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Abstract

The control of bribery is a policy objective in many developing countries. It has been argued that asymmetric punishments could reduce bribery by incentivizing whistle-blowing. This paper investigates the role played by asymmetric punishment in a setting where bribe size is determined by Nash bargaining, detection is costly, and detection rates are set endogenously. First, when detection rates are fixed, the symmetry properties of punishment are irrelevant to bribery. Bribery disappears if expected penalties are sufficiently high; otherwise, bribe sizes rise as expected penalties rise. Second, when detection rates are determined by the bribe-giver, a switch from symmetric to asymmetric punishment either eliminates bribery or allows it to persist with larger bribe sizes. Furthermore, when bribery persists, multiple bribe sizes could survive in equilibrium. The paper derives parameter values under which each of these outcomes occurs and discusses how these could be interpreted in the context of existing institutions.

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Asymmetric Punishment as an Instrument of Corruption Control*

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1 Introduction

Corruption is a major concern in several countries. One reason it is difficult to control is that those involved have an incentive to collude to prevent detection. While this is a feature of many criminal activities, the problem under corruption is heightened by criminal codes that, in most countries, penalize the bribe-giver and the bribe-taker equally.[1] As a result, all participants in a bribing scheme, including those who might otherwise be considered victims and could be tempted to act as whistle-blowers, have a vested interest against doing so.

How could such collusion be weakened and bribery reduced? A possible solution that we discuss in this paper lies in *asymmetric punishments*. The basic justification for asymmetric punishments is that, by penalizing some parties less than others, the government can create ex-post incentives for agents to report the crime and thereby stop colluding.

The idea of asymmetric punishment for crime is not new and it has been implemented in various forms around the world. For example, prosecutors in the United States sometimes offer immunity to those who reveal financial crimes that they might themselves have been complicit in. In Italy, similar schemes have been used to fight organized crime.

If asymmetric punishment is quite widespread in the case of financial and organized crime, it is relatively rare in the case of bribery.[2] This is somewhat surprising, especially in the context of *harassment bribes* where (i) citizens are asked to pay a bureaucrat to receive services that they are legally entitled to, and (ii) the bribe does not itself change the nature of the services being exchanged.[3]

Harassment bribes are pervasive in developing countries (and sometimes beyond) and directly affect large segments of populations.[4] This means that there might be significant political returns to tackling such corruption with innovative solutions. In a note for India's Ministry of Finance, one of us (Basu, 2011) proposed the following: decriminalize the giving (but not taking) of harassment bribes and require the bribe-taker to return the bribe to the citizen if caught.[5] This would create ex-post incentives for citizens to reveal that bribes were paid, and could end up discouraging bureaucrats from demanding bribes in the first place.

Inspired by the animated discussion that followed this proposal,[6] and to

[1] See Linklaters (2012) for a survey.

[2] There are some exceptions, discussed in Li (2012) and Engel et al (2012).

[3] As would be the case if, for example, an entrepreneur were paying a bribe to avoid complying with environmental standards.

[4] While not relevant to this paper, the distinction between harassment bribes (a type of extortion) and other forms of bribery is a complex one. See, for example, Carson (1985) and Oak (2013).

[5] According to India's Prevention of Corruption Act (1988), the giver and the taker of a bribe are considered equally culpable and can be financially penalized and incarcerated for up to five years.

[6] The proposal led to a large controversy with questions being raised by members of the Indian Parliament. It received wide publicity in the print and electronic media. See, for instance, The Economist (2011), Dreze (2011), Sainath (2011), Mitra (2011), Seabright (2011), Haider (2012), and Zakaria (2011).

assess its "robustness", in this paper we study how different punishment schemes are likely to affect the size and incidence of harassment bribes. This allows us to shed some new light on the conditions under which asymmetric punishment is able to deter bribe-giving effectively.

We develop a simple model in which a bureaucrat can costlessly provide a service that creates a surplus for the citizen, but might demand a bribe in exchange. If a bribe is demanded, the bureaucrat and the citizen split the surplus through a process of Nash bargaining.

We first analyze a benchmark case where the fines for bribe-giving and bribe-taking and the probability of detection are exogenous. In such a setting, a bribe is exchanged as long as the total expected penalty is small enough. Interestingly, the symmetry properties of the punishments are irrelevant to the incidence of bribery. Whether the penalty burden falls disproportionately on the bureaucrat or the citizen, and whether the bureaucrat is required to repay part of the bribe, do not matter: the bribe size will adjust to keep the surplus equally split.

Furthermore, we show that bribe sizes could rise when anti-corruption enforcement is strengthened. Intuitively, if penalties are at all asymmetric, as enforcement improves the citizen must pay a larger bribe to compensate the bureaucrat for his relatively larger expected penalty. This means that if bribery is measured by bribe size, an attempt to reduce bribery might instead increase it.

Next, we relax the assumption that the probability of detection is exogenous, and we assume that it depends on costly actions undertaken by the state and/or the citizen. We show that asymmetric punishment increases the incentives for the citizen to whistle-blow. However, whether this leads to the elimination of bribery, as in Basu (2011), or to an exacerbation of the problem–in which bribery persists and the bribe size rises to account for the greater probability of detection–depends on the effectiveness of law enforcement agencies in detecting corruption. Asymmetric punishments could also give rise to multiple equilibria with two possible outcomes–one where the bribe size is small and the probability of detection is also small, and another where both the bribe size and probability of detection are large.

This necessarily complicates policy prescriptions. If it is sufficiently easy for a citizen to get the corrupt bureaucrat caught, asymmetric punishment can be an effective tool to eliminate bribery. However, in countries where the marginal cost of improved detection is high, possibly the same countries where harassment bribes are a problem in the first place, bribery will survive under asymmetric punishment. When this is the case, bribe size might rise to account for the fact that the official is more likely to be penalized due to the entrepreneur's efforts to report. Here, asymmetric punishment in fact creates an efficiency loss through the costs associated with whistle-blowing. Our model could therefore partly explain why a country like China, which implemented asymmetric punishments in 1997 but has high costs of reporting, has not experienced a discernible reduction in corruption (Li, 2012).

Bribery and corruption have been subjects of economic inquiry for some time (see Bardhan, 1997, for a comprehensive survey). In their seminal paper, Shleifer and Vishny (1993) show how institutions affect the prevalence and efficiency implications of corruption. More recently, several papers present theoretical analyses of approaches to reduce corruption (see, among others, Andrianova and Melissas, 2008 and Dixit, 2013). The present paper belongs to that tradition and relates closely to the growing academic literature on the possibilities and limitations of asymmetric punishment (see Rose-Ackerman, 1999; Lambsdorff and Nell, 2007; and Oak, 2013). On this topic, Rose-Ackerman (2010) and Dufwenberg and Spagnolo (2013) are particularly relevant to our analysis.

The first paper, which is a critical survey of the law and economics of bribery and extortion, provides a wide-ranging discussion of how different punishment schemes affect the bargaining between the bribe-giver and bribe-taker. While some of the intuition of our paper can be found there, our contribution lies in the formalization of the analysis and the endogenization of costly actions undertaken by the bribe-giver.

Dufwenberg and Spagnolo (2013) provide a rigorous game theoretic formulation of Basu's (2011) proposal. In a non-cooperative framework, they show that, in a one shot game, asymmetric punishment either has no effect or prevents bribery but at the cost of the service offered. Which of these is realized depends on whether, in the absence of a bribe, institutions are effective enough to incentivize the bureaucrat to offer the service. They then consider a repeated version of the game in which the bureaucrat has an incentive to build a reputation of being corrupt. In such a set-up, they show that asymmetric punishment indeed becomes an effective instrument to fight corruption but only if institutions are good.

Our paper complements Dufwenberg and Spagnolo (2013) through the introduction of a new set of realistic and consequential considerations. By modeling the interaction between the bureaucrat and citizen as a bargaining game, we endogenize bribe size, making it a function of the punishment regime as well as the probability of detection. In addition, by endogenizing probabilistic detection we generate some nuanced results including the possibility that asymmetric punishment could raise bribe size.

Aside from the theoretical research, there is a limited but growing empirical literature on the effectiveness of asymmetric punishment in deterring harassment bribes. On the one hand, Abbink et al. (2014) provide some experimental evidence supporting the use of asymmetric punishment. On the other, Engel et al. (2013) use a lab experiment to show that, when the bureaucrat can bestow favors in response to a bribe, asymmetric punishment raises the incidence of bribery. Additional empirical work, guided by economic theory, can continue to refine our understanding of how alternative forms of punishment may affect incentives to demand and pay bribes.

Our goal is to bring some carefully constructed game theoretic methods to investigate a subject of great practical significance and vigorous public debate. Not surprisingly, the analysis does not lead to a unique prediction, but to conditional results which try to delineate where a certain kind of law will work and where it will not. Our model provides a stylized description of the mechanics that underlie bribery, and emphasizes the subtle interaction of two fundamental choices–bribe size and detection probability. It is hoped that by bringing dispassionate analysis to bear on this emotive subject, we are able to shed some light on what is ultimately a practical matter of policy in law and economics.

2 Setup

2.1 Assumptions

Suppose an entrepreneur (denoted E) needs a licence to conduct his business. The license gives him a benefit of $L > 0$. The government official (denoted O) is able to deliver the license costlessly. However, he considers the possibility of charging the entrepreneur for the license; that is to demand a bribe. Assume the official has two choices–deliver the license for free, or make license delivery conditional on a bribe being paid. If he chooses the latter, he and the entrepreneur must bargain over the bribe size, and if they are unable to agree, no license is delivered.

Suppose the official decides to demand a bribe. If a bribe size is agreed upon and paid, it is detected with probability $p \in [0, 1]$. If detected, the entrepreneur is penalized $F_E \geq 0$ and the official is penalized $F_O \geq 0$. These penalties could constitute fines or other non-pecuniary costs. In addition, the official is required to return a fraction $\beta \in [0, 1]$ of the bribe paid. We define *perfectly symmetric* punishment as $F_E = F_O$ and $\beta = 0$, and *perfectly asymmetric* punishment as $F_E = 0$ and $\beta = 1$.

We shall throughout assume that the fine on the official is at least as large as the fine on the entrepreneur:

A1. $F_O \geq F_E$.

In the case of harassment bribes this is a reasonable assumption and allows us to limit the cases we study without altering the qualitative conclusions of the analysis.

2.2 Bargaining

We use the standard Nash bargaining solution to determine the bribe size. For any bribe $B \in [0, L]$, the entrepreneur's utility is:

$$V_E(B) \equiv L - B - pF_E + p\beta B. \tag{1}$$

Similarly, the official's utility is:

$$V_O(B) \equiv B - pF_O - p\beta B. \tag{2}$$

If the players fail to agree on a bribe size, they both receive their outside options valued at 0.

If a solution exists, it is given by the following:

$$B^* \equiv \arg\max_B [V_E(B) - 0][V_O(B) - 0]. \tag{3}$$

Since $\{(V_E(B), V_O(B)) : B \in [0, L]\}$ is a compact and convex set, a Nash bargaining solution exists as long as the penalties are sufficiently small; that is, if there is some $\tilde{B}$ such that $\left(V_E\left(\tilde{B}\right), V_O\left(\tilde{B}\right)\right) \geq (0, 0)$. We assume that the official decides to demand a bribe if, and only if, a Nash bargaining solution exists (which, given the threat points, would automatically leave him weakly better off than not demanding a bribe).

Indeed, the exchange of a bribe comes closest to the kind of two-person negotiating situation that Nash (1950) had envisaged. Because of its illegal nature, there is seldom a third party or competitor involved during a transaction. It is a face-off between two individuals–a classic bargaining situation. While there are competing bargaining models, such as the one by Kalai and Smorodinsky (1975), which have the advantage of a slightly wider domain of application (see Anant, Mukherji, and Basu, 1990), in this case they are unlikely to make any substantial difference.

3 Benchmark Model

Assuming a bribe is paid, the equilibrium bribe size is determined by:

$$\max_B (L - B - pF_E + p\beta B)(B - pF_E - p\beta B). \tag{4}$$

This yields the following bribe size:

$$B^* = \frac{L + p(F_O - F_E)}{2(1 - p\beta)}. \tag{5}$$

The corresponding utility is:

$$V_E(B^*) = V_O(B^*) = \frac{L - p(F_O + F_E)}{2}. \tag{6}$$

First, let us analyze the utility from a bribe. The Nash bargaining solution leaves the players with identical utility–they essentially agree to split the gains generated by the license. Any rise in penalties results in a smaller surplus to be shared, so utility drops. Observe that the resulting utility is unaffected by β, the fraction that the official must return if caught. Since β does not affect the total surplus to be shared, any redistribution that emerges from punishment is accounted for in the bribe size–a larger β results in a larger bribe size.

Next, we analyze equilibrium bribe size. We can see that a solution exists if and only if $p(F_O + F_E) \leq L$. In other words, for a bribe to be exchanged, there must remain some surplus beyond the total expected punishment.

Equation 5 lends itself to some natural comparative statics analysis. In particular, we might be interested in how the punishments and especially their symmetry properties affect equilibrium outcomes. It can easily be verified that $\frac{\partial B^*}{\partial F_0} > 0$ and $\frac{\partial B^*}{\partial F_E} < 0$. Intuitively, the one who expects to get penalized more heavily needs to be given more up-front. Similarly, $\frac{\partial B^*}{\partial \beta} > 0$ – if the official expects to have to return some of the bribe, more needs to be paid. Finally, consider how B^* changes in response to p:

$$\frac{\partial B^*}{\partial p} = \frac{(F_O - F_E) + \beta L}{2(1-\beta p)^2}, \tag{7}$$

$$\frac{\partial^2 B^*}{\partial p^2} = \frac{\beta\left[(F_O - F_E) + \beta L\right]}{(1-\beta p)}, \tag{8}$$

The first and second derivatives are weakly positive if, and only if, $F_O - F_E \geq -\beta L$. This means that the bribe size rises in p if the rise in p hurts the official sufficiently more than it hurts the entrepreneur. This condition is automatically satisfied by Assumption 1.

The results above are summarized in Proposition 1.

Proposition 1 *Suppose F_O, F_E, β, and p are set by the government. (a) If $p\,(F_O + F_E) > L$, bribes are eliminated. (b) If $p\,(F_O + F_E) \leq L$, a bribe is exchanged and the bribe size is strictly rising in F_O, strictly dropping in F_E, and strictly rising in β. Given A1, the bribe size is strictly rising in p except if $F_O = F_E$ and $\beta = 0$, when it is constant in p.*

Two important lessons emerge even from this simple setting. The first is that the symmetry properties of the punishment are irrelevant to the elimination of bribery. Bribery is eliminated as long as $(F_O + F_E)$ is large enough. Whether the penalty burden is on the official or the entrepreneur, and whether the official is required to repay part of the bribe, do not matter, since the bribe size can adjust to account for them. To eliminate bribery, the state simply needs to drive up the expected total punishment high enough that the official will not ask for a bribe. How it does so depends on its costs of adjusting p, F_O, and F_E. In the next section, we introduce a richer and arguably more realistic setting to further examine how asymmetric punishment might affect bribery.

The second lesson is that bribe sizes can rise when anti-corruption enforcement is strengthened. If bribery is measured by bribe size, an attempt to reduce bribery can instead increase it. In particular, if the penalty is low to begin with, a rise in the official's fine or in the detection probability will result in a larger bribe. Our point here is that a larger bribe should not be interpreted as more severe bribery–it is simply a reflection of the reallocation of surplus between entrepreneur and official. Larger bribes seem to suggest a more acute problem, but policies designed to detect bribery might themselves raise the size of the bribe.

3.1 Bribe Size as a Function of Detection Probability

As Equations (5) and (7) show, B^* is rising in p. Figure 1 depicts $B^*(p)$ for some relevant parameter values. As noted before, the incidence of bribery is unaffected by the symmetry properties of punishment. However, bribe size, and the effect of p on bribe size, depend on whether punishment is symmetric or not. Under perfect symmetry, bribe size stays constant at $\frac{L}{2}$ as long as punishment is sufficiently small. If $\beta = 0$ but fines are asymmetric, bribe size rises linearly in p. If fines are asymmetric and some of the bribe must be returned upon detection, bribe size is rising and convex in p.

In fact, if $F_O + F_E \leq L$ (so that a bribe is feasible for all p) and $\beta = 1$, bribe size rises to infinity as p approaches 1. Intuitively, for high p, the official gets a large bribe which he gets to keep with low probability, while the citizen pays a large bribe which is most likely returned to him.

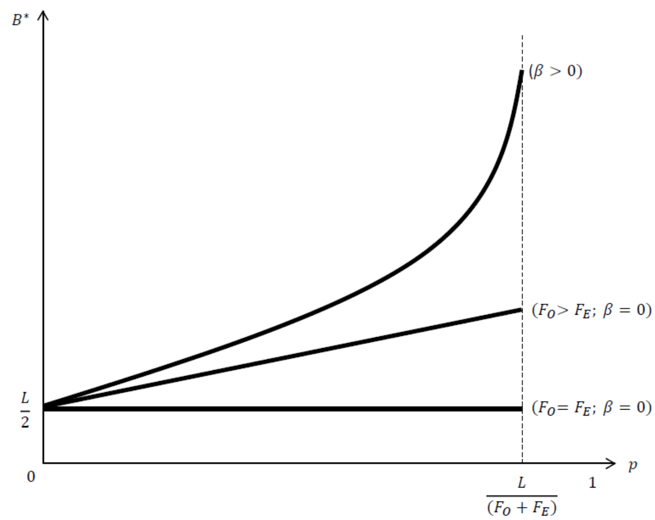

Figure 1: Equilibrium bribe size as a function of detection probability.

4 Endogenizing Detection Probability

We continue with the assumptions above, but with one modification. The entrepreneur or the state can choose to incur a cost to raise p above a benchmark level (which could be zero). This is a reasonable and important assumption. Both the state and the players involved in bribery presumably have some control over, and interest in setting, p. How they choose to exercise this control depends on their incentives–they must weigh the benefits of raising p against the costs. Therefore, it will be necessary to define a cost function, $c(p)$, over the relevant domain.

It will also be necessary to modify our notion of equilibrium to accommodate an endogenous choice of p. We will assume that the selection of B and p satisfies rational expectations.

First, suppose the entrepreneur controls p. Now, the anticipated costs of whistle-blowing must be incorporated in the entrepreneur's utility, so that:[7]

$$V_E(B) \equiv L - B - pF_E + p\beta B - c(p). \tag{9}$$

We use a modified rational expectations approach to define equilibrium: First, $B^*(p)$ is determined taking p as given (if there is no solution, a bribe is not requested). Subsequently, the entrepreneur chooses p according to some function $p^*(B)$. In equilibrium, the p assumed during bribe size negotiations must be the same as the actual p the entrepreneur selects.[8] For (p^*, B^*) to constitute an equilibrium, it must satisfy $p^* = p^*(B^*)$ and $B^* = B^*(p^*)$.

Second, suppose the state controls p. On the one hand, bribe size is determined by Nash bargaining. Given p, the optimal bribe size depends on the function $B^*(p)$, from equation (5). On the other hand, depending on the state's incentives, p possibly depends on bribe size, resulting in a function $p^*(B)$.[9] An equilibrium with bribery, if it exists, is denoted by the pair (p^*, B^*) that satisfies $p^* = p^*(B^*)$ and $B^* = B^*(p^*)$. The bribe size must be a best response to the detection probability, and vice versa.

4.1 Entrepreneur Chooses p

Suppose now the benchmark detection probability, set by the state, is $\underline{p} < 1$, but the entrepreneur can raise the probability to some $\bar{p} \in (\underline{p}, 1]$ at a cost k.[10] So,

$$c(p) = \begin{cases} 0, \text{ if } p = \underline{p}; \\ k, \text{ if } p = \bar{p}. \end{cases}$$

To make the problem interesting, we assume that $\underline{p}$ is low enough to support bribery:

A2. $\underline{p} < \frac{L}{F_O + F_E}$

The Nash bargaining solution, if it exists, for either $p \in \{\underline{p}, \bar{p}\}$ is given by:

$$B^*(p) = \frac{L - p(F_O - F_E) - c(p)}{2(1 - \beta p)}. \tag{10}$$

[7] This continues to satisfy the convexity requirements of the Nash Bargaining problem.

[8] This is a non-standard concept of equilibrium as it combines cooperative and non-cooperative choices. Intuitively, a way to think of this within the standard framework of a non-cooperative game is the following: consider simultaneous moves made by two "players," where one player is the entrepreneur who must choose p and the other player is the entrepreneur-official pair who must choose B according to their own objective function which, in this case, is provided by Nash bargaining.

[9] It is not being assumed that the government knows in advance what the bribe size will be, but that it has a rational expectation about the size of bribe for this class of crime. Note that this includes the special case where $p^*(B)$ remains unchanged across different values of B.

[10] For ease of exposition, we assume there are only two possible values of p. It is straightforward to extend the analysis to a continuum of possible values. Notes are available upon request.

Note that $B^*(p)$ may no longer rise in p; indeed, if k is sufficiently large, $B^*(\bar{p}) < B^*(\underline{p})$. This is because there are now two forces at play as p rises: first, as before, a higher p reduces the surplus to be split, with a weakly greater burden imposed on the official, causing the bribe size to rise; second, a higher p imposes a whistle-blowing cost on the entrepreneur, causing the bribe size to drop.

4.1.1 Symmetric Punishment

The entrepreneur's optimal choice of p, $p^*(B)$, depends on the punishment regime. Clearly, under perfectly symmetric punishment, the entrepreneur gains nothing from raising p. Regardless of bribe size, he has no incentive to encourage detection since that would simply imply a higher probability of incurring F_E. Therefore, $p^*(B) = \underline{p}$. The equilibrium outcome under symmetric punishment is depicted in Figure 2. $p^*(B)$ is constant at $\bar{p}$. $B^*(p)$ is now defined at only two points. Since we have symmetric punishment, $B^*(\underline{p}) < B^*(\bar{p})$. The equilibrium outcome lies at the intersection of the "best-response functions" $B^*(p)$ and $p^*(B)$.

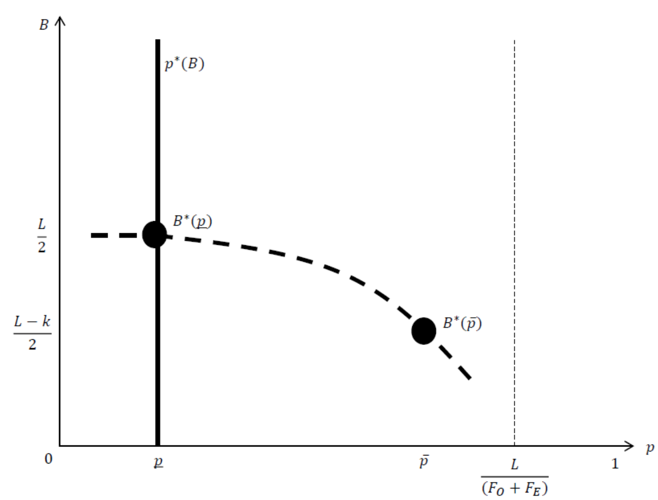

Figure 2: Bribery survives under symmetric punishment and endogenous choice of p.

4.1.2 Asymmetric Punishment

Now, consider a switch to perfectly asymmetric punishment. The entrepreneur must trade off the cost of whistle-blowing against the potential benefit in the form of greater expected bribe recovery.[11] He will choose $p = \bar{p}$ if the potential

[11] Over a continuous domain, she would raise p as long as $c'(p) > \beta B$.

recovery is sufficiently large, so:[12]

$$p^*(B) = \begin{cases} \underline{p}, \text{ if } B \geq \frac{k}{\bar{p}-\underline{p}} \\ \bar{p}, \text{ if } B < \frac{k}{\bar{p}-\underline{p}} \end{cases} \tag{11}$$

We can now analyze the impact of a switch from perfectly symmetric to perfectly asymmetric punishment in two cases. First, suppose the highest detection probability still allows a bribe to be given ($\bar{p} < \frac{L}{F_O}$). An equilibrium with a bribe size of $B^*(\underline{p})$ and detection probability $\underline{p}$ exists if each is a best response to the other; that is, using (10) and (11), if

$$\begin{aligned} & B^*(\underline{p}) < \frac{k}{\bar{p}-\underline{p}} \\ \iff \quad & k > k_L \equiv \frac{(L+\underline{p}F_O)(\bar{p}-\underline{p})}{2-2\underline{p}}. \end{aligned} \tag{12}$$

An equilibrium with bribe size of $B^*(\bar{p})$ and detection probability $\bar{p}$ exists if each is a best response to the other; that is, using (10) and (11), if

$$\begin{aligned} & B^*(\bar{p}) \geq \frac{k}{\bar{p}-\underline{p}} \\ \iff \quad & k < k_H \equiv \frac{(L+\bar{p}F_O)(\bar{p}-\underline{p})}{2-(\bar{p}+\underline{p})}. \end{aligned} \tag{13}$$

It can easily be verified that $k_H > k_L$, so there is a range of parameter values that supports two equilibria–one with low detection and small bribes, and another with high detection and large bribes.

Next, suppose a bribe is impossible at $\bar{p}$ ($\bar{p} \geq \frac{L}{F_O}$). An equilibrium with low detection exists if $k > k_L$ as defined above. Otherwise, if $k \leq k_L$, an equilibrium with bribery cannot survive. This is summarized in the next proposition.

Proposition 2 *Consider a switch from symmetric to asymmetric punishment.*

(1) If $\bar{p} < \frac{L}{F_O}$, bribery will not be eliminated. For $k > k_L$, there will be a unique equilibrium with $B^*(\underline{p})$ and $\underline{p}$, as under symmetric punishment. For $k \leq k_H$, there will be a unique equilibrium with $B^*(\bar{p})$ and $\bar{p}$. For $k \in (k_L, k_H]$, there will be two equilibria.

(2) If $\bar{p} \geq \frac{L}{F_O}$ and $k > k_L$, there will be a unique equilibrium with $B^*(\underline{p})$ and $\underline{p}$, as under symmetric punishment. If $\bar{p} \geq \frac{L}{F_O}$ and $k \leq k_H$, the license is delivered without a bribe.

We now discuss the proposition intuitively. For bribery to exist, there must be an equilibrium bribe size (B^*) and detection probability (p^*) such that p^* is a best response to the bribe size and B^* is a "best response" to the detection

[12] We are assuming that, when indifferent, the entrepreneur chooses the higher detection probability.

probability. In other words, p^* should be such that the entrepreneur's benefits from whistle-blowing are greater than the costs of doing so. $p^*(B)$ is (step-wise) rising in B–under perfectly asymmetric punishment, a higher bribe means he stands to gain more from whistle-blowing. And B^* should be such that, given p, the bribe maximizes the Nash product or, in this case, divides the surplus equally across both parties. The possible equilibrium outcomes are depicted in Figures 3-6. A bribery equilibrium exists if the best response functions intersect.

If k is low, whistle-blowing is cheap. So, for a given bribe size, the entrepreneur is more willing to set a high p. The best response to a high p is a high bribe size. But if $\bar{p}$ is high enough, it is impossible to find a bribe size for which the probability of detection will be low enough to generate any surplus. So there will be no intersection of the best response functions (Figure 3). The official will provide the license without asking for a bribe.

The above analysis shows that, even in this more realistic framework, the basic logic of asymmetric punishment (Basu, 2011) remains intact in that it encourages whistle-blowing, but at the same time the model demonstrates that the control of corruption has greater complexity than suggested in that paper. If asymmetric punishment encourages enough whistle-blowing, bribery is eliminated. But, if whistle-blowing is expensive or there are limits to how high detection probability could go, bribes might get bigger under asymmetric punishment. If k remains low enough to encourage whistle-blowing and $\bar{p}$ is low enough to sustain bribery, asymmetric punishment simply leads to a rise in the bribe size which must occur to account for the higher likelihood of detection (Figure 4).

Finally, if k is high enough, the low bribe outcome continues to survive in equilibrium. At such a bribe size, the entrepreneur does not have the necessary incentives to raise p. If k is very high, this is the only equilibrium (Figure 5). For intermediate values of k, two equilibria can coexist (Figure 6). However, in such cases, since the high detection equilibrium is Pareto dominated, we might conjecture that it is unlikely to be selected.[13]

4.2 Costly Adjustment of p by the State

There are two reasons the state might prefer to encourage revelation by citizens rather than relying on its own detection. The first is that detection by the state could be particularly costly. To detect bribery, it has to be vigilant across all transactions, even those where no bribes are exchanged. On the other hand, it

[13] Though Dufwenberg and Spagnolo (2013) emphasize a different and complementary set of considerations, it is useful to contrast our results to those in their benchmark game. In their model, if the official incurs a cost of delivering the license, asymmetric punishment induces the official to reject any offered bribe but to also not deliver the license (a bribe functions as compensation for the official's costs, and asymmetric punishment makes it impossible for the official to be compensated). In the current paper, even if we were to introduce costs associated with license delivery, our results would remain qualitatively unchanged (asymmetric punishment could eliminate bribery or cause a rise in bribe size). This is because we implicitly treat *not* delivering the license as a dereliction of duty that subjects the official to punishment as if he had demanded a bribe.

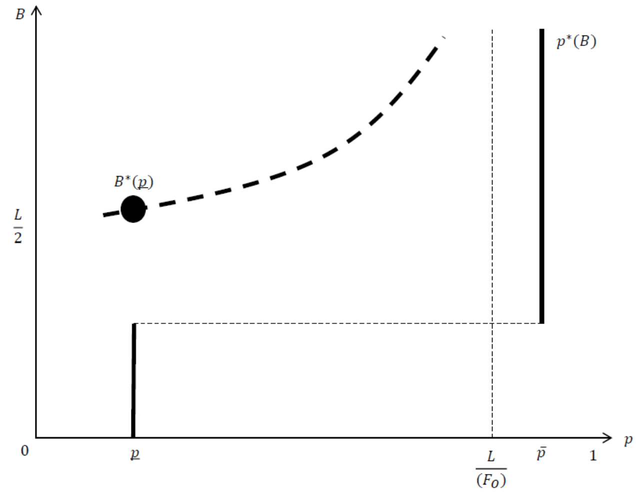

Figure 3: If k is low enough and $\bar{p}$ high enough, asymmetric punishment eliminates bribery.

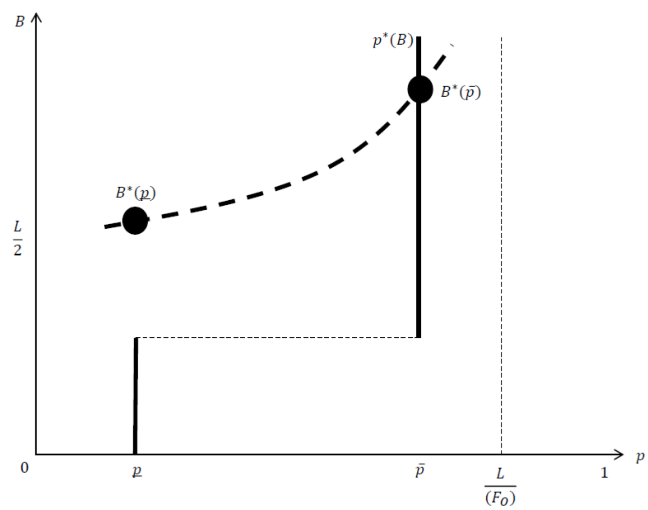

Figure 4: If both k and $\bar{p}$ are low, bribe size rises under asymmetric punishment.

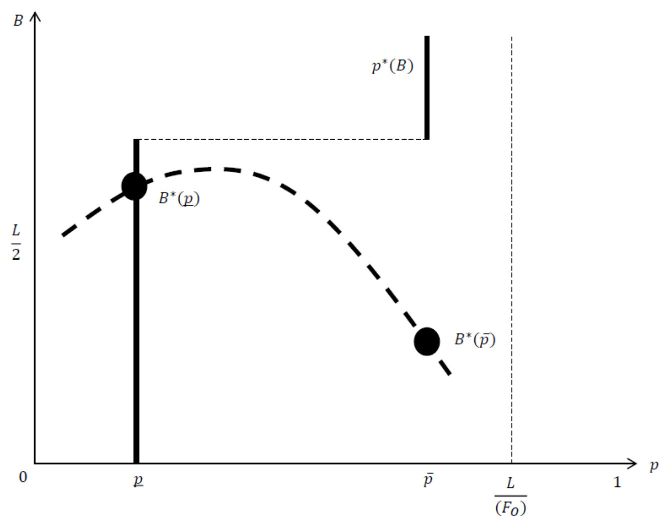

Figure 5: If k is high, the low bribe equilibrium survives. Also note that, because of the high cost of whistle-blowing, $B^*\left(\underline{p}\right)$ might be greater than $B^*\left(\bar{p}\right)$.

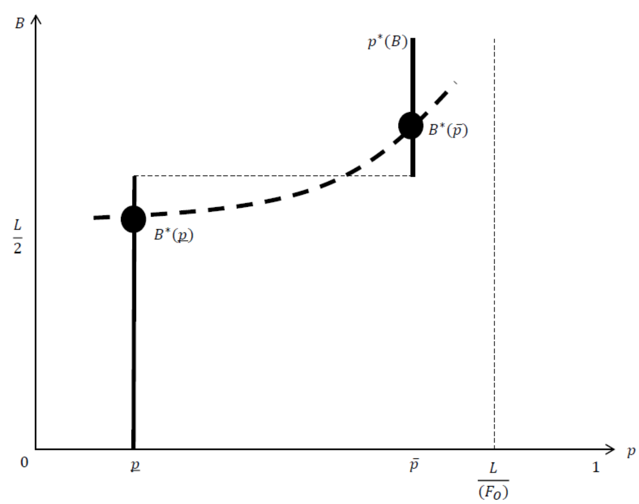

Figure 6: With a low $\bar{p}$ and at intermediate values of k, both low bribe and high bribe equilibria are feasible.

might be cheaper for individuals to reveal that bribery has occurred, since they know exactly who was involved and how much was exchanged.

The second is that a government that would like to detect bribery would still have to rely on an enforcer who is himself subject to a cost-benefit analysis. As we argue next, while one can easily see how it would be in the interest of a decriminalized bribe-giver to have the bribe detected, this is less clear in the case of a government enforcer. Suppose p is set by a government enforcer at cost $c(p)$. We could ask how the incentives for the enforcer should be set up.

First, note that it is very hard to incentivize the enforcer to minimize the incidence of bribery. Since the state cannot distinguish between $p = 0$ (under which no bribes will be detected) and $p = 1$ (under which bribery will actually be eliminated), the enforcer has no incentive to exert any effort to raise p. Bribe-enforcers have less of an incentive to eliminate bribery than bribe-givers do. Alternatively, suppose the bribe-enforcer is rewarded by the number of bribes detected or the amount in bribed detection. This actually incentives higher detection probabilities, but it is never in the enforcer's interest to raise detection so high that bribery is eliminated.

5 Discussion and Conclusion

In the preceding sections, we built a simple model of harassment bribes. If a government official demands a bribe in exchange for his service, he and the entrepreneur must bargain over the bribe size. The official demands a bribe only if a Nash bargaining solution exists (given our construction of threat points, existence of a solution ensures that the official is better off by demanding a bribe than otherwise). Bribe size rises in detection probability, the official's fine, and fraction of bribe the official must repay if detected. Bribe size drops in the entrepreneur's fine. Importantly, these bribe size effects exist solely to reallocate surplus. They should not be viewed as indicators of the severity of corruption. We find that the incidence of bribery does not depend on the symmetry properties of punishment. A bribe is paid as long as the total expected fines are less than the surplus generated by the license. To eliminate bribery, the state must raise expected punishment to a sufficiently high level. If punishment is raised but inadequately, bribery will persist with higher bribe sizes.

To examine more carefully the implications of asymmetric punishment, we expanded the model to endogenize detection probability. If the official demands a bribe, the entrepreneur must choose detection probability. Now, the symmetry properties of punishment matter. Under symmetric punishment, endogenous selection of detection probability changes nothing since it is not in the entrepreneur's interest to have the bribe detected. However, under asymmetric punishment, the entrepreneur is willing to incur some costs to raise detection probability as this allows him to get his money back. If bribery survives, bribe size and detection probability must be best responses to each other. We find that asymmetric punishment eliminates bribery if whistle-blowing is effective and cheap. Otherwise, bribery survives and bribe sizes can rise relative to symmetric punishment.

Our results here are quite parameter-specific, and importantly so. Consider variation in k and $\bar{p}$. These two variables describe the ease with which a citizen can reveal bribery to the government, and they depend on the ability to verify a bribe payment, the responsiveness of government departments to such claims, the extent to which the whistle-blower is protected after the act, the effectiveness of the judicial system, etc. If k is low and $\bar{p}$ high, so the country has the infrastructure to allow reporting at low cost, asymmetric punishment is an effective solution for eliminating bribery. The change in the entrepreneur's incentives drives detection probabilities so high that it is impossible to arrive at a bribe size that is large enough to make bribery worthwhile for the official. As k rises and $\bar{p}$ drops (i.e. whistle-blowing gets more difficult), we move from zero bribery to large bribe sizes. As k rises further, bribe sizes drop down to the levels under symmetric punishment. This leads to some unusual cross-country predictions. If countries were ordered by ease of reporting bribes, all else equal, we should see bribery appear the most severe for intermediate countries where whistle-blowing is cheap enough that a lot of it happens, but not so cheap that bribery can be eliminated. The possibility of multiple equilibria adds additional complexity, as identical underlying conditions could lead to substantially different bribe sizes.

This model suggests some ways to structure our thinking about anti corruption policy. Clearly, one way to eliminate bribery is to make punishments severe and probability of detection high (see Becker, 1968). However, severe fines are often politically infeasible and detection, if carried out by government enforcers, can be expensive (where should we look?) and hard to incentivize (how do we distinguish between eliminating bribery and failing to detect it?). In this context, it makes sense to transfer the task to signaling bribery to those who know it best–the parties involved. This can be incentivized through asymmetric punishment. But for asymmetric punishment to work, whistle-blowing needs to be sufficiently cheap–the state must not only encourage entrepreneurs to reveal bribery, it must allow them to do so easily. This requires careful attention to several aspects of bureaucratic and legal institutions. If the state is unable to make whistle-blowing sufficiently cheap to eliminate bribery, then somewhat perversely, it is best to make whistle-blowing expensive so it happens less. This is because the effort expended in revealing a bribe creates a pure surplus loss unless bribery is actually eliminated. So, if countries with bribery problems are also countries with weak institutions for reporting, they can be stuck in corruption traps where asymmetric punishment makes matters worse, not better.

The model above is stylized to isolate some key effects. There are some natural extensions that could help build a richer understanding of the design and implications of anti-corruption policy. First, the model could be extended to non-harassment bribes. Consider the following example: the agent has violated the law and stands to lose L. Instead, he could pay a fine B to the bureaucrat. The problem remains identical to ours but notions of efficiency might change. This also creates room for thinking about endogenizing the agent's decision to commit the crime in the first place.

Second, it might be instructive to analyze a setting with heterogeneity in license benefit and moral costs, where these are private information.

Finally, recall that one prediction of our model is that if fines are small, bribe sizes can get indefinitely large as the probability of detection approaches one. While it could be argued that $\lim_{p \to 1} B^{*}(p)$ is not empirically relevant, this does raise a concern about the depths of entrepreneurs' pockets. Our model could quite easily be re-analyzed with an additional "liquidity constraint." This will serve to discourage bribery. Also, tight liquidity constraints could raise the effectiveness of asymmetric punishment by making it more likely that the intersection of the best response functions lies outside the acceptable range of bribe sizes. When populations are poor, this constraint can be expected to be tight. As countries grow and pockets get deeper, the liquidity constraint will loosen and corruption will rise. Simultaneously with growth, we might expect an improvement in institutions and the costs of whistle-blowing, which could deter corruption. How these countervailing effects affect outcomes is a potentially interesting question for continuing empirical and theoretical analysis.

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