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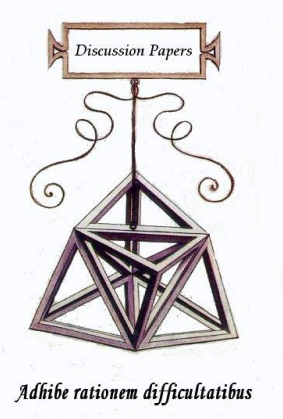

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Private vs Public incentives: an experiment on motivation crowding and social trust

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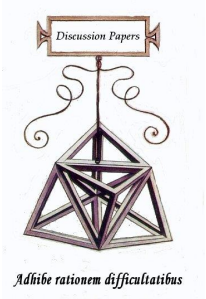


D'Alessandro S. Giannetti C. Guarnieri P.

Private vs Public incentives: an experiment on motivation crowding and social trust

Abstract

Relying on a threshold public good game, we experimentally investigate the effect of two types of incentives on prosocial behaviours. On the one hand, a private type of incentive targets individuals by reducing their cost of contribution. On the other hand, a public type of incentive targets groups by providing an investment that directly support the achievement of the collective objective (i.e. the threshold in the public good game). Thus, we study how expectations on others determine the impact of incentives on prosocial behaviours and how incentives themselves affect these expectations in turn. We interpret this mutual relation as reflecting an endogenous relation between incentive provision and social trust.

Keywords: Motivation crowding, Social Norms, Incentives

JEL: C92, D04

1 Introduction

Experimental and behavioural economics has provided significant evidence of both motivation crowding in and out of several kind of pro-social motivations (Andreoni, 1993; Frey, 1994; Frey and Jegen, 2001). Explanations of such effects has mainly focused on psychological factors, internal to decision-making process (Bowles and Polania-Reyes, 2012; Gneezy et al., 2011; Fehr and Falk, 2002). The literature has highlighted that the effect of an incentive may depend on the circumstance that it sometimes uncover information concerning the agent providing it (Benabou and Tirole, 2003; Fehr and Rockenbach, 2003). Moreover, it has been shown that the incentive may point out the normative appropriate behaviour, reinforcing it (Barr et al., 2009; Henrich et al., 2010). However, an incentive may also cause a reaction of resistance by the agents subject to it, so causing crowding out (Falk and Kosfeld, 2006; Gneezy and Rustichini, 2000). Relatively less theoretical effort has been paid to endogenize these psychological mechanisms and place them in the contexts in which incentive provision takes place.

Our starting point is the observation that incentives are endogenous with respect to the diffusion of social trust (Glaeser et al., 2000; Berg et al., 1995) in the contexts in which they are implemented. On the one hand, pre-existing social trust may affect the effect of incentives on prosocial motivations. On the other hand, incentive provision may affect the social trust by changing the expectations on others pro-social behaviour. We contribute to motivation crowding literature by studying a) how individuals' social trust influence the impact of incentives on prosociality; b) how different types of incentives provision may change social trust, so that the impact of the incentives on pro-sociality is in turn further affected. In this way, we connect motivation crowding theory with the streams of research that interpret pro-social behaviors and commitment to norms and institutions by focusing on expectations (Aoki, 2007; Bicchieri, 2005, 2016). If expectations are among the factors explaining pro-osociality and normativity, it seems then crucial to investigate to what extent incentives may affect individual expectations on the behaviors of others, and thus, in turn, on their own behaviour.

To this purpose, we implement a threshold public good game (TPG) in which decision makers are asked to choose whether to invest a part of their endowment in order to reach a defined overall contribution threshold (Spiller and Bolle, 2017; Marks and Croson, 1998; Andreoni and Gee, 2015). If the threshold is reached or overcome everyone obtain a reward; if not, those who has contributed looses the investment. Hence, we compare two types of incentives, an *individual-oriented* type of incentive, that we name *private incentive* and a *collective-oriented* type of incentive, that we name *public incentive*. The former type targets individuals by reducing the cost of individual contribution and thus allocating extra-payoffs to them. The latter type targets groups and consists in a public investment that supports the achievement of a collective goal.

We measure individual social trust in terms of the expectation concerning others contribution to the achievement of the collective goal, i.e. the belief concerning how many

individuals are going to contribute to the public good. Thus, we investigate two effects connected to the two different modes of incentive provision: a *direct effect* consisting in the change of prosocial performances of incentivized individuals, given their initial expectation on others' contribution; an *indirect effect* due to the change in expectation caused by the incentives, which may lead either to a reinforcement or a weakening of the direct effect (Imai et al. 2010a,b).

The comparison between the direct and indirect effect may reveal significant policy implications. Indeed, it allows for an analysis of the the mutual effect of social trust and incentives that appears relevant in the case policies – such as those connected to environmental issues – whose success crucially depends on the capability to convey a sense of collective endeavour. In this regard, different types of incentives may interact more or less effectively with the pro-social predispositions available in the social context where the policy is applied. And, under this perspective, policies themselves may be considered as responsible for creating the conditions that are necessary for their own success.

2 The design

Our TPG is played by 6 participants for two periods. The threshold is fixed at 4 euro of overall contributions. In each period each participant is endowed with 5 Euro. In the first period, we run the baseline game (BASE) where participants have to decide whether to contribute with 1 euro to the public good. Thus, if the total amount of contribution reaches 4 euro or more, everyone (including non-contributors) are rewarded with 3 euro each.

The treatments differ with respect to the incentive scheme provided in the second period after the aforementioned round of the BASE game. The two types of incentives are implemented as follows:

Private incentive (PRIV): the experimenter pays back 0,5 euros to each contributors, so their cost of contribution is reduced and the payoffs connected to the contribution are increased with respect to BASE;

Public incentive (PUB) the experimenter directly invests 2 euro in the public good, so that the individual cost of contribution remains constant, but the threshold to get the reward decreases with respect to BASE.

Thus, in the private policy treatment (PRIV) participants play the BASE game and then the private incentive game. In the public policy treatment (PUB) participants play the BASE game and then the public incentive game.

To study whether order effects depending on the time of the introduction of the incentive are at stake, we also conduct sessions where the private (PRIV-INV) and the public (PUB-INV) incentives have been provided in the first period instead of in the second one. Therefore, in PRIV-INV and in PUB-INV individuals play the TPG with the respective incentive in the first period, and then, in the second period, they play the BASE. The structure of

Table 1: SUMMARY OF TREATMENTS AND OF GAMES FEATURES

TREATMENT	1ST PERIOD (BASE)		2ND PERIOD		
	NO INCENTIVES		INCENTIVE		
	COST	# CONTRIBUTORS		COST	# CONTRIBUTORS
PRIV	1 Euro	4	0.5 euro payed back to contributors	0.5 euro	4
PUB	1Euro	4	2 euro added to overall contributons	1 euro	2

TREATMENT	1ST PERIOD			2ND PERIOD (BASE)	
	INCENTIVE			NO INCENTIVES	
		COST	# CONTRIBUTORS	COST	# CONTRIBUTORS
PRIV-INV	0.5 euro payed back to contributors	0.5 euro	4	1 Euro	4
PUB-INV	2 euro added to overall contributons	1 euro	2	1Euro	4

each treatment, both standard and inverted, and the features of each game are summarized in Table (2).

We elicit participants beliefs at the end of each period of the TPG, both in the standard and in the inverted treatments, in order to size the indirect effects of incentives and compare it to the direct one. In particular, we pay 2 Euro to each partecipant who exactly guesses the number of contributors in her own group.[1] This allows us to measure the probability p that each participant assigns to others contribution. Hence, we compare p before and after the incentive provision to measure the effect of the incentive on beliefs. A questionnaire focused on social trust and on pro-social orientations concludes the experiment and provided us relevant control variables.

Finally, in some sessions we also run trial sessions where individuals played a repeated baseline TPG for 4 periods with the same group of participants and with feedbacks. The choices of these periods were not paid and, after a rematching, individuals play the standard PRIV and PUB treatments. The aim of these trial session (PRIV-REAP and PRIV-REAP) is to test whether individuals' beliefs change after having gained more experience in the game.

The experiment took place on June 2018 at the Laboratory of Experimental Economics of the University of Pisa. We run 12 sessions overall, including 2 PRIV treatments and 2 PUB treatments, 2 PRIV-INV and 2 PUB-INV, and 2 PRIV-REAP and 2 PUB-REAP. However, since we do not find any significant difference between the results of PRIV-REAP and PRIV and between the results of PUB-REAP and PUB, we aggregate them.

[1] In particular, we asked "Out of 6 participants in your group, how many do you think contributed in this period?"

3 Theoretical prediction

In this section we describe, by making reference to the standard treatments, i.e. PRIV and PUB, how the probability that the decision maker assigns to others' contribution , i.e. p, affects contribution choice under the different types of incentives in our treatments. In particular, Figure (1) compares expected payoffs of contributing (C) and non-contributing (NC) in PRIV. The black and the blu line represent the level of expected payoffs when contributing and not contributing in the first period, i.e. in the BASE TPG. As in the standard public-good game, the individual has (almost) no incentive to contribute in BASE; there is a marginal interval of p in which the expected payoffs connected to contribution are higher than the expected payoffs connected to non-contribution and the decision maker is willing to contribute. Instead, the red line represents the expected payoffs connected to contribution after the introduction of the private incentive, while the expected payoffs connected to non-contribution remains the same as in BASE (the black line). Independently on p, we thus observe that payoffs connected to contribution are higher in with the private incentive than in the BASE game. Moreover, we observe that under the private incentive a larger interval of p - approximately ranging from 0.3 to 0.8 - in which the expected payoffs connected to contribution are higher than the expected payoffs connected to non-contribution, and the individual prefers to contribute.

Figure 1: BASELINE VS PRIVATE INCENTIVE

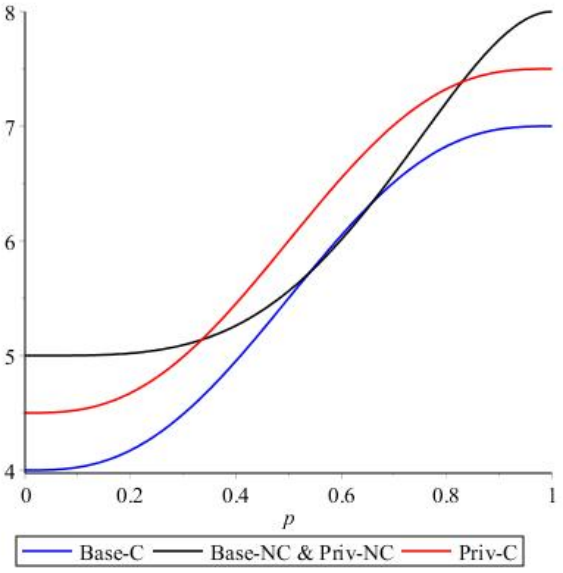
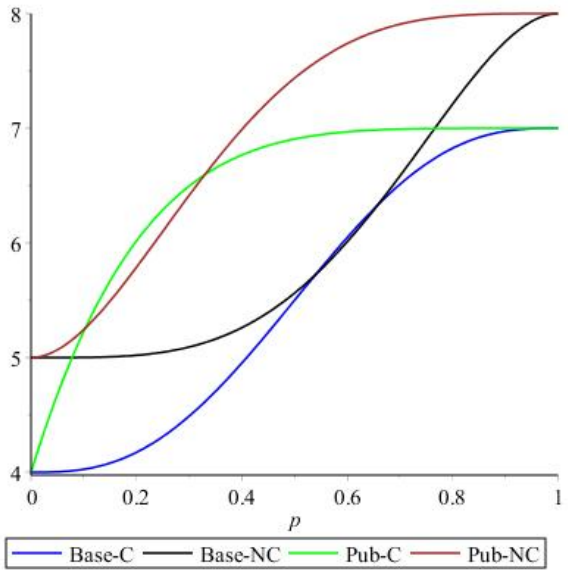


Figure (2) compares expected payoffs of contributing (C) and non-contributing (NC) in the PUB. Once again, the black and the blu line represent the level of expected payoffs when contributing and not contributing in the first period, i.e. the BASE TPG. The red and green line represent respectively the level of expected payoffs of contributing and not contributing once the public incentive is introduced. We notice that, independently on p, the expected payoffs connected to contribution, as well as the expected payoffs connected to non-contribution, are higher with the public incentive than in the baseline game. There-

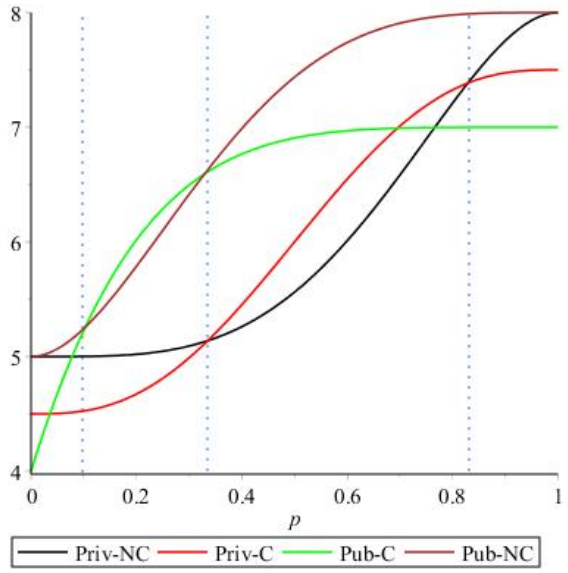
fore, in PUB the incentive also incentivizes non-contribution. Moreover, under the public incentive there is an interval of p – approximately ranging from 0.1 to 0.3. - in which the expected payoffs connected to contribution are higher than the expected payoffs connected to non-contribution and the individual prefers to contribute.

Figure 2: BASELINE VS PUBLIC INCENTIVE



Finally, Figure (3) compares expected payoffs of contributing (C) and non-contributing (NC) after the introduction of the incentive in PRIV and in the PUB. We observe that in PRIV there is a larger interval of p in which the individual prefers to contribute (i.e. $0.3 < p < 0.8$) compared to PUB, where the interval of p in which the individual prefer to contribute is smaller (i.e. $p<0.3$). At a very high level of p, no rational individual would contribute.

Figure 3: PRIVATE INCENTIVE VS PUBLIC INCENTIVE



On the ground of this analysis, we can formulate the following theoretical prediction that we experimentally test to measure the direct effect of incentives.

1. **Hypothesis.1** *The introduction of both the private incentive and the public incentive in the second period increases the level of overall contribution w.r.t to the first period, i.e. BASE.*

On average overall contributions after the incentive provision should be higher in PRIV than in PUB. However, since the two incentives have a positive impact at different levels of p, we better qualify the previous hypothesis by observing that :

1. ***Hypothesis.1A*** *At high level of p, the private incentive crowds-in prosocial behaviours, while the public crowds-out – i.e. we expect higher contributions in the second period of PRIV w.r.t PUB ;*

2. ***Hypothesis.1B*** *At very low level of p, the public incentive crowds-in prosocial behaviours, while the private incentive crowds-out – i.e. we expect higher contributions in the second period of PUB* t *w.r.t. PRIV.*

In other words, the introduction of private incentives will promote contribution in those situations in which public incentives crowd it out, i.e. when the expectation about others' contributions are high. On the contrary, public incentives will promote contribution when the expectation about others' contribution is extremely low, and private incentives crowd out pro-social behaviour.

Concerning the indirect effect, our theoretical analysis does not sustain any straightforward prediction. It may be the case that the sign of the change in p due to the introduction of the incentive depends on the initial level of p, so that under certain circumstances the indirect effect might oppose the direct effect and in others reinforce it. We thus formulate the following *behavioral* hypotheses:

1. ***Hypothesis 2:*** *The introduction of the incentive in PRIV might increase p, given the lower contribution cost, while the introduction of PUB might decrease p, given the higher probability to reach the threshold.*

2. ***Hypothesis 3.*** *The introduction of private or public incentives might affect the perception of an underlying social norm (Krupka and Weber, 2013).*

As far as the effects of incentive provisions in the inverted treatments are concerned, our theoretical model predicts that the removal of the policy should in principle produce a change in contribution and beliefs similar in magnitude but in the opposite direction with respect to the standard treatments (in which the policies are introduced in the second period). Accordingly, the removal of the public incentive in PUB-INV should increase both contribution and believes, while the removal of the private incentive in PRIV-INV should decrease them. However, this prediction does not take into account the possibility that differences in the framing of the decision may actually produce the order effect that we are indeed testing with the inverted treatments.

4 Results

Table (2) illustrates the differences between treatments in contributions and beliefs. The same results are graphically represented in the bar charts in Figure (4). As one might expect, there are no significant differences in contribution across the BASE periods, i.e. the first ones in PRIV and PUB and the second one PRIV-INV e PUB-INV. This result signals that our sample homogeneously responds to the baseline TPG. The same result can be observed by taking into consideration beliefs in the BASE periods, where the overall difference is not statistically significant across treatments.

When looking at contribution in periods in which incentives are provided, i.e. the second period in PUB and PRIV and the first period in PUB-INV and PRIV-INV - the first thing to notice is that the differences in the effects of the two policies are always significant. In particular, contribution after the incentive is significantly higher (0.312) in PRIV than in PUB (p-value=0.000) and weakly higher (-0.142) in PUB-INV than in PRIV-INV (p-value=0.064). However, the overall contribution - obtained by jointly considering both the differences of standard and inverted treatments - is higher when the private incentive is provided instead of the public incentive (0.139, p-value=0.028). When looking at beliefs in periods when the policies are implemented, we observe a significantly higher expectations in PRIV than in PUB (1.667, p-value=0.000), awith an aggregate difference (overall) being significantly higher on average (1.000 difference, p-value=0.000).

Table (3) shows the differences within treatments in contribution and beliefs (see also Figure 4). By comparing the first and the second period we can measure the direct effect of our incentives. In line with hypotheses 1A, we observe that contribution tends to decrease when the public incentive is introduced in the second period (-0.208, p-value=0.019), while they are higher in the first period in PUB-INV in comparsion with the second period in which the policy is removed, although the difference (0.133) is only weakly significant (p-value=0.067). The overall effect of public incentives, however, is not significantly different from zero. On the contrary, the effect of private incentives is - as expected – always positive (both in standard and inverted treatments), although never significant. Moreover, the change in beliefs due to the introduction of the public incentive is negative and significant in the standard treatment (-1.020, p-value=0.000) and when looking at the overall difference between beliefs in the periods without and without the public policy (-0.679, p-value=0.000). The impact of the private policy on beliefs is only weakly significant (0.347, p-value=0.053) when looking at the overall difference, but it shows the expected positive sign.

Another interesting result concerns the hypothesis that the two incentives may impact the effect of an underlying social norm sustaining contribution (Hp.3). A possible indicator

Table 2: CONTRIBUTION & BELIEFS: DIFFERENCES BETWEEN TREATMENTS

CONTRIBUTION					
TREATMENT	PERIOD	OBS	MEAN	DIFF .	*p-value*
PRIV (Base)	1	48	0.792	0.083	0.176
PUB (Base)	1	48	0.708		
PRIV-INV (Base)	2	24	0.667	-0.133	0.137
PUB-INV (Base)	2	30	0.800		
Overall (Base)				0.006	0.464
PRIV	2	48	0.813	0.312	0.000
PUB	2	48	0.500		
PRIV-INV	1	24	0.791	-0.142	0.064
PUB-INV	1	30	0.933		
Overall				0.139	0.028
BELIEFS					
PRIV (Base)	1	48	4.854	0.437	0.017
PUB (Base)	1	48	4.412		
PRIV-INV (Base)	2	24	3.833	-0.900	0.011
PUB-INV (Base)	2	30	4.733		
Overall (Base)				-0.024	0.450
PRIV	2	48	5.063	1.667	0.000
PUB	2	48	3.3963		
PRIV-INV	1	24	4.458	-0.142	0.353
PUB-INV	1	30	4.600		
Overall				1.000	0.000

Table 3: CONTRIBUTION & BELIEFS: DIFFERENCES WITHIN TREATMENTS

CONTRIBUTION					
TREATMENT	PERIOD	OBS	MEAN	DIFF .	*p-value*
PUB (Base)	1	48	0.708	-0.208	0.019
PUB	2	48	0.500		
PUB-INV (Base)	2	30	0.800	0.133	0.067
PUB-INV	1	30	0.933		
Overall Public				-0.078	0.148
PRIV (Base)	1	48	0.792	0.021	0.400
PRIV	2	48	0.813		
PRIV-INV (Base)	2	24	0.667	0.125	0.170
PRIV-INV	1	24	0.792		
Overall Private			0.056		0.210
BELIEFS					
PUB (Base)	1	48	4.417	-1.020	0.000
PUB	2	48	3.396		
PUB-INV (Base)	2	30	4.733	-0.133	0.330
PUB-INV	1	30	4.600		
Overall Public				-0.679	0.000
PRIV (Base)	1	48	4.854	0.208	0.153
PRIV	2	48	5.063		
PRIV-INV (Base)	2	24	3.383	0.625	0.091
PRIV-INV	1	24	4.458		
Overall Private				0.347	0.053

Table 4: NORM FOLLOWERS & IRRATIONAL: DIFFERENCES BETWEEN TREATMENTS

NORM FOLLOWERS					
TREATMENT	PERIOD	OBS	MEAN	DIFF .	*p-value*
PRIV (Base)	1	48	0.604	0.145	0.078
PUB (Base)	1	48	0.458		
PRIV-INV (Base)	2	24	0.208	-0.426	0.001
PUB-INV (Base)	2	30	0.600		
Overall (Base)				-0.041	0.311
PRIV	2	48	0.646	0.500	0.000
PUB	2	48	0.146		
PRIV-INV	1	24	0.625	0.125	0.184
PUB-INV	1	24	0.500		
Overall				0.357	0.000
IRRATIONAL					
PRIV	2	48	0.646	0.186	0.000
PUB	2	48	0.458		
PRIV-INV	1	24	0.625	-0.275	0.007
PUB-INV	1	24	0.900		
Overall				0.101	0.447

that a social norm is actually at stake is the presence of a significant number of decision makers that decided to cooperate even if they held the expectation that many others would have done the same. We name this type of cooperators "norm followers" and count them by creating a dummy variable *Norm Follower* that equals 1 when the individual decides to contribute and expects that at least four others (i.e. when p equal or greater than 5) are going to cooperate. In this way, we are thus capturing *an* empirical expectations about the adherence to a social norm by a majority of people (Bicchieri, 2005, 2016). However, when a public incentive is provided, it is also not rational to contribute when p is greater of equal to 2. Therefore, we create a dummy variable *Irrational* in order to account for irrational decisions. Obviously, in the case of the private incentive there is no difference between *Norm Follower* and *Irrational.*

Table (4) compares the number of norm followers between treatments. We obtain two main results. The first is a significant non-result, i.e. there is no significant differences in the overall number of norm-followers in the BASE periods. Secondly, the overall number of norm followers is higher (0.357) in the treatments with the private incentive than in the treatments with the public incentive (p-value=0.000). The results for irrational decisions are also reported in Table (4). They highlight that the effect of incentives provision is similar to that on norm followers only in the case of standard treatments where the frequency of irrational play is significantly higher in PUB than in PRIV.

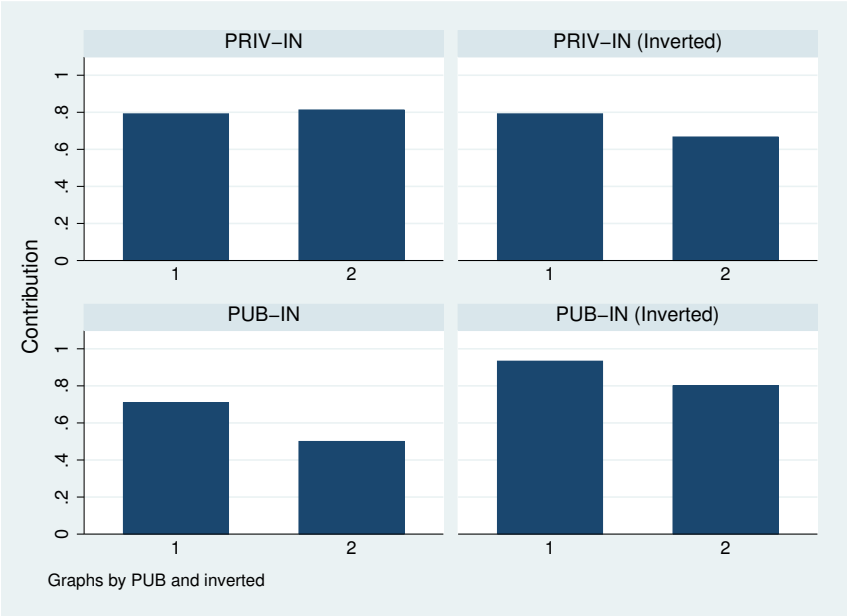
Table (5) compares the number of norm followers and of irrational decisions within treatments. Our results show a significant decrease in norm followers due to the introduction of the public incentive in PUB (-0.313, p-value=0.000) that is reflected in the overall trend for the public incentive (-0.231, p-value =0.002). On the other hand, in the private treatments we observe a positive overall difference between the treatments with the incentive and those without (0.167, p-value=0.021) and a positive significant difference in PRIV-INV (0.417, p-value=0.001). A far as the irrational decisions are concerned, we observe a significant difference only in the case of PUB-INV, where the period with the incentive has a higher percentage of irrational players compared to the period without the incentive (0.300, p-value=0.003).

4.1 Mediation analysis

In the following we rely on a Mediation analysis (Imai et al. 2010b) to disentangle the two effects – as indentified in section 3 – that the introduction of a public and a private incentive can have on the probability of contributing: a direct effect on the choice (in the following ADE), and an indirect effect through the modification of beliefs on others' contribution (in the following ACME). Specifically, the main objective of this analysis is to quantify how much of the incentive is transmitted to contribution choices by the mediating variable, i.e. the participant's beliefs on others' contribution (our proxy for social trust). In other words, the participant's beliefs about others' contribution represent a mediator variable as defined by Imai et al. 2010b, i.e. a post-treatment variable that occurs before the outcome is realized.

Figure 4: COMPARISON ACROSS TREATMENTS

a. Contribution



b. Beliefs

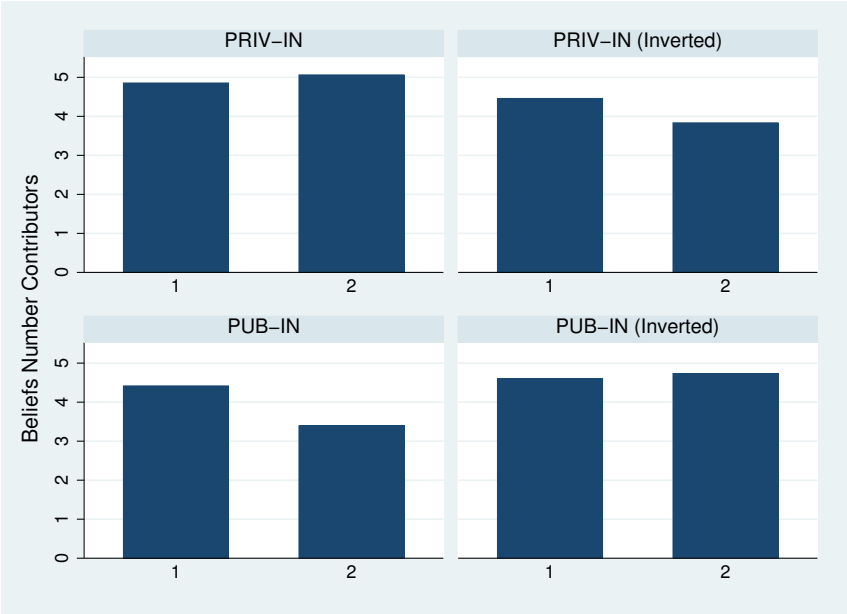
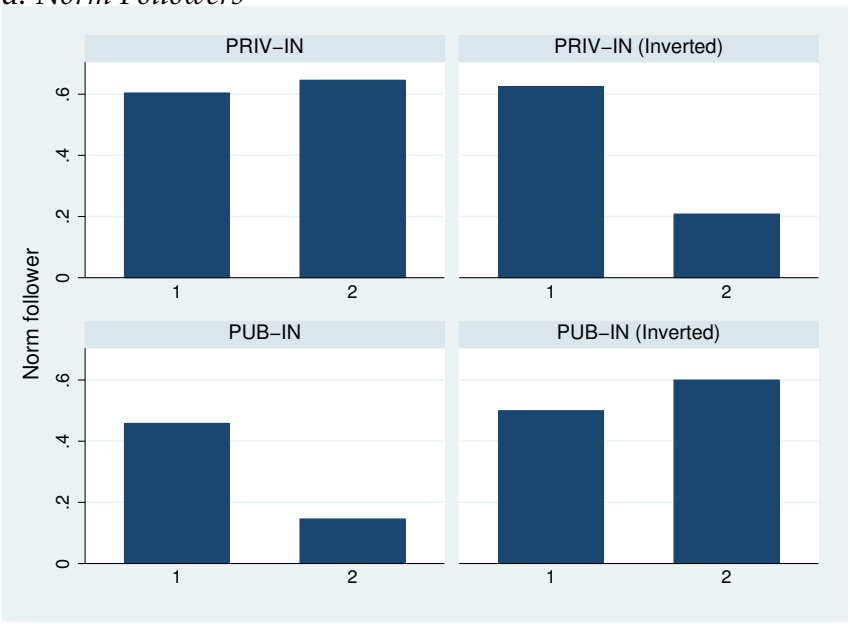


Figure 5: NORM FOLLOWERS AND IRRATIONAL INDIVIDUALS ACROSS TREATMENTS

a. *Norm Followers*



b. *Irrational*

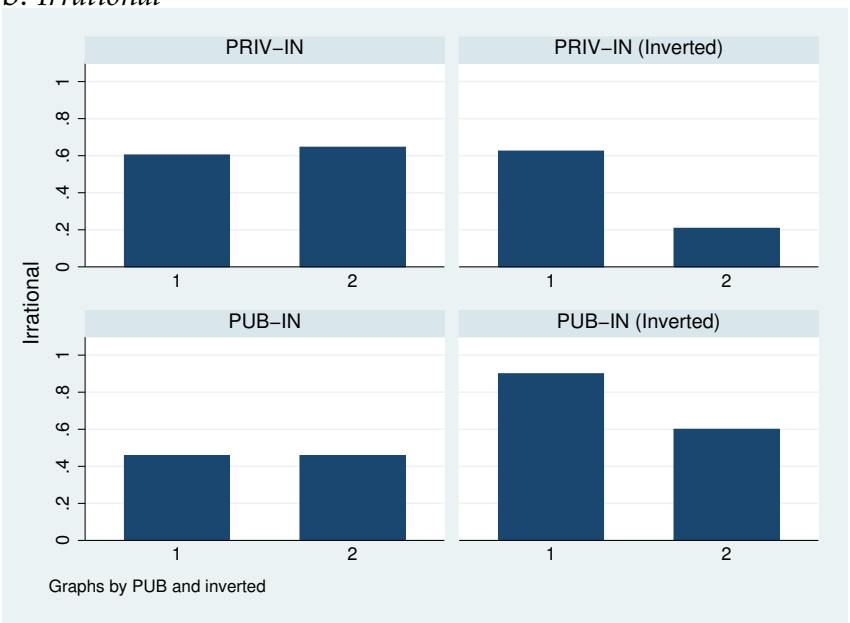


Table 5: NORM FOLLOWERS & IRRATIONAL: DIFFERENCES WITHIN TREATMENTS

NORM FOLLOWERS					
TREATMENT	PERIOD	OBS	MEAN	DIFF .	*p-value*
PUB (Base)	1	48	0.458	-0.313	0.000
PUB	2	48	0.146		
PUB-INV (Base)	2	30	0.600	-0.100	0.224
PUB-INV	1	30	0.500		
Overall Public				-0.231	0.002
PRIV (Base)	1	48	0.604	0.042	0.339
PRIV	2	48	0.646		
PRIV-INV	2	24	0.209	0.417	0.001
PRIV-INV (Base)	1	24	0.625		
Overall				0.167	0.021
IRRATIONAL					
PUB (Base)	1	48	0.458	0	0.500
PUB	2	48	0.458		
PUB-INV (Base)	2	30	0.600	0.300	0.003
PUB-INV	1	30	0.900		
Overall				0.115	0.074

To conduct the mediation analysis, we rely on linear simultaneous equations model (LSEM) estimating the following system:

$$\begin{cases} Beliefs_{it} = \beta_1 PUB_{it} + \beta_2 PRIV_{it} + \beta_3 PRIV\ INV_{it} + \beta_4 PUB\ INV_{it} + \eta_1 Individual\ Char_i + \varepsilon_{1t} \\ Contribution_{it} = \gamma_1 Beliefs_{it} + \beta_5 PUB_{it} + \beta_6 PRIV_{it} + \beta_7 PRIV\ INV_{it} + \beta_8 PUB\ INV + \eta_2 Individual\ Char + \varepsilon \end{cases} \tag{1}$$

where *Beliefs* is a variable measuring the number of contributors an individual expect in his group. *PUB* is a dummy variable equal to 1 in Period 2 for individuals in *PUB* treatment, while *PUB-INV* is a dummy variable for individuals in Period 1 in the *PUB-INV* treatment. Similarly, PRIV is a dummy variable equal to 1 in Period 2 for individuals in PRIV treatment, while while *PRIV-INV* is a dummy variable for individuals in Period 1 in the *PRIV-INV* treatment. The base category is BASE, i.e. the basic game with no incentives in all treatments. *Individual Char* represents a number of control variables, such as donation, field of study (i.e. Economics) and sex as collected in the exit questionnaire.

Recently Imai et al.(2010a; 2010b) developed a general algorithms to estimate causal mediation effects as in (1) for both linear and non-linear relationship, with parametric and non-parametric models.[2] In a linear model, these methods returns point estimates essentially

[2]The mediation analysis rely on two assumptions:

1. the treatment assignment is assumed to be ignorable (i.e. statistically independent of potential outcomes and potential mediators);
2. given the actual treatment status and pretreatment confounders, the observed mediator is ignorable (i.e. observed mediator is independent of all potential outcomes and pre-treatment covariates).

identical to the traditional product-of-coefficients method (i.e. "Barron-Kenny procedure"), i.e in which one has to estimate each equation in (1) by OLS and then multiply the relevant coefficients. For example, the direct effect on contribution of the incentive in PUB is $\hat{\beta_3}$, while $\hat{\gamma_1}\hat{\beta_1}$ can be interpreted as valid estimates of the casual mediation effects that unfold through expectation on others' contribution. In the same way, one can also compute the indirect effects of private incentive ($\hat{\gamma_1}\hat{\beta_2}$) as well as of individual characteristics that unfold through beliefs ($\hat{\gamma_1}\hat{\eta_1}$).

Table (6) reports results from the mediation analysis based on the non-parametric bootstrap algorithm with 100 resample as proposed by Imai et al. (2010a). As this table highlights, in line with the hypothesis 2 and 3, we observe that the standard public incentive (PUB) has an indirect and significant negative effect (-0.176, p-value=0.000) on contribution. The direct effect is also negative, being equal to -0.078, although not statistically significant. The overall effect of a standard public incentive is also economically and statically significant. Similarly, in line with hypothesis 2 and 3, the indirect effect of private incentives (PRIV) is also positive and statistically significant (0.084, p-value=0.000), while the overall total effect is not statistically significant. The effect of an initial public incentive (in PUB-INV) has instead no significant indirect effect on the beliefs, while it has a positive direct effect on contribution (0.167, p-value=0.000). The overall total effect is also positive and statistically significant (0.176, p-value=0.000). The effect of an initial private incentive (in PRIV-INV) does not have any significant effect. Overall, these results suggest that the effect of public incentive depends on the timing of introduction, while the effect of private incentive is more robust to this issue. Moreover, the effects of both types of incentives mainly unfold through a modification of beliefs when are introduced in the second period.

The effect of individual characterstics on contribution is instead only a direct and ignificant one. In particular, the average direct effect of being a donor (outside the laboratory) has a positive and significant effect on contribution (0.116, p-value=0.000), while being a student in Economics has a negative and significant effect on contribution (-0.167, p-value=0.000).

4.2 Sensitivity analysis

Imai et al. (2010b) suggested a way to assess the sensitivity of the results to the violation of the (sequential) ignorability of the mediator, i.e. the presence of any counfounders that simultaneously affect the mediator and the outcome. More precisely, the suggested approach is based on the correlation between an omitted variable that is related to both the observed value of the mediator and the potential outcome, yielding a non-zero correlation between the two errors in (1):

$$\rho \equiv Corr(\varepsilon_1, \varepsilon_2)$$

where $-1 < \rho < 1$.

Since treatments are randomly assigned to groups the first assumption is always satisfied. On the contrary, the second assumption may fail because there may exist counfounders simultaneously affecting the mediator and the outcome. We address this concern in the sensitivity analysis.

Table 6: MEDIATION ANALYSIS

Each cell shows a point estimate and its corresponding 95% confidence intervals based on nonparametric bootstrap with 100 resamples.

	PUB	**PRIV**	**PUB-INV**	**PRIV-INV**	**Female**	**Donation**	**Economics**
ADE	-0.078	-0.029	0.167	0.102	0.101	0.116	-0.167
	[-0.255 0.061]	[-0.133 0.062]	*[0.065 0.274]*	[-0.35 0.244]	[-0.014 0.171]	*[0.044 0.201]*	*[-0.275 -0.081]*
ACME (Indirect)	-0.176	0.084	0.009	-0.007	-0.012	-0.022	-0.019
	[-0.251 -0.081]	*[0.041 0.137]*	[-0.046 0.077]	[-0.135 0.090]	[-0.054 0.021]	[-0.002 0.010]	[-0.071 0.040]
Total Effect	-0.254	0.055	0.176	0.095	0.089	0.094	-0.186
	[-0.435 -0.118]	[-0.047 0.162]	*[0.072 0.275]*	[-0.103 0.261]	[-0.006 0.181]	[0.005 0.170]	*[-0.306 -0.087]*

In particular, Imai et al. (2010b) show by varying the value of ρ, and thus computing the corresponding estimate of the ACME for different value of ρ, it is possible to assess the robusteness of the mediation results. To this purpose, in Figure (6) we assess how large ρ have to be in order to make the causal mediation effect go away. If small departures of ρ from zero produces very different ACME estimations from the one obtained under sequential ignorability, it would suggest that the results are extremely sensitive to the violation of the sequential ignorability assumption.

In our case, Figure (6) shows that the effect of beliefs for PUB remains negative and highly significant for very high negative values of ρ, as well as for positive value up to 0.2, suggesting that the indirect effect of PUB is robust to unobservable factors which generate correlation between beliefs and contribution. Similarly, the indirect effect of PRIV remains positive and significant for very high negative values of ρ. We do not report results for PUB-INV and PRIV-IN as the indirect effects was never significant (and similarly the sensitivity analysis).

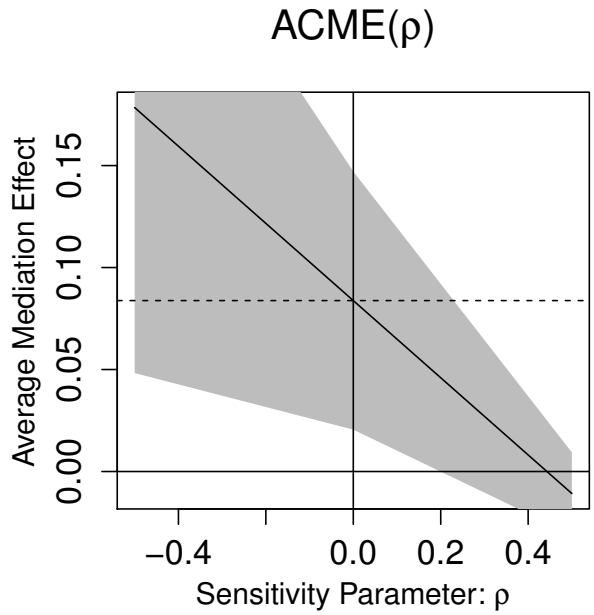
5 Conclusions

Relying on a threshold public good game (TPG), in this paper we study the effect that private and public incentives can have in order to reach a defined overall contribution. While private incentives targets individuals by reducing their cost of contribution, public incentives targets groups by providing an investment that directly support the achievement of the threshold in the public good game. Specifically, we investigate how the two types of incentives differently affect social trust, and in turn individual contribution.

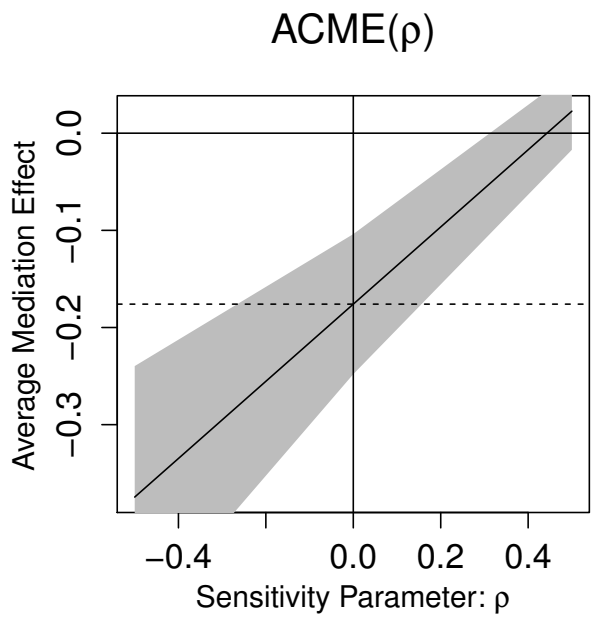
Our results confirm the theoretical prediction that, in the case of high level of social trust (i.e. high expectations on others' contribution), the private incentive crowds-in pro-social contribution, while the public incentive crowds it out. In particular, the effects of these incentives mainly unfold through a modification of beliefs that goes in the same direction of the change in contribution, i.e. beliefs decrease after the introduction of the public incentive while they increase after the introduction of the private one. On the contrary, this indirect effect is not at stake in the inverted treatments, where we only observe a significant direct effect of the public incentive, while the private incentives remain positive (although not significant).

Figure 6: SENSITIVITY ANALYSIS

a. Private incentives



b. Public incentives



The dashed line represents the estimated effect of the mediation effect for $\rho = 0$. The solid line represents the estimated average effect at different value of ρ. The gray areas represent the 95% interval for the mediation effects at each value of ρ.

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