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Abstract

The influence of wages on public officials' corruptibility: a laboratory investigation

by Roel van Veldhuizen*

Previous studies have proposed a link between corruption and wages in the public sector. The present paper investigates this link using a laboratory experiment. In the experiment, public officials have the opportunity to accept a bribe and can then decide between a neutral and a corrupt action. The corrupt action benefits the briber but poses a large negative externality on a charity. The results show that increasing public officials' wages greatly reduces their corruptibility. In particular, low-wage public officials accept 91% of bribes on average, whereas high-wage public officials accept 38%. Moreover, high-wage public officials are less likely to choose the corrupt option. Additionally, the results suggest that a positive monitoring rate may be necessary for these effects to arise.

Keywords: Bribery; corruption, experimental economics, laboratory experiment

JEL classification: D73, C91, K42

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1 Introduction

Corruption is a significant problem in large parts of the world. Following the World Bank (World Bank, 1997), corruption has been widely defined as "the abuse of public office for private gain" (see also Buehn and Schneider, 2009). In a similar spirit, Shleifer and Vishny (1993) define corruption as "the sale by government officials of government property for personal gain" and Banerjee, Hanna, and Mullainathan (2012) define it "as breaking of a rule by a bureaucrat (or an elected official) for private gain." Other definitions have broadened the scope of these definitions to include corruption in the private sector. For example, Transparency International defines corruption as "the abuse of *entrusted* power for private gain" (Transparancy International, 2012, emphasis added). The 1999 Criminal Law Convention on Corruption (European Union, 1999) also explicitly incorporated corruption in the private sector as a form of corruption.

Corruption is widely thought to be widespread. For example, the World Bank has estimated that at least 1 trillion dollars in bribes changed hands in 2002 (Kaufmann, 2005). As a consequence, fighting corruption has become a primary goal for many of the world's governments in recent years. One possible policy instrument that has prompted considerable debate is the level of public official compensation. Theory (starting with Becker and Stigler, 1974, see also Cadot, 1987; Besley and McLaren, 1993; Acemoglu and Verdier, 2000) suggests that increasing the wages of public officials should reduce their corruptibility. If this holds, it provides governments with a policy instrument that falls directly under its control and would therefore be relatively easy to implement.

There are at least two reasons why increasing public officials' wages could reduce the level of corruption. Firstly, increasing public official wages would increase the expected monetary costs of corruption. A wage increase would reduce the relative value of the wage a public official could expect to earn in

the private sector. With the right combination of monitoring and punishment, the amount of money a public official will expect to lose from corruption will increase, inducing them to behave less corruptly (this is the mechanism suggested by Becker and Stigler, 1974; see also Olken, 2007; Tanzi, 1998).[1]

Secondly, increasing public officials' wages may also increase the non-monetary or 'moral' costs of corruption for at least three reasons. A first reason is that public officials may perceive a high wage as being more fair, making it more costly for them to go against the government's wishes by behaving corruptly; this idea is similar to the fair wage-effort hypothesis (Akerlof and Yellen, 1990; see also Van Rijckeghem and Weder, 2001). A second reason is that there may be a social norm condoning side payments for low-wage public officials but not for high-wage public officials (Fisman and Miguel, 2007). A third reason is that inequality averse public officials may be more willing to increase their income through corruption if their wage is lower than the comparison wage (Fehr and Schmidt, 1999; Abbink, 2005).

However, field studies have produced little evidence in favor of the link between corruption and public sector wages. Svensson (2005) discusses four directly relevant studies: Rauch and Evans (2000), Treisman (2000), Van Rijckeghem and Weder (2001) and Di Tella and Shargrodsky (2003). Of these four, the first two find no robust evidence; the latter two find a small negative association. However, as Svensson argues, the first three studies are based on perception-based cross-country data that hinder causal inference; moreover, they use ranked data rather than absolute levels to measure corruption. Di Tella and Schargrodsky (2003) make use of exogenous variation in the audit probability in the city of Buenos Aires, which increases corruption risks and does not directly affect the relative wage of public officials.

In response to this apparent difficulty in acquiring high-quality data, the

[1] An additional mechanism applies if public officials' utilities are a concave function of money. Having a large salary will then decrease their marginal utility of money, decreasing the attractiveness of accepting bribes.

last decade has seen a large increase in the number of laboratory experiments in the area of corruption.[2] Starting with Frank and Schulze (2000) and Abbink, Irlenbusch, and Renner (2002), corruption experiments have investigated issues ranging from the effect of staff rotation (Abbink, 2004), culture (Barr and Serra, 2010; Cameron, Chaudhuri, Erkal, and Gangadharan, 2009) and intermediaries (Drugov, Hamman, and Serra, 2011) to comparing top-down and bottom-up monitoring (Serra, 2011), the effects of risk attitudes (Berninghaus, Haller, Krüger, Neumann, Schosser, and Vogt, 2013) and small bribes and gift giving Malmendier and Schmidt (2012). See Abbink and Serra (2012) for an overview.[3]

Laboratory experiments have also previously been utilized to investigate the influence of public officials' wages on their corruptibility. Abbink (2005) investigates the link between wages and corruption by varying the wage of public officials with respect to the wage of a third party and finds no effect. Frank and Schulze (2000) and Schulze and Frank (2003) vary the fixed payment received by public officials in a one-shot game and also find no effect. Armantier and Boly (2008) compare the results of a framed lab and field experiment in which participants have to grade homeworks. In one of the homework sets, graders receive a bribe accompanied by a request to be lenient in grading. They find that increasing graders' wages decreases their corruptibility, although this effect is significant only in the lab with a large set of controls. Azfar and Nelson (2007) find that higher wages decrease the corruption of an executive party in a public choice experiment but have no effect on the corruptibility of an attorney general. Finally, Jacquemet (2012) studies a three-player corruption game with delegation and finds that corruption actually *increases* in the wage

[2]For a discussion of the advantages and disadvantages of different methods used to measure corruption, see Armantier and Boly (2012); Schneider (2005); Sequeira (2012); Olken and Pande (2012) and Banerjee et al. (2012) among others.

[3]Related studies focusing on different forms of illegal or immoral behavior include Kirchler, Hoelzl, and Wahl (2008), Coricelli, Joffily, Montmarquette, and Villeval (2010) and Kogler et al. (2013) who study tax evasion and strategic tax compliance, Schwieren and Weichselbaumer (2010) and Cassar, Friedman, and Schneider (2009) who study cheating, and Gneezy (2005) and Dreber and Johannesson (2008) who study deception.

of the public officials.[4] Overall, the laboratory evidence on the link between wages and corruption appears to be rather mixed as well.

One possible reason why previous studies examining the link between wages and corruption have yielded mixed findings is that they employed different reference wages. Indeed, both monetary and non-monetary considerations require a reference wage to determine what wage should be regarded as 'high' or 'low'. Field studies have tended to take aggregate level variables as reference wages, such as, for example, the average wage in the manufacturing sector (e.g., Van Rijckeghem & Weder 2001).

However, previous work in both psychology and economics suggests that people compare themselves to individuals who are similar to them and whom they often interact with (see e.g., Festinger, 1954; Buunk & Mussweiler, 2001; Suls, Martin, and Wheeler, 2002; Sweeney & McFarlin, 2004; or see Linde and Sonnemans, 2012, for a recent application in economics). By this line of reasoning, income comparisons are likely to be part of the bribery process when private parties are in long-term personal corruption relationships with relatively similar public officials.

Long-term relationships are particularly likely to develop in low-level (or petty) corruption, where private parties repeatedly pay small bribes to obtain special privileges or to increase the working speed of public officials. Developing a long-term relationship between a private party and a public official can be beneficial for both parties, since doing so increases trust between them, which makes the relationship more profitable overall. Long-term relationships may also arise out of a selection effect when the private party gradually finds out which public official is most receptive to his interests and then persists with bribing this public official. In many parts of the world, persistent bribery

[4] Jacquemet conjectures that this is caused by the fact that being corrupt is costly in the experiment, so high-wage public officials can more easily afford to be corrupt. Barr et al. (2009) also document a link between public officials' wages and corruption in a laboratory experiment. However, in this study the monitoring rate is endogenously determined and increasing in the public official's wage; hence it becomes impossible to separate the effect of wages on corruptibility from the effect of monitoring.

relationships are also part of a longstanding cultural or historical tradition (Hooker, 2009). By contrast, income comparisons are less likely to occur in high profile (or grand) corruption cases, which are less frequent and in which the private party (e.g., a large firm) is too dissimilar to the public official. Thus, in long-term corruption relationships the briber's income is likely to be an important reference wage for public officials.

However, several existing experimental studies (Armantier & Boly, 2008, Frank & Schulze, 2000, Schulze & Frank, 2003) look at one-shot games where a long-term corruption relationship cannot arise and hence find little evidence of a wage effect on corruption. Abbink (2005) varies the reference wage in a repeated setting by varying the wage of a third party that plays no role in the experiment other than absorbing negative externalities.[5] Hence there was no interaction between public officials and the third party, and no wage effect on corruption. Jacquemet (2012) considers two possible reference wages and Azfar and Nelson (2007) do not explicitly address what constitutes the appropriate reference wage in their experiment.

This paper contributes to the experimental literature by studying the relationship between the relative wage of public officials and their corruptibility by using a different, more salient (and perhaps more natural) reference wage in the experiment. Additionally, it introduces a new way of implementing corruption in the lab by deducting money from a charity (chosen by participants) every time public officials make a corrupt decision. Using a charity as the victim of corrupt behavior reflects the way corruption imposes negative externalities on society in the field. In particular, just as corruption is almost universally regarded as a bad thing, so is taking away money from a charity not condoned. By contrast, existing experimental work has largely imposed negative externalities on other laboratory subjects, which may not have such clear negative moral connotations. For example, if a participant in an experiment expects

[5]The third party was performing a useful task, but not one that was related to the experimental situation the public official and the potential briber were partaking in.

other participants to be corrupt, he may actually feel that they deserve to have money taken away from them.

Thus, this paper presents the results of a laboratory experiment in which participants in the role of public officials either accept or reject a bribe and then decide between a neutral and a corrupt action. The corrupt action benefits the briber but poses a large negative externality on a charity. In the experiment, I exogenously vary public officials' wages and hypothesize that increasing public officials' wages will make them less likely to accept the bribe and will make them less likely to choose the corrupt action. The results are in line with these hypotheses: the wage increase makes experienced public officials (i.e., those who have already interacted for 10 rounds) 53 percentage points less likely to accept a bribe and reduces the number of corrupt choices by 27 percentage points. Additionally, the results of a robustness check suggest that a non-zero level of monitoring may be necessary for a link between wages and corruptibility to appear.

The remainder of the paper is organized as follows. Section two provides an overview of the bribery model that forms the basis of the experiment. Section three covers the design of the experiment and section four explains the experimental hypotheses. Section 5 presents the results of the experiment and in section 6 I present the results of the robustness check. Finally, section 7 offers a short discussion of the results.

2 The Bribery Model

To study bribery in an experimental context, I use an adapted version of the experimental bribery game of Abbink et al. (2002). The bribery game describes a situation in which a citizen (or firm) can use a bribe in an attempt to convince a public official to select a favorable action (or policy) to implement. This reflects, for example, situations where a citizen needs to acquire a driver's license

or needs a permit to sell his products in a market. Importantly, the action that is favorable to the citizen imposes a negative externality on society, as is the case, for instance, if the citizen is an incapable driver or if his products do not meet a minimum quality standard.

The experiment is a repeated game of 25 periods to allow for a long-term relationship to develop between the citizen and the public official. In the stage game (displayed in figure 1), the citizen (C) decides whether to offer a transfer (or bribe) of a nonnegative integer amount t to the public official (P). If a positive transfer has been offered (i.e., if $t > 0$), the public official decides whether to accept or reject the transfer. If the public official decides to accept the offer, there is a small probability (.003) that both players will be caught and will receive a punishment.[6] To mimic the possibly large fines and job loss associated with getting caught in the corrupt act in practice, the punishment in the experiment is set to the largest feasible level. This means that caught players will be disqualified from the experiment, which entails losing all their earnings in the current and preceding periods and not being allowed to participate in subsequent periods.[7]

Provided players have not been disqualified, the public official can then choose between two alternatives, G and B. Here G is a status quo action and B is a corrupt alternative. What makes option B corrupt is that choosing it takes money away from a good cause (a charity). However, a selfish citizen strongly prefers option B to option G, which represents the gains of corruption. Option B is slightly less favorable to the public official, which represents the idea that she will need to exert some effort to justify a 'corrupt' choice to her superiors.

[6]This probability is the same as the probability used by Abbink et al. (2002) and in line with the perceived low conviction rates for corruption-related crime in practice. For example, among an estimated 45 million public servants in India in 2009, only 9,580 were faced with charges of corruption, of whom only 746 were convicted (Debroy, 2011). Yet Transparancy International (2013) estimates that upwards of 62% of Indian respondents reported having paid at least one bribe that year, implying a far larger number than 746 public officials having been corrupt.

[7]In the experiment, disqualified participants still received a show-up fee of € 7. With the probability of punishment set to .003, pairs with positive transfers in all 25 periods had a probability of $1 - .997^{25} = .072$ of being disqualified.

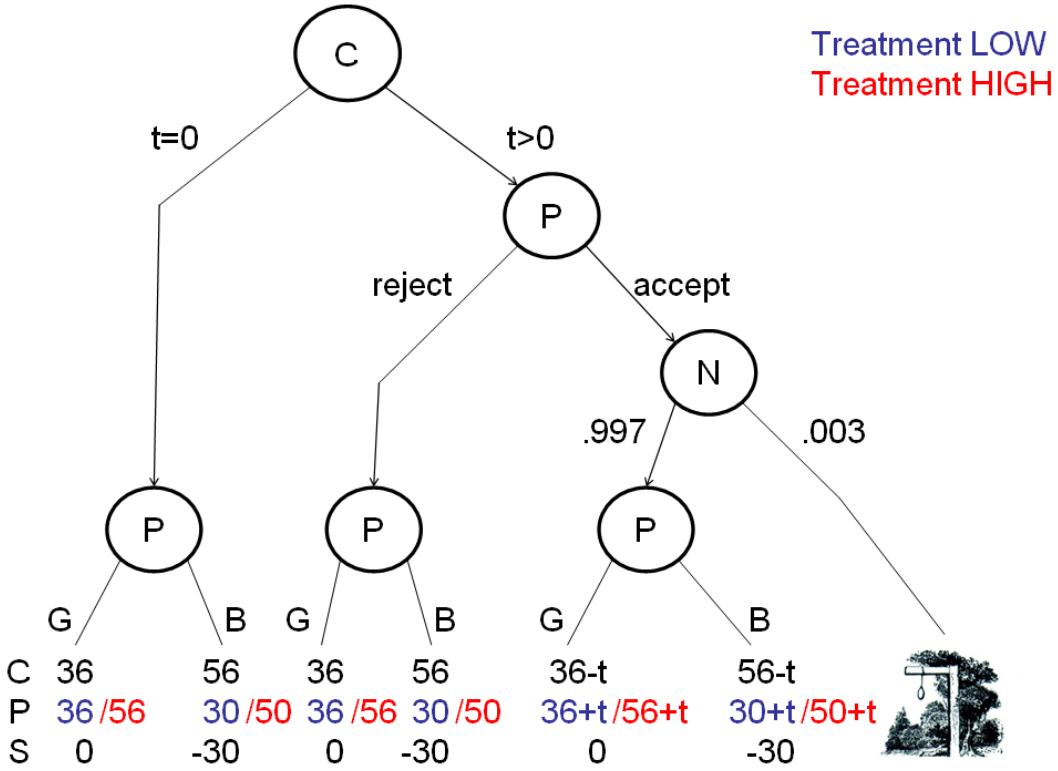

Figure 1: The experimental game tree

Notes. In the figure, C represents the citizen, P represents the public official, N is nature and S is society. The transfer is represented by 't' and G and B are the two options that can be chosen by the public official.

Note that the subgame perfect Nash equilibrium of the stage game (for selfish preferences) is for the public official to always choose option G and for no transfers to take place. Being the last mover, a selfish public official will always choose option G –the option that gives her the highest payoff. As a consequence, the citizen knows that he should not offer a transfer, since offering a transfer can only lower his payoff.[8] Moreover, Abbink et al. (2002) use a mathematical induction argument to show that the stage game result also holds for all periods in a repeated game.

The experiment uses two treatments varying with respect to the public official's wage. Figure 1 gives the payoffs associated with both treatments. The public official's wage is either equal to the income of the briber in the status quo option G (treatment LOW) or higher (treatment HIGH).[9]

3 Experimental Design

The experiment was conducted with 76 participants over four sessions in June 2010 and June 2011 at the CREED laboratory of the University of Amsterdam. Participants signed up using an online recruitment procedure. 75 participants indicated that they were students, with the largest fraction (44%) from the economics department.

The experiment itself was computerized using PHP/MySQL. Upon entering the laboratory, subjects were randomly assigned to a computer terminal and received a set of instructions. As part of the instructions, participants worked through a set of questions to make sure they fully understood the instructions. The instructions and questions are reproduced in appendix A.

[8] Technically this holds only if the citizen expects the public official to accept the transfer with positive probability, otherwise the citizen will be indifferent between proposing and not proposing a transfer.

[9] Thus, this study differs from Abbink et al. (2002) in that negative externalities are imposed on a charity and there is a treatment difference in the public official's wage. Additionally, in this study the value of the bribe is not tripled if accepted by the public official so as to avoid bribery being efficient for a citizen/public official pair. This study also does not impose an upper bound on the size of the bribe and does not impose a small cost (of 2) on citizens when they attempt a bribe.

At this point, it is worthwhile emphasising that the experiment avoided corruption-related words such as bribe, citizen, or public official. Instead, the experiment referred to the citizen, the public official, and a bribe as player 1, player 2, and a transfer, respectively. Note, however, that Abbink and Hennig-Schmidt (2006) found no evidence of a framing effect on the results in a bribery experiment that also builds on Abbink et al. (2002).

After finishing the check-up questions participants were asked to choose a charity for the current session. At the beginning of every session, a substantial sum of money (5000 experimental points or 50 Euros) was reserved for a single charity. As part of the instructions, participants were told that every time any public official in the current session chose option B (the corrupt option), this would lower the charity fund by 30 points. At the end of the instructions, participants were asked to pick one charity from a list of five charities that are well-known in the Netherlands.[10] These were UNICEF, the Red Cross, the World Wildlife Foundation, Cliniclowns, and the Prins Bernhard Cultuurfonds.[11] They could also specify another charity of their choosing, although they were told that including a controversial charity could lead to the payment being awarded to another charity instead. At the end of the session, the charity choice of one randomly determined participant was implemented.[12]

After every participant had finished the instructions and check-up questions and chosen a charity, the experiment started. Each session consisted of 25 periods. Before the first period, every participant was told his/her role (citizen

[10]Relative to a fixed charity, allowing participants to select from multiple charities made it possible for them to select a charity that better suited their personal taste. Since choosing a certain charity increased the chance that this charity would be picked, each participant had the incentive to pick his or her preferred charity.

[11]Of these five charities, the first three are also well-known internationally. The Cliniclowns is an organization of Dutch clown doctors, who seek to help alleviate some of the stress for seriously ill, hospitalized young children. The Prins Bernhard Cultuurfonds sponsors a wide range of cultural activities in the Netherlands, such as theater, art, and the conservation of architectural monuments.

[12]The number of participants that chose UNICEF, the Red Cross, the WWF, the Cliniclowns, the Prins Bernhard Cultuurfonds and another charity was equal to 34, 15, 14, 6, 1 and 6, respectively. None of the six alternative charities were too controversial to exclude. The winning charities were the Red Cross (once) and the WWF (three times).

or public official). Their role remained during the course of the experiment and public officials were matched to the same citizen for all 25 periods.[13]

Every period in the experiment consisted of five stages (see figure 1). In the first stage, citizens decided whether or not to offer a bribe. Conditional on offering a bribe, they could specify the size of the bribe in stage 2. In stage 3, public officials decided whether or not to accept the proposed bribe. Conditional on accepting the bribe, stage 4 consisted of a random draw that determined disqualification; disqualified subjects were immediately notified and asked to fill out an unrelated questionnaire for the remainder of the experiment. Finally, in stage 5 public officials had to choose between options G and B. Note that many pairs skipped stages 2, 3, and/or 4 in several periods. For example, citizens who did not offer a bribe would skip stages 2, 3, and 4. The decision screen displayed all possible moves by both players and indicated at what stage the players had currently arrived. A screen shot of the decision screen can be found in appendix B.

Every period ended after all pairs had completed stage 5; for all pairs the waiting screen between periods displayed the results of all preceding periods for the given pair. After 25 periods, one subject was randomly picked to roll a die to determine the winning charity. Participants then received an overview of their earnings and were asked to fill out a questionnaire. The questionnaire contained background questions, motivational questions, a questionnaire related to corruption taken from Rabl and Kühlmann (2008) and a psychological questionnaire relating to aggression from Buss and Perry (1992). Upon finishing the questionnaire, participants were paid their earnings (including a show-up fee of € 7) and were kindly requested to leave the laboratory.

Participants earnings ranged from € 14.14 to € 23.70 with an average of € 17.63. Charities earned between 20.60 and 41.90 euros, with an average of 31.40 euros. In total every session lasted approximately 75 minutes (15 minutes

[13] See Abbink (2004) for an experimental analysis of the effect of using a partners or strangers design in a bribery experiment.

for the instructions, 30 minutes for the decision problem, and 30 minutes for the questionnaire plus payment). Since no feedback from other pairs was given to participants, the number of independent observations is equal to 38.

4 Hypotheses

This study examines the relationship between an increase in the relative wage of public officials and their corruptibility.[14] There are at least two reasons for high-wage public officials to be more reluctant to accept a bribe. Firstly, public officials may face higher non-monetary costs of corruption in treatment HIGH than in treatment LOW. Inequality averse (Fehr and Schmidt, 1999) public officials will, for example, note that accepting a bribe in treatment HIGH will increase advantageous inequality (a bad thing), whereas accepting a bribe in treatment LOW may decrease disadvantageous inequality (a good thing). Thus, public officials who care about status can guarantee themselves a higher income level than the briber's without accepting a bribe in treatment HIGH and only with accepting a large bribe in treatment LOW, respectively. Secondly, public officials in treatment HIGH have more to lose in terms of monetary costs.[15] Both monetary and non-monetary mechanisms lead to the following hypothesis.[16]

> Hypothesis 1: Public officials are less likely to accept a bribe in treatment HIGH than in treatment LOW.

[14] In the remainder of the paper I will focus mostly on the behavior of public officials. The reasons for deemphasizing citizens are that citizen behavior (a) is not directly relevant to the link between the wages and corruptibility of public officials, (b) is less interesting in scope (only a transfer offer) and (c) crucially depends on how they expect public officials to behave (in contrast to public officials, who already know the behavior of the citizen by the time they have to make their decisions).

[15] Section 6 gives the results of a robustness check where the monitoring rate is set to zero and hence only the former mechanism plays a role.

[16] A possible third mechanism could be that public officials' utility functions are concave in money. However, for small amounts it is reasonable to assume that utility functions are approximately linear.

Accepting a bribe could lead to a reciprocal relationship between a briber and a public official. Such a relationship could ensue if public officials picked option B after accepting a bribe either to reward the briber or to induce him to offer another bribe in the next period. If hypothesis 1 holds, i.e., if public officials do not want to accept bribes in treatment HIGH, there is no reason for them to reward the briber or maintain a bribery relationship with the briber. This means that public officials should be less likely to pick option B, therefore leading us to the next hypothesis.

Hypothesis 2: Public officials are less likely to choose the corrupt option B in treatment HIGH than in treatment LOW.

5 Results

This section presents the results of the experiment. Before moving on to test hypotheses 1 and 2, it is important to recall that the Nash equilibrium prediction of the model is that no bribery will take place. However, figure 2 shows that in almost all (34/38) pairs transfer proposals occurred at least once. Moreover, for many pairs, transfer proposals were present in a substantial number of periods; the median number of periods a bribe was offered is equal to 8.5 (out of 25). Though somewhat less frequent, B choices also occurred in a large majority of pairs (28/38); the median number of periods a B decision was made is equal to 3.5.

In the remainder of this section I report the results for both the whole sample and for periods 11 to 25; I include the latter to minimize the noise generated by participants who were still trying to learn the game. Note, however, that investigating public officials' corruptibility is only possible for public officials who have been offered at least one bribe. In four pairs (three in treatment LOW, one in treatment HIGH) no bribe was ever offered and therefore these

Figure 2: Incidence of transfers and B choices

Notes. The left bar is a box plot of the fraction of periods a positive bribe was offered for each pair. The right bar is a box plot of the fraction of periods a B choice was made, again for each pair. In both cases, every public official/citizen pair is treated as one observation. The figure pools the data from both treatments; separate graphs per treatment are available on request.

pairs cannot be incorporated into the analysis.[17]

For all statistical tests employed in this section, every citizen/public official pair is treated as one independent observation. For non-parametric tests involving data from multiple periods, this entails using average behavior over all periods as the unit of observation.

5.1 Bribe Acceptance

Hypothesis 1 suggests that public officials in treatment HIGH should be less likely to accept bribes. Figure 3 shows that this is indeed the case. Public officials in treatment LOW accept on average 80% of proposed bribes (91%

[17]Because of random assignment, whether public officials were ever offered a bribe is random for the whole sample; therefore it is not a problem for any statistics that apply to all periods. For periods 11–25, however, one may worry that attrition may be non-random since bribers may be induced to stop bribing by their public official's behavior in the preceding periods. In particular, it may be that the results reported in this section overstate the actual wage effect if bribe-rejecting public officials are more likely to drop out in treatment LOW and/or bribe-accepting officials are more likely to drop out in treatment HIGH. However, since rejected bribes are costless there is no reason for bribers to stop bribing if bribes are rejected and there is no evidence that this happened.

for periods 11–25), whereas public officials in treatment HIGH accept 44% of bribes (38% in periods 11–25). This difference is statistically significant for the whole sample (Mann-Whitney; $N_{LOW} = 17$, $N_{HIGH} = 17$, z=3.109, p=.002) and for periods 11 to 25 (Mann-Whitney; $N_{LOW} = 12$, $N_{HIGH} = 15$, z=3.653, p=.000). Hence, the evidence is in line with hypothesis 1: increasing public officials' wages reduces the acceptance rate of bribe offers.[18]

Table 1 shows that the results are very similar if a probit regression is used instead, and that the treatment effect is larger when controls are included for gender, economics students and age. The table also shows that economics students are significantly more likely to accept bribes than other participants; the marginal effect is approximately 31 percentage points. This is in line with the results of Frank and Schulze (2000), who also find that economics students are more inclined to behave corruptly than other participants. However, there are no gender differences, in contrast to some previous research (e.g., Frank, Lambsdorff and Boehm, 2011; or Alatas et al., 2009) which suggests that if women are involved in a corrupt transaction, it is more likely to fail. Finally, there are no age effects, which is not very surprising considering that the experimental sample consisted mostly of students.

These results by themselves do not tell us why public officials chose to accept fewer bribes in treatment HIGH. One possible reason is that public officials in treatment HIGH were offered smaller transfers. This would require (a) that citizens in treatment HIGH indeed offered smaller transfers and (b) that public officials were more likely to reject smaller transfer offers. However, the data provide little evidence for either claim. Indeed, although the proposed transfer size is slightly lower in treatment HIGH (9.57) than in treatment LOW (11.39), the difference between treatments is significant at the 10% level only for the whole sample (Mann-Whitney; $N_{LOW} = 17$, $N_{HIGH} = 17$, z=1.671, p=.095)

[18] In total, 120 bribes were accepted over all sessions; no pair was actually disqualified in the experiment. The probability of no disqualifications with 120 bribes is equal to $(1 - .003)^{120} = .697$.

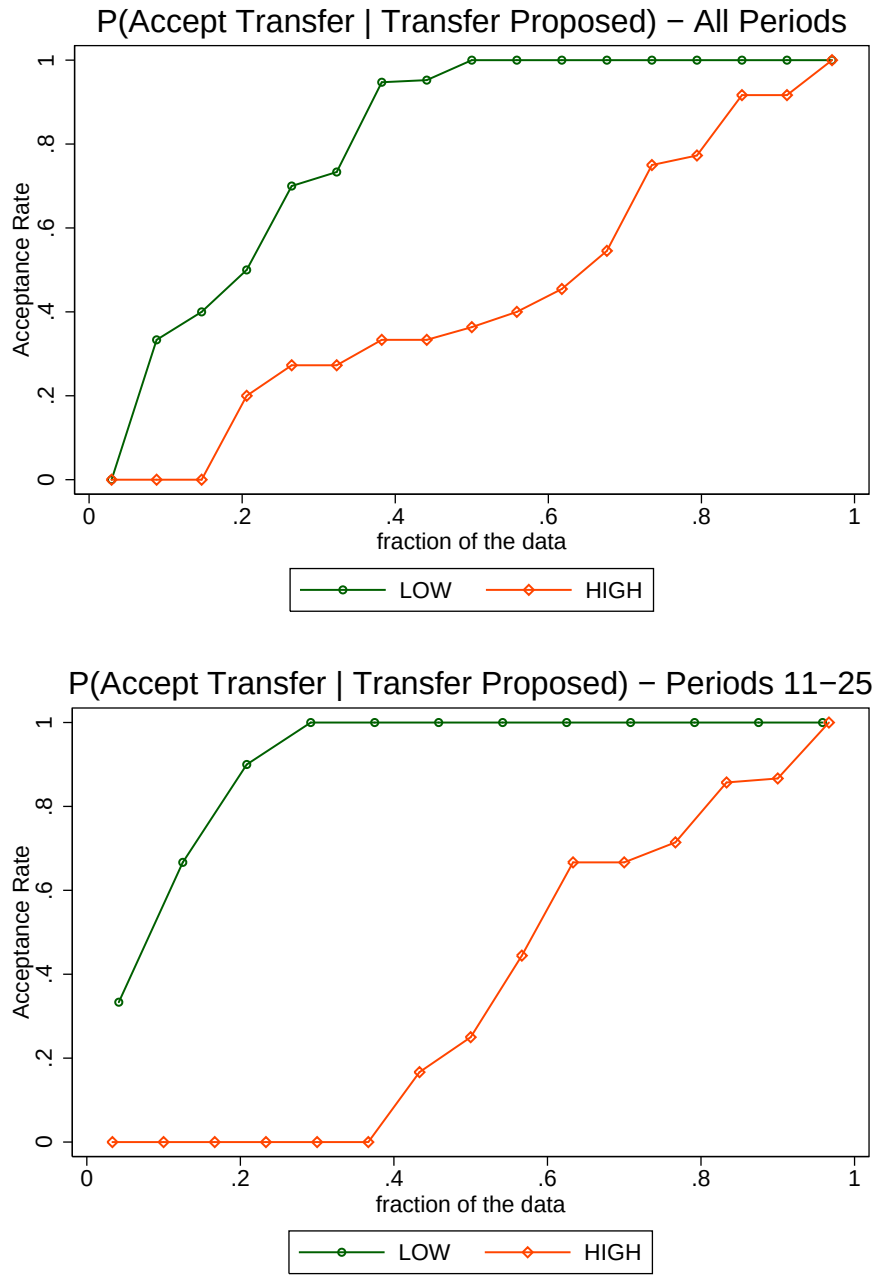

Figure 3: Fraction of accepted transfers

Notes. The figure plots the empirical distribution of transfer acceptance rates using a quantile plot. Every dot in the graph represents one public official/citizen pair. The upper panel reports the results for all periods, the lower panel reports the results for periods 11–25.

Table 1: Probit estimates for bribe acceptance

	Dependent Variable: Bribe Accepted (1=yes)			
	(1)	(2)	(3)	(4)
High Wage	-.400***	-.553***	-.468***	-.682***
	(.055)	(.083)	(.061)	(.130)
Male			.071	.059
			(.073)	(.168)
Economics Student			.308***	.305***
			(.061)	(.084)
Age			.008	-.008
			(.014)	(.021)
Periods	all	11–25	all	11–25
Observations	372	193	348	179
Conditional on a Transfer Having Been Proposed	yes	yes	yes	yes

* significant at 10%; ** significant at 5%; *** significant at 1%

Notes. This table displays the results of four probit regressions. The reported numbers are marginal effects; the numbers in parentheses are standard errors corresponding to these marginal effects. The regressions use the data for public officials only and use bootstrapped standard errors (1,000 replications). The regressions with controls include fewer observations, since one public official did not report his/her gender, age, and field of study.

and not significant for periods 11 to 25 (Mann-Whitney; $N_{LOW} = 12$, $N_{HIGH} = 15$, z=1.199, p=.230).[19] Importantly (and perhaps suprisingly), public officials are not more likely to reject smaller transfer offers in treatment HIGH.[20] These two findings combined suggest that the difference in acceptance rates between treatments cannot be explained by differences in transfer amounts.

Possible supplementary evidence for the motivations of public officials comes from the post-experimental questionnaire. In the questionnaire, public officials answered the following questions: "In deciding to accept player 1's [i.e., the citizen's] transfer offer the charity's/my own/player 1's payoff was an important

[19]Interestingly, citizens are actually more likely to offer a bribe in treatment HIGH (48% of periods) than in treatment LOW (31%). This difference is significant at the 5% level (Mann-Whitney; $N_{LOW} = 20$, $N_{HIGH} = 18$, z=-2.242, p=.025) for the whole sample and at the 10% level for periods 11–25 $N_{LOW} = 20$, $N_{HIGH} = 18$, z=-1.676, p=.094).

[20]In a probit regression of the transfer acceptance decision on transfer amount and a constant, the p-value for transfer amount equals .544 for the whole sample and .545 for periods 11–25.

Table 2: Motivations for bribe acceptance

	LOW	HIGH	Difference	P-value
Own payoff	4.30	3.89	-.41	.562
Charity payoff	3.15	4.95	1.80	.004
Player 1's payoff	3.95	3.95	.00	.952
Observations	20	18		

Notes. This table gives the average response to three questions in the post-experimental questionnaire. These questions were "In deciding to accept player 1's transfer offer the charity's/my own/player 1's pay-off was an important factor." Answers were reported on a Likert Scale ranging from 1 to 7. The reported p-values are calculated using Mann-Whitney tests.

factor." Table 2 reports the results of the three questions by treatment. For public officials in treatment HIGH, avoiding damage to the charity was named as the most important factor in deciding (not) to accept bribes, whereas for public officials in treatment LOW, the charity was the least important factor. This finding is not consistent with a monetary cost explanation, since for a monetary cost explanation the payoff of the charity is irrelevant. It does however fit with the idea that non-monetary costs are increasing in public officials' wages (as per hypothesis 1), since high-wage public officials care relatively little about their own payoff and the payoff of the briber.

5.2 G and B Choices

So far we have seen that public officials are less likely to accept transfers in treatment HIGH and that this difference is not driven by differences in proposed transfer size but may be driven by differences in the non-monetary costs of corruption. Hypothesis 2 states that this difference in transfer acceptance rates should also be reflected by the percentage of B choices. Figure 4 gives an overview of the percentage of B choices conditional on a transfer having been proposed. For the whole experiment, the percentage of B choices is 51% and 36% in treatments LOW and HIGH respectively; this difference is not significant (Mann-Whitney; $N_{LOW} = 17$, $N_{HIGH} = 17$, z=.975, p=.330). For periods 11 to 25 the difference becomes larger (60% versus 33%) and significant at the 10%

level (Mann-Whitney; $N_{LOW} = 12$, $N_{HIGH} = 15$, z=1.876, p=.061). Thus, the number of B choices seems to reflect the difference in bribe acceptance rates described above, although the effect is smaller (27 versus 53 percentage points for periods 11–25).[21] When no transfer was proposed, the fraction of B choices was very small at 5.2% and 10.8% in treatment LOW and HIGH respectively, the treatment difference is not significant (for periods 11–25 the percentages were 4.1% and 11.0% respectively). The fraction of B choices was significantly smaller when no transfer was proposed for both treatments (Wilcoxon; $N = 17$, p=.003 for LOW and $N = 17$, p=.034 for HIGH) [22]

Table 3 shows that the results of a probit regression are very similar, and that once again the treatment effect is larger when controls are included for gender, economics students and age. With these controls, the marginal effect of the HIGH wage treatment is 28 percentage points for the whole sample, which is significant at the 1% level. For periods 11–25, the difference is larger (42 percentage points). As before, economics students are more corrupt than other participants. Moreover, men are more likely to choose option B for all periods though this effect is no longer significant in periods 11–25. Overall, the results are in line with hypothesis 2: public officials are less likely to choose the corrupt option B in treatment HIGH.

[21]There are at least two reasons why the difference between B choices is smaller than the difference between transfer rates. For one, not all accepted transfers lead to B choices; the percentage of accepted transfers leading to G choices is equal to 27.8% for treatment LOW and 21.3% for treatment HIGH. For another, the fraction of B choices taken after rejected transfers is not equal to zero (it is equal to 9.5% and 13.6% for treatments LOW and HIGH, respectively).

[22]There was no evidence that public officials were less likely to choose option B in period 25. The percentages were 67% and 50% in treatments LOW and HIGH respectively for period 25, compared with 63.6% (77.3%) and 45.7% (47.7%) in all other periods (periods 11–24). When a period 25 dummy and this dummy interacted with the treatment dummy are added to the regressions of table 3, both coefficients are small and neither is ever significant in any of the specifications.

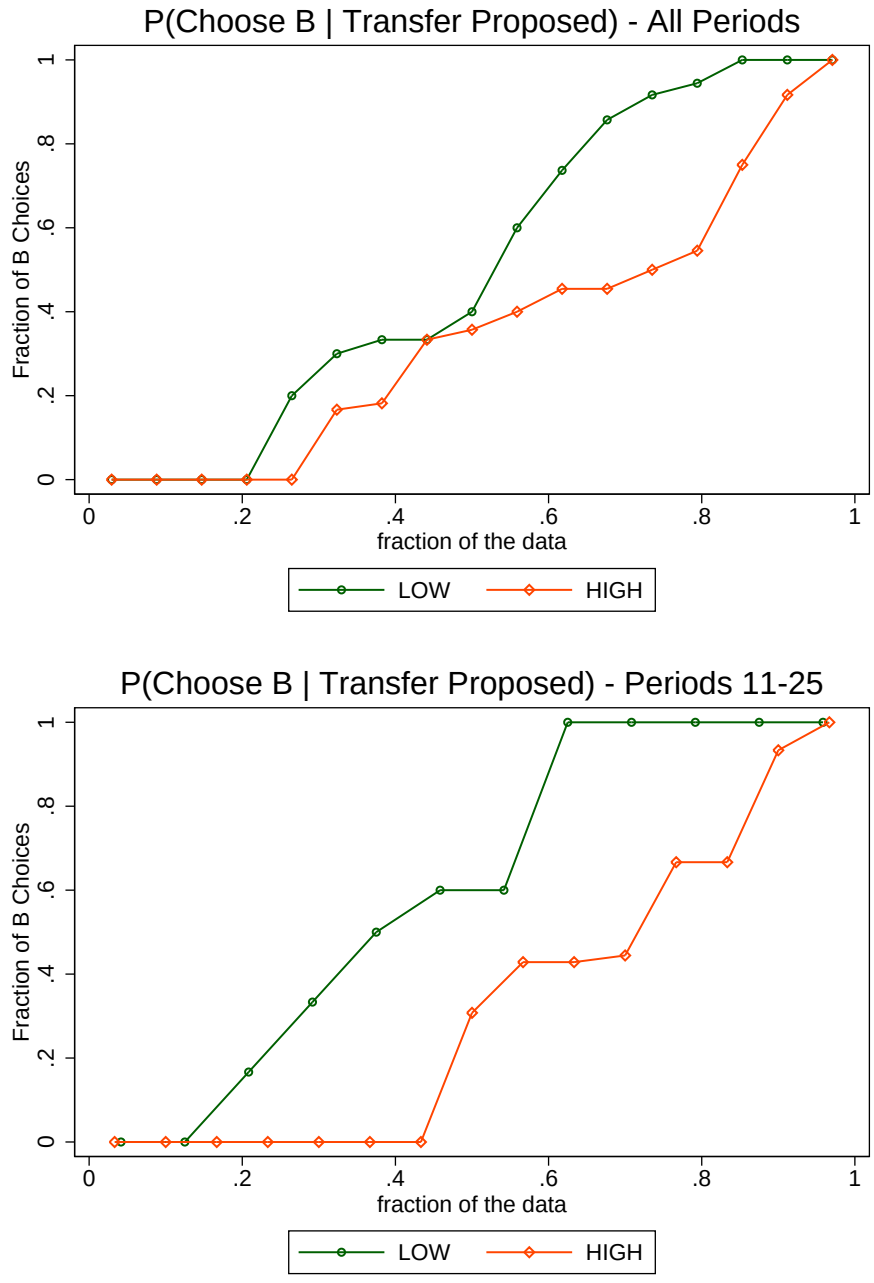

Figure 4: Fraction of B choices

Notes. The figure plots the empirical distribution of the percentage of B choices by pair for both treatments using a quantile plot. Every dot in the graph represents one public official/citizen pair. The upper panel reports the results for all periods, the lower panel reports the results for periods 11–25.

Table 3: Probit estimates for G and B choices

	Dependent Variable: B Choice (1=Yes)			
	(1)	(2)	(3)	(4)
High Wage	-.180***	-.305***	-.280**	-.422***
	(.052)	(.077)	(.060)	(.091)
Male			.208***	.131
			(.070)	(.114)
Economics Student			.244***	.256***
			(.057)	(.088)
Age			.023	.016
			(.014)	(.020)
Periods	all	11–25	all	11–25
Observations	372	193	348	179
Conditional on a Transfer Having Been Proposed	yes	yes	yes	yes

* significant at 10%; ** significant at 5%; *** significant at 1%

Notes. This table displays the results of four probit regressions. The reported numbers are marginal effects; the numbers in parentheses are standard errors corresponding to these marginal effects. The regressions use the data for public officials only and use bootstrapped standard errors (1,000 replications). The regressions with controls include fewer observations, since one public official did not report his/her gender, age, and field of study.

6 Robustness: Bribery without Monitoring

Thus far we have seen that increasing public officials' wages decreases the fraction of transfers they accept and the number of corrupt (B) choices they make. This tells us that within the current experimental setting (positive monitoring rate, large penalty to the charity), increasing public officials' wages reduces their corruptibility. This section describes the results of additional sessions that explore the robustness of these findings to setting the monitoring rate to zero. A zero monitoring rate is also of practical interest, since monitoring activities in practice are costly and are often subject to corruption themselves; they should as such only be maintained if they actually reduce corruption levels.

Setting the monitoring rate to zero removes the possibility of disqualification from the experiment and therefore removes monetary costs considerations from public officials. Thus, to the extent that monetary costs were relevant with a monitoring rate of .003, we should expect a smaller treatment effect with a monitoring rate of zero. However, monetary costs were already quite small even with monitoring. Indeed, with monitoring the only predicted difference for risk neutral public officials is that they should accept all bribes larger than 3 in treatment LOW and all bribes larger than 5 in treatment HIGH.[23] In the experiment, however, only 5% of proposed bribes were equal to 3 or 4. Therefore with risk neutrality monetary costs can only explain a small fraction of the total difference between treatments.[24]

[23] In the experiment, average earnings over all periods for public officials in treatment LOW and HIGH were 943 and 1,420 points respectively. Thus, accepting a single bribe leads to an expected loss from disqualification equal to $.003 * 943 = 2.83$ and $.003 * 1420 = 4.26$ for treatments LOW and HIGH, respectively. Risk-neutral public officials should only accept bribes that exceed the expected loss from disqualification.

[24] Risk aversion cannot explain the observed treatment difference, either. To see this, first note that for risk aversion to explain the difference, it cannot be too large, since large risk aversion would imply rejecting all bribes in both treatments. Second, risk averse public officials will have a larger bribe acceptance threshold than risk neutral public officals. With intermediate risk aversion, it is possible for the threshold to be small enough in treatment LOW to accept most bribes there but be large enough in treatment HIGH to reject the majority of bribes there. However, for risk aversion to explain the treatment difference, this would still require public officials in treatment HIGH to accept large bribes but reject all bribes of intermediate size. As we previously saw, however, public officials in treatment HIGH are equally likely to reject large and small bribes.

Setting the monitoring rate to zero may also affect the non-monetary costs of corruption. Recall that the experiment was neutrally framed. Hence, a positive monitoring rate may have served as a signal to participants that accepting a transfer is not a moral or normative thing to do. This may have been true in particular, since the punishment level (exclusion from the experiment) was rather large. With a zero monitoring rate this signal disappears, which could induce public officials to be more corrupt.

To investigate the influence of setting the monitoring rate to zero I ran four additional sessions in June 2011. These sessions were identical to the sessions described in the preceding sections, except that the monitoring rate was equal to zero instead of .003. In total, 84 subjects took part in these sessions, earning between € 13.42 and € 21.88. Charities earned between € 11.00 and € 34.10, with an average of € 25.50.

To analyze the influence of monitoring on the influence of wage increases on corruptibility, I compare the results of these sessions with the results of the previous section. Figure 5 and table 4 give the transfer acceptance rates for treatment HIGH and treatment LOW for sessions with monitoring and sessions without monitoring. In sessions without monitoring, the difference in transfer acceptance rates falls from .53 to .18 in periods 11 to 25 (Mann-Whitney; $N_{LOW} = 15$, $N_{HIGH} = 19$, z=2.417, p=.016 with monitoring) and from .36 to .09 in all periods (Mann-Whitney; $N_{LOW} = 18$, $N_{HIGH} = 21$, z=.721, p=.471 with monitoring).[25] The difference-in-differences is significant for all periods (p=.049) and periods 11–25 (p =.013) (see table 4). This change is driven almost exclusively by the greater corruptibility of HIGH wage public officials in sessions without monitoring. The difference in the percentage of B choices also falls from 27 percentage points to 4 percentage points in periods 11–25 and from 15 percentage points to 1 percentage point in all periods.[26]

[25] In a probit regression, the treatment difference is significant at the 5% level for all periods and at the 1% level for periods 11–25, with or without controls. None of the control variables are significant. The full results of the probit are available from the author's website.

[26] The difference-in-differences is not significant. The difference between LOW and HIGH is

Table 4: Bribe acceptance rates with and without monitoring

	LOW	HIGH	Difference	P-value
Monitoring	.91	.38	-.53	.000***
No Monitoring	.97	.79	-.18	.016**
Difference	.06	.41	.35	.013**
P-value	.368	.002***	.013**	

* significant at 10%; ** significant at 5%; *** significant at 1%

Notes. This table gives the mean transfer acceptance rates conditional on a transfer being offered. That is, first I computed the average acceptance probability for every pair and then averaged these probabilities over all pairs. The reported p-values for the difference estimators are calculated using Mann-Whitney tests. The p-value for the difference-in-difference estimator (.35) is calculated using an OLS estimator of the transfer acceptance decision on a treatment dummy, a dummy for monitoring and an interaction of the two dummies; the p-value corresponds to the p-value of the interaction term. In both cases only periods 11 to 25 are used, in the latter case bootstrapped standard errors are used (with 1,000 replications).

Table 5: Motivations for bribe acceptance with and without monitoring

	LOW	HIGH	Difference	P-value
Monitoring	3.15	4.94	1.79	.004***
No Monitoring	3.79	3.48	-.30	.565
Difference	.62	-1.47	2.10	.015**
P-value	.236	.035**	.015**	

* significant at 10%; ** significant at 5%; *** significant at 1%

Notes. This table gives the average response to the question "In deciding to accept player 1's transfer offer the charity's pay-off was an important factor" in the post-experimental questionnaire. Answers were reported on a Likert Scale ranging from 1 to 7. The reported p-values for the difference estimators are calculated using Mann-Whitney tests. The p-value for the difference-in-difference estimator (2.10) is calculated using an OLS estimator of the transfer acceptance decision on a treatment dummy, a dummy for monitoring and an interaction of the two dummies; the p-value corresponds to the p-value of the interaction term. The regressions uses bootstrapped standard errors (1,000 replications).

Finally, table 5 shows that self-reported care for the charity in treatment HIGH drops to the level of treatment LOW in sessions without monitoring, whereas it was substantially higher in sessions with monitoring.

All in all this suggests that the evidence presented in the previous section is only partially robust to the removal of monitoring. In fact, it suggests that both monitoring and a high wage are necessary to decrease corruption. However,

also not significant using Mann-Whitney tests or a probit regression without controls. With controls, it is significant at the 5% level for periods 11–25 only. The results of the probit regression further show that men are more likely to choose option B, whereas economics students are *less* likely to choose option B, both at the 1% level for both periods 11–25 and all periods. The full results of the probits are available from the author's website.

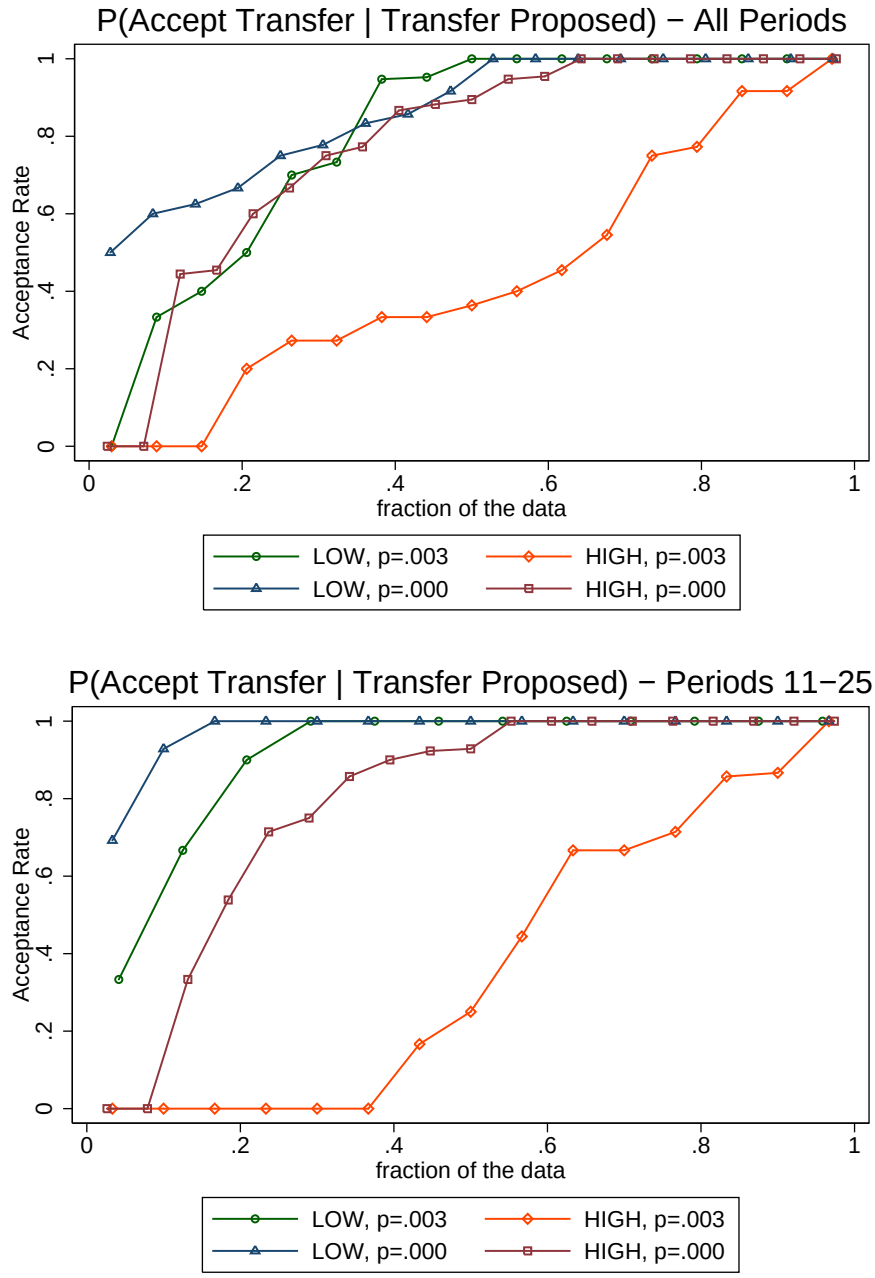

Figure 5: Transfer acceptance rate with and without monitoring

Notes. The figure plots the empirical distribution of transfer acceptance rates by pair for both sessions with monitoring and sessions without monitoring using a quantile plot. Every dot in the graph represents one public official/citizen pair. The top panel displays the results for all periods and the lower panel displays the results for periods 11–25.

this result may also be due to a ceiling effect in the transfer acceptance rates in treatment LOW. Even with monitoring public officials in treatment LOW accepted 91% of proposed transfers on average in periods 11–25, meaning there was hardly any scope for the transfer acceptance rate to increase. On the other hand, with monitoring the average acceptance rate was only 38% in treatment HIGH, leaving a lot of room for the transfer acceptance rate to increase.

7 Discussion

In this study, I have investigated the link between public officials' wages and their corruptibility. The results show that increasing the wage of public officials greatly reduces their corruptibility. In particular, experienced low-wage public officials accept 91% of bribes, whereas experienced high-wage public officials accept only 38%. Moreover, experienced high-wage public officials are 27 percentage points less likely to choose the corrupt option. The results also show that economics students are approximately 30 percentage points more likely to accept bribes and choose the corrupt option than other participants. Finally, a robustness check suggests that a positive monitoring rate may be necessary for higher wages to reduce the corruptibility of public officials.

In conclusion, these results provide greater support for a link between wages and bribery than past experimental studies. The contrast with Abbink (2005) may be particularly illuminating since its experiment is based on the same bribery model and also has a positive level of monitoring. The difference in findings suggests that the reference wage is important; if a third party is used as a reference wage as in Abbink (2005), the relative wage of the public official does not seem to matter. By contrast, if the briber is used as the reference wage as in this study, there is a large and statistically significant effect. This suggests that in empirical studies which investigate the link between wages and corruption, it is important to use an appropriate reference wage. In particular,

if the wage that is employed in the study is not used as a reference wage by public officials, one will not find a relationship between wages and corruption even if the actual reference wage affected corruption levels.

As the robustness check has shown, a positive monitoring rate seems to be necessary for high wages to decrease corruption. At the same time, even the positive monitoring rate in the experiment was very small. This suggests that the mere presence of monitoring may have served as a signal to public officials that accepting bribes is not a moral thing to do. Even if non-monetary costs are important, a small but positive level of monitoring may thus be necessary to reduce corruption.

The results of the experiment are in line with corruption levels reported by Transparancy International (2012). Highly developed countries, in which public sector wages are significantly higher than in developing countries, report lower corruption levels. Although this empirical observation is correlational and subject to many possible alternative explanations, the results of this experiment provide evidence in favor of a causal effect of wages on corruption levels.

It is also interesting to compare the results to Maréchal and Thöni (2007), who find that sales representatives who offer a small gift to a store manager are rewarded with an increase in sales income.[27] Though their setting is not typical for bribery in some ways (e.g., they look at the private sector, no clear externalities, developed country), their results do suggest that reciprocity can lead to successful bribery in the field. The authors also emphasize that this relationship only holds for managers and representatives who had previously interacted with each other. This suggests that preventing such long-term relationship from forming may prove to be another way to combat bribery.

This experiment was done with a relatively small number of participants who were mainly economics students with little or no experience in the public sector. Though the findings of this study indicate that wage motives play an

[27] Thanks to an anonymous referee for this suggestion.

important role in explaining corruption within the reported experiment, to what extent these findings will generalize to the field settings and other subject pools remains an open question. Armantier and Boly (2008) explicitly address the external validity of laboratory experiments on corruption by running the same set-up in the laboratory in both Canada and Burkina Faso as well as in the field in Burkina Faso. After controlling for individual characteristics, the treatment effects they measure are statistically indistinguishable in each of these three settings. Additionally, Armantier and Boly (2012) examine the external validity of laboratory experiments by comparing the results of conventional lab experiments on corruption with framed lab experiments, artefactual experiments and natural field experiments. Though many of the studies they discuss have different designs and are thus difficult to compare, several treatment effects persist among the different types of experiments, leading to a cautiously optimistic concluding statement. Still, further studies that directly compare the field and the lab would be helpful.

For future lab experimental work, several extensions are also possible. It may, for example, be interesting to vary the wage of public officials within the same session. To the extent that the wages of colleagues can also serve as reference points, it may be expected that public officials with wages that are higher than both colleagues and bribers will be even less likely to accept bribes. Another possibility would be to allow public officials to solicit bribes rather than have them wait for bribers to offer one, as in Barr and Serra (2010). These extensions may help provide additional insights into the conditions that need to be met for the link between wages and corruptibility to appear.

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Appendices

A Instructions

Welcome to the CREED laboratory. Please read the following instructions carefully.[28]

In today's experiment, there are two types of participants: Player 1 and Player 2. Your type will be randomly drawn after everyone has finished the instructions. You will then also be randomly matched to a player of the other type. **Both your type and the player you are matched with will remain unchanged throughout the experiment.**

All in all the experiment consists of 25 periods. The payment you receive at the end of the experiment depends on the decisions you make. Moreover, you will be able to earn money for a charity. The currency of the experiment is the experimental franc. At the end of the experiment, all francs you earned will be converted into euros at a rate of 100 francs per euro, such that 1000 francs are worth 10 euros. You will also receive a show-up fee of 7 euros.

[28]These instructions are the instructions for both public officials and citizens in the LOW wage treatment with monitoring. In sessions without monitoring, stage IV is omitted and stage V is called stage IV instead.

Decision Situation

Every period in this experiment consists of 5 stages, which will always take place in the following order:

Stage 1: Transfer or no Transfer

Player one decides whether or not he wants to transfer an amount to player two. If he does, then the period is continued with stage 2. If player one decides not to transfer an amount, then the period continues with stage five.

Stage 2: The Amount to Be Transferred

Player one decides on the amount to be transferred to player two. The transferred amount can be any whole number greater than zero. The period then continues with stage 3.

Stage 3: Acceptance or Rejection of the Transfer

Player two then decides whether he accepts or rejects the proposed transfer. If player two decides to accept the transfer, the proposed amount is removed from player 1's credit and added to player 2's credit. The period then continues with stage 4. If player two rejects the transfer, then the credits remain unchanged. The period is then continued with stage four.

Stage 4: Possibility of Getting Disqualified

If player 2 decided to accept the transfer in stage 3, a number out of the range from 0 to 999 is randomly drawn. If the number is 0, 1 or 2, then both player 1 and player 2 are disqualified. That means that the experiment ends for these two players and all their previous earnings are canceled. (At the end of the experiment, both players receive only their show-up fee.) The two disqualified participants fill in a questionnaire until the experiment has ended. For the other participants, the experiment continues normally. If the randomly drawn

number is 3, 4, ..., 998, or 999, the period is continued with stage 5 (see next page).

Stage 5: Player 2 Chooses Between X and Y

	X	Y
Player 1	36	56
Player 2	36	30
Charity	0	-30

Player 2 chooses one of the alternatives X or Y. If player 2 selects alternative X, then his credit is increased by 36 and the credit of player 1 is increased by 36 (as in the table above). The credit of the charity remains unchanged. If player 2 selects alternative Y, then his credit is increased by 30 and the credit of player 1 is increased by 56. The credits of the charity are decreased by 30 francs.

There will be only one charity for this experiment. The charity starts off with a total of 5000 francs, which is equal to 50 euros. The final donation depends on the decisions made by the participants in the experiment. The donation will be strictly anonymous; no mention will be made of either the UvA, CREED or any participant of this experiment.

After stage 5, the period has ended. Overall pay-offs are the sum of all changes of credits during the 5 stages of the period.

The Pay-Offs

The decision situation will be repeated for 25 periods. You receive your earnings at the end of the experiment, where the exchange rate is 1 euro for 100 francs. In addition you will receive a show-up fee of 7 euros.

Question 1

Suppose you are player 2 and player 1 has proposed a transfer of 8. If you accept, what will be your (player 2's) pay-off if you choose option X? What will be player 1's pay-off in this case? What will be the pay-offs for option Y? TIP: look up the values for X and Y on one of the previous pages or on the printout of the instructions.

Question 2

In this experiment, there are a total of 20 participants, such that there are 10 pairs. Suppose that in a certain period there are 5 pairs in which player 2 chooses option Y. How many francs will the charity lose in this period?

Charities

For this experiment, we have selected a total of five charities. At the end of the experiment, we will pick the charity selected by one randomly determined person. Thus, the likelihood that a charity is picked is proportional to the number of people that picked this charity. For example, a charity chosen by six people will be three times more likely to be picked than a charity chosen by two people. If you would like to support another charity, you can select option 'F: Other Charity' and type the name of the charity in the text box. We must emphasize that a self-chosen charity will only be paid out if it passes a 'fit-and-proper-charity' test. For example, organizations like AlQaeda or your best friend's holiday fund will be considered invalid charities. If an invalid option is drawn, we will redraw until a valid charity has been selected.

A. UNICEF: Created by the United Nations General Assembly on December 11, 1946, to provide emergency food and health care to children in countries that had been devastated by World War II. Presently, its activities include promoting childrens rights, and securing worldwide visibility for children threatened by poverty, disasters, armed conflict, abuse and exploitation.

UNICEF was awarded the Nobel Peace Prize in 1965.

B. WWF/WNF: Founded on September 11, 1961, its official mission is "to halt the destruction of our environment". Currently, the WWF focuses on restoring populations of 36 species (including elephants and tunas) as well as conserving 25 globally important ecoregions (including the Amazon Forest).

C. Red Cross: Founded on February 9, 1863, its official mission is "to stand for the protection of the life and dignity of victims of international and internal armed conflicts." Amongst its activities, it attempts to organize nursing and care for those who are wounded on the battlefield; it also supervises the treatment of prisoners of war.

D. Cliniclowns: Founded in 1992, its goal is to cheer up severely sick or handicapped children to help them recuperate from their ailments. Its most important activity is to send clowns to visit children's wards to cheer up the children, but it has also started a theater tour for children with multiple disabilities.

E. Prins Bernhard Cultuurfonds: Founded in 1940 by Prince Bernhard of the Netherlands, its goal is to support projects that work to preserve Dutch cultural and natural heritage. Its activities include awarding prices and scholarships to talented musicians, poets and other artists. On average, it supports 4000 projects per year.

B Decision Screen

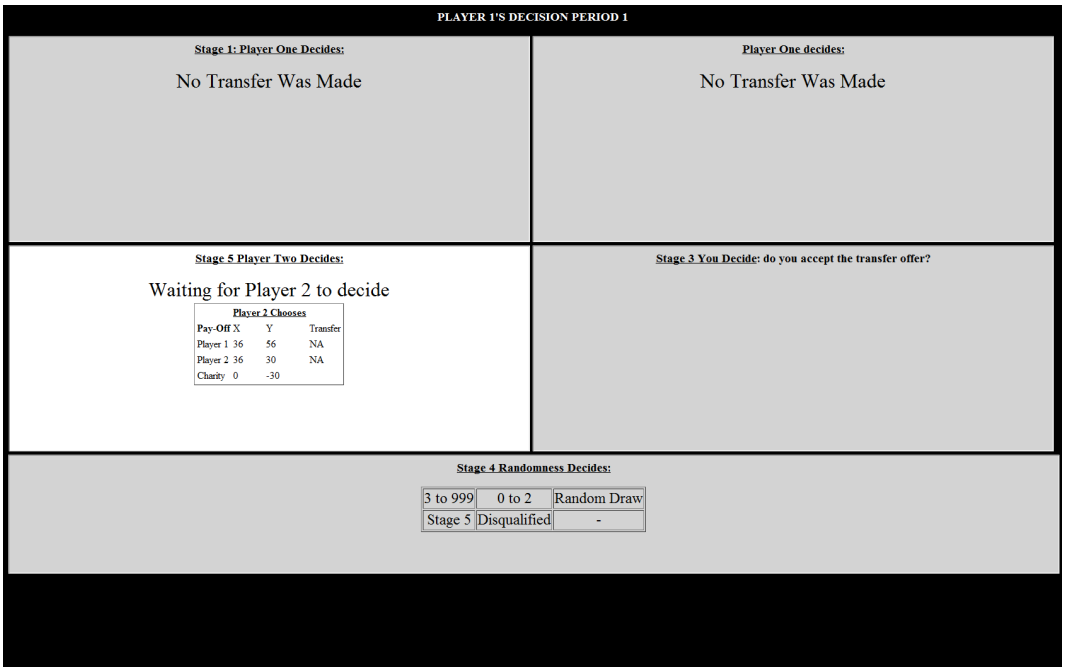

Figure 6: Decision Screen

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