $y = 2$, such a choice would correspond to an amount kept (payoff) by the second mover of $\pi_2 = (y - 1) \times x = (2 - 1) \times 3 = 3$ quarters, whereas the first mover would earn a payoff of $\pi_1 = 3x + 4 - \pi_2 = 3 \times 3 + 4 - 3 = 10$ quarters. The options were explicitly mentioned in the experimental instructions as well as indicated on the subjects' computer screens. The round was completed with the earnings of the subject for the specific round indicated on the screen along with the cumulative earnings of the subject thus far in the game. The detailed instructions are reported in the Appendix.

The experimental sessions were conducted in the XSFS computer lab of the Florida State University in May of 2010. 16 subjects participated in each session; they were recruited from the undergraduate population of the Florida State University using an electronic recruitment system. Participants were allowed to participate in only one session. Each session lasted approximately 45 min. The experiments were programmed and conducted with the use of the experimental software z-Tree (Fischbacher, 2007).

Table 1 reports the descriptive statistics on the raw experimental data. Panel A presents the frequency of the transfer and the choice variables. 35% of first movers chose to transfer 0 quarters to second movers. Transfers of 1 quarter and 3 quarters were the least frequent choices of first movers. Furthermore, only 36.7% of the first movers transferred more than half of their endowment to second movers. On the other hand, 57.7% of second movers kept the entire allowable amount, whereas only 24.4% selected one of choices $y = 2, 3$. In Panel B, we show how the distribution of each choice y changes with the first mover's transfer. With the exception of 6 observations at choice $y = 2$ (for $x = 4$), all other observations for transfers greater than 1 quarter were allocated to choices $y = 3, 4, 5$. When first movers transferred only one quarter, then 100% of the second movers chose to keep the entire amount. The percentage of second movers keeping the entire allowable amount remained high at 42.9%, 60%, and 48.3% for transfers $x = 2, 3, 4$, respectively.

Table 1
Descriptive statistics of transfers and choices.

Panel A

	Transfer x	Freq.	Percent	Choice y	Freq.	Percent
	0	252	35.0	1	0	0.0
	1	78	10.8	2	6	1.3
	2	126	17.5	3	108	23.1
	3	90	12.5	4	84	18.0
	4	174	24.2	5	270	57.7
Total		720			468	

Panel B

Choice y	Transfer x							
	1		2		3		4	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
1	0	0.0	0	0.0	0	0.0	0	0.0
2	0	0.0	0	0.0	0	0.0	6	3.5
3	0	0.0	42	33.3	24	26.7	42	24.1
4	0	0.0	30	23.8	12	13.3	42	24.1
5	78	100.0	54	42.9	54	60.0	84	48.3

Notes: In Panel A, we provide the frequencies and percentages of each transfer x and choice y. If the first mover transfers 0 quarters, then the game ends; thus, the frequency of choice y is conditional on a transfer $x > 0$. In Panel B, we provide the frequencies and percentages of choices for each transfer amount x.

3. Structural model

We assume a specific functional form of social preferences that has been used extensively in the literature to model linear altruism.

[2] For a transfer $x = 4$, the third option allocated 8 quarters to the first mover and 8 quarters to the second mover.