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Transparency reduces bribery by shaping beliefs in a public goods experiment with corruption opportunities

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We examine the relationship between actual and perceived corruption, exploring how individuals' direct experiences of corruption align with their beliefs about group-level corrupt behavior. Using a repeated public good game with an option to bribe a computerized bureaucrat, we analyze how the availability of information on corrupt behavior affects both individual willingness to engage in corruption and group-wide perceptions of corruption. Our findings indicate that when information about corruption is not publicly shared, individuals are more likely to offer bribes, exacerbating a collective action problem where the public good is undermined by free-riding behavior. However, when information about corruption is transparently communicated, individuals are less inclined to act corruptly, reflecting the potential of transparency to solve collective action dilemmas by aligning personal actions with the collective interest. These results highlight the pivotal role of perceived group behavior in shaping individual decisions and suggest that policies fostering transparency and information-sharing can mitigate corruption by avoiding the deterioration of the social norm and the consequent collective loss.

Keywords Collective action, Group behavior, Information, Corruption, Experiment, Beliefs, Public goods

Corruption, broadly defined as the misuse of public office for private gain[1,2], is a widespread problem that undermines governance, weakens institutions, and erodes public trust. It affects all levels of government and public services, appearing in forms such as bribery, embezzlement, and clientelism. Both bureaucratic (petty) and political (grand) corruption have serious consequences, including inefficiency in public goods provision and hindered economic development[3]. Despite global recognition of these effects, corruption remains difficult to address due to its secrecy and a persistent gap between perceived and actual corruption levels[4–6].

This "corruption gap" poses a major challenge for policy-making, as behavior is often shaped more by what people believe others are doing than by reality. When individuals assume corruption is widespread, they are more likely to engage in it themselves. Our study tackles this problem by testing whether transparency and information-sharing can reduce the gap between perception and reality. Using a controlled experiment, we examine how different information environments influence individuals' beliefs and decisions about engaging in corrupt behavior, providing insight into how transparency can reshape social norms and expectations.

Recent research has increasingly focused on how perception shapes corruption-related behavior. Beliefs about the prevalence of corruption-shaped by social networks, peer interactions, and information-can significantly influence collective behavior[7–9]. When people believe corruption is common and tolerated, they are more likely to act corruptly themselves[10]. On the other hand, transparency about others' wrongdoing can foster accountability and reduce the desire to bribe by raising concerns over reputation and norms[11,12]. Social dynamics are key in aligning individual actions with group norms, and information flow within groups plays a crucial role in either curbing or reinforcing corruption. Studies show that sharing information about group behavior can foster accountability and reduce corrupt actions[13,14]. These findings highlight the importance of understanding how transparency can shape social norms and influence decision-making.

In this study, we explore how transparency and information about corrupt behavior affect individuals' willingness to engage in bribery. We ask whether perceptions of group-level corruption differ from actual

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behavior, how information about others' actions changes those perceptions, and how these dynamics evolve over repeated interactions.

We use a controlled laboratory experiment that allows precise observation of corrupt behavior. Participants engage in a repeated public good game with the option to bribe a computerized bureaucrat. Before deciding on their contribution level, participants choose whether to bribe, with the availability of information about those choices systematically varied. We manipulate whether these bribery attempts are visible to others or kept private and elicit participants' beliefs about the level of corruption within the group. This setup allows us to examine how social image concerns, belief formation, and conformity influence corruption. Building on prior work[15,16], our approach offers a window into corruption in a controlled environment.

This study makes several important contributions to the literature on corruption and transparency. First, it moves beyond the general claim that transparency reduces corruption by offering micro-level evidence on the psychological and social mechanisms involved. By directly observing belief formation and behavior under varying informational conditions, we show that transparency works not only by deterring through reputational costs but also by reshaping perceptions of group norms and social acceptability. Second, the experimental setting eliminates the confounding effects of enforcement by using a non-human, computerized bureaucrat, showing that transparency can deter corruption even without human oversight or sanctions; in fact, we emphasize the role of perceived norms as an actionable policy target alternative to formal enforcement. Third, we provide empirical evidence of path dependence in corrupt behavior: once norms are established early in the interaction, they tend to persist, reinforcing the case for early-stage transparency interventions. These findings deepen our understanding of how information shapes moral behavior in collective settings and offer concrete implications for the timing and structure of anti-corruption policies.

Our findings provide important insights into the mechanisms through which information dissemination can alter social norms, discourage corrupt actions, and foster collective accountability. These results have significant implications for the design of anti-corruption policies, particularly in settings where transparency and information-sharing can be leveraged to reduce corrupt practices.

Results

Design

We design a repeated public good game experiment with minimal contribution requirements and an opportunity for bribing. In each of the 20 rounds, participants decide how much to contribute to the public good, with a mandatory minimal contribution level equal to 1/3 of their endowment. To introduce uncertainty about others' corrupt and contribution behavior, we allow for heterogeneous endowment levels (12, 15, 18, 21 or 24 tokens). Participants have the option to bribe a computerized bureaucrat, who accepts a bribe of 2 tokens with some probability (unknown to participants) and grants the participant the opportunity to free-ride. In each round, we elicit participants' willingness to bribe and contribution level, together with their beliefs regarding the corrupt behavior of other group members (n hereafter) and the probability of bribe acceptance (p hereafter). To prevent competitive bribery, only one randomly selected bribe attempt per group is implemented in each round. The methods section provides additional details on the experimental design.

Since our main focus is to deepen the analysis of the interplay between the dissemination of 'social information' (see[17]), the perception of group behavior and individual corruptibility, we manipulate the availability of information on corruption attempts and test two between-subject conditions. In the *Private information* treatment, hereafter PRI, the decision to corrupt and whether the eventual bribe is accepted remain private information of the selected group member; in the *Public information* treatment, hereafter PUB, both these information are revealed to all group members.

Behavioral hypotheses

Our experimental design allows us to study how individual choices depend on the expected behavior of others, how the latter are formed, and how both depend on the institutional setting in terms of information diffusion.

Regarding the belief formation process, expecting participants to rely on a Bayesian updating mechanism after receiving *(i)* private feedback whenever selected to bribe and *(ii)* public feedback in the PUB treatment, is straightforward. However, we also expect to observe some form of reflection in belief formation, with participants more inclined to bribe, expecting others to do the same and vice versa[18,19]. We introduced ambiguity on others' choices to leave room for uncertainty when forming expectations of others' behavior. Similar to Zou and Qin[20], our experimental participants face a monetary-morality tradeoff: bribing raises non-monetary costs, while conforming to a social norm reduces them. Thus, expecting others to be corrupt increases the net benefits of bribing. We therefore hypothesize

Reflection in belief formation (RBF): *Bribers expect the group corruption rate to be higher.*

The literature has extensively shown how social influence and conformity shape behavior[21], although the effect of social norms on one's behavior is often underestimated[22]. With specific reference to dishonest behavior, this is more frequently observed when information on others' wrongdoing is shared, leading to the erosion of social norms (see, among others,[23], for empirical evidence on corruption scandals, and[13], for experimental analyses). Similarly, our participants state their beliefs on group-level corruption, in terms of the number of others' corruption attempts, and, in the PUB treatment, also receive information on whether the selected participant chose to bribe. We, therefore, expect to confirm the following behavioral hypothesis

Conformity to the social norm (CSN): *Corruption attempts are more frequent when participants expect others to act dishonestly*.

Simultaneously, participants are also asked to form a belief on the probability of bribe acceptance and, if selected, receive information on whether their bribing attempt was successful. It is reasonable to expect participants to rely on such beliefs and information, though for a different reason, which is payoff maximization,

as a higher bribe acceptance implies a higher chance to free-ride. This mechanism is irrelevant for participants with a low or null propensity to bribe, e.g., those characterized by higher moral costs associated with dishonesty. However, we overall expect participants willing to bribe to act in a payoff-maximizing manner. The hypothesis that follows is

Payoff maximization (PM): *Corruption attempts are more likely when the probability of bribe acceptance is expected to be higher*.

Information diffusion can impact the willingness to corrupt in two ways. On one hand, spreading news about bribery attempts may erode social norms and increase one's willingness to bribe[23,24]; on the other hand, it may reduce bribery due to the stigma associated with information diffusion[25–27]. One explanation behind these opposite results lies in the setting: while in larger contexts and grand corruption events there is a clear separation between the corrupted party (i.e., public administrations) and the subjects of the study (i.e., citizens), shame aversion and image concerns are more likely to emerge in smaller communities or petty corruption. Similarly to Dhami et al.[28], our setting mimics smaller groups, such as firms, small municipalities, or communities. Furthermore, experimental studies on deception have shown how information leaks may prevent dishonest behavior via image concerns[29–31]. Similarly, we wish to test whether spreading information about corruption attempts may reduce the willingness to bribe. The corresponding behavioral hypothesis is

Social image concerns (SIC): *Corruption attempts are less frequent when information about one's wrongdoing is publicly shared*.

The diffusion of information on corruption attempts can, therefore, have an ambiguous effect on behavior: if *CSN* is verified, then others' wrongdoing might push group members to bribe as well; if, instead, individuals have social image concerns (*SIC*), then we should observe lower bribery rates when information is publicly shared. In other words, the sign of the effect of information diffusion in our PUB treatment will depend on the relative strength of these two effects.

Finally, the literature has shown that corruption undermines the voluntary contribution mechanism in public goods, as it diminishes cooperation among participants[10,32,33]. The visibility of corrupt behavior could further discourage participants from contributing, either due to heightened mistrust or a perceived normalization of corrupt practices. As a result, pro-social motivations could be hindered, with a consequent reduction of one's own willingness to contribute to the public good. In this regard, our experimental design deliberately renders others' contributions opaque to avoid the confounding effect of conditional cooperation behaviour. The associated hypothesis is

Corruption effects on contributions (CEC): *Contributions to the public good decrease when corruption events are publicly known*.

In the online Appendix A, we provide a toy model incorporating our behavioral hypotheses. Table 2 in the Methods section lists the variables used in the analyses, with their description and summary statistics.

Treatment effects

Table 1 reports the mean, standard deviation, and tests for treatment differences of (i) the stated beliefs on the probability of bribe acceptance (p), and on the number of bribe offers (n), (ii) their distance from the actual value and (iii) corruption and contribution choices.

This preliminary analysis shows substantial treatment effects on corruption choices: both own and (expected) others' bribing attempts are higher in the PRI treatment. However, participants similarly overestimate others' corruption attempts in both treatments. Regarding beliefs about the probability of bribe acceptance and their distance from the true value, we do not observe significant differences. The same holds for contribution levels, with participants investing in the public good in PRI and PUB, respectively, 42.5% and 40.4% of their endowment, i.e., mildly above the minimal contribution.

Participants' beliefs

Figure 1 summarizes the results of the analysis of participants' beliefs on the corrupt behavior of other group members. In particular, panel *a* reports the average belief per period on the number of corruption attempts in the group by treatment; panel *b* shows the fraction of such beliefs that were above (medium-shaded area), equal (lighter-shaded area) or below (darker-shaded area) the actual number of corrupters; panel *c* shows the size of the gap between beliefs and the actual number of corrupters; lastly, panel *d* shows the determinants of participants' beliefs, analyzed via two specifications which differ in how we introduce the decision to corrupt at period $t-1$. Figure 2 reports the same analyses for participants' beliefs on the probability of bribe acceptance.

As the t-test in Table 1 confirms, the belief about the number of corrupters is lower when information regarding the corruption choice of the selected group member is shared (panel *a* of Fig. 1). This result suggests that the availability of information on other people's experiences of corruption may affect one's perception of corruption. Following a standard belief-updating process, when information about specific corruption cases is shared, individuals adjust their beliefs accordingly. However, while the gap between actual and perceived corruption appears to narrow somewhat over successive rounds (panel *c*), panel *b* indicates that despite differences in absolute beliefs, the availability of information does not improve the accuracy of beliefs. In both treatments, participants show a strong tendency to overestimate the group's actual level of corruption. Such tendency is, however, slightly decreasing throughout periods, in favor of a higher fraction of correct beliefs (i.e., the lighter-shaded area increases with periods in panel *b*).

Finally, the results reported in panel *d* of Fig. 1 show that participants who received positive feedback on their corruption choice in the previous period are more likely to increase their beliefs in overall corruption, compared to those who received no feedback. Furthermore, participants who engaged in bribery in the previous round also tend to raise their beliefs. These two results support our research hypothesis *RBF*, as individuals more prone to corruption are also more likely to think that others are similarly corrupt. Furthermore, as already shown in

Variable	PRI Mean/(SE)	PUB Mean/(SE)	PRI - PUB t-test
Beliefs			
Others (*n*)	1.802	1.487	0.315^{***}
	(0.085)	(0.060)	
Belief - actual *n*	0.875	0.815	0.060
	(0.059)	(0.058)	
Bureaucrat (*p*)	0.486	0.455	0.032
	(0.016)	(0.015)	
Belief - actual *p*	0.006	-0.031	0.037
	(0.049)	(0.042)	
Choices			
Corrupt	0.612	0.455	0.157^{***}
	(0.039)	(0.034)	
Contribute	0.425	0.404	0.021
	(0.014)	(0.014)	
N	17	17	

Table 1. Between-treatment differences and t-test of choices and beliefs. The values displayed for t-tests are the p-values of a two-independent sample t-test run on independent observations. The test used is an ultra-conservative two-sample *t* test[34], where the independent unit of observation is the group; therefore, we average variables over group members and periods. PRI indicates Private Information treatment, and PUB indicates Public Information treatment; for both, we have 17 independent observations. Significance: ***0.01, **0.05, *0.1

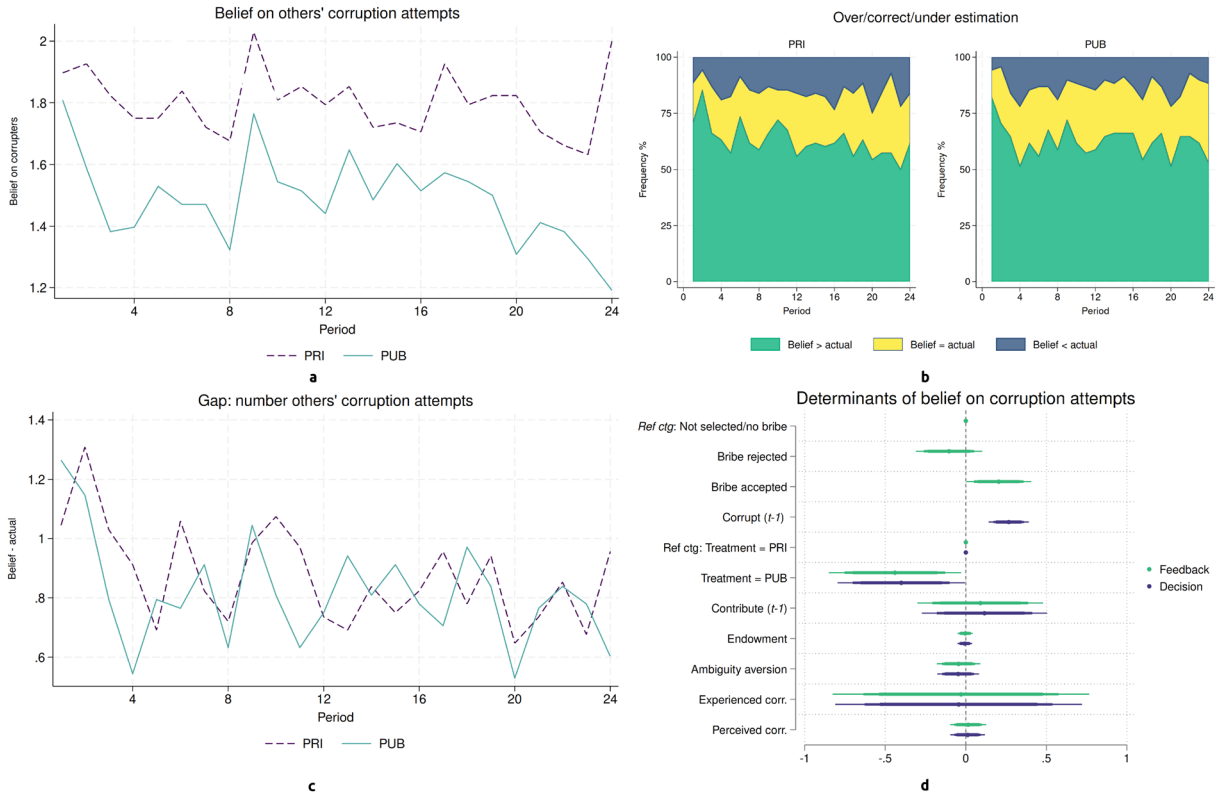

Fig. 1. Beliefs on the number of corrupters: dynamics (**a**), estimation errors (**b**) and average per-round gap (**c**) by treatment, and determinants assessed via regression analysis with 99%, and 95% and 90% confidence intervals (**d**).

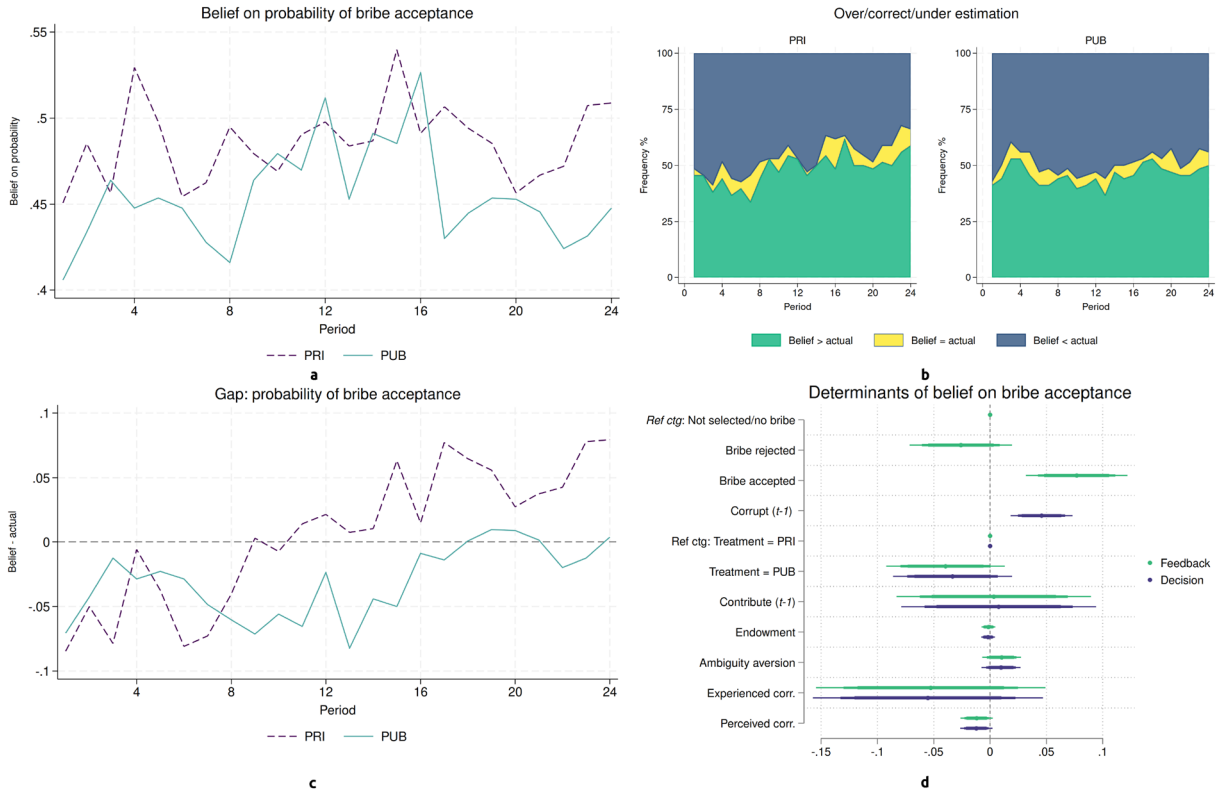

Fig. 2. Beliefs on the probability of bribe acceptance: dynamics (**a**), estimation errors (**b**) and average per-round gap (**c**) by treatment, and determinants assessed via regression analysis with 99%, and 95% and 90% confidence intervals (**d**).

the descriptive statistics, participants playing in a setting where only private information is available (treatment PRI) are more likely to increase their beliefs about the overall corruption level of the group, compared to subjects receiving public information (treatment PUB). This can be a consequence of the combined effect of the *RBF* and social image concerns (*SIC*) if the latter is confirmed. When bribery is associated with social image concerns due to public exposure of individual corrupt acts, participants may anticipate that others will also feel deterred by public scrutiny. Consequently, they have lower expectations regarding others' corruption rates in this public information setting.

Concerning the belief on the probability of bribe acceptance, panel *a* of Fig. 2 suggests that it does not vary in the two treatment conditions. Forming such beliefs is, of course, complicated by the change in probability every 8 periods and by its wide range of possible values. However, if we analyze how the gap between the belief and the actual probability evolves, we can spot some effects of the information provided. Panels *b* and *c* show that, although precisely estimating the probability is challenging (see the lightest area in panel *b*), participants with additional information tend to form beliefs closer to the actual probability of bribe acceptance.

The data also suggest that participants, on average, tend to underestimate the probability of bribe acceptance in the early periods across both treatments. However, over repeated rounds and without receiving information (treatment PRI), they increasingly overestimate this probability, showing a similar tendency as observed for beliefs about others' behavior. Lastly, panel *d* reports the result of our estimated model, revealing similar patterns to those seen about beliefs on *n*: participants who bribed in the previous round or had their bribe accepted are more likely to increase their belief about the probability of bribe acceptance, *p*, following a standard Bayesian updating process. Additionally, respondents who perceive their living area as more corrupt (i.e., individuals with high perceived corruption) have lower beliefs regarding the likelihood of bribe acceptance. This finding suggests that the contextual features of one's place of residence play a significant role in shaping opinions about the prevalence of corruption among public officials. Specifically, individuals living in high-corruption areas may develop greater tolerance toward corrupt practices, particularly petty corruption, leading them to underestimate its impact[35,36].

This tolerance often results from weakened social norms that do not strongly condemn corruption, allowing people to justify or downplay it[37].

Corruption and contribution choices

We next analyze the two choices that our experimental participants are asked to make, i.e., corrupt to free-ride and contribute to the public good. In what follows, by *Corrupt*, we refer to a participant's willingness to bribe, which we elicit through the strategy method; this is, unless otherwise stated, irrespective of whether the subject

is then selected for attempting to corrupt and of the success of the attempt. The variable *Contribute* is the share of the endowment contributed in a given round, to allow comparability across differently-endowed individuals.

Figure 3, panel *a* plots the frequency of corruption choices by round. It clearly shows how giving public feedback on corruption choices (PUB treatment), even anonymously and without monetary consequences, discourages bribery attempts.

The lower corruption rate causes a lower perceived group-level corruption in the PUB treatment (see Fig. 1): subjects update their belief about others' behavior based on their own actions. Therefore, knowing that they are less willing to bribe when information on corrupt behavior is spread, participants also expect others to be less inclined to bribe.

Panel *b* of Fig. 3 reports the results of the estimated models with corruption choice as the dependent variable. The *Decision* specification also includes the first-round bribing decision (see Methods section), which can be interpreted as the individual's intrinsic propensity to engage in petty corruption. This interpretation follows from the literature using first-round behavior in repeated public good games as the subject's intrinsic pro-sociality (see, among others,[38]).

Results show how beliefs about others' actions play a crucial role: if the expected corruption rate is larger than the actual one, which implies a tendency to overestimate others' bribing, participants are more inclined to engage in bribery themselves. This suggests that misbehavior can be sustained through social learning, as individuals may imitate (what they believe is) others' behavior or feel justified in misbehaving if they see others doing the same, thereby eroding social norms. This cognitive dimension of corruption relies on the expectations of what other people are doing when faced with similar choices[39]: individuals adjust their behavior based on what they think other agents will do, and these expectations are generated endogenously by information about what other agents have done (as the PUB treatment shows). This means that expectations about corruption are underpinned by a self-fulfilling mechanism that sustains corrupt behavior over time. People's expectations about others' behavior directly influence their own (mis)behavior, making corruption persist[40]. This result is, therefore, a confirmation of our *CSN* hypothesis.

Regarding beliefs about the probability of bribe acceptance, the lagged gap between the stated belief and the actual value (p) is only weakly significant in the *Feedback* specification (p-value = 0.093). However, we find a strong and negative effect of a previously rejected bribe, suggesting a profit-maximizing logic. Notably, the influence of beliefs-both about p and n-on bribing behavior appears stronger when using contemporaneous values (see Table A.1 in Appendix E). While we avoid drawing causal inferences due to possible endogeneity, the effects shown in panel *b* of Fig. 3 can be interpreted as a lower bound of conservative estimates. We therefore do not reject our *PM* hypothesis.

The results of our *Decision* specification indicate that participants show internal consistency, as their behavior correlates with both first-round behavior and that of the previous round. Our interpretation is that first-round behavior captures a set of intrinsic characteristics that identify the subject as more or less willing to engage in corruption. Additionally, the fact that decisions made in the previous period significantly influence current decisions contributes to the persistence of this behavior.

The behavior observed in the two treatment conditions differs significantly from the early stages of the game; in particular, in the PUB treatment, the corruption rate is lower from the very first round (see Fig. 3, panel *a*). Given the absence of significant differences between the two samples-neither in demographic nor in corruption-related characteristics (see the balance tests in Table A.2 of the Appendix)- we cannot reject the hypothesis that this effect is due to the behavioral consequences of disclosing public information. Since such information carries no monetary consequences, one possible explanation is that the 'public exposure' of one's wrongdoing triggers social image concerns. Additionally, in the PRI setting, participants are intentionally prevented from inferring the contribution choices of others. As a result, a low return from the public good could be due to a successful corruption attempt, an unfavorable random assignment of endowments, or minimal contributions from all group members. In contrast, in the PUB treatment, publicizing information about bribery attempts removes participants' ability to " shift the blame" when they choose to engage in corruption and free-riding behavior

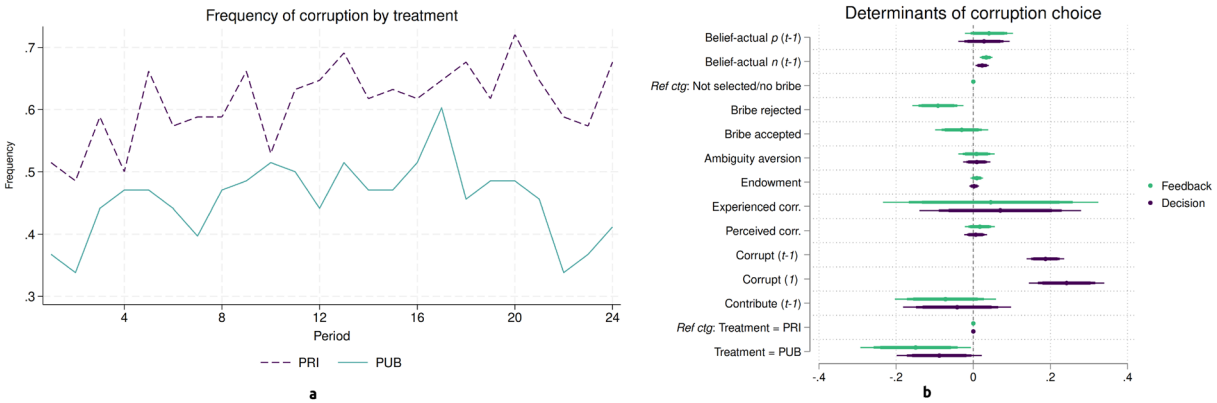

Fig. 3. Dynamics by treatment (**a**) and determinants with 99%, and 95% and 90% confidence intervals (**b**) of corruption choices.

(see[41–43]). Furthermore, this transparency mechanism is in place from the beginning of the game (see Table A.3 in Appendix E for a set of t-tests, analogous to those of Table 1, run on outcomes of round 1).

This suggests that the lower corruption rate observed in the PUB treatment is not solely driven by feedback from repeated rounds (i.e., the establishment of a social norm). Instead, it arises primarily from the mere fact that information about bribery is made public. This overall supports our *SIC* hypothesis.

Figure 4 reports the same analyses of Fig. 3 for contribution choices. In particular, panel *a* displays the average contribution to the public good by round and by treatment, expressed as a share of the endowment. Consistent with previous studies on repeated public good games (e.g., Andreoni[44]), contributions decline over rounds. The figure also shows that contributions are slightly lower in the PUB treatment, though this difference is not statistically significant (see Table 1). Our findings of the endowment's contribution to the public good, shown in panel *b*, indicate that individuals with larger endowments make smaller contributions. Furthermore, the *Decision* specification shows that there is clear and strong path dependence in contributions, as it is often found in repeated public good experiments: subjects who contributed more in the previous period (and in the very first one) also contribute more in the present one. Lastly, regression results only provide a weak confirmation that contributions are smaller in the PUB treatment, as this is only true for the *Decision* specification (see Table A.4 in Appendix E). As mentioned in the discussion of the *CEC* hypothesis, the diffusion of information about bribing can discourage voluntary contributions. However, our analysis can only provide weak support to the *CEC* hypothesis.

Discussion

The findings of this study provide experimental evidence that transparency can mitigate corruption by reshaping social norms and individual expectations. In the Public (PUB) treatment, where information about bribery attempts was shared, individuals were significantly less likely to engage in corruption. This supports the idea that transparency deters corrupt behavior by increasing reputational costs and disrupting social incentives[13,11].

Social norms and collective beliefs proved crucial in influencing behavior. Participants adjusted their actions based on their expectations of others, aligning with perceived group norms. Transparency in the PUB treatment led to lower beliefs about others' likelihood of bribing, which contributed to reduced corruption. These findings highlight the potential of leveraging social conformity in anti-corruption strategies[4,12].

Transparency works through social image concerns, belief updating, and behavioral conformity. Even anonymous disclosures reduced bribery attempts, suggesting that the threat of public exposure-despite no formal punishment-triggers reputational concerns that deter unethical behavior. Access to information also enabled participants to revise their beliefs, lowering perceived corruption rates and reducing its social acceptability.

However, the effects of transparency depend on the context. In environments where corruption is normalized or where public information is distrusted, its deterrent impact may be limited. For instance, participants who believed corruption was widespread in their area underestimated bribe rejection likelihood, indicating that local norms shape expectations and weaken transparency's impact[35,36]. In the Private (PRI) treatment, where no public information was available, participants overestimated corruption and their behavior became self-reinforcing-consistent with a cognitive trap sustaining corrupt norms[40]. These findings highlight the need to tailor transparency initiatives to specific cultural and institutional settings.

Another insight from the study is that perceived corruption slightly reduced contributions to the public good. When corruption was visible, some participants were less inclined to cooperate, possibly due to perceived unfairness or reluctance to contribute when others were shirking responsibilities. This highlights a complex relationship between fairness perceptions and collective action, meriting further study[14].

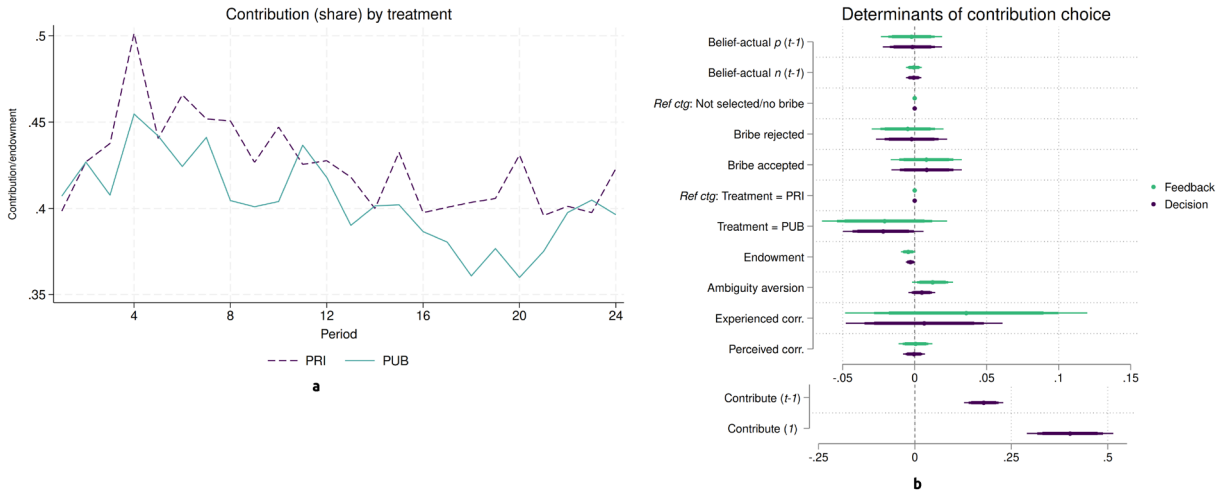

Fig. 4. Dynamics by treatment (**a**) and determinants with 99%, and 95% and 90% confidence intervals (**b**) of contributions (as a share of the endowment).

The study also emphasizes the potential of transparency to foster accountability and align perceived and actual corruption levels. By informing individuals more accurately, transparency can build trust and encourage ethical behavior-especially in settings where formal enforcement mechanisms are weak[45,46].

Social image concerns were a powerful behavioral lever. Even anonymous exposure in the PUB treatment discouraged bribery, as individuals anticipated social judgment. This suggests that anti-corruption strategies could benefit from harnessing reputational incentives, especially where legal penalties are limited[30].

Patterns of path dependency in decision-making also emerged. Participants' choices in earlier rounds influenced later behavior, especially in the PRI condition, where a lack of transparency led to entrenched corruption. This reinforces the value of early interventions to prevent norm internalization and promote lasting ethical conduct[10,39].

These findings offer clear implications for policy. Transparency mechanisms-such as publishing audits, anonymous reporting systems, or digital dashboards-can shift behavior by increasing visibility, even without direct punishment. When introduced early, such as at entry points into public service via integrity training or feedback during probation, transparency can shape norms before corruption becomes habitual. For effectiveness, these tools must ensure anonymity, credibility, and minimize risks of backlash or disengagement.

In summary, transparent information reduces corruption by aligning beliefs with reality, discouraging unethical behavior through reputational concerns, and reinforcing prosocial norms. By reducing ambiguity surrounding others' actions and making misconduct visible, transparency can promote ethical conduct and collective accountability.

Methods

Experimental design

The experiment consists of two independent phases followed by a final questionnaire. Instructions for each phase were provided to participants and read aloud by the experimenter only after the completion of the previous phase. The structure of the experiment is summarized in Fig. 5.

During phase 1, subjects repeatedly play the public good game with corruption; the two treatments, Private information and Public information differ in this phase only and are implemented between subjects. Phase 2 of the experiment consists of an incentivized task aimed at measuring participants' ambiguity aversion (presented with neutral wording). According to Moore and Eckel[47], choices under risk are typically those where the probabilities of each outcome are known, whereas choices under ambiguity have unknown probabilities and/or outcomes. Given that our setting is much closer to the second definition and that we elicit participants' beliefs on such unknown probabilities, we must elicit their ambiguity aversion to account for it in our analysis. The final questionnaire includes the subjects' demographics and a set of corruption-related questions taken from the European Quality of Government Index (EQI)[48] and the Italian National Institute of Statistics (ISTAT) surveys (the questionnaire, including EQI and ISTAT questions, is reported in Appendix B).

Phase 1 of the experiment is framed as a bribing game (the experiment instructions and the screenshots of phase 1 are reported in Sections C and D of the Appendix). At the beginning of phase 1, subjects are randomly matched into 4-participant, constant groups (partner matching protocol) and each subject is assigned an endowment level, $e_{i,g}$, with $e_{i,g} \in \{12, 15, 18, 21, 24\}$. Partner matching was preferred over random matching to balance the design in terms of strategic uncertainty and cognitive burden, given that our participants already face the uncertainty related to others' endowments, on top of the usual one associated with others' contributions in public good games. Subjects are informed about the possible values of their endowment, their equal likelihood, and the impossibility of knowing the endowments assigned to other group members. The endowment is renewed at the beginning of every period and its level, once assigned before period 1, stays the same for the whole phase 1. We implemented heterogeneous endowments, among other reasons explained below, to avoid confounding effects due to commonly observed behavioral regularities such as conditional cooperation or retaliation.

After the matching, subjects play for 24 rounds a public good game with minimal contribution, i.e., the minimum possible contribution is equal to 1/3 of the endowment. They can therefore contribute an amount $c_{i,g} \in [e_{i,g}/3, e_{i,g}]$. Each group is associated with a computerized 'bureaucrat', which has some probability p of accepting a bribe b of 2 tokens to allow participants to free-ride, i.e., contribute exactly 0.

The choice of a computerized bureaucrat, of which subjects are aware, is due to two main reasons. The main focus of our study is the active decision to bribe and how this is affected by (the belief concerning) others' bribing decisions. Having computerized acceptance avoids the confounding effects of dealing with participants' subjective willingness to accept the bribe and moral concerns. Secondly, by imposing an exogenous probability of accepting the bribe, we can assess the gap between participants' perceptions and the actual level of corruptibility. The size of the bribe and its effects were chosen so to (i) avoid demand effect as much as possible (by avoiding too high positive or negative effects on the payoff) and (ii) having a bribe lower than the lowest compulsory contribution, i.e., that of subjects endowed with 12 tokens, to avoid contributing being more convenient than bribing.

In each round, one randomly chosen participant from each group has the opportunity to engage in corruption. Limiting it to a single bribery decision avoids competition among potential bribers (or the need for additional rules regarding multiple bribery proposals) and maintains uncertainty about others' actions. If the bribe is accepted, she only pays 2 tokens to the 'bureaucrat' and gets the returns from the public good. If the bribe is not accepted, she has to pay both the bribe and the minimal contribution.

The probability of acceptance, p, is randomly determined every 8 rounds (i.e., at the beginning of rounds 1, 9 and 17) and can be equal to 0, 5, 10..., 95, 100, with all values equally likely. The change in probability serves two main purposes: first, to mimic changes in institutional settings (e.g., turnover in local authorities), and second, to prevent subjects from always choosing to bribe simply to guess the correct probability of acceptance (to obtain the reward for beliefs). However, we did not want to eliminate the possibility of multiple interactions with the

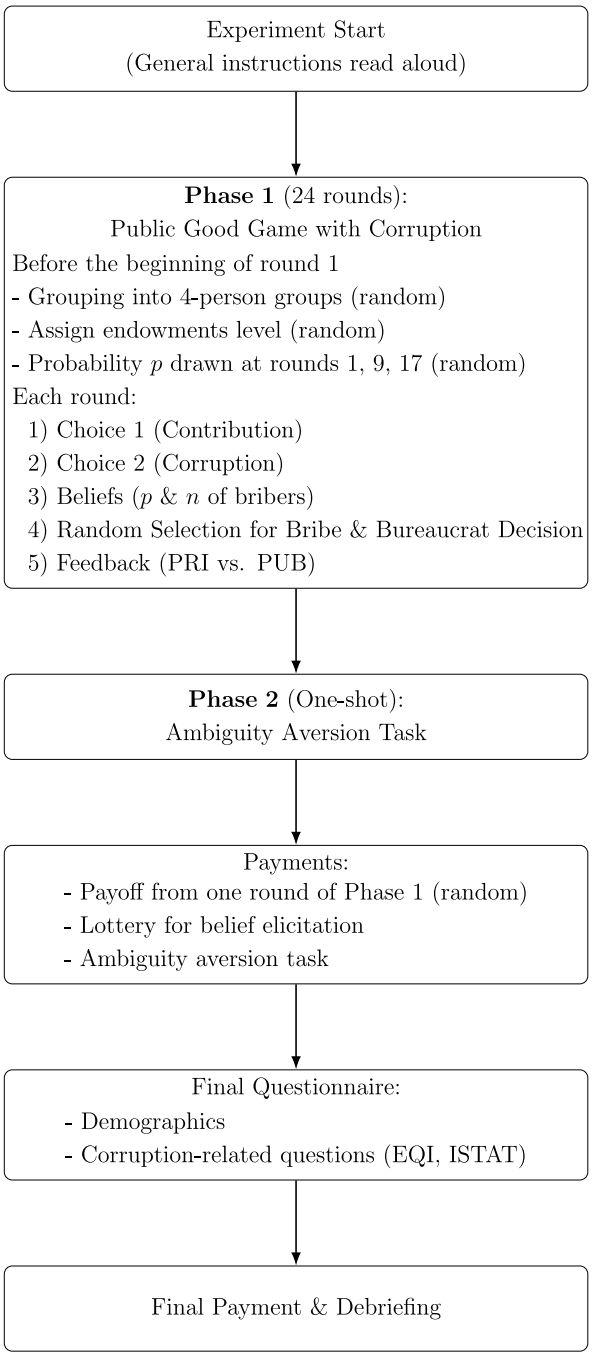

Fig. 5. Experimental design.

computerized bureaucrat entirely. Therefore, we have chosen an interval of 8 rounds, allowing each participant to be selected to bribe, on average, twice. Although participants are aware of all the possible values of p, its uniform probability, and when it will be re-drawn, they are never informed about its actual value.

To elicit both contributions and willingness to corrupt, we ask our experimental participants to make their choices conditional on the two possible scenarios, i.e., being or not being selected for bribing. In other words, using the strategy method[49], we ask participants to make two choices in each of the 24 rounds:

choice 1 they have to state how much they want to contribute to the public good, with the minimal contribution being 1/3 of their endowment and maximal contribution equal to the endowment itself. This choice is implemented if the subjects are not selected for the bribing attempt;
choice 2 they are asked to state whether they want to try to corrupt *in case they will be selected*. Therefore, this choice is elicited for all 4 group participants, even though it will be implemented for only one of them. When a subject is not selected for the corruption attempt, her *choice 1* is automatically implemented;

Furthermore, before receiving end-of-period feedback, we ask participants to state two empirical expectations:

belief 1 what is the probability of bribe acceptance, p;
belief 2 how many players, in their group of N members, they believe made a corruption attempt in the current period, n.

Beliefs are incentivized via a binary lottery: participants gain, for every correct answer of each type, 2% probability of winning the higher prize (10 tokens) in a lottery, which is administered at the very end of the experiment.

To sum up, a single round of the game develops according to the following timeline:

1. Contribution choice (strategy method)
2. Corruption choice (strategy method)
3. Beliefs elicitation: how many corruption attempts in the group in the current round, n? How much is the probability of acceptance, p?
4. The program randomly selects the group member whose corruption choice has to be implemented and, if needed, randomly draws the acceptance or rejection according to p.
5. End-of-period feedback is communicated to participants.

As mentioned above, the two treatments differ in the end-of-period feedback. In the PRI treatment, subjects are only informed about the payoff they earned for the period and whether they have been selected for the corruption attempt. Selected participants are also told whether the bribe was accepted and, therefore, whether their *choice 1* or *choice 2* has been implemented. In PUB, end-of-period feedback includes not only the player's own payoff but also the result of the corruption attempt, even for non-selected players. All group members are, therefore, told whether the selected participant has made a corruption attempt and, in case she did, whether the bribe has been accepted or not.

However, it is important to stress that in none of the treatments, subjects can find out the result of the corruption attempt through the payoff they earn. Similarly, they cannot recover the endowment level of other group members. All they can recover, or at least have an idea about, is the aggregated level of contribution to the public good in their group. Therefore, if they experience poor contributions, this can be due to either a successful corruption attempt, or all group members having low endowments or, lastly, everybody contributing minimal amounts.

The actual payment for phase 1 coincides with how much subjects earned in a randomly selected round, to which we add the outcome of the binary lottery incentive for belief elicitation. The choice to pay a single, randomly selected round is aimed at avoiding house money effects, which would cause a change in behavior due to the amount of money earned in previous rounds. Before knowing which round is selected for final payment and the outcome of the binary lottery, subjects perform a task aimed at eliciting their attitude towards ambiguity. Similarly to Lauriola and Levin[50] and to Cavatorta and Schröder[51], participants are asked to choose between pairs of Ellsberg-like urns (see[52]). In every pair, the first urn contains a known number of green and yellow balls, while the second has an unknown composition. We keep the winning prize fixed (10 tokens) and vary the proportion of winning balls in the first urn. Subjects are asked to state their preference between the two urns for every couple and are paid according to the result of a draw from the urn they preferred in one randomly selected pair.

The main limitation of our study is related to the generalizability of its results, as typical with laboratory experiments. Using the methodology proposed by List[53], we discuss here the four *SANS* transparency conditions. For what concerns *Selection*, our sample is composed of university students randomly selected from the pool of the CESARE laboratory. The treatment was randomly assigned to each session to guarantee a homogeneous distribution of demographic characteristics in the differently-treated samples. *Attrition* was not present, as all subjects decided to participate in the experiment after being informed about the task (i.e., after reading the instructions). When considering the *Naturalness*, on the one hand, we are aware that the artificial laboratory setting is quite far from the natural one where bribing decisions take place. Furthermore, the choice of a computerized bureaucrat, which removes the additional complexity of dealing with social norms and morality concerns in two parallel interactions (in bribing the bureaucrat and in the public good with peers), renders the setting less natural. On the other hand, as discussed in the introduction, we have purposefully framed the experiment as a bribing game exactly to increase its naturalness[16]. As far as *Scaling* is concerned, our study is scalable in other laboratory settings, for example, by including students from different countries to investigate cultural differences. Nevertheless, our study offers insights into the relationship between information diffusion, beliefs, and corruption, which are aspects hardly measurable with observational data.

Experimental details and sample

The experiment was programmed in zTree[54] and carried out at CESARE lab (LUISS 'Guido Carli' University, Rome) between March and May 2018 in accordance with the standard guidelines in Experimental Economics and all the relevant regulations. The experimental protocol was approved by the Director of the laboratory; participants' consent, acceptance of the laboratory rules, and of its privacy policy were obtained upon enrollment in the Orsee platform, as per the laboratory rules at the time when the experiment was carried out.

We recruited 136 participants from the University's pool of subjects via the ORSEE platform[55] and allowed them to participate in a single session only. Each session included either 20 or 24 participants randomly matched into four-subject groups; this excludes any possibility of personal identification of members of the same group. In each session, participants were randomly assigned to a computer and, before the experiment started, instructions were read aloud, and questions were answered privately. Overall, we ran three sessions,

Variable	Mean	sd	Variable description
Bureaucrat (p)	0.470	0.247	Subject's belief on the 'bureaucrat"s acceptance probability
Others (n)	1.645	0.932	Subject's belief on corruption attempts in own group in current round
Corrupt	0.533	0.499	Dummy: subject has attempted to corrupt at period t
Contribute	0.415	0.158	Share of endowment contributed to the public good
Private information	0.199	0.541	Private (individual-level) feedback at round $t-1$:
			not selected/did not bribe = no feedback received
			(either not selected or did not offer a bribe);
			rejected = selected and offered a bribe which was rejected;
			accepted = selected and offered a bribe which was accepted
Public information	0.449	0.882	Public (group-level) feedback at round $t-1$, PUB treatment only:
			did not bribe = selected subject did not offer a bribe;
			rejected = bribe was rejected;
			accepted = bribe was accepted
Endowment	17.60	4.424	Subject's endowment level, {12, 15, 18, 21, 24}
Treatment	0.500	0.500	Dummy for PUB treatment
Belief - actual p	− 0.0125	0.347	Gap between the individual's belief and the true probability of acceptance
Belief - actual n	0.845	1.230	Gap between the individual's belief and the true number of corruption attempts
Individual characteristics			
Female	0.404	0.491	Gender dummy (ref. cat.: male)
Age	22.64	2.322	Age
News exposure	2.593	0.706	Exposure to newspaper, news on TV and internet (0 = 'never', 4 = 'Everyday')
Experienced corr.	0.197	0.270	Self-reported experienced corruption (frequency in 4 possible public services, each $\{0, 1\}$)
Perceived corr.	4.898	2.130	Self-reported corruption level in area of origin (mean of 6 public services, each [0, 10])
Ambiguity aversion	7.500	1.627	Score in ambiguity aversion task
South (dummy)	0.544	0.498	Geographic origins: south or islands
Observations	3,264		

Table 2. List of variables.

which yielded 68 participants and 17 independent four-player groups, for each treatment. A session lasted, on average, 90 minutes, with participants gaining an average payoff of 16.5 €. Participants in our sample are, on average, 22.6 years old, with 40.4% being female and 54.4% coming from southern Italian regions. The rationale for controlling for the geographic origins of participants lies in the fact that Italian southern and insular regions are associated with higher corruption rates[56]. Balance tests reveal no differences in the two samples exposed to the experimental treatments in terms of demographic characteristics and corruption experiences (see Table A.2 in Appendix E).

Table 2 reports a description and summary statistics for all the variables used for the analysis, both descriptive and econometric.

Econometric strategy

To investigate the determinants of subjects' beliefs, we resort to random-effect tobit regressions where the dependent variable is the participants' belief, either on the corruptibility of the 'bureaucrat' (i.e. the probability of bribe acceptance, p) or on the corruption level of other group members (i.e. the number of corruption choices in the group, n). While random effects allow us to accommodate the longitudinal structure of our data, the tobit approach accounts for the truncated nature of our dependent variables. In particular, the belief on n is bounded between 0 and 3 while that on p is between 0 and 1. All regressions include the set of individual characteristics presented in Table 2 and period dummies.

Specifications *Feedback* and *Decision* differ only in how we introduce the decision to bribe at period $t-1$. In models *Feedback* , we use such a decision to build the variable 'Private information', which captures the end-of-period feedback that the subject receives in response to her bribing offer. The reference category for this variable is the situation in which the subject received no feedback whatsoever from her corruption choice in the previous round, either because she was not selected for proposing a bribe or because she did not offer one. In models *Decision* we introduce directly the decision to corrupt in the previous round, independently from its outcome and whether the subject is then actually selected for offering a bribe. The time-invariant nature of the treatment dummy and of the individual controls does not allow for a fixed-effect approach. Table A.5 in Appendix Section E reports the results of the same specifications to which we have added, following Mundlak[57], the individual averages of the time-varying covariates to take care of the potential correlation between observed and unobserved variables. Results are consistent with those of Figures 1 and 2.

When analyzing corruption choices, we use a random-effect probit approach and report the corresponding marginal effects in our coefficient plot. For contribution choices, we resort again to random-effect tobit due to the censored distribution of the variable. All specifications include the same set of demographic controls included

in the analysis of beliefs, period dummies, and the gap between beliefs and actual p and n in the previous round. The gap is lagged to avoid potential endogeneity between beliefs and behavior. Including this gap at round t gives very similar results reported in Table A.1 of the SI Appendix, Section E. Following Wooldridge[58], we also include in both dynamic specifications (i.e., *Decision* models) the choice each subject has made in the very first round of play, to get rid of the so-called 'initial condition problem'. As for the analysis of beliefs, a fixed-effects approach is unfeasible. Table A.6 in the Appendix, Section E, reports the results of the same specifications with the Mundlak correction, showing that they are consistent with those of Figs. 3 and 4.

Data availability

The data and code for replicating the results are available at https://osf.io/sykau/?view_only=9c8446ebe647445fafd4efc8f2e16b90

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Author contributions

G.C., L.C. and F.M.: conceptualization. GC: funding acquisition. F.M.:experimental design, formal analysis and data curation. All authors: writing - draft and review.

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Declarations

Competing interests

The authors declare no competing interests.

Additional information

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