Intermediaries and Corruption

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Abstract
Surveys of businessmen and anecdotal evidence blame intermediary agents---middlemen hired by corporations and individuals---for increasing corruption in the developing world. Although this problem has gained the attention of policy makers, there has been little formal analysis of it in the economics literature. In a game theoretic model analyzing the interaction between clients, public official and intermediary agents, we find that intermediary agents do worsen the impact of corruption and that traditional methods of fighting corruption can actually increase corruption in the presence of intermediary agents.

JEL classification: D73, K42, L14, O17

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1 Introduction

Despite the widespread introduction of laws against bribery for international businesses, financial corruption remains a serious problem. In a survey of business development directors of 50 US and 50 European companies, an overwhelming majority of those surveyed stated that US companies used middlemen such as agents, joint venture partners or foreign subsidiaries to avoid direct involvement with corruption either 'regularly' or 'occasionally' (Control Risks Group, Information Services Team [6]). There is also plenty of anecdotal evidence which blames intermediary agents—middlemen hired by corporations and individuals—for increasing corruption in the developing world (Wiehen [18]). Although this problem has gained the attention of policy makers and non-governmental organizations there has been little formal analysis of it in the economics literature.

What are the effects of intermediary agents on corruption? Do the solutions to the corruption problem change in the presence of intermediaries? In this paper, we develop a simple model that captures the effect of key policy variables that are used to fight corruption. We then examine how the presence of intermediary agents change the amount of corruption and the effectiveness of policy variables in fighting corruption. We show that intermediaries worsen the impact of corruption and make it impossible to eradicate corruption using traditional techniques. In fact standard techniques like increasing monitoring or penalties can worsen the impact of corruption. Methods that do not consider the impact of intermediaries are unlikely to succeed.

Several authors have pointed out that intermediary agents may enable corruption by acting as guarantors in the dealing between client and bureaucrat (Bayar [3], Lambsdorff [10], Oldenburg [15], della Porta and Vanucci [16]). There are important transaction costs, including the costs of searching for partners, determining contract conditions and enforcing contract terms, in any corrupt business deal. Intermediary agents can lower transaction costs of a corrupt deal by providing information to potential clients with respect to the capability of the bureaucrat to actually provide the required service (Lambsdorff [10]). When there is the possibility that the bribed officials may not deliver the promised services due to either inability or unwillingness, an established intermediary agent with superior knowledge about the trustworthiness and ability of the bureaucrat to complete the corrupt transaction can be essential. Unlike the actual supplier of a corrupt service, an intermediary may be in a position to publicly disclose her past record and establish a reputation for getting deals done. Her repeated relationship with the bureaucrat can induce cooperation from the bureaucrat to complete the corrupt transaction. We incorporate these ideas to our model by allowing that a bribed official may not always deliver the "goods" when interacting with a client directly but always keeps his promise if an intermediary is involved.

To our knowledge ours is one of the first papers that analyze the effects of intermediary agents on corruption by developing a formal theoretical model. Bayar presents a preliminary model which makes some strong simplifying assumptions. For example she assumes that if there are intermediaries then bureaucrats will only ask for bribes from intermediary agents. This is contradicted by casual empiricism. We often observe that some clients pay bribes directly while others use intermediaries. We believe that such an outcome should be an implication of equilibrium and not a modelling assumption. In the equilibrium of our model it is very common for some clients to offer bribes directly to the bureaucrat while others choose to hire intermediary agents. In fact optimal government policy will make this even more common.

In this paper we are purely focusing on reducing corruption. We assume that there is some optimal level of regulation set by the government and clients (individuals or firms) may be willing to pay bribes to circumvent this regulation. We show that intermediaries do decrease the quantity of regulation, as expected, but do not actually change the number of bribes paid to bureaucrats. Interestingly a wide variety of techniques used by governments might worsen corruption in the presence of intermediaries. Not only increasing penalties and monitoring, but also steps such as rotating bureaucrats in order to prevent entrenchment or requiring signatures from multiple bureaucrats in order to limit their discretionary power may result in reduced regulation.

There is a strand in the corruption literature suggesting that in the context of pervasive and cumbersome regulations in developing countries, corruption may actually improve efficiency and help growth (Leff, [12]). For example, if corruption is considered as speed money which reduces delay in moving files in administrative offices and in getting ahead in slow-moving queues, one can argue that corruption may improve efficiency. Critiques of this literature point out that quite often distortions are not exogenous to the system and are instead often part of the built-in corrupt practices of a patron-client political system (Bardhan [2]). As for speed money, Myrdal [13] points out that corrupt officials may instead of speeding up, actually cause administrative delays in order to attract more bribes. Banerjee [1] examines situations where bureaucrats create red tape and use it to screen clients of different types. Recent empirical studies have shown that the extent of corruption is significantly linked to paucity of GDP growth [14].

In this paper we are going to sidestep the argument that corruption may increase efficiency if there is excessive regulation. We will assume that regulation is justified and corruption is undesirable. The optimal level of regulation is not zero. We need regulations to enforce legal rights, administer quality standards, solve problems arising from negative externalities of production and exchange and prevent tax evasion. Is increasing fines and penalties for corrupt behavior the solution to the corruption problem? Will moving bureaucrats around the country help reduce entrenchment of corrupt actors? Of course the interested reader could easily take the opposite position that corruption improves efficiency and still benefit from our analysis.

There is some empirical evidence that investors' confidence is not only adversely affected by corruption but also by the lack of predictability and confidence that accompanies corrupt deals (Campos, Lien and Pradhan [4], Kaufmann and Wei [9]). Based on this evidence one could argue that intermediary agents might increase investors' confidence by increasing the predictability and reliability of corrupt deals. Lambsdorff [11] provides evidence to the contrary and in a cross-country study shows that confidence in corrupt deals enhances the further spread of corruption.

In the next section, we present our formal model. Section 3 presents the equilibrium without intermediaries. Section 4 presents the equilibrium in the presence of intermediary agents. In section 5, we discuss whether solutions to the corruption problem change when intermediaries are present. In section 6 we discuss several extensions and modifications of our basic model, and section 7 concludes.

2 Model

In this paper, the term corruption refers to the use of public office for private gains, where a bureaucrat entrusted with carrying out a task by the public engages in some sort of malfeasance for private enrichment which is difficult to monitor by the public. Specifically a corrupt bureaucrat can reduce the efficient level of regulation in exchange for a bribe.

In any model of this sort one will have three primary types of players. First is the *client*—the individual or the corporation that is subject to a bureaucratic regulation, second must be the *bureaucrat* who is responsible of administering the regulation and making sure that each client complies with it. Third is the *intermediary*—an entity that the client can hire to deal with the bureaucrat on her behalf. The bureaucrat will have monopoly power since clients must satisfy the regulations. There will be a large number of clients—technically a continuum. Since the market for intermediaries is informal—generally without government license or even recognition—and without high fixed costs we assume that this market is competitive. In Section 4.1 we discuss the impact of altering this assumption.

Before the interaction the bureaucrat sets two bribe levels—the amount they demand from a client who comes directly and the amount they demand from intermediaries. One can think of this as clients and intermediaries knowing these amounts based on past interactions, but formally this is the first stage in our extensive form game. Then the intermediary determines his fees, and the client's type is determined. Next, the client decides whether or not to use the intermediary and finally either the intermediary (if used) or the client (if intermediary is not used) decides whether or not to bribe the bureaucrat.

Clients will have a marginal opportunity cost of the regulations $\theta \in \left[\underline{\theta}, \overline{\theta}\right]$ where $0 \leq \underline{\theta} < \overline{\theta}$ with a cumulative distribution function $G(\cdot)$ (which is differentiable and has an increasing hazard rate[1]). We can interpret this difference in opportunity costs of regulations as if regulations are more difficult to meet for less worthy clients. For simplicity we normalize the mass of clients to one. A client who has to go through a level of regulation r and pay fees of t then has a utility:

$$U(\theta, r, t) = v - \theta r - t \tag{1}$$

where v is value of service, $r \in \{r_l, r^*\}$. The level r^* is the optimal regulation the government wants the client to face, and r_l is the level the bureaucrat can decrease it to if he wishes; let $\Delta = r^* - r_l > 0$. We assume that $v > \overline{\theta} r^*$ or that it is always worthwhile getting the service. In the case of indifference clients will offer bribes and use intermediaries.

The intermediary's payoff then is:

$$u_I = \begin{cases} t - c & \text{if services are used.} \\ t & \text{else} \end{cases}$$

Where t is the amount of transfers paid and received, and c is the opportunity cost of using the intermediary. Notice that $c < 0$ is allowed, what this means is that while the intermediary does have direct costs—her time and expenses—through her knowledge of the regulations she saves clients so much that it is cost effective to use the intermediary. Remember that a common justification for using intermediaries is that they know the bureaucracy better, thus it is quite possible that the opportunity cost of using them is negative. Formally one should recognize that the price an intermediary charges for her services in our model is the *opportunity cost price* for the client.

[1] It is standard to assume that hazard rate (defined as $\frac{g(\theta)}{1-G(\theta)}$) is increasing. This property is satisfied by normal, uniform and most other common distributions.

Since in this paper we are discussing the impact of intermediaries it does not make sense to consider the situation where intermediaries are not viable. To avoid this situation we assume that $c < \bar{\theta}\Delta$. What this assumption means is that it is not cost prohibitive for the highest type to use the intermediary in return for a lower level of regulation. Also notice how weak of an assumption this is, if we think of Δ as a period of time it will take to satisfy the regulations then this is equivalent to assuming that the highest wage individual can always find someone who will work for less. One might want to consider c as a function of Δ, we will consider this extension in Section 6.1.

The bureaucrat has a simple profit function, just $\Pi = t$, where t is the amount the bureaucrat is paid for being bribed. We should note that some bureaucrats might be honest and never offer bribes, and also that this bureaucrat is paid a salary which we normalize to zero.

Both bureaucrats and clients have reasons to prefer intermediaries as stated in the following two assumptions:

Assumptions Bureaucrats bribed by:

1. Clients do not always "stay bribed," i.e., sometimes they do not reduce the level of regulations.
2. Intermediaries always "stay bribed" and are never caught.

The reason for these assumptions is based on the repeated nature of the interaction between an intermediary and a bureaucrat. A client generally only wants a service once, thus after being bribed it might be easier for the bureaucrat to just take the money without reducing the amount of regulation. In other words, a bureaucrat faces a moral hazard problem since his relationship with the client is a one shot interaction. On the other hand an intermediary will have a repeated relationship with the bureaucrat, requiring the service multiple times on behalf of different clients, thus it would not be sensible for the bureaucrat to renege on the deal. As Lambsdorff [10] argues the intermediary may act as the guarantor of the deal. Technically the first assumption means that clients who bribe bureaucrats directly face regulation level r_l with probability $\eta \in (0, 1)$, with probability $1 - \eta$ they face regulation level r^*. If a client uses an intermediary to pay a bribe then the regulation level is r_l.

The assumption that bureaucrats bribed by an intermediary can not be caught is based on the government needing the briber's testimony to convict a bureaucrat. As Lambsdorff [10] argues bureaucrats prefer dealing with intermediaries to avoid the risk of exposure from corrupt deals. Formally we assume that the government investigates each bureaucrat-client interaction with probability ρ, and if it finds that regulation level is reduced to r_l and that a bribe has been paid it fines the bureaucrat by the amount F.[2] If the government only discovers that regulation level is reduced without finding evidence that a bribe has been paid, this is not sufficient to find a bureaucrat guilty

[2] F can also be considered as jail time or lost wages.

of corruption—such an outcome might be the result of an honest mistake. Hence the government requires evidence on bribery and corruption which only the client or intermediary can provide. It is fairly simple to design an incentive scheme for truthful testimony from the client. We will assume that according to this incentive scheme, the cost of her regulation will not change as a reward for truthful testimony. On the other hand it is unlikely that the intermediary will testify against her partner in crime. Due to the repeated nature of her business with the bureaucrat an intermediary agent is a lot more vested in the continuance of this relationship than the client. An intermediary agent which blows the whistle on the bureaucrat essentially looses his job. Thus intermediaries never testify, and bureaucrats who are bribed by intermediaries have nothing to fear from the government. Also clients who use intermediaries will never testify since as far as they are concerned they pay a fee to the intermediary and not a bribe to the bureaucrat. Hence our second assumption indicates that for a bureaucrat to be caught he must have reduced the level of regulations and have been bribed directly by a client.

Notice that this model could easily be modified so that the client only sometimes confesses when she bribes the bureaucrat directly. We could also allow for the possibility that intermediaries sometimes confess, however since they generally exist in an informal sector they have little incentive for this. We think that confession is possible only if government regulates this industry and discuss this possibility in Section 6.2.

The bureaucrat will choose two bribe levels, one for clients who use the intermediary (b_i) and one for people who come direct (b_d), $\{b_d, b_i\} \in \left\{\left[0, \overline{\theta}\Delta\right] \cup \emptyset\right\}^2$. If a bribe is $\emptyset$ then no bribe is asked. If the client pays no bribe the regulation level is r^*.

Monitoring bureaucracy ρ, fines on corrupt officials F, bureaucrat's trustworthiness η, and his discretionary power Δ are the policy variables that we will focus on in our analysis. To fight corruption, governments may investigate more cases (increase ρ), increase the penalties for bureaucrats who are caught (raise F), limit bureaucrats' discretionary power (decrease Δ) by for example requiring signatures from multiple officials and reduce bureaucrats' trustworthiness (decrease η) by preventing entrenchment through periodic job rotation. We are interested in analyzing the effects of these policy variables on the quantity of regulation and corruption with or without the presence of intermediary agents.

3 The Equilibrium without Intermediaries

We now present our base case which is the equilibrium without any intermediaries. The profit function of the bureaucrat in this case is:

$$\Pi(b_d,\theta_d) = \begin{cases} (b_d - \eta\rho F)(1 - G(\theta_d)) & b_d \neq \emptyset \\ 0 & b_d = \emptyset \end{cases} \tag{2}$$

Where θ_d is the marginal type who is indifferent between paying and not paying the bribe. To explain this profit function if $\theta \geq \theta_d$ then the bureaucrat's revenue is b_d. If he does not reduce the red tape he has no expected cost, and he only reduce the red tape with probability η. If he does, then with probability ρ they have to pay the fine of F, so their expected cost per bribe accepted is $\eta\rho F$. To find the marginal type who will pay the bribe we look at the equation:

$$E_r[U(\theta_d, r, b_d)] = U(\theta_d, r^*, 0) \tag{3}$$

where $E_r[U(\theta_d, r, b)] = v - \theta_d(\eta r_l + (1-\eta) r^*) - b_d$, the solution to this is $b_d = \theta_d \eta \Delta$.

Define

$$H(\theta) = \theta - \frac{1 - G(\theta)}{g(\theta)} \tag{4}$$

then we can write the optimal level for θ_d as:

$$H(\theta_d) = \frac{\rho F}{\Delta} \tag{5}$$

If $H(\bar{\theta}) < \frac{\rho F}{\Delta}$ then we can set $\theta_d = \bar{\theta}$, if $H(\underline{\theta}) > \frac{\rho F}{\Delta}$ then we can set $\theta_d = \underline{\theta}$.

When bribes are offered and accepted, bureaucrat's profit is given by:

$$\Pi^d = \eta\Delta \frac{(1 - G(\theta_d))^2}{g(\theta_d)} \tag{6}$$

Notice we use a d superscript on this case to facilitate comparison with the cases when the bureaucrat can accept bribes from intermediaries.

Lemma 1 (Existence) *When $b_d \neq \emptyset$ it must be that the expected benefit to the highest type is higher than the expected cost to the bureaucrat.*

Proof. Notice that $H(\theta)$ is strictly increasing and that $H(\bar{\theta}) = \bar{\theta}$. Furthermore the first order condition of the bureaucrat's objective function can be written as $\frac{\rho F}{\Delta} - H(\theta) = 0$. Thus $b_d \neq \emptyset$ if and only if $\frac{\rho F}{\Delta} - \bar{\theta} \leq 0$. If the latter statement is true then this means $\eta\bar{\theta}\Delta \geq \eta\rho F$ which is the mathematical expression of the statement above. ■

Notice how this model captures standard government strategies to fight corruption (Bardhan [2], Rose-Ackerman [17]). To fight corruption, governments will investigate more cases (increase ρ), increase the penalties for bureaucrats who are caught (raise F), and limit bureaucrats' discretionary power by decreasing the amount they can reduce the level of regulation (Δ). In our model, these all directly decrease the amount of bribery by increasing θ_d. Reducing η on the other hand, directly increases the quantity of regulation even though it does not directly effect θ_d. While initially it might seem surprising that it does not change θ_d the intuition for this is straightforward. While reducing η will reduce expected benefits to the client from a possible regulation reduction it also decreases her costs proportionally since bureaucrats must lower their bribe levels for a less certain favor.

4 The Equilibrium with Intermediaries

To find the equilibria we just need to look for the profit maximizing alternative among the four options available to the bureaucrat: 1) He never accept bribes, 2) He only accepts bribes directly from clients, 3) He only accepts bribes from intermediaries; 4) He always accepts bribes (both directly and from intermediaries). We will find the equilibrium by first finding the bureaucrat's profits under each option and then maximizing his profits over his various options.

4.1 Bureaucrat's Profit under his Four Options

The first option, never accepting bribes, will occur only when all other alternatives give negative payoffs, we denote this as $b_i = \emptyset$ and $b_d = \emptyset$. The second option, only accepting bribes directly from clients, is essentially the same as the case without intermediaries, discussed in Section 3; now we can denote this as $b_i = \emptyset$ and $b_d \neq \emptyset$. This leaves the last two options to be analyzed. The third option can be characterized as $b_i \neq \emptyset$ and $b_d = \emptyset$ and the fourth as $b_d \neq \emptyset$ and $b_i \neq \theta$. Notice that throughout this analysis we only allow for intermediaries, whether or not they are used will be endogenous to the model. One general result is that:

Lemma 2 *If intermediaries are used and p_i is the intermediary's fee to reduce regulation then $p_i = b_i + c$.*

This is a simple implication of the competitive nature of the intermediaries market. If the market is not competitive then it would make clients less likely to use intermediaries but would not change the existence conditions. To understand this consider the extreme case when the intermediary is a monopolist. In this case she and the bureaucrat would charge the client a double markup, decreasing the incentive to use an intermediary. But the existence conditions would remain the same because essentially the bureaucrat and intermediary would be splitting the profits. Though the profits of the bureaucrat will be reduced he will prefer positive profits to no profits, thus any time intermediaries are used in the following analysis they would be also be used under this alternative model.

4.1.1 The Third Option: All Bribers choose to use Intermediaries ($b_d = \emptyset$)

This case is very similar to the case without intermediaries. The bureaucrat's profit function is:

$$\Pi(b_i, \theta_i) = \begin{cases} b_i (1 - G(\theta_i)) & b_i \neq \emptyset \\ 0 & b_i = \emptyset \end{cases} \tag{7}$$

Where θ_i is the marginal type who is indifferent between using the intermediary and not paying a bribe. Notice that here there is no expected cost since the bureaucrat will never be caught. How we determine θ_i depends on whether c is positive or negative. If c is positive clients have essentially the same choice as in the direct case, only this time they will just hire the intermediary instead of paying a bribe and their expected level of regulation will be lower, or $U(\theta_i, r_l, p_i) = U(\theta_i, r^*, 0)$, and then $b_i = \theta_i \Delta - c$. If c is negative it is cost saving for everyone to use the intermediary, thus we will assume that everyone uses intermediaries but only some of them might be paying bribes. In this case θ_i is determined by $U(\theta_i, r_l, p_i) = U(\theta_i, r^*, c)$, or $b_i = \theta_i \Delta$. We can summarize both cases by saying that θ_i is found as $H(\theta_i) = \max\left\{\frac{c}{\Delta}, 0\right\}$. If $H(\underline{\theta}) > \max\left\{\frac{c}{\Delta}, 0\right\}$ then we set $\theta_i = \underline{\theta}$. We use an i superscript on the profit function to denote the case where all bribers choose to use intermediaries and throughout this analysis θ_i denotes a person who has a choice between not bribing and using an intermediary to bribe.

When all bribers choose intermediaries, bureaucrat's profit is given by

$$\Pi^i = \Delta \frac{(1 - G(\theta_i))^2}{g(\theta_i)} \tag{8}$$

Lemma 3 (Existence) *If all bribers choose to use intermediaries then the expected benefit to the highest type must be greater than the cost of using the intermediary.*

Proof. See the proof of Lemma 1. ■

Note that we always assume the condition in this lemma which is $\bar{\theta}\Delta > c$. This assumption is equivalent to intermediaries being economically viable. Essentially this shows that if *someone* will use the intermediary then this market will exist. One interpretation of θ is the opportunity cost of the clients' time. Clearly intermediaries will have a lower value for their time than $\bar{\theta}$—the highest wage in the economy, thus the only reasonable way this can fail is if the amount of regulation reduction (Δ) is trivially small. Also notice that if $c \leq 0$ then this market always exists. One must increase c to stop this equilibrium.

4.1.2 The Fourth Option: Some Bribers choose to use Intermediaries ($b_d \neq \emptyset$ and $b_i \neq \theta$)

In this case, we define θ_d^b as the lowest type who prefers bribing the bureaucrat directly to all other options. Similarly, we define θ_i^b as the lowest type who prefers using the intermediary for bribing to both bribing the bureaucrat directly and not offering a bribe (b superscript is for the existence of *both* types of bribes). This insight is crucial for the following lemma.

Lemma 4 *If $\theta_d^b \geq \theta_i^b$ then no one will directly bribe the bureaucrat, and $b_d = \emptyset$ is optimal.*

Proof. Note that by revealed preferences, for θ_i^b

$$v - \theta_i^b \left(\eta r_l + (1-\eta) r^*\right) - b_d \leq v - \theta_i^b r_l - p_i \tag{9}$$

which is equivalent to $\frac{p_i - b_d}{(1-\eta)\Delta} \leq \theta_i^b$. Since this is also true for all $\theta \geq \theta_i^b$, these clients will prefer using the intermediary to bribing the bureaucrat directly. Hence if $\theta_d^b \geq \theta_i^b$ then no one will directly offer a bribe and we have $b_d = \emptyset$. ■

Given this lemma for both direct and indirect bribes to exist it must be that $\theta_d^b < \theta_i^b$ and therefore $b_d < b_i$. The profit function of the bureaucrat is:

$$\Pi(b_d, b_i) = (b_d - \eta\rho F)\left(G\left(\theta_i^b\right) - G\left(\theta_d^b\right)\right) + b_i\left(1 - G\left(\theta_i^b\right)\right) \tag{10}$$

and θ_d^b is determined as before, or $b_d = \theta_d^b \eta\Delta$. The marginal type who uses the intermediary now is indifferent between using the intermediary and bribing directly, or:

$$U\left(\theta_i^b, r_l, p_i\right) = E_r\left[U\left(\theta_i^b, r, b_d\right)\right] \tag{11}$$

and this gives us $b_i = b_d + (1-\eta)\theta_i^b \Delta - c$. Using this we can simplify the profit function to:

$$\begin{aligned}\Pi\left(\theta_d^b, \theta_i^b\right) &= \left(\eta\Delta\theta_d^b - \eta\rho F\right)\left(1 - G\left(\theta_d^b\right)\right) \\ &\quad + \left((1-\eta)\theta_i^b\Delta + \eta\rho F - c\right)\left(1 - G\left(\theta_i^b\right)\right)\end{aligned} \tag{12}$$

The most startling thing about this objective function is that $\theta_d^b = \theta_d$. In other words, the lowest type who prefers bribing the bureaucrat directly to all other options is unchanged from the case where there is no intermediary, or it is the θ_d that solves $H(\theta_d) = \frac{\rho F}{\Delta}$ (with $\theta_d = \underline{\theta}$ if $H(\underline{\theta}) > \frac{\rho F}{\Delta}$). This result, however, would be true in general. It is based on the fact that this marginal person is still making the same decision as before. They are still choosing between not bribing and facing the regulation or paying the bribe. Hence, from now one we will drop the b superscript for this type and use θ_d.

Of course this logic does not hold for the person indifferent between using an intermediary and any other method, it is now:

$$H\left(\theta_i^b\right) = \frac{c - \eta\rho F}{(1-\eta)\Delta} \tag{13}$$

We don't have any caveat on what to do when there is no such θ, if $H(\underline{\theta}) > \frac{c-\eta\rho F}{(1-\eta)\Delta}$ then there is no one paying a direct bribe, if $H\left(\bar{\theta}\right) < \frac{c-\eta\rho F}{(1-\eta)\Delta}$ there is no one using an intermediary.

The bureaucrat's profits are

$$\Pi^b = \eta\Delta\frac{\left(1 - G(\theta_d)\right)^2}{g\left(\theta_d^b\right)} + (1-\eta)\Delta\frac{\left(1 - G\left(\theta_i^b\right)\right)^2}{g\left(\theta_i^b\right)} \tag{14}$$

where $\theta_d \in \left[\underline{\theta}, \overline{\theta}\right)$ and $\theta_i^b \in \left(\theta_d, \overline{\theta}\right)$.

Lemma 5 (Existence) *When $b_d \neq \emptyset$ and $b_i \neq \emptyset$ it must be that $\rho F \leq c \leq (1-\eta)\,\Delta\bar{\theta} + \eta\rho F$.*

Proof. See the discussion above. ■

4.2 The Equilibrium

In the previous subsection we analyzed the four options available to the bureaucrat. Since he has first mover's advantage we now find the equilibrium by finding out which option maximizes his profits. Notice that by revealed preferences one should expect that if bureaucrats can take bribes both directly and indirectly then this will be profit maximizing. In general the only reason to constrain your choices is if one of your unconstrained choices is not feasible, and that is what occurs here. We actually prove that if taking bribes both directly and through intermediaries is feasible it has a strictly higher profit. If this does not happen then the bureaucrat falls back on choosing the cost minimizing option. The cost of decreasing regulations when one takes a bribe from an intermediary is c, the implicit cost of reducing regulations when one takes a bribe from the client is ρF, if $c \leq \rho F$ the bureaucrat only accepts bribes from intermediaries. The bureaucrat only takes bribes directly when both of the above conditions fail, or $c \geq (1-\eta)\,\Delta\bar{\theta} + \eta\rho F$. This is the essence of Proposition 1 in subsection 4.2.1, in subsection 4.2.2 we discuss the possible equilibria under optimal government policy.

4.2.1 Equilibrium with all Government Policies

Proposition 1 *In equilibrium if:*

1. $\rho F < \frac{c}{\eta} - \left(\frac{1-\eta}{\eta}\right)\Delta\bar{\theta}$ *then all bribers directly bribe the bureaucrat;*

2. $\frac{c}{\eta} - \left(\frac{1-\eta}{\eta}\right)\Delta\bar{\theta} \leq \rho F < c$ *then some bribers use intermediaries and some directly bribe the bureaucrat;*

3. $\rho F \geq c$ *then all bribers use intermediaries.*

Proof. It is easiest to prove the parts of the proposition in reverse order.

To establish part 3 note that when $\rho F \geq c$ we can not have bribes being taken both from intermediaries and clients. Furthermore this implies $\theta_i \leq \theta_d$ thus $\Pi^i > \Pi^d$ and bribes will only be accepted from intermediaries.

For part 2 note that if $\theta_i^b \leq \bar{\theta}$ then $\Pi^b \geq \Pi^d$, $\theta_i^b \leq \bar{\theta}$ is implied by $\frac{c}{\eta} - \left(\frac{1-\eta}{\eta}\right)\Delta\bar{\theta} \leq \rho F$. Furthermore if $\rho F < c$ then $\Pi^b > \Pi^i$. To see this first notice that if $c = \rho F$ then $\theta_i = \theta_i^b = \theta_d$ and therefore $\Pi^i = \Pi^b$, furthermore one can show that $\frac{\partial \Pi^b}{\partial c} = -\left(1 - G\left(\theta_i^b\right)\right)$ and $\frac{\partial \Pi^i}{\partial c} = -\left(1 - G\left(\theta_i\right)\right)$

thus when $\rho F < c$ $\theta_i^b > \theta_i$ and $\frac{\partial \Pi^b}{\partial c} > \frac{\partial \Pi^i}{\partial c}$.[3] These facts imply that for $\rho F < c$ $\Pi^i < \Pi^b$.

Finally, notice that when $\rho F = \frac{c}{\eta} - \left(\frac{1-\eta}{\eta}\right)\Delta\bar{\theta}$ we have $\Pi^d = \Pi^b$, and by the above we know that $\Pi^b > \Pi^i$, and also $\frac{\partial \Pi^d}{\partial c} = 0 > \frac{\partial \Pi^i}{\partial c}$, thus $\Pi^b > \Pi^i$ when $\rho F < \frac{c}{\eta} - \left(\frac{1-\eta}{\eta}\right)\Delta\bar{\theta}$. ■

Notice how much more common corruption is due to intermediaries. The conditions of Lemma 1 offer a wide variety of policies that could stop corruption, in Proposition 1 it is impossible to stop bribery. This greatly limits government's ability to control corruption.

To illustrate these conditions consider the simple case where $G(\cdot)$ is the uniform distribution with an upper bound of $\bar{\theta}$ and a lower bound of $\underline{\theta}$. Then $\theta_d = \frac{1}{2}\frac{\rho F + \bar{\theta}\Delta}{\Delta}$, $\theta_i^b = \frac{1}{2}\frac{c - \eta\rho F - (1-\eta)\Delta\bar{\theta}}{(1-\eta)\Delta}$, and $\theta_i = \frac{1}{2}\frac{c + \bar{\theta}\Delta}{\Delta}$ and the profit under each option is:

$$\begin{aligned}
\Pi^d &= \frac{\Delta}{4\left(\bar{\theta} - \underline{\theta}\right)} * \eta\left(\bar{\theta} - \frac{\rho F}{\Delta}\right)^2 \\
\Pi^i &= \frac{\Delta}{4\left(\bar{\theta} - \underline{\theta}\right)} * \left(\bar{\theta} - \frac{c}{\Delta}\right)^2 \\
\Pi^b &= \frac{\Delta}{4\left(\bar{\theta} - \underline{\theta}\right)} * \left(\eta\left(\bar{\theta} - \frac{\rho F}{\Delta}\right)^2 + (1-\eta)\left(\bar{\theta} - \frac{c - \eta\rho F}{(1-\eta)\Delta}\right)^2\right)
\end{aligned}$$

and it is easy to see that when both are possible $\Pi^i > \Pi^d$, and with a little more algebra one can show that $\Pi^b > \Pi^i$ when $c \in \left(\rho F, (1-\eta)\Delta\bar{\theta} + \eta\rho F\right]$.

4.2.2 Equilibrium with Optimal Expected Punishment

In this section, we will find optimal expected punishment by government and show that under optimal expected punishment, if all bribery takes place via intermediaries then the opportunity cost of using an intermediary must be negative.

To find optimal expected punishment, we define the *external cost of policy variables function*—$eC(\rho, F, \eta, \Delta)$. This function essentially represents the tax burden imposed by trying to control corruption.

Unlike a traditional cost function there is no reason to assume that the marginal cost of any of these parameters is positive or negative. In fact it is not uncommon that analysts assume $\frac{\partial eC}{\partial F} < 0$—or the money collected from the bureaucrat can be put to good use. What we will assume is:

Assumption Increasing the level of monitoring (ρ) has a positive marginal external cost, or $\frac{\partial eC}{\partial \rho} > 0$.

[3] For clarity note that $\frac{\partial \Pi_B}{\partial c} = \frac{\frac{d}{d\theta}\left(\frac{(1-G(\theta))^2}{g(\theta)}\right)}{H'(\theta)}$ and

$$\begin{aligned}
\frac{d}{d\theta}\left(\frac{(1-G(\theta))^2}{g(\theta)}\right) &= -(1-G(\theta))\left(1 - \frac{d}{d\theta}\left(\frac{(1-G(\theta))}{g(\theta)}\right)\right) \\
H'(\theta) &= \left(1 - \frac{d}{d\theta}\left(\frac{(1-G(\theta))}{g(\theta)}\right)\right)
\end{aligned}$$

If this is true then simple optimization shows that at any optimal level of regulation $\frac{\partial eC}{\partial F} > 0$.

Lemma 6 *At any optimal level of expected punishment, $z = \rho^* F^*$ then either $\frac{\partial eC}{\partial F} > 0$ or $z = 0$.*

Proof. Notice that everywhere in our analysis we could replace ρF with $z = \rho F$ without loss of generality. Thus we can solve the social cost minimization problem:

$$eC^* (z, \eta, \Delta) = \min_{\rho, F} \max_{\lambda} eC (\rho, F, \eta, \Delta) - \lambda (\rho F - z)$$

When $z = 0$ we do not have a claim. Hence let us consider when $0 < z \leq \rho F$ or $\rho^* > 0$ and $F^* > 0$. Since from a first order condition $\frac{\partial eC}{\partial \rho} - \lambda F = 0$ and from our assumption $\frac{\partial eC}{\partial \rho} > 0$, it must be the case that $\lambda > 0$. Since $\frac{\partial eC}{\partial F} - \lambda \rho = 0$, it must be that $\frac{\partial eC}{\partial F} > 0$. ■

The intuition behind this result is immediate, if society benefits from increasing F and decreasing ρ then it is obvious what to do. It is only when both techniques are costly that society might want to limit F. One might wonder how this is possible. Surely increasing fines always benefits society? If bureaucrats had unlimited budgets then this would be true, but since bureaucrats have a limited lifetime income there is a point where this tactic will not work in the real world. In this case the only way to increase F would be through jail time, which does have a positive external cost. Also if F is too high the investigators might be less willing to expose a bureaucrat if his crime doesn't seem "too severe," and the investigator might start taking bribes from the bureaucrat. Both of these things would mean that the external cost of increasing F is positive. This result immediately gives us the following corollary.

Corollary 1 *If and only if all clients are using intermediaries can the opportunity cost of using the intermediary be negative under optimal government policy.*

Proof. >From Proposition 1 we observe all clients using intermediaries if and only if $c \leq \rho F$. If $c \leq 0$ then $c \leq \rho F$, and by Proposition 1, all clients use intermediaries. If $c > 0$ and $c \leq \rho F$ then increasing ρF has no impact on the quantity of corruption or the utility of any person involved in the model, and by Lemma 6 it has a positive external cost, thus $\rho F < c$. Hence some clients will not be using the intermediary. ■

This is a simple and testable implication of our model. In any market where everyone uses intermediaries it must be that the regulation requires so much knowledge and expertise that only an intermediary can handle it efficiently. However notice that this does not prove that there is corruption. The negative opportunity cost of the intermediary does not depend on their ability to reduce the level of regulation. In such a market everyone uses intermediaries even if there is no corruption.

5 Fighting Corruption

Since our paper necessarily only has a partial model of the economy, if we were to construct a welfare function both the benefits of regulation and the cost of policy variables would necessarily be a reduced form function. This would complicate analysis without increasing our understanding of the fundamentals, thus instead we focus on a simpler objective where the impact of policy variables is clear within our analysis, the impact of intermediaries and policy variables on the quantity of regulation (Q_r). An analyst or government with a well specified general welfare function can then take our analysis of this variable as an input into their welfare maximization.

The implicit assumption is that it is welfare maximizing to have all clients face the given optimal regulation level. This is appropriate if not meeting the regulation imposes some externality on the economy. Hence when we say a policy will increase regulation we mean that the increase is towards the optimal quantity. Regulation can also address allocational issues—see Guriev [8] for example—but in our paper we are not considering this type of regulation.

We will consider three policy variables, η, ρF, and Δ. The first one (η) represents the trustworthiness of bureaucrats, η near one means the bureaucrat is trustworthy. If a client tries to bribe him directly then he almost always reduces the regulation. This can be reduced by moving bureaucrats around in the government, if a bureaucrat is not in one department for long he can not develop a reputation for taking bribes and thus it is not worth it to him to reduce regulation level. Bardhan [2] suggests periodic job rotation as an anti-corruption measure, so that a bureaucrat does not become too cozy with a customer over a long period. We assume that it is not possible to reduce η to zero.

The second variable (ρF) is the expected punishment, as discussed above in our model it does not affect anything to vary the probability of an investigation (ρ) and the fine imposed (F) independently, thus we will simplify the discussion by only changing them jointly. The third variable (Δ) represents the amount of control the bureaucrat has over the level of regulation. Government can control this variable to a limited degree by making the bureaucrat provide more documentation and signatures from other bureaucrats. In the absence of intermediary agents, limiting discretionary power of bureaucrats is considered an important tool to combat corruption (Rose-Ackerman [17], Bardhan [2], [5]). We will refer these additional requirements for documentation as "secondary red tape" and discuss its effects in more depth below. For now, let us consider that Δ can be between $\underline{\Delta}$ and r^*, where $\underline{\Delta} > 0$. We will continue to assume that the highest type can afford to use an intermediary, or that $\bar{\theta}\underline{\Delta} > c$.

Proposition 2 *Intermediaries always strictly reduce the quantity of regulation, by:*

1. $\Delta(1-\eta)\left(1-G\left(\theta_i^b\right)\right)$ *if* $\rho F < c$
2. $\Delta(1-\eta)(1-G(\theta_i)) + \eta\Delta(G(\theta_i) - G(\theta_d))$ *if* $\rho F \geq c$ *(note that* $G(\theta_i) - G(\theta_d) > 0$*)*

Proof. This is immediate once we establish what the quantity of regulation is in each situation. When clients can only bribe the bureaucrat directly the expected regulation is $\eta r_l + (1-\eta) r^* = r^* - \eta\Delta$, clients who do not bribe face regulation r^*, thus:

$$Q_r^d = r^* - \eta\Delta(1 - G(\theta_d))$$

If all clients who want to bribe choose to use intermediaries then people who offer bribes face regulation level $r_l = r^* - \Delta$, thus in this case the quantity of regulation is $Q_r^i = r^* - \Delta(1 - G(\theta_i))$. By combining these two cases one can find that when some clients offer bribes directly and some choose to use intermediaries then $Q_r^b = r^* - \Delta\left(1 - G(\theta_d)\eta - (1-\eta)G\left(\theta_i^b\right)\right)$. Thus, when $\rho F < c$, Q_r changes from Q_r^d to Q_r^b decreasing regulation by the amounted stated in (1) and when $\rho F \geq c$, Q_r changes from Q_r^d to Q_r^i decreasing regulation by the amount stated in (2). ■

The intuition behind the quantity $\Delta(1-\eta)\left(1 - G\left(\theta_i^b\right)\right)$ is immediate. The only change when intermediaries are present is for those who use them, and they have their regulation decreased by the quantity Δ with an additional probability of $1-\eta$. When $\rho F \geq c$ there is also the fact that more people now choose to offer bribes because it is "cheaper" for the bureaucrat to accept them.

While this is an interesting—and not unexpected—conclusion what is more important for a government in such a situation is how well they can control the quantity of regulation. Here again the news is generally bad. Two of their three instruments have a reduced level of power, and what formerly increased regulation will sometimes decrease it. For simplicity we will assume in the following proposition that $\left\{\theta_d, \theta_i, \theta_i^b\right\}$ are all in the interior of the support of θ—$\left[\underline{\theta}, \bar{\theta}\right]$. The reader can clearly extend the analysis to the cases where this is not true.

Proposition 3 *Assume that $c > 0$. Then when there are no intermediaries increasing expected punishment (ρF) and decreasing the reliability of bureaucrats (η) and the amount they can change regulation (Δ) increase the quantity of regulation.*

When intermediaries are present increasing expected punishment and reducing bureaucrat's trustworthiness are less effective in increasing the level of regulation. In fact these policies may decrease the quantity of regulation.

On the other hand decreasing the amount of control that the bureaucrat has over the level of regulation (Δ) is more effective than before.

Proof. Notice that $\frac{\partial \theta_d}{\partial \rho F} = \frac{1}{\Delta H'(\theta_d)}$, $\frac{\partial \theta_d}{\partial \eta} = 0$, and $\frac{\partial \theta_d}{\partial \Delta} = -\frac{\rho F}{\Delta^2}\frac{1}{H'(\theta_d)}$ where $H'(\theta) \geq 1$, then the partial derivatives when all clients bribe the bureaucrat directly are:

$$\frac{\partial Q_r^d}{\partial \rho F} = \eta \Delta g(\theta_d)\frac{\partial \theta_d}{\partial \rho F} > 0, \quad \frac{\partial Q_r^d}{\partial \eta} = -(1 - G(\theta_d))\Delta < 0, \quad \frac{\partial Q_r^d}{\partial \Delta} = -\eta(1 - G(\theta_d)) + \eta \Delta g(\theta_d)\frac{\partial \theta_d}{\partial \Delta} < 0$$

establishing the first part of the claim. For the second part notice that $\frac{\partial \theta_i^b}{\partial \rho F} = \frac{-\eta}{(1-\eta)\Delta}\frac{1}{H'\left(\theta_i^b\right)} < 0$

and $\frac{\partial\theta_i^b}{\partial\eta} = \frac{c-\rho F}{(1-\eta)^2\Delta}\frac{1}{H'\left(\theta_i^b\right)} > 0$. Given this the relevant derivatives are:

$$\begin{aligned}
\frac{\partial Q_r^b}{\partial\rho F} &= (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\rho F} + \eta g\left(\theta_d\right)\Delta\frac{\partial\theta_d}{\partial\rho F} \\
&= \frac{\partial Q_r^d}{\partial\rho F} + (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\rho F} \\
\frac{\partial Q_r^b}{\partial\eta} &= \left(G\left(\theta_d\right) - G\left(\theta_i^b\right)\right)\Delta + (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\eta} \\
&= \frac{\partial Q_r^d}{\partial\eta} + \left(1 - G\left(\theta_i^b\right)\right)\Delta + (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\eta}
\end{aligned}$$

and these derivatives are now closer to zero or might have changed sign.

For the claim of proposition 3, $\frac{\partial\theta_i^b}{\partial\Delta} = -\frac{c-\eta\rho F}{(1-\eta)\Delta^2}\frac{1}{H'\left(\theta_i^b\right)} < 0$ and thus:

$$\begin{aligned}
\frac{\partial Q_r^b}{\partial\Delta} &= -1 + (1-\eta)\, G\left(\theta_i^b\right) + \eta G\left(\theta_d\right) + (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\Delta} + \eta g\left(\theta_d\right)\Delta\frac{\partial\theta_d}{\partial\Delta} \\
&= \frac{\partial Q_r^d}{\partial\Delta} - (1-\eta)\left(1 - G\left(\theta_i^b\right)\right) + (1-\eta)\, g\left(\theta_i^b\right)\Delta\frac{\partial\theta_i^b}{\partial\Delta}
\end{aligned}$$

and this is still negative and has a higher absolute value than $\frac{\partial Q_r^b}{\partial\Delta}$. ■

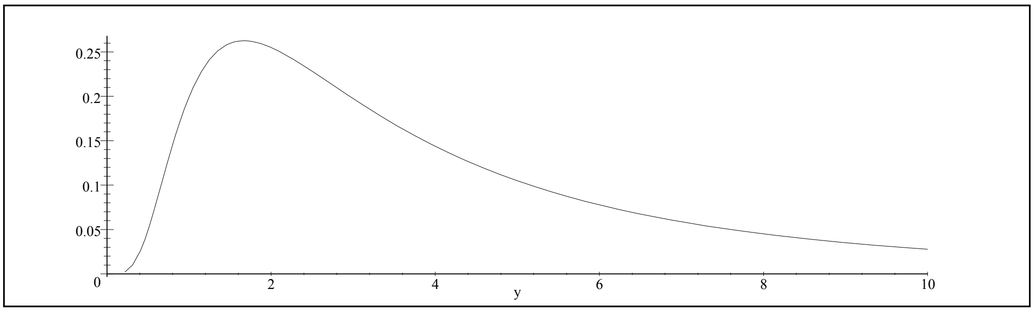
The reader might wonder when the derivatives with respect to η and ρF have the wrong sign. Actually $\frac{\partial Q_r^b}{\partial\rho F} \leq 0$ only requires that $\frac{g(\theta)}{H'(\theta)}$ is decreasing. One can show that:

$$\frac{\partial Q_r^b}{\partial\rho F} = \eta\left(\frac{g\left(\theta_d\right)}{H'\left(\theta_d\right)} - \frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}\right).$$

While we would not want to assume that $\frac{g(\theta)}{H'(\theta)}$ is decreasing we know that it is decreasing over at least part of the range for several common distributions. For the Uniform distribution it is constant, for the Exponential distribution $\frac{g(\theta)}{H'(\theta)} = g(\theta) = e^{-\frac{x}{\mu}}$, and it is always decreasing. For the Weibull distribution with a shape parameter of a and a scale parameter of b:

$$\frac{g\left(\theta, a, b\right)}{H'\left(\theta, a, b\right)} = \frac{a^2\theta^{2a-1}b^{-a}e^{-\theta^a b^{-a}}}{\theta^a a + b^a a - b^a}$$

and this is always decreasing for large enough θ. If $a \geq 1$ then it is decreasing when $\theta \geq 1.04b$, for $a \in \left[\frac{1}{2}, 1\right]$ it is always decreasing, for $a \leq \frac{1}{2}$ it is only decreasing when $\theta \geq \left(\frac{2a^2-3a+1}{a^2}\right)^{\frac{1}{2a}} b$. The function $\frac{g(\theta)}{H'(\theta)}$ is also decreasing for large θ with the log-normal distribution, for example if the mean of $\ln\theta$ is zero and it's standard deviation is one, then a graph of $\frac{g(\theta)}{H'(\theta)}$ is:



Graph of $\frac{g(\theta)}{H'(\theta)}$ when θ has a standard log-normal distribution.

the function is decreasing when $\theta \geq 1.669$, or when $G(\theta) \geq .7$.

It might be rarer that $\frac{\partial Q_r^b}{\partial \eta} > 0$, one can show that:

$$\frac{\partial Q_r^b}{\partial \eta} = (c - \rho F)\left(\Delta \frac{G(\theta_d) - G\left(\theta_i^b\right)}{c - \rho F} + \frac{1}{(1-\eta)} \frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}\right) .$$

and what we need is either that $\frac{G(\theta_d) - G\left(\theta_i^b\right)}{c-\rho F}$ is small or $\frac{1}{(1-\eta)} \frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}$ is large. The latter is probably common if η is nearly one, the former is harder to satisfy. Both the numerator and denominator are decreasing as $\rho F \to c$, thus what we need is that $G(\theta_d) - G\left(\theta_i^b\right) \to 0$ faster than $c - \rho F$. It is hard to know when such a specific condition is true.

In the uniform case both of these derivatives are zero, or if some clients use intermediaries then η and ρF have no effect. When all clients offer bribes directly $Q_r^d = r^* - \eta \frac{1}{2} \frac{\bar{\theta}\Delta - \rho F}{\bar{\theta} - \underline{\theta}}$, when some clients use intermediaries and some go directly it is $Q_r^b = r^* - \frac{1}{2} \frac{\bar{\theta}\Delta - c}{\bar{\theta} - \underline{\theta}}$, and $Q_r^i = Q_r^b$.

Thus it is probably common that when some clients use intermediaries and some offer bribes directly, increasing the expected punishment has the wrong effect. It is harder to guess how common it is that decreasing the trustworthiness of bureaucrats has the wrong effect, but in at least one case we can illustrate it has no effect on the quantity of regulation.

6 Extensions and Discussion

Before we conclude, we would like to discuss two topics more closely. First, it is common for governments to limit the discretionary power of bureaucrats (decrease Δ) by using "secondary red tape." For example forms need to be filled out in triplicate, signed by multiple bureaucrats in separate buildings, etcetera. We define these as socially wasteful regulation that serves no purpose other than to make $r^* - r_l$ smaller. However, as we will clarify below, one should realize that this will also make c lower. The more the secondary red tape the more benefit there is to having a specialist who knows her way around the bureaucracy. Thus we would like to discuss when secondary red tape can increase or decrease the quantity of regulation.

Second, we want to discuss what happens when intermediaries or clients using intermediaries are legally liable for corruption. We model this as investigators sometimes being able to prove that the intermediary did offer a bribe. Foreign Corrupt Practices Act (FCPA) of US and similar laws introduced by OECD countries make it possible to prosecute companies in their home countries for paying bribes abroad. OECD anti-bribery convention signed by member countries in 1997 makes it clear that the anti-bribery laws apply to bribes paid "directly or indirectly" and US authorities have on several occasions prosecuted companies in cases where intermediaries paid bribes on their behalf. Hence, these observations suggest that we should consider the case where corruption is discovered with some probability when intermediaries are involved.

6.1 Limiting the Discretionary Power of Bureaucrats by "Secondary Red Tape"

A common occurrence in corrupt bureaucracy is that government imposes excessive checks and balances to limit the discretionary power of bureaucrats. Each piece of paperwork has to be signed by multiple bureaucrats, each action must be cross-checked several times. The goal of these checks is to make certain that the regulation is satisfied in the first place, or to decrease the amount that a bureaucrat can reduce the level of regulation, increasing the effective r_l. Rose-Ackerman [17] has suggested that multiple officials with overlapping jurisdictions may help because the potential briber has to face the prospect of "persuading" all the officials involved, which raises costs and uncertainty for the corrupt project. We refer to these types of regulations as secondary red tape.

The problem with secondary red tape in the presence of intermediaries is that it increases the benefit of using an intermediary. Since intermediary agents deal with the bureaucracy for a living, they know all the rules, regulations, and secondary checks required. In other words, when government increases secondary red tape, the opportunity cost of using the intermediary decreases, and people are more likely to use intermediaries.

To illustrate this point we want to look at a pure form of secondary red tape. The type of red tape that does not actually increase r_l, it merely increases the cost of getting the regulation level r_l. Thus we will assume that the true regulation clients face is not changed—it is always r_l, but instead the amount they have to pay to get the regulation level r_l increases to $r_l + s$, or the bureaucrat can only reduce the cost of regulation by $\tilde{\Delta} = r^* - r_l - s$. We will also assume that the opportunity cost of using the intermediary is a function of s, $c(s)$, and it is decreasing ($c'(s) < 0$). In this situation increasing s will have a reduced impact in the presence of intermediaries, and can actually reduce regulation.

Proposition 4 *If $c > 0$ and $c'(s) \leq -\frac{c}{\Delta}$ then when $\rho F \geq c$ regulation will decrease, if in addition, $\frac{g(\theta)}{H'(\theta)}$ is decreasing regulation will also decrease when $\rho F \leq c$.*

Proof. One can easily verify that $\frac{\partial\theta_d}{\partial s} = \frac{1}{H'(\theta_d)}\frac{\rho F}{\tilde{\Delta}^2}$, $\frac{\partial\theta_i^b}{\partial s} = \frac{1}{(1-\eta)H'(\theta_i)}\frac{1}{\tilde{\Delta}}\left(c'(s) + \frac{c-\eta\rho F}{\tilde{\Delta}}\right)$ and $\frac{\partial\theta_i^i}{\partial s} = \frac{1}{H'(\theta_i)\tilde{\Delta}}\left(c'(s) + \frac{c}{\tilde{\Delta}}\right)$. Furthermore,

$$\begin{aligned}
\frac{\partial Q_r^b}{\partial s} &= \Delta\left(g(\theta_d)\frac{\partial\theta_d}{\partial s}\eta + (1-\eta)\, g\left(\theta_i^b\right)\frac{\partial\theta_i^b}{\partial s}\right) \\
\frac{\partial Q_r^i}{\partial s} &= \Delta g(\theta_i)\frac{\partial\theta_i^i}{\partial s}
\end{aligned}$$

after substitution and simplification:

$$\begin{aligned}
\frac{\partial Q_r^b}{\partial s} &= \Delta\left(\frac{g(\theta_d)}{H'(\theta_d)} - \frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}\right)\frac{\eta\rho F}{\tilde{\Delta}^2} + \Delta\frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}\frac{1}{\tilde{\Delta}}\left(c'(s) + \frac{c}{\tilde{\Delta}}\right) \\
\frac{\partial Q_r^i}{\partial s} &= \Delta\frac{g(\theta_i)}{H'(\theta_i)}\frac{1}{\tilde{\Delta}}\left(c'(s) + \frac{c}{\tilde{\Delta}}\right)
\end{aligned}$$

>From above equations, we see that if $c'(s) \leq -\frac{c}{\tilde{\Delta}}$ then $\frac{\partial Q_r^i}{\partial s} < 0$ and the second term in $\frac{\partial Q_r^b}{\partial s}$ is negative. For $\frac{\partial Q_r^b}{\partial s}$, the first term will also be negative if $\frac{g(\theta)}{H'(\theta)}$ is decreasing in θ. ■

Thus increasing secondary red tape arbitrarily can worsen the situation. We would also suggest that in many cases secondary red tape has already created a situation where $c < 0$, simplifying red tape will reduce corruption in that case.

6.2 Regulation of Intermediaries

To a certain extent regulating intermediaries is impossible. What is the difference between an intermediary agent and a firm which specializes in dealing with the bureaucracy? Or a friend who just came along to help out? It seems difficult to eliminate them by simply making them illegal. Catching intermediaries bribing someone is even more difficult. Clients do not even need to know what the money given to the intermediary was spent on.

However regulating intermediaries is not necessarily without hope. As we mentioned earlier, there is an international consensus emerging towards holding clients responsible if intermediaries pay bribes on their behalf. Furthermore, if intermediaries are required to get a license then they can also be required to account for their fees. Also, an illegal intermediary can not advertise easily or do business with large corporations providing an incentive to intermediaries operate within the formal sector.

Thus we want to extend our model in a simple manner that will allow the reader to see how the possibility of discovering corruption when intermediaries are involved would change things. We suggest that when an investigator finds something suspicious about a bureaucrat (where investigations occur with probability ρ) then he can—by investigating the intermediary and the client using the intermediary—find corroborating evidence with probability μ. We assume that if this occurs there is not actually any penalty imposed on the intermediary, but that the bureaucrat is fined like before.

The impact of this is to effectively increase the cost of the intermediary to the bureaucrat by $\mu\rho F$, and with this modification the equilibrium conditions are:

$$\begin{aligned} H(\theta_i) &= \max\left\{\frac{c+\mu\rho F}{\Delta}, \frac{\mu\rho F}{\Delta}\right\} \\ H\left(\theta_i^b\right) &= \frac{c-(\eta-\mu)\rho F}{(1-\eta)\Delta}. \end{aligned}$$

Thus the general effect is just to replace c with $c+\mu\rho F$ everywhere. Thus Propositions 1 and 2 are unchanged except for this, and in Proposition 3 most of the differences can be modeled by making this change. The most significant change is the effect of increasing the expected punishment. Under the new conditions:

$$\frac{\partial Q_r^b}{\partial \rho F} = \eta\left(\frac{g(\theta_d)}{H'(\theta_d)} - \frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}\right) + \mu\frac{g\left(\theta_i^b\right)}{H'\left(\theta_i^b\right)}$$

and this will be negative less frequently if μ is large (never if $\mu > \eta$), and obviously increasing ρF can have an impact when all bribers use intermediaries—$\frac{\partial Q_r^i}{\partial \rho F} > 0$.

Thus it is clear that if intermediaries are effectively regulated then corruption can be stopped.

7 Conclusion

In this paper we analyzed the effects of intermediary agents on corruption and regulation and discussed whether solutions to the corruption problem change in the presence of intermediaries. In our analysis the level of regulation set by the government is assumed to be optimal. Clients may pay bribes directly or indirectly—using intermediaries—to circumvent the necessary regulations.

We show that if intermediaries are economically viable then they always reduce the quantity of regulation below its optimal level. Furthermore, policies such as increasing expected punishment for the corrupt bureaucrat and moving bureaucrats around to prevent entrenchment are less effective in increasing the level of regulation towards the efficient level. In fact these policies may decrease the quantity of regulation. Limiting the discretionary power of the bureaucrat is the only policy that might be more effective in the presence of intermediaries. However even this needs to be exercised with caution. In order to limit the discretionary power of bureaucrats governments often rely on excessive documentation and multiple signatures which in turn increase the benefit of using intermediaries.

The primary implication of our work is that ignoring intermediaries will lead to misguided policies, which might make corruption worse. This point is also supported by cases studies like Fjeldstad

[7]. The Tanzanian government launched an anti-corruption campaign by firing all corrupt bureaucrats. Private business immediately hired these bureaucrats, who used their insider contacts to construct new corruption networks. What seemed like a simple solution increased the problem because the government ignored the market for intermediaries.

What are the possible solutions then to the corruption problem in the presence of intermediaries? Increasing opportunity cost of using an intermediary by simplifying red tape and not moving bureaucrats around may help reduce corruption. Regulation of intermediaries should help as well; if intermediaries could not advertise or work for large corporations without a license then it would be possible to monitor their behavior and audit their accounts. It would also be helpful to hold clients accountable if intermediary agents pay bribes on their behalf. What is clear is that if governments ignore the problem of intermediaries then they will have little success in eliminating corruption.

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