On controlling crime with corrupt officials

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Abstract

This paper attempts to synthesize the recently developed strategic approach towards modeling corruption and the classical views. The following propositions are sought to be proved: (a) If reward schemes are introduced, the classical and the strategic approaches yield similar results so far as controlling crime is concerned; (b) With probability of detection being dependent on the effort of a corrupt official, crime cannot be controlled; and (c) In the context of an infinitely repeated game of crime, the corrupt law enforcing agent might choose less bribes and lower effort level than the myopic optimal and hence would strategically pamper crime. © 1998 Elsevier Science B.V.

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1. Introduction

This paper attempts to synthesize the classical and the strategic views of crime and punishment. The classical view could be dated back to Becker (1968) which pioneered the literature on crime and punishment. Following Becker (1968), several authors have focused on the nature of criminal offenses and the means to eradicate crime (see for example, Rose-Ackerman, 1975, Lui, 1985, Lui, 1986, Cadot, 1987). This literature has been surveyed by Becker in his Nobel lecture (Becker, 1993). Recently, Basu et al. (1992), hereafter B-B-M, question the assumption of honest law enforcing agents usually made in the traditional literature and raise the issue of the control of corruption when the person apprehending a criminal can also accept a bribe and let the culprit go free. They

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argue that when the possibility of collusion between law enforcing agents and criminals is introduced, control of corruption becomes more difficult than is suggested by the Beckerian approach. They explicitly introduce a Nash-bargaining framework for the determination of an equilibrium bribe structure. They also demonstrate the hierarchical ‘chain’ of corruption and detection. We define this as the ‘strategic’ view of the theory of crime and punishment. In the concluding section of B-B-M (1992), they mention two possible extensions of their paper, namely, endogenizing the probability of detection, and introducing reward schemes. Several studies (for example, Chander and Wilde, 1992, Beale and McLaren, 1993, Mookherjee and Png, 1995) have investigated these issues in different contexts.

The purpose of this paper is threefold. First, we construct a model to illustrate that both Becker (1968) and B-B-M (1992) are special cases of a more general structure when reward schemes are introduced for the honest officials. Secondly, following existing literature but in a slightly different context, we argue that control of corruption is almost impossible if the law enforcing agents can manipulate the probability of detection through their efforts. In this case, the law enforcing agents will optimally select an effort level that pampers the criminal acts and seek bribes in their own interests; therefore, crime will certainly occur. Thirdly, we question the validity of the Nash-bargaining scheme and introduce an alternative bargaining scheme between criminals and law enforcing agents. We construct several models with different timing to demonstrate that this alternative bargaining scheme gives law enforcing agents an additional freedom in negotiating with culprits and makes crime control even more difficult.

In this paper, we assume that both criminals and law enforcing agents are rational homo oeconomicus who are then modeled to maximize the expected monetary returns.\(^1\)

The organization of the paper is as follows. The next section discusses three models with the first (2.1) to investigate the equivalence between two alternative approaches, the second (2.2) to extend the model by endogenizing the probability of detection, and the third (2.3) to investigate several games with an alternative bargaining scheme to emphasize the difficulty of controlling crime with corrupt officials. The last section concludes the paper.

### 2. Models

#### 2.1. Reward schemes

Consider a case where a criminal act involves a net payoff of the amount \(x\). The criminal can be caught eventually with a probability \(p\) and then would be made to pay a fine \(\alpha x\), \(\alpha > 1\). However, the law enforcing agent who catches the criminal can either be bribed an amount \(b \alpha x\) \((0 \leq b \leq 1)\) so that the criminal is allowed to go free or bring the criminal to the court of law and receive a reward \(\lambda \alpha x\), where \(0 \leq \lambda \leq 1\). The assumption

\(^1\) Unlike B-B-M (1992) who introduce elite forces and social finiteness, and that was strongly argued by one referee that the social elite forces are an important factor to deter criminals and an explanation for the different crime rate in developed countries and developing countries, we adopt the simple assumption in the main parts of this paper.
that the reward can be at most the fine imposed on the criminal is made to highlight the ‘balanced budget’ criterion. This is the case of a self-financing organization where the basic salary is provided from the public budget and further monetary payments have to be self-financed. The criminal, after being caught, engages in conventional Nash-bargaining with the captor to determine an equilibrium bribing fraction \( \hat{b} \) which maximizes,

\[
\max_b (\alpha x - b \alpha x) b \alpha x - \lambda \alpha x
\]

(1)

Therefore,

\[
\hat{b} = (1 + \lambda)/2
\]

(2)

Before committing the crime, the potential criminal calculates the net expected returns \( R \) from the criminal acts.

\[
R = (1 - p)x + p[x - \alpha x (1 + \lambda)/2]
\]

(3)

Hence,

\[
R < 0, \quad \text{iff, } p\alpha > 2/(1 + \lambda)
\]

(4)

Case 1: Assuming \( \lambda = 1 \), that is, the reward schemes are designed such that all money collected from the penalty is fully compensated to the captor, so the captors would be better off to be honest to capture the maximum amount of money reward. Condition (4) becomes \( p\alpha > 1 \), that is the condition initially suggested by Becker (1968).

Case 2: Assuming \( \lambda = 0 \), that is, there is no rewards for captor, so the captors would be better to negotiate with the criminal to capture half of potential penalty. Condition (4) turns out to be \( p\alpha > 2 \), that is the crime control condition suggested by B-B-M (1992).

This basic model can be easily extended to include an infinite number of corruptible law enforcing agents. B-B-M (1992) consider a recursive case where a corrupt official can eventually be apprehended by an incorruptible one. Therefore, while accepting a bribe the agent must take into account the possibility that he might be caught by another official. It is easy to see from the simple Nash-bargaining framework we have been using so far, that the equilibrium bribe would be the solution to

\[
\max_b (\alpha x - b \alpha x)(b \alpha x - q\alpha B - \lambda \alpha x)
\]

so

\[
\hat{b} = \frac{1}{2} \left( 1 + \frac{\lambda}{1 - q\alpha} \right)
\]

(5)

Control of crime is possible in this case iff:

\[
\frac{p\alpha}{2} \left( 1 + \frac{\lambda}{1 - q\alpha} \right) > 1
\]

(6)

where \( q \) is the probability of detection for bribe-taking. It is clear that (2) is a special case of (5) when there is no chance of further detection \( (q = 0) \). The equilibrium bribe increases in this case (recall \( 0 < q\alpha < 1 \) is the condition for the captor to accept a bribe).
and the condition for controlling crime gets weaker. An interesting comparison suggests that if there is no reward schemes, i.e. \( \lambda = 0 \), the equilibrium bribe and the crime control condition remains the same no matter whether there is recursive detection of corruption. This result is consistent with B-B-M (1992) who assume \( \lambda = 0 \) and get \( \alpha x/2 \) as the equilibrium bribe even with the possibilities of chain arrests.\(^2\) Once \( \lambda > 0 \) the condition for crime control is weaker in the recursive case.

This shows that both the traditional approach and the strategic view are special cases of a more general structure where we introduce rewards as well as punishments. This does have important policy implications. For so long as \( \lambda < 1 \), control of crime would be more difficult than suggested in the traditional case. This discussion leads us to the following proposition:

**Proposition 1:** The difficulty of crime control depends on the reward schemes. The higher the proportion of the penalty which is used as rewards, the easier it will be to control the crime. This is even so in the recursive case.

### 2.2. Endogenizing the probability of detection

Until now, we have treated \( p \) as exogenous. Now suppose that \( p \) could be altered by the amount of effort on the part of the law enforcing agent. We postulate a function,

\[
p = p(e), \quad p'(e) > 0, \quad p''(e) < 0
\]

where \( e \) denotes the effort put into by the law enforcing agent to detect the crime. We also assume away the criminal’s effort to evade arrest. From our previous discussion it follows that the expected net benefit to the law enforcing agent would be given by,

\[
p(e) \frac{\alpha x(1 + \lambda)}{2} - c(e)
\]

where \( c(e) \) denotes the disutility of effort with \( c' > 0, c'' > 0 \).

Note that the net return to the law enforcing agent is on top of the salary he receives. The law enforcing agent’s objective is given by,

\[
\text{Max} : \quad p(e) \frac{\alpha x(1 + \lambda)}{2} - c(e)
\]

s.t. \( p(e)\alpha < 2/(1 + \lambda) \)

The following proposition is immediate.

**Proposition 2:** Even with the reward schemes, crime can never be controlled, if law enforcing agents happen to be able to manipulate the probability of detection of crime.

\(^2\) This actually follows from a rather peculiar property of the Nash bargaining exercise. If \( \lambda = 0 \), the product bargaining function, \((\alpha x - b\alpha x)\) alters by a proportion \((1-p\alpha)\) to yield \((\alpha x - b\alpha x) b\alpha x(1-p\alpha)\) when one includes the possibility that a corrupt official would be apprehended by an incorruptible one. Hence, \( b = 1/2 \) continues to maximize the bargained payoff. We challenge this proposition in Section 2.3.
Proof: Let $\tilde{e}$ solve $p(\tilde{e})\alpha = 2/(1+\lambda)$ which implies $\forall e < \tilde{e}$, $p(e)\alpha < 2/(1+\lambda)$ inducing the criminal to commit a crime. Let $e^0$ solve the unconstrained maximization problem for the law enforcing agent. Then it is obvious that for $e^0 < \tilde{e}$, a crime would definitely be committed. For $e^0 > \tilde{e}$, the law enforcing agent cannot expect any income as $p(e^0)\alpha > 2/ (1+\lambda)$. Therefore, for $e^0 > \tilde{e}$, the law enforcing agent would choose some $e$ a little smaller than $\tilde{e}$ and that would be better than choosing $e^0$, that is, the law enforcing agent would be better off by choosing an effort level that induces crime rather than choosing an effort level that prevents it.\(^3\) QED

Fig. 1 captures the essence of Proposition 1; law enforcing agent’s net payoff is concave up to $e = \tilde{e}$. After that point, no crime is committed and the net payoff is $-c(e)$. If $\tilde{e} > e^0$ (as in panel (a) of Fig. 1), the law enforcing agent puts in $e^0$; if $\tilde{e} < e^0$ (as in panel (b) of Fig. 1), the law enforcing agent puts in effort level $e$ close to $\tilde{e}$. In the latter case no unique equilibrium can be determined, as for any $e < \tilde{e}$ the payoff could be improved by increasing $e$. But the law enforcing agent can always control $e$ so that the crime is committed and he gets the bribe.

A rather strong implication of our results is that even increasing $\alpha$, the penalty rate, to a very high level may not deter crime. Control of crime as a concept loses its meaning when the probability of detection depends on the effort level of the law enforcing agent. In such a system the agent can always choose an effort level so that the crime is committed. Therefore, with corrupt officials, controlling crime would not only be difficult but would be an impossible task.

The introduction of recursive detection does not change the nature of the problem. Suppose all law enforcing agents in every layer of an administrative hierarchy are rational homo oeconomicus, then selecting an effort level which pampers the acts of crime is always better than stopping the crime. Pampering the acts of crime could either be

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\(^{3}\) This is actually consistent with the observations made in the literature. For example, Mookherjee and PNG (1995) show in a different context that ‘If, initially, bribery is profitable, raising the penalty on the inspector for corruption will reduce her incentive to monitor. The reduction in monitoring may reduce the expected penalty for pollution, hence the result may be more pollution.’
rewarded if the law enforcing agents honestly report the crime or if they are engaged in rounds of negotiations with criminals from which some positive monetary gains are expected.

The introduction of endogenized probability of crime detection makes the prospective of crime control very dim. Even establishing an elite group\(^4\) may not be a solution to this problem. Besides the costs in establishing such a group, it may not be sufficient to stop the crime. In a simple administrative hierarchy, the existence of an elite could only eliminate crime upwards but not downwards, since the downward corruptible officials will always be better off by selecting an effort level to pamper the acts of crime to collect the rewards even if his/her direct supervisor is an incorruptible elite.

One may argue that the probability of crime detection would not be purely endogenous and it depends on the social environment in which collective attitudes and actions may exert some influences. For example, in a community the probability of detection is influenced by the collective efforts of all law enforcing agents who work in the area. Among these law enforcing agents, an incorruptible official will significantly increase the probability of detection, that is, \(p(e_1, e_2, e_3, \ldots) \geq \bar{p} > 0, e_i \in [0,1]\) for the effort level of every respective law enforcing agent. In this case, as long as \(\bar{p} \alpha > 2/(1 + \lambda)\), crime can still be controlled. However, we would argue in a more realistic bargaining scheme, as will be constructed in the next subsection, this argument may be less credible.

2.3. An alternative bargaining scheme

The foregoing discussion focuses on the Nash-bargaining solution to determine the equilibrium bribing scheme. In fact, the Nash-bargaining solution puts more than the required structure constraint on a possible bargaining equilibrium. Actually, the criminal can always offer some bribe which is much less than \(\alpha x(1 + \lambda)/2\) and get freed. With this in mind, we develop an alternative framework in this subsection.

We alter the existing framework to isolate cases where the criminal or the captor can dictate the terms of the bribing game. We first highlight the case where the criminal, after being caught, can make a ‘take-it-or-leave-it’ offer to the captor in terms of the bribe to be paid for committing the crime.

If \(b\alpha x\) is the bribe a criminal will pay to the captor (where \(0 \leq b \leq 1\)), the net expected gain from the criminal act is given by

\[
(1 - p)x + p(x - b\alpha x)
\]

Note that for \(p\alpha > 1/b\) no crime would be committed. When \(b = 1/2\), we get the Nash-bargaining solution (without reward schemes). Incidentally, when the criminal makes an offer to the captor, he can always offer some \(b, b \in (0, 1/p\alpha)\). Given that the reservation payoff to the official is negligible without reward schemes, it is obvious that the offer would be accepted. Since for small enough values of \(b, p\alpha\) would be lower than \(1/b\) and crime would always be committed. The captor can make a similar ‘take-it-or-leave-it’ offer. As long as \(b \in (0, 1/p\alpha)\), crime cannot be controlled anyway.

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\(^4\) We define an elite as a person who is willing to contribute the maximum amount of efforts to stop the crime and report honestly any crime committed in whatever the pecuniary costs.
If the probability of detection can be somehow manipulated by the captor, the expected net benefit to the captor is \( p(e)b - c(e) \), subject to \( p(e)ab \leq 1 \). In fact, for \( \lim_{e \to 0} p(e) = 0 \), the optimum solutions for the captor are: \( b^* = 1 \) and \( e^* = p^{-1}(1/\alpha) \), that is, the captor will optimally select the highest \( b = 1 \) and the lowest \( e = p^{-1}(1/\alpha) \) to pamper crime and capture the criminal, for efforts level \( e \) involves disutility of \(-c(e)\). If we follow the arguments above by assuming \( p = p(e_1, e_2, e_3, \ldots) \geq \bar{p}, \bar{p}(e_1, e_2, e_3, \ldots) > 0 \), and \( p(0, 0, \ldots) = \bar{p} \), for \( e_i \in [0,1] \), the optimum solutions are \( e_i^* = 0 \) and \( b^* = 1/\bar{p}\alpha \). In essence, this alternative bargaining rule gives the captor an additional instrument, the bribing fraction \( b \) (in addition to the effort level \( e \)) to manipulate the outcome in his own interests. This makes the control of crime more difficult, if possible.

Introducing reward schemes increases the reservation payoff to the official and therefore increase the lower bound of the bribing fraction. The criminal can then offer \( b \in (\lambda, 1/p\alpha) \), for \( \lambda < 1/p\alpha \) to successfully bribe the official.

The introduction of recursive detection will increase the reservation payoff to the official by increasing the opportunity costs to \( \lambda \alpha x + qb\alpha x \), where \( q \) is the probability of detection for the bribe-taking. So the viable bribing fraction is \( b \in (\lambda/(1-q\alpha), 1/p\alpha) \).

This discussion leads us to:

**Proposition 3:** If the criminal can make a ‘take-it-or-leave-it’ offer of a bribe to the captor, crime control is impossible without reward schemes and is more difficult than that under the Nash-Bargaining scheme even with reward schemes.

Proposition 3 suggests that control of crime is impossible since the criminal can always offer a bribe to the captor to increase their salary when there is no reward for capturing the criminal. Therefore, sticking to a particular solution, say, \( b = 1/2 \) (as in B-B-M, (1992)) undermines the possibility of offense.

More interesting is that even though a potentially corruptible official can benefit from crimes committed, by charging a bribe that makes the potential criminal’s expected value of crime higher than zero, once the criminal is captured, the captor has the incentive to dictate the amount of the bribe to be paid; and if the total penalty is \( \alpha x \), the whole amount is liable to be extracted by the captor \( (b = 1) \). In a one-shot game he can always rationally deviate from his promise and increase the amount of bribe from \( \alpha x/p\alpha (b = 1/p\alpha) \) to the full amount of the penalty \( \alpha x(b = 1) \) after the criminal has been caught.\(^5\) \( b \leq 1/p\alpha \) is thus incredible. Therefore, it seems that as long as \( p\alpha > 1 \), even though the potential captor will pretend to charge \( b \leq 1/p\alpha \), crime would not be committed in the first place.

However, with the possibility of repeated incidents of crime, it might be credible for a rational law enforcing agent to insist on posterior \( b \leq 1/p\alpha \).

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\(^5\) One referee questioned that since bribing is an informal contract why should not the officer renege on the contract. We thought it is not in officer’s interest to do that. Taking a bribe and then reporting the case do make officer better off at the first place. However, the criminal suffers double losses [paying bribe (\( b\alpha x \)) + penalty (\( \alpha x \))] and will have incentive to report the corruption of bribe-taking. This will significantly increase the probability for the officer to be caught by other law enforcing agents. Even without confirmed evidences of bribe-taking, the office is in a worse position than before.
Consider a case where a criminal decides to engage in a series of criminal acts over time. Each of such acts yields $x$ as the net return. The rule of the game is that once the criminal is caught and somehow makes a net loss once, he does not engage in further criminal acts.

First, we assume the game will repeat infinitely. The law enforcing agent can either (i) extract $b = 1/p\alpha$ for all periods and therefore earn $\alpha x(1/p\alpha)(1 + \delta + \delta^2 + \cdots)$ and crime is committed for all periods to come, where $\delta$ is the time discount factor of captor, or (ii) change posterior $b = 1$ and then crime is ruled out afterward. The captor will stick to $b = 1/p\alpha$, iff

$$[1/p\alpha(1 + \delta + \delta^2 + \cdots)]\alpha x > \alpha x$$

so,

$$\delta > 1 - \frac{1}{p\alpha} \tag{10}$$

Introducing reward schemes and recursive detection will only influence the lower bound of the bribing fraction $b$ and therefore will not affect the outcome as long as $\lambda/(1-\alpha) < 1/p\alpha$. Endogenizing the probability of detection will just mimic the results in the one-shot game discussed above, that is, the captor will charge the maximum bribing fraction $b^* = 1$ and apply an effort level $e^* = p^{-1}(1/\alpha)$ in every period.

On the other hand, if the game is a finitely repeated game and the duration of the game is public information and known to both the captor and the criminal, crime can be controlled in our basic model, if $p\alpha > 1$. Considering a $m$ period repeated game, where $m$ is an arbitrary number and the rule of the game is the same; such that once the criminal is caught and somehow makes a net loss once, he does not engage in further criminal acts. We can justify the rules of the game by noticing that once a criminal has been caught his bad character could be registered. This will significantly increase the probability to be caught in the future event. The captor has the incentive to derive from $b = 1/p\alpha$ and charge $b = 1$ in the last period. Realizing that $p\alpha b > 1$ in the last period, crime will be acted in the last period. Then, $(m-1)$th period becomes the last period for the criminal to possibly commit crime. Again, the captor has the incentive to charge $b = 1$ and therefore committing a crime will make a loss. Backward reasoning shows that crime will not be acted in the first period as long as $p\alpha > 1$. Reward schemes and recursive detection will not change the nature and the outcome of the game.

This outcome is obviously not in the interests of both the captor and the criminal. The lack of ex ante credible signals forces both parties trapped into a prisoner’s dilemma and some sorts of cooperation could make both parties better off. The probability of detection may be qualified as a credible signal. Let us assume that the probability of detection is endogenous and exclusively depends on the effort level exerted by the law enforcing agent and observable to the potential offender. It is in the policeman’s interests to exert an effort level such that $p(e^*)\alpha \leq 1$ to pamper the acts of crime in every period. By doing that, the potential offender observes that even with posterior $b = 1$, the effort level of the law enforcing agent is such that $p(e)\alpha b \leq 1$ in every period. Crime will therefore be committed.

The following proposition describes the outcomes of the games.
Proposition 4: Under the alternative bargaining scheme, given \( pa > 1 \), although crime can be controlled in a finitely repeated game setting, it cannot be controlled in an infinitely repeated game if \( \delta > 1 - 1/pa \) where \( \delta \) is the time discount factor of captor, \( 0 < \delta < 1 \). Moreover, if the probability of detection is endogenous and dependent on some observable factors (for example, the effort level exerted by captor), crime cannot be controlled in both games. Rewards scheme and recursive detection do not change the outcome at all.

3. Concluding remarks

We have argued by using a simple model of crime and corruption that it is almost impossible to control crime with corrupt law enforcing officials. So long as the criminal can match the reservation payoff of the official, crime cannot be controlled. Even when the announced penalty for the crime is very high (very high \( \alpha \)), controlling crime becomes difficult because the probability of detection can be affected by the effort of a corrupt official. When \( p \) and \( \alpha \) are exogenous and the captor has all the bargaining power to determine the equilibrium bribe, the corrupt captor has a strategic incentive to pamper crime for dynamic gains. These results do not change if the reward schemes are designed to promise at most the value of the penalty from the crime to the captor.

It might be argued that since prevention of crime generates a social surplus, the amount available for the reward should be greater than \( \alpha x \), the maximum that can be paid by the criminal. In that case a sufficiently high reward level would deter crime. But there might be difficulties in ascertaining the increment in quantifiable social value by preventing a particular type of criminal activity. However, this paper is not to be viewed as the ultimate analysis of crime and punishment. We have tried to demonstrate the fragile nature of economic incentives/disincentives in implementing a desired social objective.

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