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# **An investment game with third-party intervention\***

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**Abstract:** This paper explores the effect of the possibility of third-party intervention on behavior in a variant of the Berg, Dickhaut, and McCabe (1995) “Investment Game”. A third party’s material payoff is not affected by the decisions made by the other participants, but this person may choose to punish a responder who has been overly selfish. The concern over this possibility may serve to discipline potentially-selfish responders. We also explore a treatment in which the third party may also choose to reward a sender who has received a low net payoff as a result of the responder’s action. We find a strong and significant effect of third-party punishment, in both punishment regimes, as the amount sent by the first mover is more than 60% higher when there is the possibility of third-party punishment. We also find that responders return a higher proportion of the amount sent to them when there is the possibility of punishment, with this proportion slightly higher when reward is not feasible. Finally, third parties punish less when reward is feasible, but nevertheless spend more on the combination of reward and punishment when these are both permitted than on punishment when this is the only choice for redressing material outcomes.

**Keywords:** Trust, punishment, third-party intervention, responsibility-alleviation

**JEL Classifications:** A13, B49, C91, D63

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# 1. Introduction

One must often take a risk in economic environments in order to secure possible gains. Purchasers order goods and presume that the quality when delivered will be suitable; principals hire agents and may not be able to effectively regulate the agent's behavior. The importance of *trust* among individuals has been the topic of considerable discussion in the recent literature. Arrow (1974) pointed out that trust must be required in much economic activity in order to have mutual gains in exchanges. La Porta, López-de-Silanes, Shleifer and Vishny (1997) show that trust has a positive effect on the government effectiveness and also find that trust is associated with lower inflation and with higher per capita GNP growth. Other authors such as Coleman (1990), Fukuyama (1995) or Gambetta (1998) find that trust has a strong effect on the functioning of the institutions of a society.<sup>1</sup>

Berg, Dickhaut and McCabe (1995) introduce the Investment Game, in which a first mover can pass some or all of his or her endowment to a responder, who receives three times the amount sent by the first mover. The responder then selects an amount to pass back to the first mover. The behavior of the first mover and the responder can be seen as proxies for 'trusting' and 'trustworthy' behavior, respectively.<sup>2</sup> This game has been used by many authors in the literature trying to obtain the level of trust in the populations analyzed.<sup>3</sup> In general, the amount

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<sup>1</sup> Others authors point out the importance of trust in e-commerce. Hoffman, Novak and Peralta (1999) show that almost 95% of consumers have declined to provide personal information to web sites and 63% of them argued that they did not trust those collecting the data. They also show that consumers do not trust Web providers to engage in exchanges, involving money, with them. Mutz (2005) examines the impact of social trust on participation in e-commerce.

<sup>2</sup> These proxies are imperfect, as people may have other motivations for their choices. For example, a first mover may have a desire to increase the total payoff of the group (see Charness and Rabin 2002); similarly, a responder may dislike inequality (rather than being concerned with being trustworthy *per se*) and so may return some to the first mover for this reason. Nevertheless, in this paper we consider a first mover who sends a positive amount to be trusting and a responder who returns at least as much as what was sent to be trustworthy.

<sup>3</sup> See for example Barr (2003), Cox (2004) or Gneezy, Güth and Verboven (2000), among others.

passed by the first mover is less than optimal, so that finding a method to increase this level could lead to improve economic transactions and corresponding benefits to society.

The question is then, how can we increase trust (as measured by the amount passed by the first mover) experimentally? Berg *et al.* (1995) find that subjects behave differently in a one-shot game if they know the results of earlier games; these results indicate that expectations have an effect on behavior. Barr (2003) shows that trusting behavior is motivated by expectation of trustworthiness. Her analysis shows that altruistic motivations and the desire of “community-build” also appear as possible explanations of trusting behavior. Cox (2002), comparing results in an investment game and in a dictator game, gives evidence that there is significant expectation of trustworthiness in the investment game.

This paper considers a simple modification of the Investment Game, in which a third-party, whose material payoff is unaffected by choices by the first mover and the responder, can choose to sacrifice some of his or her material payoff to punish a responder who presumably returns an insufficient amount to the first mover. The aim of our study is to explore whether introducing the presence of a third-party punisher who will assess other players’ performance increases ‘trusting behavior’ (amounts sent by first movers) of individuals, based on the above idea that expectations of ‘trustworthiness’ (amounts returned) play an important role.<sup>4</sup>

The punishment performed by uninvolved third parties is not trivial or incidental. Why do people punish others’ behavior at a cost for themselves? The economics literature has developed some explanations for this kind of behavior. Levine’s (1998) model rests on the

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<sup>4</sup> It is not necessarily the case that the first mover actually trusts the responder more when there is a third party, but that it is instead the combination of trust and the fear of punishment by the third party that induces higher transfers by the first mover. This clearly goes to the the question of the meaning of trust. We will continue to operationally define ‘trust’ in terms of the amount sent by the first mover, while noting that this term is certainly less than perfect. One suspects that social capital is not *per se* increased by salient threats of punishment or enforcement.

assumption that there is a willingness to punish individuals with spiteful preferences. Fehr and Fischbacher (2004) show that third-party sanctions are driven by negative emotions and negative fairness judgments towards norms violators. Gintis, Bowles, Boyd and Fehr (2003) and Fehr, Fischbacher and Gächter (2002) give empirical evidence of what they call “strong reciprocity”, the predisposition to cooperate with others and to punish those who violate the norms of cooperation at a personal cost. There are also other possible explanations for this behavior, such as fairness or equality (see Fehr and Schmidt 1999, Charness and Rabin 2002 or Rabin 1993).

To the best of our knowledge, no paper has analyzed the effect of third-party punishment on trusting behavior. We introduce two variants, one in which the third party can only choose whether or not to punish the responder, and one in which the third party can choose to either punish the responder, reward the first mover, or do neither (or both). Reward in this framework has been previously considered mainly in relation to second-party punishment (players who make the punishment decision are involved in the game).<sup>5</sup>

Our results in both variants show that the existence of a person who can observe and punish the violation of the distribution norm (see Fehr and Fischbacher 2004) significantly and substantially increases the amount of money sent by first movers in our population.<sup>6</sup> We find little difference in the amount sent by first movers when reward is feasible (compared to when only punishment is feasible). Responders return a significantly higher amount when third parties can intervene than in the control treatment. The amount sent back is somewhat lower when

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<sup>5</sup> See for instance Sefton, Shupp and Walker (2002), Fehr & Gächter (2003), Sutter, Haigner and Kocher (2006), Eckel & Grossman (1996).

<sup>6</sup> The Fehr and Fischbacher (2004) study has some similarities to ours, but the game analyzed is different and they did not use reward to enhance cooperation. In one of their treatments they run a Prisoner’s dilemma with third-party punishment in two stages. In the first stage, players A and B, who were endowed with 10 points, had only two choices: keep or transfer all points. In the second stage, an external observer endowed with 40 points has the opportunity to punish A and/or B with a ratio of 3 to 1. They focus their analysis in punishers’ behavior and found that almost half of C players punished the defector when the other player has cooperated.

reward is feasible; perhaps this stems from responders perceiving that some third parties might wish to increase the total social payoffs and thus reward impoverished first movers rather than punish misbehaving responders. There is also evidence that the level of punishment, in general, increases with increasing difference between first-mover and responder profits. Finally, results show that, although the third party sacrifices more in total when both reward and punishment are feasible, the level of punishment is higher when only punishment can be chosen.

The remainder of the paper is organized as follows. Section 2 briefly describes some of the relevant literature and presents our hypotheses. We present the experimental design and procedures in section 3. The main results are reported and we offer some discussion in section 4. We conclude in section 5.

## **2. Previous literature & hypotheses**

The Berg *et al.* (1995) Investment Game features two players, A and B. Both A and B receive an endowment of \$10. In the first stage, A can pass some, all, or none of his or her endowment to the paired B. Each dollar sent to Player B is tripled. In the second stage, after observing the amount transferred by A, B decides how many dollars to send back to A, keeping the remainder. The amount B sends back to A is not tripled. If we presume selfish preferences, the subgame-perfect equilibrium prediction for this game is for A to send nothing and for B to return nothing. It is clear that this outcome is not Pareto-efficient, and that the only Pareto efficient allocations occur if and only if A passes his or her entire endowment to B.

Berg *et al.* (1995) found that on average A players sent \$5.16 and B players returned \$4.66. Thus, on average, A's lose money by sending positive amounts. While B's who receive more do tend to pass more, the proportion returned by B's is uncorrelated with the amount B's

receive in their No History treatment; however, there is a positive correlation when Social History has been provided to the participants, who then have more well-developed expectations about behavior.<sup>7</sup> Expectations clearly matter; since the presence of a third-party punisher can affect these expectations, it seems reasonable to expect this presence to affect behavior.

The Investment Game has been extensively analyzed in the experimental literature in a search for the motivations behind trust.<sup>8</sup> However, the possibility of third-party punishment in this game has not yet been studied. Although many papers have investigated second-party punishment in experimental games,<sup>9</sup> only a few papers analyze third-party sanctions in response to unfair behavior, supporting the idea that those kinds of players do punish in a wide variety of games and contexts, despite the fact that third-party punishers must sacrifice their endowment to penalize an action in which they are not involved. Fehr and Fischbacher (2004) study third-party sanctions in a Dictator Game and in a Prisoners' Dilemma. They find that, in the Dictator Game, most third parties punished dictators who transferred less than half of the pie. In the Prisoners' Dilemma, results show that 46% of third parties punish defectors if their partners cooperated.

Based on the idea that, in the Investment Game, expectations affect subjects' behavior and also based on results showing the positive effect of the presence of a punisher in the level of cooperation in different strategic environments,<sup>10</sup> we test the following hypotheses concerning the effect of introducing a third-party punisher in the BDM investment game:

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<sup>7</sup> The Spearman correlation coefficient is  $r_s = 0.01$  in the No History treatment, compared to  $r_s = 0.34$  in the Social History treatment.

<sup>8</sup> See for instance Croson & Buchan (1999), Cox (2002), Cox (2004), Gneezy *et al.* (2000).

<sup>9</sup> See, for example, Camerer (2003), Güth, Schmittberger and Schwarze (1982), Fehr, Gächter and Kirchsteiger (1997) or Ostrom, Walker and Gardner (1992) among others.

<sup>10</sup> See, for example, Fehr and Gächter (2000) or Fehr and Gächter (2002), who find that the threat of punishment has a positive effect on contributions in public-goods games.

**H1:** Introducing a third party who can intervene will lead to A's sending more to B's.

**H2:** B's will return more to A's if there is a third party who can intervene.

For motivating H1, we presume that one of the main considerations people have about sending money in the Investment Game is that they would like to receive back at least the same amount that they have sent, ending up no worse off. Cox (2002) and Barr (2003) provide results supporting this assumption. The idea behind third-party intervention is that uninvolved players can punish unfair behavior or perhaps also help victims of violations to this 'norm', so that A's feel safer sending more to B's.

Reward has been principally analyzed in combination with second-party punishment. Sefton *et al.* (2002) compare second-party reward to cooperators versus punishment to defectors in a public goods game and found that reward is less efficient, especially when the decay over time is considered.<sup>11</sup> Andreoni, Harbaugh and Vesterlund (2003) analyze an ultimatum game with an additional stage where the responder can reward or punish the proposer (with some cost). They run four treatments: the baseline, only punishment, only reward, and both punishment and reward. They find that reward and punishment are complements, so the last treatment is the most efficient for enhancing cooperation. Charness and Levine (forthcoming) incorporate both second-party punishment and reward in a design where the final "wage" received by the responder is in part stochastic; even at the same net wage, the responder chooses reward (punishment) more frequently when the first mover has chosen a high (low) wage.

Third-party punishment and reward are combined in Ottone (2005), who proposes a Dictator Game with a second stage where an external observer could punish dictators and/or

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<sup>11</sup> Fehr & Gächter (2003) also found similar results in a public goods game. Sutter et al. (2006) introduce endogenous choice of the reward or sanction system in a public goods game and they show that cooperation is higher when subjects can choose the system than when it is exogenously imposed.



reward recipients. She shows that the level of punishment is proportional to unfair offers of dictators. Although Ottone also analyzes the presence of third-party punishment and reward, there are some key differences with respect to our design. The first difference is that there are strategic considerations (with respect to the active players) in the Investment Game, but not in the Dictator game. Second, we introduce a third-party punisher who observes A's and B's behavior and who makes the decision regarding punishing B; thus, in contrast to Ottone, A's behavior may be affected by the presence of the punisher not because she perceives the threat of punishment, but because she thinks that B's behavior will be affected by the threat of punishment. Finally, in the Investment Game (but not in the Dictator Game), preferences about efficiency may play a relevant role in the decision of Player A.

In order to compare reward and punishment to punishment only, we also run a treatment in which the third party, after observing A's and B's behavior, has the opportunity to reward player A and/or punish player B. Thus, we also test the following hypotheses:

**H3:** First movers will transfer more when both reward and punishment are feasible than when only punishment is feasible.

**H4:** Responders will return less when both reward and punishment are feasible than when only punishment is feasible.

To motivate H3, we consider that a first mover may feel safer in transferring a larger amount when there is the additional possibility that the third party can remedy a shortfall from the responder. Regarding H4, a responder may perceive less of a threat, as a third party who cares about efficiency may choose to help the first mover, rather than to punish the responder.<sup>12</sup>

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<sup>12</sup> Note that reward here is a substitute for punishment, particularly for those third parties who have preferences for efficiency. There is a trade-off between the utility gained by choosing to punish misbehavior or choosing to help to make a victim whole.

The notion of *responsibility alleviation* (Charness 2000) suggests that responders will make more pro-social choices (return more) when they are fully responsible for the first mover's payoff (in the punishment only case).

### **3. Experimental design**

We conducted six sessions at UCSB, two for each of the three different treatments, with 16-24 participants per session. Subjects were recruited from a university-wide e-mail database of interested students. All sessions were run in a large classroom divided into two sides and in each row four people sat sufficiently separated. No one was allowed to participate in more than one session. On average, each person received about \$13 for a one-hour session.

The first treatment was the standard Investment Game where both players A and B received an endowment of 10 points. The other two treatments featured potential third-party punishment. At the beginning of the second and third treatments, participants were handed out a label with a number printed in it. After we explained the game in detail, people voted for the third parties; those people receiving the most votes became the third parties, with ties broken randomly. The elected third parties then were asked to move to the back of the room, maintaining separation among them. Sample instructions can be found in the Appendix.

In all treatments, the roles for A and B were randomly assigned with labels drawn from an opaque bag (in the second and third treatments new labels were distributed for the remaining participants after the voting for third parties); each label had a letter and a number. Once the roles were determined, A's and B's were seated on opposite sides of the room, with separation between all individuals for privacy. In treatments 2 and 3, the third parties then received a label with a letter (C) and a number.

In all treatments, A's and B's were endowed with 10 points; in treatments 2 and 3, C's were endowed with 40 points.<sup>13</sup> The conversion rate for points to dollars was 2:1 for A's and B's; the conversion rate for C's (in treatments 2 and 3) was 3:1. Each participant in treatments 2 and 3 knew that the conversion rate for C's could be different than the rate for A's and B's, which they knew was the same for both A's and B's. C's could choose to punish (and/or reward, in treatment 3); each point sacrificed by C decreased B's payoff by three points or (with reward) increased A's payoff by three points, and this was common information.

There were three rounds in each session, with no feedback given. Subjects retained their role in all rounds, but they were matched with different partners in each one.<sup>14</sup> Participants were told at the outset that they would be paid for only one of the three rounds, chosen randomly at the end of the session by rolling a die. The experiment was structured in the following way. First, decision sheets were passed out to all participants. A's decision sheets had the label they had drawn written in the top left corner of each decision sheet. A's passed their decision sheets face down toward the center aisle and these were then collected. We then wrote the label for the corresponding B in the top right corner of A's decision sheet, and cut off the corner where the A player's label was written. These decision sheets were distributed to the corresponding B's.

Each B observed what A has chosen and then made a decision on a separate decision sheet with B's label in the top right corner; this was passed face down to the center aisle and collected, along with A's decision sheet. We then wrote the identification of the corresponding C in the top left corner of both decision sheets and cut off the top right corner of the decision.

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<sup>13</sup> We decided to endow C with a sufficiently large amount of points to avoid C comparing his or her points with B amount. Thus, in the most favorable case for B, when A transfers 10 points, C will not punish B in order to decrease the difference in payoffs between B and C (see Fehr & Fischbacher 2004).

<sup>14</sup> This was common information among subjects.

Next, we distributed both sheets to C, who observed A's and B's decisions and made choices about punishment (and/or reward, in treatment 3). These were collected face down and placed in a folder. This process was repeated in each of the three rounds. When a round was selected for payment at the end of the session, we opened the corresponding folder and calculated actual payoffs.

A final operational note is that we decided to have the participants themselves vote for the third parties, rather than choosing them at random. Here the idea was to increase the sense of responsibility for the third parties. The intuition behind this is that when third parties know that they have been *selected* as punishers by the rest of participants in the experiment, they will feel more involved in their task. We asked subjects to stand simultaneously and show their 'identification numbers'; they then voted for the holder of one of these identification numbers. No other information was provided to the subjects before the voting process, as having additional personal information could have affected the perceived social distance, which has been shown to have an important effect.<sup>15</sup>

#### 4. Results

In this section, we first present the results for A's, then the responses by B's, and then the choices made by C's. In the process, we also discuss how the data either support or reject our hypotheses. As a summary, we can say that the presence of a third party has a strong effect on both the amounts sent by A's and the amounts returned by B's. C's are more prone to sacrifice points when there is a larger difference between the corresponding A and B payoffs at the time of C's decision, and C sacrifices slightly more when both punishment and reward are feasible.

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<sup>15</sup> See for instance Bohnet & Frey (1999), Charness & Gneezy (forthcoming).

In treatments 1, 2, and 3, we had 16, 14 and 12 groups of subjects respectively. As we run three rounds for each experiment, we have tested if the three different rounds for A, B and C players could be pooled in a single sample (of 48, 42 and 36 observations respectively). We have used a single-factor within-subjects analysis of variance test that is appropriate for two or more dependent populations. On this basis, we pool results across rounds, as we do not find substantial differences over time.<sup>16</sup>

### Amounts sent by A's

Table 1 shows the average amount of points sent by player A in each treatment.

**Table 1: A's choices, by treatment**

	Treatment 1	Treatment 2	Treatment 3
Mean transfer	3.73	6.02	6.14
Observations	48	42	36

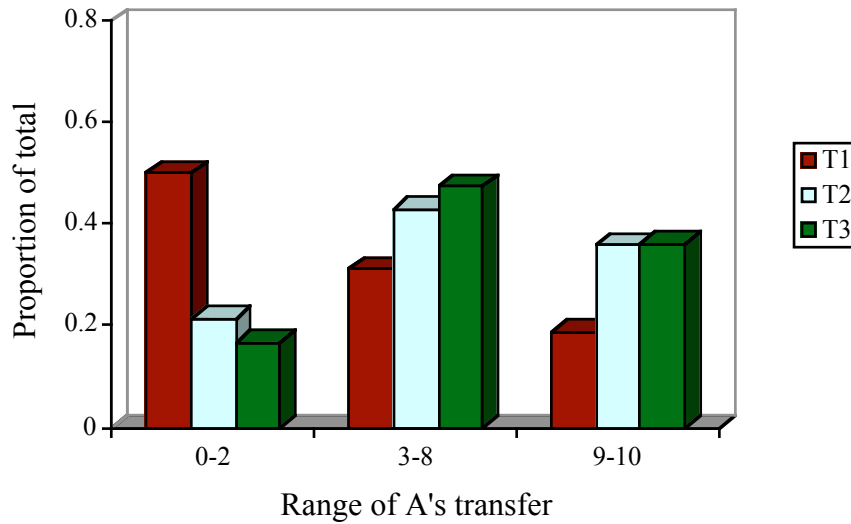
We see that A's transfers are more than 60% higher when there is the possibility of third-party punishment, and that there is very little difference in A's behavior depending on whether the third party can also choose to reward A.

Figure 1 shows the distribution of low, intermediate, and high A transfers in each treatment.

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<sup>16</sup> Pooling across rounds seems particularly innocuous for A's, as they have received no feedback at all at the time of their decisions in rounds 2 and 3.

**Figure 1 - A's transfers, by treatment**



Visually, we see that these results are driven by the fact that low transfers are much more frequent without third-party punishment, and high transfers are considerably more common when third-party punishment is permitted.

A conservative Wilcoxon-Mann-Whitney ranksum test using each individual's average transfer as one observation confirms that the difference between treatment 1 and treatment 2 is statistically significant ( $Z = 1.98$ ,  $p = 0.024$ , one-tailed test), as is the difference between treatment 1 and treatment 3 ( $Z = 2.05$ ,  $p = 0.020$ , one-tailed test). The observed behavior therefore confirms **H1**, that A's transfer more when there is the possibility of third-party punishment. This is the main result of the paper. On the other hand, the lack of difference between A's transfers in treatments 2 and 3 (the Wilcoxon ranksum test gives  $Z = 0.13$ , n.s.) goes against **H3**, the hypothesis that A's will transfer more when reward is feasible.

## Amounts sent by B's

The effect of potential third-party intervention on responder behavior could be analyzed from several alternative points of view. For instance, while it might seem obvious to simply consider the absolute amounts transferred from B to A, one concern is that we are comparing treatments where, in one of them, the amount sent by A is much lower than in the others. One might therefore expect B's transfers to be higher in treatments 2 and 3, even if B's had no concern with possibly being sanctioned. Another possibility may be to analyze B's behavior in terms of the proportion of the original A transfer. Yet this approach also has problems – when A's transfers are low, then it is inexpensive for B to return a high percentage of the points transferred by A. However, if A's transfers are high, then B must give up a larger sum of money to achieve this same proportion.

As with nearly all studies investigating behavior in a sequential prisoner's dilemma game such as ours, there is a strong positive relationship between the amount sent by the first mover and the responder's choice; in all treatments, the correlation between A's transfer and B's transfer is positive and highly significant.

Table 2 shows the mean transfer by B's in each treatment, as well as the average ratio of B's transfer to the amount sent by A (not tripled).

**Table 2: B's choices, by treatment**

	Treatment 1	Treatment 2	Treatment 3
Mean transfer	4.65	8.33	6.99
Mean ratio to A's transfer <sup>17</sup>	1.11	1.40	1.30
Observations	48 (36)	42 (37)	36 (33)

The number in parenthesis in the last row of Table 2 are the observations for the mean ratio to A's transfer.<sup>18</sup>

<sup>17</sup> The mean ratio to A's transfer represents the amount of points B's return to A's, compared to the amount sent by A's to B's. We consider the mean ratio because simply calculating the aggregate ratio in each treatment will give excessive weight to observations where A passed a higher amount.

An interesting observation from Table 2 is that, on average, A's do benefit from transferring positive amounts in the baseline, in contrast with previous studies (e.g., Berg *et al.* 1995) in which A's lose a small amount of money on average from making positive transfers<sup>19</sup>; subject pools may vary in this respect either internally or externally. Nevertheless, even when B's return higher proportions in the control treatment, the presence of a third party has a positive effect on B's behavior.

We see that B's transfer substantially more to A's in treatments 2 and 3, with a corresponding (although less pronounced) difference in the average ratio. The relationship between these average ratios is an intuitive one: Introducing a third party increases B's responsiveness to A's transfer in both treatments 2 and 3, but this increase is smaller in treatment 3 when the third party can choose to reward A as well as to punish B.

For the reasons explained above, we might analyze B's transfers as a variable conditioned on the amount sent by A. Thus, we consider the General Lineal Model:

$$E(Y|X = x_i) = a + bx_i,$$

where  $Y|X = x_i$  is the amount B returns to A conditioned to the fact that A has transferred  $x_i$  points to B. In order to test Hypothesis 2 we need to analyze if the conditioned B's transfers are higher in treatment 2 (and 3) than in treatment 1. Therefore, we will use the Chow test (Chow 1960) to compare the estimated coefficients in the linear regression corresponding to each pair of different treatments. Here the null hypothesis is:

$$H_0: a_i = a_j, \quad b_i = b_j, \quad \text{where } i, j = 1, 2, 3; \quad i \neq j.$$

If we compare the coefficients in treatment 1 with those in treatment 2 or 3, the Chow test confirms that B's transfer is higher when there is a third party than when there is not, although

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<sup>18</sup> We drop the observations where A transferred 0, as the ratio is undefined in that case.

<sup>19</sup> The mean ratio in the Berg *et al.* (1995) treatment without history was 0.90, as calculated from their Figure 2.



the evidence is stronger for treatment 2 ( $F = 10.208$ ,  $p = 0.000$ , T1 vs. T2 and  $F = 2.837$ ,  $p = 0.064$ , T1 vs. T3, one-tailed tests). Therefore, we find some support for **H2**.

We find some modest support for **H4**. Although the average A's transfer is a bit higher when only punishment is feasible, Table 2 indicates that the average transfer in treatment 2 is higher than in treatment 3. The Chow test finds a marginally-significant difference in the levels of B's transfer across treatments 2 and 3 ( $F = 2.315$ ,  $p = 0.104$ , one-tailed test). This result is compatible with B's responsibility alleviation, given that in treatment 3 A's profit depends not only on B's transfer but also on C's reward.

### Amounts sacrificed by C's

While the behavior of the elected third parties is not the main focus of our study, we nevertheless briefly present these results. Table 3 shows the average amount of money spent by third parties in treatments 2 and 3.

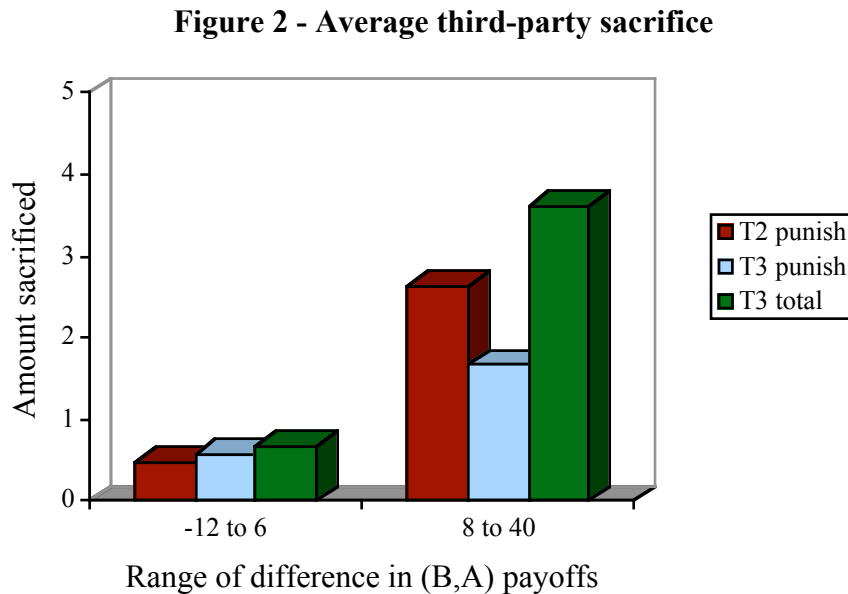
**Table 3: Average third-party choices, by treatment**

	Treatment 2	Treatment 3
Amount spent to punish	1.45	1.03
Amount spent to reward	-	0.86
Total amount spent	1.45	1.89
Observations	42	36

We observe 41% more points spent on punishment when this is the only tool available. On the other hand, the total expenditure on intervention is 30% higher when both reward and punishment are feasible. Although reward is the most efficient action in treatment 3, C nevertheless prefers to sacrifice 20% more points to punish than to reward. Thus, a form of indirect negative reciprocity is at least as strong as the efficiency considerations for our parameters. However, since the third parties tend to intervene only when B misbehaves, we have

relatively few ‘useful’ observations.<sup>20</sup> Thus, statistical tests have little power here and neither rank-sum tests nor regressions find either difference to be significant.

Nevertheless, there is a clear relationship between third-party behavior and the combination of A and B choices, as shown in Figure 2 below (the two ranges were chosen to give roughly equal numbers of observations):



There is little sacrifice by C’s when the difference between B’s payoff and A’s payoff is relatively small, but a sizable amount of punishment when this difference is larger. The amount of reward is a bit larger than the amount of punishment when the difference in payoffs is larger. It is clear that C’s are not acting in a random fashion.

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<sup>20</sup> There are many cases where B returns a considerable proportion of what B receives from A, so that C does not punish. In addition, C never punishes B when A sends 0.

**Table 4: Tobit Regressions on Payoff Differences and Punishment/Reward**

Independent variable	Dependent variable		
	(1) Punishment	(2) Reward	(3) Total
B payoff – A payoff	0.122** (.053)	0.194*** (.052)	0.180*** (.039)
Treatment 3	-1.985 (1.442)	-	0.438 (1.042)
Constant	1.601 (3.497)	-4.279*** (1.485)	-3.114 (2.675)
N	78	36	78

Standard errors are in parentheses.

\*\*\*, \*\*, and \* indicate significance at  $p = 0.01, 0.05,$  and  $0.10,$  respectively

Table 4 confirms the visual results in Figure 2, as the difference between B’s payoff and A’s payoff is highly significant and appears to drive third-party intervention; when this disparity is too large, some third parties sacrifice payoffs.<sup>21</sup> As mentioned above, we find no statistically-significant treatment effect.<sup>22</sup> On average, an increase of 5.6 points in this difference leads to an increase of one unit in total intervention.

In line with footnote 12, the choice of reward or punishment, when both options are available, is likely to be influenced by player C’s taste for efficiency. This effect is not reflected in the regressions in Table 4. To really measure this effectively, one would need control treatments where the reward ratio is varied systematically; this is beyond the scope of our paper.

## 5. Conclusion

In this paper, we investigate whether the possibility of intervention by an external third party can affect the behavior of individuals in a form of the Berg *et al.* (1995) Investment Game.

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<sup>21</sup> Note that it is unnecessary to run a regression in which A’s payoff is an independent variable, given that the difference of payoffs between A’s and B’s is very high if and only if A’s send many points and B’s return a very low amount.

<sup>22</sup> We note that our regression results are robust to a number of other specifications.

In particular, we are interested in whether the amount passed by the first mover, which is the source of social gains in this game, is increased when a third party can make a sacrifice to bring payoffs closer to balance. We consider one variation in which punishment is the only feasible intervention and another variation in which both reward and punishment are possible.

We find that first movers are willing to ‘trust’ more when a third party is present, presumably through the belief that the responder is less likely to be selfish. The average amount passed increases by over 60% over the no-punishment baseline in both treatments with feasible third-party intervention.

Regarding the amount returned by responders, we find that third-party intervention also positively affects this amount. Nevertheless, the amount sent back is higher when only punishment is feasible than when both reward and punish are possible. The threat of punishment might be perceived weaker by responders when reward is also a possible action.

The third parties are in fact willing to spend some of their payoff to redress payoff disparities, as the amount spent is strongly correlated with the amount by which the responder’s payoff exceeds the first-mover’s payoff. There is more punishment when this is the only available sacrifice, but the total sacrifice is greater when reward is also an option. While responders return more in the treatments with a third party, this amount is lower when reward is also feasible. As we have controlled for the effect of the amount received by responders, we may rule out the idea that this higher return is due to the fact that first movers have passed more in the first place.

Our study demonstrates the relevance of external third parties in a sequential game. It seems that some people in the experimental population expect that an outsider will be willing to incur some personal cost to punish the greedy or to help the victims of greed. In our

environment, the result is more trusting behavior, in the sense that the first mover passes more. To the extent that the laboratory is indicative of behavior in the field,<sup>23</sup> perhaps there is scope for policy mechanisms such as third-party intervention to improve social outcomes more generally. One caveat, however, concerns whether having an external enforcement mechanism leads to more actual trust (in the Putnam, 2000 sense of social capital) or better behavior due to fear of punishment. Nevertheless, it is conceivable that the presence of potential enforcement can strengthen the salience of a norm of social justice and thereby promote beneficial habit-formation.

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<sup>23</sup> Since emotion in the field tends to run higher than emotion in the laboratory, one might even consider laboratory punishment understates punishment in the field.

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## APPENDIX – INSTRUCTIONS (Treatment 3)

Welcome to the experiment!

This is an experiment to study how people solve decision problems. Our goal is to see how people act on average; not what you, particularly, do. Do not think, then, that we expect you to perform some concrete behavior. But, on the other hand, take into account that your behavior will affect the amount of money you will earn throughout the experiment.

This sheet contains the instructions explaining the way the experiment works. Please do not converse with the other participants during the experiment. If you need any help, please, raise your hand and wait in silence. We will attend to you as soon as is possible.

The experiment is described as follows.

In this experiment each of you will be divided randomly in groups of 3 people. You will not know who will be in your group either during or after the experiment. There will be 3 types in this experiment: A, B and C. For the moment, you don't know which role will you play. Each A and each B has been assigned an endowment of points. Each A will have the opportunity to send to the paired B some, all or none of his or her endowment. Each point sent to Player B will be tripled. For example, if A sends 2 points to B, B will receive 6 points. If Player A sends 9 points to B, B will receive 27 points. The points sent by A are subtracted from A's total. B will then decide how many points to send back to A, keeping the remainder. Finally, C will also be endowed with some number of points and he or she will observe the behavior of the A and B in the group. Once he or she has observed B's behavior, C has the opportunity to use some, all or none of his or her points either to reduce B's points or to increase A's points, if he or she feels it is appropriate to do so. The points you are endowed with will be converted to actual dollars at the end of the experiment. This experiment is structured so that no one, including the experimenters, will know the personal decisions of people playing as A, B or C.

Your first task is to vote for the people you want to be in the role of C. The subjects who get the most votes will play as C's. The rest of people will be randomly assigned the role they will play (A or B).



**Voting procedure.**

Please, write below the number of the person you want to be in the role of C.

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### Instructions for A.

You are endowed with 10 points. You may send some (between 0 and 10 points, inclusive) of your points to B. The points you send will be tripled by the experimenter, so B will receive 3 times the number of points you send. For example, if you send 2 points to B, B will receive 6 points. If you send 9 points to B, B will receive 27 points. Your points (and B's points) will be converted to actual dollars at the rate of 2 points to \$1; in addition, both B and you will receive a \$5 show-up fee.

B is also endowed with 10 points. After observing how many points you have sent, B will decide how many points to send to you (not tripled), so you finally will get the points you have kept plus the points B returns to you. There will be three periods in the session; you will be paired with a different B in each period. You will not be told what B has chosen before proceeding to the next period. At the end of the experiment, we will roll a die to determine which period is chosen for actual payoff. One of the people chosen in the previous voting process will be C in your group. C is endowed with 40 points and will observe your behavior and B's behavior. If C feels that it is appropriate to do so, he or she may use some, all or none of his or her points either to reduce B's points, or to increase your points, if he or she feels it is appropriate to do so. For each point C uses, either Player B's points will be reduced by 3 units (that is, if C uses 4 points, then B's points will be reduced in 12 units) or your points will be increased in 3 units (that is, if C uses 4 points, then your points will be increased in 12 units). Each point that C uses is deducted from his or her total. You will not learn C's choice before proceeding to the next period. You have 10 points, how many points do you wish to send to Player B?

**Decision sheet for A.**

You have 10 points, how many points do you wish to send to Player B?

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### Instructions for B.

A has been endowed with 10 points and he or she must decide how many points to send to you. The points A sends are tripled by the experimenter, so you will receive 3 times the number of points A sends to you. For example, if A sends 2 points to you, you will receive 6 points. If A sends 9 points to you, you will receive 27 points. Your points will be converted to actual dollars at the rate of 2 points to \$1; in addition, both A and you will receive a \$5 show-up fee.

You are also endowed with 10 points. You will decide how many points to send to A, so Player A at the end will get the points she or he has kept plus the points you return to her or him. There will be three periods in the session; you will be paired with a different A in each period. At the end of the experiment, we will roll a die to determine which period is chosen for actual payoff.

A has sent you \_\_\_\_ points (from the 10 points she or he had), so you receive \_\_\_\_ points. Now, you must decide how many points you wish to send to A (from 0 to \_\_\_\_ points, inclusive). These points are not tripled. One of the people chosen in the previous voting process will be C in your group. C is endowed with 40 points and will observe your behavior and A's behavior. If C feels that it is appropriate to do so, he or she may use some, all or none of his or her points either to reduce your points or to increase A's points. For each point C uses, either your points will be reduced in 3 units (that is, if C uses 4 points, then your points will be reduced in 12 units) or Player A's points will be increased in 3 units (that is, if C uses 4 points, then A's points will be increased in 12 units). Each point that C uses is deducted from his or her total. You will not learn C's choice before proceeding to the next period. You now have a total of \_\_\_\_ points. How many points do you wish to send to A?

**Decision sheet for B.**

A has sent you \_\_\_\_ points (from the 10 points she or he had), so you now have a total of \_\_\_\_ points. How many points do you wish to send to A?

\_\_\_\_\_

### Instructions for C.

Each A and each B has been endowed with 10 points. Each A can send some, all or none of points to the B with whom he or she is paired. Each point sent to B will be tripled and subtracted from A's total points. For example, if A sends 2 points to B, B will receive 6 points. If A sends 9 points to B, B will receive 27 points. After observing A's choice, B will then decide how many points to send A and how many points to keep.

You are endowed with 40 points. Your points will be converted to actual dollars at the rate of 3 points to \$1. There will be three periods in the session. At the end of the experiment, we will roll a die to determine which period is chosen for actual payoff. You will observe the behavior of the A and B in your group. If you feel it is appropriate to do so, you can then use some, all or none of your points either to reduce B's points (you can use from 0 to 40 points, subject to the restriction that B's total points cannot be negative), or to increase A's points (from 0 to 40 points, inclusive). If you choose to reduce B's points, for each point you use, you will reduce by 3 points B's amount (that is, if you use 6 points, you will reduce B's amount in 18 points). If your choice is to increase A's points, for each point you use, you will increase by 3 points A's amount (that is, if you use 6 points, you will increase A's amount in 18 points). A and B know the previous information.

B has received \_\_\_ points (so B has a total of \_\_\_ points) and she or he has sent \_\_\_ points to A.

How many points, if any, do you wish to use to either reduce B's total points or to increase A's total points?

**Decision sheet for C.**

B has received \_\_\_ points (so B has a total of \_\_\_ points) and she or he has sent \_\_\_ points to A. How many points, if any, do you wish to use to either reduce B's total points or to increase A's total points?

\_\_\_\_\_ Points to reduce B's points.

\_\_\_\_\_ Points to increase A's points.