CORRUPTION AND PUBLIC DISPLAY OF WEALTH

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ABSTRACT. We build a principal-agent-client model of corruption, allowing for heterogeneity of the value of public projects relative to the cost of monitoring their virtuous execution. In an environment in which potential corruptors face uncertainty about the type of project followed by officials, we show under which conditions officials with low-value projects have an incentive to signal their projects type – and thereby their corruptibility – by means of public display of wealth. We then show that, even though public display of wealth by those officials reduces the offer of bribes to officials following high-value projects, in equilibrium government is better off inhibiting it.

KEYWORDS: Corruption, Incentives, Signaling, Public Display of Wealth
JEL CLASSIFICATION: D73, D82

1. INTRODUCTION

Monitoring of property and assets of public employees has become part of the tools that are regularly employed by governments around the world in their fight against corruption (see, for example, Colombo, 1997, di Tella and Weinschelbaum, 2008, and Rodrigues-Neto, 2010). This would imply that corrupt officials have an incentive to hide consumption that goes beyond the means of their official salary from the public. Following this argument, it has been suggested to select poor agents for public office because it facilitates their monitoring (di Tella and Weinschelbaum, 2008).

However, in the presence of uncertainty with respect to the corruptibility of an official, consumption beyond the official's means may serve as a signaling device, facilitating corrupt transactions. Uncertainty has been shown to affect the

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overall level of corruption in an economy (Lambsdorff, 2007) as well as the individual propensity to bribe (Herrera, Lijane, and Rodriguez, 2007); and in recent work, Ryvkin and Serra (forthcoming) show how uncertainty can be exploited by governments as part of their public policy in their fight against corruption.

In this paper, in an environment in which potential corruptors face uncertainty about the type of project followed by officials, we assign the public display of wealth the role of a signaling device for officials who use it to advertise their corruptibility to potential corruptors. We characterize a separating equilibrium in a principal-agent-client model of corruption, in which officials managing projects with relatively low benefit to society – relative to the cost of enforcing virtuous behavior – advertise their corruptibility whereas officials managing projects with relatively high benefit to society – again relative to the cost of enforcing virtuous behavior – do not.

As compared to an equilibrium in which no official publicly displays his wealth, in the equilibrium with public display of wealth, potential corruptors are less inclined to offer bribes to an official who does not advertise his corruptibility and more inclined to offer bribes to an official who does. We show that a virtuous government would be strictly better off inhibiting officials from using this signaling device as it increases corruption and decreases the expected value of public projects to society.

We show that this separating equilibrium exists if, in the bargaining between officials and potential corruptors, the officials possess a sufficiently high bargaining power and, thereby we give guidance as to when to expect and, thus, fight public display of wealth as a corruption-facilitating device. Because the public display of wealth is easier for poor agents, our results caution that the selection of poor agents for public office may backfire if the officials use it to signal their corruptibility.

There is an extensive literature on the detrimental effects of corruption on economic activity (see, e.g., Shleifer and Vishny, 1993, or Bliss and di Tella, 1997, for theoretical contributions; Bardhan, 1997, and Aidt, 2003, for surveys; and Hall and Jones, 1999, for an empirical contribution), growth (see, e.g., Mauro, 1995, Knack, 1996, Keefer and Knack, 1997, Mo, 2001, or Pellegrini and Gerlagh, 2004), and income inequality (see, e.g., Gupta, Davoodi, and Alonso-Terme, 2002, Dincer and Gunalp, 2008). More recently contributions highlight the trade-off between market failures and corruption (see, e.g., Acemoglu and Verdier, 1998, 2000) and the relation between corruption and lobbying (Harstad and Svensson, 2011).

In most empirical studies on the topic, institutional quality in the form of corruption is dealt with as an endogenous explanatory variable, which depends on economic activity, growth, and/or income distribution. Economic activity, it is argued, pays for ensuring institutional quality, including the incentives to government agents (in short "officials"). These incentives have been argued to be crucial to fighting corruption (see, e.g., Kaufmann, 1997, Bardhan, 1997, or Acemoglu and Verdier, 2000). This paper is a contribution to the literature on how to structure those incentives. In particular, we take a principal-agent-client approach to law-enforcement (see, e.g., Becker, 1968, Becker and Stigler, 1974, Rose-Ackerman, 1978, Klitgaard, 1988, Mookherjee and Png, 1992 and 1995, Banerjee, 1997, or Acemoglu and Verdier, 2000) and are, thus, also related to the literature on optimal regulation under asymmetric information (see Laffont and Tirole, 1993).

2. Baseline Model: Homogenous Projects

We start our analysis with the benchmark case in which there is no heterogeneity with respect to the value of the project to be undertaken.

Assume there to be three agents, a government g, an official o, and a corruptor c. The government employs the official to execute public projects of value $V_g \in \{0, R\}$, with $R \in \mathbb{R}_+$, which is commonly known to all agents in the economy, and pays a fixed wage of w to the official. Denote the probability that the high outcome R is reached by p and the probability that the public project produces zero value by $1-p$. We assume the official has some latitude over how to implement the project. On the one hand, the official can choose to be virtuous and implement the project such that it succeeds with a high probability $p = p_H$. On the other hand, the official can choose to be corrupt and, if a corruptor approaches him with a bribe B, implement the project in a way that generates a private value V_c to the corruptor, but lowers the probability of the project succeeding to $p = p_L$.[1] Denote the difference of the technologies in their probability of success by $\Delta p := p_H - p_L > 0$.

[1] Implicitly, by doing so, we assume that every official is corruptible – if "the price is right." Our model could easily be extended to account for officials, who are virtuous irrespective of the size of a potential bribe, without losing any of our insights, but also without gaining additional understanding.

The official's choice over the technology is his private information, which the government cannot observe unless it monitors the official. Monitoring an official's interaction with a potential corruptor costs μ and, with probability ψ, it enables the government to detect (i) whether the corruptor attempted to bribe the official and (ii) whether the official accepted the bribe, if it was offered. We assume that, if the government detects that a bribe is offered, it is able to keep the bribe and, in addition, if it detects that a bribe has been accepted, it can punish the official by paying a wage of zero.[2] Finally, we assume that a government that detected a corrupt act can restore the efficient technology, p_H.

We model this interaction as a simultaneous move game between the three players, in which the government chooses the probability γ with which it monitors the official's interactions, the corruptor chooses the probability σ with which he offers a bribe B to the official, and the official chooses the probability ν with which he accepts a bribe that is offered to him. We model the amount of the bribe B as the solution to the generalized Nash bargaining problem between the official and the corruptor assuming the official's relative bargaining power is $\beta \in [0, 1]$.

We now characterize the payoffs for the three agents in each realization of the actions they randomize over, to monitor or not to monitor, to offer a bribe B or not to offer a bribe B, to accept a bribe B that is offered or to reject it. First consider the government's choice whether or not to monitor. Assume first, the government monitors an official's interaction. In this case, it incurs a cost μ. The corruptor offers a bribe with probability σ, which the official accepts with probability ν. In case the bribe is offered and accepted, the government finds out with probability ψ, in which case it implements the efficient technology p_H, does not pay the wage to the official, and keeps the bribe B. With the counter probability $1 - \psi$ the government does not find out, the inefficient technology is implemented, the government pays the official's wage w, and cannot appropriate

[2]An interpretation of this assumption is that officials and corruptors are protected by some degree of limited liability: Officials cannot be paid less than zero, and corruptors cannot be punished beyond the amount of the bribe that was offered.

the bribe B. Hence, if it monitors, its expected payoff is

$$EU_g(\text{monitor}) = \sigma\left(\nu\left(\psi\left(p_H R + B\right) + (1-\psi)\left(p_L R - w\right)\right) + (1-\nu)\left(p_H R - w + \psi B\right)\right) + (1-\sigma)\left(p_H R - w\right) - \mu. \tag{1}$$

Assume now that the government does not monitor an official's interaction. Again, the corruptor offers a bribe with probability σ, which the official accepts with probability ν. Hence, with probability $\sigma\nu$, the inefficient technology is implemented and the government pays the official's wage w. With the counter probability $1-\sigma\nu$, the efficient technology is implemented and the government pays the official's wage w. Therefore, if the government does not monitor the official's interactions, its expected payoff is

$$EU_g(\text{do not monitor}) = \sigma\nu\left(p_L R - w\right) + (1-\sigma\nu)\left(p_H R - w\right). \tag{2}$$

Now, consider the corruptor's choice whether or not to offer a bribe B. Assume first, a corruptor offers a bribe B. With probability γ the government monitors and with probability ν the official accepts. If the official accepts and the government monitors, the government detects the corruptor's attempt to bribe with probability ψ, in which case the corruptor does not receive the private benefit V_c, and loses the bribe B to the government. With the counter probability $1-\psi$, the government does not detect the attempt to bribe, the corruptor receives the private benefit V_c and pays the bribe B to the official. If the official does not accept and the government monitors, with probability ψ the government detects the attempt to bribe and appropriates the bribe B. If the government does not monitor and the official accepts the bribe, the corruptor receives the private benefit V_c and pays the bribe B to the official. Hence, if the corruptor offers a bribe, his expected payoff is

$$EU_c(\text{offer}) = \gamma\left(\nu\left((1-\psi)V_c - B\right) - (1-\nu)\psi B\right) + (1-\gamma)\nu\left(V_c - B\right). \tag{3}$$

In the event the corruptor does not offer a bribe, his payoff is simply

$$EU_c(\text{do not offer}) = 0. \tag{4}$$

Finally, consider the official's choice whether or not to accept a bribe B if it is offered by the corruptor. Assume first that the official decides to accept the bribe. Again, the government monitors with probability γ. If monitoring occurs, the government detects the official's acceptance of the bribe with probability ψ and, in this case, the official both loses his wage w and cannot keep the bribe B. With the counter probability $1-\psi$, the government does not detect the acceptance of the bribe and the official receives both his wage w and the bribe B. If the government does not monitor, the official receives the bribe that has been offered as well as his wage. Hence, if the official accepts a bribe B that is offered to him by the corruptor, his expected payoff is

$$EU_o(\text{accept}) = \gamma\,(1-\psi)\,(B+w) + (1-\gamma)\,(B+w)\,. \tag{5}$$

If the official rejects a bribe offered to him by the corruptor, he gets paid his wage w and his expected payoff is simply

$$EU_o(\text{do not accept}) = w. \tag{6}$$

To concentrate on interesting cases, in which the government has a meaningful choice about whether or not to monitor the official's interactions, assume that it is too costly to monitor just to save the official's wage and to appropriate the bribe. Assume $\mu > \psi(B+w)$.

Using equations (5) and (6), we find that the official accepts a bribe that is offered if

$$\gamma(1-\psi)(B+w) + (1-\gamma)(B+w) > w$$

or

$$\gamma < \frac{1}{\psi}\frac{B}{B+w}.$$

Using equations (3) and (4), we find that the corruptor offers a bribe if

$$\gamma(\nu((1-\psi)V_c - B) - (1-\nu)\psi B) + (1-\gamma)\nu(V_C - B) > 0$$

or

$$\nu > \frac{\gamma\psi}{1-\gamma\psi}\frac{B}{V_c - B}.$$

Finally, using equations (1) and (2), we find that the government monitors if

$$\nu\sigma(\psi\,(p_H R + B) + (1-\psi)\,(p_L R - w)) + (1-\nu)\sigma(p_H R - w + \psi B) \\ + (1-\sigma)(p_H R - w) - \mu > \nu\sigma(p_L R - w) + (1-\nu\sigma)(p_H R - w)$$

or

$$\sigma > \frac{\mu}{\psi(B + \nu(\Delta pR + w))}.$$

These conditions imply that those projects, for which the value of having a virtuous official is too low (ΔpR), are not worth monitoring: Even if the corruptor always offers a bribe, which the official always accepts, that is, if $\sigma = \nu = 1$, as long as $\mu \geq \psi\,(B + \Delta pR + w) \Leftrightarrow \Delta pR \leq (\mu - \psi(B + w))/\psi$, the best the government can do is not to monitor, that is to implement $\gamma = 0$. In that case, it is easy to verify that $\sigma = \nu = 1$ are best responses.

Lemma 1. *If $\Delta pR \leq (\mu - \psi(B + w))/(\psi)$, in equilibrium, the government does not monitor, and corruptors always offer bribes, which officials always accept: $\gamma = 0$ and $\sigma = \nu = 1$.*

On the other hand, those projects, for which the gain of inducing virtuous behavior of an official is sufficiently large, are worth monitoring. In this case, there exists an equilibrium in mixed strategies.

Lemma 2. *If $\Delta pR > (\mu - \psi(B + w))/(\psi)$, in equilibrium, the government monitors with probability $\gamma = B/(\psi(B + w))$, officials accept bribes with probability $\nu = B^2/(w(V_c - B))$, and corruptors offer bribes with probability $\sigma = (\mu w(V_c - B))/(\psi B(wV_c + B\Delta pR))$.*

When we solve the generalized Nash bargaining problem, assuming the official's relative bargaining power is β, we obtain the following value for the bribe

$$\begin{aligned} B^* &= \arg\max_B \left\{((1 - \gamma\psi)(B + w) - w)^{\beta}((1 - \gamma\psi)V_c - B)^{1-\beta}\right\} \\ &= (1 - \beta)\frac{\gamma\psi}{1 - \gamma\psi}w + \beta(1 - \gamma\psi)V_c. \end{aligned}$$

Agreeing on a bribe B, the official has a payoff of $(1 - \gamma\psi)(B + w)$, while his outside option is to reject the bribe and keep the wage w. Agreeing on a bribe B, the corruptor has payoff $(1 - \gamma\psi)V_c - B$, while the outside option for the corruptor has value 0. For $\gamma = 0$, $B^* = \beta V_c$. We can use this equilibrium bribe to define the thresholds given in Lemmas 1 and 2 in terms of the exogenous parameters of the model and formulate the following result.

Proposition 1. *If $R \leq (\mu - \psi(\beta V_c + w))/(\Delta p \psi)$, in equilibrium, the government does not monitor, and corruptors always offer bribes, which officials always accept: $\gamma = 0$, $\sigma = \nu = 1$, and $B^* = \beta V_c$. If $R > (\mu - \psi(\beta V_c + w))/(\Delta p \psi)$, in equilibrium, the government monitors with probability $\gamma = B^*/(\psi(B^* + w))$, officials accept bribes with probability $\nu = (B^*)^2/(w(V_c - B^*))$, and corruptors offer bribes with probability $\sigma = (\mu w(V_c - B^*))/(\psi B^*(wV_c + B^* \Delta p R))$ with $B^* = (1-\beta)\frac{\gamma\psi}{1-\gamma\psi}w + \beta(1-\gamma\psi)V_c$.*

Assuming $R > (\mu - \psi(\beta V_c + w))/(\Delta p \psi)$, and using B^* and γ, we find that $B^* = \frac{w}{2} + \sqrt{\left(\frac{w}{2}\right) + wV_c}$.

3. Heterogenous Projects

We now analyze a model in which there is heterogeneity with respect to the value of the project to be undertaken by officials. We first study this model with a government that inhibits public display of wealth by officials and then with a government that does not.

3.1. **Inhibited public display of wealth.**

Assume there are two types of projects, some of which have a higher value than others. In particular, assume $R \in \left\{\underline{R}, \overline{R}\right\}$. Assume that an official's type of project is unknown to the official's corruptor, but it is known to the government and the official.[3] The corruptor only knows that $\Pr\left(\overline{R}\right) = \theta \in \left]0,1\right[$ and $\Pr\left(\overline{R}\right) = 1-\theta$. Assume $\Delta p \underline{R} \leq (\mu - \psi(\beta V_c + w))/\psi < \Delta p \overline{R}$.

Denote the probability that the government monitors the high-value project by $\overline{\gamma}$ and the probability that it monitors the low-value project by $\underline{\gamma}$. Given our assumption on $\underline{R}$, in this environment, the government has an incentive to monitor only high-value projects with positive probability, thus $\underline{\gamma} = 0$. Furthermore, we denote the probability that an official considers accepting a bribe by $\overline{\nu}$ if he follows the high-value project and by $\underline{\nu}$ if he follows the low-value project. Given the government's incentives not to monitor the low-value project, we know that $\underline{\nu} = 1$.

An official with a high-value project accepts a bribe if

$$\overline{\gamma} < \frac{1}{\psi}\frac{B}{B+w}$$

[3]The implicit assumption is that the official cannot credibly convey the project's type to the corruptor. That may be the case because the type is soft information and any communication about it is cheap talk.

and the government monitors the high-value project if

$$\sigma > \frac{\mu}{\psi\left(B + \overline{\nu}\left(\Delta p\overline{R} + w\right)\right)}.$$

The corruptor has to reason in expectation: He cannot observe the type of the project. He only knows that the high-type project occurs with probability θ. With the counter probability $1-\theta$, the project is of low value, thus, the government monitors with probability $\gamma = 0$, and the official accepts with probability $\nu = \underline{\nu} = 1$. Hence, the corruptor offers a bribe if

$$\theta(\overline{\gamma}(\overline{\nu}((1-\psi)V_c - B) + (1-\overline{\nu})(-\psi B)) + (1-\overline{\gamma})\overline{\nu}(V_C - B)) + (1-\theta)(V_c - B) > 0$$

or

$$\overline{\nu} > \frac{\overline{\gamma}\psi}{1-\overline{\gamma}\psi}\frac{B}{V_c - B} - \frac{1-\theta}{\theta}\frac{1}{1-\overline{\gamma}\psi}. \tag{7}$$

Simplifying equation (7), we note that the corruptor always offers a bribe ($\sigma = 1$) as long as $\theta \leq 1 - \overline{\gamma}\psi\frac{B}{V_c - B}$. In this case, an official with a high-value project accepts a bribe if $\overline{\gamma} < \frac{1}{\psi}\frac{B}{B+w}$ and the government monitors the high-value project if $\overline{\nu} > \frac{\mu}{\psi\left(\Delta p\overline{R}+w\right)} - \frac{B}{\Delta p\overline{R}+w}$.

When we solve the generalized Nash bargaining problem keeping the official's relative bargaining power of β, assuming project heterogeneity, that the corruptor does not know the project's type, while the government and the official do, we obtain an equilibrium bribe of

$$\begin{aligned} B^{**} &= \arg\max_B \left\{((1-\overline{\gamma}\psi)(B+w) - w)^{\beta}((1-\overline{\gamma}\theta\psi)V_c - B)^{1-\beta}\right\} \\ &= (1-\beta)\frac{\overline{\gamma}\psi}{1-\overline{\gamma}\psi}w + \beta(1-\overline{\gamma}\theta\psi)V_c. \end{aligned}$$

For a given monitoring probability $\overline{\gamma}$, the acceptance probability $\overline{\nu}$ that makes the corruptor indifferent between bribing and not bribing is increasing in the probability that the project is of high value, θ. For any given acceptance probability $\overline{\nu}$, the monitoring probability $\overline{\gamma}$ that makes the corruptor indifferent between bribing and not bribing is also increasing in the probability that the project is of high value, θ.

Proposition 2. *Assume* $R \in \left\{\underline{R}, \overline{R}\right\}$ *with* $\Pr\left(\overline{R}\right) = \theta \in]0,1[$ *and* $\Delta p\underline{R} \leq (\mu - \psi(\beta V_c + w))/\psi < \Delta p\overline{R}$. *Then, in equilibrium,*

(1) *corruptors bribe with probability* $\sigma = \mu/(\psi(B^{**} + (w + \Delta p\overline{R})(\frac{(B^{**})^2}{w(V_c - B^{**})} - \frac{(B^{**}+w)(1-\theta)}{w\theta})))$, *the bribe is* $B^{**} = (1-\beta)\frac{\overline{\gamma}\psi}{1-\overline{\gamma}\psi}w + \beta(1-\theta\overline{\gamma}\psi)V_c$;
(2) *officials with projects characterized by* $\underline{R}$ *accept bribes with probability 1 and the government monitors projects characterized by* $\underline{R}$ *with probability zero;*
(3) *officials with projects characterized by* $\overline{R}$ *accept bribes with probability* $\overline{\nu} = (B^{**})^2/(w(V_c - B^{**})) - ((1-\theta)(B^{**}+w))/(\theta w)$ *and the government monitors projects characterized by* $\overline{R}$ *with probability* $\overline{\gamma} = B^{**}/(\psi(B^{**}+w))$.

Using B^{**} and $\overline{\gamma}$, we find $B^{**} = \frac{w+(1-\theta)V_c}{2} + \sqrt{\left(\frac{w+(1-\theta)V_c}{2}\right)^2 + wV_c}$. For $\theta = 1$, the bribe for high-value projects without signaling, B^{**} equals B^*, that is, it corresponds to the level of the bribe obtained in the homogenous project case for projects of high value. Note that $\frac{dB^{**}}{d\theta} < 0$. This implies that for $\theta < 1$, $B^* < B^{**}$.

3.2. **Signaling by means of public display of wealth.** Consider a modification to the setup whereby the official can burn an amount of money, ϕ, and assume that this is publicly observable by his corruptors and the government. After observing the official's burning of money, the corruptor makes his decision whether or not to offer negotiations over a bribe, and the official decides whether or not to enter into these negotiations, while the government makes its decision whether or not to monitor.

Denote the probability with which the government monitors a high-value project when $\phi = 0$ with $\overline{\gamma}_0$ and that with which it monitors a high-value project when an amount $\phi > 0$ was burned with $\overline{\gamma}_\phi$. Denote the probability with which an official following a high-value project accepts a bribe when $\phi = 0$ with $\overline{\nu}_0$ and when he burned $\phi > 0$ with $\overline{\nu}_\phi$. Denote the probability with which a corruptor bribes after observing ϕ with σ_ϕ and the one after observing no burned money with σ_0.

Consider a separating equilibrium candidate, in which officials burn an amount of $\phi > 0$ only if they have a project of low value and they burn no money at all otherwise.

Officials with a low-value project enters into negotiations over bribes with probability 1, the government monitors low-value projects with probability zero. If a corruptor observes that an official burned an amount $\phi > 0$, he enters into negotiations over bribes with probability 1. The bribe in case $\phi > 0$ is burned is $B_\phi = \beta V_c$.

Officials with high-value projects do not burn money ($\phi = 0$) and accept bribes with probability $\overline{\nu}_0$; in case they did burn $\phi > 0$, they accept bribes with probability $\overline{\nu}_\phi$. The government monitors high-value projects with probability $\overline{\gamma}_0$ if no money was burned and with probability $\overline{\gamma}_\phi$ if money was burned. If they do not observe the official burn $\phi > 0$, corruptors offer a bribe with probability σ_ϕ. The bribe in case no money was burned is $B_0 = (1-\beta)\frac{\overline{\gamma}_0\psi}{1-\overline{\gamma}_0\psi}w + \beta(1-\overline{\gamma}_0\psi)V_c$.

In this equilibrium candidate, the continuation equilibrium after an official with a high-value project did not burn money is as follows: The government monitors with probability $\overline{\gamma}_0 = B_0/(\psi(B_0+w))$, officials accept bribes with probability $\overline{\nu}_0 = (B_0)^2/(w(V_c - B_0))$, and corruptors offer bribes with probability $\sigma_0 = (\mu w(V_c - B_0))/(\psi B_0(wV_c + B_0\Delta pR))$.

Consider the choice of an official with a low-value project. If he burns $\phi > 0$, he has an expected payoff of $B_\phi + w - \phi$. If he does not burn any money ($\phi = 0$), the government still does not monitor him, hence he enters into negotiations over bribes with probability 1. The corruptor does not know the project's type and enters into negotiations only with probability σ_0. Therefore, if the official does not burn any money, he has an expected payoff of $\sigma_0 B_0 + w$. He is better off burning some money $\phi > 0$ if

$$\phi < B_\phi - \sigma_0 B_0 := \overline{\phi}.$$

Given $B_\phi = \beta V_c$ and $\sigma_0 B_0 \geq 0$, for very small β, there is no amount of burned money $\phi > 0$ that satisfies this condition. On the other hand, for $\beta = 1$, we have $\overline{\phi} = \overline{\gamma}_0\psi V_c > 0$. There needs to be sufficiently large bargaining power of the official for this equilibrium to exist.

Consider the choice of an official with a high-value project. If he burns money, the corruptor offers a bribe B_ϕ with probability 1. In the ensuing mixed strategy equilibrium, the government monitors with probability $\overline{\gamma}_\phi = \frac{1}{\psi}\frac{B_\phi}{B_\phi+w}$ and the official accepts the bribe with probability $\overline{\nu}_\phi = \frac{\mu-\psi B_\phi}{\psi(\Delta pR+w)}$. The official has an expected payoff of $\overline{\gamma}_\phi(\overline{\nu}_\phi(1-\psi)(B_\phi+w) + (1-\overline{\nu}_\phi)w) + (1-\overline{\gamma}_\phi)(\overline{\nu}_\phi(B_\phi+w) + (1-\overline{\nu}_\phi)w) - \phi$. If the official does not burn money, the corruptor bribes with probability σ_0, the government monitors with probability $\overline{\gamma}_0 = B_0/(\psi(B_0+w))$, and the official accepts a bribe with probability $\overline{\nu}_0 = (B_0)^2/(w(V_c - B_0))$. The official has an expected payoff of $\overline{\gamma}_0(\sigma_0\overline{\nu}_0(1-\psi)(B_0+w)+(1-\sigma_0\overline{\nu}_0)w)+(1-\overline{\gamma}_0)(\sigma_0\overline{\nu}_0(B_0+w)+(1-\sigma_0\overline{\nu}_0)w)$. He is better off not burning the money if

$$\phi > \overline{\nu}_\phi B_\phi(1-\overline{\gamma}_\phi\psi) - \sigma_0\overline{\nu}_0 B_0(1-\overline{\gamma}_0\psi) - \psi w(\overline{\gamma}_\phi\overline{\nu}_\phi - \overline{\gamma}_0\overline{\nu}_0\sigma_0) := \underline{\phi}.$$

For $\underline{\phi} - \overline{\phi} < 0$, there exists an amount of money to be burned, $\phi > 0$, such that the official with the low-value project has an incentive to burn ϕ, while the official with the high-value project does not have an incentive to burn ϕ.

Proposition 3. *Assume the government credibly commits not to inhibit public display of wealth. Then, for $0 < B_\phi - \sigma_0 B_0$, there exists a $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$ for which officials following a project with value $\underline{R}$ signal their corruptibility, publicly displaying their wealth by burning an amount of ϕ, and officials following a project with value $\overline{R}$ do not. In this equilibrium,*

1. *corruptors bribe officials who publicly display their wealth with probability one, officials with projects of low value accept the bribe with probability one, the government monitors officials with projects of low value with probability zero, and the bribe is $B_\phi = \beta V_c$;*
2. *corruptors bribe officials who do not publicly display their wealth with probability $\sigma_0 = (\mu w(V_c - B_0))/(\psi B_0(wV_c + B_0\Delta pR))$, officials with projects of high value accept bribes with probability $\overline{\nu}_0 = (B_0)^2/(w(V_c - B_0))$, and the government monitors officials with projects of high value with probability $\overline{\gamma}_0 = B_0/(\psi(B_0+w))$. The bribe is $B_0 = (1-\beta)\frac{\overline{\gamma}_0\psi}{1-\overline{\gamma}_0\psi}w + \beta(1-\overline{\gamma}_0\psi)V_c$.*

Proof. Existence of the separating equilibrium:

$$\underline{\phi} - \overline{\phi} = B_0\sigma_0(1-\overline{\nu}_0) - B_\phi(1-\overline{\nu}_\phi) + (B_0+w)\sigma_0\overline{\nu}_0\overline{\gamma}_0\psi - (B_\phi+w)\overline{\nu}_\phi\overline{\gamma}_\phi\psi.$$

Note that $\overline{\gamma}_\phi = \frac{B_\phi}{\psi(B_\phi+w)}$ and $\overline{\gamma}_0 = \frac{B_0}{\psi(B_0+w)}$. Substituting this into $\underline{\phi} - \overline{\phi}$, we get

$$\underline{\phi} - \overline{\phi} = B_0\sigma_0(1-\overline{\nu}_0) - B_\phi(1-\overline{\nu}_\phi) + B_0\sigma_0\overline{\nu}_0 - B_\phi\overline{\nu}_\phi = B_0\sigma_0 - B_\phi.$$

Note that $\overline{\phi} > 0 \Leftrightarrow B_\phi - B_0\sigma_0 > 0$. Hence, whenever $\overline{\phi} > 0$, $\underline{\phi} - \overline{\phi} < 0$, which proves the existence of the separating equilibrium.

The probabilities of offering and accepting bribes as well as of monitoring in the separating equilibrium follow directly from the text. □

Proposition 3 establishes that, whenever the official has sufficient bargaining power vis-à-vis his corruptor, he would find it worthwhile signaling his corruptibility if he has drawn the low-value project.

3.3. **Comparison of the equilibria with and without public display of wealth.** When we compare the equilibria with and without signaling by means of public display of wealth, we note that the corruptor bribes less often than in the equilibrium without signaling ($\sigma_0 < \sigma$) and the official accepts (conditional on having received an offer) more often ($\overline{\nu}_0 > \overline{\nu}$).

Compare the government's expected payoff when signaling is allowed to its payoff when signaling is inhibited. For low-value projects, allowing for signaling increases the occurrence of corruption, which decreases the government's expected payoff. The payoff difference for low-value projects is $\Delta U_g(\underline{R}) = -(1-\sigma)\Delta p\underline{R} < 0$. If the share of projects with low value is relatively large, that is, $\theta \leq 1 - \overline{\gamma}\psi\frac{B^{**}}{V_c - B^{**}}$, then, even with signaling inhibited, the corruptor always bribes, that is, $\sigma = 1$. Thus, if the share of low-value projects is sufficiently low, there is a benefit from inhibiting signaling coming from low-value projects. Only if that share is too high, there is no benefit to the government from inhibiting signaling coming from low-value projects.

Now compare the payoffs for high-value projects. Noting that the government is indifferent between monitoring and not monitoring, we derive the payoff difference for high-value projects as $\Delta U_g(\overline{R}) = -\left(\sigma_0\overline{\nu}_0 - \sigma\overline{\nu}\right)\Delta p\overline{R}$ and, if the share of projects with low value is relatively large, that is, if $\theta \leq 1 - \overline{\gamma}\psi\frac{B^{**}}{V_c - B^{**}}$, we get $\Delta U_g(\overline{R}) = -\left(\sigma_0\overline{\nu}_0 - \overline{\nu}\right)\Delta p\overline{R}$. Next, note that despite the fact that the corruptor plays a pure strategy, $\sigma = 1$, both the government and the official still play mixed strategies. This implies that, in equilibrium, (1) the government is still indifferent between monitoring and not monitoring and (2) the official is still indifferent between accepting a bribe and not accepting a bribe. The fact that the government is indifferent between monitoring and not monitoring whether or not it allows for the signaling has implications for the level of corruption for high-value projects in both scenarios.

If the government inhibits signaling, it is indifferent between monitoring and not monitoring if

$$\sigma = \frac{\mu}{\psi\left(B^{**} + \overline{\nu}\left(\Delta p\overline{R} + w\right)\right)} \Leftrightarrow \frac{\mu}{\psi} = \sigma B^{**} + \sigma\overline{\nu}\left(\Delta p\overline{R} + w\right).$$

If it does not inhibit signaling, it is indifferent between monitoring and not monitoring if

$$\sigma_0 = \frac{\mu}{\psi\left(B_0 + \overline{\nu}_0\left(\Delta p\overline{R} + w\right)\right)} \Leftrightarrow \frac{\mu}{\psi} = \sigma_0 B_0 + \sigma_0\overline{\nu}_0\left(\Delta p\overline{R} + w\right).$$

These two equations imply

$$\sigma_0 B_0 + \sigma_0\overline{\nu}_0\left(\Delta p\overline{R} + w\right) = \sigma B^{**} + \sigma\overline{\nu}\left(\Delta p\overline{R} + w\right)$$

or

$$0 = \sigma B^{**} - \sigma_0 B_0 + \left(\sigma\overline{\nu} - \sigma_0\overline{\nu}_0\right)\left(\Delta p\overline{R} + w\right).$$

Using $B_0 = \frac{w}{2} + \sqrt{\left(\frac{w}{2}\right)^2 + wV_c}$ and $B^{**} = \frac{w+(1-\theta)V_c}{2} + \sqrt{\left(\frac{w+(1-\theta)V_c}{2}\right)^2 + wV_c}$, and noting that the probability of offering a bribe without signaling (σ) is larger than with signaling (σ_0), we find that $\sigma\overline{\nu} - \sigma_0\overline{\nu}_0 < 0$, implying $\Delta U_g(\overline{R}) < 0$.

Proposition 4. *For heterogenous projects and sufficiently high relative bargaining power of officials public display of wealth occurs, which is to the detriment of the government's expected payoff from*

(1) *public projects of high value; and*
(2) *public projects of low value as long as their share is sufficiently low.*

If officials have a sufficiently high relative bargaining power, they have an incentive to signal their corruptibility to reduce the potential corruptors' uncertainty. If they do so, they (weakly) increase corruption for both low- and high-value projects, and they decrease the government's expected payoff.

4. Discussion

The official's relative bargaining power, β, is determined by – among other things – the competition in the public sector or by the need for complementary goods, services, or permits from other officials. Our separating equilibrium exists if and only if officials have sufficiently high bargaining power. That may be the case due to relatively little competition among officials for, for example, issuing permits needed for corruptors to appropriate their private benefits, diverting resources from public projects. If officials keep too low a share in the surplus generated by the bribe, it is not worth their while to advertise their corruptibility by means of wasteful public display of wealth, violating their incentive compatibility constraint. With this result, our paper relates to the Industrial Organization of corruption, as introduced in Shleifer and Vishny (1993), which shows that competition among bureaucrats will reduce corruption. In addition to the result in Shleifer and Vishny (1993), it will also impair the profitability of public display of wealth by one group of officials – those with lower-value projects, for which it is not beneficial to monitor whether they behave in a virtuous fashion – which reduces corruption not only for officials who are not worthwhile monitoring, but also for those who are monitored anyway.

Ceteris paribus, an increase in the monitoring cost μ makes it less profitable to monitor either of the projects. This positively affects the corruptor's probability of offering a bribe to an official who does not publicly display his wealth, σ_0, and, hence, makes it less profitable to publicly display wealth for officials with low-value projects. Hence, for a given relative bargaining power of the official, the separating equilibrium exists only if the cost of monitoring is not too high.

The share of high-value projects may capture an economy's degree of development. Economies at later stages of development tend to bring about more public projects with large externalities for society. In these economies, the optimal degree of corruption is smaller, and public display of wealth – advertising corruptibility – is more detrimental to society.

Finally, our analysis assumes that the public display of wealth is costly to the official. It costs an amount ϕ. Clearly to some degree, public display of wealth constitutes consumption and as such should not only be costly but also generate utility for the official. Taking this into account, in our model the amount ϕ captures the cost of public display of wealth that goes beyond the utility created. For example, the official could be driving a luxury car that is not appropriate for local conditions or live in a mansion that is too large to be fully used.

5. Conclusion

Incentives have been argued to be crucial in fighting corruption. In this paper we argue that, if monitoring is costly and government implement partial corruption, that is, decide not to monitor officials following projects of low-value, those officials – if they have high bargaining power – will have an incentive to use public display of wealth as a corruption-facilitating device. We show that such public display of wealth is to the detriment of the government, particularly so if projects with large positive externalities to society are very frequent. Our results imply that competition among officials should reduce their incentive to signal their corruptibility by means of public display of wealth, thus, reducing corruption, and increasing the expected value of public projects to society.

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