Further notes on information, corruption, and optimal law enforcement

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Abstract We consider two important notes on optimal law enforcement with corruption. First, we analyze the role of asymmetric information on the emergence of collusion between criminals and enforcers. Second, our paper proposes that the optimal criminal sanction for the underlying offense is not necessarily maximal. We achieve this result by coupling the criminal sanction for the underlying offense with a criminal sanction for corruption, both imposed on offenders. A higher criminal sanction for the underlying offense implies that the government must spend more resources to detect and punish corruption (since the likelihood of collusion increases). Thus, the government could reduce this sanction, save on detection, and increase the criminal sanction for corruption (in order to offset the negative effect on deterrence).

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1 Introduction

Corruption has been an important issue in the economic literature of law enforcement. In their seminal article, Becker and Stigler (1974) argued that it

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might be advantageous to extend private enforcement to the criminal law and other areas where the law is now enforced publicly. Their principal argument was that public enforcement creates incentives to bribery which undermine deterrence. If law enforcement were privatized, however, competitive private enforcers could be rewarded with the fines offenders paid and enforcers would have no incentive to take bribes. In the last few years scholars have begun to pay more attention to corruption in corruption. A central conclusion of this literature is that corruption is usually socially undesirable, because it dilutes deterrence. As a consequence, it is usually optimal to expend resources to detect and penalize corruption.

The first point of our paper is to consider the role of asymmetric information on the emergence of collusion between criminals and enforcers, in the framework proposed by Bowles and Garoupa (1997) and Chang et al. (2000), and to same extent by Polinsky and Shavell (2001). Indeed, particularly in the case of casual corruption, the hypothesis of asymmetric information about private costs (opportunity costs) of enforcers engaging in collusion seems very plausible. The asymmetry of information leads the enforcers to overestimate this cost in order to increase their corruption rent. Therefore, asymmetric information might eventually deter corruption and deter bargaining between the two parties. We show otherwise, and discuss the shortcomings of the solutions proposed by Bowles and Garoupa (1997) and Polinsky and Shavell (2001). In particular, we provide a comprehensive characterization of incentives and derive an endogenous likelihood of corruption under asymmetric information.

Our second point is to consider a collusion-proof solution as in the regulatory literature (Laffont and Tirole 1993). We show that the optimal criminal sanction for the underlying offense is not necessarily maximal as in Bowles and Garoupa (1997) and Polinsky and Shavell (2001). We achieve this result by coupling the criminal sanction for the underlying offense with a criminal sanction for corruption, both imposed on offenders. A higher criminal sanction for the underlying offense implies that the government must spend more resources to detect and punish corruption (since the likelihood of collusion increases). Thus, the government could reduce this sanction, save on detection, and increase the criminal sanction for corruption (in order to offset the negative effect on deterrence).
We differ from Chang et al. (2000), because we do not incorporate social norms. They show that a less than maximal sanction could be optimal due to the ‘snow-balling’ effect of social norms; raising fines could be counterproductive in deterring crime if collusion is widespread. Our result instead could be seen as an application of the marginal deterrence principle. If detecting the underlying offense is more expensive than detecting corruption, deterring the underlying offense is relatively more important than deterring corruption. Thus, the optimal criminal sanction for the underlying offense is maximal. However, if detecting the underlying offense is less expensive than detecting corruption, deterring corruption is relatively more important than deterring the underlying offense. Thus, the optimal criminal sanction for the underlying offense is less than maximal, whereas the optimal sanction for corruption is higher than otherwise.6

The paper goes as follows: In Sect. 2, we introduce the basic model from Bowles and Garoupa (1997) and Polinsky and Shavell (2001). In Sect. 3, we analyze the bribing game under asymmetric information; in section four, we discuss optimal deterrence in the context of a corruption proof solution. Final remarks are addressed in section five. Proofs of results are in appendix at the end of the paper.

2 Basic model

Each risk neutral individual decides whether or not to become an offender. Once he acts as a criminal, he may be detected or not (the probability of detection and punishment of an offender is \( p \)). If detected, he starts a bargaining process over the bribe with the police officer. If such process is successful (it will be with probability \( 1-r \), where \( r \) is the rate of honesty across enforcers), he pays a bribe \( R \) to the corrupted police officer. After the bribery has occurred, the corrupted police officer may be detected (the probability of detection and punishment of an enforcer is \( q \)), and if so, both enforcer and offender are punished.

There are four possible states of nature: (a) an offender is not detected, (b) an offender is detected and does not collude with the enforcer (he pays the sanction for the underlying offense, that is, a fine \( F \)), (c) an offender is detected and colludes with the enforcer; they are detected by the government (an offender pays a fine \( F \) plus a penalty \( T \) for corruption, and the enforcer pays a fine \( S \)), (d) an offender is detected and colludes with the enforcer; they are not detected by the government.

The prospective gain from crime to the offender is \( b \), and the expected utility of each potential offender who commits the act is given by

\[
U = (1-p)b + p\{r(b-F) + (1-r)q(b-R-F-T) + (1-r)(1-q)(b-R)\} \\
= b - p[r + (1-r)q]F - p(1-r)qT - p(1-r)R.
\]

(1)

The expected utility of an enforcer who accepts the bribe is:

\[
V = (1-q)R + q(R-S-T) \\
= R - q(S + T)
\]

(2)

6 Notice that on the side of the enforcer the marginal deterrence problem is less interesting since there is only one offense, i.e., accepting a bribe (corruption).
where $\psi$ includes, for example, psychological costs and opportunity costs borne by a police officer when she is bribed and shamed for exposition (hence, we could say that it is the cost of shame).

3 Bribing game under asymmetric information

In Bowles and Garoupa (1997), the costs represented by $\psi$ are public information in the moment of the bargaining. In our model, $\psi$ is private information to enforcers. We relax the assumption that $\psi$ is observable by criminals and suppose that it is known only to the officer when the bargaining takes place. Indeed, particularly in the case of casual corruption, the hypothesis of asymmetric information about private costs of enforcers engaging in collusion seems very plausible.

The asymmetry of information of course leads the enforcers to overestimate this cost in order to increase their corruption rent. Therefore, asymmetric information might eventually deter corruption and break bargaining between the two parties. The purpose of this section is to analyze the extent asymmetric information affects corruption.

The private cost $\psi$ is a continuous parameter that belongs to the closed interval $I = [\psi, \bar{\psi}]$, where $\bar{\psi} > \psi$. Hereafter $\psi$ denotes a realization of a random variable with cumulative distribution $L(\psi)$ and the corresponding positive probability density function $l(\psi)$. By making use of the incentive contract theory and the revelation principle as developed by Laffont and Tirole (1993) we can show the following result:

**Proposition 1** Corruption occurs with the following probability: one if $\psi \leq \psi_0$ and zero if $\psi > \psi_0$. The endogenous number of corrupted officers is given by $1 - r = L(\psi_0)$, where

$$(1 - q)F = q(S + T + \psi_0 + L(\psi_0)/I(\psi_0))$$

Contrary to Bowles and Garoupa (1997) and Polinsky and Shavell (2001), we have an endogenous likelihood of corruption under asymmetric information. A higher fine for the underlying offense seems to reduce the rate of honesty since criminals are willing to pay higher bribes, making officers more willing to accept a bribe. Punishment of corruption deters bribing by increasing the rate of honesty across offenders, either in the form of more severe punishment for corrupted officers and corrupter offenders, or in the form of higher likelihood of punishment.

The optimal bribe under asymmetric information is given by $q(S + \psi_0)$, for all $\psi \leq \psi_0$. This is an important corollary because it implies that the amount offered as bribe does not depend on the type of enforcers $\psi \in I$. The bribe is determined at the marginal level (by type $\psi_0$). The informational rent for an enforcer type $\psi \leq \psi_0$ is a proportion of the difference between her own private costs and the critical level for bribing given by $q(\psi_0 - \psi)$, for all $\psi \leq \psi_0$.

Having determined the optimal bribe contract in presence of corrupted officers and asymmetric information, we analyze the incentive individuals have to commit the underlying offense. We rewrite (1) as:
\[ U = b - p[r + (1 - r)q]F - p(1 - r)qT - p(1 - r)R \]
\[ = b - p[F - qL^2(\psi_0)/I(\psi_0)] \tag{3} \]

Hence crime occurs if and only if the gain obtained by the offender more than compensates him for the expected loss:

\[ b \geq p[F - qL^2(\psi_0)/I(\psi_0)] = z(p, q, F, S, T) \]

As in the usual models, we will assume that the illegal gain an individual obtains from committing an offense is not known to the government, but the density \( g(b) \) of gains among the population of potential offenders is known, where \( g(b) > 0 \) and \( b \in [0, \infty) \).

### 4 Corruption proof solution

In this paper we follow the usual approach of the regulation literature by studying a corruption proof solution, that is, the optimal policy when the government seeks to completely eliminate corruption. Corruption proof solution is standard in Laffont and Tirole’s literature on regulation, but is not always optimal. A possible justification is that corruption is socially very harmful or generates important distortions with a large deadweight loss.\(^7\) Other reasons to study corruption proof solutions are the important symbolic value of eliminating corruption across law enforcement and the positive externality on social change.

The social welfare function is the sum of illegal gains plus social damage minus enforcement costs as in Polinsky and Shavell (2000). Note that bribes and sanctions are assumed to be costless transfers:

\[ W = \int_{z}^{\infty} (b - h)g(b) \, db - c_1q - c_0p \tag{4} \]

where law enforcement exhibits constant returns to scale, and \( h \) is the social harm caused by crime. The government maximizes social welfare in \( \langle p, q, F, S, T \rangle \) subject to maximal fines \( \{F, S\} \) interpreted as total (exogenous) wealth of offenders and enforcers. Notice that by construction the bribe paid by the offender is always less than total wealth.

Corruption is deterred by setting the likelihood of detecting and punishing corruption \( \tilde{q} = F/(F + S + T + \psi) \) so that \( \psi_0 = \tilde{\psi} \) (therefore we must use \( \tilde{q} \) in (4) in order to have a corruption proof solution). In a corruption proof solution, the planner maximizes the following Lagrangean in \( F, S, T, \) and \( p \):

\(^7\) In Bowles and Garoupa (1997) and Polinsky and Shavell (2001), the harmfulness of corruption and optimal policies when corruption is not harmful are considered and harmful corruption is briefly mentioned. Here we have in mind that corruption distorts incentives within the law enforcement agency multitasks. Hence, apart from the effect on deterrence, we might require a corruption proof solution to achieve the proper balance of incentives across different enforcement tasks, from those directly in contact with corruption or illegal activities to those that are less exposed, e.g., administrative tasks in the police station.
\[
\mathcal{L} = \int_{pF}^{\infty} (b - h)g(b) \, db - c_1 F/(F + S + T + \psi) - c_0 p + \lambda_0 (\bar{F} - F - T) + \lambda_1 (\bar{S} - S)
\]  

(5)

where \(\lambda_0, \lambda_1\) are the associated multipliers.

**Proposition 2**  
Corruption-proof law enforcement is characterized by

(i) \(F(h - pF)g(pF) = c_0\),  
(ii) \(S = \bar{S}\),  
(iii) \(F = \bar{F}\) and \(T = 0\) if \(c_0 p \geq c_1 \bar{q}\),  
(iv) \(F = c_0 p \bar{F}/(c_1 \bar{q})\) and \(T = \bar{F} - F\) if \(c_0 p < c_1 \bar{q}\).

The collusion proof solution implies that it is optimal to impose a maximal fine on officers while the optimal fine on criminals may be lower than maximal. This results contrasts with Polinsky and Shavell (2001) since they have shown that all fines should be maximal when controlling corruption. The rationale for this result is obtained when enforcement costs are higher for corruption than for the underlying offense. The fine imposed on criminals should be less than maximal because a higher sanction makes bribes more likely and thus more costly to deter. However, note that the fine should not be zero since then no one would be punished and everyone would commit the underlying offense. The sanction for corruption imposed on criminals is positive and determined by the wealth constraint.

When enforcement costs are higher for the underlying offense than for corruption, the fine imposed on criminals should be maximal and, by the wealth constraint, the fine for corruption imposed on offenders is zero. It is more important to deter crime than corruption because crime detection is more expensive than corruption detection.

5 Conclusion

This paper presents a simple model to evaluate the alternative enforcement policies in presence of corruption with asymmetry of information. We have shown that the optimal criminal sanction for the underlying offense is not necessarily maximal in a corruption-proof solution.

There are two main public policy implications from these notes on optimal law enforcement with corruption. First, if deterring corruption is a priority for the government, then the fine for the underlying offense should not be maximal in contrast with Bowles and Garoupa (1997) and Polinsky and Shavell (2001) because some marginal cost should be borne by an offender who prefers to bribe the prosecutor rather than pay his dues. Second, by creating more shame for only a subset of corrupted enforcers, the government is able to reduce corruption and hence also deter the underlying offense more effectively. The rationale is that there is asymmetry of information, and hence the relevant indicator for offenders is the distribution of costs from shame, not the exact cost for a particular enforcer. By concentrating shame on a small group of enforcers (but enough to
change the individual at the margin), the government may achieve general deterrence.

Appendix: Proofs

Proof of Proposition 1

We make the following (usual) assumption about the distribution $L(.)$; it satisfies the monotone hazard rate property:

$$\frac{\partial}{\partial \psi} \left( \frac{L(\psi)}{l(\psi)} \right) \geq 0$$

In this setup, an offender designs a compensation (bribe) structure that maximizes his expected utility while guaranteeing the enforcer at least her reservation utility.\footnote{The alternative sequential model would be for the enforcer to propose a menu of contracts to an offender. Another possibility is to consider a simultaneous (bribing) game that, given the linearity of the menu of contracts, is analytically isomorphic to the game we present. Given the need for consistent beliefs and the nature of the asymmetry of information, any other model would be more complex. See Inderst (2002). Furthermore, we are in the context of casual corruption where it makes more sense to expect offenders to make a first move.}

The proof consists in maximizing the expected utility of an offender subject to the standard participation and incentive compatibility constraints by which the enforcer is willing to participate and reveal her private costs.

From Laffont and Tirole (1993), it is well known that, without loss of generality, one can restrict the search to the class of mechanisms that induces a truthful revelation of the enforcer’s cost parameter $\psi$. In our context, it is easy to see that any optimal mechanism $M$ that induces a truthful reporting can be represented as the following $M = (\sigma(\psi), R(\psi))$, where $\sigma(\psi)$ is the probability of offering a bribe of amount $R(\psi)$ for the corrupted enforcer of type $\psi \in I$.

Given a mechanism $M$, let the level of utility achieved by the officer of type $\psi$ if she reports type $\tilde{\psi}$ be $V(\psi, \tilde{\psi}) = \sigma(\tilde{\psi})[R(\tilde{\psi}) - q(S + \psi)]$, where $V(\psi) = V(\psi, \psi)$ denotes truthful reporting of costs.

The incentive compatibility constraint (IC) to guarantee truthful reporting is given by $V(\psi, \psi) \geq V(\psi, \tilde{\psi})$, for all $\psi, \tilde{\psi} \in I$. The individual rationality constraint (IR) is $V(\psi) \geq 0$, for all $\psi \in I$.

In this context the problem for the offender is to maximize his expected utility subject to (IC) and (IR). Once detected by an officer, the expected utility of a criminal is:

$$U_c = \sigma(b - R - qF - qT) + (1 - \sigma)(b - F)$$

$$= b - F - \sigma(R + qT - (1 - q)F)$$

where the bribe is accepted with probability $\sigma$.

The criminal solves the following program:
\[
\max_{(\sigma, R)} \left\{ \int_I [b - F - \sigma(\psi)(R(\psi) + qT - (1 - q)F)] \, dL(\psi) \right\}
\]

subject to (IC) and (IR).

We are now able to solve the problem of side payments (bribing) with asymmetric information. To find the optimal solution, we begin by characterizing the class of bribing contracts that satisfies the incentive constraint in order to implement \( M \) in a dominant strategy.

Define \( V_c(\psi) \) such that:

\[
V_c(\psi) = \max_{\tilde{\psi} \in I} \{ \sigma(\tilde{\psi})[R(\tilde{\psi}) - q(\psi + S)] \}
\]

Then \( V_c(\psi) \) is an upper envelope of a linear function in \( \psi \), it is convex and we have almost everywhere (using the envelope theorem):

\[
\begin{align*}
V'_c(\psi) &= -q\sigma(\psi) \\
V''_c(\psi) &= -q\sigma'(\psi) \geq 0
\end{align*}
\]

only if \( \sigma'(\psi) \leq 0 \) for all \( \psi \in I \).

By integration of \( V'_c(\psi) \) such that \( V_c(\tilde{\psi}) = 0 \), we obtain

\[
V_c(\psi) = q \int_{\psi}^{\tilde{\psi}} \sigma(x) \, dx
\]

The following lemma follows:

**Lemma 1**  The bribe contract satisfies the incentive constraint if and only if

1. \( V_c(\psi) = q \int_{\psi}^{\tilde{\psi}} \sigma(x) \, dx \) and
2. \( \sigma'(\psi) \leq 0 \) for all \( \psi \in I \).

The rent from corruption \( V_c(\psi) \) is the informational rent left to an officer of type \( \psi \) by the criminal. Indeed because of asymmetric information about private costs of enforcer, the criminal is forced to give up a costly rent to the officer. The informational rent is used to discipline the enforcer into revealing her true private cost of being bribed. From the first lemma, we can remark that the informational rent is decreasing in \( \psi \). Hence to be willing to reveal her cost, a lower \( \psi \) type must be rewarded with a more substantial rent than a higher \( \psi \) type. Furthermore, from the monotonicity assumption such that \( \sigma'(\psi) \leq 0 \), an officer with low private cost is characterized by an increased probability of being offered a side contract (i.e., a bribe). Note also that the informational rent increases with \( \sigma(\cdot) \).

In order to find the components of the optimal bribing contract \( M \), we must determine the expected utility of the criminal. From the definition of \( V_c(\psi) \) we have:

\[
\sigma(\psi)R(\psi) = q(\psi + S)\sigma(\psi) + V_c(\psi)
\]
where the left-hand-side is the expected bribe, and the right-hand-side is the sum of the expected cost of being bribed plus the informational rent.

The expected utility of an offender is:

\[
U = \int [b - F - \sigma(\psi)(R(\psi) + qT - (1 - q)F)] dL(\psi)
\]

\[
= \int [b - F + \sigma(\psi)(1 - q)F - \sigma(\psi)q(\psi + S + T) - \mathcal{V}_c(\psi)] dL(\psi)
\]

with

\[
\mathcal{V}_c(\psi) = q \int_\psi \sigma(x) dx
\]

as showed in lemma one.

Then, after integrating by parts, we derive:

\[
U = \int [b - F + \sigma(\psi)(1 - q)F - \sigma(\psi)q(\psi + S + T) - \sigma(\psi)qL(\psi)/l(\psi)] dL(\psi)
\]

The first part of the proposition follows easily from maximizing $U$ in $\sigma$. The optimal $\sigma^*(\psi)$ is determined by the first-order condition:

\[
\frac{\partial U}{\partial \sigma(\psi)} = (1 - q)F - q(S + T + \psi + L(\psi)/l(\psi))
\]

Then $\sigma^* = 1$ if $(1 - q)F > q(S + T + \psi + L(\psi)/l(\psi))$. And $\sigma^* = 0$ if $(1 - q)F < q(S + T + \psi + L(\psi)/l(\psi))$. Let $\psi_0$ be given by

\[
(1 - q)F = q(S + T + \psi_0) + qL(\psi_0)/l(\psi_0)
\]

Therefore, from assumption one (on monotone hazard rate of $L(\cdot)$), it follows that $\sigma^*(\psi) = 1$ holds only if $\psi \leq \psi_0$ given that $\sigma'(\psi) \leq 0$. Conversely $\sigma^*(\psi) = 0$ when $\psi > \psi_0$. The second part of the proposition is a corollary.

Also notice that from lemma one we have:

\[
\mathcal{V}_c(\psi) = q \int_\psi^{\psi_0} \sigma^*(x) dx + q \int_{\psi_0}^{\psi} \sigma^*(x) dx = q(\psi_0 - \psi)
\]

By construction, we have:

\[
R(\psi) = q(S + \psi) + \mathcal{V}_c(\psi)
\]

where the bribe (when occurs with probability one) equals expected cost plus informational rent. Then, for $\psi \leq \psi_0$,

\[
R(\psi) = q(S + \psi) + q(\psi_0 - \psi) = q(S + \psi_0)
\]
Proof of Proposition 2

The first-order conditions are:

\[ L_p = F(h - pF)g(pF) - c_0 = 0 \]
\[ L_S = c_1 F/(F + S + T + \psi)^2 - \lambda_1 = 0 \]
\[ L_F = p(h - pF)g(pF) - c_1(S + T + \psi)/(F + S + T + \psi)^2 - \lambda_0 = 0 \]
\[ L_T = c_1 F/(F + S + T + \psi)^2 - \lambda_0 = 0 \]

Second-order conditions are assumed to be satisfied. From the first-order condition with respect to \( S \), we have \( \lambda_1 > 0 \) and \( S = \bar{S} \).

From the first-order condition with respect to \( p \), we can write:

\[ (h - pF)g(pF) = c_0/F \]

From the first-order condition with respect to \( T \), we can write:

\[ \lambda_0 = c_1 F/(F + \bar{S} + \psi)^2 \]

We can rearrange the remaining first-order condition as:

\[ L_F = pc_0/F - c_1/(F + \bar{S} + \psi) = 0 \]

The optimal solution depends on the following situations:

(a) \( c_0p \geq c_1 \bar{q} \). We should have \( F = \bar{F} \) and \( T = 0 \).

(b) \( c_0p < c_1 \bar{q} \). We should have \( F = pc_0\bar{F}/(c_1\bar{q}) \) and \( T = \bar{F} - F \).

References


