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Abstract

A primary means of bureaucratic oversight is consumer complaints. Yet, this important control mechanism has received very little attention in the literature on corruption. I study a model of corruption with incomplete information in which consumers require a government service from officials who may be corrupt. A victim of corruption can report corrupt officials to higher-ranking officials (supervisors) who may be corrupt or honest. I find that social welfare may be non-monotonic in the proportion of honest supervisors. In some cases, an increase in the proportion of honest supervisors increases social welfare only if there is a *critical mass* of honest supervisors. Under certain conditions, there is, surprisingly, an equilibrium in which no one reports corruption regardless of the proportion of honest supervisors although all lower-ranking officials are corrupt. The analysis shows that using an increase in consumer complaints as a measure of the success of an anti-corruption campaign may be wrong because the consumers may benefit in other ways (e.g., a fall in the equilibrium bribe). I also fill a gap in the literature by endogenizing an official's decision to engage in "corruption with theft" or "corruption without theft" as defined by Shleifer and Vishny (1993) and use the model to shed light on recent anticorruption initiatives such as the *Punjab Citizen Feedback Model* in Pakistan and a recent proposal by Kaushik Basu (2012).

JEL-Code: H800, K420.

Keywords: bribes, consumer complaints, corruption with theft, corruption without theft, Bayesian equilibrium.

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"*AN ACT to provide for the manner in which individuals may in the public interest disclose information that relates to unlawful or other illegal conduct or corrupt practices of others; to provide for the protection against victimisation of persons who make these disclosures; to provide for a Fund to reward individuals who make the disclosures ....*" --- Whistleblower Act 720, Parliament of the Republic of Ghana, October 16, 2006.

1. Introduction

Government corruption can be defined as "the sale by government officials of government property for personal gain" (Shleifer and Vishny, 1993). In many less-developed countries, one must pay a bribe to obtain a routine government service such as getting a child into a public school, a driver's license, a building permit, a passport, a birth certificate, clearing goods at customs, etc. There is, of course, corruption in developed countries even if to a lesser extent.

Studies have found that corruption has a negative effect on economic performance (e.g., Mauro, 1995; Bardhan, 1997). Policies to control corruption include monitoring, functional rotation of bureaucrats, efficiency wages, encouraging whistle blowers, etc (see, for example, Klitgaard, 1988; Banerjee, Hanna, and Mullainathan, 2012). In addition to these factors, a primary means of bureaucratic oversight is consumer complaints. If the victims of corruption do not report corrupt conduct, it would be almost impossible to effectively fight corruption.[1] For example, Ghana's Whistleblower Act referred to above, the *Punjab Citizen Feedback Model*, and a recent proposal by Basu (2012) seem to recognize this point. Yet, this crucial oversight role by consumers (e.g., citizens) of government services has received very little attention in the

[1] In a related but different context, Brunneti and Weder (2003) find, in an econometric study of 125 countries, that increasing press freedom reduces levels of corruption. Using a policy experiment, Reinikka and Svennson (2011) demonstrate that public access to information is an effective tool for controlling corruption.

literature.[2] This paper studies the role of consumer complaints in the fight against corruption and the implications for social welfare.

In their influential paper on corruption, Shleifer and Vishny (1983) made a distinction between two types of corruption: (1) corruption with theft, and (2) corruption without theft. In "corruption without theft", a corrupt official charges the legal price for a government service, puts the entire revenue in state coffers, but also extracts a bribe from the consumer for his private gain. "Corruption with theft" occurs when the official does not put the full revenue due to the state in the coffers of the state. In this case, he might charge the consumer a price lower than the legal price and use the entire revenue for his private gain. If a consumer pays a price smaller than legal price under "corruption with theft", then the consumer and the official are involved in a mutually beneficial but illegal deal and so the consumer will not report the official. Under "corruption without theft", the official does not give the consumer any deal. The bribe is a form of extortion or, to use Basu's (2012) terminology, a "harassment bribe". So under "corruption without theft", a consumer has the incentive to report a corrupt official if he believes that upper-level officials are honest.

Twenty years have passed since Shleifer and Vishny (1993). Yet, there has been not any formal work to endogenize an official's decision to engage in "corruption with theft" or "corruption without theft", what one might call the "nature or form of corruption". I believe that this omission in the literature is due to the fact that this problem cannot be studied without building a model that incorporates and *endogenizes* consumers' reports or complaints about bribery to higher-level officials. In this paper, I build such a model which allows me to study this issue and, among others, study the effect of reports by consumers on social welfare.

[2]There is a small literature on whistleblowers. But it focuses on *employees* as whistleblowers.

Recently, Basu (2012) proposed that bribe-giving (but not bribe-taking) should be treated as legal in order to encourage people who pay *harassment bribes* to report corruption and thus deter demands for bribes by government officials.[3] I use my framework to examine this proposal by Basu and also examine an innovative anti-corruption strategy, the *Punjab Citizen Feedback Model* in Punjab (Pakistan) which was developed in partnership with the World Bank (see Callen and Hasanain (2011) for a review of the Punjab Model).[4]

The paper is motivated by the observation that the ability of honest supervisors (superiors) to control the behavior of their corrupt subordinates is hampered if the victims of the officials' corrupt behavior do not report such incidents to these supervisors. However, the victims need to feel that their complaints will be taken seriously lest their complaints become a waste of their valuable time. Thus consumers are more likely to complain if they believe that a corrupt official's superior is honest.

To elaborate, I study a model in which consumers of a government service encounter corrupt officials whose superiors may be corrupt or honest. Whether a corrupt official's supervisor is corrupt or honest is known to the official but not to the consumer. If an official's supervisor is honest, then his decision to demand a bribe depends on the probability that the consumer will report him. If a consumer rejects a demand for a bribe and reports corruption, he

[3]Kaushik Basu originally proposed this idea in 2011 when he was the Chief Economic Adviser to the Government of India. He is now Senior Vice President and Chief Economist at the World Bank. His proposal attracted the attention of **The Economist** in an article titled "A Novel Way to Combat Corruption", May 7-13 2011, p. 70: http://www.economist.com/node/18652037. It was also covered in Fareed Zakaria's *CNN show*, **GPS**, May 2011. It attracted comments from many people including an article titled "The bribing game" in the *Indian Express* by Jean Dreze: http://www.indianexpress.com/news/the-bribing-game/780094/

[4] It is also referred to as the *Jhang Model of Governance* because it was initially implemented in Jhang district in the State of Punjab, Pakistan. The model is a brainchild of Zubair Bhatti (now at the World bank), who was a Coordination Officer at the local land registry (Land Revenue Department) in Jhang district. It involves an audit (phone calls) to ascertain consumer feedback, and whether or not they were made to pay a bribe for a government service. I discuss the model in detail in section 3.

gets the service without paying a bribe if the supervisor is honest. This is the benefit of reporting corruption. If the supervisor is corrupt, nothing is done about the consumer's complaint and he does not get the service. So he loses a positive surplus if the bribe he refused to pay was smaller than his valuation. This is the cost of reporting corruption.

I find that in some cases, social welfare is non-monotonic in the proportion of honest supervisors. In particular, it may be *decreasing* in the proportion of honest supervisors. The intuition is that while increasing the proportion of honest supervisors results in higher reports, it may also result in an increase in the number of consumers who do not get the service because their complaints were handled by corrupt supervisors. This may decrease social welfare. In some cases, an increase in the proportion of honest supervisors increases social welfare only if there is a *critical mass* of honest supervisors.

There is an equilibrium in which no one reports corruption regardless of the proportion of honest supervisors, although all officials are corrupt.[5] In this equilibrium, social welfare is independent of the proportion of honest supervisors. Corrupt lower-ranking officials strategically respond to an increase in the proportion of honest supervisors by reducing the size of the bribe and therefore making it less worthwhile for consumers to report corrupt conduct. These very low levels of reports may explain why in spite of some of the best anti-corruption efforts (e.g., proportion of honest supervisors is very high), corruption may persist in certain countries. However, anti-corruption efforts are still useful since the bribe is set at a lower level when such efforts are intensified. Therefore, a fall in the number of consumer complaints need not be seen as a failure of an anti-corruption policy because it may be the consequence of a smaller bribe or a smaller number of corrupt officials. Thus using an increase in consumer complaints or a higher

[5] In its first year, only five cases were reported under Ghana's Whistle Blowers Act of 2006: http://news.myjoyonline.com/news/200711/10417.asp

incidence of convicted corrupt officials as a measure of the success of an anti-corruption campaign may be wrong. What matters is a credible threat of being caught (e.g., more honest supervisors) and convicted reinforced periodically by actual conviction and punishment.

I find that whether officials who engage in "corruption with theft" are able to offer the service at a price below the legal price depends on what consumers know about their type (whether their superiors are honest or corrupt) and whether it is commonly known that weak institutional checks and balances allow them to engage in "corruption with theft".

To the best of my knowledge, this is the first model of corruption in which consumers have the option of reporting corruption *and* studies the factors that affect the rate of consumer reports, the level of such reports, and their effect on social welfare. It is also the first model to endogenize "corruption with theft" and "corruption without theft" (i.e., the nature of corruption) and how this affects social welfare.

Mookherjee and Png (1992) compare the relative efficiencies of monitoring and investigation in controlling malfeasant behavior. Investigation is contingent on complaints by consumers. However, in their model, the probability of consumer complaints is exogenous, the regulator is not corrupt and there is no bribery. Prendergast (2002, 2003) considers a model of consumer complaints about a government bureaucracy's service where the bureaucrat is not necessarily corrupt. One of his main results is that the threat of consumer complaints causes bureaucrats to inefficiently accede to consumer demands. In my model, acceding to consumer demands is not inefficient. His model has one consumer, an agent (bureaucrat), and a principal (the bureaucrat's superior). Like Mookherjee and Png (1992), the principal is never corrupt. To elaborate, in Prendergast (2002, 2003), the consumer and bureaucrat are privately informed about what the correct allocation of a good from a bureaucrat to the consumer should be. The

probability that the bureaucrat's superior (principal) will investigate the bureaucrat's allocation decision depends on the consumer's complaint. The bureaucrat may incorrectly allocate the good to the consumer in order to avoid a complaint[6] and the consumer will not complain if this is the case. This is not the case in my model. In my model, consumers cannot use the threat of complaints to get the bureaucrat to make the wrong decision (i.e., incorrectly allocate the good). My results are also different from the results of these papers.

In the next section, I analyze a model of corruption with asymmetric information and consumer complaints (reports of demands for bribes). A sub-section discusses the results and section 3 extends the model to endogenize "corruption with theft" and "corruption without theft". Section 4 discusses further extensions and section 5 concludes the paper.

2. The Model

Consider a government agency with risk-neutral officials of unit measure who provide a service to risk-neutral members of the public (consumers). Each official has a supervisor (superior) who is corrupt or honest. Call an official whose supervisor is honest an H-type official and if his supervisor is corrupt call him a C-type official. An official's type is his private information and the proportion of officials with an honest supervisor is $\pi \in (0,1)$.[7]

Each H-type official's per-period valuation of his job is s, where s is distributed on $[\underline{s}, \bar{s}]$ with continuous density $f(s) > 0$ and distribution function $F(s)$; $\underline{s} \geq 0$. An official's valuation of

[6] The bureaucrat does not know with certainty that he has incorrectly allocated the good because, conditional on exerting effort, he only gets a signal of the true state of the world (e.g., does the consumer's medical condition require surgery? or is he eligible for unemployment benefits?). However, when a complaint triggers an investigation, the (honest) principal will find out the true state.

[7] Alternatively, one may also assume that there is single supervisor who colludes with a proportion $1 - \pi$ of officials (his subordinates) in corrupt transactions and shares the rents from bribery according to some exogenous formula. However, this supervisor is tough on the other officials of size, π. This may be the supervisor's ploy of masquerading as an honest official.

his job is also his private information. I assume that each official has an infinite horizon and can serve only one consumer per period. The discount factor is $\delta \in (0,1)$. Assume that when a type-H official demands a bribe and is reported, he is fired immediately but he keeps all the previous bribes collected. I assume that he is replaced by a random selection from the same population. [8] A C-type official is not punished and his superior does nothing about consumers' complaints.

There is a unit measure of risk-neutral consumers each with valuation, v, for the service, where v is distributed on $[\underline{v}, \overline{v}]$ with continuous density $g(v) > 0$ and distribution function $G(v)$; $\underline{v} \geq 0$ and $\overline{v}$ may be very large. A consumer's valuation is his private information.

There is a bribe, b, which may be demanded by a corrupt official.[9] The official price of the service is $k \geq 0$, where $\underline{v} \geq k$. I focus on equilibria in which $b > k$. I assume that a corrupt official does not take any revenue from the government's coffers; he puts k into the government's coffers and keeps $b - k > 0$. This means that a corrupt official can only engage in "corruption without theft". Without loss of generality, I assume that $k = 0$ which means that I focus on equilibria with $b > 0$.[10] I shall relax these assumptions in section 3. Note that, in effect, a consumer who gets the service from a corrupt official pays a total price (inclusive of the bribe) equal to $b > k$.

I assume that after an initial (costless) contact with an official, the cost of further search is so high that if the official turns out to be corrupt, consumers do not continue to search till they meet an honest official. This assumption is necessary in order to build a model that allows

[8] For simplicity, I assume that since an official deals with one consumer per period in his office, firings are not observed by consumers who are yet to be served because a consumer does not know the identity of an official until he enters his (official) office. This ensures that the consumers do not get additional information when an official is fired. Alternatively, we may assume that consumers observe firings of consumers but there is replacement or death of supervisors with some known probability and such replacement of supervisors is also observed by consumers. This does not affect the analysis. The proof is available on request.

[9] Later, I shall show that the size of the bribe will be same for all corrupt officials. Note that corrupt officials are not made up of only C-type officials because some H-type officials may also be corrupt.

[10] Note that in some developing countries, public elementary school education is free (i.e., $k = 0$). However, officials of the school may demand a bribe before admitting one's child.

reports by consumers to play a meaningful role. Since the consumers only report an official's demand for a bribe with the hope of meeting an honest superior, it follows that allowing consumers to keep searching for an official till they meet an honest official makes reporting by consumers redundant in the model, which is an undesirable feature of a model that purports to examine the role of consumer reports in fighting corruption.[11] Furthermore, there are certain services for which you cannot search even if search is costless. For example, when an immigration official, customs official, or an official who issues passports demands a bribe, you cannot go to another official because the original official will not transfer your file and once he has denied your application, another official may not process your application unless you lodge a formal and successful complaint to a higher-ranking official.[12] Also, as I show below, there is an equilibrium in which all officials are corrupt. This equilibrium is not affected by consumers' ability to search. Finally, in section 3 where I consider "corruption with theft", consumers are unlikely to search if they meet an official who practices this type of corruption even if search is costless.

I assume that a consumer who pays a bribe and then reports the official does not get his bribe refunded even if the official's superior is honest. This may be because of the lack of funds,

[11] To elaborate, consider the following quote in Shleifer and Vishny (1993, p. 607): "A citizen can obtain a U.S. passport without paying a bribe. The likely reason for this is that if an official asks him for a bribe, he will go to another window or another city. Because collusion between several agents is difficult, bribe competition between the providers will drive the level of bribes down to zero." Therefore, very small search costs and competition among corrupt officials *may* eliminate corruption (bribery in this case). However, the goal of this paper is to study corruption in an environment where the consumers that government officials serve can report corruption. It is impossible and meaningless to build such a model if very small search costs, competition, and no reporting by consumers are enough to eliminate corruption. Therefore, I need a model in which consumer reports may play a meaningful role. To do so, I simply assume that the cost of search is sufficiently high, which restricts the consumer to the following options: (a) don't pay the bribe and report the demand for the bribe or (b) pay the bribe. This limited set of choices biases the model towards reporting bribes. Yet, as I show, there are equilibria with no reporting. These equilibria are not affected by consumers' ability to search because all officials are corrupt.

[12] I thank Henry Thille for this point. Note also that the equilibrium in which all officials are corrupt because the bribe is very low and therefore no one reports corruption is not affected even if the cost of search is zero. This is because it is pointless to search for an honest official given that all officials are corrupt.

paying a bribe is illegal, and the difficulty of retrieving the bribe from the official. In my model, consumers do not report an official out of spite or hatred, so their reports are credible. Therefore, consumers who intend to report a demand for a bribe will not pay the bribe upfront and those who have already paid a bribe do not report corruption.

Without loss of generality, I assume that the bribe demanded by a C-type official is kept by him even if he is reported to his supervisor. As will be shown below, assuming that there is some exogenous division of the bribe between a C-type official and his supervisor will not affect the analysis.[13]

It is important to note that I assume that honest supervisors only act when a consumer reports an official. In the absence of reports by consumer, they do not know if their subordinates sell the service beyond the official price (demand *harassment* bribes) or are engaged in "corruption with theft". Alternatively, they cannot fire their subordinates unless there is a report by consumers. This allows me to focus on the role of consumers' reports or complaints in fighting corruption.

To ease exposition, we think of the sequence of actions as follows:

1. Each consumer (atomistic) forms an expectation of the measure of other consumers who will report a demand for a bribe. This is the probability that an official who demands a bribe will be reported.

[13]I assume that corrupt supervisors do not demand bribes from consumers who report bribery. This may be due to the following reasons: (a) it is too risky for them to do so. It is much less risky for the supervisors to hide behind their subordinates and use them as conduits for their illicit income, and (b) if corrupt supervisors directly demanded bribes from consumers (who reported corruption), they will be undermining their subordinates because every consumer will report corruption hoping to get the service at a lower bribe price from a corrupt supervisor or a zero bribe price from an honest supervisor. This will effectively make C-type officials redundant. This is inconsistent with collusive and corrupt arrangements (networks) between junior and senior officials in the civil service. If the supervisors demand a bigger bribe, the results of this paper will be unaffected. Alternatively, ruling out a demand for bribes by supervisors can be justified under the following valid re-interpretation of the model: all supervisors are honest in the sense that they do not demand bribes. But some supervisors are incompetent, have no sense of duty, and so, in effect, condone corruption. This group of supervisors may even believe that the salaries of lower-level officials are too low, so they need bribes to make ends meet. Another group of supervisors is competent, has a high sense of duty, and take reports about corruption very seriously.

2. Without observing an official's bribe or his type, a consumer approaches an official for the government service in each period.

3. When a consumer meets an official, the official -- based on the probability of being reported in stage 1 – decides to demand a bribe. If the bribe is zero, the consumer is served without paying a bribe. If the bribe is positive, then the consumer has two choices: (a) refuse to pay the bribe and report the official; or (b) pay the bribe and not report the official.

4. Payoffs for the consumer and official are realized; if the official is not fired in a given period, another consumer approaches him in the next period and we repeat the process starting in stage 3. If the official is fired he is, as previously, stated replaced by another official who is randomly chosen from the same population.

Before I proceed to the solution of the model, it is important to reiterate that consumers who paid a bribe are not rewarded for reporting corruption and consumers cannot search. I need these frictions in the model because a model of corruption cannot be a first-best model. After all, corruption tends to exist because we are not in a first-best environment. Otherwise, eliminating or reducing corruption becomes a trivial problem. For example, it is obvious that corruption can be eliminated by combining a small audit or monitoring probability with a very high fine or very severe punishment for offenders. However, there are standard second-best arguments (e.g., wealth constraints of offenders) in the law and economics literature for why this solution cannot or should not be implemented. But the frictions in my model were not chosen arbitrarily. They were chosen with the goal of constructing a second-best model that rules out the attainment of a first-best outcome through certain well-known channels (e.g., introducing competition among

government officials by allowing consumers to search) and thus give a possible non-trivial role to consumer complaints in the control of corruption.[14]

2.1 Equilibrium analysis

I look for a perfect Bayesian equilibrium in pure strategies. [15] The payoffs of the players are as follows: if a consumer does not consume the service, his payoff is zero. If he reports a demand for a bribe and the official's superior is honest, his payoff is v because the supervisor gives him the service without demanding a bribe; if the superior is corrupt, nothing is done about his complaint and he gets zero.[16, 17] If he does not report the demand for a bribe, then he pays the bribe and gets $v - b$ if $b \leq v$; if $v - b < 0$ and he does not report the demand for a bribe, he goes without the service and so his payoff is zero.

[14] For example, Lazear (2006) assumes exogenous fines/punishment in order to focus on alternative measures of dealing with malfeasant behavior. The same is also true in many models of corruption.

[15]Notice, for example, that there cannot be an equilibrium in mixed strategies for consumers because the model has a continuum of consumers with different valuations. So for a given bribe, when a consumer with a given valuation is indifferent between reporting and not reporting corruption, then this condition will not hold for other consumers.

[16]In general, what we need is that a consumer's payoff after an unsuccessful complaint (i.e., if the official is C-type) is lower than his payoff after a successful complaint (i.e., if the official is type-H). Also, to make the analysis meaningful, there must be a cost to complaints. Otherwise, all consumers will always complain (i.e., report corrupt officials) in any equilibrium, which will not be a desirable feature of the model. Unsuccessful reports only occur when the official is C-type.

[17]While this assumption is a way of introducing a cost of reporting corruption in the model, it may also be justified on the grounds that a consumer cannot rejoin the queue after reporting corruption or a disgruntled consumer is not served by a C-type official. In the latter case, this may be due to the following reasons: (a) C-type officials feel insulted by a consumer's rejection of their demand for a bribe and the consumer's audacity to report them, (b) C-type officials may want to deter consumers from engaging in an activity (i.e., complaints) that only result in delays in the payment of bribes, and (c) a (disgruntled) consumer who has reported a demand for a bribe is one who is not a trust-worthy "partner" in an illegal activity. Even in highly corrupt countries, there are a few corrupt officials who are periodically used as scapegoats; these are typically bureaucrats as opposed to politicians. So those who engage in bribery cannot be reckless. Besides, those who are able to escape justice are the very powerful and influential politicians and bureaucrats. Most officials, in charge of issuing permits or providing other government services, and their immediate superiors do not typically have this clout. Such corrupt officials need the trust of consumers to engage in corruption. It takes two to tango.

Let $r \in [0,1]$ be the probability that an official who demands a bribe will be reported by the consumer. This is the measure of consumers who will report an official *if* the official demands a bribe. Given that a consumer who is willing to report a demand for a bribe might end up meeting an honest official, r is not the proportion of consumers who report demands for a bribe. However, for the sake of exposition, I use the expressions "the measure of reports" and "the measure of consumers who are willing to report" interchangeably.

Definition: A pure-strategy perfect Bayesian pooling equilibrium of this game is a bribe-report probability pair, $(\hat{b},\hat{r})$, and consumers' beliefs about an official's type such that (i) given $(\hat{b},\hat{r})$ and consumers' beliefs, each official chooses to be corrupt or honest, where honest officials choose a zero bribe, corrupt officials choose $\hat{b} \geq 0$, and no official has the incentive to change his bribe, (ii) given $(\hat{b},\hat{r})$ and a consumers' beliefs, each *atomistic* consumer maximizes his payoff by choosing whether or not to report an official if the official demands a bribe; (iii) given $\hat{b}$, the measure of consumers in (ii) who will report corruption is indeed $\hat{r}$, and (iv) whenever possible, the consumers' beliefs are derived from the officials' strategies using Bayes' rule.

For now, I focus on equilibria with $b \in (0,\bar{v})$ and $r \in (0,1)$.[18] Stage 4 is trivial. I solve the game in stage 3. In stage 3, I focus on an official's sub-decision to demand a positive bribe of a given magnitude. I shall later show that all C-type officials will be corrupt and that *all* corrupt officials (including corrupt H-type officials) will demand a bribe of the same size (a pooling equilibrium). Therefore, I use a given bribe of common size for all corrupt officials. This, of

[18] I discuss equilibria with $b \notin (0,\bar{v})$ in appendix A.

course, means that in a pooling equilibrium, I have to show that, for H-type officials who choose to be corrupt, $b(s) = b > 0 \ \forall\ s$.

Consider H-type officials in stage 3. Consumers approach an official sequentially and since they do not observe an official's type or his bribe before approaching him, they approach officials *randomly* in stage 2. To an H-type official, each consumer's type is an identical and independent draw from the same distribution. Therefore, an H-type official's belief of the probability that a consumer will report a demand for a bribe is the same for each consumer. Recall that an official who is reported is fired immediately and gets a payoff of zero thereafter but keeps previous bribes collected. Hence an official's decision to be corrupt in a given period is not influenced by previous bribes collected. Accordingly, for an H-type official with valuation s, the Bellman equation for a corrupt strategy, given a bribe, b, is $V_t = (1 - r)[(s + b) + \delta V_{t+1}]$, where V_t is the value function for period t. The preceding arguments, risk-neutrality, and infinite horizon imply that an official's problem is stationary. So imposing stationarity (i.e., $V_t = V_{t+1}$ for all t) gives the payoff from a corrupt strategy as $V^{*B} = (1 - r)(s + b)/[1 - \delta(1 - r)]$. It is easy to show that the payoff from a non-corrupt strategy is $V^{*NB} = s/(1 - \delta)$. Hence an H-type official with valuation s, will be corrupt if

$$V^{*B} \geq V^{*NB}. \qquad (1)$$

Then the inequality in (1) implies that H-types with valuation $s \leq \hat{s}$ will demand bribes from their consumers and those with $s > \hat{s}$ will not, where $\hat{s} \equiv (1 - \delta)(1 - r)b/r$. Therefore, for a given b and r, the proportion of H-type officials who are corrupt is

$$\rho(b, r) = \int_{\underline{s}}^{\hat{s}} dF(s) = F(\hat{s}) = F\left(\frac{(1-\delta)(1-r)}{r} b\right). \qquad (2)$$

Holding b fixed for now, we get

$$\frac{\partial \rho(b,r)}{\partial r} = -(1-\delta) b f(\hat{s}) / r^2 < 0 . \qquad (3)$$

Hence, the higher is the probability of being reported, holding b fixed, the lower is the measure of corrupt H-type officials. Also, the measure of corrupt H-type officials is increasing in the bribe.

Consider a C-type official in stage 3. Since a consumer who reports an official cannot rejoin the queue or is not served by a C-type official, the probability of being reported affects the payoff of C-type officials, even though they are not fired if reported. The Bellman equation for a C-type official is $\Omega_t = (1 - r)[(z + b) + \delta\Omega_{t+1}] + r[z + \delta\Omega_{t+1}]$, where Ω_t is the value function for period t and z is a type-C official's valuation of his job.[19] As before, imposing stationarity (i.e., $\Omega_t = \Omega_{t+1}$ for all t) gives $\Omega(b,r) = [b(1 - r) + z]/(1 - \delta)$. For any $r \in [0,1)$ and $b > 0$, it is obvious that being corrupt is a strictly dominant action for C-type officials since being honest gives $z/(1 - \delta) < \Omega(b,r)$.

Now consider the consumers in stage 3. Given the strategy of H-types which, in the aggregate, is summarized in equation (2) and the fact that all C-types demand a bribe, a consumer's belief that an official is an H-type given that he has demanded a bribe, $b > 0$, is:

$$\lambda(b,r) \equiv \Pr\left(H - type \middle| b\right) = \frac{\rho(b,r)\pi}{\rho(b,r)\pi + (1-\pi)} . \qquad (4)$$

Note that if $0 < \rho < 1$, then $\lambda(b, r) - \pi = -\pi(1 - \pi)(1 - \rho(b, r))/\Delta < 0$,

where $\Delta \equiv \rho(b,r)\pi + (1-\pi)$.

Holding b fixed, we get

[19] Setting z = s will not change the analysis. The current formulation is only to ease exposition.

$$\frac{\partial\lambda}{\partial r}=\frac{\pi\rho_r}{\Delta}(1-\lambda)<0, \tag{5}$$

where $\rho_r \equiv \partial\rho/\partial r$. Hence, holding b fixed, the higher is a consumer's belief of the frequency of reports, the higher is his belief that an official who demands a bribe is a C-type. This is because for, a given bribe, an official who demands a bribe when there is a higher probability of being reported is more likely to have a superior who is also corrupt. Also,

$$\frac{\partial\lambda}{\partial\pi}=\frac{\rho(b,r)}{\Delta}\left(1+\frac{\pi(1-\rho(b,r))}{\Delta}\right)>0. \tag{5a}$$

A consumer of type v for whom $v - b \geq 0$ will report a demand for a bribe if $\lambda(b, r)v + (1 - \lambda(b, r))(0) \geq v - b$. Also, consumers with $v - b < 0$ will always report a demand for a bribe hoping to get an expected payoff of $\lambda(b, r)v + (1 - \lambda(b, r))(0) \geq 0 > v - b$. Therefore, in either case, a consumer of type v will report a demand for a bribe, given $b > 0$, if and only if

$$\lambda(b,r)v+(1-\lambda(b,r))(0)\geq \max[0,v-b]. \tag{6}$$

The set of consumers who satisfy the inequality in (6) have valuation $v \in [\underline{v}, \hat{v}]$, where $\lambda(b,r)\hat{v}+(1-\lambda(b,r))(0)=\hat{v}-b$. This gives $\hat{v}(b,r)=b/(1-\lambda(b,r))>b$. Any consumer with valuation $v \leq \hat{v}$ will report a demand for bribe and those with $v > \hat{v}$ will not. Hence,

$$r=\int_{\underline{v}}^{\hat{v}} dG(v)=G(\hat{v})=G\left(\frac{b}{1-\lambda(b,r)}\right). \tag{7}$$

Holding the bribe fixed and differentiating $r = G(b/(1 - \lambda(b,r))$ with respect to π, we get

$$\frac{\partial r}{\partial\pi}=\frac{g(\hat{v})b\rho r^2}{(1-\pi)[(1-\pi)r^2+(1-\delta)\pi g(\hat{v})f(\hat{s})b^2]}>0. \tag{8}$$

The sign of the derivative in (8) accords with intuition and is driven by the sign of the derivative in (5a): more consumers are willing to report corruption when the proportion of honest

supervisors increases because their posterior belief that a corrupt official has an honest supervisor increases.

Notice that since $\hat{v} > b$ and we construct equilibria in which $b > \underline{v}$, there is a positive measure G(b) of consumers for whom the cost of reporting corruption is zero. In these equilibria, these consumers have valuation $v \in [\underline{v}, b]$. Also, the cost of reporting corruption is not necessarily the same for different consumers whose valuation is $v \in (b, \hat{v}]$; the cost is higher, the higher is their valuation because the surplus lost, $v - b > 0$, is higher if the supervisor is corrupt.

The game has multiple equilibria. For now, I focus on *pooling* equilibria with $\hat{b} \in (0, \bar{v})$ and $\hat{r} \in (0, 1)$. It is important to note that corrupt H-type officials cannot choose a positive bribe different from the bribe chosen by C-types because they would reveal their type if they did so and be reported for sure.[20] Therefore, for corrupt H-type officials, $b(s) = \hat{b} \ \forall s$. In fact, this is the bribe chosen by all corrupt officials. These arguments imply there is no equilibrium with two or more different and positive bribes.[21] This is a very important point.

I support the pooling equilibria with the following out-of-equilibrium beliefs: if a consumer observes $b \neq \hat{b}$, he believes that the official is H-type. This satisfies the intuitive criterion. To see this, suppose an official deviates from the equilibrium bribe, $\hat{b}$. The most favorable scenario is for the consumers to believe that he is a C-type and so will not report a corrupt official. Let $\bar{b} = \arg\max_b b(1 - G(b))$. Then *corrupt* officials of either type, given that

[20]Note that consistency of beliefs require that in an equilibrium where H-types choose a bribe that is different from C-types, types must be revealed.

[21] This is a consequence of the assumption that the officials cannot engage in "corruption with theft". I relax this assumption in section 3.

consumers will *not* report any bribe demanded, will deviate if $\widehat{b} \neq \hat{b}$.[22] Suppose $\widehat{b} = \hat{b}$. Then neither type of corrupt officials will deviate. Intuitively, given that a corrupt official will not be reported, a C-type official and corrupt H-type official are now the same and so have *identical* incentives to deviate (i.e., any profitable deviation by the C-type will also be profitable for the corrupt H-type and vice versa). In either of the two cases considered above, *honest* H-types will deviate from a zero bribe to a positive bribe. The analysis therefore implies that the out-of-equilibrium belief chosen satisfies the intuitive criterion.

Therefore, we can support a pooling equilibrium by assuming that any official who demands a bribe $b \neq \hat{b}$ will be considered to be an H-type. Hence, he will be reported and will get no income from bribes regardless of his type. It follows that no corrupt official will deviate from $\hat{b}$. Note that a C-type official's decision is not affected even if he has to transfer a fixed proportion, α, of every bribe to his superior because $(1-\alpha)\hat{b} > 0$, where $0 < \alpha < 1$.

The following lemma is useful in subsequent analysis:

Lemma 1: *There is no equilibrium with* $b \in (0, \overline{v})$ *and r = 1 (i.e., all consumers are willing to report corruption).*

Proof: Towards a contradiction, suppose $b \in (0, \overline{v})$ and r = 1 is an equilibrium. Then no H-type official will be corrupt. However, given that no H-type official is corrupt, it is not an optimal

[22] Intuitively, the total measure of consumers who are willing to pay a bribe rather than walk away is 1 – G(b). Therefore, given that a consumer randomly approaches an official and the total mass of officials is 1, it follows that a corrupt official's expected bribe income, given that the consumer will not report him, is b[1 – G(b)]. If no consumer will report a corrupt official regardless of the bribe demanded, then the officials solves the standard monopoly profit-maximization problem where a consumer's only options are either to (i) buy if the price (bribe) is not greater than his valuation, or (ii) refuse to buy if the price (bribe) is above his valuation.

response for *all* consumers to report a demand for a bribe since $b \in (0, \bar{v})$ *and* any official who demands a bribe must be a C-type (i.e., $\lambda = 0$). That is, the inequality in (6) does not hold for all v if $\lambda = 0$ and $b \in (0, \bar{v})$. Hence, r = 1 and $b \in (0, \bar{v})$ cannot be an equilibrium. **QED**

2.1.1 Closing the model

So far, this is what we have done: (i) given the bribe and reports, we found the optimal (best) response of each consumer as summarized in the aggregate by equation (7), and (ii) given reports and bribe, we found the optimal response of C-type and H-type officials. Consistent with definition of the game's perfect Bayesian equilibrium given above, an equilibrium of this game is a set of beliefs *and* a (b, r) pair that satisfies equation (7).

Define $\hat{G}(r) \equiv G(\hat{v}(\hat{b}, r))$. The solution to equation (7) is a fixed point: $r = \hat{G}(r)$. As is standard in these models, this fixed-point can be seen as a rational-expectations equilibrium in which each agent, in his decision-making calculus, forms an expectation of the aggregate reports and, in equilibrium, this expected aggregate report becomes the actual aggregate report. That is, we may imagine that each agent forms an expectation, r_e, of the aggregate measure of consumers who are willing to report corrupt conduct. In a rational-expectations equilibrium, we want $r = r_e$ for all agents and accordingly write $r = \hat{G}(r)$.[23]

So consider stage 1 where the equilibrium measure of reporters, r, is determined. Recall that $\hat{G}(r) \equiv G(\hat{v}(\hat{b}, r))$. Differentiating $\hat{G}(r)$ with respect to r, we get

$$\frac{\partial \hat{G}(r)}{\partial r} = \frac{g(\hat{v})\hat{b}\lambda_r}{(1-\lambda)^2} < 0, \qquad (9)$$

since $\lambda_r \equiv \partial\lambda / \partial r < 0$ according to (5).

[23] See also Amegashie (2008), Alesina and Angelotos (2005), and Lindbeck, Nyberg, and Weibull (1999).

Given $\hat{s} \equiv (1-\delta)(1-r)b/r$, we note that $\rho = F(\hat{s})$ which affects $\hat{v}$ through its effect on $\lambda(b, r)$ is undefined for r = 0. Therefore, $\hat{G}(r)$ is undefined at r = 0. However, $\hat{G}(r) \to \infty$ as $r \to 0$.[24] Also, $\hat{G}(1) = G(\hat{b}) < 1$ since $\hat{b} \in (0, \overline{v})$.[25] Then given that $\hat{G}(r)$ is continuous and strictly decreasing in r, it follows that there exists a unique fixed point, $\hat{r} \in (0, 1)$ of $\hat{G}(r)$.

I state the following proposition:

Proposition 1: *Consider* $\hat{b} \in (0, \overline{v})$ *and let* $\hat{r} \in (0,1)$ *be the solution to (7) given* $\hat{b}$. *Suppose* $\hat{s} \equiv (1-\delta)(1-\hat{r})\hat{b}/\hat{r} \in (\underline{s}, \overline{s})$.[26] *Then there exists perfect Bayesian equilibria with bribes* $\hat{b}$ *and reports* $\hat{r}$ *such that all C-type officials are corrupt and the proportion of corrupt H-type officials is* $\hat{\rho} = F(\hat{s}) \in (0,1)$. *Each consumer's belief that a corrupt official has an honest supervisor is* $\lambda(\hat{b}, \hat{r}) = \pi\hat{\rho}/[1 - \pi + \pi\hat{\rho}]$ *if* $b = \hat{b}$ *and* $\lambda(b, \hat{r}) = 1$ *if* $b \neq \hat{b}$.[27]

Later, I shall present an example of the equilibria in proposition 1. The proposition does not include equilibria with r = 0. Accordingly, I state the following proposition:

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[24] To see, this, note that $\rho \to \infty$ as $r \to 0$. By L'Hopital rule, $\lambda \to 1$ as $\rho \to \infty$. Finally, $\hat{G}(r) \to \infty$ as $\lambda \to 1$.

[25] Note that when r = 1, then $\rho = 0$, so $\lambda = 0$. This gives $G(\hat{b}/(1-\lambda)) = G(\hat{b}) = \hat{G}(1)$.

[26] Note that $\hat{r} = G(\hat{v}) \in (0,1)$ implies $\hat{v} \in (\underline{v}, \overline{v})$.

[27] It would appear that it is optimal for every consumer to always threaten to report a demand for a bribe in the hope that if the official is an H-type, he will give them the good without the consumer paying a bribe. But such a threat is not credible for consumers for whom $\lambda(b, r)v + (1 - \lambda(b, r))(0) < v - b > 0$; call them high-valuation consumers. Consumers for whom $\lambda(b, r)v + (1 - \lambda(b, r))(0) \geq \max[0, v - b]$ have a credible threat; call them low-valuation consumers. However, the official does not know a consumer's type and if corrupt type-H officials always gave in to these threats, they will get nothing from bribery. Therefore, they have to take the risk of calling the bluff of consumers since the consumer may be a high-valuation type, in which case the threat is only a bluff. These types will pay the bribe when their bluff is called. And while low-valuation consumers will not pay the bribe if their bluff is called, this does not necessarily signal that they are low-valuation types because refusing to pay the bribe when their bluff is called is a *battle of wills* that high-valuation consumers could also engage in. Notice also that by calling the consumer's bluff, an H-type official may also be sending the message that he is a C-type official, so that reporting the demand for a bribe is a waste of the consumer's time. Both players are uninformed about each other's type. Because of incomplete information on the part of both players, it is reasonable to assume that the official does not budge. And even if the consumer leaves with the threat that he will report the official, the official will still not budge because leaving may simply be a bluff by the consumer to fool the official to capitulate. So essentially, this interaction is akin to brinkmanship between the official and the consumer with the consumer threatening to report the official if the official insists on him (consumer) paying the bribe. So long as, for the reasons given above, the official does not budge, the analysis in this paper is correct.

Proposition 2*: Given* $\pi \in (0,1)$, s*uppose* $\underline{v} > 0$. *Then there exists perfect Bayesian equilibria (with corruption) as follows:* $\hat{b} \in (0, \overline{b}]$, $\hat{r} = 0$, and $\hat{\rho} = 1$, where $\overline{b} = (1-\pi)\underline{v} > 0$. *That is, all officials demand the bribe,* $\hat{b}$, *and no consumer reports corruption. Each consumer's belief that a corrupt official has an honest supervisor is* π *and any official who demands* $b \neq \hat{b}$ *is believed to have an honest supervisor.*

Proof: Consider the equilibrium with $\hat{b} = \overline{b} = (1-\pi)\underline{v} > 0$. Recall that each consumer is atomistic. Suppose that each consumer believes that all other consumers will not report corruption, so that r = 0. Then all officials will be corrupt.[28] So a consumer's posterior belief that an official who demands a bribe is type-H is π. Then a consumer will not report a demand for a bribe if $v - \hat{b} > \pi v$, which is true for all v, given $\hat{b} = (1-\pi)\underline{v} > 0$.[29] Given the out-of-equilibrium beliefs, no official has the incentive to deviate. So $\hat{b} = \overline{b}$, $\hat{r} = 0$, and $\hat{\rho} = 1$ is an equilibrium. Then it is obvious that $\hat{b} \in (0, \overline{b})$, $\hat{r} = 0$, and $\hat{\rho} = 1$ is also an equilibrium. **QED**.

Example: Note that if $\hat{b} \in (\overline{b}, \overline{v})$, then the equilibria in proposition 1, if they exist, are the only equilibria. And in this case, the equilibrium measure of reports is unique for a given $\hat{b}$. For example, suppose $\pi = 0.3$, $\delta = 0.1$, v is uniformly distributed on [1,2], and s is uniformly distributed on [0,1]. Suppose $\hat{b} = 1.2$. Then solving (7) gives $\hat{r} = 0.5884$ and this gives $\hat{\rho} =$ 0.7553. So given $\pi = 0.3$, $(\hat{b} = 1.2, \hat{r} = 0.5588)$ is an equilibrium of the game. Since $\hat{b} = 1.2 > \overline{b}$

[28] Note, however, that $\rho(b, r)$ in equation (2) is undefined for r = 0. This is because when r = 0, the weak inequality in (1) does not hold with strict equality for any b > 0.

[29] At this bribe-price, the consumer with valuation $\underline{v}$ is indifferent between reporting and not reporting and so according to (6), he will report. But since this consumer is of zero measure, the claim that r = 0 in this equilibrium is still valid. At the risk of belaboring the obvious, note that although the minimum valuation of consumers is $\underline{v}$, the minimum expected price they are willing to pay is $(1-\pi)\underline{v}$ because with probability π they can get the service at a zero price (i.e., if they report the demand for a bribe, then with probability π, they will meet an honest superior). Hence, at a corner solution the bribe must be $(1-\pi)\underline{v} > 0$.

= 0.7, the equilibria in proposition 2 do not exist when $\hat{b} = 1.2$. When $0 < \pi \leq 0.2101$, we cannot construct an equilibrium with $\hat{b} = 1.2$ as in proposition 1 because the requirement that $\hat{s} \in (\underline{s}, \overline{s})$ is violated. This is because the bribe is too high and reports are so low that $\hat{s}$ is too high. To construct an equilibrium of the type in proposition 1, we may have to reduce $\hat{b}$ as π falls.

2.2 Social Welfare

Using an expected utilitarian social welfare function that treats bribes as purely redistributive transfers, we may write the equilibrium expected social welfare as:

$$\hat{W} = ((1-\pi) + \pi\hat{\rho})\int_{\hat{v}}^{\overline{v}} vg(v)dv + \pi\hat{\rho}\int_{\underline{v}}^{\hat{v}} vg(v)dv + \pi(1-\hat{\rho})\int_{\underline{v}}^{\overline{v}} vg(v)dv. \qquad (10)$$

The first term is the payoff of consumers who are willing to pay the bribe weighted by the probability of meeting a corrupt official and the second term is the payoff of consumers who will report a demand for a bribe weighted by the probability of meeting a corrupt official whose supervisor is honest (i.e., a corrupt H-type official). The final term is the payoff of all consumers weighted by the probability of meeting an honest H-type official.

Equation (10) simplifies to

$$\hat{W} = (1-\pi)\int_{\hat{v}}^{\overline{v}} vg(v)dv + \pi\int_{\underline{v}}^{\overline{v}} vg(v)dv. \qquad (11)$$

As written in (11), it would appear that social welfare is independent of $\hat{b}$, $\hat{r}$, $\hat{\rho}$. But this is incorrect because $\hat{v}$ depends on these values.

Although the game has multiple equilibria, I undertake comparative static exercises by assuming that the bribe is fixed. In effect, I assume that starting from a given equilibrium, the bribe, perhaps as a result of social norms, does not change when π changes.[30] Only the measure of corrupt H-type officials and the measure of consumers who are willing to report corruption may adjust to changes in π. This is not unreasonable because, in some cases, corrupt officials respond to higher levels of monitoring not by adjusting the bribe but by reducing the frequency of their corrupt transactions. I also discuss equilibria in which the bribe may adjust.

Using Leibniz's rule, simplifying, and noting that $\hat{r} = G(\hat{v})$ implies $\partial\hat{r}/\partial\pi = g(\hat{v})(\partial\hat{v}/\partial\pi)$, we get

$$\frac{\partial \hat{W}}{\partial \pi} = \int_{\underline{v}}^{\hat{v}} v g(v) dv - (1-\pi)\hat{v}\frac{\partial \hat{r}}{\partial \pi}. \qquad (12)$$

Consider the equilibrium in proposition 1 where $\hat{v} \in (\underline{v}, \overline{v})$. The effect of an increase in reports on social welfare is ambiguous because the first term in the derivative in (12) is positive while the second term is negative given that $\partial\hat{r}/\partial\pi > 0$ (according to (8)) and $\hat{v} \in (\underline{v}, \overline{v})$. Social welfare could *decrease* in the proportion of honest supervisors. The intuition is as follows: as the proportion of honest supervisors increases, the measure of reports also increases. However, $(1-\pi)(\partial\hat{r}/\partial\pi)$ of these complainants will meet a corrupt supervisor and so will *not* get the service. If the increase in $\hat{r}$ is sufficiently high, then $(1-\pi)(\partial\hat{r}/\partial\pi)$ will increase when π increases; that is, the expected measure of consumers who will not be get the service will increase. In addition, the valuations of these consumers also matters. If they are sufficiently high, then welfare will be adversely affected. Given $\hat{v} \in (\underline{v}, \overline{v})$ in proposition 1, $\underline{v} \geq 0$, and $\partial\hat{r}/\partial\pi > 0$,

[30] I return to this point in section 4 of the model where I discuss the robustness of results. As explain there, a model in which the bribe adjusts to π does not affect the results.

one can see that the second term in (12) captures the effect discussed above. If this term is sufficiently large, then the derivative in (12) will have a negative value. Of course, equation (12) also implies that an increase in reports could enhance social welfare.

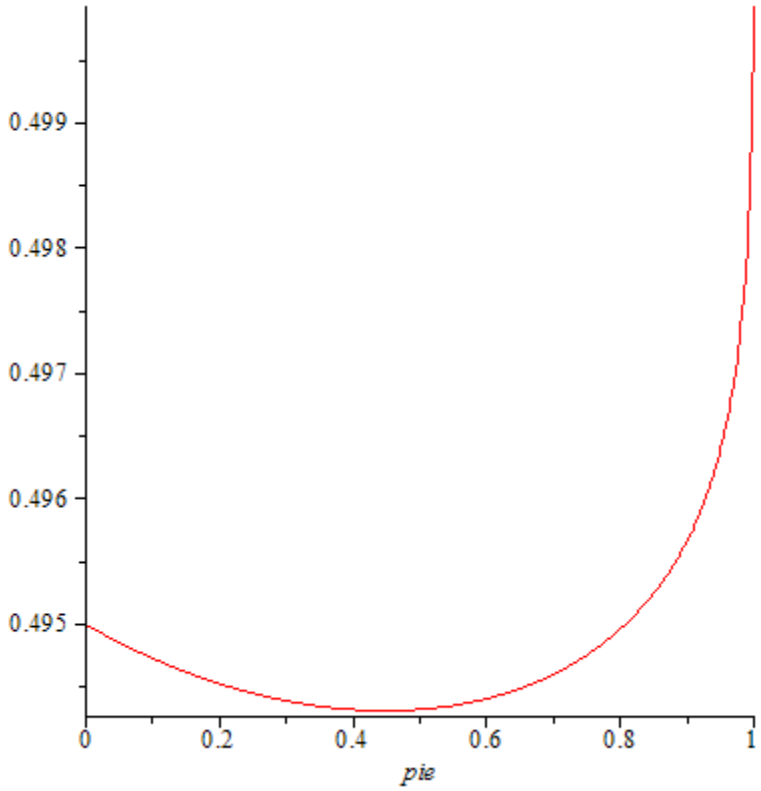
To illustrate the effect of π on social welfare, consider the equilibria in proposition 1. Suppose that $\delta = \hat{b} = 0.1$ and v and s are each uniformly distributed on [0,1]. It can be shown that[31]

$$\hat{r} = \frac{5\left(100 - 109\pi + \sqrt{14200\pi - 24119\pi^2 + 10000}\right)}{10000(1-\pi)}.$$

Plotting the equilibrium social welfare, $\hat{W}$, on the domain $\pi \in (0,1)$ gives the following figure:

[31]This was obtained by using the math software, Maple V. I also plotted $\hat{r}$ on the domain $\pi \in (0,1)$ to confirm that $\hat{r}$ was indeed in the feasible interval (0,1). I did the same for $\hat{\rho}$. The equilibria in proposition 1 exist for all values of $\pi \in (0,1)$. In this example, $\hat{r} = 0.1$ when $\pi = 0$. This is a trivial case where given $\hat{b} = 0.1$ and the uniform distribution on [0,1], a measure $\hat{r} = G(\hat{b}) = 0.1$ of consumers report corruption even though all officials are corrupt supervisors. For these consumers, the cost of reporting corruption is zero because $\hat{b} \geq v$.

Figure 1: A plot of social welfare and π, given δ = $\hat{b}$ = 0.1, G(v) = v, and F(s) = s.



Therefore, in this example, social welfare is decreasing in the proportion of honest supervisors when this proportion is sufficiently low. In this example, an increase in the proportion of honest supervisors leads to an increase in social welfare only if there is a *critical mass* of honest supervisors. In general, since social welfare is continuous in π and is maximized at π =1, social welfare must necessarily increase in π if π is sufficiently close to 1. Therefore, while social welfare can monotonically increase in the proportion of honest supervisors for all π ∈ [0,1], it cannot monotonically decrease in π for all π ∈ [0,1]. I state the following proposition:

Proposition 3: *Social welfare **may** be non-monotonic in the proportion of honest supervisors. In particular, below a critical mass of honest supervisors, social welfare may decrease as the proportion of honest supervisors increases.*

Proposition 3 has implications for policy. It implies that piecemeal anti-corruption measures may be less effective relative to a big-push approach.

Proposition 2 demonstrates an extreme case of low reports. In this equilibrium, no one is willing to report corruption regardless of the proportion of honest officials (i.e., for any $\pi \in (0,1)$) and social welfare is independent of π. If the officials are able to coordinate on this equilibrium where *all* of them are corrupt and choose the Pareto-dominant bribe, $\hat{b} = \overline{b} = (1-\pi)\underline{v} > 0$, in this class of *all-corrupt* equilibria, then as π rises, the officials reduce the size of the bribe (i.e., $\partial \hat{b} / \partial \pi = -\underline{v} < 0$). A smaller bribe and the common belief that no one will report corruption sustain this equilibrium. The lower-ranking officials strategically nullify any effect of an increase in π on the incidence of corruption by reducing the size of the bribe In fact, the bribe is so low that $\hat{b} = (1-\pi)\underline{v} < \underline{v}$. Everyone is served and thus social welfare is maximized, given that bribes are treated as purely redistributive transfers. And $\hat{b} \to 0$ as $\pi \to 1$. In this case, social welfare is independent of the proportion of honest supervisors.[32]

The above discussion implies that that using an increase in consumer complaints or a higher incidence of convicted corrupt officials as a measure of the success of an anti-corruption campaign may be wrong because the consumers may benefit in other ways (i.e., a fall in the equilibrium bribe). What may be important is a credible threat of being caught and convicted (e.g., a high π) reinforced periodically by actual conviction and punishment.

[32] In this case, the derivative in (12) is equal to zero because $\hat{v} = \underline{v}$, so the first term is zero and the second term is also zero because the equilibrium measure of reports is independent of π.

3. The Nature of Corruption: "corruption with theft" versus "corruption without theft"

I have assumed that a corrupt official stole nothing from the government's coffers. Therefore, even C-type officials put the official revenue of k per unit of the service in the government's coffers. Why might this be the case? Suppose that the "corruption with theft" will be detected with certainty because monitoring systems are such that not raising any revenue for the government will be detected with certainty by officials who are above the supervisors of C-type officials. Then C-type officials can only engage in "corruption without theft". To elaborate, suppose that issuing a genuine government document (e.g., a passport) to a consumer requires that the details of the transaction, the consumer's details, and the fee paid by the consumer must be recorded. Otherwise, the only way to keep the revenue due to the government is not to record the details of the transaction. But this would be tantamount to issuing a fake document (e.g., a fake passport). *If* such fake documents can be detected with certainty, then all officials may only engage in "corruption without theft." This is consistent with Shleifer and Vishny (1993, p. 604) who correctly argue that "... the first step to reduce corruption should be to create an accounting system that prevents theft from the government." Of course, when $k = 0$, as assumed in the previous section, then "corruption with theft" where the official sells the service below the legal price is not possible.

As is the case in many countries, suppose instead that "corruption with theft" is possible. This may be due to weak accounting and auditing systems. Suppose that C-type officials can engage in this type of corruption with no risk of being punished. Assume that if H-type officials engage in "corruption with theft", they will be caught with certainty even if there are no reports by consumers. As before, consider an equilibrium in which $\hat{b} > k$ and so consumers who get the service pay a price $\hat{b}$ greater than the official price. Suppose $k > 0$. In this case, C-type officials

keep the entire bribe, while H-type officials put k in the government coffers and keep $\hat{b} - k > 0$. In this case, the payoff function of C-type officials remains unchanged in our analysis. But we have to replace the bribe in the payoff of corrupt H-type officials with $\hat{b} - k > 0$. This does not affect the results above.[33]

I shall maintain all the assumptions in the previous section but consider an extension of the model to endogenize an official's decision to engage in "corruption without theft" or "corruption with theft" where any official can engage in either type of corruption but not both.[34] In particular, I assume that an H-type official can engage in "corruption with theft" *without being detected if his misconduct is not reported*.

Assume that $k > 0$. Given $\underline{v} \geq k > 0$, each consumer will approach an official hoping to encounter an honest H-type official or an official who is engaged in "corruption with theft". Consider an equilibrium with two prices for the service[35]: $\hat{b}$ and $\tilde{b}$. Let C-type officials choose $\hat{b} \in (k, \bar{v})$; all C-types engage in "corruption with theft". We want to construct an equilibrium in which a subset of H-type officials engages in "corruption without theft" by demanding $\hat{b}$ and putting k in the government's coffers. Then there is also another subset of H-type officials who demand $\tilde{b} \in (0, k]$ and engage in "corruption with theft" by putting nothing in the government's coffers. Finally a subset (possibly of zero measure) of H-types officials will not engage in corruption.

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[33] Notice that while "corruption without theft" implies that an official does not give a consumer the service at a price lower than the official price, it does not necessarily follow that "corruption with theft" implies that every corrupt official sells the service at a price lower than the official price. Given our assumptions, C-type officials could sell the service above the official price but not put any revenue in the government's coffers.

[34] The analytical structure is very similar to the one in the previous section. Any further details, if necessary, are available on request.

[35] When $k = 0$, b is the price of the service and it is also the bribe. When $k > 0$, b is still the price of the service but the bribe is $b - k$ if $b \geq k$ and the official is engaged in "corruption without theft") or b if $b \leq k$ and the official is engaged in "corruption with theft". Sometimes, I simply refer to b as the price of the service.

Following Shleifer and Vishny's (1993) reasoning, we require that the probability of being reported and fired when an H-type official engages in "corruption with theft" is lower than when he engages in "corruption without theft". Given $\tilde{b} \in (0, k]$, this probability is zero for those who engage in "corruption with theft" and is $\tilde{r} \in (0,1)$ for those who engage in "corruption without theft". Note that $\hat{b} > \tilde{b}$. Since there is a higher probability of being reported when an official engages in "corruption without theft", we require $\hat{b} - k > \tilde{b} > 0$. Otherwise, no H-type official will engage in "corruption without theft".

Writing payoffs recursively as before, it is easy to show that the payoff of an H-type official with job valuation, s, who engages in "corruption with theft" is

$$V_{wt}^{B} = \frac{s + \tilde{b}}{1 - \delta}, \tag{13}$$

and if he engages in "corruption without theft", then his payoff is:

$$V_{wot}^{B} = \frac{(1 - \tilde{r})(s + \hat{b} - k)}{1 - \delta(1 - \tilde{r})}. \tag{14}$$

If after being reported, a corrupt H-type official's only punishment is losing his job, then when he gets $\hat{b}$, he has no incentive to put the official fee of k dollars in government coffers. Therefore, I assume that when an H-type official is reported and is found to have engaged in "corruption with theft", he not only loses his job but is also given an additional punishment. In effect, "corruption with theft", if detected by an honest supervisor, is treated as a more serious form of misconduct than "corruption without theft." Let the monetary cost of this additional punishment be P > 0 and assume that when an official is reported, "corruption with theft" will be detected with certainty if this is indeed the case. Then when an H-type official demands $\hat{b}$ and does not put the official fee, k, in government coffers, we can write his payoff recursively as

$W = (1 - \tilde{r})[(s + \hat{b}) + \delta W] - \tilde{r}P$. This gives

$$W_{wt}^{B} = \frac{(1-\tilde{r})(s+\hat{b}) - \tilde{r}P}{1-\delta(1-\tilde{r})}. \tag{14a}$$

Given $\tilde{r} \in (0,1)$, we get $\Theta \equiv V_{wot}^{B} - W_{wt}^{B} = \frac{\tilde{r}P - (1-\tilde{r})k}{1-\delta(1-\tilde{r})}$. I assume that P is sufficiently high such that Θ is positive. That is, having worked with equation (14) and found the equilibrium reports and prices for the service, I evaluate Θ at the equilibrium value $\tilde{r} \in (0,1)$ and choose a sufficiently high value of P to ensure that Θ is positive. Then H-type officials who demand $\hat{b}$ do not have a profitable deviation by engaging in "corruption with theft". Therefore, H-type officials who demand $\hat{b}$ will engage in "corruption without theft" and will only lose their job if reported.

Given that "corruption with theft" comes with a zero probability of being reported, all H-type officials will be corrupt because $V_{wt}^{B} > s/(1-\delta)$ for all s and $\tilde{b} > 0$.

It is easy to show that $V_{wot}^{B} \geq V_{wt}^{B}$ if

$$s \leq \frac{[(1-\tilde{r}) - \delta(1-\tilde{r})](\hat{b} - k) - [1-\delta(1-\tilde{r})]\tilde{b}}{\tilde{r}} \equiv \tilde{s}. \tag{15}$$

Suppose $\tilde{s} \in (\underline{s}, \bar{s})$.[36] H-type officials with $s \leq \tilde{s}$ will engage in "corruption without theft" and those with $s > \tilde{s}$ will engage in "corruption with theft". Intuitively, those who value their job sufficiently high avoid the risk of being reported by engaging in "corruption with theft". Therefore, the measure of H-type officials who engage in "corruption without theft" (by hiding behind C-type officials) is $\rho_{wot} = F(\tilde{s})$.

[36] I shall later present an example.

A consumer may report corruption if the bribe $\hat{b} \in (k, \bar{v})$ is demanded. The marginal consumer has valuation, $\tilde{v}$, which satisfies $\lambda(\hat{b}, \tilde{r})(\tilde{v} - k) + (1 - \lambda(\hat{b}, \tilde{r}))(0) = \tilde{v} - \hat{b}$, where

$$\lambda(\hat{b}, \tilde{r}) \equiv \Pr\left(H - type \middle| \hat{b}\right) = \frac{\pi\rho_{wot}}{\pi\rho_{wot} + (1 - \pi)}. \quad (16)$$

The equilibrium measure of consumers who will report corruption when $\hat{b}$ is demanded is given by

$$\tilde{r} = \int_{\underline{v}}^{\tilde{v}} dG(v) = G(\tilde{v}) = G\left(\frac{\hat{b} - \lambda(\hat{b}, \tilde{r})k}{1 - \lambda(\hat{b}, \tilde{r})}\right), \quad (17)$$

All consumers will pay $\tilde{b} \in (0, k]$ when it is demanded and will not report corruption even though, in equilibrium, they know that the official is an H-type (has an honest supervisor). Therefore, in equilibrium, $\Pr\left(H - type \middle| \tilde{b}\right) = 1$. Profit-maximizing behavior implies that, in equilibrium, $\tilde{b} = k$. In this case, the consumers are certain that the official is an H-type but they do not know that he is engaged in "corruption with theft" because he demands the official price as the fee for the service.

The out-of-equilibrium beliefs are such that when the consumers see a bribe, $b \notin \{\hat{b}, \tilde{b}\}$, they believe that the official is an H-type official. So every consumer reports an official who demands $b \in (k, \hat{b})$ or $b > \hat{b}$. If $b < k$, the consumers accept the price and do not report corruption. Note that given that $\underline{v} \geq k$, no official has the incentive to deviate to a price less than k. As in the previous section, it is easy to show that the out-of-equilibrium beliefs satisfy the intuitive criterion.

Note that $\tilde{b} = k = 0$ gives the case studied in section 2. In general, we get the model in section 2 if $\tilde{b} = k \geq 0$ but the official puts $\tilde{b} = k$ in the government's coffers because, by assumption, he cannot practice "corruption with theft".

As an example, suppose s and v are uniformly distributed on [0,1] and [1,2] respectively. Let $\pi = 0.8$, $\delta = 0.3$, $k = 0.2$, and $P > 0.1747$. Then $\tilde{r} = 0.5334$, $\hat{b} = 1$, and $\tilde{b} = k = 0.2$ is an equilibrium of the game, where $\tilde{\rho}_{wot} = 16.68\%$ of H-type officials engage in "corruption without theft" and the rest engage in "corruption with theft".[37] Note that the analysis is not affected even if those who engage in "corruption with theft" put a positive proportion, $1 - \gamma$, of $\tilde{b}$ in the state's coffers, where $0 < \gamma < 1$. In that case, we replace $\tilde{b}$ with $\gamma\tilde{b}$ in the payoffs of H-type officials who are engaged in "corruption with theft".

Holding $\tilde{b} = k$ and $\hat{b} \in (k, \bar{v})$ fixed, the following derivative is instructive:

$$\frac{\partial \tilde{s}}{\partial \tilde{r}} = -\frac{\theta}{\tilde{r}^2} - \frac{(1-\delta)(\hat{b}-k) + \delta\tilde{b}}{\tilde{r}} < 0, \tag{18}$$

where $\theta \equiv [(1-\tilde{r}) - \delta(1-\tilde{r})](\hat{b}-k) - [1-\delta(1-\tilde{r})]\tilde{b}$. But since $\tilde{r}$ is an endogenous variable and it is increasing in the proportion of honest supervisors (i.e., the analogue of the derivative in (8)), the derivative we ultimately want is

$$\frac{\partial \tilde{s}}{\partial \pi} = \frac{\partial \tilde{s}}{\partial \tilde{r}} \frac{\partial \tilde{r}}{\partial \pi} < 0. \tag{19}$$

The derivative in (19) implies that an increase in π leads to a reduction in $\rho_{wot} = F(\tilde{s})$ and an increase in the measure of H-type officials who engage in "corruption with theft". That is,

[37] If "corruption with theft" is not possible as in section 2, then holding the price fixed at $\hat{b} = 1$, the equilibrium reports will increase from 0.5334 to 0.7148 and the proportion of H-type officials engaged in "corruption without theft" will increase from 16.68% to 22.34%. Although the price is fixed and reports have increased, more H-type officials are engaged in "corruption without theft" because the current alternative of being honest is less attractive than the previous alternative of engaging in "corruption with theft".

$1 - F(\tilde{s})$ increases. This leads to the following proposition:

Proposition 4: *Anti-corruption measures which make "corruption **without** theft" less profitable -- by increasing the probability of being reported by consumers -- may lead to a reduction in this type of corruption but an increase in the incidence of "corruption **with** theft" where the risk of being caught is much lower*.

Government's revenue is crucial for development (i.e., for the provision of public goods). Given a unit measure of consumers, the maximum revenue when there is no corruption is $k > 0$. We may write social welfare by treating the theft of government revenue as a cost and putting the revenue into the government's coffers as a benefit.[38] But we continue to treat the bribes from consumers to the officials as pure transfers. Then the analogue of equation (11) becomes

$$\tilde{W} = (1-\pi)\int_{\tilde{v}}^{\bar{v}} vg(v)dv + \pi\int_{\underline{v}}^{\bar{v}} vg(v)dv + \pi F(\tilde{s})k - \pi[1-F(\tilde{s})]k - (1-\pi)k. \tag{20}$$

Simplifying and differentiating (20), the analogue of equation (12) is

$$\frac{\partial \tilde{W}}{\partial \pi} = \int_{\underline{v}}^{\tilde{v}} vg(v)dv - (1-\pi)\tilde{v}\frac{\partial \tilde{r}}{\partial \pi} + 2F(\tilde{s})k + 2\pi k\frac{\partial F(\tilde{s})}{\partial \pi}. \tag{21}$$

For $k \geq 0$, the general restatement of proposition 2 is that when "corruption with theft" is not possible, there exist corrupt equilibria with no reports and bribes (prices), $\hat{b} \in (k, \bar{\bar{b}}]$, where $\bar{\bar{b}} = (1-\pi)\underline{v} + \pi k > k$, if $\underline{v} > k$. Start from a situation where "corruption with theft" is not possible. Suppose that we are in an equilibrium in which there are no reports (i.e., $\hat{r} = 0$) and all

[38]This, of course, implies that the theft of government revenue is not a pure transfer but instead has negative efficiency effects. This is based on the assumption that the government is more efficient than private individuals in the provision of certain goods (in particular, public goods). It also assumes that while there is some corruption in the revenue-collection arm of the government (e.g., the Internal Revenue Service), the officials in charge of spending this revenue are honest. These assumptions are necessary in order to focus on the effects of "corruption with theft" by lower level officials. It also allows us to study corruption without stacking the cards too much against anti-corruption policies.

officials are corrupt as in proposition 2. The corrupt H-type officials must put k dollars in government coffers and keep $\hat{b} - k > 0$. Now suppose that "corruption with theft" is possible and all players are able to coordinate on a zero-report (i.e., $\hat{r} = 0$) equilibrium. Then profit-maximizing corrupt officials will choose $\hat{b} = k$. Therefore, if we are stuck in the equilibrium with no reports, the possibility of "corruption with theft" makes consumers better off but reduces government revenue.

3.1 An extension

The equilibria we have obtained hold if the consumers do not know that "corruption with theft" is possible in the bureaucracy. If an H-type official demands the official price but does not put the revenue in the government's coffers, the consumers do not report him because they believe that an accounting system that prevents theft from the government exists, so theft is not possible. In this case, they only report corrupt officials if they demand more than the official price of the service and have a sufficiently high belief that his supervisor is honest.

Suppose instead the consumers know that an H-type official can engage in either "corruption with theft" or "corruption without theft". Then, in the equilibrium above, they should correctly infer that officials who ask for a fee of $\tilde{b} = k$ are not only H-types but also they do not put the revenue in government coffers. Recall that if they were to report the official, this will lead to the discovery that he did not put the revenue in government coffers.[39] Then the consumers can use this threat to extract some surplus from officials who demand $\tilde{b} = k$ because, in equilibrium, they know that these officials are H-types *and* engage in "corruption with theft".

[39]This may be a report by a consumer that he suspects that the official is engaged in "corruption with theft', whereupon his supervisor will investigate this allegation. Recall that to focus on reports by consumers, I have assumed that honest supervisors are only able to fire their subordinates when they receive complaints or reports from consumers.

Given that the official wants income from bribery while keeping his job and the consumer does not mind getting the service at a price below the legal price, both parties will be engaged in a mutually-beneficial and illegal transaction. Suppose that the agreed price is $b = \sigma k$, where $0 < \sigma < 1$ reflects a *social norm* regarding the proportion of the theft, k, from government coffers that goes to the official.[40] Then, in equilibrium, H-type officials who engage in "corruption with theft" will sell the service at a price of $\sigma k < k$. So the analysis and equilibrium remain the same as before except that we have to replace $\tilde{b} = k$ with $\tilde{b} = \sigma k$.[41]

This brief extension leads to an important insight: whether officials who engage in "corruption with theft" are able to offer the service at a price below the legal price depends on what consumers know about their type (whether their superiors are honest or corrupt) and whether it is commonly known that weak institutional checks and balances allow them to engage in "corruption with theft".

3.2 Applications: Kaushik Basu's proposal and the Punjab Citizen Feedback Model

The substitution effect, as stated in proposition 4, from "corruption without theft" to "corruption with theft" has a broad implication for anti-corruption policies. For example, it has implications for Basu's (2012) proposal discussed in section 1. Harassment bribes are a form of extortion and so they are the bribes under "corruption without theft" in my model. While Basu's

[40]For example, $\sigma = 1/2$ or $\sigma = 2/3$. Alternatively, the consumer does not have to report that the official demanded a bribe or that he (the consumer) suspects that the official is engaged in "corruption with theft". *Given that he knows that the official's supervisor is honest*, he can threaten to refuse to buy the service from the official at the legal price of k and instead go to his supervisor to complain about the rejection of his application without complaining about corruption. The supervisor, being honest, will ensure that he gets the service but will not punish his subordinate (the official). We may assume that the consumer and H-type official bargain over the distribution of k. Since the consumer knows that the official's supervisor is honest, he is guaranteed a payoff of $v - k$ in the event of a disagreement (i.e., if there is no sale). If there is no sale, the official's payoff is zero. Then we may choose b to maximize the Nash product, $N = [(v - b) - (v - k)]^{(1-\sigma)}[b - 0]^{\sigma}$. Then $\partial N/\partial b = 0$ gives $b = \sigma k$.

[41]Any official who deviates by demanding a bribe, $b \leq k$ where $\sigma k < b \leq k$, reveals that he is an H-type engaged in "corruption with theft" and so this results in the price of σk. Of course, no official will deviate to $b < \sigma k$ and, if they did, consumers will accept the price with no complaints.

proposal allows consumers who pay a bribe to report corruption, the broad implication of the substitution effect in proposition 4 is relevant in any situation where corrupt officials can choose between “corruption with theft” and “corruption without theft”. Making bribe giving legal and encouraging bribe-givers to report corrupt officials in the hope of reducing corruption could backfire because, by making “corruption with theft” less profitable (increasing the probability of being reported), it will have the same effect as an increase in π in my model and could therefore lead to a reduction in "corruption without theft" but an increase in "corruption with theft". To the extent that the latter form of corruption leads to a loss of revenue to the government and hence a fall in the provision of public goods, Basu's proposal may be welfare-reducing. Within the context of my model, this negative *revenue* effect on social welfare is captured by the last term in equation (21) where $\partial F(\tilde{s})/\partial\pi < 0$. In this case, “corruption with theft” where corrupt officials sell the service below the legal price will still be preferred by consumers even if, as Basu proposes, harassment bribes will be reimbursed to whistle-blowers. This is because the reimbursement of harassment bribes means that the consumer still pays the legal price of the service. So based on only monetary considerations, a consumer has no incentive to report "corruption with theft" since he will end up paying $k \geq \tilde{b}$ by reporting or will gain nothing from reporting. And in fact, $\tilde{b}$ is *not* a harassment bribe in the sense of Basu (2012). Under "corruption without theft", he gains $\hat{b} - k > 0$ if the bribe is reimbursed. To the best of my knowledge, the perverse substitution effect identified here has not been pointed out by commentators on Basu's proposal and certainly not in

a formal model.[42] An implication of the analysis is that Basu's proposal is more likely to be effective in environments where corrupt officials do not have the option of engaging in "corruption with theft. Otherwise, it might backfire. See appendix B for further details.

A recent and innovative anti-corruption initiative is the "Punjab Citizen Feedback Model" or "Punjab Model for Proactive Governance" in Punjab, Pakistan. The model as described at the official website of the Government of Punjab works as follows:[43] "When a citizen goes to a government office to avail a service (e.g. driving license, character certificate, property registration) the office records his or her mobile number along with the transaction details. This data is passed on to local officers and to a call center through an online data entry form or through SMS. The local officers call some of the citizens. The call center sends SMS messages to citizens and also calls a much greater percentage to inquire about quality of service received. Thus, the state, instead of passively waiting for the citizen to file a complaint, if there is indeed cause of such a grievance, proactively engages the citizen and gets his feedback to improve service delivery and, especially, weed out corrupt government officials."

To the extent that an official cannot hide the issue of a government document or cannot issue a fake document, he can only engage in "corruption without theft". Therefore, in these cases, the Punjab model is effective in reducing corruption. However, the discussion has only focused on "corruption without **monetary** theft." But there are other ways of stealing from the government if stealing is broadly defined as any conduct that reduces social welfare (i.e., any

[42]This result is also not obtained by Dufwenberg and Spagnolo (2013) who study Basu's proposal because they do not endogenize the decision to engage in "corruption with theft" or "corruption without theft". In their model, consumers can offers bribes and can be fined; officials may reject the consumers' offer of a bribe and can report that a consumer tried to bribe them; there is also no incomplete information in their model and in all equilibria, the consumer always reports corruption or does not report corruption: $r = 1$ or $r = 0$. The focus and results of their paper are different from the current paper. Abbink et al (2012) study Basu's proposal in the lab. They found that when bribe-giving is legalized, reporting increases and demands for bribes decrease. However, reporting decreases if the official has the option to retaliate. They do not consider the possibility of "corruption with theft".

[43]More details are available at the website of the Government of Punjab: http://punjabmodel.gov.pk/

moral hazard behavior from the standpoint of the government). Hence an official may engage in "corruption without monetary theft" and yet steal from the government by issuing government documents to those who do not deserve them. For example, he may accept bribes higher than the official price and put the appropriate amount of the revenue in government coffers and yet give a driver's license to someone who actually failed the test. In their field experimental study, Bertrand et al. (2007) found that corruption in Delhi, India resulted in people getting driver's licenses without knowing how to drive. In this case, when some citizens are called by officials (under Punjab model) they may express satisfaction with the service when indeed corruption may nevertheless have taken place.[44] Hence, the increased monitoring under the Punjab model may lead to an increase in a different type of corruption (i.e., issuing more documents to people who do not deserve them and getting a bribe in return). This strategic response by corrupt officials is similar to a reduction in the equilibrium bribe when the proportion of honest supervisors increases as was found in the previous section. The difference though is that while that strategic response is welfare-improving because bribery only had a redistributive effect, the strategic response discussed here is welfare-reducing. A similar distinction is made in Bertrand et al. (2007), although their context is different.

A look at data at the website of the Punjab Citizens feedback model reveals that out of 1,744,713 citizens contacted, 3927 of them gave a negative feedback of services.[45] It also indicates that 6895 cases of corruption were reported by citizens. While there may be double counting (e.g., the same citizen may have given a negative feedback about both the quality of service and demand for bribe), a reasonable interpretation of the data suggests that less than 1%

[44] In such cases, Dufwenberg and Spagnolo (2012) propose a controversial but clever idea, which is a modification of Basu's proposal. That is, by legalizing bribe giving and compensating consumers who report that they got the service illegally, the misallocation of the service can be corrected (e.g., the consumer's illegally acquired license will be revoked) and social welfare will increase.

[45] The website was last accessed on April 27, 2013.

of citizens reported demand for bribes and/or gave a negative feedback about the service. One cannot definitely tell if this very low percentage is due to a much better service or a higher incidence of "corruption without monetary theft" as explained above.

My point is *not* that innovative anti-corruption initiatives such as the Punjab Model are not effective or commendable. Instead, I am drawing attention to trade-offs that policy-makers need to pay attention to. For example, my argument here means that the Punjab Model will be more effective for services which do not require passing a test or for which the eligibility requirements are easily verifiable (e.g., getting a passport).[46] For others, such as getting a driver's license which require passing a test administered by officials who may be corrupt, extra monitoring or measures are necessary to enhance the effectiveness of the Punjab Model.

Callen and Hasanain (2011) have carried out a preliminary evaluation of the Punjab Model. As they note, the future progress of the Punjab Model depends, inter alia, on whether "… the program can provide citizens the correct incentives to report bribe-taking truthfully and accurately?" Based on a sample of calls made to health beneficiaries from March 29 – June 06, 2011, Callen and Hasanain (2011, p. 35) claim that "There were merely 12 messages with negative feedback. If this were representative, it would imply that merely 4% of all transactions in the offices studied are subject to corruption or poor service delivery. The anecdotal evidence is overwhelmingly against such an implication, and the result suggests that there is some stage at which the process is not yet successful in eliciting truth from a large section of respondents." They argue that while a low percentage of negative feedback may reflect improvements in service delivery, another reason may be the fear of the official who called to ask for information.

[46] Even in these cases, a corrupt official can use delays and red-tape to extract bribes and thereby engage in welfare-reducing conduct. So long as officials have monopoly power and can use discretion, welfare-reducing forms of bribery cannot be ruled out (e.g., see Klitgaard, 1988). More generally, the opportunities available to a corrupt official spans a continuum from extortion (corruption without theft) to collusion (corruption with theft). I thank Zubair Bhatti for this point.

This apparent lack of trust in the system may induce a citizen to give a positive feedback when this is not case. This mistrust of the system is consistent with the presence of C-type officials in my model.

Bertrand et al (2007, p. 1641) found that in some cases, the procurement of a driver's license in Delhi was done through agents and that bribes were "... mainly fees to "agents", professionals who "assist" individuals in the process of obtaining their driver's licenses." However, they also found that some consumers (patrons) did not hire agents and, of course, the Punjab Model shows that there is direct interaction between officials and consumers. The organization of corruption differs from place to place and depends on the nature of the service. But the point of this discussion is that the possibility of using agents may be another dimension of adjustment for corrupt officials in response to higher levels of monitoring. In order to reduce the risk of being caught, they may use intermediaries (agents) if possible. Indeed, Bertrand et al. (2007) found that some corrupt officials in Delhi used agents as conduits for their illicit income.

4. Robustness and Extensions

To ease exposition, I revert to the original model in section 2.

The intuitive criterion had no bite and I did not use a stronger refinement or a rationale to select one of the equilibria of the game because it made no difference to the results. In a different version of the paper, available on request, I assume that the equilibrium bribe is $\hat{b} = \arg\max_b \Omega(b,r)$, where $\Omega(b,r) = [b(1 - G(\hat{v}(b,r)) + z]/(1 - \delta)$. That is, the corrupt officials coordinated on the bribe which maximized the payoff of C-type officials. This is arguably sensible because this the most preferred bribe of all the C-type officials while each H-type official's most preferred bribe is different depending on his valuation, s, of his job. In this case,

the equilibrium bribe is a function of π and adjusts when π changes. This formulation complicated the analysis without affecting the results.

The paper can be extended in many ways. An extension is to relax the assumption or the feature of the model which ensures that the reports of the consumers are credible. For example, suppose that a consumer must pass a test in order to qualify for the service (e.g., a test for a driver's license, business permit, etc). Then when a consumer complains to a superior about bribery, the superior cannot be certain that the consumer is credible because he (the consumer) may have truly failed the test or was unable to meet certain requirements. But, of course, the official may also have unfairly failed the consumer in order to demand a bribe. As in Mookherjee and Png (1992) and Prendergast (2002, 2003), this may require the supervisor to engage in costly and, perhaps, imperfect investigation. If honest supervisors do not necessarily trust consumers' reports of bribery, then this is likely to result in fewer consumers willing to report bribery.

A challenging but interesting extension is to allow signaling by supervisors. While honest supervisors have the incentive to reveal themselves, the corrupt supervisors have the incentive to mimic the honest supervisors because not doing so will mean that their subordinates' (cronies) types will be revealed which will eliminate their (i.e., corrupt supervisors) illicit source of income. In this case, the honest supervisors, being public-spirited, will have an objective function such as the social welfare function in (10) while the corrupt supervisors' objective function will be a proportion of the illicit income of C-type officials. One can imagine the signal taking the form of the ease with which consumers can lodge complaints. For example, this may be a 24-hour phone hotline which consumers can call to initiate the process of lodging complaints. The fixed cost of this discretionary service must be financed by each supervisor from the budget allocated to his/her outfit. Then we can construct a separating equilibrium where the

types of supervisors are revealed if the net benefit of this service is sufficiently high for honest supervisors than it is for corrupt supervisors. Otherwise, we can construct a pooling equilibrium where all supervisors invest in the same service and so our results will still go through. With the possibility of signaling by the supervisors, the lower-rank C-type officials may be forced to transfer a bigger proportion of their illicit income to their supervisors in order to make it worthwhile for them (i.e., their supervisors) to invest in the signal. This is especially so if the money invested in the signal used to be diverted by corrupt supervisors for their own private gain. In practice such signaling, for example, in the context of the Punjab Model is not that easy.

It would appear that the assumption that a consumer who lodged an unsuccessful report is not served makes the cost of reports too high and biases the results towards low reports as in proposition 2. This argument is not correct for the following reasons: (a) even when the expected cost of an unsuccessful report is low because there is a high proportion of H-type officials, we are still able to construct equilibria with low reports, (b) the conditions for zero reports in proposition 2 do not depend on a high cost of unsuccessful reports, and (c) in equilibria with positive reports, there exists a positive measure $G(\hat{b})$ of consumers for whom the cost of reporting corruption is zero.

One may argue that the mechanism for the persistence of corruption is fragile because as long as some victims report corrupt officials, this information will eventually spread in society and potential victims will, *over time*, demand the service from only officials whose supervisors are honest. In other words, the officials' types will eventually be revealed as consumers repeatedly demand the service. First, this is a moot point because there is indeed an equilibrium (i.e., proposition 2) in which no one reports corruption. Second, this criticism is applicable to any one-shot game of asymmetric information if one decides to re-cast it as a repeated game. For

example, it is equally applicable to Akerlof's famous adverse selection result because in a repeated setting the lemons will eventually become public information and so, over time, the adverse selection result will be significantly weakened.[47] It is also well known that informational cascades are fragile because a little public information can cause the equilibrium to unravel. Hence, in a repeated setting, the results of informational cascades are likely to be overturned. Yet, like the literature on adverse selection, this literature -- pioneered by Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) -- has led to useful insights. Finally, one may think of a durable and non-transferable service like getting a passport which is only renewable after say ten years. So, after ten years, any information about the officials' types is forgotten.

5. Conclusion

Recent proposals such as Basu (2012) and initiatives like the *Punjab Citizen Feedback Model* are clear indications that policy-makers recognize that the patrons of government services can play an important role in fighting corruption. They also have the added advantage of encouraging citizens' engagement and participation in development. Models of corruption which incorporate consumers' complaints are necessary to help shed light on these policies. This paper has presented such a model and undertaken this type of exercise. The paper also took the first step of endogenizing the decision to engage in "corruption with theft" or "corruption without theft".

Subject to some modifications, the model could be applied to not only corruption but to other aspects of poor consumer service in both the public and private sectors. We can re-define the bribe as the delay in customer service and the size of the bribe as the length of the delay.

[47] See, for example, Hendel, Lizzeri, and Siniscalchi (2005).

Delays reduce the welfare of customers while they increase the welfare of workers because it allows them to work at a slower pace.

Both appendices are not for publication

Appendix A: Equilibria with $b \notin (0, \bar{v})$ in section 2

In the main text, I focused on equilibria with $b \in (0, \bar{v})$ in section 2. I now consider equilibria with $b \notin (0, \bar{v})$ based on the model in section 2.

Suppose that $b \geq \bar{v}$. Then the inequality in (6) holds for all v, so all consumers will report corruption. Then given r = 1, any $b \geq \bar{v}$ is an equilibrium bribe where only C-type officials demand this bribe. Hence, ($b \geq \bar{v}$, r =1) is an equilibrium of the game in which *only* C-type officials demand a bribe.

Suppose r = 1. Then b = 0 is the equilibrium bribe for all officials. Given b = 0, there is no need to report corruption since no official demands a bribe, so the inequality in (6) is not applicable. But r = 1 is still an optimal response by the consumers because the consumers' willingness to report corruption is *conditional* on an official demanding a positive bribe. Hence, (b = 0, r = 1) is an equilibrium.

In both equilibria, all officials get *no* income from bribes. An official of either type will like to deviate to $b \in (0, \bar{v})$ if he will be perceived as a C-type official. Hence, the intuitive criterion has no bite and so we can support these two equilibria with the out-of-equilibrium belief that consumers believe that when an official deviates, that official must be an H-type.

In the equilibrium with (b = 0, r = 1), each official gets a payoff of zero from bribery because no official demands a bribe. I rule out this equilibrium since it is inconsistent with

empirical facts; *for example*, in most low-income countries, paying a bribe for government services is very common.

In the equilibrium with ($b \geq \bar{v}$, r =1), only C-types demand a bribe but both types get a zero payoff from bribery since every consumer reports corruption. I rule out this equilibrium because corrupt officials demand a positive bribe which they know will *certainly* give a zero payoff. This also does not accord with casual empiricism.

Appendix B: Legalizing bribe-giving

In the main text, I stated that the substitution effect in proposition 4 was applicable to any policy that increases the probability of reporting officials engaged in "corruption without theft". In particular, I argued that making bribe giving legal and thereby encouraging bribe-givers to report corrupt officials (i.e., increasing the probability of being reported) will have the same effect as an increase in π in my model and could therefore lead to a reduction in "corruption without theft" but an increase in "corruption with theft". I shall demonstrate this result in this appendix.

Consider an equilibrium as in section 3.0 or section 3.1 in which all C-types and a positive measure of H-types choose $\hat{b} \in (k, \bar{v})$ and the rest of the H-types choose $\tilde{b} \in (0, k]$. Consumers believe that an official who demands $\hat{b}$ is an H-type with probability, $\tilde{\lambda} \equiv \lambda(\hat{b}, \tilde{r}) \in (0,1)$. Recall that in this equilibrium, a consumer cannot pay a bribe and then report corruption because paying a bribe is illegal. Therefore, those who pay a bribe cannot report corruption; corruption is only reported by those who reject a demand for a bribe.

Suppose instead that, in addition, those who pay a bribe can also report corruption and the bribe will be refunded as per Basu (2012). Then *all* consumers who pay $\hat{b} \in (k, \bar{v})$ will still

accept this price but will now report corruption because $\tilde{\lambda}(v-k)+(1-\tilde{\lambda})(v-\hat{b}) > v-\hat{b} \geq 0$. Then no H-type official will demand $\hat{b}$. So the equilibria in sections 3.0 and 3.1 will collapse. However, the switch to legalized bribe-giving results in a separating (intuitive) equilibrium in which *all* H-types choose $\tilde{b} \in \{\sigma k, k\}$ and all C-types choose $\hat{b} \in (k, \overline{v})$, where each official is engaged in "corruption with theft"; no official is reported; and anyone who deviates is believed to be an H-type official.[48]

An equilibrium in which some H-types hide their type by pooling with C-types and choose $\hat{b} \in (k, \overline{v})$ does not exist. If a positive measure of H-types pool with C-types, then $\lambda > 0$. But this implies that consumers will report any official who demands a price of $\hat{b} \in (k, \overline{v})$. Then no H-types will pool with C-types at a price of $\hat{b} \in (k, \overline{v})$.

Another (intuitive) equilibrium is one in which all officials demand b = k and engage in "corruption with theft"; $\lambda = \pi$ and anyone who deviates is believed to be an H-type.

So consistent with the discussion in section 3.2, legalizing bribe-giving increases the measure of officials who engage in "corruption with theft".

[48] Given that in this separating equilibrium, a C-type official is fully revealed and hence the consumer has no incentive to report him and cannot go elsewhere for the service, C-type officials will choose a price for the service to maximize b[1 − G(b)]. I assume that this maximization problem results in a price greater than k. Given that $\underline{v} \geq k$, the C-type officials will necessarily choose a price which is, at least, equal to k, so a separating equilibrium always exists if $\tilde{b} = \sigma k < k$.

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