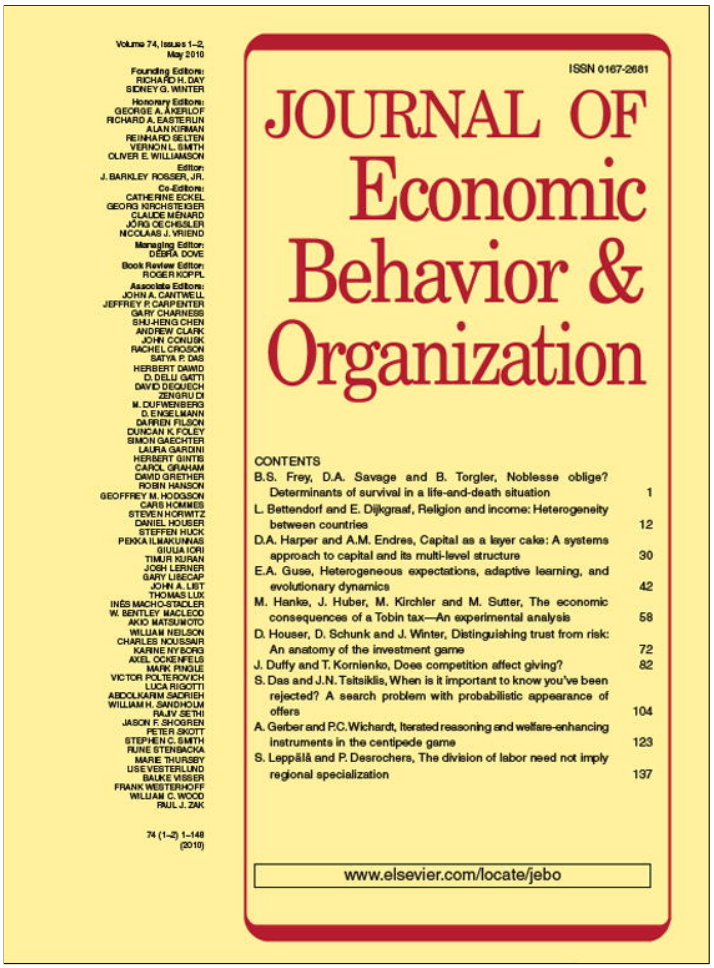

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Does competition affect giving?☆

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ABSTRACT

Charities often devise fund-raising strategies that exploit natural human competitiveness in combination with the desire for public recognition. We explore whether institutions promoting competition can affect altruistic giving – even when possibilities for public acclaim are minimal. In a controlled laboratory experiment based on a sequential "dictator game", we find that subjects tend to give more when placed in a generosity tournament, and tend to give less when placed in an earnings tournament – even if there is no award whatsoever for winning the tournament. Further we find that subjects' experimental behavior correlates with their responses to a post-experiment questionnaire, particularly questions addressing altruistic and rivalrous behavior. Based on this evidence, we argue that behavior in our experiment is driven, in part, by innate competitive motives.

> "I talked to both Bill Gates and Warren Buffett, the two richest men in the country, and they would be inclined to give more if there was a list of who did the giving rather than the having." Ted Turner (as quoted by Dowd, 1996)

1. Introduction

Media mogul Ted Turner suggested that natural human competitiveness might be exploited to stimulate charitable giving, by publishing a rank list of the largest U.S. givers. As Dowd (1996) described Turner's idea, "Why not start an annual list of the most generous, offering an "Ebenezer Scrooge Prize" that embarrasses stingy billionaires and a "Heart of Gold Award" to honor philanthropists?" If winning a generosity tournament confers some rank or social status, competitive altruism might counteract competitive selfishness. This suggestion prompted the creation of Slate magazine's rankings of the most generous Americans, as an antithesis to Forbes magazine's list of the wealthiest Americans.

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Does competition affect charitable giving? Many charities seem to think so. As Glazer and Konrad (1996) observe, charities frequently publish the names of contributors providing various threshold amounts of giving in clearly defined, rank-ordered categories with labels such as "contributor" , "benefactor" and so on (in lieu of reporting the actual amounts given). They develop a model in which individuals can signal their unobservable income via the level of their giving. Similarly, Harbaugh (1998) uses empirical data on charitable contributions grouped by threshold categories to estimate a utility function that can differentiate between intrinsic motivations and extrinsic concerns for "prestige," and reports that both factors play a role in the amounts given. While winning a competition can certainly result in public acclaim, prestige and other extrinsic rewards, we argue in this paper that giving behavior may be affected by much weaker, intrinsic competitive motives, e.g., with regard to one's standing relative to others, and that such competitive urges will be operative even when possibilities for public acclaim or other extrinsic rewards are absent.[1]

We report on a controlled laboratory experiment aimed at understanding whether the purely intrinsic motive of *competition*, here with regard to relative standing, can be mechanistically exploited to affect giving behavior.[2] Our experiment involves three different treatments of a *dictator contest*. This contest is a sequential version of a "dictator game" in which individuals are anonymously paired and one member of each pair – "the dictator" – unilaterally determines how to allocate a given endowment ($10 per decision round) between himself and his unique "match." At the end of each round, all dictators are publicly *ranked* (without disclosing the identities of players) according to a particular experimental "frame" (e.g., Kahneman and Tversky, 1979; Andreoni, 1995a) corresponding to one of our treatment conditions. In our "Altruistic" treatment, dictators are ranked in descending order according to the amount they *give away*, while in our "Selfish" treatment they are ranked in descending order according to the amount they *keep for themselves*. In a third "Control" treatment, ranks are known to be awarded spuriously. Ranking was done without disclosing the actual amounts that were given and kept so as to minimize the possibility of conformism or other norm-driven behavior. In all three treatments, subjects were specifically instructed that their earnings were unaffected by their rank.

We explore whether these seemingly minor interventions can have measurable effects on subjects' giving behavior. We report three main findings. First, and most importantly, socially relevant information on relative standing interacts with innate competitive urges to yield significant differences in giving behavior, even in anonymous settings lacking in public acclaim or other extrinsic rewards. On average, subjects in our Selfish treatment give away the least, while those in our Altruistic treatment give away the most; amounts given away by subjects in the Control treatment lie in between. Remarkably, subjects in our Selfish treatment give an average of just 7.4 percent of the pie, which is, to our knowledge, the lowest recorded average giving in dictator games with a positive domain of offers – *cf.*, Camerer (2003, Table 2.4 in pp. 57–58), even lower than the double-blind design of Hoffman et al. (1994).[3]

Second, our findings are not easily attributed to "experimenter demand effects," i.e., the desire by subjects to behave in a way they believe the experimenter wishes them to behave (see, e.g., Zizzo, 2010). While demand effects may be unavoidable given our design, we do not find, for instance, that subjects in the Selfish treatment start out giving the least or that subjects in the Altruistic treatment compete so as to increase their giving over time as one would expect under a "demand effects explanation" of our findings. Rather, we find that giving behavior is more complex and appears to depend both on group dynamics as well as on individual motives.

Finally, we observe that there is considerable heterogeneity in subject behavior, especially when socially relevant information is provided. We find that some subjects never change their allocations over the course of a session, that is, they are "Resolute" in their giving decisions, and there are more of these "Resolute" types in the Control treatment, where socially relevant information is absent. When giving was not encouraged (in the Selfish and Control treatments), most Resolute-type subjects kept everything though when giving was encouraged, as in the Altruistic treatment, Resolute-type subjects were equally split between those who kept everything and those who gave away half. Among Non-Resolute types, we find evidence that these subjects respond to the social information provided in the Selfish and Altruistic treatments. We observe the greatest overall variance in giving behavior in the Altruistic treatment and the lowest overall variance in giving behavior in the Selfish treatment.

In summary, our content-free Control treatment yields a strong and consistently discouraging effect on giving. The social incentives imbedded in the content-loaded Selfish and Altruistic treatments yield more complex dynamics for giving behavior. Over time, the Selfish treatment discourages giving even more intensely than the Control treatment. In contrast, the social incentives of the Altruistic treatment initially have a comparative encouraging effect on giving, yet this effect is found to erode over time as subjects gain experience with the environment.

[1] Frey and Osterloh (2002, p. 8) suggest that extrinsic motivation "serves to satisfy indirect or instrumental needs" while intrinsic motivation "satisfies a direct need in its own right." They suggest that money or peer group recognition are examples of extrinsic motivations while satisfaction with a job well done or the achievement of personal goals are examples of intrinsic motivations.

[2] As List (2007, p. 492) pointed out, "simple dictator games . . . can elicit different behaviors towards others and shed light on how institutions affect behavior in subtle ways" . By contrast with field or survey data, laboratory research affords the greatest control in assessing causal relationships. For instance, in the laboratory we can assess whether a single factor, e.g., information on the charitable contributions of others, as opposed to other, potentially confounding factors, e.g., the tax-treatment of certain charitable gifts, affects the amount of charitable contributions.

[3] List (2007, p. 484) suggested that some experimental setups may provide "the dictator with the "moral authority" to give nothing." Indeed this effect may further augment the competitive pressures of the Selfish treatment, contributing to the extremely self-regarding behavior found here.

To explore the interplay between subjects' motives and their behavior in the experiment we asked subjects to complete a post-experiment questionnaire. We designed this questionnaire to address several distinct possible motives for subject behavior: altruism, rivalry, conformism, money-seeking, variety-seeking and a desire to please others (experimenter demand). We found that only two of these motives – "altruism" and "rivalry" – could be reliably evaluated using our questionnaire. We further found that the scores on questions addressing these two motives are highly correlated. To better capture the complex interdependencies between these altruism and rivalry motives and to create orthogonal factors suitable for a subsequent regression analysis, we conducted a principal factor analysis. This analysis revealed that there are two latent factors underlying subjects' altruism and rivalry motives. The primary factor can be interpreted as subjects' disposition towards rivalry and against altruism, while the secondary factor can be interpreted as subjects' disposition towards both rivalry and altruism. Consistent with our competitive hypothesis, the primary factor was significant in explaining behavior in the Selfish treatment for all variables of interest, and never significant in the Altruistic treatment, while the secondary factor was significant in explaining behavior in the Altruistic treatment, particularly as a determinant of a subject's lack of disposition to give zero in all ten rounds, as well as a subject's disposition towards competition in giving. In other words, while other motives (such as experimenter demand, social acceptability, boredom, etc.) may have played a role in subjects' behavior in our experiment, we cannot rule out the hypothesis that our subjects' behavior is driven, at least in part, by innate competitive motives.

2. Related literature

Economists have accumulated strong empirical evidence that economic performance is enhanced by competitive motives (see, e.g., Weiss and Fershtman, 1998) and, moreover that higher rank in the "pecking order" leads to greater well-being (see, e.g., Brown et al., 2008). While most economic contests have been designed so that interpersonal competition further promotes *self-regarding* behavior, there have been few attempts to use tournament-like environments to alter other-regarding behavior. Andreoni (1995b) reports that, in a public goods experiment, giving information on an individual's rank in earnings or paying subjects according to this rank induces less cooperative behavior relative to the standard experimental design where information on relative earnings is not provided. Bolton (1991) reports that in an alternating-offer bargaining game, paying subjects according to their relative performance in a group promotes self-regarding behavior. With the exception of Barclay (2004), who shows that competitive altruism may help to maintain cooperative behavior in public goods games, most of the studies that employ tournament-like elements explore how monetary (extrinsic) incentives may weaken or enhance non-monetary (intrinsic) motives.

As recent research suggests, the relationship between intrinsic and extrinsic motivations is complex; extrinsic motivations may encourage or frustrate intrinsic motivations. Gneezy and Rustichini (2000) report that when extrinsic, (i.e., monetary) incentives are "too small" they may hinder intrinsic motivations, but when "large enough" extrinsic motivations may have the opposite effect, following the general pattern of a "W" (see more on this in Gneezy, 2003). Bénabou and Tirole (2003) further identify circumstances where explicit incentives may reinforce or weaken intrinsic motivations. Here we explore the opposite possibility that non-monetary, competitive motives may weaken or enhance monetary motives.

Experimental studies by Ball et al. (2001); Kumru and Vesterlund (2008) and Dufwenberg and Muren (2006) have studied giving behavior in *non-anonymous* settings, where giving may be closely tied up with such extrinsic, instrumental factors as status, social acclaim or individuals' perception of the social situation, as opposed to being governed by the more subtle intrinsic influences we focus on in our anonymous giving design. By disclosing subjects' identities and utilizing "strong" experimenter demand effects, these studies looked at *strong*, instrumental-type concerns. We, instead, are interested in whether individuals make choices that allow them to stand "higher" than the rest, under weaker (if any) experimenter demand effects. If subjects' giving is malleable, even by the *weak* competitive incentives of our design, the effect seems likely to be more pronounced in non-anonymous environments where payoffs are further enhanced by social acclaim and prestige, e.g., among the "Ted Turner crowd" of large donors.

Competitive mechanisms such as winner-pay and all-pay auctions and lotteries have been found to be successful in counteracting free-riding in public goods games, particularly for charity auctions – both in the laboratory and the field – see Carpenter et al. (2008); Corazzini et al. (in press); Duffy and Matros (2009); Orzen (2008), and Schram and Onderstal (2009). In contrast to the design employed here, these mechanisms typically involve an explicit prize to the winner, thus providing strong, extrinsic incentives to compete.

Subjects may seek information for a variety of reasons. Samuelson (2004) argues that Nature may have built relative concerns into individual preferences for the purpose of *information-gathering*: the decisions of compatriots provides valuable information about the state of the environment and it may be optimal to use such information in making one's own decisions. Thus, behavior might be driven by information-gathering motives in the spirit of Samuelson (2004), rather than the competitive motives stressed by Veblen (1899) and Frank (1985a). Cason and Mui (1998) consider the possibility that subjects extract information about what level of giving is socially acceptable in dictator experiments; they provide subjects with one such observation. Duffy and Feltovich. (1999) do the same in ultimatum game experiments. Krupka and Weber (2009) find that subjects generally behave more pro-socially when they observe more pro-social behavior on the part of others. In the context of public goods provision problem, Vesterlund (2003) explored the possibility that the prior contributions of others may provide a signal about the quality of a public good. Eckel and Wilson (2006) examined social learning when individuals, whose decisions were observed by others, differed in social status. Croson (2007) explored the

possibility that subjects might condition their contributions on the lowest, middle, or highest contribution, and thus might seek information differentially depending on their conditional strategy. Kurzban and DeScioli (2008) further explore such information-seeking behavior in public goods games and report that subjects systematically differ in the information they solicit, with "reciprocators" typically interested in information about the median contribution while "free-riders" are more interested in information about the highest contribution. Frey and Meier (2004); Shang and Croson (2009) and Chen et al. (in press) show that providing socially relevant information - for example, about other people's contributions, has a sizeable effect in field experiments. Interestingly, as Andreoni and Petrie (2004) find, disclosing the entire distribution of contributions within each group does not change the overall levels of contributions relative to the standard treatment. While statistics representing central tendencies (such as mean or median) are payoff-relevant in public good games, in contrast, Offerman and Schotter (2009) find that in single-person decision problems subjects tend to sample from the decisions of either the best-performing or the worst-performing individuals, and rarely from average-performing individuals.

A number of studies suggest that subjects' giving in dictator games may be particularly sensitive to the interplay of the experimental setup and moral considerations. Rigdon et al. (2009) find that even subtle cues suggesting that individuals may be observed can have a sizeable effect on subjects' choices in dictator games leading to more other-regarding behavior. Bardsley (2008) finds that dictators' choices become significantly more selfish when it is possible to take money away from the recipient. This was also explored by List (2007), who suggests that whenever the experimental setup provides the dictator with a moral authority to give nothing, other-regarding behavior reduces dramatically. Lazear et al. (2009) find that when subjects can opt out of a dictator game, those who remain tend to make more self-regarding choices.

Several recent studies have also sought to identify subjects' motivations from their experimental actions (e.g., Houser et al. (2004); Kurzban and Houser (2005); Bardsley and Moffat (2005); Ashley et al. (in press) in public good games, McKelvey and Palfrey (1992) in the centipede game). To our knowledge, attempts to infer the motivations behind giving in dictator experiments have been scarce. Iriberri and Rey-Biel (2009) find that subjects' responses to information about other dictators' giving varies systematically across their identified social preference types; social information has little effect on "selfish" types and tends to affect those with interdependent preferences in the direction of fostering more selfish choices.

Most theoretical models that allow agents to have relative concerns either assume that individuals are informed about the *levels* of other players' payoffs – either on an individual level (Fehr and Schmidt, 1999) or on an aggregate level (Bolton and Ockenfels, 2000), – or involve only two agents (Charness and Rabin, 2002). In our experiment, we have more than two subjects and none are aware of the levels of others' payoffs. Thus, to our knowledge, neither existing models nor existing methodologies are suitable for the issues we seek to address with our design.

3. Experimental design

We employ a novel experimental design, which we refer to as a *dictator contest*. Our dictator contest is a combination of the one-shot dictator game design of Forsythe et al. (1994), the sequential dictator game design of Cason and Mui (1998) and the rank information design of Andreoni (1995b).

In a one-shot dictator game, each subject is randomly and anonymously paired with another subject. One member of each pair is designated as the "dictator," the other is designated as the "recipient," and a fixed amount of money is provisionally allocated to each pair. The dictator then unilaterally decides on (dictates) how the amount of money is to be divided between him/herself and the recipient or "match" . The two players are then paid according to the dictator's allocation. If a dictator's only goal is to maximize his earnings, then he should keep all of the money for himself, allocating zero to his match. However, there is now overwhelming evidence that many subjects give a substantial share of the money to their match (see Camerer, 2003). Various explanations for this finding have been offered all of them suggesting that subjects care not only about their monetary earnings but also about behaving in a socially appropriate way (see Forsythe et al., 1994; Hoffman et al., 1994). In Cason and Mui's (1998) sequential dictator game design, subjects make two dictator decisions and receive information about one other subject's first-round dictator allocation before making their second-round allocation decision.[4] In Andreoni's (1995b) "RegRank" treatment, subjects participating in a public goods game received information about their relative rank in experimental earnings, though they were paid in the "regular" fashion, i.e., according to their individual earnings.[5]

In our *dictator contest*, subjects receive information about their relative standing with respect to *all* other dictators (subjects) in the room (as in Andreoni (1995b), but in contrast to Cason and Mui who provide information only about one other dictator's allocation). Specifically, in our dictator contest, dictators are informed of their rank, with first (i.e., top) rank going to the player(s) who kept the most for themselves in the Selfish (S) treatment and to the player(s) who gave away the most (kept the least for themselves) in the Altruistic (A) treatment. In a third Control (C) treatment, players were informed that ranks were randomly assigned; therefore such rank assignments conveyed no information about the behavior of other play-

[4] In another treatment, Cason and Mui (1998) also provide subjects with socially irrelevant information, and, contrary to their expectations, find that more subjects changed their allocation once presented with irrelevant information, rather than after learning about another dictator's choice.

[5] Andreoni (1995b) reports that contributions were lower in the RegRank treatment than in the "regular" treatment where information on relative earnings was not given. Andreoni's motivation for the RegRank treatment was to reduce *confusion* among subjects in a public good game, as opposed to stimulation of selfish, competitive urges.

ers. To allow subjects to adapt to their social surroundings (i.e., the other subjects in the room), and develop their strategies, dictator-subjects played 10 rounds of the dictator contest with the same group of dictators.

Each of our experimental sessions involves 15 subjects who were randomly assigned to one of the three treatments (five subjects per treatment). The three treatments were conducted simultaneously by three experimenters in three different rooms. In each room, instructions were handed out and then read aloud.[6] Players were informed that they were matched with another player in another room and that this player would be the recipient of their dictator decision. The five dictators in each room were then asked to simultaneously and privately allocate a fixed amount of money between themselves and their anonymous, fixed match for 10 rounds. While subjects were informed that they had a matched recipient in another room, they were *not* informed (until the end of the experimental session) that they had also been randomly and anonymously assigned to be the *recipient* of the decision made by another dictator, and that in this "recipient role" they would also receive the amount allocated to them by that dictator.[7] Thus, each subject in a particular treatment (room) was matched with two other subjects (one each from the other two rooms) – his recipient in one room, and his dictator in the other, but in making decisions was aware only of his match to a recipient of his/her dictator allocation. In all transactions and postings of information, subjects were identified by a private ID letter only.

Each of the 10 rounds of our dictator contest consists of three steps. In the first step, subjects make decisions (on proposal forms) as to how they wish to divide the $10 that has been provisionally allocated to them – they must specify dollar amounts (in one cent increments) for themselves and their match that add up to $10. Next, the subjects' folded proposal forms were collected in a basket and the basket was shaken up so that it was not possible to associate any subject with his/her proposal form. The experimenter then privately reviewed and sorted the proposals according to the treatment-specific criterion. Finally, the experimenter presents the ranked list of subjects' letter IDs on a blackboard according to the treatment-specific order; this ranking is observable to all subjects in the room. Note that information on dollar amounts is *not given*; the information displayed on the blackboard consisted of a rank-ordered display of subjects' letter IDs only. While subjects' letter IDs remained constant over all rounds, these IDs were private information; subjects were *not* identifiable to other subjects in the room or to the experimenter. Once subjects had time to observe their rank and to record their rank on a record sheet, a new round would begin. Rank information from previous rounds was left on the blackboard for all to see. Subjects were specifically instructed that their rank did not affect their payoff in any way and that in addition to a show-up fee, the money they allocated to themselves in one of the 10 rounds, chosen at random at the end of the session, would be paid to them in cash.

We chose to use anonymous rank orderings so as to avoid any experimenter-led social acclaim (used in previous studies exploring social standing), thus minimizing the possibility of confounding individual competitive motives with desires for status or social acclaim from other subjects or from the experimenter.[8] Notice further that, by informing subjects of their rank, rather than of the individual dollar amounts kept or given by others, we minimize the effect that such information might have on the development of social norms of keeping or giving.[9] Finally, we note that in our dictator contest, each subject in the dictator role has a unique matched partner to whom they may choose to allocate a part of their endowment. This design carefully avoids free-riding effects that might arise, e.g., if groups of players (dictators) were deciding how much to give to a single charity; such free-riding effects could confound effects generated by the social information (rank lists) we provide and we wanted to avoid such difficulties.

The treatment-specific procedures were as follows. In the Selfish (S) treatment, proposal forms were collected and sorted by the experimenter in descending order of the amounts subjects allocated to themselves. The letter ID of the person(s) who allocated the largest amount to him/herself relative to the rest of the subjects in the group, was (were) assigned 1st rank, the next largest amount was (were) awarded second rank, etc. Letter IDs and ranks were written on the blackboard for all to see. Conversely, in the Altruistic (A) treatment, the proposal forms were sorted in descending order of the amounts subjects allocated to their match. The letter ID of the person(s) who allocated the largest amount relative to the rest of the subjects in the group was (were) assigned 1st rank, and so on. In the Control (C) treatment, after the proposal forms were collected, ranks were assigned according to the random order in which proposal forms were drawn from a basket by the experimenter.[10] In all three treatments, if ties occurred, rank places were skipped. For instance, if two players tied for first rank, then there would be no second rank, and the next highest amount was awarded third rank, etc. Appendix

[6] The interested reader can read/download the instructions used in all three treatments of the experiment at: http://www.pitt.edu/ jduffy/dictator/.

[7] We did not want subjects to think they should offer more as dictators because they were simultaneously serving in the recipient role. Given the complexity of our three-room matching design, providing such information had the potential to create extra confusion and distraction. While using a real charity as the recipient might eliminate reciprocal concerns, it could compromise our desire to maintain the anonymity of subjects's giving and possibly lead to some free-riding. Notice that, whatever consequences our design choices may have had on subjects' behavior, these consequences should be symmetric across the three treatments.

[8] Indeed some studies have found that subjects give much more generously in public rather than in private settings. See, e.g., Andreoni and Petrie (2004) or Rege and Telle (2004).

[9] The latter design feature is also consistent with the practice by charities of grouping contributions into rank-ordered categories as noted above, perhaps for the same reason we give. We decided against using "category reporting" in our design as it could affect subjects' allocation decisions by shifting contributions toward the lower end of each category – see Harbaugh (1998) as well as Andreoni and Petrie (2004) – a phenomenon we wanted to avoid.

[10] We chose to assign spurious ranks in the Control treatment (rather than making no rank assignments) so as to minimize differences in the design of this treatment relative to the Altruistic and Selfish treatments. In the Control treatment, if the experimenter picked up two proposal forms at once (a rare event), a tie rank was declared for those two subjects (letter IDs).

B provides a table with all our experimental data including the rankings of letter IDs as presented to subjects in each round.

The procedures for rank assignment in the three treatments were carefully explained in the instructions and can be regarded as public information. Subjects knew the meaning of the rank information presented in the Selfish or Altruistic treatments and they also knew that rank information in the Control treatment was spurious. Subjects knew their own letter ID, but could not associate other letter IDs with the names or faces of any other individual in their group, though they did know that letter IDs were constant over all rounds played. Finally, subjects were specifically instructed that "your rank (place) in the list on the blackboard does not determine your money payment," so truly self-interested individuals should have avoided conditioning on the rank information given.

Thus, each subject made their first decision in the absence of any socially relevant information. The subsequent nine decisions were made after all subjects learned how their previous allocations stood relative to *all* four others in their group in the Selfish and Altruistic treatments, or among the randomly assigned ranks of the Control treatment. Since the highest amount kept is the lowest amount given away, the potential difference (if any) between the three treatments is entirely due to the competitive frame provided.

A total of 60 subjects participated in four sessions; no subject participated in more than one session. Each session consisted of three groups of five subjects each (one five-member group for each of the three treatments). The subjects were recruited from the undergraduate population of the University of Pittsburgh and had no prior experience with this experimental design. Subjects were guaranteed $10 just for participating in the one-hour experiment and were told that they "may earn an additional amount of money."[11] Subjects learned that they were the recipient of another dictator's decisions only following the last round of a session, and no subject was ever identified by name. Following the completion of the 10th round of the dictator contest, subjects were asked to complete a questionnaire. The list of questions asked and the means and standard deviations of subjects' responses are found in Appendix C. This questionnaire was designed to assess individual subject motives so that we might better understand subjects' giving behavior in our experiment. Subjects were not informed of this questionnaire in advance of its administration at the end of the session. They were offered $5 if they provided answers to all 24 questions, and all subjects agreed to do so.

Thus, subjects' earnings for this one-hour experiment were the sum of four numbers: the $10 participation payment, the amount they chose to allocate to themselves (out of $10) in the one randomly chosen round, the amount they received from another dictator (in another room) in one randomly chosen round, and finally $5 for completing the questionnaire.

4. Experimental results

Our main experimental hypothesis is that the incentives provided by competitive, tournament-like institutions reinforce subjects' intrinsic competitive motives affecting their giving decisions in a predictable manner. According to this hypothesis, overall giving should be highest in the Altruistic treatment, lowest in the Selfish treatment, and in-between in the Control treatment. Appendix A provides a theoretical foundation for this competitive hypothesis.

The raw data on amounts given by each subject in each round of all our experimental sessions including the ranking information that was presented to the subjects is shown in Table B1 in Appendix B.[12] In the following sections we provide an analysis of how well that data conform to our experimental hypothesis and we also attempt to account for heterogeneity in subject behavior.

4.1. Aggregate behavior

As Table 1 reveals, in line with the predictions of the competitive hypothesis, the mean amount given away is highest in the Altruistic treatment, lowest in the Selfish treatment, and in-between in the Control treatment.

Observe further that, in all three treatments, the frequency distributions (Fig. 1, left panel) exhibit a pronounced mode at zero giving, consistent with other dictator game findings. The Selfish treatment exhibits the highest frequency of zero offers (64 percent), followed by the Control treatment (63.5 percent), with the lowest frequency in the Altruistic treatment (36.5 percent). A second mode is observed around $5 with the highest frequency of such "equal split" offers in the Altruistic treatment (24.5 percent), followed by the Control treatment (17.5 percent), and with the lowest frequency in the Selfish

[11] The $10 participation payment was intended to provide subjects with sufficient compensation for their time spent in the experiment (one-hour). We were careful to avoid suggesting how much subjects could earn in addition to the participation payment to avoid creation of norms regarding socially acceptable amounts of giving.

[12] Table B1 in Appendix B also indicates the gender of each subject. While there were 9 males and 11 females in the Selfish treatment, 11 males and 9 females in the Altruistic, and 12 males and 8 females in the Control, the differences in gender allocations across treatments are not significant ($\chi^2 = 0.9375$, $p = 0.7$). We further conducted 2-sided t-tests of whether there were any significant differences in round 1 giving amounts between males and females in each of our three treatments. We also looked for gender differences in average giving over rounds 2–10 of all three treatments when social information was present. We found no significant differences between male and female giving in any of these tests ($p > 0.10$ in all cases). We therefore do not address gender as a factor in our analysis of the experimental data.

Table 1
Aggregate descriptive statistics for giving in the three treatments.

All subjects	No. of observations	Selfish (S)	Altruistic (A)	Control (C)
Total giving: mean (std. dev.)	200	$0.74 (1.49)	$2.59 (2.60)	$1.37 (1.99)
Round 1 giving: mean (std. dev.)	20	$1.77 (1.99)	$3.00 (2.64)	$1.25 (1.97)
Rounds 2–10 giving: mean (std. dev.)	180	$0.62 (1.39)	$2.54 (2.60)	$1.38 (1.99)

treatment (8.5 percent). Furthermore, only the Altruistic treatment exhibits any offers above $5 (9.5 percent), with giving of $10 (the whole "pie") amounting to 3 percent of all offers.

Consistent with the competitive hypothesis, giving in the Altruistic treatment first-order dominates giving in the other two treatments, while giving in the Selfish treatment is first-order dominated by the other two treatments (see Fig. 1, right panel). Furthermore, as our first Finding summarizes, overall giving in the Selfish treatment is significantly lower than in both the Altruistic and Control treatments (nonparametric, robust rank order test statistics using the four session-level means for each pair of treatments are $\grave{U}_{4,4} = \infty$, $p = 0.01$ and $\grave{U}_{4,4} = 4.483$, $p = 0.025$, respectively), while mean giving in the Altruistic treatment is marginally greater than in the Control treatment ($\grave{U}_{4,4} = 1.586$, $p = 0.10$).

Finding 1 *In line with the competitive hypothesis, the Altruistic treatment yields the highest overall giving, followed next by the Control treatment, which is in turn followed by the Selfish treatment, where we observe the lowest overall giving.*

While aggregate behavior is consistent with the competitive hypothesis, it is also possible that subjects' behavior might be due to "demand effects" , i.e., a desire to please the experimenter (see, e.g., Zizzo, 2010). If a demand effect was indeed the driving force behind subjects' behavior, it should be particularly strong in the very first decision round, before ranking information is revealed, with mean first-round giving being highest in the Altruistic treatment, lowest in the Selfish treatment, and intermediate in the Control treatment. However, the evidence for such a prediction is mixed. As Table 1 shows, initial giving in the Altruistic treatment is significantly higher than in the Selfish treatment ($\grave{U}_{4,4} = 4.483$, $p = 0.025$), but at the same time initial giving in the Control treatment is (marginally) significantly lower than in the Selfish treatment and is significantly lower than in the Altruistic treatment ($\grave{U}_{4,4} = 1.586$, $p = 0.10$ and $\grave{U}_{4,4} = 8.090$, $p = 0.025$, respectively).

Finding 2 *Initial giving is lowest in the Control treatment, slightly higher in the Selfish treatment and highest in the Altruistic treatment.*

One might further expect that, if a desire to please the experimenter remained operative over the course of the session, then, over time, giving would decrease in the Selfish treatment and increase in the Altruistic treatment. In fact, as Figs. 2 and 3 demonstrate, the dynamics of subjects' giving behavior is more complex. In the early stages of the game (rounds two through four), the Altruistic frame does weakly increase giving, though this increase, relative to round one giving levels, is insignificant

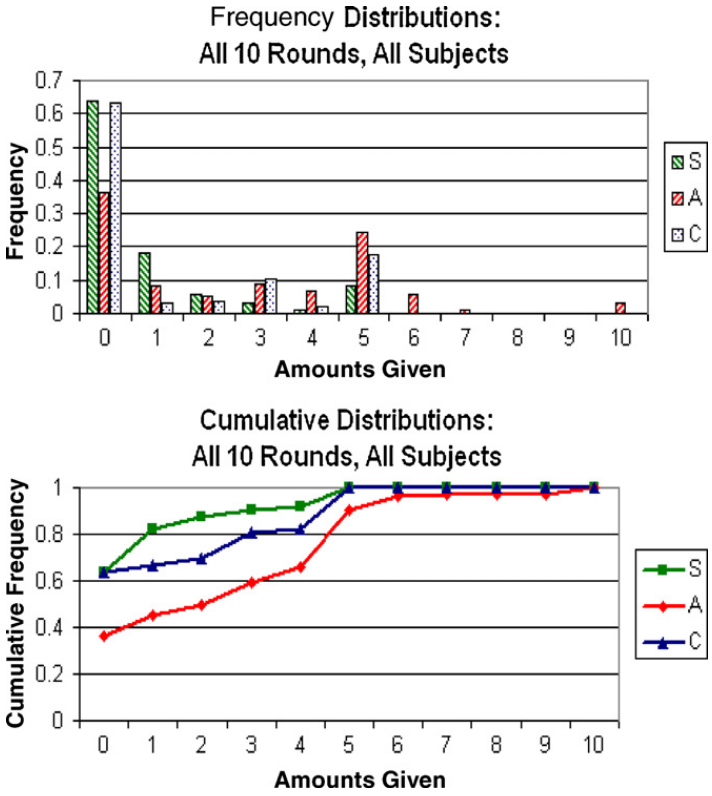

Fig. 1. Distributions of giving for all observations.

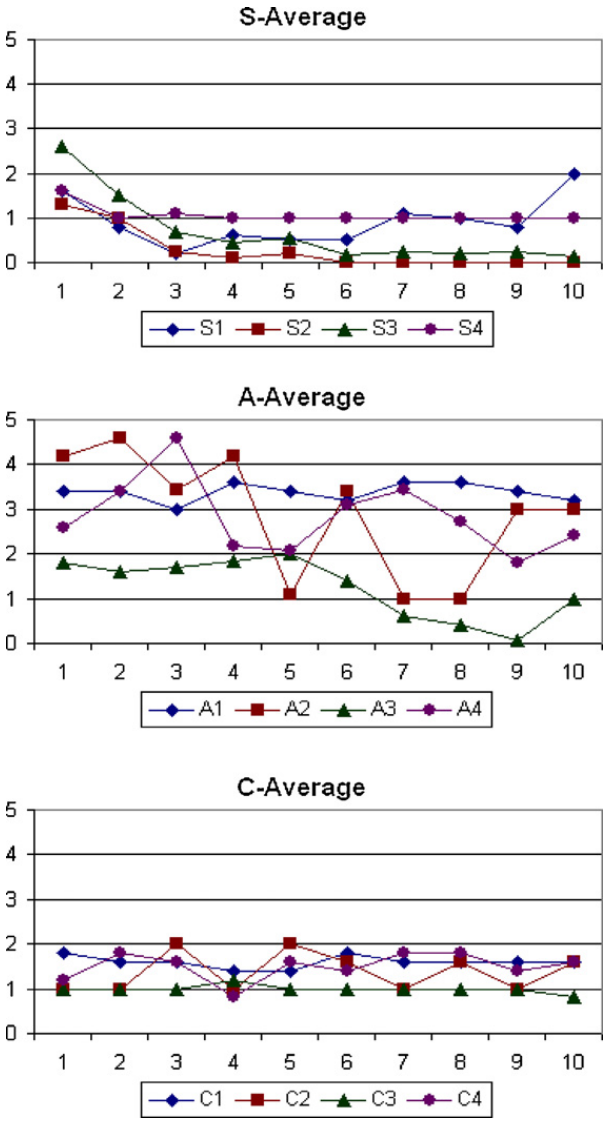

Fig. 2. The average amounts given by all subjects in each round of the four sessions of each of the three treatments.

(Wilcoxon sign-rank test, $p = 0.3125$). By contrast, for the same block of three rounds, the Selfish frame exerts a strong influence, with giving dropping more than 50 percent relative to initial, round 1 giving. Surprisingly, as the game progresses into the fifth through seventh rounds, subjects in both the Selfish and Altruistic treatments significantly *decrease* their giving relative to the previous three rounds ($p = 0.0420$ for the Selfish treatment and $p = 0.0471$ for the Altruistic treatment). In the last three rounds, giving further significantly declines in the Altruistic treatment ($p = 0.0757$ relative to the previous three periods), while it insignificantly increases in the Selfish treatment ($p = 0.4727$). Giving in the Control treatment exhibits insignificant volatility ($p > 0.20$ for all pairwise comparisons between blocks of three rounds).

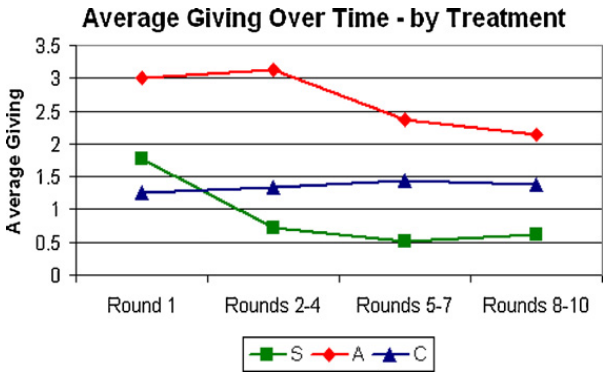

Fig. 3. The average amounts given by all subjects in the four sessions for the different blocks of rounds in each of the three treatments.

Table 2
Giving by Resolute subjects (those who gave the same amount in each of the ten rounds) by treatment.

No. of Resolute subjects	Selfish (SN)	Altruistic (AN)	Control (CN)	All treatments
Giving \$0	8	4	11	23
Giving \$3			1	1
Giving \$4.99			1	1
Giving \$5	1	3	1	5
Totals	9	7	14	30
Average giving	\$0.55	\$2.14	\$0.93	

Comparing overall giving in rounds two through ten, when social information is present, with round one giving, when social information is absent, reveals that giving significantly decreases in the Selfish treatment ($p = 0.0625$), and also declines (albeit insignificantly, $p = 0.1875$) in the Altruistic treatment. By contrast, in the Control treatment, there is an insignificant increase in giving in rounds two through ten relative to round one ($p = 0.5625$). The decline in giving in the two treatments with social information is even more pronounced if we compare giving in round 1 with giving in the final three rounds (eight through ten). Giving in the last three rounds is significantly lower in both the Selfish and Altruistic treatments ($p = 0.0093$ and $p = 0.0839$, respectively), and is insignificantly higher in the Control ($p = 0.4063$). Thus, while the potential for experimenter demand effects cannot be avoided by our research design, it does not appear to play a predictable role in the actual dynamics of subjects' behavior.

Instead, our findings suggest that the main effect of providing socially relevant information in both the Selfish and Altruistic treatments is to depress giving. Indeed as Fig. 3 makes clear, it appears that "learning to give less" relies upon the social information provided in the Altruistic and Selfish treatments and not so much on "second thought," introspective reasoning, as there is no decrease in average giving in the Control treatment.[13] Mean giving in the Selfish frame declines dramatically, "overshooting" the low giving in the content-free Control treatment, and resulting in, perhaps, the lowest recorded average giving in dictator games with a restricted choice set.

While the severe decline in giving in the Selfish treatment is consistent with subjects responding to the competitive frame (giving less in order to be ranked higher), the erosion of giving in the Altruistic treatment is not. We can think of two explanation for the erosion in giving in the Altruistic frame. One is that some subjects are using the rank information to learn what constitutes an acceptable norm of giving; while the rank information does not convey information about amounts given, subjects can make inferences about these amounts by experimenting with the amounts they give themselves and observe how their rank changes. Such subjects might be tempted to reduce their giving if they perceive that they are giving more than the socially acceptable amount. Second, we note that the price of competing in the Altruistic frame is considerably greater than in the Selfish frame, where competing goes hand in hand with increasing one's own payoff. The higher price of competing in the Altruistic frame may lead some subjects to drop out of the competition or to compete only sporadically. Notice that both of these explanations have the same empirical implication, namely that we should see more heterogeneity and hence greater variance in giving over time in the Altruistic treatment as compared with the Selfish or Control treatments.

Indeed as Fig. 2 demonstrates, giving in the Altruistic treatment exhibits the greatest volatility and a much more slight downward trend relative to the Selfish treatment. Next, compare the standard deviations in giving in rounds 2–10 (when subjects could observe rank information) with initial first-round giving amounts (where ranking information is absent) in Table 1. Rank information has almost no effect on subject behavior in the Control treatment, where the standard deviation in round 1 giving is about the same as for giving in rounds 2–10. By contrast, in the content-loaded treatments, rank information had a differential effect, leading to more homogeneous behavior in the Selfish treatment, where the standard deviation in giving declined relative to the first-round value. By contrast, the standard deviation in giving in rounds 2–10 of the Altruistic treatment remains at the same high level that is observed for round 1 giving – the highest standard deviation in giving amounts across the three treatments.

Finding 3 *Over time, giving is most volatile in the Altruistic treatment and least volatile in the Selfish treatment. Giving amounts decrease over time in both the Selfish and Altruistic treatments, with the Selfish treatment generating the most significant decline. Giving amounts do not change much in the Control treatment.*

The next section addresses heterogeneity in subject behavior in more detail.

4.2. Subject heterogeneity

We first report that, as in Cason and Mui (1998), some subjects never changed their allocation decision from the one they made in the very first round. These subjects made the same allocation in all 10 rounds, and we label them as *Resolute* subjects. Details on the allocation decisions of these Resolute subjects are provided in Table 2. We observe that there were 9

[13] See Rick and Weber (2010) for an experiment where subjects may learn in the absence of feedback.

Table 3
Descriptive statistics for giving by Non-Resolute subjects in the three treatments.

Non-Resolute subjects	Selfish (S)	Altruistic (A)	Control (C)
Number of Non-Resolute subjects	11	13	6
Total giving: mean (std. dev.)	$0.88 (1.41)	$2.83 (2.63)	$2.40 (1.96)
Round 1 giving: mean (std. dev.)	$2.77 (1.69)	$3.46 (2.60)	$2.00(2.10)
Rounds 2–10 giving: mean (std. dev.)	$0.67 (1.21)	$2.76 (2.64)	$2.44 (1.96)

(45 percent) Resolute subjects in the Selfish treatment, 7 (35 percent) in the Altruistic, and 14 (70 percent) in the Control.[14] In other words, when social context is present (as in the Selfish and the Altruistic treatments), there is a more extensive adjustment process in giving decisions; this same process is strikingly absent when social context is absent (as in the Control treatment). In each of the three treatments, there were many subjects who gave away nothing in all 10 rounds and there were a few who chose an equal ($5) split. Finally, we observe that average giving amounts among subjects classified as Resolute, remains consistent with our competitive hypothesis: average giving by Resolute subjects is greatest in the Altruistic treatment lower in the Control treatment and lowest in the Selfish treatment.

Finding 4 *More subjects never change their allocations (are "Resolute") when socially relevant information is absent (in the Control treatment) than when such information is present (in the Selfish and the Altruistic treatments). Moreover, when giving was not encouraged by the experimental design (in the Selfish and Control treatments), most Resolute subjects kept everything, while when giving was encouraged (in the Altruistic treatment), Resolute subjects were about equally split between those who gave away half of their endowment, and those who kept everything.*

In contrast, we label those subjects who changed their allocation decision at least once over the 10 rounds as *Non-Resolute* subjects, and we present the descriptive statistics of their giving in Table 3. In the Selfish and Control treatments, Non-Resolute subjects gave, on average, significantly more than Resolute subjects (robust rank order test $\grave{U}_{11,9} = 3.55$, $p = 0.00023$ and $\grave{U}_{6,14} = 2.95$, $p = 0.0016$, respectively), while there is no significant difference between aggregate allocations made by the two types (Resolute and Non-Resolute) in the Altruistic treatment (robust rank order test $\grave{U}_{13,7} = 0.57$, $p = 0.2843$).

As one can see from Table 3,the rank of average giving among Non-Resolute subjects across treatments is again consistent with our competitive hypothesis.

In contrast to Finding 1, Non-Resolute subjects give significantly less only in the Selfish treatment relative to the other two treatments ($\grave{U}_{4,4} = \infty$, $p = 0.01$ for both pairwise comparisons), while their giving in the Altruistic treatment is only insignificantly greater than that in the Control ($\grave{U}_{4,4} = 1.206$).

The dynamics of Non-Resolute subjects' giving follows the pattern found for all subjects as discussed in the previous subsection, with, again, the highest initial (round 1) giving observed in the Altruistic treatment, followed by the Selfish treatment and with the lowest initial giving in the Control treatment. Initial giving by Non-Resolute subjects in the Selfish treatment is insignificantly different from that in the Altruistic and Control treatments ($\grave{U}_{4,4} = 0.8341$ and $\grave{U}_{4,4} = 0.6458$, respectively), with initial giving in the Altruistic treatment being marginally higher than in the Control treatment ($\grave{U}_{4,4} = 1.586$, $p = 0.10$). Furthermore, as Cason and Mui (1998) also found, subjects who kept everything in the initial round were less likely to change their decision at least once (i.e., among subjects giving zero in the first round, 4 out of 5 were "Resolute" in the Altruistic treatment, 11 out of 13 were Resolute in the Control treatment and all 8 were Resolute in the Selfish treatment).

In the subsequent rounds 2–10, Non-Resolute subjects give significantly less on average in the Selfish treatment than in the Altruistic and Control treatments, respectively ($\grave{U}_{4,4} = \infty$, $p = 0.01$ for both pairwise comparisons), while Non-Resolute subjects give only insignificantly more in the Altruistic treatment than in the Control treatment ($\grave{U}_{4,4} = 0.7762$). In other words, while we observe a significant and dramatic decline in giving by Non-Resolute subjects in the Selfish treatment ($\grave{U}_{4,4} = \infty$, $p = 0.01$), by contrast, the initial gap in giving between Altruistic and Control treatment erodes over time from being marginally significant to becoming insignificant, with those in the Control treatment insignificantly increasing their giving in rounds 2–10 relative to round 1 ($\grave{U}_{4,4} = 0.3723$), and those in the Altruistic insignificantly decreasing their giving ($\grave{U}_{4,4} = 1.2060$). Furthermore, as one can observe from comparing the standard deviations of giving in round 1 versus rounds 2–10 in Table 3, as well as from Fig. 4, the Non-Resolute subjects' giving in the Selfish treatment became more homogenous over time, catching up with more self-regarding Resolute subjects. Averaging over all ten rounds, the Non-Resolute subjects in the Selfish treatment give significantly less than their counterparts in the Altruistic and Control treatments (robust rank order test $\grave{U}_{11,13} = 4.30$, $p = 0.00003$ and $\grave{U}_{11,6} = 3.66$, $p = 0.00016$, respectively). In contrast, Non-Resolute subjects in the Altruistic treatment, on average, gave similar amounts to their counterparts in the Control treatment ($\grave{U}_{13,6} = 0.19$, $p = 0.4247$) (see also Fig. 4).

Finding 5 *Those subjects who adjust their allocations at least once (who are "Non-Resolute") start out by giving away marginally greater amounts in the Altruistic treatment than in the Control treatment, with initial giving by such Non-Resolute subjects in the Selfish treatment lying in-between and being insignificantly different from that in the other two treatments. These Non-Resolute subjects tend to adjust their giving downwards, but only in the treatments with socially relevant information.* To summarize, a

[14] Compare this to Cason and Mui (1998) who found that, 9 out of 20 subjects never changed their decisions in the control treatment, but only 16 out of 40 subjects changed their decision when social information was present.

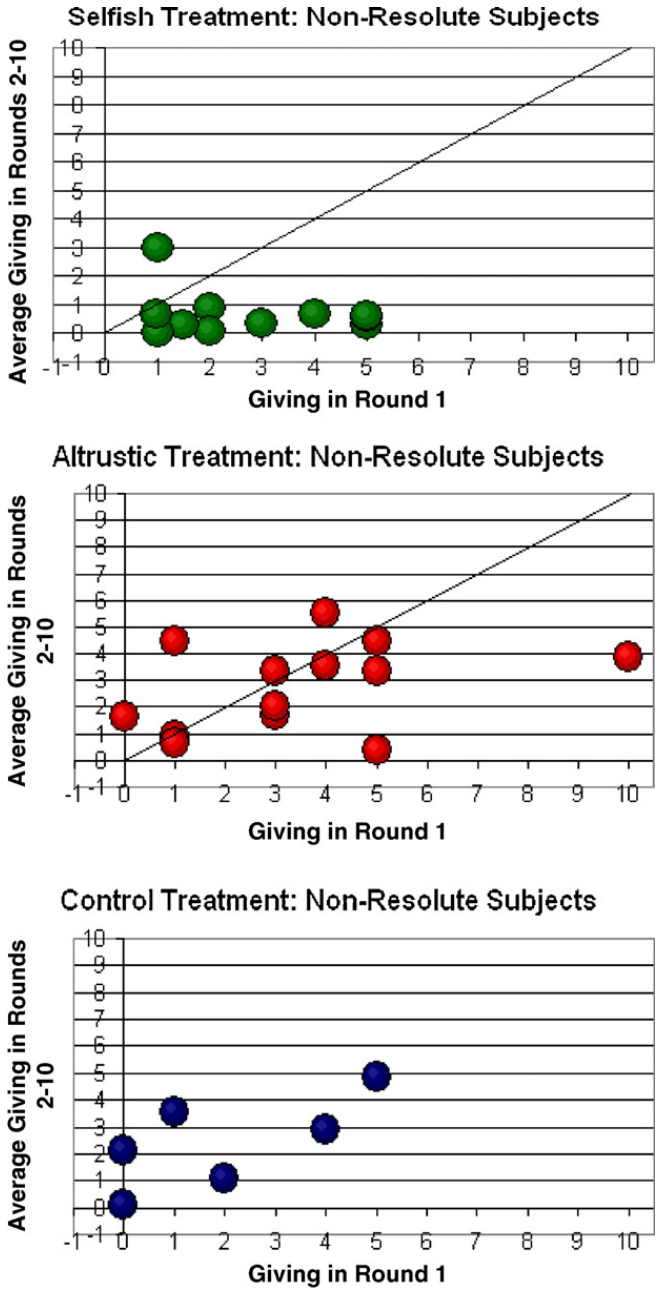

Fig. 4. Average giving in rounds 2–10 versus giving in round 1, for each Non-Resolute subject (represented by a circle).

majority of subjects in the content-free Control treatment see no incentive to give, "resolving" to keep the entire endowment for the duration of the experiment. The remaining subjects either resolve to give the same amount in every round of the game or vary their giving somewhere between giving zero and $5. In the Altruistic treatment, which provides some social incentives to give, a few subjects resolve to give nothing, and similar numbers resolve to split their endowment equally, with the remaining Non-Resolute subjects varying their allocations over time, giving statistically similar overall amounts to their counterparts in the Control treatment.

The latter finding might arise because Non-Resolute subjects in the Altruistic treatment have doubts about "which end is up" – namely, whether they are competing to achieve the top or bottom rank. Indeed, at least two Non-Resolute subjects in the Altruistic treatment do oscillate between giving zero and giving some amount exceeding $5, sometimes even the entire $10. Overall, Non-Resolute subjects in the Altruistic treatment learn to give less, catching up with their more self-regarding counterparts in the Control treatment. This learning to give less phenomenon is conspicuously absent in the Control treatment, suggesting that the social information present in the Altruistic treatment may be crucial for subjects' adjustment behavior.

By contrast, the social content of the Selfish treatment strongly discourages giving. However, just as in the Altruistic treatment, there may also have been some uncertainty about "which end is up" in the Selfish treatment. For instance, we observe fewer "Resolute, zero-contribution" subjects in the Selfish treatment than in the Control treatment (see Table 2).

Furthermore, some Non-Resolute subjects in two Selfish treatment sessions behaved as if they were competing for bottom rank in the last rounds of the session. Nevertheless, these anomalies appear small when compared with the dramatic decline over time in average giving engendered by the Selfish competitive frame.

We summarize the above results as follows.

Finding 6 *Overall, the content-free Control treatment provides a strong and constant discouraging effect on giving. The social incentives imbedded in the Selfish treatment also have strong discouraging effect that starts out small and grows over time, discouraging giving more intensely than in the Control treatment. By contrast, the social incentives of the Altruistic treatment have a comparative encouraging effect on giving, but this effect erodes a little over time.*

5. Exploring subjects' motives and behavior

In this section we further explore heterogeneity in subjects' motivations in an effort to better understand subjects' behavior in our experiment. To our knowledge, no existing personality scale addresses the subject of our study, namely, the effect of institutions mobilizing innate competitive urges on giving behavior.[15] We therefore designed our own questionnaire to elicit information on subjects' behavioral characteristics, and administered it to subjects at the end of each experimental session.

5.1. Assessing the internal consistency of questions

The questionnaire consisted of 24 items (questions) – four questions for each of six different possible "motives" which we label as "altruism," "rivalry," "money-seeking," "experimenter demand," "conformism," and "variety-seeking." The 24 questions, the motive each addresses and the mean and standard deviation of subjects' responses to those questions (on a scale of 1–6) are all provided in Table C1 of Appendix C. In addition, the table reports the correlation between the numeric answers to each question and giving amounts in round 1 or rounds 2–10 of the Selfish (S), Control (C) or Altruistic (A) treatments.

Following standard practice in personality research, for each motive we provided four questions, using two "positively" keyed questions balanced by two "negatively" keyed questions, indicated by "+" and "-" signs in the motive column of Table C1 in Appendix C. This was done so as to balance biases in a subjects' tendency to agree or to disagree, as well as to eliminate the idiosyncratic effects of any particular question.

Our first step in analyzing the questionnaire data was to assess the *internal-consistency* or *reliability* of our question groups (motives), that is whether each set of four questions reliably measured the motive they were intended to capture. A standard reliability test statistic is Cronbach's α coefficient, which ranges from 0 to 1.0 and measures the intercorrelation between every item in a given set; higher values of Cronbach's α indicate greater reliability.[16]

Of the six motives (four question sets), only the altruism and rivalry questions had Cronbach's α coefficients that satisfied the recommended 0.75 cut-off value (0.8349 for altruism and 0.8759 for rivalry); the remaining four motives (question sets) all had α coefficients below 0.75 (money-seeking – 0.6129, experimenter demand – 0.6645, conformism – 0.4456, variety-seeking – 0.5804).[17] In other words, while the questions designed to address altruism and rivalry motives appear to have been well-designed, the rest of the questions addressing experimenter demand, conformism, money-seeking or variety-seeking motives failed to reliably capture the motives they were designed to address among the participants in this study.

Nevertheless, we wish to note that the correlation between giving amounts and an experimenter demand motive appears weak; the correlations between giving amounts and answers to the experimenter demand set of questions are significantly different from zero only for first round of the Control treatment. For the Altruistic an Selfish treatments, there is no significant correlation between responses to any experimenter demand question and giving amounts in round 1 or over rounds 2–10 (see the correlations in Table C1 of Appendix C).

5.2. Deducing common motivational factors

Our subsequent analysis will involve only the eight items (questions), that were sufficiently well-designed to reliably capture the altruism and rivalry motives. Answers to these questions are not only highly correlated with giving behavior in our experiment – see again the correlations in Table C1 of Appendix C – but the responses to these eight questions are also highly correlated with one another; indeed, we find that the two motives, altruism and rivalry, exhibit a complex pattern of interdependencies preventing their use as two orthogonal motives. To capture these interdependencies among subjects'

[15] For example, while the low "agreeableness" as measured by the Big Five Personality questionnaire is often interpreted as competitiveness, it seems to be related more to a lack of compassion toward or interest in others rather than to a desire to compete with others. While the two are, perhaps, correlated, they nevertheless seem to represent two different personality traits.

[16] See, e.g., Allen and Yen (1979).

[17] While Cronbach's α of 0.75 is an acceptable value for large-scale studies, Lounsbury et al. (2006, p. 136) recommend a higher value of 0.8 for Cronbach's α for newly developed personality scales such as ours. The α's for the altruism and rivalry motives meet this higher criterion as well.

Table 4
The results of principal factor analysis of eight items representing altruism and rivalry motives. The uniqueness value is equal to one minus *communality*, a measure of the percentage of a variable's variance that can be jointly explained by all factors (variables with high communality are less unique).

	Question	Factor *F*1 Loadings	Factor *F*2 Loadings	Uniqueness
1	Feel indifference to others' misfortunes.	0.6667	−0.4955	0.3099
2	Try not to do favors for others.	0.3832	−0.4740	0.6285
3	Feel sympathy for those who are less fortunate than me.	−0.6709	0.4337	0.3617
4	Love to help others.	−0.7212	0.3112	0.3830
5	Avoid competitive situations.	−0.5589	−0.4931	0.4444
6	Feel that winning or losing doesn't matter to me.	−0.7499	−0.3960	0.2808
7	Drawn to compete with others.	0.7195	0.4378	0.2906
8	Feel that I must win at everything.	0.7977	0.1753	0.3329

motives, while at the same time characterizing heterogeneity among subjects' questionnaire responses with the minimum number of common motivational factors, we conducted a factor analysis of subjects' responses to these eight questions.[18] The eight questionnaire items exhibit acceptable factorability, having a Cronbach's α of 0.8521 and a Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy of 0.7924. The latter statistic measures (on a 0 to 1.0 scale) the likelihood that common factors account for the observed correlations among a set of items; a KMO value of 0.79 is viewed as "middling" , bordering on "meritorious" .[19] These findings justified our further use of factor analysis of these eight items to identify any possible latent common factors underlying the altruism and rivalry motives.[20]

Application of factor analysis to the eight question items resulted in only two factors with eigenvalues greater than unity – a standard cutoff criterion, since a factor with an eigenvalue less than unity accounts for less variation in subjects' responses than does a single question item. The factor loadings of these two factors, which represent the correlation between a variable (question item) and the common factor (and so range from −1.0 to 1.0), along with the uniqueness values, representing the proportion of a variable's idiosyncratic variance, i.e., total variance not explained by common factors, for all eight items are presented in Table 4.[21] As all variables have factor loadings of at least 0.4 on at least one of the two factors, and all uniqueness values lie below 0.7, all variables were retained for the factor analysis.

Based on the signs of the factor loadings shown in Table 4, the first common factor, Factor *F*1 (eigenvalue 3.5905, accounting for 75.79 percent of variability) can be interpreted as a tendency for being rivalrous and non-altruistic. The second common factor, Factor *F*2 (eigenvalue 1.3776, accounting for 29.08 percent of variability) can be interpreted as a tendency for being rivalrous and altruistic. We thus hypothesize that subjects with large values of Factor *F*1 would tend to give less and compete in keeping, while those with large values of Factor *F*2 would tend to give more and compete in giving.

5.3. Using the motivational factors to analyze giving behavior: preliminaries

In this section, we address the suitability of the two latent factors we have identified for our subsequent regression analysis. By construction, these factors are independent across all subjects and treatments and they are also orthogonal within each treatment and thus they are suitable for our regression analysis.

Furthermore, only Factor *F*1, representing a hypothetical tendency for competition in keeping, is found to be highly and positively correlated with being male ($r = 0.4202$, $p = 0.0008$). However, we also found that gender is a poor proxy for subjects' competitive motives; for example, replacing Factor *F*1 with a male dummy variable in the regressions we report on below typically results in a worse overall regression fit as reflected in a lower R^2. Specifically, the coefficient estimates on the gender variable are always less significant than on the Factor *F*1 variable.

Finally, as our primary interest lies in the interplay between subjects' motives and their behavior in the presence of the competitive institutions provided by our different experimental treatments, we need to check whether our results are entirely driven by the subjects' allocation across treatments. Using two-sided *t*-tests, we found no significant differences in the value of Factor *F*1 (the tendency to compete and keep) in all three pairwise comparisons between the three treatments. Factor *F*2 (the tendency to compete and give) is not significantly different between the Selfish and Control treatments, or between the Selfish and Altruistic treatments, but Factor *F*2 is significantly lower in the Altruistic treatment than in the Control treatments ($t = 2.4491$, two-sided $p = 0.0198$). We note that the significantly lower value of Factor *F*2 (tendency

[18] Factor analysis is a popular statistical method which allows one to reduce the dimensionality of the problem and describe variability of subjects' responses in terms of a small number of common factors. For an introduction to factor analysis see, e.g., Gorsuch (1983).

[19] See, e.g., DiLalla and Dollinger (2006, p. 250).

[20] We also performed a factor analysis on a larger set of 12 questions including the eight altruism and rivalry questions and the four experimenter demand questions. Recall the four experimenter demand questions had the highest Cronbach's alpha, 0.6645, that was below the 0.75 cut-off. In this case, our factor analysis yielded three latent factors, leaving us with insufficient degrees of freedom to evaluate the overall statistical significance.
Furthermore, despite one of the three new factors might potentially be interpreted as being influenced by experimenter demand, the treatment point estimates do not conform with such interpretation. The details are available from the authors upon request.

[21] To ease the interpretation, we used the negatives of the original factors in our analysis, and thus report the reversed signs of the factor loadings. We used Stata to estimate the factors and factor loadings.

Table 5
The results of regressions with robust standard errors for giving in round 1 and average giving in rounds 2–10, clustered on groups of 5 subjects, for all 60 subjects. The baseline assumption is that giving in all periods equals zero and that motivational factors have no consequences for behavior. Robust standard errors are in parentheses.

Variable	Giving in round 1		Average giving in rounds 2–10	
DummyA	3.2617	(0.5289) ***	2.7366	(0.2495) ***
DummyS	1.9366	(0.1537) ***	0.7958	(0.1705) ***
DummyC	1.0450	(0.2690) ***	1.0640	(0.3044) ***
Factor $F1 \times$ DummyA	−0.0147	(0.7633)	−0.2863	(0.6083)
Factor $F1 \times$ DummyS	−0.6736	(0.2457) **	−0.8450	(0.3425) **
Factor $F1 \times$ DummyC	−0.6992	(0.3474) *	−0.7108	(0.2863) **
Factor $F2 \times$ DummyA	0.6817	(0.6371)	0.5833	(0.5400)
Factor $F2 \times$ DummyS	0.1119	(1.0802)	0.5347	(0.1812) **
Factor $F2 \times$ DummyC	0.3209	(0.3370)	0.6780	(0.5848)
Test statistics	$F(9, 11) = 116.72$		$F(9, 11) = 30.88$	
Significance		0.0000		0.0000
R^2		0.5392		0.5938

* $p = 0.10$.
** $p = 0.05$.
*** $p = 0.01$.

to compete and give) for subjects in Altruistic treatment relative to the Control treatment may have worked against the influence of the competitive frame in the Altruistic treatment.

5.4. The interplay between motivational factors and behavior

We can now explore the relationship between subjects' giving behavior and the two motivational factors we have identified. Here we hypothesize that the two factors have asymmetric effects in the two treatments with meaningful social information relative to the baseline assumption of constant giving of zero, and we are agnostic about the effects of the two motivational factors in the Control treatment. Our econometric specification for giving by subject i in round j in a treatment k is as follows:

$$G(j)_i = \sum_{k=A,S,C} \alpha_k Dummy_k + \sum_{k=A,S,C} \beta_k Dummy_k F1_i + \sum_{k=A,S,C} \gamma_k Dummy_k F2_i + \epsilon_i.$$

We begin with an attempt to explain subjects' initial giving in the first round, before any rank information was available, by regressing subjects' initial giving on the two motivational factors. As one can see from Table 5 (left column), initial giving is significantly different from zero in all three treatments as revealed by the coefficient estimates on the three treatment dummy terms (DummyA = Altruistic treatment, DummyS = Selfish treatment, DummyC = Control treatment). Moreover, the coefficient estimates on the treatment dummy terms in the two treatments with meaningful social information is significantly different from that in the Control treatment (p-values are 0.0033 and 0.0150 for the Altruistic and Selfish treatments, respectively) and, moreover, the treatment dummy coefficients in the Altruistic treatment and Selfish treatments are significantly different (p-value = 0.0349). Furthermore, in these regressions (as well as those that follow), all signs on the two motivational factors (in interactions with the treatment dummy variables) are consistent with our hypotheses – that is, Factor $F1$ (the tendency to compete and keep) contributes negatively to initial giving, while Factor $F2$ (the tendency to compete and give) contributes positively to initial giving. Furthermore, Factor $F1$ significantly decreases initial giving in both the Selfish and Control treatment, while the effect of Factor $F2$ is insignificant.

For average giving over rounds 2–10 (see Table 5, right column), the effect of Factor $F1$ is again significantly negative in the Selfish and Control treatments, yet Factor $F2$ now has a significant positive effect on giving in the Selfish treatment. One possible interpretation for the latter finding is that subjects with strong tendencies to give and compete in giving will tend to resist the Selfish frame, though this tendency seems to be captured only by the average levels of giving in rounds 2–10. Furthermore, the coefficient estimates on the treatment dummy terms are significantly different from zero. While the Altruistic treatment dummy coefficient is significantly different from the dummy coefficients for the other two treatments (both p-values are less than 0.005), the Selfish and Control treatment dummy coefficients are not significantly different from one another (p-value = 0.4582).

We further looked at whether motivational factors explain the behavior of the "Resolute" subjects (i.e., those who gave the same amount in all ten rounds). Across the three treatments, there were 23 subjects who gave zero in all 10 rounds, and seven subjects who gave a constant non-zero amount (see Table 2). We chose to conduct a probit regression on a dummy variable equal to 1 if a subject gave zero in all 10 rounds, i.e., if a subject resolutely gave zero in every round. Again, in accordance with our hypothesis of asymmetric effects of the two factors in the two treatment with meaningful social

Table 6
The results of probit regression with robust standard errors on a dummy variable indicating that a subject gave zero in all 10 rounds, clustered on groups of 5 subjects, for all 60 subjects. The baseline assumption is that the probability a Resolute type gives 0 in all rounds is 1 and that motivational factors have no consequences for behavior. All dummy variables are significantly different from one. Robust standard errors are in parentheses.

Variable	Zero Resolute giving	
DummyA	−1.1364	(0.2264) ***
DummyS	−0.4156	(0.2024) **
DummyC	0.2503	(0.0355) ***
Factor $F1 \times$ DummyA	0.0494	(0.4259)
Factor $F1 \times$ DummyS	0.5377	(0.2727) **
Factor $F1 \times$ DummyC	0.4110	(0.2154) *
Factor $F2 \times$ DummyA	−0.4956	(0.2190) **
Factor $F2 \times$ DummyS	−0.0886	(0.2878)
Factor $F2 \times$ DummyC	−0.1711	(0.4045)
Test statistics	Wald χ^2 (9) = 2660.48	
Significance		0.0000
Log pseudolikelihood		−33.8419

* $p = 0.10$.
** $p = 0.05$.
*** $p = 0.01$.

information, our econometric specification is:

$$Pr(\text{Give Nothing})_i = \sum_{k=A,S,C} \alpha_k Dummy_k + \sum_{k=A,S,C} \beta_k Dummy_k F1_i + \sum_{k=A,S,C} \gamma_k Dummy_k F2_i + \epsilon_i.$$

As Table 6 reveals, subjects are significantly less likely to give zero in all 10 rounds in treatments with meaningful social information, as indicated by the significantly negative coefficients on the Altruistic and Selfish treatment dummy variables, and more likely to give zero in the Control treatment, as indicated by the significantly positive coefficient on the Control treatment dummy variable, with all dummy coefficients being significantly different from each other (all p-values are less than 0.02).

Furthermore, Factor $F1$, representing a tendency to give less and compete in keeping, significantly increases the chance that a subject resolutely gives 0 in both the Selfish and Control treatments. By contrast, Factor $F2$, representing a tendency to give more and compete in giving, significantly decreases the chance that a subject resolutely gives 0 only in Altruistic treatment.[23]

We are further interested in the interplay between subjects' motives and their response to the rank information in the Selfish and Altruistic treatments. In particular, we look at how previous-period rank affects subjects' giving in rounds 2–10 in the Selfish and Altruistic treatments only. Since subjects in our experiment had only ordinal information about other subjects' giving, the evolution of the absolute values of giving is less informative than subjects' ordinal responses to their rank information. A change in a subject's giving has a discontinuous effect on her rank – that is, a 1-cent change in giving may have the same effect on a subject's rank as a $10 change in giving, as rank depends not only on one's own behavior, but also on the behavior of other subjects in the group. It is thus more meaningful to look at the *directional changes* in giving in response to the rank information – that is, whether a given subject increased her giving, decreased it, or made no change when she was ranked top, bottom, or somewhere "in the middle".[24] Furthermore, since rank in giving is the reverse of rank in keeping, a given subject in a given period may have chosen to participate in a "race to the bottom" as well as in a "race to the top".

We thus are interested in quantifying subjects' tendencies to increase or decrease their giving in response to prior round rank information. We examined whether a subject ranked first, middle (i.e., neither first nor last), or last in round $t-1$ responded to this rank information so that their giving in round t, x_t, was higher, lower, or the same relative to her giving, x_{t-1}, in round $t-1$. We hypothesized that if a subject *competes in giving*, then she should have no incentive to change her next-round giving whenever she is ranked first in the Altruistic treatment or last in the Selfish treatment, and she should increase her giving otherwise. Similarly, a subject who *competes in keeping*, should have no incentive to change her next-round giving whenever she is ranked first in the Selfish treatment or last in the Altruistic treatment, and she should decrease her giving otherwise. Table 7 provides a complete characterization of these predicted directional adjustments.[25] We have

[23] As there were just seven Resolute subjects who gave non-zero amounts, a similar attempt to identify the motives for giving constant, non-zero amounts resulted in over-identification.
[24] This "crude" classification of ranks was necessitated by a high incidence of ties – particularly at the top and at the bottom – in the treatments with meaningful social information.
[25] In addition, we classify a given subject's behavior as adjustment towards competition in keeping, if in a particular round of Altruistic treatment all subjects gave nothing (so that everyone was ranked first), and if this subject kept her giving unchanged. However, we never observed this situation.

Table 7
Classification of subjects' directional adjustment of giving x according to whether the subject competes in giving or in keeping – for each of the two competitive treatments.

Altruistic				Selfish			
Rank_t	$x_t > x_{t-1}$	$x_t = x_{t-1}$	$x_t < x_{t-1}$	Rank_t	$x_t > x_{t-1}$	$x_t = x_{t-1}$	$x_t < x_{t-1}$
Top	Giving	Giving	Keeping	Top	Giving	Keeping	Keeping
Middle	Giving	Not classified	Keeping	Middle	Giving	Not classified	Keeping
Bottom	Giving	Keeping	Keeping	Bottom	Giving	Giving	Keeping

Table 8
The results of a regression with robust standard errors, clustered on groups of 5 subjects/session, for all 40 subjects in Selfish and Altruistic treatments. The baseline assumption is that Direction equals nine and that motivational factors have no consequences for behavior. All dummy variables are significantly different from nine. Robust standard errors are in parentheses.

Variable	Direction	
DummyA	0.7068	(0.7185)
DummyS	5.1761	(0.3572) ***
Factor $F1 \times$ DummyA	0.5937	(2.2588)
Factor $F1 \times$ DummyS	2.9603	(1.2831) *
Factor $F2 \times$ DummyA	−2.6035	(0.9979) **
Factor $F2 \times$ DummyS	−1.7380	(0.9719)
Test statistics	$F(6, 7) = 107.34$	
Significance		0.0000
R^2		0.6051

* $p = 0.10$.
** $p = 0.05$.
*** $p = 0.01$.

no predictions for what subjects should do in response to their rank information in the Control treatment, and thus in the subsequent analysis we concentrate only on subjects' directional responses to rank information in Altruistic and Selfish treatments.

We constructed an index of directional competition (which we call *Direction*) by subtracting the number of times a subject behaved as if she competed in giving from the number of times she competed in keeping out of the nine rounds in which social information was available. For example, at the extremes, a subject who always gave zero would get a Direction index value of 9 in either the Altruistic or the Selfish treatment, and vice versa, a subject who always gave the whole \$10, would get a Direction index value of −9 in either the Altruistic or Selfish treatment. Thus, the values of the Direction index are integers between −9 and 9,

with positive values indicating a tendency to make choices consistent with competition in keeping (and thus a tendency to be near the top of the rank list in the Selfish treatment and near the bottom in the Altruistic treatment), while negative index values represent a tendency to make choices consistent with competition in giving (and thus a tendency to be near the bottom of the rank list in the Selfish treatment and near the top in the Altruistic treatment).

We then regressed the Direction index on the motivational factors in the Selfish and Altruistic treatments.[26] Our regression specification here is:

$$\text{Direction}_i = \sum_{k=A,S} \alpha_k \text{Dummy}_k + \sum_{k=A,S} \beta_k \text{Dummy}_k F1_i + \sum_{k=A,S} \gamma_k \text{Dummy}_k F2_i + \epsilon_i$$

The results are reported in Table 8. There we observe that the Selfish competitive frame strongly encourages subjects' adjustments towards competition in keeping as represented by significantly positive coefficient on the Selfish treatment dummy, which is nevertheless significantly different from nine (p-value = 0.0000). In addition, the tendency to compete in keeping, Factor $F1$, has a strong positive effect in the Selfish frame, further pushing subjects' directional adjustment towards making choices consistent with competition in keeping, while the tendency to compete in giving, Factor $F2$, is insignificant in the Selfish frame.

By contrast, the coefficient on the Altruistic treatment dummy is insignificantly different from zero, as is the coefficient on Factor $F1$, the tendency to compete in keeping, in the Altruistic frame. However, the tendency to compete in giving, Factor $F2$, has a strong discouraging effect on subjects' directional adjustment towards competition in keeping in the Altruistic frame and, instead, encourages subjects' adjustment toward competition in giving. In other words, our hypothesis that the competitive environments of our Selfish and Altruistic treatments work to exploit subjects' innate competitive urges, finds some support in our analysis of directional adjustments.

[26] We also conducted an ordered probit analysis, which is more appropriate for our discrete, Direction index variable, and we obtain results that are qualitatively similar to ordinary least squares regression results reported in Table 8. Details are available from the authors upon request.

6. Conclusions

We have explored the effect of competitive institutions on giving behavior using a novel dictator contest design that avoids free-riding behavior, and focuses attention on relative performance. Specifically we explore whether the design of the competitive institution, as either a generosity tournament (our Altruistic treatment), an earnings tournament (our Selfish treatment), or neither (our Control treatment), interacts with intrinsic competitive motives to affect giving behavior in the absence of any extrinsic rewards (such as social acclaim or prestige). We find support for our main hypothesis that the competitive frame does affect giving. However, we also find that the competitive institutions have a non-uniform effect on subject behavior. As our findings for the Control treatment indicate, in the absence of any social content, most subjects never change their allocation decisions and tend to behave in a more self-regarding matter. That is, these Resolute subjects in the Control treatment give less on average. With social information, subjects are less likely to be Resolute with their giving decisions and many appear responsive to the rank information in the directions suggested by our competitive hypothesis. Specifically, the Selfish frame, where subjects compete for top rank in keeping, works to quickly reduce giving amounts. The Altruistic frame, where subjects compete for top rank in giving, does lead to higher overall giving amounts relative to the other two treatments, but there is some erosion in giving behavior in this treatment over time.

Further analysis reveals that there is considerable heterogeneity in individual giving behavior, especially in the two treatments with social information. In an effort to better characterize this heterogeneity, we attempted to uncover subjects' behavioral motives by conducting a post-experiment questionnaire. Analysis of this questionnaire data reveals that subjects' choices in the experiment are correlated with their responses to questions addressing their disposition toward altruistic and rivalrous behavior. We also attempted to uncover other possible motives – specifically, the desire to please others (experimenter demand effects), conformity, variety-seeking and money-seeking motives. However, subjects' responses to questions addressing these other motives failed to yield reliably measurable results and were largely uncorrelated with giving decisions. Thus, while we do not rule out the possibility that experimenter demand effects or other motives were operative in our experiment, we believe that our findings are driven, at least in part, by innate competitive motivations.

As a practical matter, our findings suggest that increases in giving brought about by competitive mechanisms such as our Altruistic frame may be difficult to sustain over time. However, we would caution that such a conclusion is based on our design involving a fixed groups of subjects – an environment that may not be relevant to real-world fundraising situations. For instance, if the composition of the group competing to be most altruistic varied over time due to the entry of new philanthropic-competitors and the exit of others, it might be possible for competitive mechanisms such as our Altruistic frame to sustain high or even increasing levels of giving over time. We leave exploration of this question to future research.

Another issue to explore in future research is whether subjects in our experiment were uncertain about "which end is up" – that is, whether they should have competed for the top or the bottom rank. While our tournament design "primes" subjects to compete to be at the top of the rank list – "1st rank" – it seems that such priming does not work uniformly across all subjects. Indeed, we find that some subjects in the Altruistic treatment demonstrate wide swings in their giving, suggesting that a designer may wish to better anchor a particular end of the competitive domain. Indeed, in an earlier version of this paper (available on request), we found that presenting a token award (a #1 button) to the player ranked first in the dictator contest reinforced the priming of the competitive institution and worked to further stimulate giving in the Altruistic treatment.[27] We suspect that adding extrinsic awards of far greater value than our token reward, e.g., social acclaim, prestige, etc. would serve to further increase competition for the top, number 1 rank. However, the finding that competition occurs even under the very weak competitive conditions of our experimental design is significant, as it suggests that innate competitive motives may play a role in giving decisions.

Two other possibilities we have not explored here are that competitive philanthropic behavior may involve signaling of (1) wealth (akin to money burning), or (2) social type (i.e., generous/altruistic/trustworthy), and thus it would be of interest to pursue a study that further explored how heterogeneity in endowments or in costs of giving affected subject behavior in the competitive frames we have considered here. We nevertheless would like to emphasize that we found substantial heterogeneity in subjects' giving behavior even when subjects had identical endowments or costs of giving. Thus, we see our study as a logical initial step towards understanding competitive philanthropy.

Appendix A. A model of competitive behavior

Consider a group of N individuals who can convert, one-for-one, their endowment z (in whole or in part) into some altruistic action x. Building on the work of Becker (1974) and Andreoni (1990), let us assume that individuals experience a "warm glow" from their altruistic action x. Following Frank (1985b) let us suppose that each individual also cares about her relative standing (or rank) with respect to the other $N-1$ individuals. Specifically, we assume that individual i's preferences over (1) her altruistic action x_i, (2) her private surplus, or "keeping," $y_i = z_i - x_i$, and (3) her rank F_i can be represented by a utility function $U_i(x_i, y_i, F_i)$, where $U_{i1} \geq 0$, $U_{i2} > 0$, $U_{i3} > 0$, and U_i is continuous and quasi-concave. Following Hopkins

[27] One may further explore the priming effects by running a "reverse tournament" where the first rank is listed at the bottom of the list, and the last rank is listed at the top of the list.

and Kornienko (2004), let us further assume that for all individuals, taste for relative position is separable from tastes for altruistic giving and money.[28]

We assume that an individual's utility function over consumption and relative position is the same in all competitive situations, but the manner in which relative position is assigned depends on the competitive situation.

1. *"Altruistic" (A) case*: Suppose the relative position of individual i is assigned according to how this individual's altruistic action x_i stands relative to that of all other individuals. Thus, i's relative position is given by some function $F(x_i, x_{-i})$ which is non-decreasing in x_i ($-i$ refers to all other individuals excluding i), so that individual i's problem is:

$$\max_{x_i,y_i} U_i^A(x_i, y_i, F(x_i, x_{-i})) \quad \text{subject to} \quad x_i + y_i = z_i. \tag{1}$$

2. *"Selfish" (S) case*: Suppose the relative position of individual i is assigned according to how this individual's private surplus $y_i = z_i - x_i$ stands relative to that of all other individuals. Thus, i's relative position is given by some function $F(y_i, y_{-i})$ which is non-decreasing in y_i, so that i's problem is:

$$\max_{x_i,y_i} U_i^S(x_i, y_i, F(y_i, y_{-i})); \quad \text{subject to} \quad x_i + y_i = z_i. \tag{2}$$

3. *"Control" (C) case*: Suppose the relative position of individual i is assigned exogenously (e.g., randomly). Thus, i's relative position is given by some function $F(t_i, t_{-i})$ where t_i is some variable beyond individual i's control, so that i's problem is:

$$\max_{x_i,y_i} U_i^C(x_i, y_i, F(t_i, t_{-i})) \quad \text{subject to} \quad x_i + y_i = z_i. \tag{3}$$

Our focus is on understanding how individual best responses to others' choices vary across the three cases, as opposed to understanding equilibrium outcomes. This allows us to keep the analysis relatively simple while continuing to entertain the possibility of heterogeneity among subjects, e.g., that subjects differ in their taste for altruism. The following Proposition captures the main differences among our experimental treatments.

Proposition 1. *Consider mechanisms A and S where relative position is assigned to individuals by the relative amount given and kept, respectively, and a mechanism C where each individual's relative position is determined exogenously. For any profile of other people's giving, a given individual i's giving, x_i, can be ranked as follows:*

$$0 \leq \text{argmax}_{x_i} U_i^S \leq \text{argmax}_{x_i} U_i^C \leq \text{argmax}_{x_i} U_i^A \leq z_i$$

Proof. Let us begin by assuming that the rank function F is continuously differentiable in the first argument (we will relax this assumption later).

Consider first Eq. (3) corresponding to the situation where relative position is exogenously determined. Here, individual i's best response to other people's choices is given simply by a solution to the following Kuhn–Tucker condition:

$$x_i(U_{i1} - U_{i2}) = 0$$

Given the separability of utility in rank, the solution is independent of others' choices and thus is equal to the individually optimal value of x_i^C. Obviously, if $U_{i1} = 0$ for all x_i, then we have a corner solution $x_i^C = 0$.

Consider next Eq. (1) corresponding to the situation where relative position is determined by relative giving, x. In this case, individual i's best response to x_{-i} is described by the following Kuhn–Tucker condition:

$$x_i \left(U_{i1} - U_{i2} + U_{i3} \frac{\partial F(x_i, x_{-i})}{\partial x_i} \right) = 0$$

Here, the third term of the above equation expresses an incentive to give, as giving implies an extra return from rank. An individual faces a trade-off between the utility from the private surplus, y_i, and relative position, $F(x_i, x_{-i})$. Here, even if $U_{i1} = 0$ for all x_i, we may not have the corner solution where the individual gives nothing. Consequently, for any profile of other people's giving x_{-i}, the best response x_i^A is weakly greater than the individually optimal value x_i^C (see Frank, 1985b and Hopkins and Kornienko, 2004 for similar discussion).

Finally, consider Eq. (2) corresponding to the situation where relative position is determined by relative private surplus, y. In this case, individual i's best response to y_{-i} is described by the following Kuhn–Tucker condition:

$$x_i \left(U_{i1} - U_{i2} - U_{i3} \frac{\partial F(y_i, y_{-i})}{\partial y_i} \right) = 0$$

[28] There is some anecdotal evidence that individuals with higher relative rankings, e.g., in terms of income, fame, feel obliged to give more. This however can be captured in our model by assuming that the individual's relative position *outside* of the laboratory (or current situation) may determine her propensity to give (e.g., see case *C* with the objective (3) below), however her taste for giving is separable from her ranking *inside* the laboratory (or current situation).

Table B1
Experimental Data, all sessions all rounds (rounds are columns labeled 1–10). S1 stands for the first session in the Selfish treatment, A1, C1 are first sessions of the Altruistic and Control treatments, etc. End-of-period rankings (1–5, leftmost column) of subject letter IDs are shown *as presented to subjects*. Ties are indicated by multiple letters at the same rank. The actual amounts given by subjects [in square brackets] were *not* publicly disclosed. The last column reports each subject's gender (Letter ID: Gender)

S1	1	2	3	4	5	6	7	8	9	10	Gender
1	FG[0]	FGI[0]	FGIJ[0]	FGHJ[0]	FGHJ[0]	FGHJ[0]	FGJ[0]	FGJ[0]	FGHJ[0]	FGJ[0]	F:M
2											G:M
3	I[1]										H:F
4	H[2]	J[2.5]					H[0.5]	H[0.01]		HI[5]	I:F
5	J[5]	H[1.5]	H[1]	I[3]	I[2.5]	I[2.5]	I[5]	I[5]	I[4]		J:F

S2	1	2	3	4	5	6	7	8	9	10	Gender
1	FGH[0]	FGH[0]	FGH[0]	FGHI[0]	FGHJ[0]	FGHIJ[0]	FGHIJ[0]	FGHI[0]	FGHI[0]	FGHI[0]	F:F
2											G:M
3											H:M
4	J[1.5]	J[2]	J[0.01]								I:M
5	I[5]	I[3]	I[1.25]	J[0.5]	I[1]			J[0.01]	J[0.01]	J[0.01]	J:M

S3	1	2	3	4	5	6	7	8	9	10	Gender
1	F[0]	F[0]	FJ[0]	FJ[0]	F[0]	FGJ[0]	FJ[0]	FJ[0]	FJ[0]	FJ[0]	F:F
2	I[0.99]	I[1.5]			I[0.3]						G:M
3	J[3]	GHJ[2]	GH[1]	I[0.4]	G[0.5]		H[0.25]	H[0.25]	H[0.15]	H[0.05]	H:F
4	H[4]			G[0.75]	HJ[1]	I[0.4]	GI[0.5]	I[0.35]	G[0.2]	G[0.2]	I:F
5	G[5]		I[1.5]	H[1]		H[0.43]		G[0.4]	I[0.8]	I[0.45]	J:F

S4	1	2	3	4	5	6	7	8	9	10	Gender
1	GH[0]	FGHI[0]	FGH[0]	FGHI[0]	FGHI[0]	FGHI[0]	FGHI[0]	FGHI[0]	FGHI[0]	FGHI[0]	F:F
2											G:M
3	F[1]										H:F
4	I[2]		I[0.5]								I:M
5	J[5]	J[5]	J[5]	J[5]	J[5]	J[5]	J[5]	J[5]	J[5]	J[5]	J:F

A1	1	2	3	4	5	6	7	8	9	10	Gender
1	CE[5]	CE[5]	CE[5]	CDE[5]	CE[5]	CE[5]	CE[5]	CE[5]	CE[5]	CE[5]	A:M
2											B:F
3	B[4]	D[4]	B[3]		B[4]	B[4]	BD[4]	BD[4]	D[4]	B[4]	C:M
4	D[3]	B[3]	D[2]	B[3]	D[3]	D[2]			B[3]	D[2]	D:F
5	A[0]	A[0]	A[0]	A[0]	A[0]	A[0]	A[0]	A[0]	A[0]	A[0]	E:F

A2	1	2	3	4	5	6	7	8	9	10	Gender
1	C[10]	C[10]	C[10]	C[10]	B[5]	D[7]	B[5]	B[5]	D[10]	D[10]	A:M
2	AB[5]	D[6]	B[5]	BD[5]	A[0.5]	BC[5]	ACDE[0]	ACDE[0]	B[5]	B[5]	B:M
3		B[5]	D[2]		CDE[0]				ACE[0]	ACE[0]	C:M
4	D[1]	A[2]	A[0.1]	A[1]		AE[0]					D:M
5	E[0]	E[0]	E[0]	E[0]							E:F

A3	1	2	3	4	5	6	7	8	9	10	Gender
1	A[5]	A[5]	A[5]	A[5]	A[5]	A[5]	C[1.99]	C[1.12]	C[0.41]	A[5]	A:M
2	C[3]	C[3]	C[2.5]	C[2.23]	D[3]	C[2.01]	D[1]	D[1]	ABDE[0]	C[0.01]	B:F
3	D[1]	BDE[0]	D[1]	D[2]	C[2.11]	BDE[0]	ABE[0]	ABE[0]		BDE[0]	C:M
4	BE[0]		BE[0]	BE[0]	BE[0]						D:F
5											E:M

A4	1	2	3	4	5	6	7	8	9	10	Gender
1	E[5]	BD[5]	D[7]	D[5.3]	D[5.4]	D[5.45]	D[5.2]	E[6]	D[6]	E[6]	A:M
2	D[4]		B[6]	E[5]	E[4]	E[5]	E[5]	D[5.1]	E[2]	D[5.5]	B:F
3	B[3]	E[4]	C[5]	B[0.5]	B[1]	A[4.99]	A[3.5]	B[2.5]	A[1]	B[0.5]	C:F
4	C[1]	A[3]	E[3]	AC[0]	AC[0]	BC[0]	B[2.5]	AC[0]	BC[0]	A[0.01]	D:F
5	A[0]	C[0]	A[2]				C[1]			C[0]	E:M

C1	1	2	3	4	5	6	7	8	9	10	Gender
1	K[5]	K[5]O[0]	M[3]	K[5]M[2]	L[0]	O[0]	L[0]	M[3]	K[5]	M[3]	K:M
2	N[0]		L[0]		M[2]	K[5]	K[5]M[3]	O[0]	M[3]	N[0]	L:F
3	O[0]	L[0]	N[0]	O[0]	N[0]	L[0]		L[0]	O[0]	K[5]	M:M
4	L[0]	N[0]	O[0]	N[0]	O[0]	N[0]	N[0]	K[5]	L[0]	O[0]	N:F
5	M[4]	M[3]	K[5]	L[0]	K[5]	M[4]	O[0]	N[0]	N[0]	L[0]	O:M

Table B1 (*Continued*)

C2	1	2	3	4	5	6	7	8	9	10	Gender
1	K[0]	L[4.99]	K[0]	M[0]	N[0]	N[0]	K[0]	N[0]	O[0]	O[0]	K:M
2	L[4.99]	O[0]	M[5]	K[0]	M[5]	O[0]	M[0]	L[4.99]	M[0]	M[3]	L:M
3	O[0]	M[0]	O[0]	L[4.99]	O[0]	M[3]	N[0]	M[3]	L[4.99]	N[0]	M:M
4	M[0]	N[0]	L[4.99]	O[0]	K[0]	K[0]	O[0]	O[0]	K[0]	L[4.99]	N:M
5	N[0]	K[0]	N[0]	N[0]	L[4.99]	L[4.99]	L[4.99]	K[0]	N[0]	K[0]	O:M

C3	1	2	3	4	5	6	7	8	9	10	Gender
1	K[0]	K[0]L[0]	K[0]	M[5]	O[0]	M[5]	L[0]	K[0]	M[5]	M[4]	K:M
2	O[0]		L[0]	O[0]	M[5]	L[0]	N[0]	N[0]	K[0]	N[0]	L:F
3	L[0]	O[0]	N[0]	N[1]	L[0]	K[0]	M[5]	O[0]	L[0]	L[0]	M:F
4	M[5]	N[0]	M[5]	L[0]	N[0]	N[0]	K[0]	L[0]	O[0]	K[0]	N:M
5	N[0]	M[5]	O[0]	K[0]	K[0]	O[0]	O[0]	M[5]	N[0]	O[0]	O:F

C4	1	2	3	4	5	6	7	8	9	10	Gender
1	M[0]	O[5]	M[0]	L[3]	K[0]	N[0]	K[2]	M[0]	O[2]	M[0]	K:F
2	N[0]	K[1]	O[3]	M[0]	N[0]	L[3]	M[0]	K[1]	M[0]	L[3]	L:M
3	K[2]	L[3]	K[2]	N[0]	M[0]	O[3]	N[0]	L[3]	N[0]	O[5]	M:M
4	L[3]	N[0]	N[0]	K[1]	L[3]	M[0]	O[4]	N[0]	K[2]	N[0]	N:F
5	O[1]	M[0]	L[3]	O[0]	O[5]	K[1]	L[3]	O[5]	L[3]	K[0]	O:F

Table C1
Answer options: "Never" (coded as 1), "Almost Never" (coded as 2), "Sometimes" (coded as 3), "Frequently" (coded as 4), "Almost Always" (coded as 5), or "Always" (coded as 6). In the experiment, the order of the questions was scrambled. The last columns show the correlations of subjects' (numerical) responses with their giving amounts in round 1 and average giving amounts over rounds 2–10.

	Question	Motive	Mean (SD)	Corr w/giving round 1			Corr w/ave giving round 2–round 10		
				S	A	C	S	A	C
1	Feel indifference to others' misfortunes.	Altruism (−)	2.45 (1.06)	−0.27	−0.32	−0.27	−0.57***	−0.45**	−0.30
2	Try not to do favors for others.	Altruism (−)	2.22 (0.90)	−0.06	−0.13	0.14	−0.39*	−0.17	−0.04
3	Feel sympathy for those who are less fortunate than me.	Altruism (+)	4.15 (1.23)	0.30	0.15	0.23	0.62***	0.25	0.20
4	Love to help others.	Altruism (+)	4.17 (1.09)	0.37	0.12	0.46**	0.71***	0.38	0.44**
5	Avoid competitive situations.	Rivalry (−)	2.85 (1.16)	0.10	−0.09	0.18	0.03	−0.09	0.16
6	Feel that winning or losing doesn't matter to me.	Rivalry (−)	2.80 (1.16)	0.34	−0.17	0.09	0.54**	0.02	0.02
7	Drawn to compete with others.	Rivalry (+)	3.58 (1.32)	−0.30	0.05	−0.33	−0.46**	−0.02	−0.20
8	Feel that I must win at everything.	Rivalry (+)	3.12 (1.47)	−0.12	0.06	−0.11	−0.54**	0.13	−0.11
9	Feel that money is not important to me.	Money (−)	2.98 (1.16)	0.40*	0.15	0.02	0.45**	0.12	−0.04
10	Need little money to get by.	Money (−)	3.23 (1.18)	0.34	0.21	0.01	0.25	0.22	−0.09
11	Feel that money is all that matters to me.	Money (+)	2.48 (1.16)	−0.11	0.06	−0.17	−0.47**	0.05	−0.16
12	Do not have enough money to satisfy my needs.	Money (+)	3.22 (1.21)	−0.32	−0.31	−0.17	−0.24	−0.21	−0.08
13	Do not care what others think of me.	Demand (−)	3.37 (1.09)	−0.08	0.02	−0.42*	−0.19	0.03	−0.28
14	Am not concerned with making a good impression on those in charge.	Demand (−)	2.38 (0.96)	0.08	−0.08	0.25	−0.08	0.02	0.32
15	Worry what others think of me.	Demand (+)	2.82 (1.08)	0.09	−0.05	0.39*	0.00	0.10	0.22
16	Do what those in charge want me to do.	Demand (+)	4.02 (0.93)	0.22	0.32	0.43*	0.25	0.26	0.24
17	Behave unconventionally.	Conform (−)	3.05 (0.93)	−0.29	−0.28	−0.41*	−0.24	−0.19	−0.27
18	Take the opposite route from everyone else.	Conform (−)	3.08 (0.77)	0.05	−0.22	−0.48**	0.05	−0.10	−0.32
19	Follow others than to search for my own path.	Conform (+)	2.42 (0.81)	0.12	0.47**	0.28	−0.13	0.51**	0.14
20	Feel that observing others' choices can help me make good choices.	Conform (+)	3.73 (1.06)	−0.29	0.15	−0.11	−0.59***	0.25	−0.09
21	Avoid change.	Variety (−)	2.82 (0.97)	−0.11	−0.20	−0.01	−0.36	−0.32	0.00
22	Do things according to a plan.	Variety (−)	4.10 (1.02)	0.23	0.25	−0.02	0.26	0.38*	−0.14
23	Am willing to try something new.	Variety (+)	4.58 (1.00)	0.12	0.18	−0.02	−0.08	0.32	−0.11
24	Seek change however small.	Variety (+)	3.48 (0.95)	0.03	−0.05	0.23	0.13	0.12	0.13

* $p = 0.10$.
** $p = 0.05$.
*** $p = 0.01$.

Here, the third term of the above equation expresses the disincentive to give, as giving implies a negative return from rank. Consequently, for any profile of other people's giving, x_{-i}, the best response, x_i^S, is weakly smaller than the individually optimal value, x_i^C. Moreover, if $U_{i1} = 0$ for all x_i, then we have a corner solution $x_i^S = 0$.

Now let us relax the continuous differentiability assumption on the rank function F and assume instead that F has some discontinuities and "flat" spots. This does not change the best response x_i^C for the benchmark C case corresponding to the Eq. (3).

Therefore, let us immediately move to the situation where relative position is determined by relative giving x, as described by Eq. (1). Note that for any profile of others' choices, x_{-i}, giving less than x_i^C is strictly dominated in this case. That is, for any $\tilde{x}_i < x_i^C$,

$$U_i(\tilde{x}_i, z_i - \tilde{x}_i,\ F(\tilde{x}_i, x_{-i})) \leq U_i(x_i^C, z_i - x_i^C,\ F(x_i^C, x_{-i}))$$

To see why, consider some $\tilde{x}_i < x_i^C$ and, without loss of generality, suppose that $\tilde{x}_i$ is such that $F(\tilde{x}_i, x_{-i})$ is constant in some vicinity of $\tilde{x}_i$. Then, $U_i(\tilde{x}_i, z_i - \tilde{x}_i,\ F(x_i^C, x_{-i})) < U_i(x_i^C, z_i - x_i^C,\ F(x_i^C, x_{-i}))$ as, by separability in relative position, x_i^C is individually optimal for any realization of F. Moreover, as F is increasing in x_i, individual i can further increase her relative position by increasing x_i. Second, if there are discrete jumps in the rank function F in the vicinity of x_i^C, individual i can increase x_i by a small amount, ϵ, and gain a discrete increase in F. Thus, when rank is determined by relative giving, giving less than x_i^C is never optimal and, moreover, giving more is sometimes optimal.

A similar argument applies to the situation where relative position is determined by relative keeping (or private surplus) y, as described by Eq. (2). That is, for any profile of others' choices y_{-i}, giving more than x_i^C is strictly dominated, and for some profiles y_{-i}, one can get a discrete improvement in relative position F by lowering x_i. Thus, when rank is determined by relative private surplus, giving more than x_i^C is never optimal and, moreover, giving less is sometimes optimal. □

Appendix B. Experimental data

See Table B1.

Appendix C. The questionnaire

See Table C1.

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