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Casual police corruption and the economics of crime: Further results

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Abstract

This article revisits the Bowles-Garoupa model with regard to corruption and crime. We interpret additional costs inflicted on a caught corrupt officer as psychological costs, and we incorporate social norms into these psychological costs. In the Bowles-Garoupa model, the deterrent effect of raising fines on crime is weakened but is not perverse in the presence of corruption. Here, due to the “snowballing” character of social norms, raising fines could be counterproductive in deterring crimes if the *status quo* corruption is widespread. As a corollary, the optimality of the maximal fine suggested by Becker need not be true even if corruption is harmless. © 2000 Elsevier Science Inc. All rights reserved.

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1. Introduction

Several corruption scandals involving the police, auditors, or law enforcement officials, in general, have surfaced in many countries. Corruption could seriously impede the deterrence of crimes, the collection of taxes, and the enforcement of regulations. Recently, in an interesting article in this journal, Bowles & Garoupa (1997) (henceforth, B-G) set up a model investigating the impact of “casual corruption” between the arresting officer and the criminal

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on the efficacy of law enforcement. In their model, the probability of successful bribery is endogenized, and prospective criminals will *internalize* this success rate in their decision over whether or not to commit crime. B-G came to the conclusion that the criminal will discount the severity of fines if he can escape conviction by paying bribes, and, as a consequence, deterrence is weakened in the presence of corruption. Although the deterrent effect of fines on crime becomes less effective due to “casual corruption,” the basic arguments of Becker (1968) with regard to the relationship between enforcement and crime remain valid (see B-G, 1997, pp. 82–83).

In this article, we revisit the B-G model to make a further investigation. Additional costs inflicted on a caught corrupt officer are regarded as objective future income forgone in B-G. Here, we interpret additional costs inflicted on a caught corrupt officer as subjective psychological costs, and we incorporate the social norms in the police officer community into these psychological costs. By means of a social custom formulation akin to Akerlof (1980) and Naylor (1989), we show that raising fines could be counterproductive in deterring crimes if corruption is widespread at the *status quo*. This result differs from that in B-G and also from the classic claim of Becker (1968), which argues that fines should be set at the maximum.

The key to our result lies in the so-called “snowballing” character of social norms. It has been shown by several authors, including B-G, that raising fines on criminals may open a larger room for officers and criminals to “gain from trade” and that, as a result, the extent of corruption could increase. As the extent of corruption increases, the deterrent effect of imposing penalties on crime tends to be weakened. When corruption is widespread, social norms can no longer take a sufficient sanction against a corrupt officer, and so widespread corruption tends to generate a critical mass effect to intensify the extent of corruption. We show that this intensified effect, due to the snowballing character of social norms, may more than offset the usual deterrent effect of raising fines on crime, resulting in a higher rather than a lower crime rate.

The rest of the article proceeds as follows. Section 2 gives an overview of the B-G model and introduces our extended model. Section 3 solves the corruption problem under complete information, and section 4 deals with the case of incomplete information. The summary is provided in section 5.

2. The model

2.1. Overview of the B-G model

The corruption problem in B-G can be sketched by the following three-stage game. Fig. 1 serves as a supplementary tool to assist our exposition.

In the first stage, each citizen contemplating a crime faces three possible states of the world:

1. The criminal is not detected with the probability $(1 - p)$, and the payoff is b . The payoff b is a “sunk benefit,” and its density function is denoted by $g(b)$. For simplicity and tractability, we let b be uniformly distributed with support on $[0,1]$;

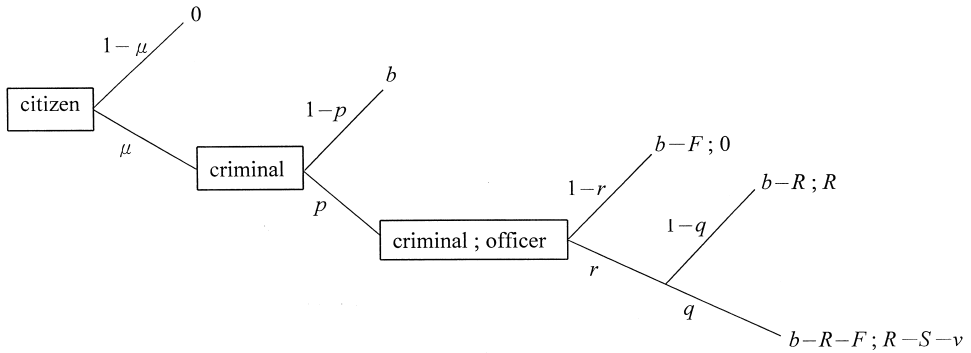


Fig. 1.

2. Given that r is the probability of an officer accepting a bribe and F is the fine imposed on convicted criminals, the criminal is detected and does not pay a bribe with the probability $p(1 - r)$ and the payoff is $b - F$;
3. Let q denote the probability of detection of the corrupt police official. When the criminal is detected and pays a bribe, R , the act of bribery is detected with the probability prq , and the payoff is $b - R - F$; while the act of bribery is not detected with the probability $pr(1 - q)$, and the associated payoff is $b - R$.

Accordingly, the expected utility of a risk-neutral criminal U is:

$$U = b - p[(1 - r) + rq]F - prR. \tag{1}$$

In this stage, each citizen will evaluate the benefit and cost of committing a crime to decide whether or not to violate the law. Normalizing the citizen’s initial income to zero, the crime is worthwhile if $U > 0$.

In the second stage, the police officer makes a decision about whether to take a blind eye for an unlawful return when the apprehended criminal offers a bribe. If the officer takes the bribe, he will confront two possible states of the world:

1. With the probability $1 - q$, the corruption is not detected, and the police officer receives R ;
2. Given that S is the fine imposed on corrupt officers and v is the additional cost of being a caught corrupt officer, the corruption is detected with the probability q and the payoff is $R - S - v$. Thus, the expected utility of a risk-neutral officer V is:

$$V = R - q(S + v), \tag{2}$$

as long as $V > 0$ the officer will be corruptible.

In the third stage, the amount of the bribe, R , is determined by bargaining between the corrupt officer and the apprehended criminal. All information is assumed to be complete, and the generalized Nash bargaining solution is utilized to calculate the equilibrium bribe.

The B-G model focuses on the “casual corruption” problem in which there does not exist a regular relationship between criminals and officers. This implies that the encounter

between the two parties is isolated and random. Another feature of the B-G model is that it is a “truncated model” in which something like an incorruptible anticorruption unit is assumed to exist.

2.2. Psychological cost interpretation of the ν term

The ν term in the B-G model corresponds to future income that a caught corrupt officer will not receive. It is perfectly observable. The innovation here is to interpret the ν term as psychological costs and to relate them to social norms. As noted by B-G (1997, footnote 6), psychological costs are usually not perfectly observable. For ease of exposition, however, we shall proceed first with the assumption of complete information. The more complicated case of incomplete information is analyzed later. As will be evident, the main results obtained under complete information remain robust with respect to the complication of incomplete information.

Following Akerlof (1980) and Naylor (1989), it is assumed that there exists a social norm (a code of honor) in the police officer community. This norm, shared commonly among officers, dictates that the police officer should be “straight” and should stick to his duties. To ensure such a norm survival, an officer who disobeys it could be sanctioned by group disapproval (Elster, 1989; Hollander, 1990), by peer pressure (Posner, 1997), and, in extreme cases, by ostracism (Tajfel, 1982; Campbell, 1982). The norm could also be sustained by feelings of embarrassment, anxiety, guilt, and shame (Elster, 1989). To embody the character of the social norm, the term ν is interpreted as the psychological costs and is specified as:

$$\nu = \epsilon \cdot Z = \epsilon(1 - r)^\delta; \quad 0 \leq \delta \leq 1. \quad (3)$$

where ϵ is an officer's *subjective* personal taste (or sensitivity indicator), and $Z(=(1 - r)^\delta)$ represents the *objective* social sanction stemming from being a caught corrupt officer.¹ The density function of ϵ is denoted by $f(\epsilon)$, which is assumed to be a uniform distribution with support on $[0,1]$. Note that the psychological costs inflicted on an individual caught officer depend not only on his own view of the code of honor (i.e., ϵ), but also on the portion of the police population adhering to the norm (i.e., $1 - r$).² If corruption is prevalent (i.e., a higher r), the psychological costs will become less intense (Akerlof, 1980; Huang & Wu, 1994). As for the parameter δ , it captures the degree of the social sanction or pressure from the police officer community. If δ atrophies to zero, our specification will reduce to that of the B-G model.

¹ According to Posner (1983), the psychological cost arising from delinquent activity includes two parts: one is the guilt cost, which is incurred even if the delinquency is not deterred, and the other is the shame of getting caught. For facilitating the comparison with the B-G model, we shall ignore the guilt cost. However, it does not change our main results even if the guilt effect is considered.

² Here, we assume that the density of corrupt officers r is public information due to sufficient social interactions among the police officers. It is consistent with the study by Geanakoplos et al. (1989), in which a psychological equilibrium requires not only the Nash equilibrium property, but also the correct expectations of all players in equilibrium.

3. Solution under complete information

The model above is solved backwards by starting with the third stage.

3.1. The Nash bargaining solution

From the sequential events that are depicted in Fig. 1, the expected utility of the two involved parties can be calculated. The expected utility for the corrupt officer is $V = R - q(S + \nu)$, while the criminal expected utility is $b - R - qF$. If they fail to reach an agreement, the asymmetric threat points in the Nash bargaining game are 0 and $b - F$, respectively. Accordingly, the equilibrium amount of bribery can be determined by maximizing the product of each party's gain from striking a deal:

$$[(1 - q)F - R]^\beta [R - q(S + \nu)]^{1-\beta}, \tag{4}$$

where β denotes the bargaining strength of the criminal in the bargaining process. It follows from Eq. (4) that the equilibrium bribe is:

$$R = (1 - \beta)(1 - q)F + \beta q(S + \nu). \tag{5}$$

Eq. (5) demonstrates that the bribe R increases with the sanction of criminal F , the fine imposed on corrupt officer S , and the psychological punishment ν but that it is ambiguous with q . The intuition behind these results is addressed in detail in B-G. It is easy to see that a bribe can change hands if and only if the gain from a bargain for each party is positive. The feasible bribery set is, thus, $(1 - q)F \geq R \geq q(S + \nu)$.

3.2. Corruption density of officers

Substituting the equilibrium bribe into Eq. (2), the expected utility of an officer can be expressed as:

$$V = (1 - \beta)[(1 - q)F - q(S + \nu)] = (1 - \beta)\{(1 - q)F - q[S + \epsilon(1 - r)^\delta]\}. \tag{6}$$

Since the officer is corruptible if V is positive, officers with a lower value of ϵ are more likely to take bribes. We can find the critical ϵ^* that makes an officer just indifferent between taking a bribe and not. That is:

$$(1 - q)F - q[S + \epsilon^*(1 - r)^\delta] = 0. \tag{7}$$

As ϵ is distributed uniformly between 0 and 1, we also have:

$$r = \int_0^{\epsilon^*} f(\epsilon) d\epsilon = \epsilon^*. \tag{8}$$

A graphical presentation borrowed from Naylor (1990) may be helpful in understanding the character of equilibrium corruption density. In Fig. 2, the pairs r and ϵ^* that satisfy Eq. (7)

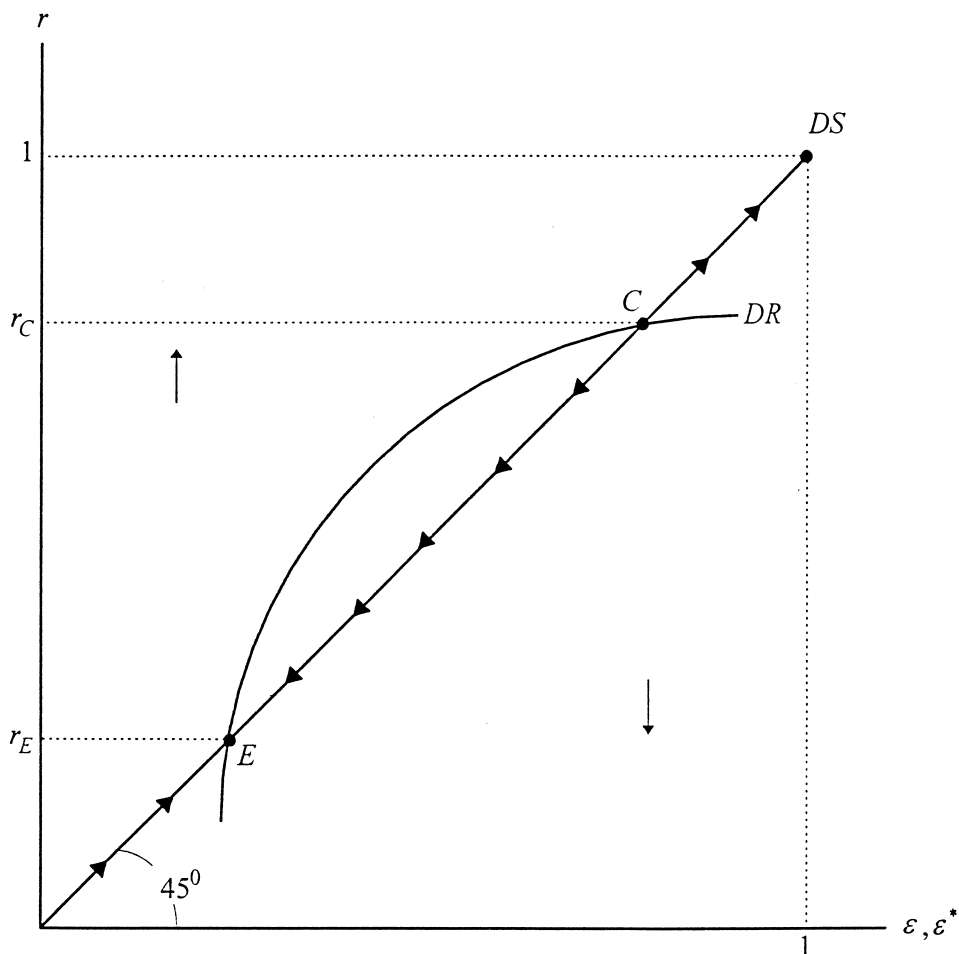


Fig. 2.

can be depicted by the decision rule locus, namely, the DR locus. The slope of the DR locus is positive and decreasing:

$$\left. \frac{\partial r}{\partial \epsilon^*} \right|_{DR} = \frac{(1-r)}{\epsilon^* \delta} > 0; \quad \left. \frac{\partial^2 r}{\partial (\epsilon^*)^2} \right|_{DR} = \frac{-(1-r)}{(\epsilon^*)^2 \delta} < 0. \quad (9)$$

Given the level of r for any pair (r, ϵ) to the right of the DR locus, corruption is not worthwhile because $\epsilon > \epsilon^*$. As a result, the corruption density declines, as pointed out by the arrow in Fig. 2. In contrast, for pairs (r, ϵ) to the left of the DR locus, the corruption density grows.

On the other hand, the distribution schedule, namely, the DS locus, in Fig. 2 traces the associations of r and ϵ^* that fulfill Eq. (8). From Eq. (8), the slope of DS is:

$$\left. \frac{\partial r}{\partial \epsilon^*} \right|_{DS} = 1. \quad (10)$$

Eq. (10) defines the relationship between the critical level of the officer’s subjective taste ϵ^* and the bribery rate r .

As indicated by the arrows in Fig. 2, the corruption density r_E is a stable equilibrium, whereas r_C is unstable. The stability condition requires that the *DR* locus be steeper than the *DS* locus in equilibrium, or equivalently, that $1 - r(1 + \delta) > 0$.

Given that $r = 1$ is an equilibrium, r_C can be viewed as a threshold level for the corrupt activity of officers. If initially $r_C < r < 1$, corruption is so widespread that the pressure of the social norm is too weak to generate a sustainable psychological cost to punish the corrupted officers. Corruption will become rampant, and the corruption density will be pushed to $r = 1$. In this case, every officer is involved in corruption, and nobody has an incentive to conform to the social norm. The social norm *de facto* disappears. In contrast, under the circumstance where $r_C < r < r_E$, the social norm will furnish a critical-mass effect to depress the corruption density to a lower level, r_E . The discipline effect of the social norm, thus, hinges on the “conditional cooperation” among officers. An officer is less likely to be corrupt if there exist “enough” others who do not choose to be corrupt either. On the other hand, an officer is likely to be corrupt if there exist “enough” others who are corrupt as well.³ As in Bardhan (1997), such a diagram as Fig. 2 can illustrate why two otherwise similar countries may end up with very different levels of corruption.

Utilizing Eqs. (7) and (8), the equilibrium corruption density r_E can be derived as:

$$r = r(F, q, S), \tag{11}$$

with

$$r_F = \frac{(1 - q)}{q(1 - r)^{\delta-1}[1 - r(1 + \delta)]} > 0; \tag{11a}$$

$$r_q = - \frac{F}{q^2(1 - r)^{\delta-1}[1 - r(1 + \delta)]} < 0; \tag{11b}$$

$$r_S = - \frac{1}{(1 - r)^{\delta-1}[1 - r(1 + \delta)]} < 0. \tag{11c}$$

Eqs. (11b) and (11c) show that a higher probability of detection, q , and a heavier fine of corruption, S , will result in less corruption. These two results are standard. Eq. (11a), however, provides an interesting result: A heavier penalty, F , imposed on a convicted criminal will encourage more rather than fewer officers to become corrupt. The intuition behind this result is simply that heavier fines open a larger amount of room for officers and criminals to “gain from trade.” Notice that this result is not peculiar to our model. Indeed, letting $\delta = 0$ in Eq. (11a) (namely, the B-G model), $r_F > 0$ still holds. A more interesting result that is peculiar to our model is the following:

³ A similar kind of argument has been raised by Cullis & Lewis (1997) that propounds that attitudes to tax evasion among colleagues is an important influence on the degree of tax evasion.

$$\frac{\partial r_F}{\partial r} = \delta(1 - q)[2 - r(1 + \delta)]/q(1 - r)^\delta[2 - r(1 + \delta)]^2 > 0. \quad (12)$$

That is, the perverse effect of raising the fine, F , becomes more severe when corruption is more prevalent at the *status quo*. This intensified effect captures the “snowballing” character of social norms. When corruption is more prevalent, the social norm will become less effective against a caught corrupt officer, and, so, more prevalent corruption tends to intensify the extent of corruption. This intensified effect, which is obviously absent in B-G, will be the key to the main result of this article.

3.3. Prospective criminal's decision and crime rate

It is clear from Eq. (5) that the amount of the bribe, R , paid by the criminal varies with the apprehending officer's personal subjective taste, ϵ (through the ν term). Given the critical value ϵ^* , all of the criminals recognize that the bribe could change hands if and only if the subjective tastes of the arresting officers are small enough (i.e., $0 < \epsilon < \epsilon^*$). Because the encounter between the criminal and the officer is random, the expected amount of the bribe, $E(R)$, is given by:

$$E(R) = (1 - \beta)(1 - q)F + \beta qS + \beta q(1 - r)^\delta E[\epsilon | 0 < \epsilon < \epsilon^*], \quad (13)$$

where $E[\epsilon | 0 < \epsilon < \epsilon^*]$ is the expected value of ϵ and is conditional on $0 < \epsilon < \epsilon^*$. Due to the specification of the uniform distribution of ϵ , we have $E[\epsilon | 0 < \epsilon < \epsilon^*] = \epsilon^*/2$.

Substituting Eqs. (11) and (13) back into Eq. (1), we obtain⁴:

$$\begin{aligned} U &= b - p[(1 - r) + rq]F - prE[R] \\ &= b - pF + pr\beta\{(1 - q)F - qS - q(1 - r)^\delta E[\epsilon | 0 < \epsilon < \epsilon^*]\} \\ &= b - pF + pq\beta[r(F, q, S)]^2[1 - r(F, q, S)]^\delta/2. \end{aligned} \quad (14)$$

A citizen will commit a crime if and only if $U > 0$. Define b^* as the critical level of b that satisfies $U = 0$ in Eq. (14). It is obvious that all citizens with $b > b^*$ will commit crime. Thus, the crime rate, μ , is:

$$\mu = \int_{b^*}^1 g(b)db = 1 - b^*. \quad (15)$$

Calculating Eq. (15) leads to the equilibrium crime density:

$$\mu = 1 - p\{F - q\beta[r(F, q, S)]^2[1 - r(F, q, S)]^\delta/2\} = \mu(F, p, q, S), \quad (16)$$

with

⁴ In Eq. (14), we have used the relation of $r = \epsilon^*$ from Eq. (8).

$$\mu_F = -p\{1 - \beta qr(1 - r)^{\delta-1}[1 - r(1 + \delta/2)]r_F\} = -p(1 - \Lambda) \cong 0; \tag{16a}$$

$$\mu_p = -b^*/p < 0; \tag{16b}$$

$$\mu_q = -pr\beta\{S + F + F(1 - r)/q[1 - r(1 + \delta)]\}/2 < 0; \tag{16c}$$

$$\mu_s = -qr\beta[1 - r(1 + \delta/2)]/[1 - r(1 + \delta)] < 0, \tag{16d}$$

where $\Lambda = \beta r(1 - q)[1 - r(1 + \delta/2)]/[1 - r(1 + \delta)] > 0$. Eqs. (16b)–(16d) indicate that the crime rate is decreasing with the detection probability of the criminal, the detection probability of the corrupt officer, and the fine for corruption. These three results are the same as those in B-G. They are also consistent with the claim of Becker (1968). Eq. (16a), however, expresses an interesting comparative static result: A heavier criminal penalty is not necessarily effective in deterring crime. This result differs from that in B-G. It is also contrary to the claim of Becker (1968).

There are two opposing effects resulting from raising the criminal penalty. A heavier fine imposed on convicted criminals, through an increase in the expected opportunity cost facing criminals, will usually create an effect to lower crime rates. However, a heavier fine also will enlarge the feasible bribery set and attract more officers to take bribes. To a criminal, a higher corruption density of the officers means that it will be easier for the criminal to avoid the sanction by offering bribes. This “corruption effect,” captured by the second term, Λ , in Eq. (16a), tends to weaken the deterrent effect of the penalty on crime. If corruption did not exist at all (i.e., $r = 0$), there would be no corruption effect either (i.e., $\Lambda = 0$).

Note that the extent of the corruption effect increases with the level of the *status quo* corruption, r , i.e.,

$$\Lambda_r = \frac{\beta(1 - q)\{r\delta/2 + [1 - r(1 + \delta)][1 - r(1 + \delta/2)]\}}{\{1 - r(1 + \delta)\}^2} > 0. \tag{17}$$

As shown by Eq. (12), in response to a more severe sanction, F , the rise in the corruption density of police officers is larger if the *status quo* corruption is widespread. This is the reason why a higher initial corruption density will result in a larger corruption effect. The result of Eq. (16a) demonstrates that the corruption effect may dominate the usual deterrent effect and encourages rather than discourages crime if corruption is pandemic at the *status quo*.

Two implications merit comment here. First, if the social norm did not have any bite (i.e., $\delta = 0$ in the B-G model), the usual deterrent effect of fines would dominate the corruption effect ($\Lambda = \beta r(1 - q)$ if $\delta = 0$). Second, verifying the second derivative of Eq. (16a), we obtain $\mu_{FF} = p\Lambda_r r_F > 0$. Thus, as shown in Fig. 3, the crime rate μ is convex on fines F .⁵ This indicates that, to deter crimes, a less than maximal sanction may be optimal when the snowballing character of social norms is taken into consideration.⁶

⁵ This convex property was pointed out to us by an anonymous referee, to whom we are grateful.

⁶ Marjit & Shi (1998) propose a different channel to obtaining a similar result. They claim that if the criminal detection probability depends on the effort level of the law-enforcing agent, the agent can always choose an effort

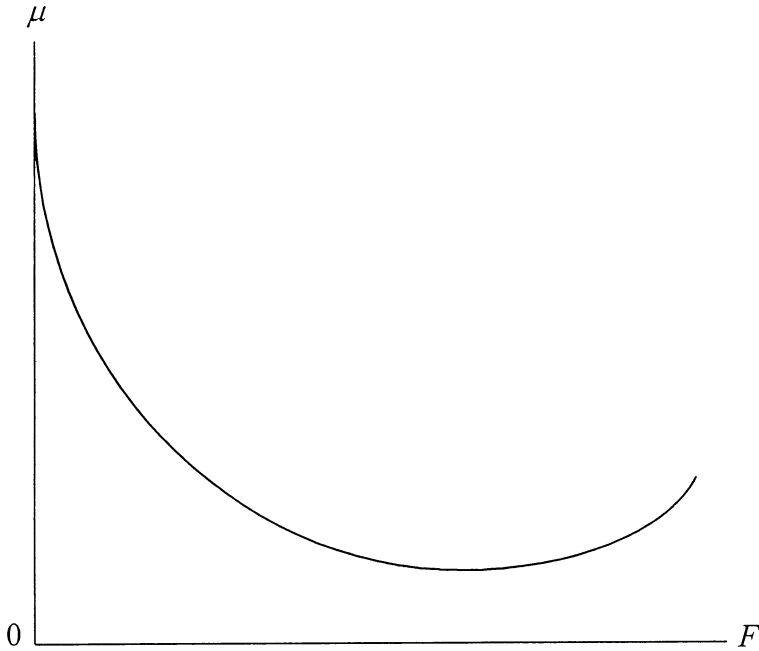


Fig. 3.

It is useful to calibrate our main result in Eq. (16a) to further investigate the corruption effect. If $\beta = 0.5$, $q = 0.4$, and $\delta = 0.4$, then the corruption effect will dominate the discipline effect (hence, $\mu_F > 0$), provided that the *status quo* corruption density is > 0.6886 . If $\beta = 0.5$, $q = 0.4$, and $\delta = 0.7$, the corruption effect will again surmount the discipline effect, provided that the *status quo* corruption density is > 0.5645 . According to Chu (1990), 80% of certified public accountants in Taiwan admitted to having bribed public tax officials. The Policy Group (1985) estimated that 76% of government tax auditors in India took bribes. It is believed, based on our finding, that a more severe punishment on criminals could be counterproductive in deterring crimes in such countries.

3.4. On the optimality of maximal fine

We now address the optimal criminal penalty. Let h denote the social harm caused by crime, and let x denote the cost of law enforcement. Following B-G, the social welfare function is:

$$Y = \int_{b^*}^1 (b - h) g(b) db - x(p, q). \quad (18)$$

level so that the crime is committed and she/he gets the bribe. As a result, with corrupt officials, increasing the penalty to a very high level may not deter crime.

Given Eqs. (15) and (16), we have⁷:

$$Y_F = (h - b^*)g(b^*)b_F^* \geq 0; \text{ if } b_F^* \geq 0, \quad (19)$$

where $b_F^* = -\mu_F$ and, hence, $b_F^* \geq 0$ if $\mu_F \leq 0$.⁸ B-G conclude that if corruption is harmless, the maximal fine will be optimal; however, if corruption is harmful, the optimal fine may be less than the maximum. Here, even without the specification of harmful corruption, Eq. (19) indicates that the maximal fine may not be the optimal solution.^{9,10}

4. Solution under incomplete information

Benson (1988) argues that corruption is a consequence of discretionary authority possessed by auditors (or officials); it is a black market for property rights over which auditors have been given some degree of discretionary power. Following this idea, we view the corrupt officer as a seller of the discretionary right and the apprehended criminal as a buyer of the right. In this section the double auction model of Chatterjee & Samuelson (1983) is applied to the bargaining between the two parties under incomplete information.

4.1. The double-auction bargaining

As stated previously, the bribe could succeed only if both parties profit from the bargaining; that is, $R \geq q[S + \epsilon(1 - r)^\delta]$ for the corrupt officer and $(1 - q)F \geq R$ for the criminal. The value $\phi_O \equiv q[S + \epsilon(1 - r)^\delta]$ can be viewed as the corrupt officer's reservation value, namely, the smallest sum he will accept for the trade. To make the problem more interesting, we specify $\phi_C \equiv [(1 - q)F - \theta]$ as the criminal's reservation value, namely, the greatest sum he is willing to pay for the trade. The parameter θ denotes the criminal's *personal* minimum gain required from committing a bribe.¹¹ Because both ϵ and

⁷ The results with respect to the optimality of p and q are the same as those of B-G.

⁸ Following B-G, we assume that $h \geq b^*$. This assumption is equivalent to saying that engaging in criminal activities is never socially beneficial. For a further discussion on the issue, see Polinsky & Shavell (1984).

⁹ See B-G for the specification of harmful corruption.

¹⁰ If imprisonment is contemplated as a form of punishment that is appropriate for corrupt police officers, an interesting implication arises. Assuming that fines are socially costless but that imprisonment is socially costly, Polinsky & Shavell (1984) propound that when fines and imprisonment are used together, it is always optimal to first use the fine to its maximum feasible extent before possibly supplementing it with an imprisonment term (see Polinsky & Shavell, 1984, 1999, for details). However, in the presence of corruption, our result casts doubt on the argument of Polinsky and Shavell. We are grateful to an anonymous referee for bringing this point to our attention.

¹¹ If $\phi_C = (1 - q)F$ (i.e., $\theta = 0$), the reservation price of the criminal is perfectly observed by the arresting official. On the other hand, the information of the officer's reservation value ϕ_O is imperfectly observed by criminals due to a subjective ϵ . Thus, any corrupt officer will ask for the maximal amount of bribe $R = \phi_C = (1 - q)F$. Once the criminal's possible gain from the bribe is totally extorted by the corrupt officer, the corruption effect will disappear. Substituting $R = (1 - q)F$ into the decision rule of the criminal in Eq. (1), one can confirm this result.

θ are private information, each party knows his own reservation assessment but is uncertain about that of his adversary. For simplicity, θ , similar to ϵ , is assumed to be a uniform distribution $z(\theta)$ with support on $[0,1]$.

Following Chatterjee & Samuelson (1983), the double-auction mechanism operates as follows. The corrupt officer and the criminal simultaneously choose bids ψ_O and ψ_C , respectively. If $\psi_C \geq \psi_O$, the trade takes place at the price:

$$\tilde{R} = (\psi_C + \psi_O)/2. \quad (20)$$

If $\psi_C < \psi_O$, the bargain is broken off. In this static Bayesian game, the corrupt officer's strategy is a function, $\psi_O(\phi_O)$, that determines his bid, ψ_O , for each possible value of ϕ_O . Likewise, a strategy for the criminal is $\psi_C(\phi_C)$, which determines his bid, ψ_C , for each possible value of ϕ_C .

Similar to Chatterjee & Samuelson (1983), we focus on the *linear* Bayesian Nash equilibrium in this bargaining problem.¹² Suppose that the corrupt officer's strategy is $\psi_O(\phi_O) = a_1 + a_2\phi_O$, then ψ_O is uniformly distributed on $[a_1 + a_2qS, a_1 + a_2q(S + \epsilon^*(1-r)^\delta)]$. The criminal's optimal strategy of bids can be derived by maximizing the following expected gain:

$$\begin{aligned} \text{Max}_{\psi_C} & \left\{ \phi_C - \frac{1}{2} [\psi_C + E(\psi_O | \psi_C \geq \psi_O)] \right\} \text{prob}(\psi_C \geq \psi_O) \\ & = \left\{ \phi_C - \frac{1}{2} \left[\psi_C + \frac{(a_1 + a_2qS) + \psi_C}{2} \right] \right\} \left[\frac{\psi_C - (a_1 + a_2qS)}{a_2\epsilon^*(1-r)^\delta} \right]. \end{aligned} \quad (21)$$

The first-order condition yields the criminal's best response to bids:

$$\psi_C = \frac{1}{3} (a_1 + a_2qS) + \frac{2}{3} \phi_C. \quad (22)$$

Analogously, suppose that the strategy of the criminal is $\psi_C(\phi_C) = a_3 + a_4\phi_C$, and, hence, that ψ_C is uniformly distributed on $[a_3 + a_4[(1-q)F - 1], a_3 + a_4(1-q)F]$. The problem facing the corrupt officer is:

$$\begin{aligned} \text{Max}_{\psi_O} & \left\{ \frac{1}{2} [\psi_O + E(\psi_C | \psi_C \geq \psi_O)] - \phi_O \right\} \text{prob}(\psi_C \geq \psi_O) \\ & = \left\{ \frac{1}{2} \left[\psi_O + \frac{\psi_O + a_3 + a_4(1-q)F}{2} \right] - \phi_O \right\} \left[\frac{a_3 + a_4(1-q)F - \psi_O}{a_4} \right]. \end{aligned} \quad (23)$$

The corrupt officer's best response to bids is:

¹² For the uniform prior distribution, the linear equilibrium strategy of the double-auction mechanism constitutes the "second-best" solution; see Myerson & Satterthwaite (1983).

$$\psi_O = \frac{1}{3} [a_3 + a_4(1 - q)F] + \frac{2}{3} \phi_O. \tag{24}$$

Utilizing the linear strategies of $\psi_O(\phi_O) = a_1 + a_2\phi_O$, $\psi_C(\phi_C) = a_3 + a_4\phi_C$ as well as Eqs. (22) and (24), the relevant coefficients can be derived: $a_1 = (1 - q)F/4 + qS/12$; $a_3 = (1 - q)F/12 + qS/4$; and $a_2 = a_4 = 2/3$. Accordingly, the linear equilibrium strategies of bids are:

$$\psi_O = \frac{1}{4} (1 - q)F + \frac{3}{4} qS + \frac{2}{3} qv, \tag{25}$$

$$\psi_C = \frac{3}{4} (1 - q)F + \frac{1}{4} qS - \frac{2}{3} \theta. \tag{26}$$

Substituting Eqs. (25) and (26) back into Eq. (20), the equilibrium bribe is:

$$\tilde{R} = \frac{1}{2} [(1 - q)F + qS] + \frac{1}{3} (qv - \theta). \tag{27}$$

Recall that the trade occurs in this double auction if and only if $\psi_C \geq \psi_O$. Using Eqs. (25) and (26), this condition can be equivalently expressed as:

$$\frac{3}{4} [(1 - q)F - qS] - (qv + \theta) \geq 0. \tag{28}$$

Given $\nu = \epsilon(1 - r)^\delta$, Eq. (28) indicates that the bargaining could succeed only if the corrupt officer's subjective sensitivity, ϵ , and the criminal's personal minimum gain requirement, θ , are low enough. Denoting the critical levels that yield $\psi_C = \psi_O$ as $\tilde{\epsilon}$ and $\tilde{\theta}$ (i.e., setting the left hand side of Eq. (28) equal to zero), we can illustrate the $\psi_C = \psi_O$ locus in Fig. 4. Letting $\tilde{\theta} = 0$, we obtain $\tilde{\epsilon} = 3[(1 - q)F - qS]/4q(1 - r)^\delta$. We can see that the $\psi_C = \psi_O$ line intercepts the ϵ -coordinate at $\tilde{\epsilon} = \epsilon^*$.¹³ Analogously, letting $\tilde{\epsilon} = 0$, we have $\tilde{\theta} = 3[(1 - q)F - qS]/4$. Due to $\tilde{\theta} = 3[(1 - q)F - qS]/4 = \epsilon^*q(1 - r)^\delta < 1$, we see that the $\Psi_C = \psi_O$ line will intercept the θ -coordinate as shown in Fig. 4. It is clear that the trade occurs in the shaded area of Fig. 4 and that the probability of successful trade, π , is the ratio of the shaded area to the total area. It can be calculated as:

$$\pi = \frac{3}{8} [(1 - q)F - qS]. \tag{29}$$

From Eq. (29), the probability of successful bargaining increases with the penalty on the criminal, F , but decreases with the fine on the corrupt officer, S , and the detection probability of corruption, q . These comparative static results seem intuitive.

¹³ From Eq. (32), this relationship is confirmed.

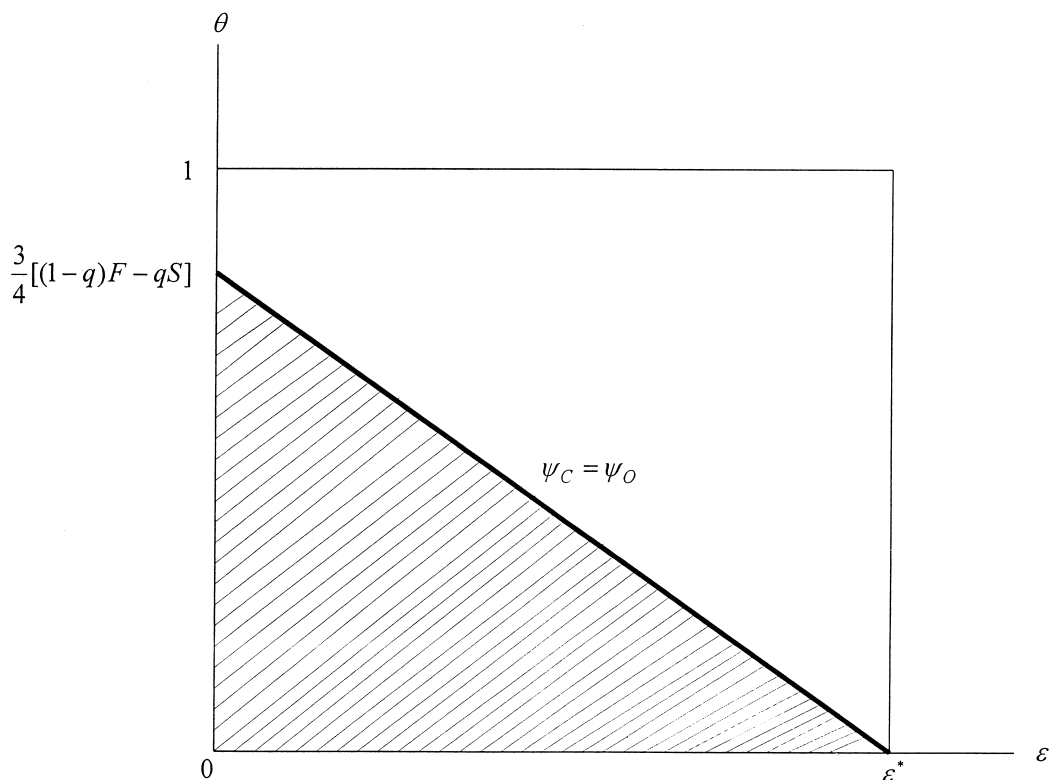


Fig. 4.

4.2. Corruption density of officers

Bargaining under incomplete information, the decision rule of officers in Eq. (2) will be modified as:

$$\tilde{V} = \pi[R - q(S + \nu)] + (1 - \pi)0 = \pi[R - q(S + \nu)]. \tag{30}$$

Once $\tilde{V} > 0$, the officer will be corruptible. Because a criminal's personal minimum gain requirement θ cannot be observed by the corrupt officer *ex ante*, the expected bribery amount, $E_o(\tilde{R})$, can be calculated from Eqs. (27) and (28) as:

$$\begin{aligned} E_o(\tilde{R}) &= \frac{1}{2} [(1 - q)F + qS] + \frac{1}{3} [q\nu - E(\theta | \tilde{\theta} > \theta > 0)] \\ &= \frac{3}{8} (1 - q)F + \frac{5}{8} qS + \frac{1}{2} q\nu, \end{aligned} \tag{31}$$

in which the relation $E(\theta | \tilde{\theta} > \theta > 0) = \tilde{\theta}/2 = \{3[(1 - q)F - qS]/4 - q\nu\}/2$ in Eq. (28) has been used.

Following the same approach in section 3, putting Eqs. (3), (8), (30), and (31) together, the equilibrium corruption density satisfies:

$$\frac{3}{4} \left[\frac{(1 - q)}{q} F - S \right] = \epsilon^*(1 - r)^\delta = r(1 - r)^\delta. \tag{32}$$

Using Eq. (32), the impact of raising the criminal penalty, F , on the corruption density can be derived:

$$r_F = \frac{3(1 - q)}{4q(1 - r)^{\delta-1}[1 - r(1 + \delta)]} > 0. \tag{33}$$

Moreover

$$\frac{\partial r_F}{\partial r} = 3\delta(1 - q)[2 - r(1 + \delta)]/4q(1 - r)^\delta[2 - r(1 + \delta)]^2 > 0. \tag{34}$$

Similar to the result in Eqs. (11a) and (12), in response to a more severe penalty on the criminal, not only is the corruption density stirred up, but its extent increases with the *status quo* corruption, r .

4.3. Prospective criminal's decision and crime rate

Under incomplete information, a prospective criminal will commit crime if his expected utility, \tilde{U} , is positive. That is:

$$\tilde{U} = b - p[1 - r\pi(1 - q)]F - pr\pi R > 0. \tag{35}$$

Note that if $\pi = 1$, \tilde{U} will reduce to U in Eq. (1).

Because there is some probability that the bargain may fail to reach an agreement, we need to derive the expected bribery amount $E_C(\tilde{R})$ to the criminal. Recalling the critical value $\tilde{\epsilon}$, other things being equal, the bargain succeeds if $0 < \epsilon < \tilde{\epsilon}$. Thus, the bribe that a criminal expects to pay *ex ante* is:

$$E_C(\tilde{R}|0 < \epsilon < \tilde{\epsilon}) = \frac{1}{2} [(1 - q)F + qS] + \frac{1}{3} [q(1 - r)^\delta E(\epsilon|0 < \epsilon < \tilde{\epsilon}) - \theta]. \tag{36}$$

From Eqs. (3) and (28), we have $E(\tilde{R}|0 < \epsilon < \tilde{\epsilon}) = \tilde{\epsilon}/2 = \{3[(1 - q)F - qS]/4 - \theta\}/2q(1 - r)^\delta$. Moreover, using Eqs. (15), (35), and (36), and the relation $\tilde{\epsilon} = \epsilon^* - \theta/q(1 - r)^\delta$, which is derived from Eqs. (28) and (32), we have:

$$\tilde{U} = b - pF + \frac{1}{2} p\pi r [qr(1 - r)^\delta + \theta]. \tag{37}$$

The crime will be worthwhile so long as Eq. (37) is positive.

From Eq. (37), we have:

$$\tilde{U}_F = -p(1 - \Omega) \cong 0 \text{ if } \Omega \cong 1, \tag{38}$$

where $\Omega = \{[qr(1 - r)^\delta + \theta](r\pi_F + r_F\pi) + q\pi r(1 - r)^{\delta - 1}[1 - r(1 + \delta)]\}/2 > 0$. If $\Omega < 1$, raising fines on criminals will push the marginal person, $\tilde{U} = 0$, down. Eq. (38) again confirms our main result: the policy of a severe criminal penalty may be counterproductive in deterring crime.

5. Concluding remarks

In this article, we interpret the additional costs inflicted on a caught corrupt officer in the B-G model as the psychological costs, and we incorporate social norms in the police officer community into these psychological costs. B-G show that the deterrent effect of raising fines on crime will be weakened but not perverse in the presence of corruption. Here, due to the snowballing character of social norms, raising fines could be counterproductive in deterring crimes if the *status quo* corruption is widespread. A clear implication of this result for policy is that, for the positive efficacy of a criminal penalty to exist, it is necessary to first put corruption under control.

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