Asymmetric Punishment as an Instrument of Corruption Control

Karna Basu, Kaushik Basu, and Tito Cordella*

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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 eliminates bribery only if whistle-blowing is cheap and the stakes are low. When bribery persists, multiple bribe sizes could survive in equilibrium. The paper derives parameter values under which each of these outcomes occurs, and discusses implications for welfare and the design of policy. (JEL Codes: H83, K14, P48)

*Karna Basu: Hunter College and The Graduate Center, City University of New York (kbasu@hunter.cuny.edu); Kaushik Basu: The World Bank and Cornell University (kb40@cornell.edu); Tito Cordella: The World Bank (tcordella@worldbank.org). This paper has benefited from conversations with Christian Ahlin, Jonathan Conning, Avinash Dixit, Randall Filer, Stephan Litschig, Ajit Mishra and Aristomene Varoudakis. We also thank conference participants at NEUDC 2014 and seminar participants at the University of Pennsylvania Law School.

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 detection of corruption might be made harder by criminal codes that, in most countries, penalize the bribe-giver and the bribe-taker equally.[1] Under such a legal framework, 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 collusion be weakened and bribery reduced? A possible solution lies in *asymmetric punishment*. The basic justification for asymmetric punishment 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 citizens are asked to pay a bureaucrat to receive services that they are legally entitled to (as opposed to cases where a bribe is paid to, say, bypass environmental regulations or violate targeting rules).

Harassment bribes are pervasive in developing countries (and sometimes beyond) and directly affect large segments of populations.[3] 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.[4] 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,[5] and to assess its ro-

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

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

[3] 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).

[4] 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.

[5] The proposal led to some 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).

bustness, in this paper we study how different punishment schemes are likely to affect the size and incidence of harassment bribes. This allows us to derive conditions under which asymmetric punishment is able to successfully deter bribe-giving, and to analyze when such deterrence is in fact desirable.[6]

We build a model in which a bureaucrat can costlessly provide a service that creates a surplus for an entrepreneur, but might demand a bribe in exchange. If a bribe is demanded, the bureaucrat and the entrepreneur 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 entrepreneur, 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 entrepreneur must pay a larger bribe to compensate the bureaucrat for his relatively larger expected penalty. This means that if corruption is measured by bribe size, an attempt to reduce bribery might have the opposite effect.

Next, we relax the assumption that the probability of detection is exogenous, and we assume that the entrepreneur has (limited) ability to raise it. We show that asymmetric punishment increases the incentive for the entrepreneur to whistle-blow. Whistle-blowing reduces the potential surplus to be shared through bargaining, both because is costly and it raises the expected penalty. However, whether this deters bribery depends on parameter values. Asymmetric punishment eliminates bribery if two conditions are satisfied: whistle-blowing must be cheap (so the citizen can credibly threaten to engage in it) and the value of the service being exchanged must be low (so that it is impossible to agree upon a new bribe size that accounts for the consequences of whistle-blowing).

These two conditions are not independent of each other. This adds some subtlety to our results. For example, suppose asymmetric punishment deters bribery. The same will not necessarily be true if, all else equal, whistle-blowing gets cheaper. This is because a drop in whistle-blowing costs raises the potential surplus that can be shared through bargaining. Now, it might be possible for a bribe to be exchanged despite the certainty that it will be followed up by whistle-blowing.

[6] While our model is motivated by harassment bribes, it will be evident that many of the arguments apply more broadly.

When asymmetric punishment fails to eliminate bribery, there are parameter regions where it has no effect, where bribery persists and the bribe size adjusts to account for the greater probability of detection, and where there are 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.

Finally, we conduct a welfare analysis of asymmetric punishment. Here, it is necessary to consider what happens in the absence of a bribe. We discuss possible objective functions, and show that the parameter region in which bribery is eliminated might not overlap with the region in which the elimination of bribery raises welfare.

Our model necessarily complicates policy prescriptions, but offers a framework for the design and analysis of anti-corruption strategies. 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 improved detection is hard to achieve, 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 change 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 whistle-blowing, 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. Banerjee (1997) analyzes how bribery and red tape emerge when bureaucrats are required to allocate goods to credit-constrained individuals. 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 (2014) 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 (2014) 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 sufficiently good.

Our paper complements Dufwenberg and Spagnolo (2014) 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 allow bribery to persist with larger bribes.

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, Wu and Abbink (2013) and Abbink et al. (2014) provide some experimental evidence supporting the use of asymmetric punishment in certain types of interactions. 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 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 Benchmark Model: Exogenous Detection

We first analyze a benchmark case in which an official and an entrepreneur come face to face, with penalties set by the government and no opportunity to whistle-blow. This allows us to illustrate the relationship between penalty design and bribe size within our modeling framework. Subsequently, we introduce the possibility of whistle-blowing.

2.1 Setup

Suppose an entrepreneur (denoted E) is eligible for a licence, which he needs to conduct his business. The license gives him a benefit of $L > 0$. The government official (denoted O) is required to deliver the license for free. However, he considers the possibility of charging the entrepreneur for the license; that is, demanding a bribe.

The official has two choices. First, he could choose to not demand a bribe. Then, he receives a benefit $\varepsilon \geq 0$ and the entrepreneur receives a benefit of ψL, where $\psi \in [0, 1]$. ε represents the reward for doing his job promptly. This could also be interpreted as the expected cost of simply asking for a bribe, regardless of whether one is paid. ψ indicates how motivated the official is to deliver the full value of the licence. In practice, the official might have a choice over different (ε, ψ) combinations. Since our analysis focuses primarily on the decision to ask for a bribe, not whether officials are motivated in the absence of one, we simply take the given (ε, ψ) to be the preferred combination from the official's perspective.[7,8]

Second, the official could demand a bribe. Conditional on successful bribe negotiations, the full value of the license is delivered to the entrepreneur.[9] In this case, the two players must bargain over the bribe size, B. If they are unable to agree, they receive their disagreement payoffs. The official's disagreement payoff is 0, and the entrepreneur's disagreement payoff is λL, where $\lambda \in [0, 1)$ represents the discounted value of an inferior license or the delay associated with reapplying for the license.[10]

If a bribe is agreed upon and paid, it is detected with a probability $p \in [0, 1]$, which is set by the government. 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. We define the total penalty as $F \equiv F_E + F_O$.

Furthermore, if detected, the official is required to return a fraction $\beta \in [0, 1]$ of the bribe to the entrepreneur.

[7] In fact, for intuitive convenience in Sections 2 and 3, the reader may prefer to assume $\varepsilon = 0$ and $\psi = 1$. These variables do not play a significant role until Section 4, when welfare is discussed.

[8] In an alternative framework, Dufwenberg and Spagnolo (2014) examine the role played by positive and negative delivery costs.

[9] By assuming that the license is delivered after a bribe is paid, we are ignoring a hold-up problem where the official takes a bribe and then fails to deliver. Probabilistic hold-up could be incorporated into the model without changing the qualitative results.

[10] Suppose the entrepreneur must reapply for the license if bribe negotiations fail. Assuming a delay cost δ, a probability γ that a random official is "corrupt" (that is that will ask a bribe if it is in his interest), and that if one bargain fails with one corrupt official it will fail with any corrupt official, the entrepreneur's outside option is given by $\frac{\delta(1-\gamma)L}{1-\gamma\delta} \equiv \lambda L$. Here, λ is a measure of how honest officials are on average.

We define *perfectly symmetric* punishment as $F_E = F_O$ and $\beta = 0$, and *perfectly asymmetric* punishment as $F_E = 0$ and $\beta = 1$.[11]

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:[12]

$$V_E(B) = L - B - p(F_E - \beta B). \tag{1}$$

Similarly, the official's utility is:

$$V_O(B) = B - p(F_O + \beta B). \tag{2}$$

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

If a solution exists,[13] it is given by the following:

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

We assume that the official decides to demand a bribe if, and only if, a Nash bargaining solution exists and leaves him weakly better off than not asking for a bribe, so that $V_O(B) \geq \varepsilon$.

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

[11] Policies with $\beta > 1$ might reinforce the incentives created by asymmetric punishment, but are likely infeasible for both reasons of political acceptability and liquidity constraints.

[12] For the purposes of our analysis, the assumption of risk neutrality is without loss of generality. However, risk-aversion could introduce a potentially interesting dimension–how outcomes vary by risk-tolerance, which in turn might be correlated with other socioeconomic variables.

[13] Since $\{(V_E(B) - \lambda L, V_O(B)) : B \in [0, L]\}$ is a compact and convex set, a Nash bargaining solution exists as long as the penalties are sufficiently small (or, the entrepreneur's outside option is sufficiently bad); that is, there exists some $\tilde{B}$ such that $\left(V_E\left(\tilde{B}\right), V_O\left(\tilde{B}\right)\right) \geq (\lambda L, 0)$.

a third party or competitor involved during a transaction. It is a face-off between two individuals–a classic bargaining situation.[14]

2.3 Benchmark Analysis

Assuming a bribe is paid, the equilibrium bribe size is determined by equation (3). This yields the following bribe size:

$$B^{*}=\frac{L(1-\lambda)+p\left(F_{O}-F_{E}\right)}{2\left(1-p\beta\right)}. \tag{4}$$

The corresponding utilities are:

$$V_{E}\left(B^{*}\right) = \frac{L\left(1+\lambda\right)-pF}{2}, \tag{5}$$

$$V_{O}\left(B^{*}\right) = \frac{L\left(1-\lambda\right)-pF}{2}. \tag{6}$$

First, let us analyze the utility from a bribe. The Nash bargaining solution leaves the players with identical utility net of the outside options–they essentially agree to split the gains generated by immediate delivery of the license. Any rise in penalties results in a smaller surplus to be shared, so utility drops. Observe that 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. A Nash bargaining solution exists if and only if $pF \leq L\left(1-\lambda\right)$. Bribery will be selected by the official if a bargaining solution exists and leaves him weakly better off than not asking for a bribe. Combining these two conditions, we can see that a bribe will be demanded if and only if

$$V_{O}\left(B^{*}\right)\geq\varepsilon \tag{7}$$

$$\iff pF+2\varepsilon\leq L\left(1-\lambda\right). \tag{8}$$

For a bribe to be exchanged, there must remain a surplus of at least 2ε beyond the total expected punishment, so that bribery is acceptable to the official.

Equation (4) lends itself to some natural comparative statics analysis. In particular, we might be interested in how the punishments and especially their symmetry properties affect

[14] 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.

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:

$$\frac{\partial B^*}{\partial p} = \frac{(F_O - F_E) + \beta L (1-\lambda)}{2(1-\beta p)^2}, \tag{9}$$

$$\frac{\partial^2 B^*}{\partial p^2} = \frac{\beta \left[(F_O - F_E) + \beta L (1-\lambda)\right]}{(1-\beta p)}. \tag{10}$$

The first and second derivatives are weakly positive if, and only if, $F_O - F_E \geq -\beta L (1-\lambda)$. 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.*

(1) If $pF + 2\varepsilon > L(1-\lambda)$, bribes are eliminated.

(2) If $pF + 2\varepsilon \leq L(1-\lambda)$, 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 persistence of bribery. Bribery is eliminated as long as the total expected penalty is large enough with respect to the value of the licence. 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. 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. A larger bribe should not be interpreted as more severe corruption–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.

It is necessary to note here that the elimination of bribery is not being viewed as preferable from a welfare perspective. Clearly, what happens in the absence of bribery must play a role

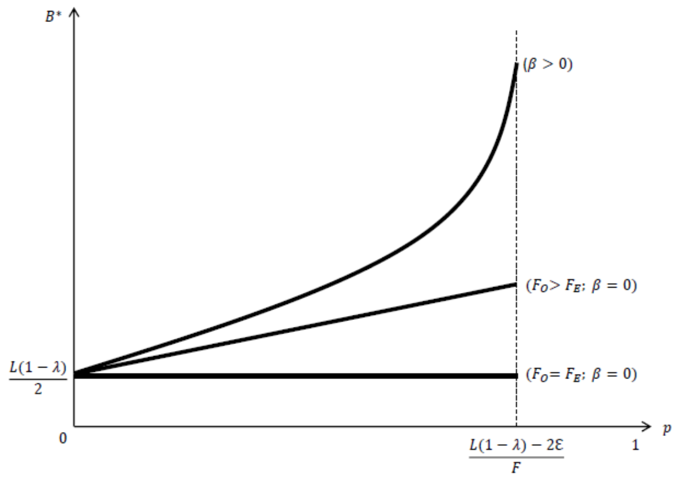

Figure 1: Equilibrium bribe size as a function of detection probability.

in determining whether it should actually be viewed as undesirable. We conduct a welfare analysis along these lines later in Section 4. But first we ask the positive question of how punishment design contributes to the elimination or persistence of bribes.

2.3.1 Bribe Size as a Function of Detection Probability

It will be useful for the next section to discuss how the relationship between bribe size and p is affected by the symmetry properties of punishment. As equations (4) and (9) show, B^* is rising in p. Figure 1 depicts $B^*(p)$ for some classes of parameter values. As noted before, the incidence of bribery is unaffected by whether punishment is symmetric or asymmetric. However, bribe size, and the effect of p on bribe size, depend on how symmetric the punishment is. Under perfect symmetry, bribe size stays constant at $\frac{L(1-\lambda)}{2}$ 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 $\underline{p}$.

In fact, if $F + 2\varepsilon \leq L(1-\lambda)$ (so that a bribe is demanded for all p) and $\beta = 1$, bribe size rises to infinity as $\underline{p}$ 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.

3 Endogenous Detection Probability

We continue with the assumptions above, but with a modification. If a bribe has been paid, the entrepreneur can choose to incur a cost to raise p above a benchmark level (which could be zero). This is a reasonable and important assumption. In addition to the state, the entrepreneur paying a bribe presumably has some control over, and interest in setting, p. How he chooses to exercise this control depends on his incentives–he must weigh the benefits of raising p against the costs. This anticipated whistle-blowing, in turn, might affect the incidence of bribery and the bribe size. In this setting, the symmetry properties of punishment play a more significant role, affecting not just bribe size but also the incidence of bribery.

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 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 bribe-monitors might have less of an incentive to eliminate bribery than bribe-givers do. 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 monitor has no incentive to exert any effort to raise p. Alternatively, suppose the monitor is rewarded by the number of bribes detected This actually incentivizes higher detection probabilities, but it is never in the monitor's interest to raise detection so high that bribery is eliminated.[15]

3.1 Setup

We first define a cost function, $c(p)$. Suppose 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.[16] So,

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

These anticipated costs of whistle-blowing must be incorporated in the entrepreneur's utility, so that:[17]

$$V_E(B) \equiv L - B - pF_E + p\beta B - c(p) \quad (11)$$

$V_O(B)$ continues to be defined as in Equation 2.

[15] Ortner and Chassang (2014) analyze the problem of potential collusion between the monitor and the bureaucrat.

[16] 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.

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

As before, the official has two choices when faced with an entrepreneur's request for a license–deliver it for free, but putting little effort, or demand a bribe and in exchange deliver the full value of the licence. However, in the event that a bribe is paid, the entrepreneur has the option of engaging in costly whistle-blowing.

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

First, the optimal bribe size B^* is determined taking p as given (according to a function $B^*(p)$ which satisfies equation (3)). Subsequently, the entrepreneur chooses p according to some function $p^*(B)$. In the spirit of rational expectations, the p assumed during bribe size negotiations must be the same as the actual p the entrepreneur selects.[18] For (B^*, p^*) to constitute a solution to the bargaining problem, it must satisfy $B^* = B^*(p^*)$ and $p^* = p^*(B^*)$. The bribe size must be a best response to the detection probability, and vice versa. If a bribe is demanded but no such solution exists, each player gets his disagreement utility.

For the remainder of the analysis, we limit our attention to the cases of interest–those where, at the benchmark detection probability, bribery actually exists:

A2. $\underline{p}F + 2\varepsilon \leq L(1-\lambda)$.

3.2 Nash Bargaining Solution

Suppose a bribe is demanded. The Nash Bargaining solution, if it exists, for either $p \in \{\underline{p}, \bar{p}\}$ is given by:

$$B^*(p) = \frac{L(1-\lambda) + p(F_O - F_E) - c(p)}{2(1-\beta p)}. \tag{12}$$

The corresponding utilities are:

$$V_E(B^*) = \frac{L(1+\lambda) - pF - c(p)}{2}, \tag{13}$$

$$V_O(B^*) = \frac{L(1-\lambda) - pF - c(p)}{2}. \tag{14}$$

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

[18] 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.

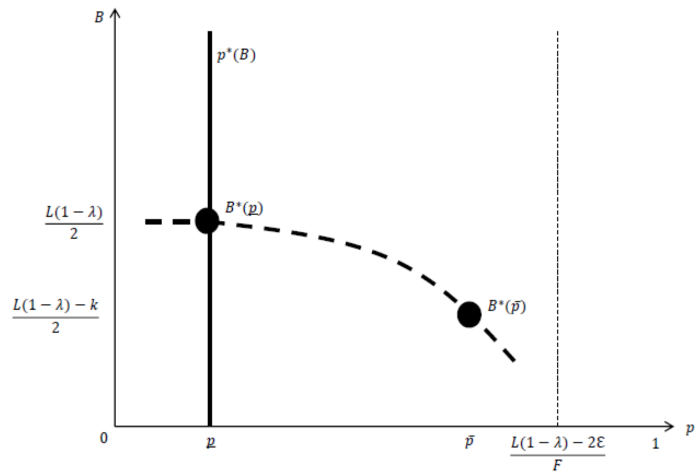

Figure 2: Bribery survives under symmetric punishment and endogenous choice of p.

bribe size to rise; second, a higher p imposes a whistle-blowing cost on the entrepreneur, causing the bribe size to drop.

3.3 Symmetric Punishment

The entrepreneur's optimal choice of p depends on the punishment regime. 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 outcome under symmetric punishment is depicted in Figure 2. $p^*(B)$ is constant at $\underline{p}$. $B^*(p)$ is now defined at only two points (under symmetric punishment, $B^*(\underline{p}) > B^*(\bar{p})$). The equilibrium outcome lies at the intersection of the "best-response" functions $B^*(p)$ and $p^*(B)$.

3.4 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.[19] He will choose $p = \bar{p}$ if the potential recovery is sufficiently large, so:[20]

$$p^*(B) = \begin{cases} \bar{p}, \text{ if } B\left(\bar{p} - \underline{p}\right) \geq k \\ \underline{p}, \text{ if } B\left(\bar{p} - \underline{p}\right) < k \end{cases} \tag{15}$$

We can now analyze the impact of a switch from perfectly symmetric to perfectly asym-

[19] Over a continuous domain, he would raise p as long as $c'(p) < \beta B$.

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

metric punishment. For the purposes of comparison, we assume the total penalty (F) remains constant across the two regimes.

For an outcome in which a bribe is demanded and $B^*\left(\underline{p}\right)$ is paid, two conditions must satisfied. First, expected penalties should be low enough so that bribery leaves the players with enough net surplus:

$$\underline{p}F + 2\varepsilon \leq L\left(1-\lambda\right); \tag{16}$$

this is satisfied by A2.

Second, at $B^*\left(\underline{p}\right)$, the entrepreneur should prefer to not whistle-blow $\left(p^*\left(B^*\left(\underline{p}\right)\right) = \underline{p}\right)$. Using (12) and (15), this condition becomes:

$$\begin{aligned} & B^*\left(\underline{p}\right)\left(\bar{p}-\underline{p}\right) < k \\ \iff \quad & k > k_l \equiv \frac{\left(L\left(1-\lambda\right)+\underline{p}F\right)\left(\bar{p}-\underline{p}\right)}{2(1-\underline{p})} \end{aligned} \tag{17}$$

Similarly, for an outcome in which a bribe is demanded and $B^*\left(\bar{p}\right)$ is paid, the following conditions must be satisfied:

$$\bar{p}F + 2\varepsilon + k \leq L\left(1-\lambda\right); \tag{18}$$

$$\begin{aligned} & B^*\left(\bar{p}\right)\left(\bar{p}-\underline{p}\right) \geq k \\ \iff \quad & k \leq k_h \equiv \frac{\left(L\left(1-\lambda\right)+\bar{p}F\right)\left(\bar{p}-\underline{p}\right)}{2-\left(\bar{p}+\underline{p}\right)}. \end{aligned} \tag{19}$$

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.

The results above are summarized in the next proposition.

Proposition 2 *Consider a switch from symmetric to asymmetric punishment with the total penalty (F) held constant.*

(1) For $k \leq k_l$: (a) if $\bar{p}F + 2\varepsilon + k > L\left(1-\lambda\right)$, bribery is eliminated; (b) if $\bar{p}F + 2\varepsilon + k \leq L\left(1-\lambda\right)$, there is a unique bargaining solution $\left(B^*\left(\bar{p}\right), \bar{p}\right)$, with greater detection than under symmetric punishment.

(2) For $k \in (k_l, k_h]$: (a) if $\bar{p}F + 2\varepsilon + k > L\left(1-\lambda\right)$, there is a unique bargaining solution $\left(B^*\left(\underline{p}\right), \underline{p}\right)$, as under symmetric punishment; (b) if $\bar{p}F + 2\varepsilon + k \leq L\left(1-\lambda\right)$, there are two possible bargaining solutions, $\left(B^*\left(\underline{p}\right), \underline{p}\right)$ and $\left(B^*\left(\bar{p}\right), \bar{p}\right)$.

(3) For $k > k_h$, there is a unique bargaining solution $\left(B^*\left(\underline{p}\right), \underline{p}\right)$, as under symmetric punishment.

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 probability (additionally, B^* must leave the official with at least ε). $p^*(B)$ is (step-wise) rising in B–under perfectly asymmetric punishment, a higher bribe means he stands to gain more from whistle-blowing. And B^* is such that, given p, the bribe maximizes the Nash product or, in this case, divides the net surplus equally across both parties. Some distinct possible 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, as this raises the possibility of recovering his bribe relatively cheaply. The best response to a high p is an adjusted bribe size that accounts for the greater likelihood that the official will be left with nothing. But if $\bar{p}$ is high enough, it is impossible to find a bribe size that leaves both players with net 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.[21]

Even in this expanded framework, the basic logic of asymmetric punishment (Basu, 2011) remains intact. 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, as in the previous paragraph, bribery is eliminated. But, if whistle-blowing is expensive or there are limits to how high detection probability could go, bribes might survive whistle-blowing under asymmetric punishment. If k remains low enough to encourage whistle-blowing while $\bar{p}$ is low enough to sustain bribery, asymmetric punishment could simply lead 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, bribery without whistle-blowing 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).

[21] In an alternative modeling framework with bribe size determined by the official, the official might do better by strategically demanding a smaller bribe to dis-incentivize subsequent whistle-blowing. However, as we argue earlier in the paper, there are some compelling reasons to model bribe size as determined by Nash barganing. Here, bribe size emerges as the outcome of a process of negotiation and is not naturally subject to the strategic considerations that would emerge if it were set by a single monopolist official.

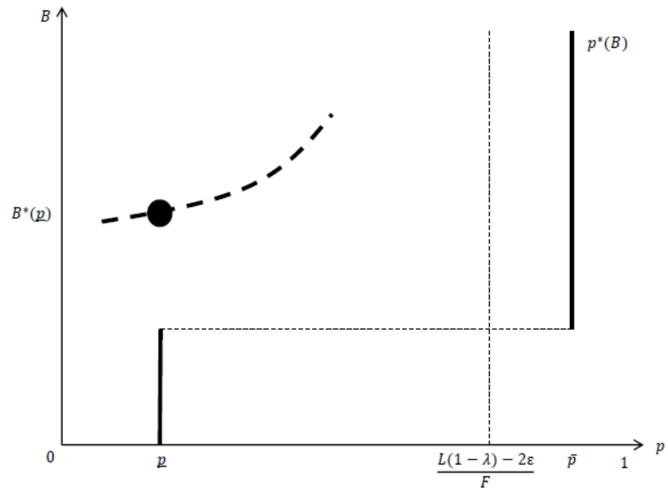

Figure 3: If k is low enough and $\bar{p}$ high enough, asymmetric punishment eliminates bribery.

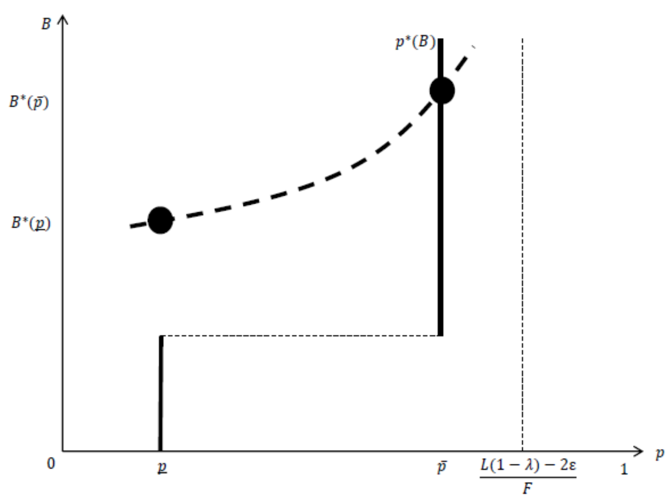

Figure 4: If both k and $\bar{p}$ are low, whistle-blowing occurs but bribery survives.

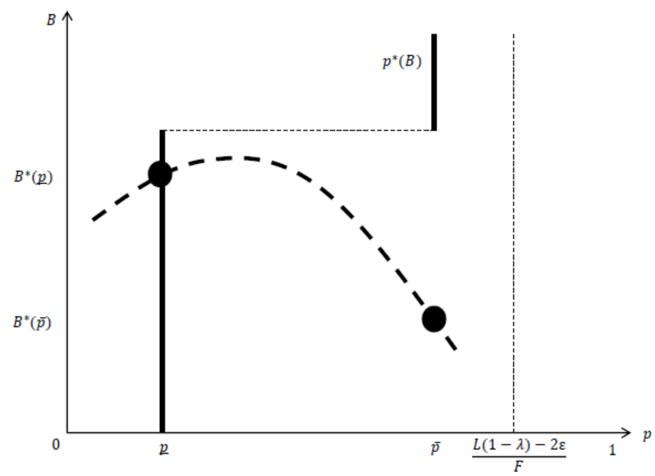

Figure 5: If k is high, the low bribe equilibrium survives. Also note that, because of the high cost of whistle-blowing, $B^*\left(\underline{p}\right)$ might be greater than $B^*\left(\bar{p}\right)$.

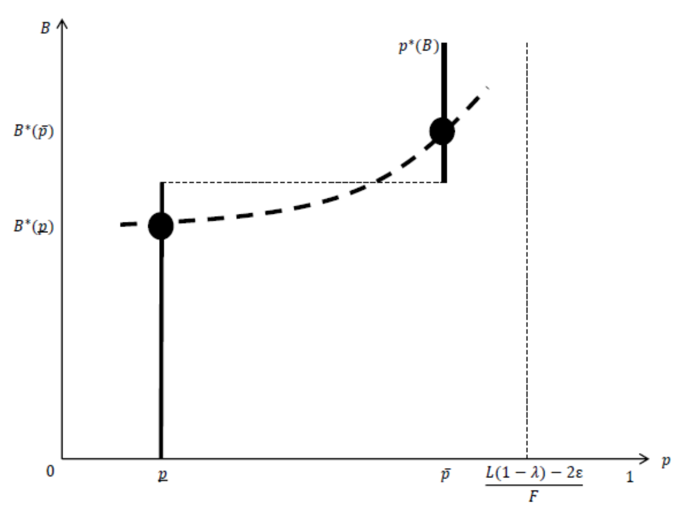

Figure 6: With a low $\bar{p}$ and at intermediate values of k, both low bribe and high bribe equilibria are feasible.

4 Welfare

The impact of a switch from symmetric to asymmetric punishment is critically contingent on parameter values. While in some cases it eliminates bribery, in others bribery persists with the same or modified bribe sizes. We now discuss the welfare implications of asymmetric punishment.

4.1 Outcomes Across Types

Within a country, a natural source of heterogeneity is entrepreneur type. Figure 7 maps our results for entrepreneurs who vary along two dimensions: L and k. The first–valuation of the license–is a measure of willingness to pay which, depending on the context, could signal productivity or wealth. The second–cost of whistle-blowing–conceivably depends substantially on political connectedness.

First, in some regions, the only possible outcome involves bribery without whistle-blowing. This happens either when whistle-blowing is very costly ($k > k_h$) or when it is moderately costly but, since the licence is not attractive enough, it would eliminate surplus if implemented ($k \in (k_l, k_h]$ and $\bar{p}F + 2\varepsilon + k > L(1-\lambda)$).

Second, when whistle-blowing is intermediately costly so that both $\underline{p}$ and $\bar{p}$ are feasible best-responses, and the license is attractive enough to leave surplus even after accounting for costly whistle-blowing (($k \in (k_l, k_h]$ and $\bar{p}F + 2\varepsilon + k \leq L(1-\lambda)$), the outcome is indeterminate. The official will ask for a bribe and negotiations could lead to either outcome. However, in such cases, since the whistle-blowing equilibrium is Pareto dominated, we assume below that it is not selected when two equilibria exist.

Third, when $k \leq k_l$, whistle-blowing is so cheap that the entrepreneur will certainly engage in it after paying a bribe. Now, if whistle-blowing eliminates surplus ($\bar{p}F + 2\varepsilon + k > L(1-\lambda)$), the official will choose to deliver the license without asking for a bribe. But if the license is attractive enough ($\bar{p}F + 2\varepsilon + k \leq L(1-\lambda)$), a bribe will be paid and the entrepreneur will engage in whistle-blowing.

In Figure 7, in the light grey regions asymmetric punishment has no effect, in the dark grey regions bribery persists but with whistle-blowing, and in the unshaded region bribery is eliminated.

So, we can see that the intended effect of asymmetric punishment–the elimination of bribery–is achieved only when the official faces entrepreneurs for whom whistle-blowing is cheap enough to ensure that it happens and the license is sufficiently unattractive that there is nothing to bargain over. In those cases where asymmetric punishment results in the persistence of bribery with added whistle-blowing, both the official and the entrepreneur are

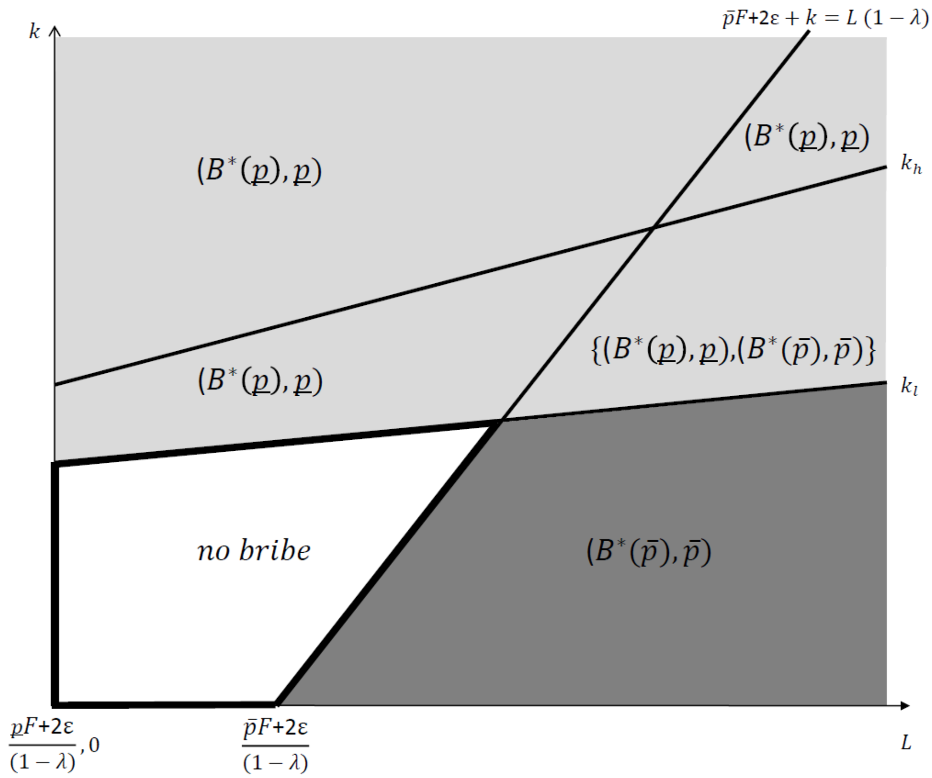

Figure 7: Outcomes under asymmetric punishment for heterogeneous entrepreneurs.

left strictly worse off. Whistle-blowing, if it doesn't discourage bribery, merely introduces surplus-burning costs.

Finally, an observation: suppose the parameter values are such that asymmetric punishment eliminates bribery. It does not follow that this outcome will persist with further reduced whistle-blowing costs or license values. For example, in Figure 7, we see that if k is already low, a further lowering reduces the range of license valuations for which bribery is eliminated. This happens because there are two effects of lowering k: whistle-blowing gets more attractive, but because the entrepreneur can raise p more cheaply, the potential post-whistle-blowing surplus *rises*. This serves to perpetuate bribery despite the higher probability of detection. A similar analysis can be conducted for cases where L drops further.

4.2 Welfare Across Types

A welfare-based determination of whether to switch to asymmetric punishment depends on a well-defined notion of welfare and the distribution of entrepreneur types. On the first, there is the question of how outcomes are evaluated for each official-entrepreneur interaction and how these are aggregated. For instance, the social objective might be to simply maximize total surplus in each interaction, or to minimize bribes because of possible externalities generated by a culture of bribery. In these cases, we could attempt a comparison of symmetric and asymmetric punishment, but this would be of second-order interest since optimal outcomes could be achieved by decriminalizing bribery in these contexts instead of attempting to combat it.

But there are other reasons a government might prefer not to leave transactions to the market. For example, bureaucrats might be needed to monitor externality-generating firms (Acemoglu and Verdier, 2000) or enforce property rights for citizens (Acemoglu and Verdier, 1998), and in each of these cases the bureaucrats' private interest could be at odds with efficiency considerations.

In this paper, we take as given that bureaucrats are needed to deliver licenses, and that it is preferable to not charge a price for these. This is not hard to justify in the case of harassment bribes. The government might simply be interested in appearing fair and non-extortionary in certain domains. Or, if entrepreneurs are required to incur a sunk cost before meeting the bureaucrat, the anticipation of a bribe could deter them from making the initial investment in the first place, resulting in an inefficient outcome.

Let us consider a natural welfare objective: maximizing the utility of the entrepreneur. If bribery without whistle-blowing persists, asymmetric punishment has no welfare effect. If there is a switch to bribery with whistle-blowing, asymmetric punishment must reduce welfare since the total surplus is lowered by the whistle-blowing effort and greater expected punishment.

So, asymmetric punishment is potentially welfare-improving only when it eliminates bribery. However, whether the elimination of bribery actually raises welfare depends on utility in the absence of bribery (which, in turn, depends on how motivated the official is to deliver the full value of the license). Under bribery without whistle-blowing, the entrepreneur's utility is $\frac{L(1+\lambda)-\underline{p}F}{2}$. Under no bribery, utility is ψL. This gives us the next proposition.

Proposition 3 *Suppose welfare is defined as the entrepreneur's utility. Asymmetric punishment is welfare-improving relative to symmetric punishment if and only if:*

(1) Bribery is eliminated ($k \leq k_l$ and $\bar{p}F + 2\varepsilon + k \geq L(1-\lambda)$); and

(2) $\psi > \bar{\psi} \equiv \frac{L(1+\lambda)-\underline{p}F}{2L}$

The interpretation of this proposition is straightforward. Condition (1) ensures that a no-bribery outcome exists and condition (2) ensures that no-bribery is preferable to bribery without whistle-blowing. If ψ is sufficiently close to one, then condition (1) satisfies condition (2). This is the case where bureaucrats have the necessary motivation to supply the license without a bribe. Then, whenever bribery can be eliminated, it raises welfare.

If ψ is small, asymmetric punishment could have opposing welfare implications within the region where bribery is eliminated. For sufficiently small license values $\left(L < \frac{pF}{1+\lambda-2\psi}\right)$, the elimination of bribery raises welfare. But for larger license values, no-bribery is worse than bribery.[22] Intuitively, this is because, as license value rises, under no-bribery a smaller fraction of utility survives than under bribery.

Clearly, this is an artifact of our assumptions and the details of the proposition might change if punishment too were linked to license size. But the point to be noted here is that parameter values matter *differently* for how asymmetric punishment changes behavior and how a change in behavior can be interpreted from a welfare-perspective.

4.3 Distributions of Types

Aggregation across interactions might take a purely utilitarian approach or, depending on the nature of the license, place relatively greater weight on the utility of entrepreneurs who value the license more (greater productivity) or less (possibly poorer). Now, the distribution of types matters. Distributions presumably vary substantially across countries, as do the degrees of correlation between L and k. While a formal discussion of welfare under different distributions is beyond the scope of this paper, the model lends itself to some general observations.

Consider populations where the costs of whistle-blowing (k) are generally high. In such cases, regardless of the distribution of L, asymmetric punishment will not raise welfare. In fact, to the extent that it encourages whistle-blowing without eliminating bribery for high-valuation types, there will be a welfare loss.

For populations where the costs of whistle-blowing are generally low, welfare depends on a trade-off: surplus in low-valuation interactions rises while the opposite happens in high-valuation interactions. So, while asymmetric punishment will be an effective tool against petty bribery, it will persist with greater surplus loss in high-stakes interactions.

Finally, one concern related to bribery is that it could lead to misallocation (see Banerjee, Hanna, and Mullainathan, 2012 and Niehaus et al., 2013). While our model allows for the license to not be delivered (if bribe negotiations fail), this is never realized as an outcome. This is due to two assumptions: there is no constraint on the number of licenses, and the official knows the entrepreneur's type before he requests a bribe. While this allows us to focus on the key mechanics of bargaining and whistle-blowing, it is worth discussing how private information about types could affect outcomes.

Suppose the official learns the entrepreneur's type only after a bribe is demanded. Then,

[22] Pilling (2014) describes some such outcomes.

his decision to demand a bribe depends on his beliefs about the distribution of types. If he does not demand a bribe, he gets the basic reward, ε.

If, on the other hand, he demands a bribe, he receives either the agreed upon bribe amount or, if negotiations fail, nothing. If a sufficient proportion of entrepreneurs have low k and low L, the official will deliver all licenses without bribes under asymmetric punishment. Otherwise, he will demand bribes from all entrepreneurs, and as a consequence those with low k and low L will end up without the license. So a slight change in the distribution of types can result in a dramatic change in the welfare implications of asymmetric punishment, with under-allocation of licenses to particular types of entrepreneurs.

5 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. Bribe size rises in detection probability, the official's fine, and the fraction of the 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.

Next, by endogenizing detection probability, this model suggests some new ways to structure our thinking about anti-corruption policy, which has been the subject of many studies.[23] Clearly, one way to eliminate bribery is to make punishments severe and probability of detection high (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, a number of conditions must be satisfied. First, the elimination of bribery must be desirable. This depends on ψ, the bureaucrat's motivation in the absence of a bribe.

Second, asymmetric punishment must actually eliminate bribery. Whistle-blowing needs to be sufficiently cheap–the state must not only offer entrepreneurs the opportunity to

[23] For examples, see Brunetti and Weder (2003) and Olken (2007).

whistle-blow, it must allow them to do so cheaply and effectively.

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 $\bar{p}$ drops (i.e., there is reduced scope for whistle-blowing), we move from zero bribery to the worst of the outcomes–bribery with whistle-blowing. Once k gets high enough, asymmetric punishment has no effect. This leads to some unusual cross-country predictions. For example, all else equal, we should see the most severe corruption in countries where whistle-blowing is cheap enough for it to occur, but the expected cost of the fine is so limited that it doesn't deter bribery. The possibility of multiple equilibria adds additional complexity, as identical underlying conditions could lead to substantially different bribe sizes.

Policy design requires careful attention to several aspects of bureaucratic and legal institutions. If the state is unable to make whistle-blowing sufficiently effective to eliminate bribery, then 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, it is possible that asymmetric punishment would make matters worse.

Furthermore, asymmetric punishment is expected to be most effective in eliminating bribery where the stakes are low, so that there would be little surplus left after whistle-blowing. This suggests that both asymmetric and symmetric punishment could coexist, with the former being more effective for petty bribery and the latter for larger-stakes transactions.

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. 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.

Finally, recall that one prediction of our model is that even 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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