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This paper is part of a project that explores the role of self-control in pro-social behavior; in particular, how temptation determines cooperation in social dilemmas. It was completed while Conny Wollbrant was visiting Universidad de Antioquia in Spring 2013

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Tangible Temptation in the Social Dilemma: Cash, Cooperation, and Self-Control

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Abstract

The social dilemma may contain, within the individual, a self-control conflict between urges to act selfishly and better judgment to cooperate. Examining the argument from the perspective of temptation, we pair the public good game with treatments that vary the degree to which money is abstract (merely numbers on-screen) or tangible (tokens or cash). We also include psychometric measures of self-control and impulsivity. Consistent with our hypothesis, we find in the treatments that render money more tangible a stronger positive association between cooperation and self-control—and a stronger negative association between cooperation and impulsivity. Our results shed light on the conditions under which self-control matters for cooperation.

Keywords: Self-control, Pro-social behavior, Public good experiment, Temptation.
JEL Classification: D01, D03, D64, D70.

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1. Introduction

The social dilemma represents not only conflict between individual rationality and the collective good, but also one within the individual—between conflicting preferences. More specifically, in contexts resembling that of the standard public good game (for surveys on public goods experiments, see, e.g., Ledyard, 1995; Zelmer, 2003; Gächter, 2007; Chaudhuri, 2011)—where the group is both abstract and anonymous—individuals are thought to experience a self-control conflict between the temptation to act 'selfishly' and the 'better judgment' to act in the interest of others (Kocher *et al.*, 2012; Martinsson *et al.*, 2012). To date, the question has been explored empirically by correlating levels of cooperation with a psychometric measure of individuals' trait capacity to exercise self-control (Rosenbaum, 1980a), with an eye to the question of conflict recognition; self-control matters only to the extent that the individual has recognized the decision at hand as a self-control conflict (Myrseth & Fishbach, 2009). Kocher *et al.* (2012) theorized about, and found evidence of, a positive association between cooperation and trait self-control among participants who reported feeling conflicted during the contribution decision—but not among participants who reported no conflict. Turning to the causality of conflict identification, Martinsson *et al.* (2010) fitted a subtle framing procedure to the public good game. They found that trait self-control was more strongly correlated with cooperation in the treatment that raised the relative likelihood of conflict identification than in the treatment that reduced the likelihood.

We explore the same conceptual framework, though from a different vantage point. Adapting a procedure for influencing the degree to which money is experienced as tangible versus abstract (Reinstein & Riener, 2011), we test the hypothesis that the positive correlation between cooperation and trait self-control is stronger in the treatment that renders money more tangible, and hence more viscerally tempting (Loewenstein, 1996). Furthermore, equipped with a measure of impulsivity, we test the converse hypothesis—that the negative correlation between cooperation and impulsivity is stronger in the treatment that renders money more tangible. We find support for our predictions.

The remainder of the paper is organized as follows. Section 2 briefly reviews the literature on the relation between pro-social behavior and self-control. Section 3 presents our model, and Section 4 outlines our experimental design. Section 5 presents the experimental results, and Section 6 discusses our findings and concludes the paper.

2. Self-control and pro-social behavior

2.1 *Conceptualizing self-control*

There are different ways of conceptualizing self-control. A common one, on which we rely here, is to understand self-control as a "cold" executive function that guides behavior in response to "hot" impulses to act against 'better judgment' (see e.g., Loewenstein, 1996; 2000; Metcalfe & Mischel, 1999; O'Donoghue & Loewenstein, 2007; Hofmann *et al.*, 2009). The executive function relies on limited resources, which we may think of as 'willpower' (see e.g., Baumeister *et al.*, 1998). In turn, the resources may include cognitive strategies to divert attention away from temptation (e.g., Mischel *et al.*, 1989), strategies of pre-commitment (e.g., Thaler & Shefrin, 1981; Schelling, 1984), or, simply, the strength of mind to resist (e.g., Myrseth & Wollbrant, 2013).

Perhaps not inconsistent with lay intuition, but noteworthy in light of the debate in social psychology about 'disposition versus the situation,' there is reason to think that the capacity to exert self-control constitutes a relatively stable personality trait. To this point, Mischel and colleagues found that a child's performance at age 4 on an instant gratification task (e.g., one marshmallow now, or two marshmallows later) predicted later in life their cognitive control (Eigsti *et al.*, 2006); ability to concentrate, self-control, interpersonal competence, SAT scores, and drug use (Mischel *et al.*, 1988; Mischel *et al.*, 1989; Shoda *et al.*, 1990; Ayduk *et al.*, 2000). Moreover, for the purpose of capturing trait self-control, a number of psychometric measures have emerged, including the Self-Control Schedule by Rosenbaum (1980a) and the Self-Control Scale by Tangney *et al.* (2004).

The visceral nature—or 'hotness'—of the temptation is central to most conceptualizations of self-control, both lay and scientific. It is thought that the immediate presence of a tempting object—say a newly baked cookie—triggers a stronger urge than does a more abstract and distant representation of the object (Metcalfe & Mischel, 1999). In other words, the mere verbal description of a cookie would represent a lesser temptation than would a steaming, fresh one, standing in full purview of the hungry shopper. It is for this reason that numerous self-control strategies involve "cooling" the temptation, for example, by directing attention away from it (Mischel *et al.*, 1989), rendering it more abstract and less tangible (for a review, see Metcalfe & Mischel, 1999), or undermining its perceived value (Myrseth *et al.*, 2009). And it is for this reason that psychometric scales of trait self-control ask individuals

about their tendencies (among other things) to engage in such behaviors (e.g., Rosenbaum, 1980a).

2.2 Self-control and social dilemmas

Loewenstein (1996; 2000), followed by O'Donoghue and Loewenstein (2007), suggest that visceral urges or drive-states may motivate 'selfish' behavior, and a growing body of empirical work has produced evidence for this conceptual framework. Most pertinent to our current endeavors are the studies that feature social dilemmas (for a review of social dilemmas, see van Lange *et al.*, 2013).

Several studies have examined the relationship between time preferences and cooperation. Taking participants in a standard public good game, Curry *et al.* (2008) found that discount rates were negatively associated with contributions to the public good. Fehr and Leibbrandt (2011) elicited time preferences of fishermen in the lab; they found that patient (vs. impatient) fishermen exhibited more cooperative behavior in the field, but they found no relationship in the lab.[4] Furthermore, Burks *et al.* (2009) report that "short-term" patience—the β in the β-δ model—is positively associated with cooperative behavior in a sequential prisoner's dilemma.[5,6]

Rand *et al.* (2012), explore the association between time decision times and cooperation, and paint a different picture. The authors report that shorter reaction times are associated with more cooperative behavior, and that treatments intended to reduce decision times boost cooperation. They conclude that "default behavior" in the typical public good games is to cooperate, an idea at odds with evidence from studies of cooperation and time preferences, and with the framework tested in this paper.

For the purpose of probing the role of self-control in cooperation, Kocher *et al.* (2012) formulate and test a model in a one-shot, linear public good game; they examine the association between cooperation, self-control, risk-preferences, and the contributions of other players. Consistent with their predictions, cooperation was positively associated with a

[4] Jones and Rachlin (2009) fail to find a correlation between temporal discounting and cooperation in a 100-person public good game—but their entire procedure is in the form of a hypothetical scenario. That they fail to a find a relationship—where others who employ incentivized procedures do—is consistent with conceptual framework presented in this paper; there is quite possibly no self-control conflict in a hypothetical scenario.

[5] There is an extensive literature on self-control and time inconsistency in economics; see e.g. hyperbolic and quasi-hyperbolic discounting models by Strotz (1955) and Laibson (1997), the "planner-doer" model by Thaler and Shefrin (1981), and the dual-self model by Fudenberg and Levine (2006). For work on procrastination, see e.g. O'Donoghue and Rabin, (1999) and Burger *et al.* (2011).

[6] However, Duffy and Smith (2012) report no effect of cognitive load—meant to impair self-control by depleting cognitive resources—on outcomes across treatments, in a repeated multi-player prisoner's dilemma.

psychometric measure of trait self-control (Rosenbaum, 1980a), and this association was moderated by an interaction with risk-preferences; higher risk aversion implied a weaker association. Moreover, they find that this interaction is moderated by the degree of cooperation of other players, captured by the conditional cooperation schedule from the strategy method; individuals feel obliged to contribute, and to expend costly effort in this pursuit, to the extent that others are also contributing to the public good. Finally, and also consistent with their model, the aforementioned patterns were obtained for individuals who reported feeling conflicted during the decision to cooperate—not for those who reported no conflict whatsoever. Notably, their study did not feature any experimental treatments, and so it left empirical questions of causality unanswered.

Martinsson *et al.* (2010) explore one of these questions, namely that of identification of self-control conflict. Borrowing an experimental framing procedure from Myrseth and Fishbach (2010), also recently adapted by Martinsson *et al.* (2012) to a dictator game, they attempted to influence identification of self-control conflict in a one-shot, linear public good game.[7] Consistent with their predictions, the frame hypothesized to promote identification of self-control conflict—relative to that hypothesized not to—yielded a stronger positive correlation between cooperation and trait self-control. This effect was obtained both for unconditional and conditional cooperation, and, in the latter case, it was stronger for higher levels of others' contributions.

This paper extends a version of the self-control model from Kocher *et al.* (2012) by explicitly incorporating temptation strength, and exploring empirically a new question of causality—that concerning the strength of temptation.

2.3 *Self-control and dictator games*

Several studies of dictator games reveal a pattern similar to that observed in social dilemmas. Piovesan and Wengström (2009) found that lower response times of participants in a repeated dictator game, which lasts 24 periods, are correlated with more selfish choices, both across and within participants. [8] These results are consistent with the interpretation that individuals' default behavior is to act selfishly, and that pro-social behavior requires the successful resolution of a self-control conflict, thereby raising response time. Following the

[7] The hypothesized mechanism behind their procedure is consistent with the "logic of appropriateness" framework, which assumes that individuals ask themselves, "What does a person *like me* do in a situation *like this* (e.g., March, 1994; Messick, 1999; Weber *et al*., 2004)?" It can then be viewed as specifying when a particular logic of appropriateness is activated, thereby activating a self-control conflict.

[8] For a general discussion of the utility and merit of response times in economics, see Rubinstein (2007).

same logic, successful resolution of conflict would require cognitive resources, and—consistent with this idea—Martinsson *et al.* (2012) show that donations to the Red Cross in a one-shot dictator game are positively correlated with participants' scores on the Rosenbaum (1980a) measure of trait self-control. Moreover, the correlation was found in the framing treatment that was expected to raise the relative likelihood of identification of self-control conflict—not in the framing treatment that was expected to reduce the likelihood. Aguilar-Pardo *et al.* (2013) obtain consistent results; young children who engaged in altruistic sharing in a dictator game exhibited later higher scores on an inhibitory control task, a measure of executive functioning.

The picture is less clear for studies that examine the relationship between cognitive load and altruistic behavior in dictator games. Hauge *et al.* (2009) report no effect of cognitive load on players in one-shot dictator games, whereas Cornellisen *et al.* (2011), find no main effect of cognitive load across three low-stake dictator games. Breaking down the data, however, they report that cognitive load increases giving among individuals classified as "pro-socials" according to Liebrand's (1984) measure of *social value orientation* (social preferences), but that there is no effect among the majority of participants, classified as "pro-selves." Schulz *et al.* (2012) report that cognitive load raises the proportion of altruistic choices in repeated "mini-dictator game," where participants face dichotomous choices, between "fair" and "unfair" allocations.

3. Model

3.1 *Utility*

We assume an agent whose preferences are described by the utility function U_i, which consists of three components:

$$U_i = u_i(\pi_i) - s_i(\omega_i, t) + f_i(c_i) \tag{1}$$

The first component, $u_i(\pi_i)$, is the utility from monetary payoffs. For simplicity, we assume that utility is linear in payoffs, and that the utility from monetary payoffs is equivalent to the payoff itself, $u_i(\pi_i) = \pi_i$. Our empirical setting is a one-shot linear public goods game,

where π_i is the payoff, e_i the endowment, c_i the contribution level, and m the marginal return from the public good:

$$\pi_i = e_i - c_i + m \cdot \sum_1^n \frac{c_j}{n}. \tag{2}$$

If $0 < m < 1$ and $m \cdot n > 1$, this payoff function satisfies the requirements of a public good.

The second component, $s_i(\omega_i, t)$, specifies the cost of exercising self-control. This cost is "opportunity-based," following Fudenberg and Levine (2006). The underlying idea is that temptation strength is proportional to the appeal of available alternatives and that cost of self-control is monotonically and positively related to temptation strength. In our case, greed grows stronger with a greater difference between the highest possible available monetary payoff. Since $c_i = 0$ maximizes monetary payoff, any positive contribution level c_i' reduces the monetary payoff and hence $\pi(0) > \pi(c_i')$, for $c_i' > 0$. We may write the difference between the two payoffs as the difference between the payoff function evaluated at zero and the payoff function itself. This quantity then becomes $\pi(0) - \pi(c_i') = c_i - mc_i = (1 - m)c_i$. The term $(1 - m)c_i$ therefore denotes greed and is the argument of the self-control cost function. Assuming a standard quadratic functional form, we may write the cost of self-control as

$$s_i(\omega_i, t) = \frac{\left(t(1-m)c_i\right)^2}{2\omega_i}, \tag{3}$$

where the self-control cost is moderated by a will-power parameter $\omega_i > 0$. The parameter $t > 0$ measures the tangibility of monetary rewards, capturing the idea that more tangible objects are also more viscerally tempting (see e.g., Lowenstein, 1996; Metcalfe & Mischel, 1999).

The third and final component in (4), $f_i(c_i)$ specifies an intrinsic benefit from contributing, similar to impure altruism models (e.g., Andreoni, 1990).

$$f_i(c_i) = \alpha_i c_i, \tag{4}$$

where $\alpha_i > 0$ is a utility weight capturing the importance of contributing.

The motivation behind our modeling approach is to describe an agent with altruistic motivations, but who nevertheless feels tempted to be selfish. That is, the agent experiences a self-control conflict between her better judgment to act pro-socially and the temptation to act selfishly. To resolve this self-control conflict, the agent must expend costly effort. This effort is modeled with the approach by Fudenberg and Levine (2006), and implemented into the utility function accordingly.[9]

We state the utility function in full as

$$. \; U_i = e_i - c_i + m \cdot \sum_1^n \frac{c_j}{n} - \frac{\left(t\left(1-m\right)c_i\right)^2}{2\omega_i} + \alpha_i c_i \; . \tag{5}$$

3.1 *Predictions*

We present here the main behavioral predictions for the public goods game. Maximization of the utility function in (5) with respect to c_i yields the first order condition

$$-1 + \frac{m}{n} - \frac{\left(t\left(1-m\right)\right)^2 c_i}{\omega_i} + \alpha_i = 0 \tag{6}$$

which implies that optimal contribution c_i^* is given by (7):

$$c_i^* = \frac{\omega_i}{t^2} \frac{\left(\alpha_i - 1 + \frac{m}{n}\right)}{(1-m)^2} \tag{7}$$

This leads us to our main prediction.

[9] A similar modeling approach is also employed by Hauge (2010), for the dictator game.

PREDICTION 1. *Given that the individual is sufficiently prosocial, such that* $\alpha_i > 1 - \frac{m}{n}$, *raising tangibility of money rewards reduces optimal contributions in the public goods game. This negative effect on contributions is smaller for higher levels of willpower.*

Proof. in Appendix A.

Because impulsivity, as a construct, ought to be negatively correlated with willpower, we also predict the following:

PREDICTION 2. *Given that the individual is sufficiently prosocial, such that* $\alpha_i > 1 - \frac{m}{n}$, *raising tangibility of money rewards reduces optimal contributions in the public goods game. This negative effect on contributions is higher for higher levels of impulsivity.*

We illustrate our predictions graphically in Figure 1. Prediction 1 implies that the two lines converge with higher levels of self-control. Prediction 2, however, implies that the two lines diverge with higher levels of impulsivity.

Insert Figure 1 about here

4. Experimental design and procedure

4.1 *The public goods game*

Our experiment features a public good game, with the following linear payoff function for individual i

$$\pi_i = 20 - c_i + 0.4 \sum_j^4 c_j, \tag{14}$$

where c_i denotes the contribution of individual i to the public good. Each individual is assigned to a group of four randomly matched individuals, and each individual receives an

endowment of 10 experimental points (the experimental currency unit). The marginal per capita return (MPCR) from investing in the public good is 0.4, which satisfies the requirements of a social dilemma. Assuming that participants are rational and self-interested, it is evident that any MPCR < 1 implies a dominant strategy to free-ride. From the perspective of social welfare, it is optimal to contribute the entire endowment as MPCR·n > 1.

Our experiment incorporates the preference elicitation and incentive mechanism from Fischbacher *et al.* (2001). Participants make two sets of decisions—first, an unconditional contribution to the public good and, second, a conditional contribution schedule. The unconditional contribution is given as a single integer, satisfying $0 \leq c_i \leq 10$. For the conditional contribution, participants indicate how much they would contribute to the public good for any possible average contribution (rounded to integers) of the other three players within their group. For each of the 11 possible averages from 0 to 10, participants decide on a contribution between (and including) 0 and 10. This is a version of the strategy vector method (Selten, 1967).

To ensure incentive-compatibility, both the unconditional and the conditional contributions are potentially payoff-relevant. For one group member, randomly determined by the toss of a four-sided die,[10] the conditional contribution is relevant; unconditional contributions are relevant for the other three group members. More specifically, the three unconditional contributions within a group, and the corresponding conditional contribution (for the specific average of the three unconditional contributions), determine the sum of contributions to the public good.

4.2 *Treatments*

Our experiment features three between-subject treatments—the cash, token, and standard treatments. The purpose of the treatments was to influence the degree to which the greed temptation was tangible. Each of the nine sessions was assigned to one of the three treatments, and participants were randomly assigned to one of the nine sessions.

The treatments were implemented with a procedure adopted from Reinstein and Riener (2011). In the cash treatment, participants received their endowment in the form of one-euro coins, packaged in envelopes, one for each participant. Participants were instructed to indicate their allocation decision on the computer screen *and* by allocating the coins to two

[10] Each group member is assigned a number from one to four. The die is rolled by a randomly selected participant in the session, and the roll of the die is monitored by the experimenter.

new envelopes, one marked for *self* and the other for the *public good*. Participants' payments at the end of the experiment were determined by the on-screen decision. Similarly, participants in the token treatment received their endowment in the form of ten tokens, packaged in one envelope for each participant. Otherwise, the procedure in the token treatment resembled that in the cash treatment. In contrast, participants in the standard treatment completed the entire decision process on-screen, using Z-tree, without receiving any envelopes or any forms of physical representation of their endowments. As such, the baseline treatment followed the procedure typically used in linear public good games (e.g., Fischbacher et al., 2001; Zelmer, 2003).

The crucial distinction between the three conditions is the physical—and hence tangible—representation of the endowment. We assumed that a more tangible representation of the source of temptation would more likely stoke stronger feelings of greed. This assumption is consistent with the work in psychology on visceral influences (Loewenstein, 1996; O'Donoghue & Loewenstein, 2007). As the cash condition represents the most tangible representation of money—the source of greed in our experimental context—we expected this condition to ignite the strongest visceral influences, or temptation. In contrast, the standard treatment provides merely an abstract representation of the endowment. We thus expected this treatment to elicit the weakest temptation. Consistent with our interpretation, Reinstein and Riener (2011) found that charitable donations were lower in the cash than in the standard treatment. Finally, while the standard treatment provides a physical representation of the endowment, the representation is more abstract than is that of the cash treatment. We thus expected the token treatment to fall somewhere between the cash and the standard treatments.

Insert Figure 2 about here

4.3 *Measurement of trait self-control and impulsivity*

To measure self-control, we implemented the Rosenbaum Self-Control Schedule (Rosenbaum, 1980a), henceforth abbreviated Rosenbaum.[11] This is a standard psychometric measure of trait self-control in the psychology literature. It has been validated against a number of relevant personality measures; and against behavioral tasks associated with self-control, such as resisting pain (Rosenbaum, 1980b); coping with stress (Rosenbaum & Smira, 1986; Rosenbaum, 1989); coping with mental disability (Rosenbaum & Palmon, 1984);

[11] The Rosenbaum Self-Control Schedule (1980a) is included in Appendix B.

managing seasickness (Rosenbaum & Rolnick, 1983); quitting smoking (Katz & Singh, 1986); saving over spending (Romal & Kaplan, 1995); and curtailing procrastination (Milgram *et al.*, 1988). More recently, the Rosenbaum has been found under certain conditions to correlate positively with donations in a dictator game (Martinsson *et al.*, 2012) and cooperation in a one-shot public good game (Kocher *et al.*, 2012; Martinsson et al., 2010).

We also included a measure of impulsivity, adopted from the German Socio-Economic Panel (GSOEP; Wagner *et al.*, 2007). It is simply one question: "How do you assess yourself personally: Are you in general a person who thinks carefully before acting, so not impulsive at all? Or are you a person who acts without thinking long, so very impulsive?" The question was answered on an 11-point scale, ranging from "not impulsive at all" (0) to "very impulsive" (10).

4.4 *Overview of procedure*

The computer-based experiment was conducted in the experimental laboratory at Technische Universität Berlin, in December 2010, with the experimental software z-Tree (Fischbacher, 2007). In total, 180 students from all disciplines, except economics, participated in nine sessions—three sessions for each treatment—with 20 participants per session. Nobody participated in more than one experimental session. Approximately 66% of participants were male. Sessions lasted up to 1½ hours, and the average payoff was 12.9 euro, including a show-up fee of 4 euro.[12]

Upon arrival, experimental participants were arranged in separate cubicles. Each session started with instructions for the public goods game. The instructions also indicated that there would be additional parts of the experiment, but that the instructions for these parts would only be provided after the completion of the current part. It was further stressed to participants that decisions in one part would be completely unrelated to those in the other parts. Participants received neutrally-framed, written instructions (see Appendix C), on-screen and on paper. The instructions were read out loud by the experimenter, who was overseeing the execution of the experiment, but not otherwise involved with the research project. Everybody had the opportunity to ask questions in private. The experiment continued only after all participants had completed a series of computerized exercises (where they calculated

[12] Each experimental point earned in the public goods game was exchanged at the pre-announced rate of 1 point = 0.33 euro.

profits for different contribution levels in the public goods game), and after all participants had correctly understood the procedures. Participants were informed that feedback and payment would only be provided at the very end of the experiment.

After finishing the public goods game, participants completed the Rosenbaum, the measure of impulsivity, and some demographic questions.

The final stage of the experiment included feedback on the decisions of group members in the public goods game and on the individual earnings. Payments were made privately and in cash.

5. Experimental results

The summary statistics in Table 1 show that unconditional contributions in our sample resemble those reported elsewhere (e.g., Fischbacher *et al.*, 2001; Fischbacher & Gächter, 2010). Also, the Rosenbaum scores correspond roughly to those found in other studies.[13] The age profile fits that of a typical student population (*Mean* = 23.3, *SD* = 4.1).

Insert Table 1 about here

Our two measures of self-control, namely the Rosenbaum and impulsivity, are negatively correlated (R = -0.26, $p < .01$). The relatively low correlation, however, is not a surprise as the relationship, at the conceptual level, is not necessarily one-to-one; it is possible to have both high levels of trait self-control, as measured by the Rosenbaum, and high levels of impulsivity.

Our analysis features the unconditional contributions as our tangibility treatments were only implemented for this measure; participants were only given cash or tokens to represent the endowment and their unconditional contributions. Conditional contributions, across treatments, were elicited with a standard variation of the vector strategy method (e.g., Fischbacher et al., 2001), where the representation of money is abstract (on-screen).

[13] The grand mean is below the corresponding range of means from the original samples studied by Rosenbaum (1980a, b)—*Mean* = 18.5 vs. *Mean*s ranging from 23 to 27. It is slightly above that (*Mean* = 16.7) obtained in Germany by Kocher *et al*. (2012), but below those (*Mean* = 32.1 and Mean = 29.7) obtained in Colombia by Martinsson *et al*. (2012; 2010, respectively).

Table 2 presents a regression analysis of the effect of treatments on unconditional contributions.[14] Consistent with our predictions, specifications (1 - 4) all reveal negative main effects for the cash and token treatments. However, statistical significance depends on the specification: the main effects are not statistically significant for specification (1) (p's > .1); in specification (2) the token treatment approaches significance (p < .1), but the cash treatment does not (p > .1); and in specifications (3) and (4) the cash treatment is significant (p's < .05), but the token treatment not (p's > .1).[15] The general tendency is that the treatments, which render the endowment more tangible, reduce cooperation. These results are consistent with Reinstein & Riener (2011), who found that a more tangible representation of endowments reduced giving in games of charitable giving.

The interaction terms in specifications (1) and (2) provide evidence for Prediction 1. In the cash treatment, specifications (1) and (2) both yield a positive association between the Rosenbaum and contributions, the former significant and the latter approaching significance . Similarly, in the token treatment, specifications (1) and (2) both yield a positive association between the Rosenbaum and contributions (p's < .1), both approaching significance. In contrast, the standard treatment in both specifications yields a negative and non-significant association between Rosenbaum and contributions (p's > .1). Moreover, in testing—directionally—whether the association between the Rosenbaum and contributions in the cash treatment is greater than that in the standard treatment, we obtain significance with specification (1) ($\chi^2(1)= 3.48$, $p < .05$) and near-significance with (2) ($\chi^2(1)= 1.68$, $p < .1$).[16]

We summarize our findings in Result 1, according to Prediction 1:

RESULT 1: *In the treatment that renders money 'tangible,' there is a positive association between levels of trait self-control and cooperation; there is no discernable association in the standard treatment, where money is represented abstractly.*

We plot in Figure 2 the estimated contributions from specification (2) as a function of the Rosenbaum, and broken down by treatments. In line with our predictions, illustrated in

[14] We use a negative binomial regression model, as our data is overdipersed; variance of the raw data is much larger than the mean. This violates the assumption of equal variance. This is confirmed by a Likelihood-ratio test, which clearly rejects the null hypothesis that Poisson is the appropriate specification.
[15] Tests are non-directional, unless indicated otherwise.
[16] Corresponding tests for the token treatment against the standard treatment are significant and near-significant at the .05 and .1 levels, respectively.

Figure 1, we observe that the lines for the cash and standard treatments converge with higher levels of the Rosenbaum.

Insert Figure 2 about here

Turning to Prediction 2, the interaction terms in specifications (3) and (4) provide evidence for Prediction 2. In the cash treatment, specifications (3) and (4) both yield a negative association between Impulsivity and contributions (p's < .05). Similarly, in the token treatment, specifications (3) and (4) both yield a negative association between Impulsivity and contributions, approaching statistical significance (p's < .1). In contrast, the standard treatment in both specifications yields a positive and non-significant association between Impulsivity and contributions (p's > .1). Moreover, in testing—directionally—whether the association between Impulsivity and contributions in the cash treatment is more negative than that in the standard treatment, we obtain significance with both specifications (1) ($\chi^2(1)= 4.53$, $p < .05$) and (2) ($\chi^2(1)= 3.65$, $p < .05$).[17] We summarize our findings in Result 2, according to Prediction 2:

RESULT 2: *In the treatment that renders money more 'tangible,' there is a negative association between levels of impulsivity and cooperation; there is no discernable association in the standard treatment, where money is represented more abstractly.*

We plot in Figure 3 the estimated contributions from specification (4) as a function of Impulsivity, and broken down by treatments. Consistent with our predictions, illustrated in Figure 1, we observe that the lines for the cash and standard treatments diverge with higher levels of Impulsivity.

6. Discussion

This paper has examined the hypothesis that cooperation is more tightly associated with self-control when an individual's endowment is tangible rather than represented more abstractly. The intuition behind this hypothesis is that a tangible representation of the endowment more likely stokes the temptation of greed, against which self-control would be

[17] Corresponding tests for the token treatment against the standard treatment are non-significant (p's > .1).

exerted for the common good. Consistent with our hypothesis, we find in a public good game that individuals' trait self-control is positively correlated with contributions to the public good when the endowment is represented physically, in coins, but not when represented abstractly, on the computer screen. Moreover, and in line with this result, individuals' trait impulsivity is negatively correlated contributions when the endowment is represented in coins, but not when represented on the computer screen.

Our results add to an ongoing line of research that explores how individuals in social interaction act on the basis of ostensibly conflicting preferences. It follows Martinsson *et al.* (2012) in exploring the idea that the question of pro-social versus selfish behavior in general may represent one of self-control. And it follows Kocher *et al.* (2012) and Martinsson *et al.* (2010) in extending this conceptual framework to the social dilemma. The primary contribution of this paper is in testing experimentally new predictions from this framework.

Whereas earlier papers have in common that they either experimentally influenced or measured perception of self-control conflict, this paper has focused on experimental variations of temptation. And it has done so by influencing the tangibility of the endowment in the public good game. As such, it tests hitherto unexplored predictions that follow from the prior conceptual framework. Moreover, while capturing self-control with the Rosenbaum (1980a) scale—like the aforementioned papers—, this paper, unlike the others, also provides converging evidence with a measure of impulsivity (GSOEP, Wagner *et al.*, 2007).

Conceptually speaking, our results are consistent with many other findings in the literature, most notably that contributions to the public good are negatively associated with discount rates (Curry *et al.*, 2008; Fehr & Leibbrandt, 2011). However, our results challenge the hypothesis recently advanced by Rand *et al.* (2012), in their Nature article, entitled "Spontaneous giving and calculated greed,"—that "our first impulse is to cooperate." Specifically, Rand *et al.* (2012) argue that cooperation represents the "default" behavioral response in social dilemmas—the option chosen in the absence of cognitive resources required for conscious ("System 2") processing. They find support for their hypothesis with a series of public good games in which lower reaction times are associated with higher levels of cooperation.[18] It is hard to reconcile the cash treatment effect—and its moderation by both self-control and impulsivity measures—with a story that posits cooperation as the generally spontaneous mode of behavior.

[18] Kocher *et al.* (2012), using a similar setup with German students in a German lab, fail to detect a statistically significant association between decision times and cooperation.

This paper has relied on the strategy of influencing the degree to which the endowment—the source of temptation—is tangible versus abstract. As such, it has rendered individuals' aptitude at self-control more or less relevant to the decision context. Future work might consider pairing this manipulation with a manipulation of the degree to which the object of altruism is tangible or abstract. In our context, the object of altruism—the common good—is highly abstract; a more tangible representation, such as an image of the beneficiaries, might flip the psychological experience of the decision problem. It is quite possible that the tangible object of altruism would stoke feelings of empathy (e. g., Small & Loewenstein, 2003; Kogut & Ritov, 2005). The self-control conflict may then stand between the temptation to act in the interest of others against the better judgment to act selfishly.

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Figures and Tables

Figure 1. Prediction illustration

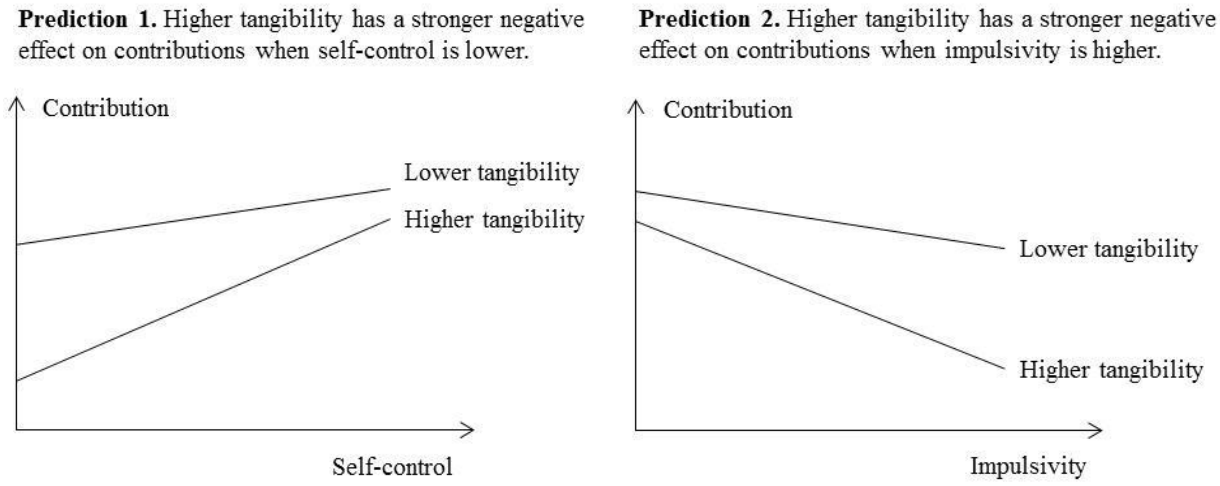
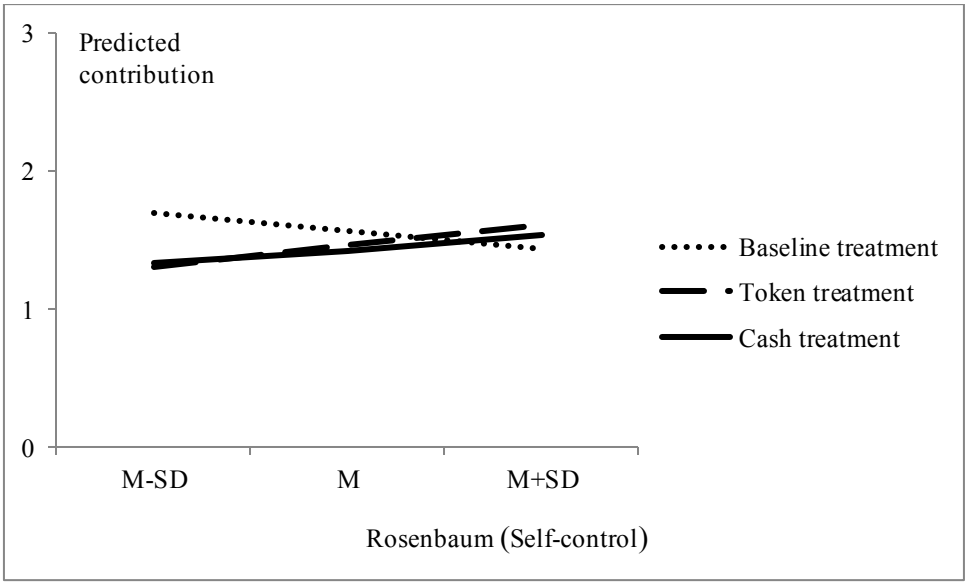


Figure 2. Self-control estimation illustration



Note: Predicted values are based on model 2 in Table 2. The effect of male and age are evaluated at their means (Male = 0.66, Age = 23.27). The predicted value of the constant in the model therefore becomes 0.963 – 0.187(0.66) + 0.036(23.27) = 1.677. We use values of the Rosenbaum score equal to the sample mean (*M* = 18.46), the mean minus one standard deviation (*M-SD* = 18.46-21.70 = -3.24), and the mean plus one standard deviation (*M+SD* = 18.46+21.70 = 40.16).

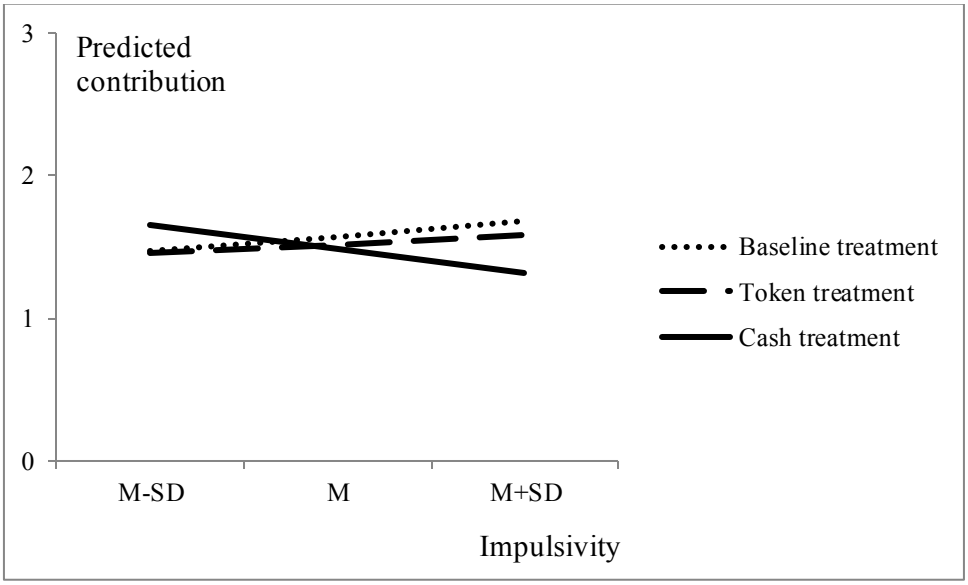
The predicted value equations by treatment therefore become:

Baseline treatment: $c_i = 1.677 - 0.006 Rosenbaum$

Token treatment: $c_i = (1.677 - 0.344) + (0.013\text{-}0.006) Rosenbaum$

Cash treatment: $c_i = (1.677 - 0.258) + (0.011\text{-}0.006) Rosenbaum$

Figure 3. Impulsivity estimation illustration



Note: Predicted values are based on model 4 in Table 2. The effect of male and age are evaluated at their means (Male = 0.66, Age = 23.27). The predicted value of the constant in the model therefore becomes 0.788 – 0.196(0.66) + 0.030(23.27) = 1.357. We use values of the Impulsivity score equal to the sample mean (M = 4.63), the mean minus one standard deviation (M-SD = 4.63-2.23 = 2.40), and the mean plus one standard deviation (M+SD = 4.63+2.23 = 6.86).

The predicted value equations by treatment therefore become:

Baseline treatment: $c_i = 1.357 + 0.047Impulsivity$

Token treatment: $c_i = (1.357 + 0.044) + (0.047-0.021)Impulsivity$

Cash treatment: $c_i = (1.357 + 0.477) + (0.047-0.123)Impulsivity$

Table 1. Summary statistics

Variable	n	M	SD	Min	Max
Unconditional contribution	180	4.69	3.27	0	10
Conditional contribution*	1980	3.05	3.41	0	10
Baseline treatment	180	0.33	0.47	0	1
Token treatment	180	0.33	0.47	0	1
Cash treatment	180	0.33	0.47	0	1
Rosenbaum	180	18.46	21.69	-41	76
Impulsivity	180	4.37	2.23	0	9
Male	180	0.66	0.47	0	1
Age	180	23.27	4.08	16	52

Note: * = variable created using the strategy vector method.

Table 2. Negative binomial regression results

Model	(1)	(2)	(3)	(4)
Dep. Var.	Contrib.	Contrib.	Contrib.	Contrib.
Token treatment	-0.281	-0.344*	0.115	0.044
	(1.53)	(1.83)	(0.33)	(0.12)
Cash treatment	-0.255	-0.258	0.651**	0.477
	(1.46)	(1.52)	(2.05)	(1.44)
Rosenbaum	-0.007	-0.006		
	(1.35)	(1.11)		
Rosenbaum × token treatment	0.013*	0.013*		
	(1.88)	(1.90)		
Rosenbaum × cash treatment	0.014**	0.011*		
	(2.08)	(1.65)		
Impulsivity			0.065	0.047
			(1.40)	(0.96)
Impulsivity × token treatment			-0.025	-0.021
			(0.40)	(0.33)
Impulsivity × cash treatment			-0.150**	-0.123**
			(2.45)	(1.97)
Male		-0.187*		-0.196*
		(1.76)		(1.87)
Age		0.036**		0.030**
		(2.38)		(2.10)
Constant	1.686***	0.963***	1.234***	0.788*
	(14.57)	(2.64)	(4.48)	(1.88)
Lnalpha	-0.880***	-0.965***	-0.891***	-0.960***
	(3.87)	(4.09)	(3.74)	(3.93)
n	180	180	180	180
Pseudo R^2	0.006	0.014	0.007	0.013

Note: absolute value of *t* statistics in parentheses; robust standard errors; * = $p < 0.1$, ** = $p < 0.05$, *** = $p < 0.01$.

Appendix A: Proof of Prediction 1.

Recall the agent's utility function:

$$U_i = e_i - c_i + m \cdot \sum_1^n \frac{c_j}{n} - \frac{\left(t(1-m)c_i\right)^2}{2\omega_i} + \alpha_i c_i$$

Maximization with respect to c_i yields the first order condition

$$-1 + \frac{m}{n} - \frac{\left(t(1-m)\right)^2 c_i}{\omega_i} + \alpha_i = 0$$

And hence optimal contribution c_i^* is given by

$$c_i^* = \frac{\omega_i}{t^2} \frac{\left(\alpha_i - 1 + \frac{m}{n}\right)}{(1-m)^2},$$

which can be written as

$$c_i^* = \omega_i \left(\alpha_i - 1 + \frac{m}{n}\right) t^{-2} (1-m)^{-2}$$

The derivative $\frac{\partial c_i^*}{\partial t}$ is then

$$\frac{\partial c_i^*}{\partial t} = -2\omega_i \left(\alpha_i - 1 + \frac{m}{n}\right) t^{-3} (1-m)^{-2}$$

This is negative if $\alpha_i + \frac{m}{n} > 1$. That is, the marginal benefit of contributing is larger than the marginal cost of contributing. Furthermore, the derivative

$$\frac{\partial c_i^{*2}}{\partial t \partial \omega_i} = -2\left(\alpha_i - 1 + \frac{m}{n}\right) t^{-3} (1-m)^{-2}$$

is negative if $\alpha_i + \frac{m}{n} > 1$. That is, if the marginal benefit of contributing is larger than the marginal cost of contributing. This demonstrates that the negative effect of increasing tangibility on optimal contributions is reduced as willpower increases. This proves the prediction.

Appendix B: Instructions for the public goods game*

1. Baseline Treatment

Instructions

Thank you for participating in the experiment. Please read the instructions carefully, as your payoff will depend on your decisions made in the experiment.
Please note that the instructions are your instructions; please do not communicate with other participants. If you have questions, please talk directly to the experimenter. If you do not adhere to this rule, you will have to be excluded from the experiment.
Your payoff in this experiment will be denoted in points. The exchange rate is:

1 Point = 1 Euro

The Decision Situation

Before you learn the full procedures of the experiment, we would like you to explain the decision situation that you are facing. At the end of the explanation you will have opportunity to answer some control questions to improve your understanding of the situation.
You will be member of a group of 4 people. Each member of this group is asked to divide 10 Tokens. You can pay these Tokens either into a private or into a public account.

Your Income from the private account

For each token in the private account you will earn exactly one point. Nobody else receives anything from your private account.

Your Income from the public account

For each token in the public account each group member will receive the same share. Each group member receives the following payoff from the public account

Income from the public account = Sum of all contributions into the public account X 0.4.

If for example all members invest 10 tokens each in the public account, then you and the other group members receive 40 X 0.4 =16 points from the public account.

Total Income

Your total income is the sum of the points from the private and the public account

Total Income = Income from private account + Income from Public account

The Experiment

In the experiment you will face the aforementioned decision situation. You will do this experiment only once. You have ten tokes at your disposal. In this experiment you have to make two types of decisions: we will call them *conditional* and *unconditional* decisions.

* Translated from German

- For the unconditional contribution, you just have to decide how much you would like to invest in the public project

- For the conditional contribution, you have to decide how much you would like to invest in the public project, given the average contribution of the other subjects (rounded to the next higher integer)

After all participants have made their decisions, a random process determines one member for each group, for whom the conditional contribution is relevant. For the other group members, only the unconditional contribution is relevant. When you make your decision, you do not know whether you will be chosen; you must therefore think about both of your decisions.

The random choice of one member will be determined as follows: Each group member receives a number between 1 and 4. One player will roll a 4 sided die. The number will then be entered into the computer. If the number drawn corresponds to you number within the group, then your conditional decision is relevant for your payoff. Otherwise, your unconditional decision is relevant.

2. Changes in the Instructions for the Token and Cash Treatments

In experimental instructions we added:

"Please open the envelope in front of you and take out the tokens (money) and two additional envelopes. Please put your unconditional contribution in the envelope labeled PUBLIC and the rest in the PRIVATE envelope. Please put the envelopes in the box at the entrance when leaving the lab."

Appendix C: The Rosenbaum Self-Control Schedule

Note: * = item is reverse scored. This is the original English version. The study used a German translation.

Directions - Indicate how characteristic or descriptive each of the following statements is of you by using the code given below

+3 very characteristic of me, extremely descriptive
+2 rather characteristic of me, quite descriptive
+1 somewhat characteristic of me, slightly descriptive
-1 somewhat uncharacteristic of me, slightly undescriptive
-2 rather uncharacteristic of me, quite undescriptive
-3 very uncharacteristic of me, extremely nondescriptive

l. When I do a boring job, I think about the less boring parts of the job and the reward that I will receive once I am finished.

-3	-2	-1	1	2	3

2. When I have to do something that is anxiety arousing for me, I try to visualize how I will overcome my anxieties while doing it.

-3	-2	-1	1	2	3

3. Often by changing my way of thinking I am able to change my feelings about almost everything.

-3	-2	-1	1	2	3

4. I often find it difficult to overcome my feelings of nervousness and tension without any outside help.*

-3	-2	-1	1	2	3

5. When I am feeling depressed I try to think about pleasant events.

-3	-2	-1	1	2	3

6. I cannot avoid thinking about mistakes I have made in the past.*

-3	-2	-1	1	2	3

7. When I am faced with a difficult problem, I try to approach its solution in a systematic way.

-3	-2	-1	1	2	3

8. I usually do my duties quicker when somebody is pressuring me.*

-3	-2	-1	1	2	3

9. When I am faced with a difficult decision, I prefer to postpone making a decision even if all the facts are at my disposal.*

-3	-2	-1	1	2	3

10. When I find that I have difficulties in concentrating on my reading, I look for ways to increase my concentration.

-3	-2	-1	1	2	3

11. When I plan to work, I remove all the things that are not relevant to my work.

-3	-2	-1	1	2	3

12. When I try to get rid of a bad habit, I first try to find out all the factors that maintain this habit.

-3	-2	-1	1	2	3

13. When an unpleasant thought is bothering me, I try to think about something pleasant.

-3	-2	-1	1	2	3

14. If I would smoke two packages of cigarettes a day, I probably would need outside help to stop smoking.*

-3	-2	-1	1	2	3

15. When I am in a low mood, I try to act cheerful so my mood will change.

-3	-2	-1	1	2	3

16. If I had the pills with me, I would take a tranquilizer whenever I felt tense and nervous.*

-3	-2	-1	1	2	3

17. When I am depressed, I try to keep myself busy with things that I like.

-3	-2	-1	1	2	3

18. I tend to postpone unpleasant duties even if I could perform them immediately.*

-3	-2	-1	1	2	3

19. I need outside help to get rid of some of my bad habits.*

-3	-2	-1	1	2	3

20. When I find it difficult to settle down and do a certain job, I look for ways to help me settle down.

-3	-2	-1	1	2	3

21. Although it makes me feel bad, I cannot avoid thinking about all kinds of possible catastrophes in the future.*

-3	-2	-1	1	2	3

22. First of all I prefer to finish a job that I have to do and then start doing the things I really like.

-3	-2	-1	1	2	3

23. When I feel pain in a certain part of my body, I try not to think about it.

-3	-2	-1	1	2	3

24. My self-esteem increases once I am able to overcome a bad habit.

-3	-2	-1	1	2	3

25. In order to overcome bad feelings that accompany failure, I often tell myself that it is not so catastrophic and that I can do something about it.

-3	-2	-1	1	2	3

26. When I feel that I am too impulsive, I tell myself "stop and think before you do anything."

-3	-2	-1	1	2	3

27. Even when I am terribly angry at somebody, I consider my actions very carefully.

-3	-2	-1	1	2	3

28. Facing the need to make a decision, I usually find out all the possible alternatives instead of deciding quickly and spontaneously.

-3	-2	-1	1	2	3

29. Usually I do first the things I really like to do even if there are more urgent things to do.*

-3	-2	-1	1	2	3

30. When I realize that I cannot help but be late for an important meeting, I tell myself to keep calm.

-3	-2	-1	1	2	3

31. When I feel pain in my body, I try to divert my thoughts from it.

-3	-2	-1	1	2	3

32. I usually plan my work when faced with a number of things to do.

-3	-2	-1	1	2	3

33. When I am short of money, I decide to record all my expenses in order to plan more carefully for the future.

-3	-2	-1	1	2	3

34. If I find it difficult to concentrate on a certain job, I divide the job into smaller segments.

-3	-2	-1	1	2	3

35. Quite often I cannot overcome unpleasant thoughts that bother me.*

-3	-2	-1	1	2	3

36. Once I am hungry and unable to eat, I try to divert my thoughts away from my stomach or try to imagine that I am satisfied.

-3	-2	-1	1	2	3

Appendix D: Conditional contributions

Table 3. Fractions of contributor type by treatment.

Contributor type	Baseline treatment		Token treatment		Cash treatment	
Conditional cooperator	38%	(0.49)	47%	(0.50)	42%	(0.50)
Freerider	25%	(0.44)	22%	(0.40)	20%	(0.42)
Humpshape contributor	8%	(0.28)	7%	(0.36)	15%	(0.25)
Others	28%	(0.45)	25%	(0.43)	23%	(0.44)

Note: Standard errors in parentheses.

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