Competition in Corruptible Markets

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PRELIMINARY

Abstract

Emerging markets offer significant business opportunities. However, local and foreign firms selling in these markets are often faced with corrupt agents. This paper investigates the marketing strategy implications for firms competing for business in a corruptible market. I consider a setting in which a buyer (a firm or government) seeks to purchase a good through a corruptible agent. Supplier firms, that may or may not be a good fit, compete to be selected by the agent. Only the agent observes whether or not a firm is a good fit. Corruption arises due to incentive of the agent to select a non-deserving firm in exchange for bribes. Intuitively and as expected, a sufficiently large monitoring of the agent eradicates corruption. But the interesting point is that increasing the monitoring from an initial low level can backfire, making the agent more likely to select a non-deserving firm. As firms become reluctant to offer bribes in response to higher monitoring, it now becomes likely that the agent receives a bribe offer, in equilibrium, only from a non-deserving firm. This non-monotonic agent behavior makes it difficult to reduce corruption. The implication is that the buyer should choose either to be ignorant or to take drastic measures to limit corruption. Further, I show that unilateral anti-corruption controls, such as the Foreign Corrupt Practices Act of 1977, on a U.S. firm seeking business in a corrupt foreign market can actually increase the profits of the U.S. firm. This is because such a control on the U.S. firm puts pressure on the buyer to set monitoring at higher levels and reduces corruption.

1 Introduction

1.1 Overview

While the GDP growth in the more developed countries remains sluggish emerging economies are forecasted to continue growing at rates over 6%, as per IMF estimates. Increased purchasing-power of the sizable middle class consumers and public investments in infrastructure and defense in emerging markets has created significant business opportunities for domestic as well as foreign firms. U.S. firms, facing saturation in domestic markets, are increasingly counting on consumers, firms and governments in emerging markets as a source of future growth.[1] One of the biggest challenges faced by U.S. firms competing for business in emerging markets is corruption.[2] Bribery in the emerging economies is considered a norm. Although more prevalent, corruption is by no means limited to emerging economies. We study competition in corruptible markets. The following examples illustrate the general framework that we have in mind.

DaimlerChrysler AG, between 1998 and 2008, paid at least $56 million in improper payments to government officials in China, Russia, Indonesia and other countries. The company earned $1.9 billion in revenue and at least $90 million in illegal profits through these tainted sales transactions. Daimler paid $185 million in fines to settle charges with the Securities and Exchange Commission (SEC) and the U.S. Department of Justice.[3]

BP, like other large oil companies, charters oil tankers from shipping firms (such as Maersk and Frontline). Tanker chartering is an area that requires specialized skills and knowledge. Lars Dencker Nielsen, a senior executive in BP's tanker chartering division, allegedly received cash payments from a shipping magnate in return for giving multimillion pound contracts over a period of five years.[4] Bribery of private sector employees is illegal according to the Bribery Act 2010 in the UK.

Bofors AB of Sweden was selected by Indian government to supply over 400 Howitzer field guns in a $285 million procurement decision in March 1986. It is speculated that Bofors paid

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[1]Foreign profits as a share of global profits for U.S. firms has increased from 21% in 2000 to 46% in 2010. (Sources: S&P 500: 2010 Global Sales report and U.S. Bureau of economic analysis)

[2]Transparency International's Perception of Corruption Index (2011) for major developing economies: Brazil 3.8, China 3.6, India 3.1, Mexico 3.0, Indonesia 3.0 and Russia 2.4.

[3]http://www.sec.gov/news/press/2010/2010-51.htm; Accessed 07/31/12

[4]http://www.telegraph.co.uk/finance/newsbysector/energy/oilandgas/9144236/BP-alerted-to-bribery-at-its-tanker-division.html; Accessed 06/15/12

$11.5 million in kickbacks to top Indian politicians and key defense officials to beat its competitor Sofma, France and secure the deal.[5] The guns were used extensively in the Kargil War between India and Pakistan in 1999 at elevations of 16000-18000 ft. The Indian army pushed the guns beyond their prescribed limits and used them in ways never before employed by the Swedish Army or Bofors. The guns gave India 'an edge' over Pakistan according to Indian Army officers in the field.[6]

There are some features, in the above examples, that we would like to highlight. The decision to select one firm over another is usually not straightforward. The selection of a firm that is best suited for a particular project requires expertise in the subject matter and information about the environment in which the product is to be used. The suppliers themselves may not know if they are best suited. The buyers, firms or governments, rely on agents such as experts or bureaucrats to make the selection decision on their behalf. This creates the scope of corruption. The agents, sometimes but not always, select a non-deserving firm in exchange for bribes. Buyers understand an agent's incentives to select a non-deserving firm. Corrupt agents sometimes get caught and punished. We capture these features in our model.

We analyze the firm's incentives for bribing an agent who selects, on the behalf of the buyer, a deserving firm from two firms that are competing for a project. Only the agent knows if a particular firm is deserving or not. The agent is willing to select a non-deserving firm in the exchange for a bribe. We refer to the selection of a non-deserving firm as a dishonest agent behavior. A dishonest agent behavior hurts the buyer. The buyer understands an agent's incentives and randomly monitors the agent. Monitoring the agent is costly. Upon monitoring, the buyer learns if a non-deserving firm was selected. A dishonest agent, if caught, is punished. Firms compete in bribes to get selected by the agent. A sufficiently large monitoring eradicates corruption as firms find it unprofitable to offer large bribes that must be offered to compensate the agent's higher expected penalty. For any smaller monitoring corruption prevails. The bribe offer equilibrium is in mixed strategies. The profits of firms increase in the monitoring. This happens because when firms are required to pay higher bribes to be selected with certainty they become less willing to do so. The equilibrium bribes decrease and result in higher profits for the firms.

[5]http://indiatoday.intoday.in/story/Key+players+in+Bofors+scandal/1/39264.html; Accessed 06/15/12
[6]http://www.ndtv.com/article/india/why-the-army-loves-the-bofors-gun-5580; Accessed 09/05/12

We also find that an increase in monitoring does not always result in more honest agent behavior. Interestingly, if bribery is prevalent, a small increase in the monitoring can make the agent more dishonest. The intuition is the following. If monitoring is small both firms offer bribes with probability one. The agent in this case often accepts the bribe offer of the deserving firm. If monitoring is increased firms become less likely to offer bribes. The agent is now faced with situations in which she receives a bribe offer only from a non-deserving firm. This forces the agent to select a bribe-offering, non-deserving firm more often. The agent becomes more dishonest as a result of higher monitoring. If the monitoring is sufficiently large the agent always selects the deserving firm. Various scholars have discussed this non-monotonic relationship between monitoring, or expected penalty, and honest behavior (see Akerlof and Dickens (1982) and Bénabou and Tirole (2006)). However, they draw upon the classic work on intrinsic motivation in psychology (see Deci (1972)). We present a rational agent model with no behavioral assumptions and show that an increase in monitoring can make the agent more dishonest. In our model, endogenous firm response to an increase in the monitoring makes the agent more dishonest.

The non-monotonic effect of the monitoring on the agent behavior makes it difficult for the buyer to reduce corruption. We find that, the buyer should either choose to be ignorant about corruption or commit to take drastic measures to limit it. A small monitoring only hurts the buyer.

Bribery of foreign government officials by U.S. firms competing in overseas markets was commonplace. During an investigation by the U.S. Securities and Exchange Commission, in mid-1970s, more than 400 U.S. companies admitted to having made questionable payments to foreign government officials. Congress enacted the Foreign Corrupt Practices Act (FCPA) of 1977 to bring a halt to the bribery of foreign officials and to restore public confidence in the integrity of the American business system.[7] This unilateral control on the U.S. firms seeking business in foreign markets has been a topic of debate. In the business community it is believed that the Act puts American businesses at a competitive disadvantage in international business (see Kaikati and Label (1980) for a discussion). The evidence from a majority of empirical studies suggests that there is little or no disadvantage posed by the FCPA (see Graham (1984), Beck, Maher, and Tschoegl (1991), and Wei (2000)). On the contrary, James R. Hines (1995)

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[7]See www.justice.gov/criminal/fraud/fcpa/ (accessed 6/19/12) for the history and details of the Act.

suggests that the FCPA serves to weaken the competitive position of the U.S. firms.

We study the effect of a unilateral anti-corruption control, such as the FCPA, on a firm's profits. We show that the profits of the controlled U.S. firm can actually increase as a result of a unilateral anti-corruption control on it. The intuition is the following. A unilateral anti-corruption control on a firm reduces the bribe that the other firm must pay in order to get selected by the agent regardless of whether it is deserving or not. As a result, the agent selects a non-deserving firm with a higher probability. This hurts the buyer. The buyer may, therefore, strategically, set a higher monitoring to discourage bribery by the firm that is not controlled. Since higher monitoring results in higher profits for both firms, a unilateral control can lead to higher profits for the controlled firm. There is evidence of higher monitoring in the Middle East in the post-FCPA era presented in Gillespie (1987). She also concludes that the potential of the FCPA to hurt U.S. exports remains unproven.

1.2   Related Literature

Corruption has been studied extensively in many different contexts in the literature (See Jain (2001) for a review). Shleifer and Vishny (1993) study the implications of the structure of the corruption network on the level of corruption in government agencies. Mookherjee and Png (1995) study the optimal compensation policy for a corruptible inspector, charged with monitoring pollution from a factory. Hauser, Simester, and Wernerfelt (1997) look at bribery, or side payments, in the context of ratings given by salesforce to internal sales support.

There is relatively smaller literature on competition in the presence of corruption. Rose-Ackerman (1975) initiate this work by presenting a model in which corruption results in allocative inefficiency. The inefficiency in her model arises due to differences in the bribing capacity of competing firms or due to vague preferences of the government. Burguet and Che (2004) allow the agent to manipulate her quality evaluations in exchange for bribes. They find that if the agent has little manipulation power, corruption does not disrupt allocation efficiency but makes the efficient firm compete more aggressively. However, if the agent has substantial manipulation power, corruption facilitates collusion among competing firms and creates allocative inefficiency as bribery makes it costly for the efficient firm to secure a sure win. Compte, Lambert-Mogiliansky, and Verdier (2005) incorporate corruption in procurement auction through

the possibility for bid readjustment that an agent may provide in exchange for a bribe. They show that corruption facilitates collusion in price between firms and results in a price increase that goes beyond the bribe received by the bureaucrat. They also show that a unilateral anti-corruption controls on an efficient firm may restore price competition to some extent. Branco and Villas-Boas (2012) investigate the effect of the degree of competition on corruption in the context of a firm's investment in behaving according to the rules of the market.

This paper also relates to literature on strategic information transmission in the presence of a third party. Scharfstein and Stein (1990) examine behavior of an advisor who cares about his reputation for accuracy and show that advisor's incentive to say the expected thing can result in herd behavior. Durbin and Iyer (2009) study information transmission to a decision maker from an advisor that values his reputation for incorruptibility in the presence of a third party who offers unobservable bribes to influence the advice. They show that the advisor may send an inaccurate message in order to bolster his reputation for incorruptibility. Inderst and Ottaviani (2012) present a model of competition in which product providers compete to influence intermediaries' advice to consumers through hidden kickbacks or disclosed commissions. They study equilibrium commissions and welfare implications of commonly adopted policies such as mandatory disclosure and caps on commissions.

This work contributes to the literature on competition in the presence of corruption by presenting a model which captures the roles of corruption. Unlike Rose-Ackerman (1975), we assume firms to be symmetric and the government preference to be well defined. The scope of corruption arises as the buyer does not have the expertise or the information needed to make the purchase decision and delegates the decision to an agent. Compte, Lambert-Mogiliansky, and Verdier (2005) exogenously impose corruption. The buyer does not need an agent in their setup. Corruption arises endogenously in our setup, more like Burguet and Che (2004). The existing papers do not explicitly model both the agent and the buyer. Our agent is strategic. She understands the implications of dishonest behavior and does not always accept the higher bribe. The buyer is also strategic. She understands the incentives of the agent and tries to discipline her. By accommodating these features, which have been largely ignored in the existing literature, we are able to gain interesting new insights on competition in the presence of corruption. We show that an agent can become more dishonest as a result of increased monitoring using a rational agent model. We also provide a formal explanation for the disconnect between the common

perception of the impact of the FCPA on the U.S. firms and the findings of the empirical studies. The findings of our work have important implications for firms doing business in international markets as well as governments.

The rest of the paper is organized as follows. The next section presents the model where we discuss firms' decisions, agent's decision and buyer's decision in order. In Section 3 the analysis of the unilateral control setup and its comparison to the model discussed in Section 2 is presented. Section 4 summarizes our results.

2   Model

Consider a buyer that needs to buy a single, indivisible good. The suppliers of the product can be one of the two possible types, good fit or bad fit. Utility of the buyer who buys the product at price p is given by $V(v_f, p) = v_f - p$, where $v_f = v$ if the product is bought from a supplier with good product fit and $v_f = 0$ if it is bought from a supplier with bad product fit. The buyer does not have the expertise or the information needed to evaluate the product fit. Therefore, firms are identical to the buyer. The reservation price of the buyer $\bar{p}$.

Two firms, $i = 1, 2$, compete to supply the product to the buyer. One of the two firm's product is a good fit, the other's product is a bad fit. The probability that firm i's product is a good fit is 0.5. Firms do not know if their product is a good fit or not. This may happen because firms may not be aware of the intended use of the good, previous training received by buyer's staff, and the environment in which the good will be used or due to the firm's own lack of prior experience. Both firms have same cost of production which is assumed to be zero.

An agent, such as a bureaucrat, selects one of the two firms on behalf of the buyer. The agent, costlessly and privately, learns the fit of the firm. This learning, while informative, is not perfect. The probability that a firm is actually a fit, given the agent's signal is fit, is $\rho > 0.5$. The agent is expected to always select the firm for which she receives a fit signal. The agent, in exchange for a bribe $b_i \geq 0$ ($b_j \geq 0$) from firm i (firm $j \neq i$), can change her report and select a firm that she believes is misfit. Both firms simultaneously and privately submit price bids p_i and p_j, and bribe offers b_i and b_j to the agent. Price bids are observed by the buyer. From here onwards, we refer to the firm, for which the agent receives a fit signal, as the deserving firm and the other firm as the non-deserving firm. The agent receives the bribe conditional on the firm

receiving the order to supply the product. The buyer understands that the agent may accept the bribe and select a non-deserving firm. In order to discourage the agent from this behavior, the buyer monitors the agent with probability $\lambda \in [0, 1]$ after the good is purchased.[8] The cost of the monitoring $c(\lambda)$ is assumed to be continuous and strictly convex with $c(0) = 0$. The buyer, as a result of monitoring, learns the signal that agent received and infers if the agent made a dishonest decision in exchange for a bribe. The buyer does not observe the bribe transfer. This is because in most cases no official record of the bribe transfer exists.[9] In cases where a record does exist the buyer may not have access to those records.[10] A penalty P is imposed on the dishonest agent. We assume that $P > \bar{p}/2$.[11] All parties are risk neutral. The expected penalty imposed on the agent, if she makes a decision inconsistent with her signal, is simply λP. The minimum bribe needed in order for the agent to select a non-deserving firm, therefore, is λP.

Now we look at the agent's incentives in the selection process. The agent compares the two bribe offers b_i and b_j. If $\mid b_i - b_j \mid > \lambda P$, she selects and accepts the bribe from the firm which made the high bribe offer regardless of whether the firm is deserving or not. The agent, in this case, pays an expected penalty of $\frac{\lambda P}{2}$. If, however, $\mid b_i - b_j \mid \leq \lambda P$ she selects the deserving firm and receives the bribe offered by that firm, even if it is lower than the bribe offered by the other firm. The agent, acting honestly for buyer, does not pay any penalty in this case. Here, the agent does not accept the non-deserving firm's bribe offer because the cost of doing so in the form of expected penalty (λP) is weakly higher than the benefit (a bribe higher by $\leq \lambda P$). We assume that the agent makes an honest decision if she is indifferent to either selecting the deserving or the non-deserving firm. The payoff function of the agent can, therefore, be written as

$$\pi_a(b_i, b_j) = \begin{cases} max(b_i, b_j) - \frac{\lambda P}{2} & if \ |b_i - b_j| > \lambda P \\ b_{des} & if \ |b_i - b_j| \leq \lambda P \end{cases}$$

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[8]In our model monitoring captures many different things. It captures the efficiency of the legal system, extent of whistle-blower protection, and extent of control on media apart from the probability with which some department or agency verifies the selection decision of the agent.

[9]Bribes are typically paid in cash or as non-monetary benefits. Also, they are often transferred to foreign bank accounts of the agent or are received by relatives of the agent.

[10]Many foreign banks typically do not disclose information about their clients' accounts to the governments. According to different estimates Indians have $500 billion to $1.5 trillion of illegal money stashed in foreign banks. According to a Global Financial Integrity report China tops the list of highest illicit financial flows (2002-2006) from developing countries accompanied by Russia, India and Indonesia in the top 10 among others.

[11]This assumption ensures that the buyer can make the agent honest with probability one by making λ sufficiently large.

where, b_{des} is the bribe offered by the deserving firm.

A particular firm gets selected by the agent with probability one (zero) if its bribe offer is higher (lower) than the bribe offer of the other firm by more than λP. If the difference in bribes offered is weakly less than λP the agent selects the firm only with probability 0.5, when it is a deserving firm. The expected profit of the firm i as a function of the bribes offered by firm i and firm $j \neq i$ can be written as

$$\pi_i\left(b_i, b_j\right) = \begin{cases} p_i - b_i & if\ b_i > b_j + \lambda P \\ \frac{1}{2}\left(p_i - b_i\right) & if\ b_j - \lambda P \leq b_i \leq b_j + \lambda P \\ 0 & if\ b_i < b_j - \lambda P \end{cases}$$

Figure 1 summarizes the timing of the actions. In the first stage, nature makes a draw of the fit, from a distribution that is common knowledge, and assigns it to firms. The buyer then sets the probability with which the agent will be monitored after making the firm selection. Firms then submit simultaneous price and bribe bids to the agent. Next, the agent compares the bids and selects one of the two firms. The selected firm receives the accepted price and delivers the good to the buyer. In the next stage, the buyer randomly monitors the agent and imposes a penalty if a dishonest behavior is inferred. Finally, payoffs are realized. We look for Nash equilibrium in pure as well as mixed strategies. The computation of the mixed strategy equilibrium is similar to that of Varian (1980) and Narasimhan (1988).
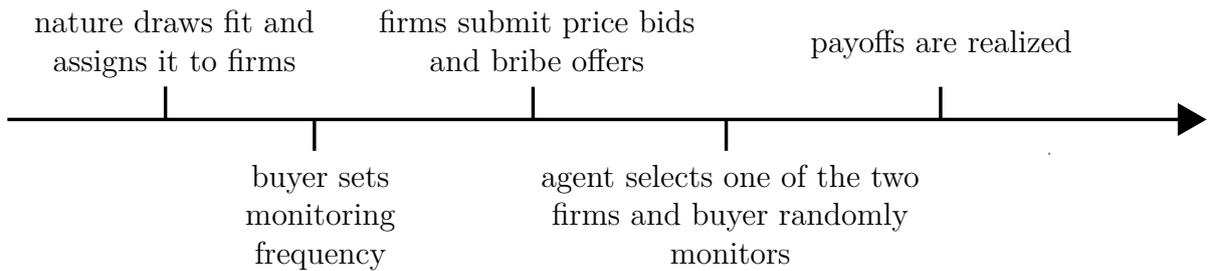

Figure 1: Timing

The framework described above has two important features that are missing in the existing literature on competition in presence of corruption. First, our agent is strategic. She does not always accept the higher bribe. Also, she does not always change her report when she accepts a bribe. There are implications for a dishonest behavior and the agent takes them into

account. The buyer is also strategic. She understands the incentives of the agent to cheat. There are, therefore, consequences for dishonest agent behavior. The buyer, in equilibrium, sets a monitoring which maximizes her payoffs.

2.1   Price and Bribe Decisions

In this section the stages of the model that are relevant for the price and the bribe offer decisions of firms are described. A firm is selected by the agent either because it is deserving or because it offers a sufficiently large bribe. The agent can classify a non-deserving firm as a deserving firm.[12] Given this power of the agent, a firm can always benefit by increasing the price bid so long as the price is not rejected by the buyer. Both firms, therefore, submit price $\bar{p}$ as their price bid and compete in bribes to be selected by the agent. This leads us to the following result:

Lemma 1 *Both firms submit buyer's reservation price $\bar{p}$ as their price bid.*

This high price bid is a typical result in the literature and has been interpreted as corruption facilitating collusion (see Compte, Lambert-Mogiliansky, and Verdier (2005)).

Firm i, when confronted with a bribe offer b_j of the firm j, responds by making a bribe offer that can have three different implications. First, it can offer a bribe which is higher than b_j by more than λP and be selected with probability one. Second, it can offer a bribe which is different from b_j by, at-most, λP and be selected only if it is deserving. Lastly, it can offer a bribe which is lower than b_j by more than λP and be selected with probability zero. However, we note that:

Lemma 2 *Firm i responds to a bribe offer b_j of firm j by offering a bribe*
$b_i \in \{b_j + \lambda P, max\,(0, b_j - \lambda P)\}.$

The intuition for this result is as follows. Any offer $b_i > b_j + \lambda P$ is strictly dominated by an offer $b_i - \varepsilon$ for small enough ε. Firm i still gets selected with probability one but offers a smaller bribe. Any bribe offer by firm i such that $b_j + \lambda P \geq b_i > b_j - \lambda P$ is strictly dominated by the

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[12]This is consistent with general observation about the discretionary power of agents in corrupt countries. (See anti-corruption profiles for various countries at www.trust.org/trustlaw for detailed information.)

offer $b_j - \lambda P$ as firm i still gets selected whenever it deserves but pays a smaller bribe. We do not consider negative bribes, as they are never accepted. Firm i, therefore, responds to bribe offer b_j by offering one of the two bribes as specified in Lemma 2.

Now we look at the equilibrium in bribes (proofs are in the Appendix).

Proposition 1 *If $\lambda \geq \frac{\bar{p}}{2P}$ in equilibrium both firms offer no bribes and the agent selects the firm that is deserving. If $\lambda < \frac{\bar{p}}{2P}$ there is no Nash equilibrium in pure strategies.*

The intuition behind this proposition is the following. Higher monitoring leads to higher expected penalty for the agent. A higher bribe, therefore, must be offered if a firm expects to be chosen even when it is non-deserving. A deviating firm's profits decrease with an increase in the monitoring. For sufficiently large monitoring ($\lambda \geq \frac{\bar{p}}{2P}$), gains from deviations are completely erased. In this region, a pure strategy Nash equilibrium exists and firms offer no bribes in equilibrium. Since firms offer no bribes and are selected when they are deserving the equilibrium profit for both firms is $\frac{\bar{p}}{2}$. This profit does not depend on the monitoring chosen by the buyer so long as it is larger than $\frac{\bar{p}}{2P}$.

If the monitoring is lower ($\lambda < \frac{\bar{p}}{2P}$), the equilibrium bribe offers are in mixed strategies. Firms respond to the other firm's bribe offer either by offering a higher bribe just enough to secure a sure win or by offering a lower bribe just enough to have the firm selected whenever it is deserving. The best response for a firm changes from a higher bribe offer to a lower bribe offer when the bribe offer of the other firm becomes high enough. This switching happens because profits on overbidding reduces faster than profits on underbidding with the increase in the bribe offer of the other firm. The best response bribe offers start increasing again and the switching happens for the other firm. The cycle continues.

We now characterize the equilibrium mixed strategies for $\lambda < \frac{\bar{p}}{2P}$. If $b_i > b_j + \lambda P$, firm i is selected with probability one. However, if $b_j - \lambda P \leq b_i \leq b_j + \lambda P$ then firm i is selected only when it is deserving. If $b_i < b_j - \lambda P$ the agent does not select firm i. The profit of firm i is given by

$$\pi_i (b_i) = prob(b_i > b_j + \lambda P)(\bar{p} - b_i) + prob(b_j - \lambda P \leq b_i \leq b_j + \lambda P)\frac{\bar{p} - b_i}{2}$$

which can be written as

$$\pi_i(b_i) = [F_j(b_i - \lambda P) + F_j(b_i + \lambda P) - \omega_j(b_i - \lambda P)]\frac{\bar{p} - b_i}{2} \qquad (1)$$

where $F_j(b_j)$ is the cumulative distribution function for firm j, and $\omega_j(b_j)$ is the density at bribe b_j.

Since the equilibrium bribing strategies depend on the range of monitoring, we specify the mixed strategy equilibrium in two different parameter spaces.

Suppose that $\lambda \leq \frac{\bar{p}}{4P}$. In this range, both firms prefer to offer bribes. Let firm i's bribe offer be b_i such that $\bar{p} \geq b_i \geq \lambda P$. Consistent with Lemma 2, firm j responds by making a bribe offer of either $b_i + \lambda P$ or $b_i - \lambda P$. A bribe offer of $b_i + \lambda P$ yields an expected profit of $\bar{p} - (b_i + \lambda P)$, whereas a bribe offer of $b_i - \lambda P$ yields an expected profit of $\frac{1}{2}(\bar{p} - (b_i - \lambda P))$ for firm j. A comparison of the profits in two options reveals that firm j, in response to b_i, is better off offering a bribe of $b_i + \lambda P$ if $b_i < \bar{p} - 3\lambda P$ whereas it is better off offering $b_i - \lambda P$ if $b_i < \bar{p} - 3\lambda P$. Firm j is indifferent about overbidding or underbidding if firm i offers a bribe of exactly $\bar{p} - 3\lambda P$. The same holds for firm i. Since both firms prefer to underbid in response to any bribe offer higher than $\bar{p} - 3\lambda P$, a bribe higher than $\bar{p} - 2\lambda P$ will never be offered. Also, since both firms prefer to overbid in response to any bribe offer lower than $\bar{p} - 3\lambda P$, a bribe lower than $\bar{p} - 4\lambda P$ will never be offered. The support of bribe offer distribution is, therefore, $[\bar{p} - 4\lambda P, \bar{p} - 2\lambda P]$. The bribing equilibrium, which is in mixed strategies, is described in Proposition 2.

Proposition 2 *If $\lambda \leq \frac{\bar{p}}{4P}$,*
(a) equilibrium bribing strategy for firm j is given by

$$F_j(b_j) = \begin{cases} \frac{3\lambda P}{\bar{p} - b_j - \lambda P} - 1 & if\ \bar{p} - 4\lambda P \leq b_j < \bar{p} - 3\lambda P \\ \frac{3\lambda P}{\bar{p} - b_j + \lambda P} & if\ \bar{p} - 2\lambda P \geq b_j \geq \bar{p} - 3\lambda P \end{cases} \qquad (2)$$

and,
(b) both firms make profits of $3\lambda P/2$.

The equilibrium bribe distribution, for both firms, is continuous and has a mass point at the

indifference point. In equilibrium, both firms offer positive bribes with probability one. The equilibrium is unique by construction. And it is straightforward to show, by contradiction, that the bribing strategies specified in Proposition 2 constitute Nash equilibrium.

It is of interest to look at how the equilibrium bribing strategies and profits respond to a small change in monitoring. An increase in monitoring requires that firms overbid their rivals by a larger amount if they wish to be selected with certainty. Given that both firms still offer bribes with probability one, it might appear counter-intuitive to see that profits are increasing in monitoring λ. The intuition for this result is the following. Since firms must overbid by a larger amount to get selected with probability one they become less willing to do so. Firms become indifferent to overbidding or underbidding the rival firm at lower bribes. As a consequence, lower bribes are offered in equilibrium which results in higher profits for both firms. We can express each point in the support of the distribution in equation (2) in the form $\bar{p} - a\lambda P$, where $2 \geq a \geq 4$. This implies that the probability at each point in the support of bribe distribution is independent of λ.

We now look at the intermediate range of monitoring $\frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P}$. Given $\lambda \leq \frac{\bar{p}}{2P}$, both firms prefer to offer bribes if the other firm is not offering a bribe. Firms prefer to overbid by λP on any rival firm's bid which is smaller than $\frac{\bar{p}}{2} - \lambda P$. Since $\lambda \geq \frac{\bar{p}}{4P}$, the alternative strategy, as per Lemma 2, is to offer no bribes that yields lower profits. Here, firms also prefer to underbid on any rival firm's bid which is larger than λP. Since firms prefer to overbid only in response to bribe offers smaller than $\frac{\bar{p}}{2} - \lambda P$, a bribe higher than $\frac{\bar{p}}{2}$ is not offered. If a firm makes a bribe offer $b \in \left(\frac{\bar{p}}{2} - \lambda P, \lambda P\right)$ it must be in response to a bribe offer higher than $\frac{\bar{p}}{2}$. However, since there are no bribe offers larger than $\frac{\bar{p}}{2}$ there are no bribe offers made in the interval $\left(\frac{\bar{p}}{2} - \lambda P, \lambda P\right)$. The support of the bribe offer distribution therefore is $\left[0, \frac{\bar{p}}{2} - \lambda P\right] \cup \left[\lambda P, \frac{\bar{p}}{2}\right]$. The equilibrium bribing strategies and profits, in this range of monitoring, are given in Proposition 3.

Proposition 3 *If $\frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P}$,*
(a) equilibrium bribing strategy for firm j is given by

$$F_j(b_j) = \begin{cases} \frac{\bar{p}+2\lambda P}{2(\bar{p}-b_j-\lambda P)} - 1 & if \ 0 \leq b_j < \frac{\bar{p}}{2} - \lambda P \\ \frac{\bar{p}+2\lambda P}{2\bar{p}} & if \ \frac{\bar{p}}{2} - \lambda P \geq b_j \geq \lambda P \\ \frac{\bar{p}+2\lambda P}{2(\bar{p}-b_j+\lambda P)} & if \ \lambda P \geq b_j \geq \frac{\bar{p}}{2} \end{cases}$$

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and,

(b) both firms make profits of $\frac{\bar{p}+2\lambda P}{4}$.

The distribution is continuous in its support. There are two mass points for each firm, one at $b=0$ and the other at $b=\frac{\bar{p}}{2}-\lambda P$. This equilibrium is also unique; it can be easily shown that the bribing strategies specified in Proposition 3 constitute Nash equilibrium. Firms do not offer bribes with probability one in this range of monitoring. As monitoring is increased, firms offer bribes with smaller probability. This happens in response to the higher amount by which firms must overbid their bribe in order to be selected with certainty. The firm profits are increasing in monitoring but at a smaller rate compared to the rate of increase in the $\lambda \leq \frac{\bar{p}}{4P}$ case. The lower bound on bribes, at zero, causes profits to increase at a slower rate. We also note that there is no discontinuity in the bribe offer distribution or the firm profits at the boundaries of this parameter space.

2.2 Agent's Selection Decision

Having described the price and bribe offer decisions in the entire range of monitoring, we now look at agent behavior. We are interested in an agent's decision to select a non-deserving firm as it is this decision that hurts the buyer. The agent does not always select a non-deserving firm when she accepts a bribe. If the difference of bribes offered by the two firms is smaller than the expected loss that the agent incurs upon selecting a non-deserving firm, the agent simply selects and accepts the bribe from the firm that is deserving. Since firms do not know if they are deserving or not, they cannot condition their bribe payments on being non-deserving. The agent selects a firm with certainty only when the bribe offers are different by more than λP. However, selecting a firm with certainty does not imply that the agent is selecting a non-deserving firm. Note that the firms are deserving with probability 0.5. We can write the probability Pr with which the agent selects a non-deserving firm as

$$Pr = \frac{1}{2} prob(|b_i - b_j| > \lambda P) \tag{3}$$

The probability Pr is computed using the equilibrium bribe distributions specified above.

We obtain the following results.

Proposition 4 *The probability with which the agent selects a non-deserving firm*
(a) is strictly positive and independent of monitoring λ, if λ is sufficiently small $(\lambda \leq \frac{\bar{p}}{4P})$,
(b) first increases and then decreases to zero at $\lambda = \frac{\bar{p}}{2P}$, when λ in increased beyond $\frac{\bar{p}}{4P}$, and
(c) is zero $\forall\ \lambda \geq \frac{\bar{p}}{2P}$.

These results are also presented graphically in Figure 2. We note two observations that were discussed earlier. First, an increase in monitoring λ increases the cost of selecting a non-deserving firm to the agent. And firms respond to higher monitoring by offering smaller or no bribes. Yet an increase in monitoring has no effect on an agent's decision to select a non-deserving firm when monitoring is sufficiently small. Even more puzzling is the increase in Pr with monitoring in the intermediate range.
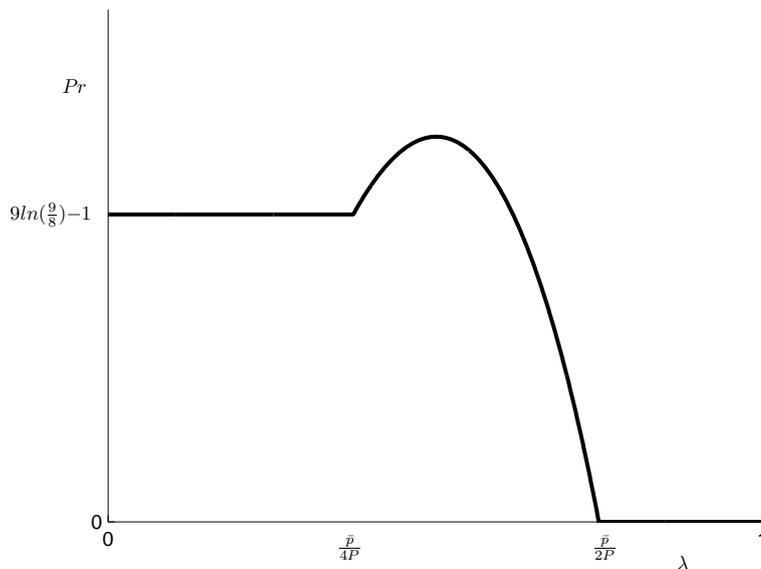
Figure 2: Probability with which the agent selects non-deserving firm as a function of monitoring

The intuition for the above results is the following. If monitoring is sufficiently small $(\lambda \leq \frac{\bar{p}}{4P})$ both firms offer strictly positive bribes with probability one. When both firms offer bribes the agent often selects the deserving firm and accepts the bribe offered by it. Since both firms offer bribes for sure in this range of monitoring the probability with which the agent selects a non-

deserving firm does not change. If monitoring probability is increased beyond $\frac{\bar{p}}{4P}$, firms become less likely to offer bribes. The agent is now faced with situations in which she receives a bribe offer only from a non-deserving firm. This makes the selection of a non-deserving firm more likely. As monitoring is further increased, firms become very unlikely to offer bribes. Therefore, the probability with which the agent selects a non-deserving firm also decreases. For a sufficiently large monitoring ($\lambda \geq \frac{\bar{p}}{2P}$), firms do not offer bribes and, therefore, the agent does not select a non-deserving firm.

Insensitivity to or increase in dishonest behavior as a result of increased monitoring, or penalty, has been widely reported in various contexts. Mazar, Amir, and Ariely (2008) find the dishonesty of test takers insensitive to monitoring. Several studies originating from Deci (1972) show in experiments that an increase in the monitoring can result in more dishonest behavior. Most related to our work is a study reported by Schulze and Frank (2003) where they show that increase in monitoring can make an agent, making a procurement decision on behalf of a principal, more dishonest as a result of monitoring. Akerlof and Dickens (1982) and Bénabou and Tirole (2006) draw on the behavioral literature and present models to derive these results. We present a rational agent model without any behavioral assumptions and show that dishonesty can be insensitive to or can even be increasing in the monitoring. This result has important implications for buyers as well as firms in markets where corruption is prevalent.

2.3   Monitoring Decision

If a firm is fit the agent finds it deserving only with probability ρ. Therefore, if the agent makes an honest decision to select the deserving firm she selects a fit firm only with probability ρ. The payoff of the buyer is v with probability ρ and zero with probability $1 - \rho$. Similarly, if the agent selects a non-deserving firm the buyer gets a payoff of v with probability $1 - \rho$ and a payoff of zero with probability ρ. The probability Pr with which the agent selects a non-deserving firm is discussed in the previous section. We can write the expected payoff of the buyer as

$$\pi_G = Pr\left[(1 - \rho)\,v\right] + (1 - Pr)\,\rho v - \bar{p} - c\,(\lambda) \tag{4}$$

We first look at $\pi_G \mid_{c(\lambda)=0}$. The expressions of Pr as given in the proof of Proposition 4 are substituted in equation (4) to get

$$\pi_G \mid_{c(\lambda)=0} \ = \ \begin{cases} \left[3\rho - 1 - 9\left(2\rho - 1\right)ln\left(\frac{9}{8}\right)\right]v - \bar{p} & if \ \lambda \leq \frac{\bar{p}}{4P} \\[2mm] \left(4\rho - 1\right)\frac{v}{2} + \frac{\bar{p}\left[\left(2\rho-1\right)v - 4\lambda P\right]}{4\lambda P} - \frac{2\left(2\rho-1\right)\lambda Pv}{\bar{p}} & if \ \frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P} \\[2mm] \quad - \frac{\left(\bar{p}+2\lambda P\right)^2\left(2\rho-1\right)v}{4\lambda^2 P^2}ln\left(\frac{\left(\bar{p}-\lambda P\right)\left(\bar{p}+2\lambda P\right)}{\bar{p}^2}\right) & \\[2mm] \rho v - p & if \ \lambda \geq \frac{\bar{p}}{4P} \end{cases} \tag{5}$$

Note that λ enters $\pi_G \mid_{c(\lambda)=0}$ only through the probability Pr with which the agent selects a non-deserving firm. It is now straightforward to understand how $\pi_G \mid_{c(\lambda)=0}$ changes with monitoring λ. For $\lambda \leq \frac{\bar{p}}{4P}$, the probability Pr does not depend on λ, therefore $\pi_G \mid_{c(\lambda)=0}$ also does not depend on λ. For $\frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P}$, the probability Pr first increases and then decreases to zero, therefore $\pi_G \mid_{c(\lambda)=0}$ first decreases and then increases to maximum value at $\lambda = \frac{\bar{p}}{2P}$. For $\lambda \geq \frac{\bar{p}}{4P}$, it stays at its maximum value which is $\rho v - \bar{p}$. These results are graphically presented in Figure 3. It is now simple to look at the buyer's choice of λ under cost of monitoring $c(\lambda)$. Buyer's payoff at zero monitoring $\pi_G(\lambda = 0)$ is $\rho v - \bar{p} - (2\rho - 1)\left[9ln\left(\frac{9}{8}\right) - 1\right]v$. Since $c(\lambda) > 0$ for every $\lambda > 0$, any monitoring $\lambda \neq 0$ for which $\pi_G \mid_{c(\lambda)=0} \leq \pi_G(\lambda = 0)$ is not optimal. Also since $c'(\lambda) > 0$, optimal λ cannot be larger than $\frac{\bar{p}}{2P}$. There is no extra benefit of increasing λ beyond $\frac{\bar{p}}{2P}$ to the buyer as the agent behaves as desired at all $\lambda \geq \frac{\bar{p}}{2P}$. Therefore, buyer chooses optimal λ from the set $\left\{0, \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right]\right\}$, where $\tilde{\lambda} \in \left(\frac{\bar{p}}{4P}, \frac{\bar{p}}{2P}\right)$ is the monitoring at which $\pi_G \mid_{c(\lambda)=0} = \pi_G(\lambda = 0)$. We see buyer as making one of the two choices. She either accepts corruption with zero anti-corruption enforcement or limits corruption, partially or fully, by setting a $\lambda \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right]$. The buyer's choice to limit the corruption or not depends on $\triangle$ which is defined as

$$\triangle \equiv \left(\pi_G - \pi_G\left(\lambda = 0\right)\right) \mid_{c(\lambda)=0} \tag{6}$$
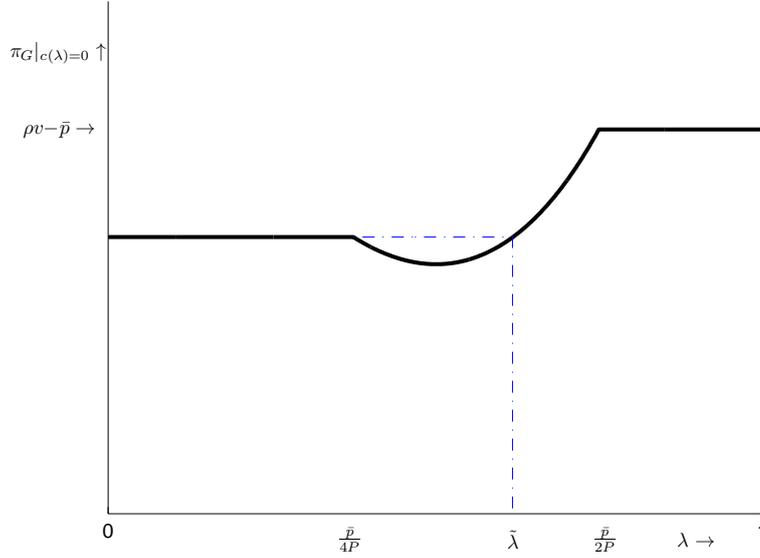
Figure 3: Buyer's payoff with monitoring (for costless monitoring)

Further examination of the $\pi_G \mid_{c(\lambda)=0}$ function leads us to the following proposition:

Proposition 5 *If $c(\lambda) > \triangle \ \forall \lambda \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right]$, the buyer allows corruption with zero anti-corruption enforcement $(\lambda^* = 0)$, else, she limits corruption by selecting a monitoring $\lambda^* \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right]$.*

The buyer sets the monitoring at either zero or at a sufficiently large value. A small monitoring does not make the buyer any better as the agent selects the non-deserving firm with the same or higher probability. A buyer selecting a positive λ expects the agent to select the non-deserving firm with a lower probability than she does when no monitoring is enforced. This happens only when $\lambda > \tilde{\lambda}$. The buyer setting a non-zero monitoring incurs a cost. If the cost is higher than the benefit that the buyer enjoys due to more honest agent behavior, the buyer sets monitoring at zero. If not, the buyer sets monitoring sufficiently large and limits corruption. In the case when the buyer allows corruption with zero anti-corruption enforcement the firms make zero profits. All the surplus is transferred to the agent in the form of bribes. However, if the buyer limits corruption firms make expected profits of $\frac{\bar{p}+2\lambda^* P}{4}$. If the buyer eliminates corruption by setting monitoring at $\frac{\bar{p}}{2P}$ the firms make expected profits of $\frac{\bar{p}}{2}$, which is the highest profit that

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the firms can make in this symmetric set-up.

We next look at the role of $c\left(\lambda = \frac{\bar{p}}{2P}\right)$, which is relevant to the analysis presented in the next section. Corruption is eradicated at the monitoring of $\lambda = \frac{\bar{p}}{2P}$. The buyer eradicates corruption only if the cost at $\lambda = \frac{\bar{p}}{2P}$ is smaller than the increase in profit the buyer enjoys as a result of honest agent behavior compared to no monitoring. This gives

$$c\left(\lambda = \frac{\bar{p}}{2P}\right) < (2\rho - 1)\left[9ln\left(\frac{9}{8}\right) - 1\right]v \qquad (7)$$

The above equation, while necessary, is not sufficient for corruption eradication. There may be a $\lambda \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right)$ that dominates eradication. While the condition $c\left(\lambda = \frac{\bar{p}}{2P}\right) > (2\rho - 1)\left[9ln\left(\frac{9}{8}\right) - 1\right]v$ implies that corruption is not eradicated, equation (7) implies that the buyer limits the corruption, partially or completely.

Buyers either choose to be ignorant or commit to take drastic measures to limit corruption. It is never optimal for the buyer to set monitoring in the interval $\left(0, \tilde{\lambda}\right)$. A small anti-corruption effort does not reduce corruption.[13] Singapore and Hong Kong were once corruption infested. However, as they implemented drastic measures to combat corruption, they have almost completely eradicated it. The efforts to limit corruption in many other emerging economies appear half-hearted. The impact on prevalence of corruption is therefore little, if any.

3   Unilateral Control

In this section, we consider that one of the firms, say firm i, as required by the law in its home country, does not offer bribes to the agent. The structure and timing of the game is exactly as in the previous section. As before both firms make a price bid of $\bar{p}$. The firm j either does not offer a bribe or it offers a bribe of λP. We assume that if firm j is indifferent between offering and not offering a bribe it does not offer a bribe. If firm j does not offer any bribe the agent selects the firm that is deserving. Both firms make an expected profit of $\frac{\bar{p}}{2}$ in this case. However, if firm j offers a bribe of λP the agent selects firm j with probability one. Any lower bribe does not make the agent select a non-deserving firm j. Any higher bribe is strictly dominated by λP. If firm j offers a bribe it makes a profit of $\bar{p} - \lambda P$ and firm i makes zero profit.

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[13]Uslaner (2008) talks about some studies indicating evidence of stickiness of corruption and its effects.

If $\lambda \geq \frac{\bar{p}}{2P}$, in equilibrium both firms offer no bribes. A possible deviation for the firm j is to offer a bribe of λP and make a profit of $\bar{p} - \lambda P$. However, given $\lambda \geq \frac{\bar{p}}{2P}$ the deviation is not more profitable than the equilibrium strategy. Similarly, if $\lambda < \frac{\bar{p}}{2P}$, firm j offers a bribe of λP in equilibrium. The buyer gets her valuation v with probability ρ if the agent selects the deserving firm, whereas she gets v only with probability $\frac{1}{2}$ if the agent selects firm j with certainty. The payoff of the buyer is

$$
\pi_G^u = \begin{cases} \rho v - \bar{p} - c\left(\lambda\right) & if\ \lambda \geq \frac{\bar{p}}{2P} \\ \frac{1}{2}v - \bar{p} - c\left(\lambda\right) & if\ \lambda < \frac{\bar{p}}{2P} \end{cases}
$$

These payoffs, assuming $c\left(\lambda\right) = 0$, are shown in Figure 4. We can now look at the buyer's decision to set monitoring.
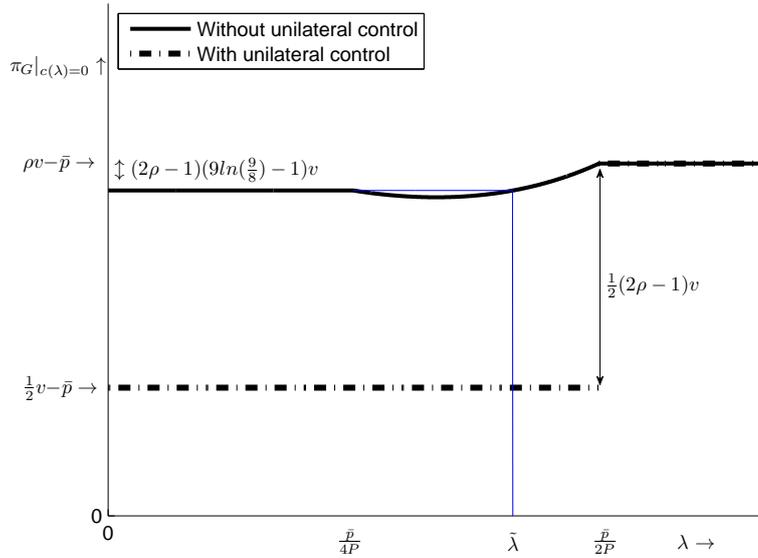
Figure 4: Buyer's payoff with monitoring with and without unilateral anti-corruption control (for costless monitoring)

The buyer either eliminates corruption by setting monitoring at $\frac{\bar{p}}{2P}$ or sets monitoring at zero. Since $c'\left(\lambda\right) > 0$, the buyer does not set any other monitoring. The buyer's decision to set monitoring depends only on the cost of monitoring at $\lambda = \frac{\bar{p}}{2P}$. If $c\left(\lambda = \frac{\bar{p}}{2P}\right) < \left(\rho - \frac{1}{2}\right)v$, the

buyer sets monitoring at $\frac{\bar{p}}{2P}$ and eliminates corruption. However, if $c\left(\lambda = \frac{\bar{p}}{2P}\right) > \left(\rho - \frac{1}{2}\right)v$, the buyer sets monitoring at zero. We ignore the equality case in which the buyer can mix between the two monitorings. A comparison of firm i's profits with and without unilateral control leads us to the following proposition:

Proposition 6 *A unilateral control on bribing on a firm in a corrupt but competitive market may increase its profits if $c\left(\lambda = \frac{\bar{p}}{2P}\right) \leq \left(9ln\left(\frac{9}{8}\right) - 1\right)(2\rho - 1)v$, would definitely increase its profits if $\left(9ln\left(\frac{9}{8}\right) - 1\right)(2\rho - 1)v < c\left(\lambda = \frac{\bar{p}}{2P}\right) < \frac{1}{2}(2\rho - 1)v$, and may decrease its profits if $c\left(\lambda = \frac{\bar{p}}{2P}\right) \geq \frac{1}{2}(2\rho - 1)v$.*

One striking result in the above proposition is that a unilateral anti-corruption control can actually benefit the firm that is being restricted from offering a bribe. A unilateral control on one firm eliminates competition in bribes. The firm that is not controlled can offer just λP and be selected with certainty. This makes the selection of a non-deserving firm by the agent more likely. The buyer may, strategically, set a higher monitoring to discourage bribery by the firm that is not controlled. This results in higher profits for a unilaterally controlled firm. A firm under unilateral control can be worse off as well. This happens if, in the absence of unilateral control, the buyer sets a non-zero monitoring, but with unilateral control the buyer sets zero monitoring. A steep increase in the cost before $\frac{\bar{p}}{2P}$ can make the elimination of corruption unattractive for the buyer. If buyer's decision to set monitoring does not change as unilateral control is introduced, the profits of the controlled firm remain unchanged.

The firm that is not controlled benefits from the unilateral control on the other firm. For the controlled firm the benefit comes as a result of the buyer setting higher monitoring. The firm that is not controlled also benefits when the buyer sets zero monitoring. Without unilateral control all the surplus was transferred to the agent in the process of competitive bribing. But with unilateral control on the other firm, a firm makes higher profits as it offers a bribe of only λP. We think that claims about competitive disadvantage faced by the controlled firm originate from this comparison where the buyer sets monitoring at zero. If the buyer sets monitoring at zero the firm that is not controlled is selected by the agent and makes higher profits than the controlled firm, which makes zero profits. However, what is not taken into consideration is that even if the unilateral control is not there the firm would still make zero profits.

The higher profits for the controlled firm results due to the buyer's choice of higher monitoring. There is some evidence of such increased monitoring. Gillespie (1987) finds evidence of this in the Middle East after 1977. It comes to us as no surprise that most empirical studies find no evidence of competitive disadvantage posed by the FCPA of 1977. We also note that the enforcement of the FCPA has increased drastically in recent years.[14] It is interesting to observe recent anti-corruption efforts in BRIC[15] countries. Brazil enacted the Freedom of Information Law of 2011, which is a step forward in the direction of reducing corruption. Russia signed the OECD's Anti-Bribery Convention in 2012. An anti-corruption movement started in India in year 2010 that seeks strong legislation and enforcement against corruption. China implemented a stricter anti-bribery law in 2011. We have no reason to believe that these efforts are only in response to the increased FCPA enforcements. However, we believe that this increase in the FCPA enforcements will make the U.S. firms better off as foreign governments take measures to limit corruption.

4   Conclusion

This paper studies competition in a corrupt market. The buyer lacks the expertise or the information needed to evaluate firms. An agent selects the firm for the buyer. This creates scope of corruption. Sometimes, the agent selects a non-deserving firm in exchange for bribes. Both the buyer and the agent are strategic. The competitive bidding behavior of the ex-ante symmetric firms is examined. A pure strategy Nash equilibrium in bribes exists only if the monitoring of the agent is sufficiently large. The expected penalty to the agent is so large that firms find it unprofitable to offer such a large bribe. The agent selects the deserving firm.

If monitoring is not sufficiently large the bribe offer equilibrium is in mixed strategies. The agent selects a non-deserving firm if its bribe offer is sufficiently larger than the bribe offer of the deserving firm. Otherwise, the agent accepts the bribe offer of the deserving firm and selects it. We find that an increase in the monitoring does not always result in more honest agent behavior. It sometimes backfires. This agent behavior originates due to the endogenous bribe offers made by firms.

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[14]According to a report published by Shearman & Sterling LLP (2012), the corporate FPCA cases increased from 14 between 2002 and 2006 to 70 between 2007 and 2011.

[15]Brazil, Russia, India and China, the major emerging economies, are collectively referred to as BRIC.

The non-monotonic agent behavior in response to changes in the monitoring, or anti-corruption efforts, makes it difficult for the buyer to reduce corruption. If bribery is prevalent, a small change in the monitoring does not reduce corruption. The buyer must take drastic measures if she wishes to curb corruption.

We find that a unilateral anti-corruption control on a firm, such as the FCPA of 1977, can result in higher profits for the controlled firm. A direct effect of the anti-corruption control is that it makes the foreign government worse off by making the selection of a non-deserving firm by the agent more likely. The foreign government may strategically set a higher monitoring. Profits of the controlled firm may increase as a result. We resolve the disconnect between the prevailing perception about the FCPA in the business community and findings of the empirical studies. Higher monitoring set by the foreign government in response to the FCPA is the key to higher profits of a controlled firm. There is some evidence of increase in anti-corruption enforcements by foreign governments in response to the FCPA.

The findings of this work have important implications for firms conducting business in emerging markets, buyers in these markets and the US government. US firms should note that the debate about the competitive disadvantage posed by the FCPA may be misplaced. Also, while governments in the emerging economies may be disinterested in reducing corruption, it is in the interest of firms to support the anti-corruption efforts. Buyers should either ignore corruption or take drastic measures to limit it. Implication for the US government is that the unilateral anti-corruption control should be aggressively enforced as it not only reduces corruption but may also increase profits of US firms. The model can be applied to various settings where an agent makes a decision, such as awarding certification, issuing permit, law enforcement or procurement, on behalf of a principal and the principal lacks the expertise or the information to make the same decision.

Appendix

Proof of Proposition 1

Profit of each firm in equilibrium is $\frac{\bar{p}}{2}$. The best possible deviation for a firm is to make a bribe offer of λP and get selected with probability one. Profit of the firm under this deviation is $\bar{p} - \lambda P$. However, deviation is not profitable given $\lambda \geq \frac{\bar{p}}{2P}$. The agent also has no profitable deviations. Hence, no bribes are offered in equilibrium.

Now, we show that there is no pure strategy Nash equilibrium for $\lambda < \frac{\bar{p}}{2P}$.

Suppose $\left(b_i^*, b_j^*\right)$ is a pair of Nash equilibrium strategies. Then there is no other b_i $(i = 1, 2)$ such that $\pi_i\left(b_i, b_j^*\right) > \pi_i^*\left(b_i^*, b_j^*\right)$. We show that such a b_i exists.

If $b_i^* = b_j^*$, any of the firms can strictly benefit by cutting the bribe offer by small ε.

If $b_i^* > b_j^*$ (the proof for $b_i^* < b_j^*$ is analogous),

Case (1) $b_i^* > b_j^* + \lambda P$

Since firm i gets selected with probability one, $\pi_i\left(b_i^*, b_j^*\right) = \bar{p} - b_i^*$.

$\exists\ \varepsilon$ such than $b_i = b_i^* - \varepsilon$ and $b_i > b_j + \lambda P$. Firm i can make larger profits by offering b_i.

Case (2) $b_i^* \leq b_j^* + \lambda P$

Agent picks firm i only when it is deserving (i.e. with probability 0.5). Equilibrium profits in this case are $\pi_i^*\left(b_i^*, b_j^*\right) = \frac{1}{2}\left(\bar{p} - b_i^*\right)$.

$\exists\ \varepsilon$ such that $b_i = b_i^* - \varepsilon$ and firm i is selected by agent whenever it is deserving. This generates strictly higher profits for the firm i.

Therefore, there is no Nash equilibrium in pure strategies.

Proof of Proposition 2

We prove Proposition 2 in following steps.

Step 1 *If firm i offers $\bar{p} - 3\lambda P$ firm j would be indifferent between overbidding and underbidding.*

Suppose firm i bids $\hat{b}_i$. Firm j can bid $\hat{b}_i + \lambda P$ (+ infinitesimally small ε) and get selected with probability one or bid $\hat{b}_i - \lambda P$ and get selected with probability $\frac{1}{2}$. Firm j would be indifferent

if

$$\frac{1}{2}\left[\bar{p}-\left(\hat{b}_i-\lambda P\right)\right] = \bar{p}-\left(\hat{b}_i+\lambda P\right)$$
$$\hat{b}_i = \bar{p}-3\lambda P$$

If $b_i > \bar{p}-3\lambda P$ firm j offers $b_j = b_i - \lambda P$, whereas if $b_i < \bar{p}-3\lambda P$ firm j offers $b_j = b_i + \lambda P$.

Step 2 $f(b_i)=0$ *for* $b_i > \bar{p}-2\lambda P$ *and for* $b_i < \bar{p}-4\lambda P$.

Suppose $b_i > \bar{p}-2\lambda P$. This can happen only if firm i offers $b_j+\lambda P$ in response to $b_j > \bar{p}-3\lambda P$. However, for any $b_j > \bar{p}-3\lambda P$, as established in Step 1, firm i responds by offering $b_j - \lambda P$. Now suppose $b_i < \bar{p}-4\lambda P$. This implies that firm i must be offering a bribe of $b_j - \lambda P$ in response to $b_j < p - \bar{3}\lambda P$. But, following Step 1, firm i should be offering $b_j + \lambda P$. Both cases lead to contradiction.

Step 3 *The equilibrium bribing strategy sets S_i^* and S_j^* are convex.*

We prove this by contradiction. Suppose there is an interval $I = \left(b^k, b^h\right)$, where $\bar{p}-4\lambda P < b^k < b^h < \bar{p}-2\lambda P$ and firm i offers $b_i \in I$ with probability zero.

CLAIM 1 *Firm j offers $b_j \in (I+\lambda P)\cup(I-\lambda P)$ with probability zero.*

(a) If $b^h \leq \bar{p}-3\lambda P$, $f(b_j)=0$ for $b_j \in I - \lambda P$ (from Step 2)

Suppose firm j offers $b' \in I+\lambda P$ with positive probability. Since $f(b_i)=0$ for $b_i \in I$, firm j can offer $inf\ (I+\lambda P)$ and make higher profit than offering any $b' \in I+\lambda P$. Therefore, $f(b_j)=0$ for $b_j \in (I+\lambda P)\cup(I-\lambda P)$.

(b) Now if $b^k > \bar{p}-3\lambda P$, $f(b_j)=0$ for $b_j \in I + \lambda P$ (from Step 2)

Suppose firm j offers $b' \in I-\lambda P$ with positive probability. Since $f(b_i)=0$ for $b_i \in I$, firm j can offer $inf\ (I-\lambda P)$ and make higher profit than offering any $b' \in I-\lambda P$. Therefore, $f(b_j)=0$ for $b_j \in (I+\lambda P)\cup(I-\lambda P)$.

(c) Lastly, if $b^h > \bar{p}-3\lambda P > b^k$, firm j will be better off offering $inf\ (I+\lambda P)$ instead of any $b_j \in (I+\lambda P)$. If $b_j \in (I-\lambda P)$, since $f(b_i)=0$ for $b_j < \bar{p}-4\lambda P$, it must be that $b_j \in [\bar{p}-4\lambda P, b^h - \lambda P)$. Note that, $\forall\ b_i < b^k$ firm j prefers to make a bribe offer $b_j = b_i + \lambda P > \bar{p}-3\lambda P$, and $\forall\ b_i > b^h$ firm j prefers to make a bribe offer $b_j = b_i - \lambda P > b_h - \lambda P$. Therefore, given $b_i \notin I$ and firm j offers $b_j \in [b^h - \lambda P, b_k + \lambda P]$.

Therefore, $f(b_j)=0$ for $b_j \in (I+\lambda P)\cup(I-\lambda P)$.

CLAIM 2 *Firm i offering $b_i \in I$ with probability zero and firm j offering $b_j \in (I+\lambda P)\cup$*

$(I - \lambda P)$ *with probability zero constitutes a contradiction.*

Let us represent $\tilde{b} \equiv \inf\left(b > b^h\right)$.

Using equation (1), we can write

$$
\begin{aligned}
\pi_i\left(\tilde{b}\right) &= \left[F_j\left(\tilde{b} + \lambda P\right) + F_j\left(\tilde{b} - \lambda P\right) - \omega_j\left(\tilde{b} - \lambda P\right)\right]\frac{\bar{p} - \tilde{b}}{2} \\
\pi_i\left(b^k\right) &= \left[F_j\left(b^k + \lambda P\right) + F_j\left(b^k - \lambda P\right) - \omega_j\left(b^k - \lambda P\right)\right]\frac{\bar{p} - b^k}{2}
\end{aligned}
$$

But since $F_j\left(\tilde{b} + \lambda P\right) = F_j\left(b^k + \lambda P\right)$, $F_j\left(\tilde{b} - \lambda P\right) = F_j\left(b^k - \lambda P\right)$ and $\omega_j\left(b^k - \lambda P\right) = 0$, profit of firm i when offering b^k is strictly higher than offering $\tilde{b}$ contradicting the assumption of an equilibrium.

Step 4 *There can be a mass point in the bribe distribution of a firm only at $b = \bar{p} - 3\lambda P$.*

Suppose firm j has a mass point at $b^* \in [\bar{p} - 4\lambda P, \bar{p} - 3\lambda P)$ equal to ω.

We can write

$$
\begin{aligned}
\pi_i\left(b^* + \lambda P + \varepsilon\right) &= \left[F_j\left(b^* + 2\lambda P + \varepsilon\right) + F_j\left(b^* + \varepsilon\right) - \omega_j\left(b^* + \varepsilon\right)\right]\frac{\bar{p} - \left(b^* + \lambda P + \varepsilon\right)}{2} \\
\pi_i\left(b^* + \lambda P - \varepsilon\right) &= \left[F_j\left(b^* + 2\lambda P - \varepsilon\right) + F_j\left(b^* - \varepsilon\right) - \omega_j\left(b^* - \varepsilon\right)\right]\frac{\bar{p} - \left(b^* + \lambda P - \varepsilon\right)}{2}
\end{aligned}
$$

Subtracting 2nd equation from 1st we get

$$
\begin{aligned}
\pi_i\left(b^* + \lambda P + \varepsilon\right) - \pi_i\left(b^* + \lambda P - \varepsilon\right) &= \frac{\bar{p} - \left(b^* + \lambda P\right)}{2}\left[F_j\left(b^* + 2\lambda P + \varepsilon\right) - F_j\left(b^* + 2\lambda P - \varepsilon\right)\right. \\
&\quad \left. + F_j\left(b^* + \varepsilon\right) - F_j\left(b^* - \varepsilon\right) - \omega_j\left(b^* + \varepsilon\right) + \omega_j\left(b^* - \varepsilon\right)\right] \\
&\quad - \frac{\varepsilon}{2}\left[F_j\left(b^* + 2\lambda P + \varepsilon\right) + F_j\left(b^* + \varepsilon\right) - \omega_j\left(b^* + \varepsilon\right)\right. \\
&\quad \left. + F_j\left(b^* + 2\lambda P - \varepsilon\right) + F_j\left(b^* - \varepsilon\right) - \omega_j\left(b^* - \varepsilon\right)\right]
\end{aligned}
$$

For small enough $\varepsilon > 0$,

$$
\pi_i\left(b^* + \lambda P + \varepsilon\right) - \pi_i\left(b^* + \lambda P - \varepsilon\right) > 0
$$

and firm i by shifting some density from bottom to top of $b^* + \lambda P$ can be strictly better off. So there can not be a mass point at $b^* \in [\bar{p} - 4\lambda P, \bar{p} - 3\lambda P)$.

Now suppose firm j has a mass point at $b^* \in (\bar{p} - 3\lambda P, \bar{p} - 2\lambda P]$.

As before, we get

$$\pi_i \left(b^* - \lambda P + \varepsilon \right) - \pi_i \left(b^* - \lambda P - \varepsilon \right) > 0$$

for small enough ε. Therefore, there cannot be a mass point in this range as well.

From above it is clear that firm j (and by the same argument firm i also) can have mass point only at $b^* = \bar{p} - 3\lambda P$.

Step 5 *Equilibrium profits for both firms are $\frac{3\lambda P}{2}$.*

Firm i is playing a mixed strategy so it must be indifferent between offering any bribe in it's support including $b_i = \bar{p} - 3\lambda P$. Profit for firm i can be written using equation (1) as

$$\pi_i \left(\bar{p} - 3\lambda P \right) \;=\; \left[F_j \left(\bar{p} - 2\lambda P \right) + F_j \left(\bar{p} - 4\lambda P \right) - \omega_j \left(\bar{p} - 4\lambda P \right) \right] \frac{\bar{p} - \left(\bar{p} - 3\lambda P \right)}{2}$$

which simplifies to $\pi_i = \frac{3\lambda P}{2}$. Proof for firm j is similar.

Step 6 *Both firms have mass points at $b = \bar{p} - 3\lambda P$.*

Suppose $\omega_j \left(\bar{p} - 3\lambda P \right) = 0$. Using equation (1), we can write

$$\begin{aligned}
\pi_i \left(\bar{p} - 2\lambda P \right) &= \left[F_j \left(\bar{p} - \lambda P \right) + F_j \left(\bar{p} - 3\lambda P \right) - \omega_j \left(\bar{p} - 3\lambda P \right) \right] \frac{\bar{p} - \left(\bar{p} - 2\lambda P \right)}{2} \\
&= \left[1 + F_j \left(\bar{p} - 3\lambda P \right) \right] \lambda P
\end{aligned}$$

But from Step 5, $\pi_i = \frac{3\lambda P}{2}$. Therefore, $F_j \left(\bar{p} - 3\lambda P \right) = \frac{1}{2}$.

Now again using equation (1), we write

$$\begin{aligned}
\pi_i \left(\bar{p} - 4\lambda P \right) &= \left[F_j \left(\bar{p} - 2\lambda P \right) + F_j \left(\bar{p} - 5\lambda P \right) - \omega_j \left(\bar{p} - 5\lambda P \right) \right] \frac{\bar{p} - \left(\bar{p} - 4\lambda P \right)}{2} \\
&= F_j \left(\bar{p} - 3\lambda P \right) 2\lambda P
\end{aligned}$$

Substituting $F_j \left(\bar{p} - 3\lambda P \right)$, we get $\pi_i = \lambda P$. We got a contradiction. The proof for firm i is identical.

Step 7 *Both firms have point mass of $\frac{1}{4}$ at $b = \bar{p} - 3\lambda P$.*

Using equation (1), we can write

$$
\begin{aligned}
\pi_i \left(\bar{p} - 2\lambda P \right) &= \left[1 + F_j \left(\bar{p} - 3\lambda P \right) - \omega_j \left(\bar{p} - 3\lambda P \right) \right] \frac{\bar{p} - \left(\bar{p} - 2\lambda P \right)}{2} \\
&= \left[1 + F_j \left(\bar{p} - 3\lambda P \right) - \omega_j \left(\bar{p} - 3\lambda P \right) \right] \lambda P
\end{aligned}
$$

similarly,

$$
\pi_i \left(\bar{p} - 4\lambda P \right) = F_j \left(\bar{p} - 3\lambda P \right) 2\lambda P
$$

Using the result from Step 5, we solve two equations to get $F_j \left(\bar{p} - 3\lambda P \right) = \frac{3}{4}$, and $\omega_j \left(\bar{p} - 3\lambda P \right) = \frac{1}{4}$. The proof for firm i is identical.

Step 8 *Equilibrium bribing strategy for firm j is given by*

$$
F_j(b_j) = \begin{cases} \frac{3\lambda P}{\bar{p} - b_j - \lambda P} - 1 & if \ \bar{p} - 4\lambda P \le b_j < \bar{p} - 3\lambda P \\ \frac{3\lambda P}{\bar{p} - b_j + \lambda P} & if \ \bar{p} - 2\lambda P \ge b_j \ge \bar{p} - 3\lambda P \end{cases}
$$

Using equation (1) and Step 5, we can write

$$
\left[F_j \left(b_i - \lambda P \right) + F_j \left(b_i + \lambda P \right) - \omega_j \left(b_i - \lambda P \right) \right] \frac{\bar{p} - b_i}{3\lambda P} = 1
$$

Using above equation and the results from Step 2 and Step 7, we can write

$$
\begin{aligned}
F_j \left(b_i + \lambda P \right) &= \frac{3\lambda P}{\bar{p} - b_i} & if \ b_i \le \bar{p} - 3\lambda P \\
F_j \left(b_i - \lambda P \right) &= \frac{3\lambda P}{\bar{p} - b_i} - 1 & if \ \bar{p} - 2\lambda P > b_i \ge \bar{p} - 3\lambda P \\
F_j \left(b_i - \lambda P \right) &= \frac{3}{4} & if \ b_i = \bar{p} - 2\lambda P
\end{aligned}
$$

Applying appropriate transformations to above three equations proves Step 8.

Proof of Proposition 3

Since the proof of Proposition 3 is similar to that of proposition 2, we only provide the steps here.

Step 1 If a firm makes a bribe offer of $\frac{\bar{p}}{2} - \lambda P$ the other firm will be indifferent between offering a bribe higher by λP and offering no bribe. It prefers to overbid on smaller offers. This holds given $\lambda \geq \frac{\bar{p}}{4P}$.

Step 2 If a firm makes a bribe offer $b \geq \lambda P$ the other firm prefers to offer $b - \lambda P$. This also holds given $\lambda \geq \frac{\bar{p}}{4P}$.

Step 3 $f(b) = 0$ for $b > \frac{\bar{p}}{2}$ and for $b \in \left(\frac{\bar{p}}{2} - \lambda P, \lambda P\right)$.

Step 4 There are no holes in the interval $\left[0, \frac{\bar{p}}{2} - \lambda P\right]$ and in the interval $\left[\lambda P, \frac{\bar{p}}{2}\right]$.

Step 5 There is no density at $b = \lambda P$ for both firms. Because, if there is firms can strictly benefit by moving density from $b = \lambda P$ to $b = \frac{\bar{p}}{2} - \lambda P$.

Step 6 Both firms make profits of $\frac{\bar{p} + 2\lambda P}{4}$. This is obtained by evaluating equation (1) at $b = \frac{\bar{p}}{2} - \lambda P$.

Step 7 There is a mass point of $\frac{4\lambda P - \bar{p}}{2(\bar{p} - \lambda P)}$ at $b = 0$ and a mass point of $\frac{\bar{p} - 2\lambda P}{2\bar{p}}$ at $b = \frac{\bar{p}}{2} - \lambda P$ for both firms.

Step 8 Using equation (1) and Step 6 we can write

$$\left[F_j(b_i - \lambda P) + F_j(b_i + \lambda P) - \omega_j(b_i - \lambda P)\right] \frac{2(\bar{p} - b_i)}{\bar{p} + 2\lambda P} = 1$$

Using Step 2, Step 7, above equation and applying appropriate transformations we get the *cdf* given in Proposition 3.

Proof of Proposition 4

(a) $\lambda \leq \frac{\bar{p}}{4P}$ case

Using equation (3), we can write Pr as

$$
\begin{aligned}
Pr &= \frac{1}{2} \int_{\bar{p}-4\lambda P}^{\bar{p}-3\lambda P} \left[1 - F_j(b_i + \lambda P)\right] f_i(b_i)\, db_i + \frac{1}{2} \int_{\bar{p}-3\lambda P}^{\bar{p}-2\lambda P} \left[F_j(b_i - \lambda P)\right] f_i(b_i)\, db_i \\
&= \frac{1}{2} \int_{\bar{p}-4\lambda P}^{\bar{p}-3\lambda P} \left(1 - \frac{3\lambda P}{\bar{p} - b_i}\right) \frac{3\lambda P}{(\bar{p} - b_i - \lambda P)^2}\, db_i + \frac{1}{2} \int_{\bar{p}-3\lambda P}^{\bar{p}-2\lambda P} \left(\frac{3\lambda P}{\bar{p} - b_i} - 1\right) \frac{3\lambda P}{(\bar{p} - b_i + \lambda P)^2}\, db_i
\end{aligned}
$$

where $f_i(b_i)$ is the *pdf* of the bribe offer and is obtained by differentiating the *cdf* described in Proposition 2. Simplifying the above equation we get $Pr = 9\,ln\left(\frac{9}{8}\right) - 1$.

(b) $\frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P}$ case

Using equation (3), we can write Pr as

$$
\begin{aligned}
Pr \;=\; & \frac{1}{2}\Bigg[\omega_i(0)\left[1 - F_j(\lambda P)\right] + \int_0^{\frac{\bar{p}}{2}-\lambda P}\left[1 - F_j(b_i + \lambda P)\right]f_i(b_i)\,db_i \\
& + \int_{\lambda P}^{\frac{\bar{p}}{2}}\left[F_j(b_i - \lambda P)\right]f_i(b_i)\,db_i\Bigg] \\
\;=\; & \frac{1}{2}\Bigg[\frac{4\lambda P - \bar{p}}{2(\bar{p} - \lambda P)}\left(1 - \frac{\bar{p} + 2\lambda P}{2\bar{p}}\right) + \int_0^{\frac{\bar{p}}{2}-\lambda P}\left(1 - \frac{\bar{p} + 2\lambda P}{2(\bar{p} - b_i)}\right)\frac{\bar{p} + 2\lambda P}{2(\bar{p} - b_i - \lambda P)^2}\,db_i \\
& + \int_{\lambda P}^{\frac{\bar{p}}{2}}\left(\frac{\bar{p} + 2\lambda P}{2(\bar{p} - b_i)} - 1\right)\frac{\bar{p} + 2\lambda P}{2(\bar{p} - b_i + \lambda P)^2}\,db_i\Bigg]
\end{aligned}
$$

where *pdf* is obtained by differentiating the *cdf* described in Proposition 3. Simplifying the above expression gives

$$
Pr = -\frac{(\bar{p} - 2\lambda P)(\bar{p} + 4\lambda P)}{2\bar{p}\lambda P} + \frac{(\bar{p} + 2\lambda P)^2}{2\lambda^2 P^2}ln\left(\frac{(\bar{p} + 2\lambda P)(\bar{p} - \lambda P)}{\bar{p}^2}\right) \tag{8}
$$

It is straightforward to check that

$$
Pr\left(\lambda = \frac{\bar{p}}{4P}\right) = 9\,ln\left(\frac{9}{8}\right) - 1 \quad ; \qquad Pr\left(\lambda = \frac{\bar{p}}{2P}\right) = 0
$$

and,

$$
\frac{\partial Pr}{\partial \lambda}\,|_{\lambda = \frac{\bar{p}}{4P}} > 0 \quad ; \qquad \frac{\partial Pr}{\partial \lambda}\,|_{\lambda = \frac{\bar{p}}{2P}} < 0
$$

The maxima of the Pr function is numerically calculated. It is found to be at $\lambda \simeq \frac{\bar{p}}{3P}$.

(c) $\lambda \geq \frac{\bar{p}}{2P}$ case

Firms do not offer bribes if monitoring is sufficiently large ($\lambda \geq \frac{\bar{p}}{2P}$). The agent, therefore,

does not select a non-deserving firm. The probability Pr is zero in this range.

Proof of Proposition 5

From equation (5), $\triangle$ is zero for $\lambda \leq \frac{\bar{p}}{4P}$. If $\frac{\bar{p}}{4P} \leq \lambda \leq \frac{\bar{p}}{2P}$, substituting the expressions of $\pi_G \mid_{c(\lambda)=0}$ and $\pi_G (\lambda = 0) \mid_{c(\lambda)=0}$ from equation (5) to equation (6) we get

$$\triangle = \left[\frac{\left[\bar{p}^2 - 8\lambda^2 P^2 + 2\bar{p}\lambda P\left(18 ln\left(\frac{9}{8}\right) - 1 \right)\right]}{4\bar{p}\lambda P} - \frac{(\bar{p}+2\lambda P)^2}{4\lambda^2 P^2} ln\left(\frac{(p-\lambda P)(\bar{p}+2\lambda P)}{\bar{p}^2} \right) \right] (2\rho - 1)\, v$$

The difference $\triangle$ is negative for all $\lambda \in \left(\frac{\bar{p}}{4P}, \tilde{\lambda} \right)$. It is zero at $\lambda = \tilde{\lambda}$ and increases to $\left(9 ln\left(\frac{9}{8}\right) - 1 \right) (2\rho - 1)\, v$ at $\lambda = \frac{\bar{p}}{2P}$.

In the range $\lambda \geq \frac{\bar{p}}{2P}$, it can be shown using equation (5) that $\triangle$ stays at $\left(9 ln\left(\frac{9}{8}\right) - 1 \right) (2\rho - 1)\, v$. The buyer would, therefore, set a λ only from the set $\left\{ 0, \left(\tilde{\lambda}, \frac{\bar{p}}{2P} \right] \right\}$. Since $\triangle$ the extra benefit of setting a non-zero λ, a cost of monitoring higher than $\triangle$ would discourage the buyer from setting that λ. If it is the case for all $\lambda \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P} \right]$ the buyer sets the monitoring at zero. If $c(\lambda) < \triangle$ for some $\lambda \neq 0$, the buyer sets a non-zero λ which maximizes her payoff.

Proof of Proposition 6

Note that the difference in buyer's payoff, when setting $\lambda = \frac{\bar{p}}{2P}$ and when setting $\lambda = 0$, is given by $\left(9 ln\left(\frac{9}{8}\right) - 1 \right) (2\rho - 1)\, v$ if there no unilateral control on firm i. It is given by $\frac{1}{2} (2\rho - 1)\, v$ if the firm i is unilaterally controlled. We now look at the three cases.

(a) $c\left(\lambda = \frac{\bar{p}}{2P} \right) \leq \left(9 ln\left(\frac{9}{8}\right) - 1 \right) (2\rho - 1)\, v$ case

The profits of firm i under unilateral control is $\frac{\bar{p}}{2}$. In the absence of the unilateral control firm i's profit is $\frac{\bar{p}+2\lambda^* P}{4}$, where $\lambda^* \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P} \right]$. The maximum profit of firm i in absence of unilateral control could be $\frac{\bar{p}}{2}$ if $\lambda^* = \frac{\bar{p}}{2P}$. Therefore, in this range of cost curves the profit for firm i as a result of unilateral control on bribes will either not change or increase. It can not decrease.

(b) $\left(9 ln\left(\frac{9}{8}\right) - 1 \right) (2\rho - 1)\, v < c\left(\lambda = \frac{\bar{p}}{2P} \right) < \frac{1}{2} (2\rho - 1)\, v$ case

The firm i still makes $\frac{\bar{p}}{2}$ under unilateral control since buyer eliminates corruption. However, if there is no unilateral control in this range of cost curves the buyer does not find it optimal to

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completely eliminate corruption resulting in profits of strictly lower than $\frac{\bar{p}}{2}$. Here, the controlled firm strictly benefits as a result of unilateral control.

(c) $c\left(\lambda = \frac{\bar{p}}{2P}\right) \geq \frac{1}{2}\left(2\rho - 1\right)v$ case

The firm i makes zero profits under unilateral control. In the absence of the unilateral control the buyer does not find it optimal to completely eliminate corruption. However, for cost curve that become very steep as they approach $\lambda = \frac{\bar{p}}{2P}$ the buyer might find it optimal to set a $\lambda \in \left(\tilde{\lambda}, \frac{\bar{p}}{2P}\right)$. Therefore, in this case the controlled firm will either make the same or lower but not higher profits compared to if it was not controlled.

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