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TO BRIBE OR NOT BRIBE?
AN EXPERIMENTAL ANALYSIS OF CORRUPTION

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To Bribe or not Bribe?
An Experimental Analysis of Corruption

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Abstract

In this paper, we use laboratory experiments to investigate the phenomenon of corruption. In the first treatment, we replicate the Negative Externality treatment of Abbink et al. (2002) to verify the role of reciprocity in establishing corrupt relationships between two agents. The second treatment introduces a third agent into each group who monitors bribery and can sanction corrupt behaviour, knowing all the moves of the members of his group. Given that revealing the corruption is costly for the third agent, this may constitute an endogenous detection mechanism. Our results show that reciprocity can establish and sustain corruption between agents even though there is a negative externality on the other subjects in the experiment. Also, we find that introducing the monitoring agent increases the levels of corruption.

JEL Classification: C92, H41, Z13.

Keywords: Corruption, Reciprocity, Experiments.

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1 Introduction

Corruption is commonly recognized as being a major problem affecting all countries in the world. Several studies investigate the negative effects of corruption on economic growth (Mauro, 1995), on financial markets (Guiso et al., 2000) and on the accountability of institutions (Hunt, 2005; Hunt and Laszlo, 2005). These empirical works are based on real-world data and aim at isolating the social and economic features of corruption. In addition, several papers analyze cross-country studies in order to investigate the determinants of corruption and their changes across cultures (Fisman and Gatti, 2002; Swamy et al., 2001).

Unfortunately, these papers cannot fully capture the determinants of the corrupt action itself. In fact, when a subject is involved in a corrupt action, he has a strong incentive in keeping it secret. Thus, it becomes extremely difficult, if not impossible, to obtain the necessary data to perform the empirical analysis. In this framework, indeed, the experimental approach represents an essential tool to the study of corruption at the individual level. The laboratory is an easily controlled environment where it is possible to isolate the specific features that can be at play when subjects send and accept bribes. We can, thus, design experiments that mimic specific aspects of corruption scenarios, although in a simplified version, in order to gather individual data.

Notwithstanding the usefulness of this approach, the experimental analysis of corruption is still in its infancy[1]. Some studies, implementing an individual decision framework, test for differences in attitudes towards corrupt actions between students of economics and students of other disciplines (Frank and Schulze, 2000) and, for the effectiveness of exogenous detection mechanisms as a tool to control corruption (Schulze and Frank, 2003). Abbink (2004, 2005a) shows that bribery is based on the establishment of reciprocal and secret relationship between two subjects. In particular, Abbink (2004) finds that the rotation of staff in some problematic areas of governmental offices is a fruitful policy tool against bribery. Abbink (2005a), does not support the hypothesis that distributive fairness considerations make relatively well-paid public officials less corruptible. Surprisingly, in a framework with such strong moral contents, the adoption of loaded instructions does not influence the crooked behaviour of subjects (Abbink and Hennig-Schmidt, 2002). Cameron et al. (2005) address the issue of capturing cultural differences in the attitudes towards corruption by designing an experiment based on a reciprocity game.

Other aspects of corruption such as the effects of grease payments to bureaucrats (Gonzalez, Güth and Levati, 2004), the phenomenon of embezzlement (Azfar and Nelson, 2003), the corruption incentives

[1] For surveys on the different aspects of corruption in experiments, see Dusek, Ortmann and Lizal (2004) and Abbink (2005b).

generated by the procurement of inputs for public projects (Buchner et al., 2005) and the role of whistle-blowing in the context of anti-trust policy (Apesteguia et al., 2003) have also been studied. However, none of the mentioned works focuses on the potential role played by an endogenous detection system in which an agent has the possibility to observe his group members, and to report their illegal behaviour.

This paper builds on the experiments reported in Abbink Irlenbusch and Renner (2002), henceforth AIR, in that it focuses on the phenomenon of corruption by analysing the behaviour of subjects when they can establish a bribe-exchange. AIR modify a trust game in which two agents (the briber and the public official) can establish a corrupt relationship imposing a negative externality on the other agents in the laboratory. Our first treatment (labelled "Pairs) is a replication of the Negative Externality treatment described in AIR.

Our second treatment (labelled "Triplets") adds a new feature to the previous treatment. We introduce a third agent (the observer) into each group, who chooses whether or not to reveal the bribery occurring between the other group members. The presence of an observer reflects different real-world situations such as a colleague who has to be silenced in order to conclude safely a bribe-exchange; monitoring authorities whose control on public contracts needs to be softened; auditors who have to be persuaded to turn a blind eye to the balance of a firm.

Introducing the observer constitutes an endogenous detection mechanism. In fact, bribery can be uncovered only if the observer makes the costly decision to reveal it. In doing so, he foregoes part of his payoffs regardless of the amount sent by the briber. Thus, we aim to study subjects' attitude towards the establishment of corrupt reciprocal behaviour and the effect of our detection mechanism on bribery. To the best of our knowledge, we are the first to design an experiment on corruption where the probability of detection is made endogenous to the game.

In our experiment, we define bribery as the reciprocal choice of a public official to advantage a briber at the expenses of the others. For this purpose, we first analyze whether the reciprocal relationship between subjects occurs despite the negative externality caused on others. In the Pairs treatment, we check whether there is a correlation between the average amounts sent by bribers to public officials and the public officials' tendency to reciprocate deciding in favour of the briber.

In contrast, in the Triplets treatment corruption takes place when the observers do not reveal the corrupt relationship between the other group members. Hence, the attention is focused on the effects of the introduction of the observer into each group. As it will be explained in the next section, given that in the Triplets treatment the returns to corruption accruing to the public officials are lower than in the Pairs

treatment, because of a share of payoffs accruing to the observer, we should observe a decrease in corruption[2]. In other words, given that the payoffs from bribery are now divided among three subjects, the corrupt action becomes less profitable to public officials. Thus, bribers should be willing to sacrifice higher portions of their payoffs to ensure the public officials receive the same amount of money. In addition to this aspect, both bribers and public officials may prefer to avoid the risk of getting zero payoffs because of observer's confession at the end of each period.

Our results show that there is a positive correlation between the average offers sent by bribers and the decision to finalize the bribery made by public officials in both treatments, as in AIR. This finding confirms the crucial role played by reciprocity in our experiment, regardless of the negative externality imposed on all the other players in the laboratory. Comparing the results of the two treatments, we notice that both average positive offers and the relative frequency of corrupt decisions do not differ significantly between treatments. However, the levels of corruption, measured as the occurrence of the negative externality, are significantly higher in the Triplets treatment compared with the Pairs treatment. Hence, the presence of the observers in the Triplets treatment failed to reduce corruption levels. The present paper is

[2] The Triplets treatment shares some features with the relevant literature analyzing the role of a third party in different experiments with the main difference being the more interactive role played by the observers in our Triplets treatment (Kahneman, Knetsch and Thaler, 1986; Knez and Camerer, 1995; Guth and van Damme, 1998; Carpenter and Matthews, 2004; Fehr and Fischbacher, 2004; Bereby-Meyer and Niederle, 2005).

structured as follows. Section 2 describes the experimental design and Section 3 the predictions and the hypotheses. Section 4 presents the results of the experiment. Section 5 provides a discussion of our findings and Section 6 concludes.

2 The Experimental Design

As mentioned above, the Pairs treatment is a replication of the Negative Externality treatment of AIR, where bribery is modelled as a relationship occurring between two subjects, based on reciprocity and causing negative effects on the other players. Hence, bribery occurs when public officials accept the offers sent by bribers and decide to reward them at the expenses of others. The Pairs treatment is divided into three stages.

Stage I

In the first stage, the briber decides whether or not to offer an amount $t \in \{0,1,2,...,9\}$ of tokens to the public official and, if yes, how much he wants to offer. In the case of a positive offer, the briber pays a transfer fee of 2. This represents the transaction cost paid by the briber even if the public official rejects the offer.

Stage II

In the second stage, the public official decides whether to reject (R) or to accept (A) the offer if a positive offer was made. In the first case, the corrupt action does not occur and the payoffs may be either almost equal between briber and public official (34 and 36 Experimental Currency, hereafter EC) or very different (54 and 30 EC) according to the choice that the public official will make in the third stage. In the second case, the public official receives the tripled amount originally sent by the briber in Pairs treatment. This feature reflects the strong impact of the bribe on the alternative honest payoff of the public official[3]. On the one hand, the tripling of the bribe may seem unrealistic; on the other hand, for instance, a poor public employee has a higher marginal utility of money that the rich owner of a firm. This aspect is indeed captured by the tripling of the bribe in the experiment.

Stage III

In the third stage, the public official chooses between two options: X or Y. The Y choice is rather in favour of the briber, whereas the X choice benefits more the public official. This difference in payoffs

[3] The incentive to bribe-taking behaviour due to low wages in the public service is well known in the empirical literature on the determinants of corruption (Treisman, 2000; Mocan, 2004; Hunt and Laszlo, 2005).

reflects the preference[4] of the public official for the honest choice (X) because of the higher effort required to conclude the bribe-exchange.

In order to capture the severe effect of corrupt behaviour on society, a fixed monetary loss is imposed on all the other subjects in the laboratory when the public official chooses Y. Like in AIR, the negative externality causes a decrease of three EC from the payoffs of the period in which bribery occurs. In each period, each subject suffers up to a maximum loss of 24 EC. Thus, the total damage goes beyond the gains achievable by each pair.

Because of the secret nature of corruption, no feedback on the levels of corruption reached in the laboratory is given to the subjects. As a consequence, subjects are not informed on the total amount of loss they suffer in each period. At the end of the experiment, subjects will be informed on the loss suffered in each period. Hence, each pair can be considered as an independent observation given that the individual's choices are not affected by other pairs' behaviour and that the same subjects play in the same pair throughout all the experiment.

The payoff structure of the Pairs treatment can be described using the following indicator functions.

[4] We are aware that public officials' preferences may be driven also by the implicit risk of detection and punishment. However, in our experiment we do not explicitly control for such possibilities.

$$i_t = \begin{cases} 1 \text{ if } t > 0 \\ 0 \text{ otherwise} \end{cases}$$

$$i_A = \begin{cases} 1 \text{ if A is chosen by the public official} \\ 0 \text{ otherwise} \end{cases} \quad (1)$$

$$i_Y = \begin{cases} 1 \text{ if Y is chosen by the public official} \\ 0 \text{ otherwise} \end{cases}$$

Thus, we obtain the following payoff functions.

$$\begin{aligned} \pi_{Briber} &= 36 - 2 * i_t - t * i_A + 20 * i_Y \\ \pi_{Public\ Official} &= 36 + 3 * t * i_A - 6 * i_Y \\ \pi_{Others} &= -3 * i_Y \end{aligned} \quad (2)$$

The Triplets treatment is played like the Pairs treatment with one exception. Namely, we introduce a new agent into each group, the observer, who decides whether to reveal or not the bribe-exchange established between the other two group members. In this case, corruption occurs when the observer does not reveal the bribe-exchange, and thus, the negative externality imposed on the others takes place. If the observer reveals the bribe-exchange he will earn a fixed amount of 15 EC, whereas the other two group members will get zero. Hence, with respect to the Pairs treatment we only add one more stage.

Stage IV

This stage is only played in the Triplets treatment. At this point, the observer decides whether to consent to (C) or to disclose (D) the corrupt relationship occurring between the briber and the public official. For this purpose, he receives complete feedback on the choices made by the other group members in the previous stages. If, on the one hand, the observer chooses to reveal the bribery, he earns a fixed amount regardless of the decisions taken in the previous stages of the game, whereas both the briber and the public official get zero payoffs. If, on the other hand, the observer complies with the bribery, he earns a higher fixed amount plus the amount sent by the briber (t). In this case, both briber and public official earn positive payoffs.

Also in this treatment there is a negative externality caused to the whole society by at least one observer accepting the bribery. In each period, each subject suffers up to a maximum loss 15 EC in the Triplets treatment, when all the observers choose C. Thus, also in this case, the total damage goes beyond the gains achieved by each group. Like in the Pairs treatment, subjects are not informed on the total amount of loss they suffer in each period. Hence, each group can be considered as an independent observation given that the individual's choices are not affected by other groups' behaviour.

To describe the payoffs structure of the Triplets treatment, we need to distinguish between two scenarios. In the first, the observer does not have the possibility to decide on the bribery. This may occur when the briber sends a zero offer, or when the public official rejects a positive offer and chooses X in stage III. If this is the case, we obtain the following payoff functions.

$$\begin{aligned} \pi_{Briber} &= 36 - 2 * t_i \\ \pi_{Public\ Official} &= 36 \\ \pi_{Observer} &= 20 \end{aligned} \tag{3}$$

In the second, the observer can decide whether to reveal or not the corruption. This occurs when the public official chooses the Y alternative in the third stage. Moreover, the observer enters the game in another case: when the public official accepts a positive offer sent by the briber and chooses X instead of Y. In this case, the detection mechanism is triggered by the acceptance of a positive offer regardless of the subsequent public official's choice. Almost the same possibility is described in AIR, where an exogenous lottery, functioning as discovery mechanism, is played out whenever a positive transfer is accepted regardless of the following public official's move. It is the case in which the public official accepts the bribe but does not choose in favour of the briber. A similar possibility

is described in AIR, where an exogenous lottery, functioning as discovery mechanism, is played out whenever a positive transfer is accepted regardless of the subsequent public official's choice.

In real-world situations, greasing up bureaucrats in order to influence or speed up some decisions does not always repay. In fact, the public servant can always take the money without favouring the briber and, then, accusing either honest colleagues or the tight monitoring of the office manager for not being able to advantage the briber. In such a situation a colleague (i.e. an observer) of the dishonest bureaucrat may be willing to punish him for both accepting the bribe and cheating on the citizen.

Hence, we consider the following additional indicator function.

$$i_C = \begin{cases} 1 \text{ if C is chosen by the observer} \\ 0 \text{ otherwise} \end{cases} \tag{4}$$

Here, we obtain the following payoff functions.

$$\begin{aligned} \pi_{Briber} &= \left[36 - 2 * i_t - t * i_A + 20 * i_Y\right] * i_C \\ \pi_{Public\ Official} &= \left[36 + 2 * t * i_A - 6 * i_Y\right] * i_C \\ \pi_{Observer} &= 20 + 5 * (i_C - 1) + t * i_C \\ \pi_{Others} &= -3 * i_C \end{aligned} \tag{5}$$

Each player receives feedback on both his own decision and the choices of the other group members in each period. As mentioned, he does not know the level of the negative externality affecting his payoffs until the end of the experiment.

Figure 1 offers summarises the Triplets treatment, whose structure can be described by a (incomplete)[5] game tree. The Figure is divided into four levels, one for each stage, and shows the actions and the moves available at each step of the game. It also illustrates all the cases in which the negative externality occurs at the end of stage IV.

Each of the two treatments is played for 30 periods. For each treatment we run two sessions. The group composition and the role assigned to each subject remain the same during the 30 periods. The experiment was conducted at the University of Catania and at the AL.EX. experimental laboratory of the University of Eastern Piedmont[6]. Both treatments were split equally across locations. A total of 66 subjects were

[5] The game tree is incomplete in the sense that the final payoffs reported do not account for the decisions of all the other groups.

[6] The adoption of two labs sited in such different Italian regions (Sicily and Piedmont) motivated us to test for possible within-country differences, as pointed out by several studies based on the Italian case (Banfield, 1958; Putnam, 1993; Guiso et al., 2000; Del Monte and Papagni, 2001 and 2005). Applying the MWU test to compare the average transfers and relative frequency of Y choice reached in the two labs, we found no significant differences between treatments with the only exception being the average offers sent by bribers in the Triplets treatment (MWU test, p=0.001). However, given that a bribe-exchange is concluded with the public official choosing Y, the difference in the average offers alone does not qualify as corruption. Hence, we provide no support for the common opinion on the lower level of "civic-ness" (Putnam, 1993) reported in the South of Italy as affecting law enforcement and the attitude towards illegal behaviours.

recruited among a population of students in economics, law and political science. Each student participated only in one session of our experiment.

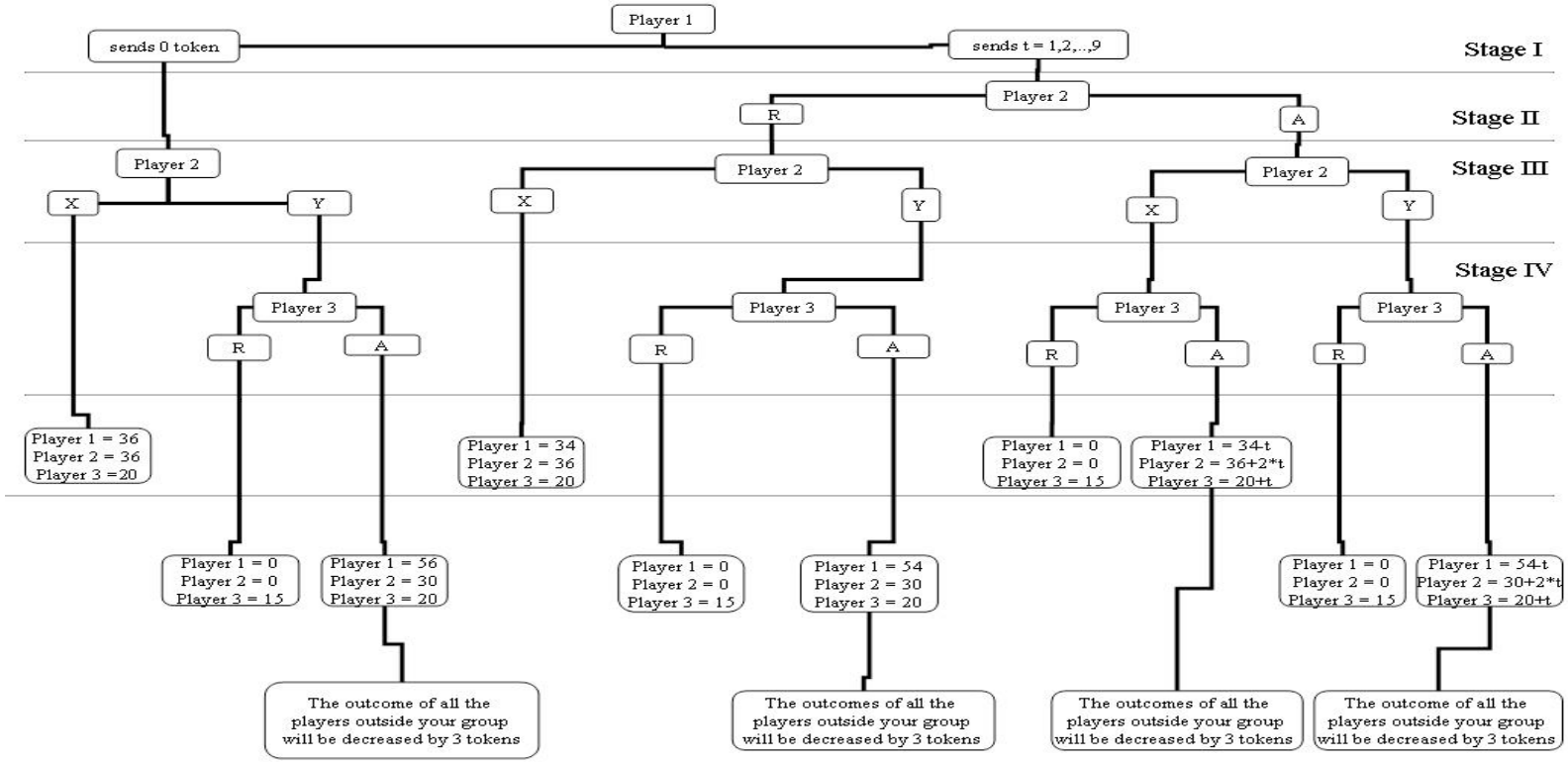
We implemented a fixed matching protocol and a neutral wording for the instructions. We obtained 12 independent observations from 36 subjects participating into the Triplets treatment and 15 independent observations from 30 subjects joining the Pairs treatment[7].

Before beginning the experiment, the instructions were read aloud and explained in detail. Each session started only after checking students' answers to a control questionnaire placed at the end of the instructions to test their comprehension of our experiment. Any kind of communication among subjects was forbidden.

Subjects typed their decisions directly into the computer at their own pace. The staff of the *Centro Informazione Giuridica* of the University of Catania developed the experimental software. At the end of each treatment, subjects were paid anonymously in cash at the following exchange rate: 1 Experimental Currency (EC) = 0.01 euro. On average, subjects earned 12 euro. Each treatment lasted between 90 and 120 minutes.

[7] We are aware of the difference in the levels of the negative externality between the sessions because of their different sizes. However, given that these differences are relatively small (6 groups in each Triplets session, 7 pairs in the first Pairs session, and 8 pairs in the second Pairs session), we do not expect to observe such a strong effect on individuals' decisions.

Figure 1: Triplets Treatment Game



3 Hypotheses

The appropriate solution concept for this game is the subgame perfect Nash equilibrium. However, as pointed out by AIR, subgame perfectness strictly speaking does not apply here because of the externality imposed on the others (which is not revealed until the end of the game). AIR show that an own-profit maximizing subject will always follow the same path, regardless of the negative externality levels. This path constitutes, then, the equilibrium path and suggests that the briber will never send any positive offer and the public official will always choose X. We follow AIR here in that our predictions are based on the equilibrium path without looking for any refinement concept. We nevertheless refer to these predictions as "equilibrium predictions".

In the Pairs treatment, the equilibrium prediction is that no corruption should occur between rational own-payoff maximizing subjects. In fact, a public official will never choose Y, given that this choice would lower his payoffs. At the same time, a briber has no incentive to send any positive amount to the public official, since this choice will not be rewarded in the following stage. By backward induction, this equilibrium path holds for all periods.

In the Triplets treatment, the same logic applies. As equations (3-5) show, an observer will always choose C whenever the game reaches

the fourth stage. However, a public official has no incentives to choose Y in the third stage. On this basis, there is no incentive for a briber to send a positive offer to a public official who will never reciprocate choosing Y. In fact, transferring a positive amount will not result in a monetary gain for a briber, compared with the other options and given the incentives on the other two players. This result is independent of the choices made by all the other groups in the laboratory.

It follows that, in both treatments, the equilibrium prediction is that bribers will send zero offer, public officials will choose X and, in the Triplets treatment only, observers will not play because the game will never reach the fourth stage.

By contrast, the experimental literature reported in the previous section suggests that corruption takes place and that subjects often fail to follow the equilibrium behaviour. Thus, we can obtain a second benchmark from the results of several experimental studies on the role of reciprocity in trust games showing that subjects reward kind acts and punish unkind acts by other agents, even if it is costly for them to do so (Berg et al., 1995; Fehr et al., 1997; Abbink et al., 2000; AIR, 2002; Dufwenberg and Gneezy, 2000). On the same line of reasoning, if agents are moved by trust and reciprocity, bribers will send positive offers and public officials will reciprocate accepting the offer (i.e. choosing A) and will reward bribers choosing Y. Then, in the fourth stage, observers will

accept the bribe (C). Hence, corruption takes the form of a reciprocal relationship between the group members. This sequence of moves constitutes our second benchmark. Table 1 summarizes the choices corresponding to each benchmark in both treatments.

Table 1: Benchmarks

	Equilibrium Strategy	Reciprocal Strategy
Pairs	t=0, X	t>0, A, Y
Triplets	t=0, X	t>0, A, Y, C

On the basis of previous experimental results, we conjecture that reciprocity may generate a correlation between the average offers sent by bribers and the average relative frequency of Y choice made by public officials. Our conjecture is corroborated by AIR's strong evidence in support of reciprocal behaviour between agents. Thus, we formulate our first hypothesis.

Hypothesis 1. In both treatments there is a positive correlation between offers and the relative frequency of the Y choice.

When public officials choose between the alternatives X or Y, there are two different ways of evaluating a bribe. Firstly, public officials may compare the offers sent by bribers with the highest feasible offers. On this basis, for example, an offer of seven tokens out of nine may be awarded by choosing Y in either treatment.

Secondly, a well-accepted offer in the Pairs treatment may become less appealing to public officials in the Triplets treatment. The reason is that, in the Pairs treatment, the amount accruing to the public official after accepting the offer is 3*t, whereas, in the Triplets treatment, the same choice is less profitable to public officials (2*t). Thus, bribers need to sacrifice more in order to ensure the public officials earn the same amount of money by accepting the offer[8]. For example, for accepting a bribe to be worthwhile, each briber needs to send a minimum offer of two tokens in the Pairs treatment but three tokens in the Triplets treatment. If these arguments are relevant, given there is an attempt to bribe ($t>0$), the amounts sent by bribers should be higher in the Triplets treatment.

However, the difference in the amounts accruing to the public official, conditional on accepting the offer, may not be relevant at all if a public official is willing to reciprocate to a positive offer from the briber by choosing Y regardless of the profitability of the offer. In fact, as

[8] In fact, the fair division offer in the Triplets treatment is to send eight tokens out of nine to public officials, whereas it is of six tokens in the Pairs treatment.

suggested by AIR , “the exchange of benefits is observable also if it does not maximize the individual player’s own payoffs” (p.438).

In any event, both bribers and public officials may be discouraged from establishing a bribe-exchange by the risk of getting zero payoffs in the case of the observer’s confession at the end of each period. That is, not only is bribery more costly in Triplets, it is also more likely to get revealed. On the basis of these effects, we formulate our second hypothesis.

Hypothesis 2. In the Triplets treatment the level of corruption is lower than in the Pairs treatment.

4 Results

4.1 Overview

Table 2 shows the average relative frequency of each sequence of choices available to subjects in both treatments over the thirty periods. We will use the above-mentioned benchmarks to analyse our results. The first benchmark corresponds to the equilibrium prediction in both treatments and, it involves zero offers from the briber and the choice of X by the public official. Table 2 shows a clear deviation from the equilibrium

prediction in 42% (Pairs treatment) and in 54% (Triplets treatment) of the cases. It follows that the equilibrium prediction can explain much but not all of the data.

Table 2: Average Relative Frequency of Decision Patterns

Pairs Treatment	Av. Rel. Freq.	Triplets Treatment	Av. Rel. Freq.
t=0, X	0.58	t=0, X	0.46
t=0, Y	0.04	t=0, Y, D	0.02
		t=0, Y, C	0.02
t>0, R, X	0.02	t>0, R, X	0.20
t>0, R, Y	0.00	t>0, R, Y, D	0.01
		t>0, R, Y, C	0.01
t>0, A, X	0.28	t>0, A, X, D	0.05
		t>0, A, X, C	0.13
t>0, A, Y	0.08	t>0, A, Y, D	0.03
		t>0, A, Y, C	0.07

Among all the possible deviations from the equilibrium prediction, the occurrence of the negative externality on the others, i.e. the establishment of corruption, takes place in the 12% (Pairs treatment) and in the 23% (Triplets treatment) of the cases. Table 2 shows the second benchmark corresponding to the reciprocal pattern in the Pairs treatment, occurring in only 8% of the cases. However, it accounts for almost the 70% of the negative externality caused. In the Triplets treatment, the same reciprocal pattern takes place in almost the same

proportion as in the Pairs treatment (7% of the cases). However, it only causes the 30% of the negative externality.

Whereas in the Pairs treatment positive offers are almost never rejected, in the Triplets treatment this happens in the 22% of the cases. Moreover, rejecting the offer and choosing X can be interpreted as honest behaviour of public officials[9]. In fact, this choice, which does not impose any externality on the others, is a lot more frequent in the Triplets treatment (20% of the cases) than in the Pairs treatment (2%).

Finally, public officials often simply play their best reply by accepting the bribe but refusing to take the corrupt action. Doing so, they avoid the creation of the negative externality on the others in the Pairs treatment. This strategy path is followed in 28% of the cases. In Triplets treatment, public officials play their best reply in 18% of the cases. This choice accounts for the 57% of the negative externality generated in the Triplets treatment.

4.2 Reciprocity and Corruption

Table 3 shows the average offer per group and the average relative frequency of Y choice made in both treatments over all periods. It provides a clear picture of the role played by reciprocity on individual

[9] This sequence of decisions takes place in the 20% of the cases.

behaviour. This role is confirmed by the strong positive correlation existing between the group averages of bribes and relative frequency of Y choice in each treatment, ρ_T=0.97 and ρ_P =0.98[10]. Thus, we notice that, in most of the groups, higher average offers sent by bribers corresponds to higher relative frequencies of Y choice made by the public officials, regardless of the negative externality caused on the others. Hence, the data confirm our first hypothesis.

Table 3: Average Offer and Average Relative Frequency of Y Choice per Group

Triplets	Pairs	Triplets	Pairs
Av. Transfer	*Av. Transfer*	*Y*	*Y*
6.8	4.2	0.40	0.37
2.9	3.8	0.30	0.37
2.5	3.2	0.23	0.30
1.7	2.7	0.20	0.23
1.7	1.9	0.13	0.17
1.4	1.6	0.10	0.13
1.3	0.9	0.10	0.10
1.2	0.7	0.10	0.07
0.6	0.6	0.10	0.07
0.5	0.5	0.07	0.03
0.5	0.4	0.07	0.03
0.1	0.3	0.03	0.00
	0.3		0.00
	0.3		0.00
	0.0		0.00
Average 1.83	1.43	0.16	0.13
St. Dev. 1.74	1.40	0.11	0.14

In addition, we check whether the results of our Pairs treatment successfully replicate those of the Negative Externality treatment of AIR. In particular, the MWU test finds significant differences between both the

[10] Both Spearman's ρ are significant at 1% level. The same result is shown in AIR.

average group offer and the average relative frequency of Y choice reached in the two treatments ($p<0.01$). In particular, the Negative Externality treatment shows higher values of both variables than the Pairs treatment. However, we are aware that the results of this comparison may be influenced by several factors such as the nationality of subjects, the number of subjects participating in the experiments, the software used to run the sessions. Hence, this result must be carefully interpreted because of its composite nature.

Figure 2 shows the distribution of the average offers sent by bribers. In both treatments, the zero offers account for at least half of the cases. Looking at positive offers only, we notice that the frequencies tend to decrease when the offers increase in correspondence of almost all the offer levels (except for the frequency of t=9 offers in the Triplets treatment)

Figure 2: Distribution of Offers

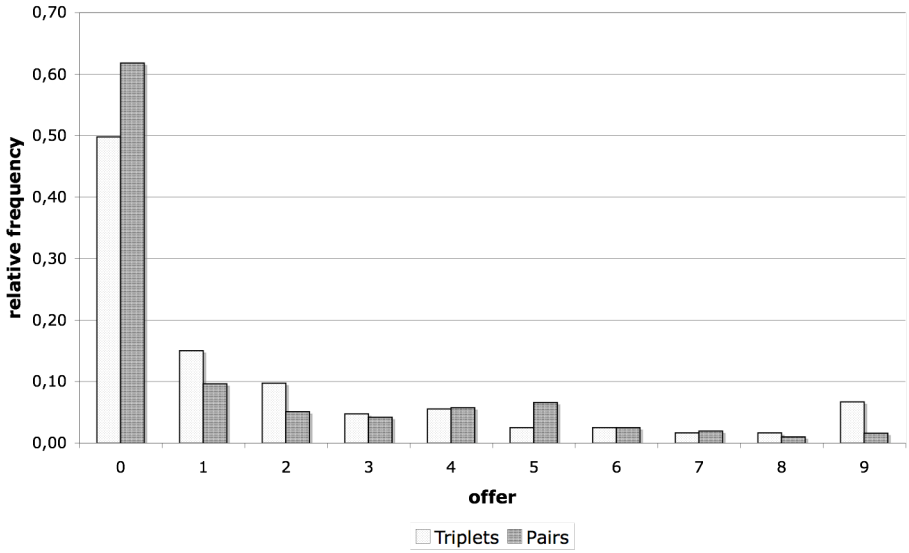


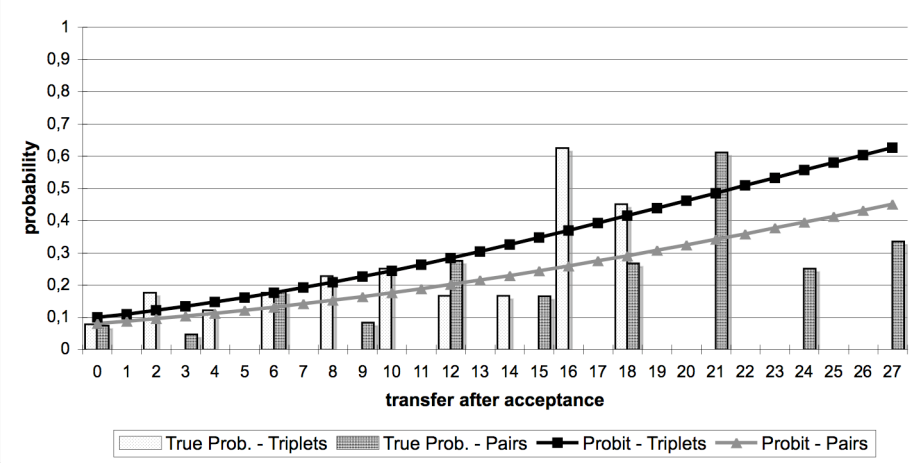
Figure 3 shows the probability distribution of a Y choice conditional on the actual amounts obtainable by the public officials when they accept the offers. We consider the distribution of the true probability of a Y choice coming from each treatment. In both cases, increasing the actual amounts public officials earn corresponds to increasing the probability of choosing Y. Thus, public officials are willing to reward high returns by choosing Y and, on the contrary, to punish bribers by choosing X after zero or low returns. In both treatments, bribers sent low offers and public officials accepted them but, they chose Y with a low frequency[11].

[11] For instance, offers smaller than the one leading to the equal share of payoffs between bribers and public officials at the end of the bribe-exchange occurred in 94% of the

To control for the robustness of the relationship just described, we run a probit regression for each treatment with the binary variable Y as dependent variable. In both cases, the explanatory variable is the average actual amount of tokens obtained by public officials after accepting the offer. Figure 3 shows the results of probit regressions. The data confirm the relationship based on the true probabilities of a Y choice. In particular, the probit analysis shows that the probability of a Y choice, conditional on the amount actually received by public officials in the Triplets treatment, is higher than in the Pairs treatment. However, whereas both coefficients (0.059 in the Triplets treatment and 0.047 in the Pairs treatment) are significantly different from zero ($p<0.001$), the difference between the two coefficients is not significant according to the Wald test ($p=0.37$).

cases in the Triplets treatment and in 93% of the cases in the Pairs treatment, whereas the corresponding average relative frequency of Y choice was 17% in Triplets treatment and 14% in Pairs treatment.

Figure 3: Probability Distribution of Y Choice on Transfers received by Public Officials

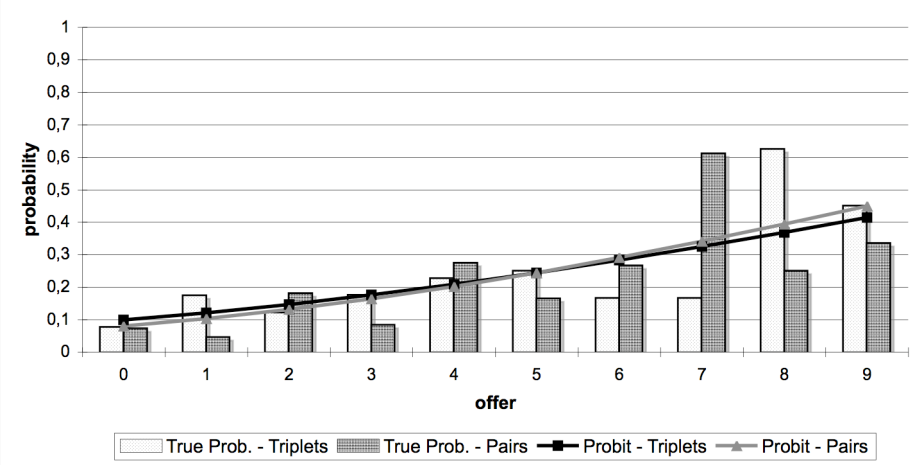


Also, we performed the same analysis considering the levels of the offer sent by bribers instead of the actual transfers received by the public officials after accepting the offers. As mentioned above, a public official may decide to accept the offer by looking at the portion of endowment that a briber is willing to sacrifice, instead of considering the actual amounts at his disposal after accepting the offer. Figure 4 shows both the probability distributions of Y choice coming from each treatment and the probit regressions. The results show that the probability of public official choosing Y increases when bribers send high offers. Also, the probit analysis supports the same finding. Moreover, the Wald test ($p=0.94$) fails to find significant difference between the two probit

coefficients[12] (0.12 in the Triplets treatment and 0.14 in the Pairs treatment). We summarize our findings as follows.

Result 1. Corruption is established out of reciprocity between agents, regardless of the negative externality caused on the others. In both treatments, an increase of the amounts sent by bribers makes the Y choice of public officials more likely to happen.

Figure 4: Probability Distribution of Y Choice on Offers sent by Bribers



[12] Both coefficients of the probit regressions are significantly different from zero ($p<0.001$).

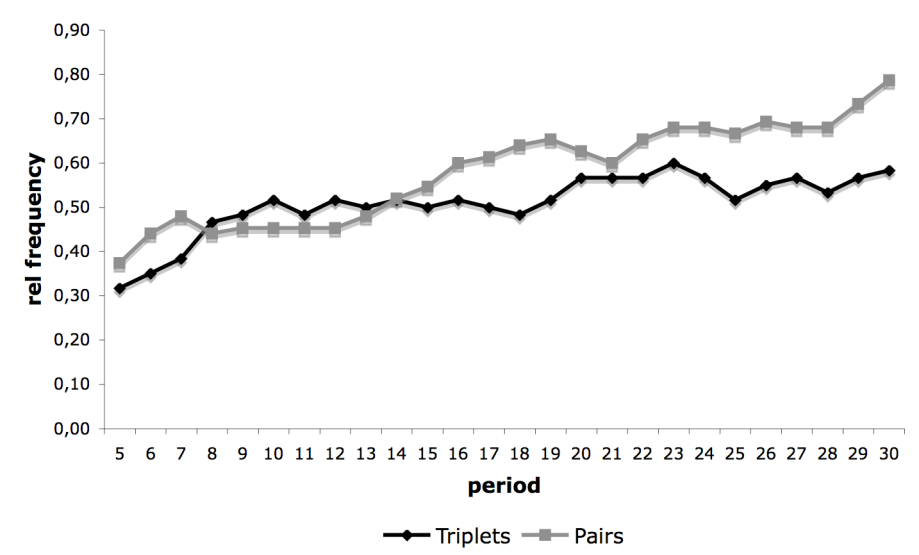
4.3 The Evolution and Level of Offers

Given our definition of corruption as a long-term relationship between agents based on trust and reciprocity, we look at the time trend and at the levels of the offers through the thirty periods of observation. We report the moving average on the last five periods of observations in order to reveal more clearly the underlying patterns of both variables.

As already shown, Figure 2 suggests a potential bias in the average offer trends due to the massive presence of zero offers in both treatments. To isolate this effect, we describe the patterns of zero offers and average positive offers with two separate Figures. In the first case, Figure 5 shows the evolution of zero offers through time in both treatments. The average relative frequency of zero offers is 0.51 in the Triplets treatment and 0.58 in the Pairs treatment. This result is quite surprising given that there is no detection mechanism in the Pairs treatment, and that even an offer of two tokens would be enough to start a bribe-exchange, as explained in the previous section. The MWU test finds significant differences between the two treatments ($p=0.04$). The trends of the two treatments are increasing, with the Pairs line being most of the times above the Triplets one[13].

[13] Both Spearman's ρ are significant at 1% level.

Figure 5: Evolution of Zero Offers



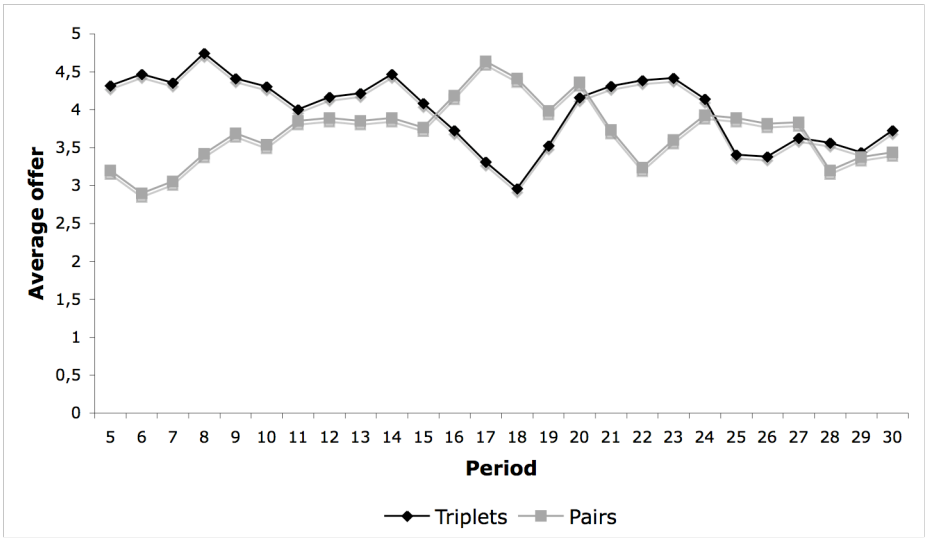
In the second case, Figure 6 shows the average offer conditional on being positive (that is, t>0) in both treatments across treatments. The average positive offer is 4 tokens in the Triplets treatment and 3.70 tokens in the Pairs treatment[14]. The MWU test fails to find significant differences between the two treatments (p=0.94). This result still holds when we include the zero offers in the calculations (p=0.32). In the Triplets treatment, bribers did not increase significantly the positive offers to ensure the public officials earn the same payoffs as in the Pairs treatment. On the one hand, the introduction of observers as endogenous

[14] In the case of the evolution of positive offers both Spearman's ρ turn out to be not significant.

detection devices limited the positive offers sent by bribers in the Triplets treatment by raising the risk of zero payoffs. However, on the other hand, it did not succeed in reducing the bribe-exchange with respect to the Pairs treatment.

Result 2. Average Offers and average positive offers do not differ between treatments. In contrast, the frequency of t=0 choices is statistically different in Pairs and Triplets.

Figure 6: Average Positive Offers

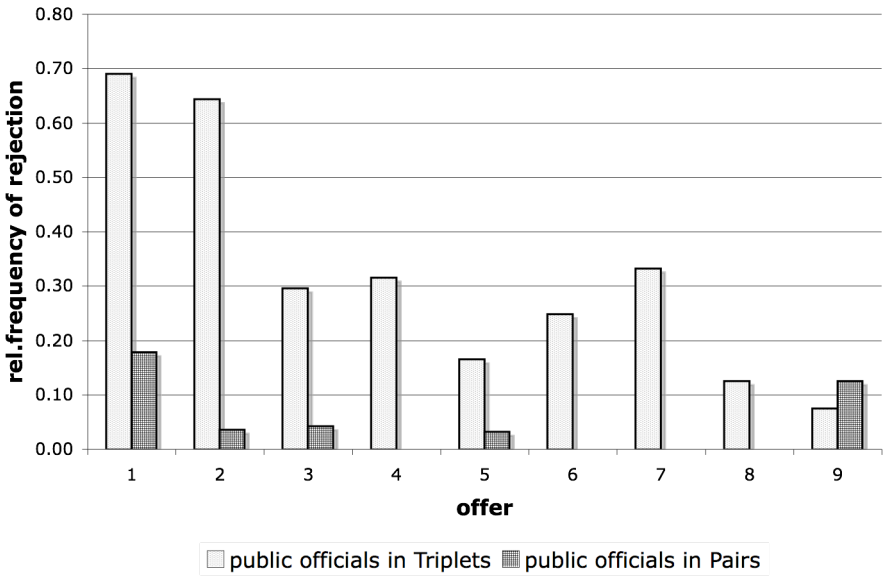


4.4 Levels of Rejections

Figure 7 shows the relative frequency of offer rejections made by public officials in both treatments. In the Pairs treatment, public officials should always accept the bribe given that it is their best reply. Accordingly, both Table 2 and Figure 7, show that rejection levels are very low in spite of the offers being often below the fair division. In other words, public officials follow almost always their best reply regardless of the amount sent by bribers. In addition, we find no significant correlation between the relative frequency of bribe acceptance and the size of the bribe ($p=0.5$).

In the Triplets treatment the frequency of *rejections* shows a significant and decreasing trend ($p=0.01$). However, the level of correlation between the relative frequency of bribe *acceptance* and the size of the bribe is not significant ($p=0.2$). In addition, the MWU test finds significant differences between the levels of rejection of public officials in the two treatments ($p=0.008$). Public officials reject offers significantly more often in the Triplets treatment than in Pairs treatment. We summarize our results as follows.

Figure 7: Distribution of Rejections



Result 3. In the Pairs treatment, few rejections occur regardless of the low offers sent whereas, in the Triplets treatment, the relative frequency of rejections decreases when offers increase. This result is clearly due to the increased risk of establishing a bribe-exchange when the observer is present. Finally, in the Triplets treatment, public officials reject offers significantly more often than in the Pairs treatment.

4.5 Triggering the Negative Externality

Figure 8 shows the average relative frequency of both Y choice made by public officials and the occurrence of the negative externality imposed on the other agents in the laboratory[15]. In this case we need to distinguish between the implications of the Y choice in the two treatments. In the Pairs treatment, the Y choice does irrevocably impose the negative externality on the others, whereas in the Triplets treatment the observer might still reveal the corrupt act (in which case the externality does not occur). The relative frequency of the negative externality in the Triplets treatment, conditional on the offers, is described by the dotted line in Figure 8.

We first look at the Y choice in the two treatments. On average, public officials choose Y in 15% of the times in the Triplets treatment and, in 12% of the times in the Pairs treatment. Given that the minimum offer that makes bribery profitable for public officials is two tokens in the Pairs treatment, we should not observe any Y choice in the case of offers lower than the minimum one. Similarly, in the Triplets treatment, the reciprocal Y choice is profitable for public officials only when it is equal

[15] Also in this case we report the moving average on the last five periods of observations.

or higher than three tokens[16]. Thus, the low frequencies of Y choice reported in both treatments point out the occurrence of low offers (or actual transfers) received from the bribers. The MWU test finds no significant difference between the Y choice in the two treatments ($p=0.27$)[17].

Second, on average in the Triplets treatment, the negative externality occurs in 23% of the cases, whereas it is reported in only 12% of the cases in the Pairs treatment. The MWU test finds significant differences between the relative frequency of the negative externality in the two treatments ($p=0.04$). In addition, in 73% of the cases in which our experiment reached the fourth stage, the observers did not reveal the bribe-exchange that occurred between bribers and public officials. This is explained by the fact that, in the Triplets treatment, complying with the bribery is always profitable for the observers regardless of the offer level. However, data show that the observers increase the rejection levels only in the case of high offers (7-9 tokens) showing positive attitude towards honest behaviour[18]. They may be willing to sacrifice a portion of their

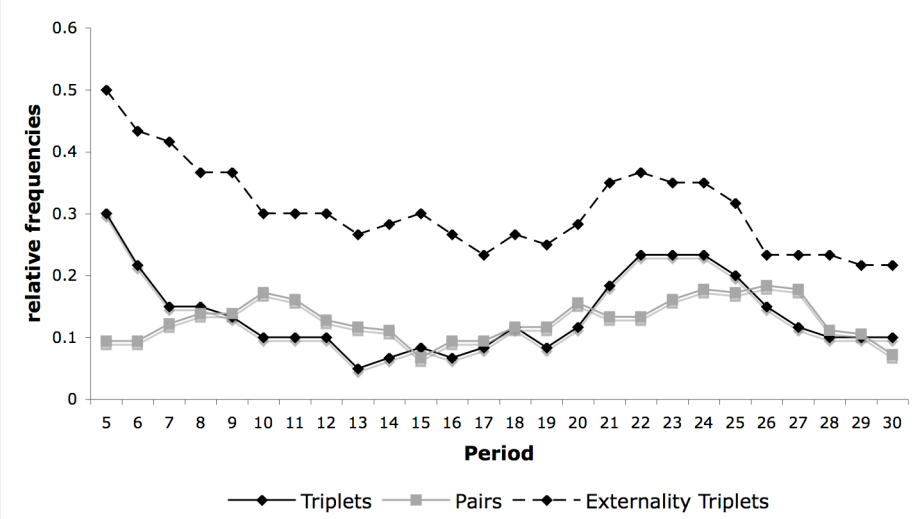
[16] The difference between the minimum offer levels is due to the lower payoffs accruing to public officials in the Triplets treatment compared with the Pairs treatment.
[17] By contrary, in the first six periods of the game, the difference between the two treatments turns out to be significant ($p=0.03$),
[18] This result has to be evaluated carefully because it is based on few observations given that the observers enter the game less frequently than public officials (31% of the cases, see Table 3). We find no significant correlation between the choice of covering up the bribe and its size ($p=0.3$).

payoffs to both punish the corrupt group members and avoid the negative externality on the other subjects in the lab to occur.

Concluding, the presence of the observers in the Triplets treatment did not affect the relative frequency of Y choice of public officials compared with the Pairs treatment, whereas it significantly increased the level of the negative externality imposed on others. The additional amount of negative externality generated in the Triplets treatment is due to the observer deciding not to reveal the corruption when the public official accepts the bribe but chooses the alternative X. Like in AIR, here the detection mechanism is triggered by the transfer acceptance regardless of the public official's move. Thus, we find that the levels of corruption in the Triplets treatment are higher than in the Pairs treatment. Hence, the data reject our second hypothesis. We can summarize our results as follows.

Result 4. The relative frequencies of the negative externality in the Triplets treatment are significantly higher than in the Pairs treatment, whereas there are no significant differences between the relative frequencies of Y choice. Hence, the introduction of the observers causes an increase in corruption levels.

Figure 8: Y Choice and Negative Externality Frequencies



5 Discussion

The role of the probability of detection and its combination with the size of the fines stimulated an extensive theoretical literature (Becker and Stigler, 1974; Rose-Ackermann, 1975; Polinsky and Shavell, 1979). Those works treat the probability of discovery as an exogenous factor, whereas other theoretical studies give a strategic role to monitoring authorities. For instance, Basu et al. (1992) analyse the case in which the agent who is caught bribes the policeman, who in turn can also bribe if his bribe-taking is discovered by another policeman, and so on. Marjit and Shi (1998) find similar results by making the probability of detection dependent on the effort of a corrupt official.

In the experimental literature, the probability of detection remains usually exogenous to the game. In Schulze and Frank (2003), the detection mechanism is given by subjects rolling a dice to determine whether they will be caught. AIR model the detection device as an exogenous lottery. The authors find that this exogenous device significantly lowers corruption. Finally, Azfar and Nelson (2003) study the role of monitoring in the case of embezzlement.

Similarly to Basu et al. (1992) and Marijt and Shi (1998), our design assigns a strategic role to the monitoring authority represented by the observers in the bribery game[19]. In the Triplets treatment, each observer chooses whether or not to reveal the corruption, where the honest choice is costly for the observer regardless of the amount sent by. This feature makes the probability of detection endogenous to the game. Our results show that this detection device fails to reduce the levels of corruption. In fact, whereas both relative frequencies of Y choice and average positive offers are not significantly different between the two treatments, the relative frequency of the negative externality is significantly higher in the Triplets treatment compared with the Pairs

[19] Cameron et al. (2005) design a one-shot three-player experiment with three stages where, in each group, one member is negatively affected by the corruption occurring between the other two members and may decide to punish the one accepting the bribe in the third stage of each period. The punishment produces a payoffs reduction for both the sender and the recipient. In contrast to our design, they do not allow for punishment towards the briber and, once the bribe is accepted, the public official cannot deviate from the reciprocal choice. The authors also find that corruption is punished in almost half of the cases.

treatment. Thus, we provide support to the negative effects due to the strategic role played by the monitoring authorities as reported by Basu et al. (1992) and Marijt and Shi (1998).

Finally, given the similarities between our design and AIR, we can qualitatively compare the performance of AIR's exogenous lottery with our endogenous mechanism. Our results show that the AIR's exogenous lottery mitigates corrupt behaviour whereas our endogenous mechanism fails to do so. Thus, monitoring institutions should be created in such a way to minimize the interaction between those in charge of monitoring and those under control.

6 Concluding Remarks

The main aim of this paper has been to study the phenomenon of corruption applying the experimental approach. Experiments, indeed, proved to be a fruitful tool to solve problems common to many works on corruption, such as the difficulty in gathering data on illegal behaviour at the individual level. For this purpose, we designed our experiment to investigate the determinants of corrupt relationships between two agents (briber and public official). We investigated this problem in the first treatment replicating the Negative Externality treatment of AIR. The second treatment added a new feature to the previous treatment. We

introduced a third agent (the observer) in each group, who decided whether or not to reveal the bribery at the end of each period.

We found that reciprocal relationships between bribers and public officials can be established despite the negative externality caused on others. In other words, we observed that offers sent by bribers and the relative frequencies of Y choice made by public officials are positively correlated in both treatments. Comparing the results of the two treatments, we can also test whether the level of corruption in the Triplets treatment was lower than in the Pairs treatment. Both average positive offers and the relative frequency of Y choice did not differ significantly across treatments. However, the levels of corruption, measured as the occurrence of the negative externality, are significantly higher in the Triplets treatment compared with the Pairs treatment. Hence, the presence of the observers in the Triplets treatment failed to reduce corruption levels. Finally, in the Triplets treatment, we found that the rates of offer rejection decreased when the amounts offered by bribers increased, whereas it stayed constant in the Pairs treatment, regardless of the offers sent. Also, public officials in the Triplets treatment rejected offers significantly more often than the agents playing the same role in the Pairs treatment.

Hence, our paper confirms that reciprocity between corrupt agents still occurs despite the negative externality caused on others and, shows

that, when the monitoring of bribery is implemented by agents and not by exogenous devices, the levels of corruption increase. The latter result refers to link between the introduction of the observer in the Triplets treatment and the increased level of the negative externality imposed on others. As shown in some theoretical papers previously discussed, the introduction of an observer may give rise to a sequence of bribe-exchange that may be stopped only in the presence of an honest public official. This is not surprising given that, nowadays, newspapers are filled with reports on policeman, judges and bureaucrats caught in the process of covering up bribe-exchanges for monetary rewards.

Our experiment accounts for an additional source of negative externality generated in the Triplets treatment. It is the case in which the public official accepts the bribe but does not choose in favour of the briber. A similar possibility is described in AIR, where an exogenous lottery, functioning as discovery mechanism, is played out whenever a positive transfer is accepted regardless of the subsequent public official's choice. In real-world situations, greasing up bureaucrats in order to influence or speed up some decisions does not always repay. In fact, the public servant can always take the money without favouring the briber and, then, accusing either honest colleagues or the tight monitoring of the office manager for not being able to advantage the briber. In such a situation a colleague (i.e. an observer) of the dishonest bureaucrat may be

willing to punish him for both accepting the bribe and cheating on the citizen.

References

Abbink, K., 2004. Staff rotation as an anti-corruption policy: an experimental study. European Journal of Political Economy 20, 887-906.

Abbink, K., 2005a. Fair salaries and the moral costs of corruption. Forthcoming in the Proceeding of the Conference on Cognitive Economics, Sofia.

Abbink, K., 2005b. Laboratory experiments on corruption. In: The Handbook of Corruption, edited by Susan Rose-Ackerman, Edward Elgar Publishers, Cheltenham, UK, and Northampton, USA.

Abbink, K., Hennig-Schmidt, H., 2002. Neutral versus loaded instructions in a bribery experiment. Mimeo, University of Bonn.

Abbink, K., Irlenbusch, B., Renner, E., 2000. The moonlighting game – an experimental study on reciprocity and retribution. Journal of Economic Behavior and Organization 42, 265-77.

Abbink, K., Irlenbusch, B., Renner, E., 2002. An experimental bribery game. Journal of Law, Economics & Organization 18 (2), 428-454.

Apesteguia, J., Dufwenberg, M., Selten, R., 2003. Blowing the whistle. Working Paper 2003-5, Department of Economics, University of Stockholm.

Azfar, O., Nelson, W., 2003. Transparency, wages, and the separation of powers: an experimental analysis of corruption. Forthcoming in Public Choice.

Banfield, E., C., 1958. The moral basis of a backward society. Free Press, New York.

Bereby-Meyer, Y., Niederle, M., 2005. Fairness in bargaining. Journal of Economic Behavior and Organization 56, 173-186.

Basu, K., Bhattacharya, S., Mishra, A., 1992. Notes on bribery and the control of corruption. Journal of Public Economics 48, 349-359.

Becker, G. S., Stigler, G. J., 1974. Law enforcement, malfeasance, and compensation of enforcers. Journal of Legal Studies 3, 1-18.

Berg, J., Dickhaut, J., McCabe, K., 1995. Trust, reciprocity and social history. Games and Economic Behavior 10, 122-142.

Buchner, S., Freytag, A., Gonzalez, L., Guth, W., 2005. Bribery and public procurement: an experimental study. Working Paper, MPI Jena.

Cameron, L., Chaudhuri, A., Erkal, N., Gangadharan, L., 2005. Do attitudes towards corruption differ across cultures? Experimental evidence from Australia, India, Indonesia and Singapore. Working Paper n°943, University of Melbourne.

Carpenter, J., Matthews, P. H., 2004. Social reciprocity. Mimeo.
Del Monte, A., Papagni, E., 2001. Public expenditure, corruption and economic growth: the case of Italy. European Journal of Political Economy 17, 1-16.
Del Monte, A., Papagni, E., 2005. The determinants of corruption in Italy: regional panel data analysis. Mimeo.
Dufwenberg, M., Gneezy, U., 2000. Measuring beliefs in an experimental lost wallet game. Games and Economic Behavior 30, 163-182.
Dusek, L., Ortmann, A., Lizal, L., 2004. Understanding corruption and corruptibility through experiments: a primer. Forthcoming in Prague Economics Papers.
Fehr, E., Fishbacher, U., 2004. Third-party punishment and social norms. Evolution and Human Behavior. 25, 63-87.
Fehr, E., Gaechter, S., Kirchsteiger, G., 1997. Reciprocity as a contract enforcement device: experimental evidence. Econometrica 65, 833-860.
Fisman, R., Gatti, R., 2002. Decentralization and corruption: evidence across countries. Journal of Public Economics 83, 325-345.
Frank, B., Schulze, G. G., 2000. Does economics make citizens corrupt? Journal of Economic Behavior and Organization 43, 101-113.
Gonzalez, L., Guth, W., Levati, V., 2004. Speeding up bureaucrats by greasing them – an experimental study. Working Paper, MPI Jena.
Guiso, L., Sapienza, P., Zingales, L., 2000. The role of social capital in financial development. NBER Working Paper Series, n°7563.
Guth, W., van Damme, E., 1998. Information, strategic behavior and fairness in ultimatum bargaining: an experimental study. Journal of Mathematical Psychology 42, 227-247.
Hunt, J., 2005. Why are some public officials more corrupt than others?. In: The Handbook of Corruption, edited by Susan Rose-Ackerman, Edward Elgar Publishers, Cheltenham, UK, and Northampton, USA.
Hunt, J., Laszlo, S., 2005. Bribery: who pays, who refuses, what are the payoffs?. NBER Working Papers 11635.
Kahneman, D., Knetsch, J. L., Thaler, R., H., 1986. Fairness and the assumption of economics. Journal of Business 59, S285-S300.
Knez, M. J., Camerer, C., 1995. Outside options and social comparison in three-player ultimatum game experiments. Games and Economic Behavior 10, 65-94.
Marjit, S., Shi, H., 1998. On controlling crime with corrupt officials. Journal of Economic Behavior and Organization 34, 163-172.
Mauro, P., 1995. Corruption and growth. Quarterly Journal of Economics 110, 680-712.

Mocan, N., 2004. What determines corruption? International evidence from microdata. NBER, Working Paper Series n° 10460.

Polinsky, M. A., Shavell, S., 1979. The optimal tradeoff between the probability and the magnitude of fines. American Economic Review 69, 880-891.

Putnam, R. D., 1993. Making democracy work: civic traditions in modern Italy. Princeton University Press, Princeton.

Rose-Ackerman, S., 1975. The economics of corruption. Journal of Public Economics 4, 187-203.

Schulze, G. G., Frank, B., 2003. Deterrence versus intrinsic motivation: experimental evidence on the determinants of corruptibility. Economics of Governance 4, 143-160.

Treisman, D., 2000. The causes of corruption: a cross-national study. Journal of Public Economics 76 (3), 399-457.