Audience Effects and Other-Regarding Preferences Against Corruption: Experimental Evidence

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Abstract

We report results from an experiment in which two firms compete for a public project by submitting offers of quality and bribery to a public official. We study the impact of audience effects (transparency) and other regarding preferences (accountability) on corruption by introducing a citizen who either observes, or is affected by the transactions, or both. The results suggest that transparency and accountability lead, independently, to lower bribe placement and acceptance. However, the conjoined effect does not promote prosocial behaviour further, indicating potential ceiling effects.

Keywords: Corruption; bribery; experiment; transparency; accountability

Classification codes: D73 · C91 · Z13

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1. Introduction

Most non- behavioral economic approaches of studying corruption focus mainly on the pecuniary aspects of corrupt transactions. Potentially corrupt agents compare the monetary rents to be enjoyed after the corrupt transaction, to the risk of being caught and punished afterwards, and depending on the result, they proceed accordingly (Becker and Stigler [1974], Shleifer and Vishny [1993]). In some neo-classical economic models, potentially corrupt agents might also carry some ethical concerns regarding the moral aspects of corruption which cause disutility (Becker [1968]). However, these models do not capture some of the important non-pecuniary aspects of corruption. For example, potentially corrupt agents might not consider only the monetary costs of being caught and punished, they might have concerns about their reputation, or they might have some concerns about how their actions affect others. In this paper aim to contribute some behavioral insights with respect to the non-pecuniary feelings that might accrue to potentially corrupt agents. We are particularly interested to see whether people change their preferences for corrupt transactions if these transactions are transparent and can be viewed by third parties (even if anonymized) or, if the transactions affect third parties.

In our laboratory set up, a "public official" decides the winner of a public project. "Firms" compete by sending proposals which can include a quality level for the project, and a bribe for the official. This feature allows us to evaluate corrupt behaviour from both, the senders' and the receivers' end. To this baseline, we introduce "citizens" who do nothing but passively observe the interactions between firms and public

officials. Any difference in the propensity to place or accept bribery in this treatment could be attributed to "audience effects", that is, to the triggering of intrinsic motivations such as shame or guilt, caused by the mere fact of another, *uninvolved*[1] party, observing one's own behaviour. Note that such motivations do not alter the fundamental function of expected payoffs, at least not as described by Becker (1968). In other words, they do not credibly increase the probability of detection, or the severity of punishment.

Further, we extent our experimental design to comparatively evaluate the impact of the awareness of externalities. Like transparency, awareness does not affect probability of detection or punishment. It triggers other types of corruption curbing intrinsic motivations, such as other regarding preferences. In this set up, the externalities corrupt actions have on other parties become more salient and discourage potentially corrupt individuals from engaging in corruption in the first place. Unlike audience effects, other-regarding preferences do not necessarily produce feelings related to shame or guilt, but, in a broad sense, feelings of accountability and concern for others. To evaluate the effects of these motivations, we have our laboratory "citizens'" payoffs directly linked to the quality level proposed by the winner of the public project. If firms and public officials are sensitive to other-regarding preferences, meaning that they harbour concerns about citizens' relative welfare, they should be placing and accepting

[1] We purposely highlight the term "uninvolved". Otherwise, if all parties are involved, alternative intrinsic motivations, such as "potential accomplice effects" (see: Barr and Michailidou, 2017) might arise that could increase corruption.

higher project quality levels which, by experimental construction, implies lower bribery levels.

In a final treatment, we evaluate the conjoined effect of audience effects and other regarding preferences by having our laboratory "citizens" both observe and be affected by public officials and firms' actions[2].

A general overlook of our results suggests that audience effects and other-regarding preferences, both have a positive impact on reducing bribery placement and acceptance. Firms place lower bribes and firms accept the highest bribe fewer times in the treatments in which audience effects or other-regarding preferences are activated. However, when both audience effects and other regarding preferences are activated simultaneously, firms and officials do not behave in a more prosocial manner, compared to the treatments in which each of these triggers is activated independently, suggesting potential ceiling effects.

For our design, we draw inspiration from the large body of literature on bribery and corruption-related games (Abbink, et al., 2002; Frank and Schulze, 2000; Abbink, 2004; Azfar and Nelson, 2007; Fisman and Miguel, 2007a; Alatas et al., 2009a, 2009b; Barr and Serra, 2009; Cameron et al., 2009; Barr and Serra, 2010; Armantier and Boly, 2011; Serra, 2012; Abbink et al., 2014; Salmon and Serra, 2017; Gneezy et al., 2018).[3]

[2] As very insightfully pointed to us by an anonymous referee, we would like to make clear to our readers *that anonymous audience effects with no consequences of any type is not what the 'real world' policy debate on transparency is about, as that is on detection and consequences, but that is significant, these may be relevant as an additional benefit of transparency*. (In italics, the words as expressed to us by the anonymous referee)

[3] For a review of experimental works on corruption see Abbink and Serra (2012).

Extensive literature has addressed the relationship between social norms, background and culture on the propensity of people to engage on corrupt or dishonest behaviour (Barr and Serra, 2010; Fisman and Miguel, 2007; Alatas et al., 2009a; Cameron et al., 2009; Salmon and Serra, 2017). Laboratory experiments have been used to show that corruption can be mitigated through monitoring, inspections, or by varying the consequent punishment (Serra, 2012; Armantier and Boly, 2011; Lowen and Samuel, 2012; Abbink et al., 2014; Abbink et al., 2002; Alatas et al., 2009b, 2009a). Most designs assume that corruption implies a negative externality on passive agents which represent society (Alatas et al., 2009a, 2009b; Cameron et al., 2009; Abbink, 2002; Salmon and Serra, 2017; Barr and Serra, 2009, 2010). Experiments have been also used to study the effect of transparency and observability on corruption (Reinikka et al., 2004; Azfar and Nelson, 2007; Peisakhin and Pinto, 2010; Di Falco et al., 2016; Salmon and Serra, 2017). Empirical data also provide insights on how corruption can be reduced by changes in the structure of municipalities, i.e. municipalities with a "council-manager" form are 57 percent less likely to have corruption convictions than municipalities with a "mayor-council form" (Nelson and Afonso, 2019).

Our design departs from the existing literature in various important points. We study how other-regarding preferences affect the propensity to engage in bribery by including a third party affected (negatively) by the (corrupt) transactions of firms and officials. Barr and Serra (2009) compare stronger and weaker effects; we compare the presence and the absence of a third party. Furthermore, we study the effect of observability (or audience effects), i.e. the change in behaviour when agents know that

their decisions are being observed by passive players. In that regard, our design is similar to that of Salmon and Serra (2017). In their treatment with hidden actions, passive players are not aware of the losses they will potentially bare if bribery occurs. In their other treatment labelled "Victim Knows", citizens and public officials are aware that a passive player will know whether they engaged in corruption. However, our approach differs; we compare the presence and the absence of an observer which allows us to elicit the effect of observability more precisely. Lastly, given our 2x2 experimental design, we are able to disentangle between the mere "audience effect" (being observed by a passive player) and the "other-regarding effect" (the existence of a passive player affected by the actions of active players).

Our design also shares many design features with another experimental study by Butler, Serra and Spagnolo, 2019 (BSS onwards). In that experiment, the authors study behavioural motivations that affect whistleblowing within corporate organizations. They do so by creating a firm structure consisting of two employees and a manager, while a group of other players serves as the "society". The employees engage in a real effort task which adds to individual and firm earnings while the players of society engage in real effort tasks that only add to individual earnings. The manager can choose to also engage in a real effort task or "break the law" which would generate positive monetary externalities for the firm but negative ones for the society. Using the strategy method, the authors elicit employees' willingness to blow the whistle in three controlled conditions; one that whistle blowing is rewarded monetarily, one in which it is subject to social judgment (via members of the society who can send smiley face

messages to the employees), and one in which the negative externalities are visible and salient for all players. In our design, there are two firms that compete (rather than employees whose payoffs are interdependent), there is no whistleblowing option available, while our citizens are always passive but can be indirectly hurt by bribery as, by constriction, their payoff is decreasing in the size of the bribe. Having citizens being passive is important as firms and public officials do not have to form beliefs about citizens' earned income like in BSS, which allows us to study other-regarding preferences more precisely. Additionally, BSS vary the visibility of the negative externalities by selectively withholding payoff information from the citizens whilst making the employees and managers aware of this withholding of information. That is, managers' decision to break the law carried negative externalities for society in all treatments – what varied is society's knowledge about it. We were more interested in generating visibility (audience effects) but in a way that would separate its effect from the effect of producing negative externalities for third parties. Had we changed the information availability similarly to BSS, firms and public officials might have had different beliefs over citizens' generated income/ effort provision across treatments. Said differently, making externalities salient the BSS way, might alter citizens' effort provision which in turn would tangle firms' reaction to this alteration with their reaction to the salient externalities. Thus, we keep information to all players constant across treatments and introduce citizens who can observe firms and public officials' actions, but crucially, we use one treatment in which these actions have no consequences for citizens and another in which they do.

In the next section we briefly describe the experimental design and the methodology followed. Section 3 is dedicated to show the results in detail. Section 4 provides the main conclusions. More details of the model as well as the experimental instructions are included in the Appendix.

2. Experimental Design

2.1. Basic Task and Payoffs

In the baseline treatment, we replicate the game introduced by Jaber-Lopez et al. (2014). In particular, the baseline game involves at least three active players, two firms and one official. Depending on the treatment, a fourth passive player named the *citizen*, may exist. The game is repeated for 15 rounds and the matching of firms and officials is fixed for these 15 rounds. In all rounds, active players start with an initial endowment of 10 experimental currency units (ECU). The two firms compete to win an auction for a public project (which yields a fixed positive monetary reward) by posting joint bids of quality and bribe. Each firm decides how much of the endowment of 10 ECU should be invested in the quality of the public project, and how much should be used as a bribe. The quality of the winning project will affect the payoffs of all active players and, depending on the treatment, it will affect also the payoff of the citizen. Once both firms have posted their bids, the official reviews the proposals and decides the winning firm. The payoffs of active players are:

$$\pi_{official} = F + a\, Q_{winner} + B_{winner}$$

$$\pi_{winner} = F + a\, Q_{winner} - c\, B_{winner} + R$$

$$\pi_{loser} = F + a\, Q_{winner}$$

where F is the fixed initial endowment in each period; Q and B are the quality and bribe bids, respectively. The loosing firm keeps the amount that was willing to invest, while the winning firm is assumed to have a return of $F+R$, which is higher than the initial amount invested. Therefore, R represents the extra monetary reward earned by the winner of the auction. Finally, parameter a denotes the social return of the winning project's quality on each player's utility. Parameter c represents the cost of the bribe to the bribing agent, implying an inefficiency in the transmission of the bribe from the firm to the official.

In the experiment, we impose the restriction $Q + B = A$ to implement the trade-off between quality and bribe, where A represents an exogenously given upper bound of firms' resources. We have used the set of parameters: (F, a, c, A, R) = (10, $\frac{1}{2}$, 2, 10, 10).[4] Given this parameterization and assuming a continuous strategy space, agents with purely monetary concerns bid according to the unique subgame perfect Nash equilibrium of the game which involves (Q, B) = (5, 5). However, given that players were choosing their strategies from a set of integer numbers, the discrete strategy space leads to multiple equilibria: (Q, B) = (5, 5); (Q, B) = (7, 3) and (Q, B) = (6, 4).

[4] The use of integer numbers facilitates subjects' calculations concerning the possible consequences of their actions.

Consequently, equilibrium (Q, B) = (5, 5) is not unique anymore, since each firm is actually indifferent between this equilibrium and posting lower bribes, i.e., becoming a loser. This is because, in that case, payoffs become identical (and equal to 12.5) for both firms. Assuming economic rationality, officials will want to maximize earnings, therefore, the subgame perfect Nash equilibrium predicts that an official with purely monetary motivation will choose the firm that offers the highest bribe.

However, subjects might also enjoy utility from other, non-monetary aspects of the process. More likely, promising or accepting bribes might yield some psychological cost due to ethical concerns. Depending on the beliefs players hold about other players' aversion to bribes, and on potential personal discomfort, the game might become one in which firms believe that officials have strong efficiency concerns and, therefore, that the competition is about quality rather than bribery. Similarly, the firms themselves might be substantially averse to placing bribes in the first place. In the Appendix, we briefly present a psychological payoff equilibrium prediction in a simple perfect information framework in which agents have both monetary and psychological concerns.

In each round, after firms place their bids and the public official makes his decision, they are informed of whether they are the winners or losers and of their respective payoffs in the current round. They are also reminded of their own offers in past rounds, but they never know the offers made by the other firm. Likewise, at the end of each round, officials receive information about their payoff in the current round. All players know that, in the end of the experiment, a randomly drawn round would

determine their earnings for participation. Players received in cash the payoffs generated in this round plus a show-up fee. We describe all treatment variations in the following subsection.

2.2. Treatments

Treatment Base (TB)

TB is the baseline treatment. Here, the baseline game is played as described above. Only active players are involved in this treatment: two firms and a public official. Participants play for 15 rounds.

Treatment Affected (TA)

This treatment is identical to the baseline treatment (*TB*) with the addition of passive players, the citizens. In this treatment, the quality placed by the winning firm affects the payoff of one citizen as follows:

$$\pi_{citizen} = Q_{winning\ firm}$$

The citizens are located in an isolated room and cannot decide or observe any of the transactions among the firms and the officials. The rules of the game were common knowledge to all, passive and active players. When subjects were waiting to enter in the lab, they were randomly assigned either to the group of active players (firms or officials) or passive ones (citizens). Citizens were then taken to a separate room facing through a wide window all the participants. In this way, we ensured that all the

participants verified that the citizens were real people and that they were not deceived. All the participants, active and passive, were informed about the way citizens' payoffs were determined. Participants played for 15 rounds.

Treatment Observer (TO)

In this treatment, the passive citizens are now observers of the transactions among firms and official, but are not affected by the quality placed by the winning firm. In particular, the citizens were seated in an isolated room and, via a monitor, they could observe the quality posted by each firm in each round, and the official's decision of the winning bid. The citizens could also see the participants through a wide window during the experiment, although they were not able to link a decision to a specific participant. The rules of the game were common knowledge to all passive and active players. Participants played for 15 rounds.

Treatment Affect-Observer (TA-O)

This treatment is the combination of treatments *TA* and *TO*. The citizens are now affected by the quality placed by the winning firm and they are also observers of the transactions among firms and officials. As in treatment *TA*, the quality placed by the winning firm affects the payoff of one citizen such that $\pi_{citizen} = Q_{winning\ firm}$.

The rules of the game were common knowledge to all passive and active players. All the participants were informed about the way citizens' payoffs were determined. Participants played for 15 rounds.

2.3. Design choices

When conceptualizing this study, we had to balance a variety of objectives. We placed high importance in keeping the fundamental structure of the design comparable to real firms. In particular, we decided to implement a fixed-sum quality and bribe scheme considering the choices firms in the field are ultimately making. Real firms' resources are not unconstrained. With their limited resources, and operating in markets that corruption can occur, firms need to make allocation decisions. The fixed-sum nature of quality and bribe in our design captures the aspects of allocation dilemmas we wish to study, while at the same time it serves some other important purposes. For example, it endogenizes externalities in a subtle way and it is easily explainable which facilitates subjects' comprehension of both, the externalities their choices carry for themselves and for others.

However, this design choice does not come without points of vulnerability. In a stylized environment, such is an experimental laboratory, the firm-official interaction might be experienced by subjects as an ultimatum under competition rather than as a moral dilemma. That is, firms might be focusing more on how to win the competition rather than on the moral load of their actions. Yet, this featured is refined by two factors. First, it remains constant across treatments, therefore, even if subjects experience the ultimatum more intensely than the moral aspect of our scenario, they

should do so similarly in all treatments. Second, the repeated interaction nature of the design, together with information about the winner, allows for learning. This means that after the first few rounds, subjects should have obtained an understanding of what it takes to win the competition and could subsequently contemplate whether they want to act to win the competition given the consequences the winning entails.

With regards to the more basic features of our design, we mainly made decisions according to the existing literature and simple intuition. For example, we did not have reasons to believe that 15 rounds of repetition would bring fundamentally different results from 10 or 20 rounds but we considered that a relatively large number (50 or more) could produce cognitive depletion towards the end which could induce subjects to decide by habit and not by reasoning. Also, a stochastic continuation could have been chosen but we conjectured this would add another layer of complexity for subjects and interfere with what we were aiming to study. Also, we could have chosen a different framing, or setting, or number of players for our experimental scenario. For example, we could have explicitly use the term bribe instead of transfer, or we could present this as a bid for a personal promotion rather than a public project. These choices could have produced different results but they would also be capturing slightly different contexts. Although all these alterations would be very interesting to study, here, our simple set up allows for a good understanding of the instructions and payoff schemes without imposing a moral connotation on choices by explicit framing. Thus, we consider this paradigm a good basic design for future research to build upon and extent.

2.4. Procedures

All the sessions were conducted in the Laboratorio de Economía Experimental (LEE) at the University Jaume I, Castellón, Spain. Average earnings were 11.60 euro per subject, and the sessions lasted around one hour. The participants were recruited using ORSEE software (Greiner, 2015) from a pool of undergraduate students and the experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). Each session, depending on whether a passive player was present, included between 30 and 44 subjects. All treatments were run in random order, that is, the sessions were pre-randomized into specific treatments, except for *TA* and *TA-O*, the sessions of which we run at a later time. We made sure to recruit more subjects than necessary to run each session accounting for the possibility of no-shows. In all treatments, we use a partners matching design and subjects remain in the same role for the 15 rounds of the experiment. The instructions were presented to the subjects both orally and in hard copy (in Spanish), and questions were answered privately by the experimenter.[5]

2.5. The Sample

Overall, the sample is composed of 162 subjects of which 129 were active players given the role of a firm or an official (mean age: 23, sd.: 2.9), and 33 were passive players

[5] Instructions to subjects are provided in Appendix A.1.

given the role of a citizen. For treatment (*TB*) we recruited 30 subjects, 20 of which were given the role of a firm and 10 the role of a public official. The roles and groups were fixed for the 15 rounds. For each of the rest of the treatments we recruited 44 subjects: 33 played either as a firm or an official, and 11 played as a citizen. In table 1 we present a summary of number of subjects and their roles in each treatment.

Table 1: Summary of Number and Type of Subjects across Treatments

	TB	***TA***	***TO***	***TAO***	**Total**
Firms	20	22	22	22	N=86
Officials	10	11	11	11	N=43
Citizens	0	11	11	11	N=33
Total	N=30	N=44	N=44	N=44	N=162

2.6. Methodology Review

Corruption is hard to study in the field. The most successful cases of corruption are those that were never revealed, making a full documentation of this phenomenon almost an impossible task. As we stand now, we cannot measure but only roughly estimate corruption and its damage to the economy and society. Laboratory experiments have a lot to offer to the effort of studying and understanding corruption. Experimentalists can develop economic micro environments and selectively isolate or

introduce institutions, information, or psychological triggers in order to observe individual or interactive choices, test theory predictions, or establish empirical regularities. First introduced to experimental methods, one might perceive the conditions participants experience in the laboratory as extremely artificial, stylized, and detached from reality. Laboratory conditions are indeed artificial and typically, artificiality increases with internal validity. The more precise the identification of a causal effect is, the more control the experimenter needs to exercise to the micro environment. Although trade-offs between internal and external validity exist, there is no universal best practice; each approach offers different contributions subject to different limitations. The so called *artificiality critique*, how it does not present a substantial philosophical objection to experimentation, but rather stifles the goals of economy inquiry has been excellently summarized by Starmer (1999). Related, Falk and Heckman (2009) explain thoroughly how and why lab experiments are a major source of knowledge in the social sciences. In particular, they discuss how objections related to sample sizes and types (students) *"clash sharply with the widely used "representative agent" model that assumes that agents are homogenous or can be represented as if they are homogenous"* and they identify how the issue of generalizability of results is inherent to all methods and fields of social sciences. Similar points, and a perspective through which experimental results should be interpreted, is provided by Guala and MIttone (2005), while a comprehensive collection of methodological discussions is offered in the special issue of JEBO "Issues in the Methodology of Experimental Economics" edited by Eckel and Rosser (2010).

Related to external validity of economic experiments, there are various books and papers focusing on the topic like Guala (2005) chapter 7, and Bardsley et al. (2010) chapter 5. However, the generalizability of experimental findings are topic and subject specific. To this point, Ostrom (2006) provides an overview regarding the findings produced from common-pool resource games. On the same topic, Cárdenas (2000) shows how non student populations (villagers) in the field behave in a manner consistent with that of undergraduate students in the lab. Another strand of experimental literature establishing external relevance with a focus on gender and competitiveness is Zhang (2013) and Buser et al. (2014). On other topics which show how lab measurements can reliably measure phenomena outside the lab, Karlan (2005) focuses on financial decisions, Fehr and Goette (2007) on wage incentives, while Meier and Sprenger (2010) on time preferences and borrowing. Turning to the external relevance of topics that are closer to moral behaviour as we study it here, Gächter and Schulz (2016) in a cross-societal study consisting of evidence from 23 countries, show how findings from a standard laboratory task measuring intrinsic honesty correlate with the prevalence of corruption, tax evasion, and fraudulent politics in each country. A broader review on the external validity of public goods experiments, tax compliance experiments, and experiments on individual responses to taxes can be found in Alm (2010) and Alm et al. (2015) in which the authors report on how behavioural patterns of subjects in the laboratory conform to that of individuals making a similar decision in naturally occurring settings and how responses of students are largely the same as non-students in identical experiments.

The literature discussed here suggests that experimental findings in general, and experimental findings about corrupt behaviour in particular, provide reliable information about behaviour in the field. However, it is important to note that as all scientific disciplines, economics might be subject to publication bias. That is, there might be studies that find no results connecting the lab with naturally occurring behaviour but are not published precisely due to the nullity of results. Therefore, the findings that we report in this experiment which suggest that audience effects and other regarding preferences independently but not conjointly promote prosocial behaviour can be trusted only as indications of behaviour that might occur in naturally occurring settings. The precise generalizability of our findings cannot be reported here. It would require intense replication of our experiment across countries and across different populations. This paper establishes a novel paradigm and conveys findings of a particular subject pool.

3. Results

3.1. General Behaviour

As discussed in section 2.1, given a discrete strategy space, the game played by firms and officials in all treatments leads to the following subgame perfect Nash equilibria (SPNE): (Q, B) = (5, 5); (Q, B) = (6, 4) and (Q, B) = (7, 3). Before we proceed with the analysis of the effects we set out to study, we report here the general behaviour of subjects in relation to these equilibria predictions. From a total of 1,290 quality and

bribe decisions made my participants in all treatments, 840 (65.12%) were consistent with SPNE. In table 2 below, we aggregate the choices consistent with SPNE.

Table 2 : SPNE Consistent Choices

		Firm A		
	(Q, B)	(5, 5)	(6, 4)	(7, 3)
Firm B	(5, 5)	30	60	21
	(6, 4)	51	192	141
	(7, 3)	21	126	198

3.2. The Citizen Effect

We vary the presence and payoff dependence of citizens across treatments with the aim of disentangling between the effect of being observed, and being responsible for another's payoff. First, audience effects, i.e., the feeling of being observed by others might invoke feelings of shame or guilt which we anticipate will reduce firms' and officials' willingness to engage in bribe placing and bribe accepting behaviour. We will be examining audience effects by comparing behaviour in *TB* to *TO*, and behaviour in *TA* to *TA-O*. Then, introducing citizens whose payoff depends on the quality placed and accepted, might induce firms and officials to behave more pro-socially due to other regarding preferences. We will be examining the effect of other-regarding preferences by comparing behaviour in *TB* to *TA*, and in *TO* to *TA-O.*

We conjectured that corrupt behaviour would be the lowest in treatment *TA-O* where both audience effects and other regarding preferences are activated compared to *TA*

and *TO*. However, our results, as presented in the following sections, suggest that although audience effects (*TB* compared to *TO*) and other regarding preferences (*TB* compared to *TA*) independently have a significant impact on both firms and officials' behaviour, their interaction does not impact behaviour significantly neither for firms or officials (*TA-O* compared to *TO* or *TA*).

3.3. Audience Effects and Other Regarding Preferences

We analyse audience effects first, by comparing the behaviour observed in treatments *TB* and *TO.* Then, we focus on the audience effects when third parties are affected, by comparing *TA* with *TA-O.*

[Figure 1 here]

Figure 1 shows the average bribe placed by firms across treatment. In particular, in panel 1.a. we show the average bribe for the 15 periods per treatment; in panel 1.b. we show the evolution of the bribe average over time. Given that subjects interact in the same group during 15 periods, henceforth we will use the average bribe offer per group for the 15 periods as one independent observation. This yields 10 independent observations in treatment *TB*, and 11 independent observations in the rest of the treatments. Average bribe placements are quite stable over time and close to our standard economic predictions, i.e. bribe bids between 3 and 4 units.

[Figure 2 here]

Similarly, figure 2 depicts officials' behaviour across treatments. In particular, panel 2.a shows the sum of times each official chose the highest bribe placed, averaged by treatment, while panel 2.b shows the percentage of bribe maximizing decisions across treatments and periods. From the graph we can infer that in all treatments and in most periods, officials chose to accept the highest bribe placed.

Turning to formal testing, we evaluate the effect of audience effects on firms and officials using two-sample Wilcoxon rank-sum (Mann-Whitney) tests. Regarding firms' behaviour, we compare the average bribe placed by all firms in *TB* ($\bar{b}$=3.32, Sd=1.68) to the average bribe placed by all firms in *TO* ($\bar{b}$=3.03, Sd=1.26). For officials' behaviour, we sum the number of times each official chose the highest bribe; then we compare the average of these sums for all officials in *TB* (10.3) to the equivalent average in *TO* (7.89). Table 3 below summarizes the results of these tests.

Table 3: TB to TO test results

	Firms	**Officials**
	Average bribe placed (3.32 vs 3.03)	Number of bribe maximizing decisions (10.3 vs 7.89)
TB vs *TO*	z=1.800 p=0.0718	z=2.199 p=0.0278

In line with our hypothesis, the tests suggest that the average bribe is lower in *TO* than in *TB* in a 10% level, and that firms accepted the lowest bribe more times in *TO* than in *TB* in a 5% level. This lets us state our first result as follows:

Result 1: *The introduction of audience effects reduces the average bribe placed by firms and decreases the number of times officials accept the highest bribe.*

We continue by evaluating the effect of other regarding preferences on bribe placing and bribe accepting behaviour. Similarly, we examine firms' behaviour by comparing the average bribe placed in *TB* ($\bar{b}$=3.32, Sd=1.68) to that in *TA* ($\bar{b}$ =2.87, Sd=1.31). To examine officials' behaviour, we compare the average sum of times officials accepted the highest bribe in *TB* (10.3) to that in *TA* (8.45). We present the results of two sample rank-sum (Mann-Whitney) tests in table 4 below.

Table 4: TB to TA test results

	Firms Average bribe placed (3.32 vs 2.87)	**Officials** Number of bribe maximizing decisions (10.3 vs 8.45)
TB vs *TA*	z=3.105 p=0.0019	$z = 1.950$ p=0.0512

From table 4, we infer that other regarding preferences have a significant effect on corrupt behaviour. When firms' and officials' decisions explicitly affect a third party, firms' average bribe placements are significantly lower in a 5% level, and officials

accept the highest bribe significantly fewer times in a 10% level. This lets us formulate result 2 as follows.[6]

Result 2: *Invoking other-regarding preferences reduces the average bribe placed by firms and decreases the number of times officials accept the highest bribe.*

To fully assess audience effects and other regarding preferences, we turn to their conjoined impact. We inquire what is the impact of audience effects when other-regarding preferences are already effectual and we proceed to answer by comparing bribe placing and bribe accepting behaviour in *TA* to *TA-O*. Reversely, we inquire what is the impact of other regarding preferences when audience effects are in place and to find out, we compare firms' and officials' behaviour in *TO* to *TA-O.* We present the results in table 5 below.

Table 5: TA to TA-O and TO to TA-O test results

	Firms Average bribe placed	**Officials** Number of bribe maximizing decisions
TA vs *TA-O*	(2.87 vs 2.59) z=0.924 p=0.3552	(8.45 vs 8) z=0.567 p=0.5708
TO vs *TAO*	(3.03 vs 2.59) z=1.619 p=0.1055	(7.82 vs 8) z=0.033 p=0.9734

[6] This result is partly similar to Barr and Serra (2009) who report that externalities to third parties are associated with less bribe acceptance and to Cameron et al. (2009) but depart from Abbink et al. (2002) who report that negative externalities had no apparent effect on an experimental bribery game.

Table 5 exhibits potential ceiling effects. When either audience effects or other regarding preferences are in effect, introducing the respective absent motivation, does not alter firms' and officials' behaviour. Bribe placing or bribe accepting behaviour is not significantly different in *TAO* than in *TA* or *TO*. This leads us to formulate our third result as follows.

Result 3: *Audience effects and other regarding preferences, conjointly, do not reduce bribe placing or accepting behaviour further than each motive does independently.*

In summary, the results presented in this section convey that audience effects and other regarding preferences can be powerful allies in curbing corrupt behaviour. When firms and officials are observed by others, others who are unaffected by their choices and who cannot trace choices to an individual level, they behave in a more prosocial manner; firms place lower bribes and officials accept the lowest of the bribes more frequently. This could be attributed to the feelings of shame or guilt, caused by the mere fact of another, uninvolved party, observing one's own behaviour. The same effects are derived when other regarding preferences are invoked meaning that feelings of accountability and concern for others can be triggered to influence individuals to behave less dishonestly. However, an important remark, potentially concerning the efficient exploitation of these intrinsic motives, is that the conjoint activation of audience effects and other regarding preferences does not produce better results than the activation of each of these motives independently. In other words,

policies that call to "follow the money" and awareness campaigns can stand equally well alone as if implemented simultaneously.

3.5. Econometric Analysis

In Table 6, we present the estimation results for OLS models with bribe amount as dependent variable. The main explanatory variables are the treatment variables *TA, TO, TA-O*, *TB* (our benchmark), and *Period*. We also include other variables: variable *Winner [lagged]* which takes value 1 if the subject was the winner in round [t-1], 0 otherwise; variable *(My bribe ≥ Other Bribe) [lagged]* which takes value 1 if the bribe offered by the subject in round [t-1] was greater or equal to the bribe offered by the other firm; we also include as a variable the interaction of these two latter variables.

In our parsimonious specification (1), we regress only the treatment variables and we confirm that bribe offers are significantly lower in treatment *TA* than in *TB*. Although treatments *TA-O* and *TB* are not directly comparable, we confirm that bribe offers are significantly lower in *TA-O* than in *TB* and this gives an important insight on how the interaction of third parties affected and observing at the same time are a relevant fact in the decreasing bribe bids.

The treatment effects hold in our full specification (2). More interestingly, note that at the bottom of the table, the interaction coefficient *[(My bribe ≥ Other Bribe) [lagged]] + [(My bribe ≥ Other Bribe) # Winner [lagged]]* is positive and highly significant. This result suggests that there is a sort of reciprocity between the wining firm and official, in the sense of

firms offering higher bribes in the next round if they had previously won. On the other hand, the variable *My bribe ≥ Other Bribe [lagged]* is negative and insignificant, meaning that losing firms in the current period do not increase their bribe offer in the next period aiming that this will increase the likelihood of being the winner. The negative significant effect of the variable *Winner [lagged]* tells us that wining firms who offered in [t-1] lower bids than their rivals tend to offer lower bribes in the current period. This result might be interpreted in two ways: a) Firms try to bribe less and win in order to maximize their earnings. b) Officials and firms tacitly collude in lower bribes aiming at maximizing social earnings.

[Table 6 here]

Further in our econometric analysis, we present in Table 7 the results of two Probit models in which officials' maximizing decisions is the dependent variable. As in our previous estimations, we include as explanatory variables: the dummy variables for treatments, being *TB* our benchmark, and *Period*. We include the variable *B winner ≥ B loser [lagged]* which takes value 1 if the bribe offered by the winning firm in [t-1] was greater or equal than the bribe offered by the losing firm, and 0 otherwise; the variable *Same firm win* which takes value 1 if the winning firm in the current period is the same winning firm as in period [t-1], and 0 otherwise; we also include the interaction of the two latter variables. We do not find any significant effect in our parsimonious specification (1). In our full specification (2) we find a slightly significant and negative effect of *TO*, confirming our result that officials are more prosocial when being aware of third parties as observers. The variable *Period* has a (small) positive and significant

coefficient, meaning that the share of bribe maximizing decisions increases over time. At the bottom of the table we find that the joint coefficient *[(B winner ≥ B loser) (lagged)] + [(B winner ≥ B loser) (lagged) # Same firm win]* has a positive and significant effect. This result suggests once more that there is a sort of tacit collusion between the firm posting the highest bribe and the official. In other words, officials choose the same firm as the winner as long as it offers not lower bid than the rival firm.

[Table 7 here]

4. Conclusion

We have offered behavioural insights on some of the factors that affect the willingness to offer and accept bribes in the context of an experimental auction. In our design, two firms compete for a public project by posting bids of quality and offering a bribe payable to the public official if the firm's proposal wins. A public official reviews the bids and decides the winner of the competition. Additionally, we introduce different treatments in which there are citizens passively observing the transactions among firms and officials, or citizens whose payoffs can be affected by the decisions taken by firms and officials, or both. Introducing the figure of the citizen invokes either audience or other-regarding effects on bribing and bribe acceptance. We associate such effects to social intrinsic motivation, unrelated to the monetary incentives of the active players.

Our results indicate that these factors independently promote more prosocial behaviour from the perspective of firms and public officials, however their conjoined

effect does not perform better than each individual effect. Specifically, bribe placements are lower when firms' experience audience effects or other-regarding preferences, compared to a baseline where neither of these psychological triggers are active. Similarly, firms accept the lowest bribe placed significantly more times when audience effects and other-regarding preferences are active. However, the conjoined activation and other regarding preferences does not lead to less bribery placement or acceptance suggesting potential ceiling effects.

Our results provide indications that transparency and awareness campaigns might be effective in deterring corruption but further laboratory and field research is necessary to evaluate fully the effectiveness of these policies.

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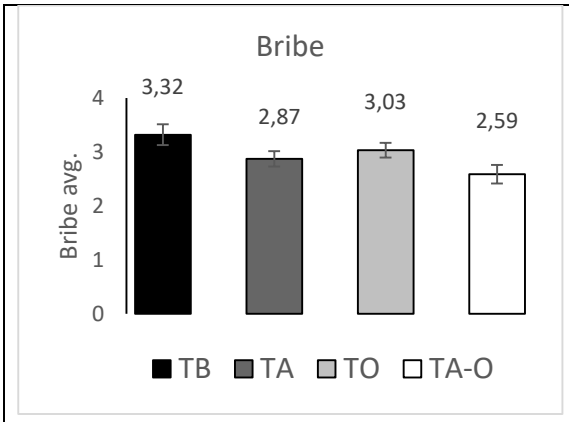


Figure 1.a.: Average bribe placed by firms across treatments. Bars show the average bribe placed and the whiskers stand for 95% confidence intervals.

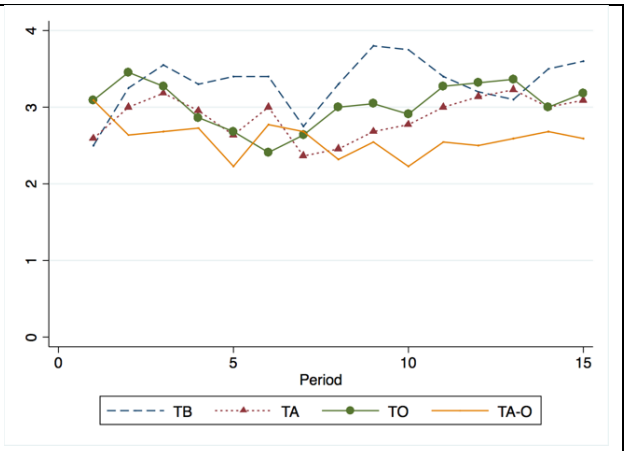
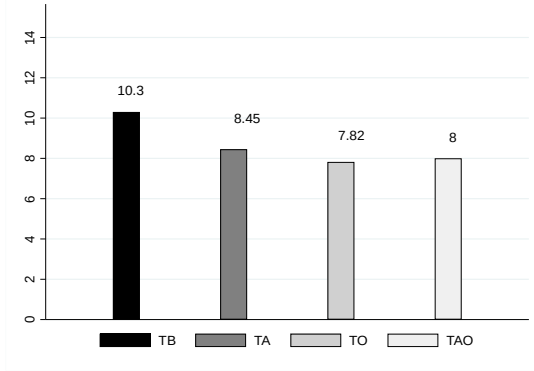


Figure 1.b.: Evolution of bribe placements by firms across treatments and rounds.

Figure 1. Firms' bribe decisions, on average, across treatments



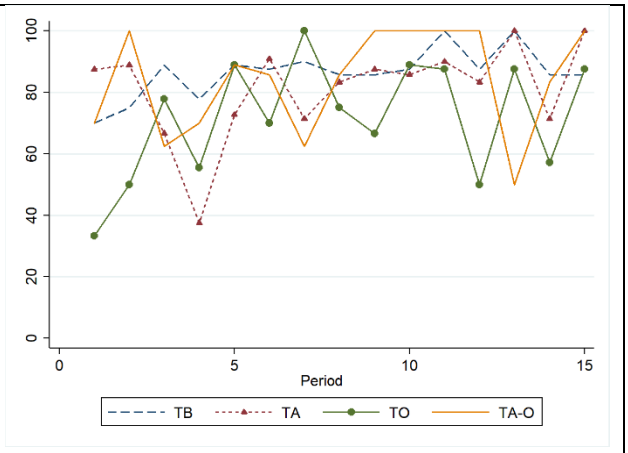


Figure 2.a.: Sum of times each official chose maximal bribe, averaged by treatments

Figure 2.b.: Evolution of percentage of officials' bribe maximizing decisions across treatments.

Figure 2. Officials' bribe maximizing decisions (including the total amount of bribe maximizing decisions)

Table 6: Panel data OLS regressions for firms' decisions. Dependent variable: Y=Bribe

Specification	**(1)**	**(2)**
	OLS	**OLS**
Dependent variable	**Bribe**	**Bribe**
TA	-0.447*	-0.489**
	(0.241)	(0.242)
TO	-0.287	-0.338
	(0.263)	(0.258)
TA-O	-0.732**	-0.848**
	(0.346)	(0.340)
Period		0.005
		(0.016)
(My bribe ≥ Other Bribe) [lagged]		-0.014
		(0.126)
(My bribe ≥ Other Bribe) # Winner [lagged]		0.943***
		(0.289)
Winner [lagged]		-0.956***
		(0.313)
Constant	3.320***	3.400***
	(0.193)	(0.243)
N	1,290	1,204
[(My bribe ≥ Other Bribe) (lagged)] + [(My bribe ≥ Other Bribe) # Winner (lagged)]		0.929***

Note: Columns (1)-(2) are estimates from panel data Ordinary Least Square regressions. Standard errors in parentheses clustered at the group level. All specifications include subject random effects. The dependent variable is the Bribe amount, and the independent variables are defined in the text. Last row indicates the joint coefficient from tests on the restriction that the respective joint coefficient is equal to zero. *N* varies across specifications depending on the number of available observations. In column (2), 86 observations from first periods are dropped to include of lagged variables. Symbols *, **, *** indicate statistical significance at the 10%, 5%, 1% levels, respectively.

Table 7: Panel data Probit regressions for officials' decisions. Dependent variable: Y=Bribe maximizing decision

Specification:	(1)	(2)
Dependent variable Y:	Bribe max	Bribe max
TA	-0.380	-0.651
	(0.608)	(0.558)
TO	-0.844	-0.977*
	(0.579)	(0.580)
TA-O	-0.480	-0.671
	(0.558)	(0.507)
Period		0.054**
		(0.024)
(B winner ≥ B loser) [lagged]		-0.240
		(0.408)
Same firm win		-1.655***
		(0.508)
(B winner ≥ B loser) [lagged] # Same firm win		1.589***
		(0.590)
N	462	425
[(B winner ≥ B loser) (lagged)] + [(B winner ≥ B loser) (lagged) # Same firm win]		1.349***

Note: Columns (1)-(2) present estimates from panel data Probit regressions. Standard errors in parentheses. All specifications include subject random effects. The dependent variable is Bribe Maximizing Decision, which takes value 1 if the official chooses as winner the firm with the highest bribe offer, and takes value 0 if the winner was the firm who made the lowest offer. Independent variables are defined in the text. The last row presents a joint coefficient from

tests under the restriction that the respective joint coefficient is equal to zero. *N* varies across specifications depending on the number of available observations. Decisions in which officials had to choose between two equal offers (N=534) are ruled out from the sample, leaving a sample of N=462. In column (2), observations from first period are dropped given that lagged variables are included. Symbols *, **, *** indicate statistical significance at the 10%, 5%, 1% levels, respectively.

Appendix

A.1. Instructions to Experimental Subjects (translated from Spanish)

Welcome and thanks for your participation in this experiment. Please switch off your mobile phones and secure your belongings away. You are going to participate in an experimental session split into two sub-sessions of 15 rounds each. You will earn an amount of money which will depend on your decisions and the decisions of other participants in the session. From this point onwards you must use only the instructions and the computer in front of you. If you have any questions throughout the session, please raise your hand and you will receive an answer by one of the experimentalists. Any communication with other participants will imply your immediate exclusion from the experiment.

[Treatment TO] & [Treatment TA-O]

At the beginning of this sub-session, you will be assigned one of two roles: `a firm' or `an official'. Your role is randomly assigned to you and remains fixed throughout the sub-session. You will be anonymously and randomly assigned to a group of three players: two firms and an official. The group will be fixed throughout the sub-session. Rounds are independent, in the sense that the payoff consequences of decisions made in any round do not carry over to subsequent rounds. Once this part is finished, the experimentalist will give you additional instructions for the second sub-session.

Decision Making

In each round, all players receive an endowment of 10 ExCU.[7]

If you are a firm: You compete with the other firm of your group for the license of a public project, the quality of which, is beneficial to all players in the group. In each round, you have to post bids on the quality of your project and a monetary transfer which you wish to send privately to the official in your group if you are chosen to undertake the project. Firms' bids are made simultaneously, so that each firm can only know its own bids, but not the bids of the other firm. The quality and the transfer to the official must sum 10, so that if your quality bid is 9 your transfer to the official in case you win will be 1. If you win the auction, apart from your round endowment, you earn an extra profit. In that case, you also have to spend on the transfer to the official double the amount you promised in your bid. If you lose the auction, apart from your initial endowment from each round, your earnings include a profit which is proportional to the quality of the winning project.

If you are an official: In each round, you receive the bids from the firms in your group. Then, you have to choose one of the two projects. Apart from your initial endowment in this round, your earnings include a profit which is proportional to the winner's quality plus the amount, if any, privately transferred to you by the winner.

If you are a citizen: You are not going to take any decision. You are associated to a group of 2 firms and 1 official. You will observe, on the screen in front of you, the quality placed by the winning firm in each period and you will be paid according to

[7] Experimental Currency Unit.

the quality winning in your corresponding group. Your earnings will be determined by a random period, in the same way that all the participants in this session.

Exact calculation of profits

From the description of strategies and earnings above, the specific formulas used to calculate your profits in each round (π) are a function of the quality (Q) and transfer (B) bids of the winner, as shown below:

1) $\pi_{official} = 10 + \frac{1}{2}.Q_{winner} + B_{winner}$
2) $\pi_{winner} = 10 + \frac{1}{2}.Q_{winner} - 2\,.B_{winner} + 10$
3) $\pi_{loser} = 10 + \frac{1}{2}.Q_{winner}$

Information received

If you are a firm: At the end of each round, you will receive information on which firm won the license, a reminder of your decisions on quality level and transfer in that round, as well as your profit for that round.

If you are an official: In each round, after firms have made their decisions, their quality and transfer bids will be displayed on your screen before you make a decision. Once you select the winning firm, you will receive information on your profits in this round.

If you are a citizen: In each round, you will observe on the screen the quality posted by the winning firm, in each group.

Monetary rewards

In order to determine your payment in this sub-session, the computer will randomly choose one of the 15 rounds at the end of the session. The amount of money you will earn from this part of the experiment will be equal to your profits in the randomly chosen round, multiplied by an equivalence ratio of 1 ExCU = ½ Euro.

A.2. Psychological payoff equilibrium prediction

We generalize the monetary payoff structure of the setup in (1)-(3), using a linear specification of utilities with an agent-specific psychological cost parameter, γ, capturing an agent's aversion to bribe due to ethical reasons, expressed as a loss per monetary unit of bribe received by the official. Thus, the three agents' utility levels after the end of the auction are given by:

1) $\boldsymbol{\pi_{official} = F + a\, Q_{winner} + \left(1 - \gamma_{official}\right) B_{winner}}$

2) $\boldsymbol{\pi_{winner} = F + a\, Q_{winner} - (c + \gamma_{winner})\, B_{winner} + R}$

3) $\boldsymbol{\pi_{loser} = F + a\, Q_{winner}}$

Assuming perfect information on the agents' preferences and symmetry in the sense that each firm correctly predicts that its rival has a similar attitude to ethics, the following cases emerge:

1. If $a \geq 1 - \gamma_{official}$, the highest quality project will be chosen by the official and firms will bid only in qualities, leading to the equilibrium: (Q, B) = (A, 0) independently of the firms' preferences.

2. If $a < 1 - \gamma_{official}$, the highest bribe will be preferred by the auctioneer. In that case, firms will bid with the maximum bribe they can, as long as the generalized bribing cost

does not exceed the fixed amount R earned by the winner. Thus, in equilibrium[8], firm i's bid will be: $(Q_i, B_i) = (A - \frac{R}{(c+\gamma_i)}, \frac{R}{(c+\gamma_i)})$.

In this set-up, the psychological cost of bribing is increasing with the size of the bribe. Another alternative would be firms and officials experiencing a one-off psychological cost attached to the mere act of placing and accepting bribery that is fixed and independent from the size of the bribe. However, considering the literature on lying and deception, the former presents a more appropriate modeling choice. For example, Mazar et al. (2008) propose that people engage in dishonest behavior to an extent that will allow them to maintain a positive view of themselves. In a more recent paper, Gneezy et al. (2018) present theoretically and experimentally how the size of the lie is an important determinant of behavior. Although lying and bribing are not identical, they do share important principles of anti-social behavior. Considering this, we conjecture that the size of the bribe, similarly to the size of the lie, is an important determinant of behavior and thus preferred to incorporate it as such in the model.

One could also argue that it is not only the winning firm and the public official that suffer psychologically, but also the losing firm and the affected or not affected citizen. However, this is considered by design. If bribery exists, quality, which is linked to the

[8] These equilibrium bids correspond to the continuous strategy case. With discrete strategies, equilibrium (Q_i, B_i)= (5; 5) disappears for i > 0, while as i increases, equilibria (Q_i, B_i) = (8; 2), (Q_i, B_i)= (9; 1) and (Q_i, B_i)= (10; 0) emerge.

payoffs of these two agents, is lower. We could incorporate an element that reduces these agents' payoffs further either in a binary manner depending on the mere existence of bribery or in accordance to its size. Yet, in the case of the citizen, this element would not alter the predictions presented here, while in the case of the losing firm this could be conceptualized as a higher γ. One could argue further, that perhaps public official bribe receivers and firm bribe givers experience an additional psychological cost (additional to the moral concerns that come with bribery) for the monetary and non-monetary externalities they impose to the other agents. Again, in our model this would translate to a merely higher γ. Further, we examine whether this argument has valid grounds, i.e., if firms and officials experience other regarding preferences when third parties (the public) are affected, by comparing TB with TA, and TO with TA-O.

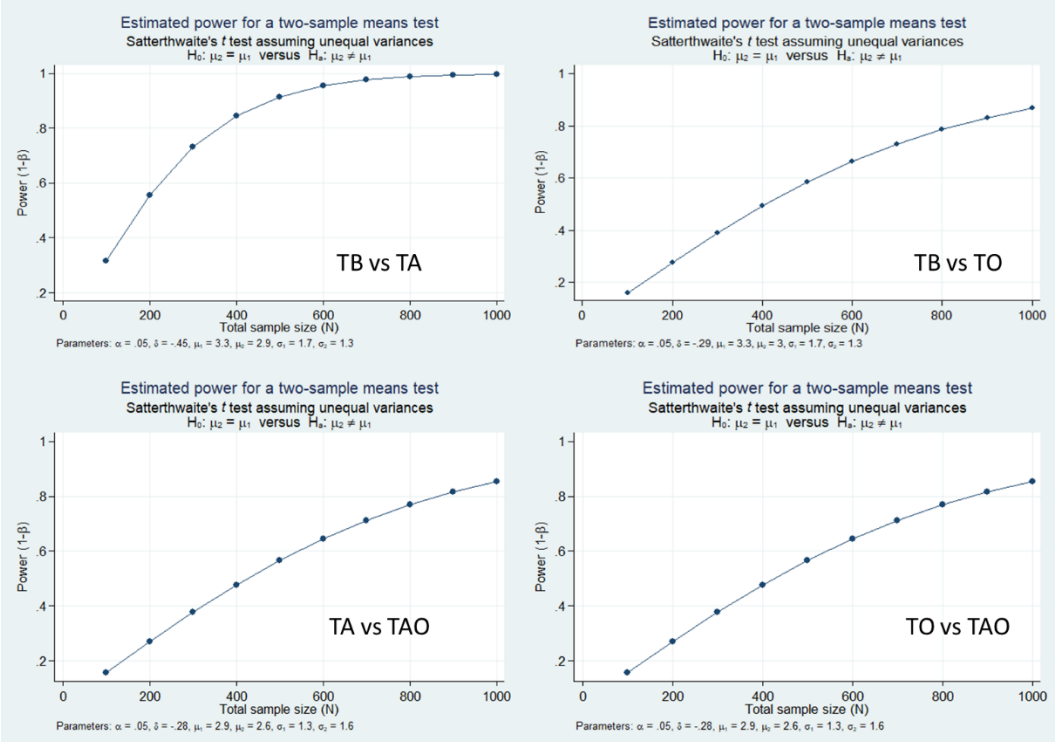
Summarizing, the model predicts that officials may choose the highest quality proposal if they are sufficiently bribery-averse, while they will choose the bidder with the highest bribe otherwise. In the perfect information setting discussed above, firms faced with a quality maximizing auctioneer, will not bid with bribes, independently of their own preferences, whereas firms anticipating a bribery-maximizing behavior by the auctioneer will promise higher bribes, the less bribery-averse they are. In the case of uncertainty regarding the official's type, a generalized version of this model would produce a continuum of equilibrium predictions, depending on the percentage of pro-social officials and the distribution of bribery-aversion costs. While the development of a general model with these characteristics is beyond the scope of this paper, it is

rather straightforward consequence of our setup that the distribution of officials' and firms' bribery-aversion parameters will have the expected result of less bribery and more pro-social project choices, the higher the density of bribery aversion parameters on larger value

A.3. Power and Sensitivity Calculations

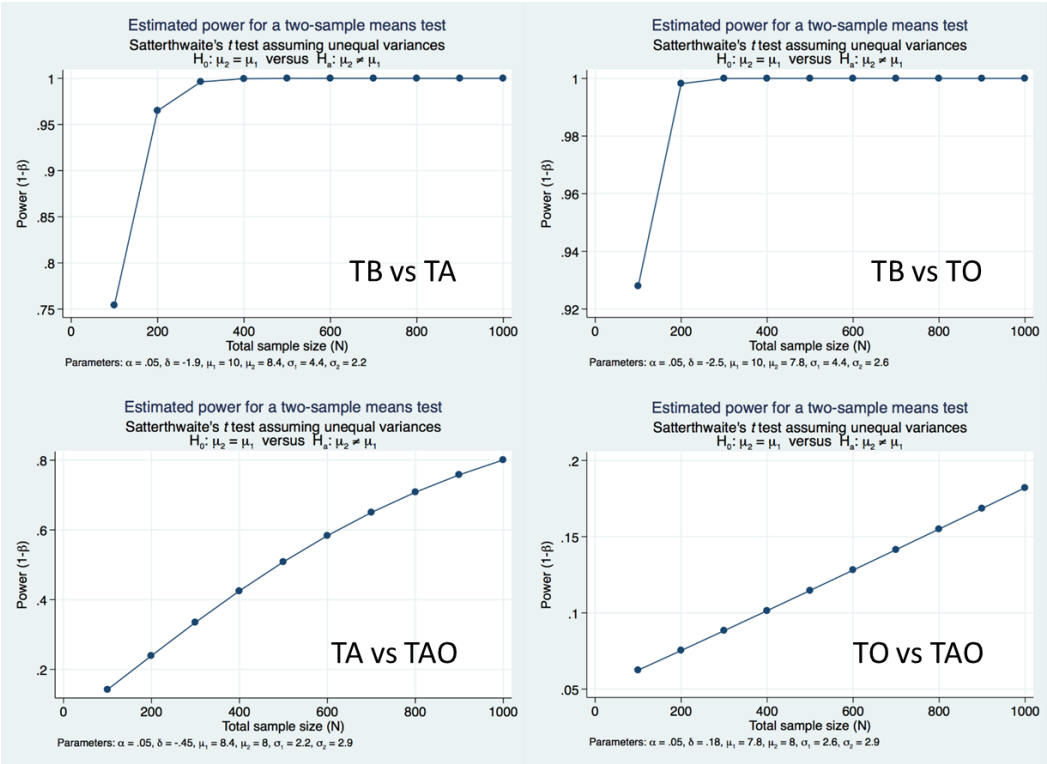
Below, we present graphically power calculations for the tests presented in the results section. We use standard Satterthwaite's t tests assuming unequal variances. The graphs present the power dynamics given the observed differences for each test indicated in the label. The y axis stands for the power and the x axis for the necessary sample for each level of power to be obtained.

Firms Behaviour



In the graph above, for the given difference in firms' bribing behaviour between treatments TB and TA to be significant in a 5% level with a power of 80% (probability of type II error) a sample of N=354 observations would be required for both treatments (177 per treatment). Similarly, for TB and TO a sample of N=830 observations would be required (415 per treatment). For TA and TAO, the necessary sample would have to be N=866, and for the TO and TAO the sample would have to be N=342. In the results section, we report the differences between TB and TA as well as TB and TO to be significant, the first in a 5% level and the second in a 10% level while the report the rest of the treatment's comparisons not to have yield significant results.

Officials' Behaviour



Comparably to the power calculations regarding the tests of firms' behavior, we now turn to the power for the tests comparing officials' behaviour across treatments. For the given differences across treatments to be significant in a 5% level with power of 80% the following samples would be necessary. For the comparison of TB to TA the number of observations would have to be N=112 (or 56 per treatment), for TB to TO the number of observations would have to be N=68 (or 34 per treatment), for TA to TAO and TO to TAO the samples would have to be N=998 and N=7142 respectively. In the results section we report the differences between TB to TA and TB to TO to be significant in a 10% level and in a 5% level respectively while we report the rest of the comparisons as not significant.