Can Self Reporting Reduce Corruption in Law Enforcement?*

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Abstract

This paper analyses the impact of self reporting on law enforcement when officers are corruptible. The threat of corruption highlights two additional advantages to the use of self reporting. First, by allowing individuals to self report their unlawful act, the government is able to increase welfare by eliminating officers' rents and the variations in their wages. Second, due to the reduction in corruption costs, the introduction of self reporting allows governments to fully eliminate corruption.

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1 Introduction

The literature on law enforcement has long noted the widespread presence of self reporting of criminal acts. Offenders choose to admit their misdeeds directly when they know the government will be lenient to them: they are better off paying a reduced fine for certain

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rather than facing a harsher sentence if detected. The government also prefers when law-breakers report their own crimes because it reduces enforcement costs. The theory behind self reporting in law enforcement has already been explored by Malik (1993) and Kaplow and Shavell (1994) (henceforth KS)[1]. Using the Becker model (1964), KS demonstrated that self reporting allows the government to save money by reducing the number of officers needed to monitor the population[2]. These cost savings hinge on one assumption, namely the enforcement agency can easily separate those who reported their crime from the rest of the population. This allows officers to concentrate their attention on the non-reporting population. Since the monitored population has shrunk, fewer officers are employed for a given level of deterrence. When this assumption holds, KS finds that self reporting benefits law enforcement. Otherwise, self reporting may not be beneficial.

Despite these restrictions, self reporting is often found in areas of law enforcement that violate this assumption. Hunting licenses in African national parks, nature reserves or game reserves provide one such compelling example. In many protected areas licensed hunting is introduced as a way for park authorities to cull wild animal populations in a controlled manner. However, in several African countries like Malawi, Tanzania and Zambia, hunting permits are used as a form of self reporting for a crime – poaching – that is difficult to control. For instance, in 1998 Tanzania introduced animal hunting licenses in game reserves and national parks during a period of falling wild animal populations, intense poaching and worries about enforcement efficacy. Since then, poaching has decreased dramatically and wild animal populations have recovered (Lamotte, 2008)[3]. In contrast, poaching in Kenya (where there are no licenses) has continued at sustained levels, and animal populations in

[1] See also Polinsky and Shavell (2000) for a more general discussion on the law enforcement theory in economic literature.

[2] A second advantage of self reporting is to reduce the risk borne by individuals. In the absence of self reporting, individuals would face uncertain sanctions. Innes (1999) shows that self reporting enjoys an additional economic advantages if ex-post benefits of remediation are considered. In this case, the violator can undertake remediation in order to reduce the harm caused. Innes (2001) argues that self reporting may also be advantageous when violators can engage in "avoidance" activities.

[3] In Tanzania it is possible to legally hunt the vast majority of wild animals, if one is willing to pay the right price. A license to shoot a lion costs $40,000 and one for a leopard $12,000. The 1998 reform legalized hunting for local populations as well, with licenses selling at a much lower cost.

the national parks continue to decline.

Despite the wide adoption of hunting permits in African parks, this form of self reporting cannot be justified by the standards set in KS. Hunters who purchase licenses can legally shoot wildlife within the park, but rangers cannot easily distinguish them from poachers. Because of this, the licenses do not affect how the park rangers patrol, and do not reduce the number of rangers needed. Why then do we observe such instances of self reporting in situations where enforcement cannot be reduced?

Our answer to that question is that self reporting has another important advantage than the ones highlighted by KS: self reporting can be used as a tool against corruption in law enforcement[4].

In this paper, we show that when officers are corruptible, self reporting reduces revenue losses associated with corruption. The problem we consider is the following: enforcement officers can accept bribes from apprehended wrong-doers in exchange for letting them go, thus challenging legal enforcement. To prevent this, the government may be compelled to offer incentives designed to keep enforcers honest. Standard treatment of these kind of asymmetric-information environments suggest the presence of conflicting goals: on the one hand, the government wants to induce officers to report thrutfully, on the other hand, it wants to fully insure them against income risk. When officers are risk averse, these two goals come into conflict because the only way to get the officers to report thrutfully is to relate their wages to the realization of their inspections, which is random. Self reporting provides an alternative to the offender, who can avoid paying either bribe or the full fine by admitting culpability and paying directly to the government. When the individual chooses this alternative, he avoids the law officer entirely, who –by being excluded– can claim neither

[4]Whether the difference in the policy outcomes between Tanzania and Kenya can be prescribed to an increase in patrolling efficiency and corruption reduction is an issue that is worth exploring in further detail. That some legalization of wildlife hunting and trade can be helpful and beneficial for conservation is a concept that is not lost for several environmental groups. In their 2008 joint report, TRAFFIC and the WWF state that "Policies that criminalize the wild meat trade have not been effective to bringing it under control...greater consideration of alternative management scenarios, including legalizing hunting and trade of certain wild species for meat is therefore required" (Roe, 2008).

bribe nor bonus[5]. By doing so, the government eliminates variations in officers' wages, and the risk-bearing concerns with it.

In second part of the paper we study the case in which the officers are risk neutral. Clearly in this case the risk-bearing concern is absent. Nonetheless, when the officiers' pay cannot fall below a certain threshold, self-reporting is still beneficial. This is because it separates innocent citizens from offenders without the *direct* intervention of the police force, and therefore deprives them of their bonuses[6]. This 'limited liability' assumption is reasonable when wages are understood in a more general sense to include 'per officer costs', which include expenditures on equipment (cars, computers, weapons) which cannot be eliminated without reducing the efficiency of the police force.

From this perspective, the role of self reporting in reducing corruption is similar to the role that pre-paid or 'top-up' systems have in many utility companies in developing countries. Companies face the problem of dishonest bill collectors who collect bribes rather than payments. In Tanzania, customers could consume electricity for years without ever paying their bills. This was quite common until TANESCO introducted 'smart' electronic meters which require payment before supplying electricity, bypassing the corrupted workers. This system was borrowed from the cell phone industry and has been successfully adopted in the water, telecommunications and trash disposal sectors[7]. In India, the *tatkal* system was introduced by the phone company to provide people with an alternative to paying bribes for quick phone line installations. The Bharat Sanchar Nigam company guaranteed speedy connections to those willing to sign up and pay into the program. The same *taktal* system was later adopted by the railways as a way for customers to avoid long waiting lists or paying

[5]Self reporting has been found to have other important properties that are not discussed here. Motta and Polo (2003) show that leniency programs deter long term illegal relationships by creating a prisoner's dilemma. In this regard, Buccirossi and Spagnolo (2005) show that leniency programs could help sustain occasional sequential illegal transactions.

[6]The same property of self reporting can be used in other settings: in a separate paper, we use a version of self reporting to create a collusion-proof mechanism that works in designing optimal contracts (Burlando and Motta 2008).

[7]Top-up systems or pre-paid services are different from self reporting in one important aspect: the client has no choice but to pre pay if he wants the service. In law enforcement, miscreants always have a choice not to self report.

bribes to intermediaries for a quick ticket.

A second issue we consider in this paper is that bribes do act as de-facto fines which discourage criminality. Because of that, certain governments may prefer an enforcement system based on corruption rather than one based on legal fines (Besley and McClaren 1993)[8]. Our paper shows that self reporting benefits all enforcement systems, be them 'clean' or corrupt. When the system in place is clean, self reporting lowers the cost of incentives; when the system is corrupt, it increases government revenues. Furthermore, we also show that once self reporting is introduced, it is always preferable to eliminate bribe exchanges and replace a corrupt regime with a clean one. Thus, governments can use self reporting as a way to clean up corrupt enforcement agencies. This result is true under specific assumptions which we relax in the later portion of the paper.

The rest of the paper is organized as follows: section 2 discusses the model and analyses the impact of self reporting on law enforcement and corruption; section 3 discusses the implications of some model assumptions; section 4 concludes.

2 The model

2.1 Structure

There is a measure 1 of risk-neutral citizens who cause a harm to society of h if they commit an unlawful act or crime. Each citizen derives a private gain x from committing the act; the gain is distributed with a continuous density function $g(.)$ and cumulative distribution function $G(.)$. To minimize the number of crimes the government employs p officers in the police force[9]. They are responsible for monitoring the population and reporting violators to a court of law, which in turn imposes fines.

In the absence of any other consideration, citizens choose to commit the unlawful act only when their private benefit exceeds the expected sanction. Enforcement determines a

[8] While bribery discourages unlawful acts, it is true that it is not necessarily an effective deterrent when compared with a system based on fines (Becker and Stigler, 1974; Polinsky and Shavell 2001).

[9] We refer to the police officer and the citizen respectively as "she" and "he".

threshold level of gain $\hat{x}$ such that only individuals whose private benefit exceeds $\hat{x}$ commit the act. The harm to society due to criminality is $[1 - G(\hat{x})]\, h$.

2.1.1 Enforcement and corruption

Monitoring by the police force is costly. The government pays an income v to each officer, which may consist of a base wage w and an incentive i. Officers are risk averse individuals with a continuos and twice differentiable utility function $u(.)$ of the expected utility form, such that $u'(.) > 0$ and $u''(.) < 0$. Furthermore, they have reservation utility $u(\bar{v})$ which they must receive in order to remain in the force. Finally, they are potentially corruptible, meaning that they will consider accepting bribes.

Each officer is randomly matched with a citizen and learns whether he is an offender. When an offense is uncovered, the officer can report the violation to the judiciary system, which levies a fine f to the offender. Alternatively, the offender may offer a bribe b to the officer in exchange for her silence. We assume that if $b \leq \sigma f$, where $\sigma \in [0, 1]$, such bribe goes undetected or, if detected, unprosecuted. If a bribe is larger than σf, then the collusion is uncovered, the officer loses her wage, and the offender is made to pay the full fine f. Because of this, officers are willing to consider bribes if $b \leq \sigma f$.[10]

The parameter σ plays an important role in the comparative statics of the model. We think of σ as a parsimonious description of how easy it is to detect collusion. The case where σ is small or zero corresponds to transparent societies where even small bribes are not tolerated; a high σ instead corresponds to potentially more corrupt societies, where even outrageous instances of bribery are not prosecuted.[11]

[10] It is common in the literature on corruption to assume that the probability of detecting bribe exchanges is a choice variable of the government. We abstract from it in order to keep the model simple. For an analysis of endogenous bribe detection, see Mookherjee and Png (1995), Polinsky and Shavell (2001). In Adving and Moene (1990), the probability of detection depends on how corrupt the overall system is. Overlapping responsibilities among different bureaucrats may also increase the chances of detection and the size of bribes, since officials may need to solve a coordination game (Rose-Ackerman 1994). See Bhardan (1997) for an insightful review.

[11] The parameter σ could also reflect the level of transactional imperfections between the colluding parties, i.e. the offender incurs a cost $(1+\tau)b$ in transferring a bribe b to the inspector. In this case, once the offender is caught, he will consider offering a bribe only if $b \leq \frac{1}{(1+\tau)} f$, where $\sigma = \frac{1}{(1+\tau)}$. Notice that the transaction cost τb is equivalent to a deadweight loss in terms of social welfare, requiring a slight modification of the

Aside from this exogenously given detection function, the government has no other 'sticks' to prevent corruption. The only anti-corruption measure would be a 'carrot': the payment of bonuses or incentives i that are paid when an officer reports an offender. Because acceptance of the bribe implies foregoing the incentive, the officer will consider only bribes that have the following characteristic: $i \leq b \leq \sigma f$.

Finally, consider the choices available to an offender: if he is caught, he will prefer the payment of the bribe when such payment is less than the fine, i.e. $b \leq f$.

The agreement on the bribe is reached through a bargaining process, which we will specify later. Regardless of how the bargain power is distributed between the two parties, to fully eliminate corruption the government must set incentives high enough according to the following no-collusion condition:

$$i \geq \sigma f \equiv i^{nc}. \tag{1}$$

In this simple model with homogeneous officers, there are only extreme outcomes. When $i < i^{nc}$, all officers accept bribes, and all criminals offer them. Since delinquents are never reported, the government neither pays incentives, nor levies fines. When $i \geq i^{nc}$, no bribes are ever exchanged, and therefore all violations are reported, all fines are levied, and all incentives are paid. We label these two states by the index $j = c, nc$.

2.1.2 Government expenditures

Government expenditures B_j consist of wage payments net of revenues from fines collected in state j. B_j is raised through distortionary taxation from the citizenship. Taxes cost taxpayers $(1 + \lambda)B_j$, where λ is a parameter that measures the size of the dead weight loss. When $\lambda = 0$, resources are costlessly shifted from taxpayers to the government, resulting in no welfare losses; when $\lambda > 0$, there is a welfare loss equivalent to λB_j.

model presented here. See Tirole (1992) for a review of this transaction cost strand of the literature.

2.1.3 Social welfare

The government maximizes a weighted average of the welfare of all members of society, which include both civilians and enforcement officers. The social welfare in state j is

$$W_j = \int_{\hat{x}_j}^{\infty} (x - h)g(x)dx - \lambda B_j \qquad \text{for } j = c, nc. \tag{2}$$

The canonical approach in KS or Polinsky and Shavell (2001) doesn't consider a government budget which include the revenues from fines collected and the effect of distortionary taxation. From this perspective, our framework is similar in nature to setups more commonly found in the literature of corruption, such as in Besley and McClaren (1993) and Laffont and Tirole (1993). This departure is justified by the nature of the problem we are analyzing: corruption affects efficiency and depends on incentives, and our paper analyzes the tradeoffs between costly incentives and police force efficiency.

In the next section, we consider the welfare functions for $j = c, nc$ under the assumption that self reporting is not possible. The government can affect the state j and the level of welfare W_j by changing the incentive paid to officers and their number p[12].

2.2 No Self Reporting

2.2.1 Clean Regime

Consider the choice faced by a citizen when the regime is clean, i.e. officers are never corrupted (because they are paid high incentives, $i \geq i^{nc}$). Since his probability of being audited is p, by committing the act he expects to pay a fine of pf. This determines the

[12]The fine f is also a policy instrument that is optimally set by the government. As in the rest of the enforcement literature, the fine is always maximal: f is set to coincide with the wealth of the citizen. For a proof, Becker (1968), Kaplow and Shavell (1994), Polinksy and Shavell (2001). There are some exceptions to this: Malik (1990) shows that when criminals engage in detection avoidance, fines are not maximal. Livernois and McKenna (1999) claim that under plausible condition higher compliance rates are achieved with lower fines. However, Ines (2001) shows that when self reporting is introduced, there is no need to engage in avoidance and therefore the Becker principle of maximal fines applies again.

threshold gain from the act, $\hat{x}_{nc}$:

$$\hat{x}_{nc} = pf.$$

The threshold determines the number of unlawful acts, $1 - G(pf)$, and is also the probability that a given audit uncovers an offender. The threshold also helps to determine the expected income v_{nc}^E for the officer, since she receives incentives only if an offender is caught:

$$v_{nc}^E = w_{nc} + i\left[1 - G(pf)\right]. \tag{3}$$

Where w_{nc} is the base wage and i is the incentive pay. The payment structure must allow officers to earn their reservation utility, so that the following participation constraint must be met:

$$\left[1 - G(pf)\right] u(w_{nc} + i) + G(pf)u(w_{nc}) \geq u(\bar{v}) \tag{4}$$

Next, consider the government's decision. The government hires p officers, pays them v_{nc}^E on average, and collects fines from caught miscreants, f.[13] Accounting for wage expenses (which include incentive payouts) and fine income, the social welfare function is a function of p, w_{nc}, and i:

$$W_{nc}(p, w_{nc}, i) = \int_{pf}^{\infty} (x - h)g(x)dx - \lambda p\left\{w_{nc} + (i - f)[1 - G(pf)]\right\}. \tag{5}$$

subject to the no-collusion bonus pay constraint (1) and the participation constraint (4). Note that the only effect of wages and incentive pay is to increase the government budget. Enforcement is neither helped nor worsened by high payouts to officers. Thus, welfare is maximized when the average income earned by officers is minimized. It is straightforward to show that, due to the concavity of the utility function, this happens when both constraints (1) and (4) bind. At the optimum, the incentive is $i^* = i^{nc} = \sigma f$ and $w^*(p; \bar{v})$ is the base wage that satisfies (4) with equality. The objective function to be minimized is then reduced

[13] A modified version of costly imposition of fines is found in Polinsky and Shavell (2000).

to a function of p only:

$$W_{nc}(p) = \int_{pf}^{\infty} (x-h)g(x)dx - \lambda p \left\{ w^*(p;\bar{v}) + f(\sigma-1)[1-G(pf)] \right\}. \tag{6}$$

The three terms in the welfare function are the following: the first term is the welfare loss due to illegal acts; the second term is the social cost of hiring p officers which are provided a base wage equal to w^*; the last term is the net revenues to the government, that is, fine income minus incentive pay.

2.2.2 Corrupt Regime

Suppose that incentives are too low, i.e. $i < \sigma f$: in this case there is scope for bribe exchange and the regime is corrupt. The agreement on the bribe is reached through Nash bargaining, with weights of μ. The equilibrium bribe is given by the following expression:

$$b = (1-\mu)i + \mu\sigma f. \tag{7}$$

The potential law breaker's choice is either to do nothing, or commit the act and pay with probability p a bribe b as defined by (7). The threshold condition is

$$\hat{x}_c = pb. \tag{8}$$

Officers have two sources of income: their base wage and the bribes. Their expected earnings are then

$$v_c^E = w_c + b[1-G(pb)]$$

In this scenario, the government pays only base wages to its officers and receives no fine income, so the government budget is

$$B_c(p,w,i) = pw_c. \tag{9}$$

As before, the wage received by officers need to satisfy a participation constraint, which now takes the following form:

$$[1 - G(pb)]\, u(w_c + b) + G(pb)u(w_c) \geq u(\bar{v}) \tag{10}$$

The welfare function takes the form

$$W_c(i, p) = \int_{pb}^{\infty} (x - h)g(x)dx - \lambda p w_c \tag{11}$$

Subject to constraints (7), (10) and for values $i < \sigma f$.

Claim 1 *In the corrupt regime, incentives are maximized and officers' participation constraint binds with equality at a wage* $w_c^*(p; \bar{v})$

Proof. For a given value of p, b and w_c, consider a corrupt regime where $i < \sigma f$. A small increase in i induces the equilibrium bribe b to increase to $\tilde{b}$ according to (7), and the participation constraint (10) slackens. The government can then choose to hire fewer officers $\tilde{p}$ such that $\tilde{p}\tilde{b} = pb$, and keep the pay w_c. With fewer officers, the wage bill is reduced without affecting the level of criminality. Thus, for any wage w_c that satisfies (10), i is set arbitrarily close to σf.[14] Next, note that the participation constraint must be biding with equality. Otherwise, the government can reduce w_c without changing either b or p, and the wage bill is reduced in a way that does not impact the amount of criminality. ■

Note that, in this case, incentives are offered but never paid out. However, they do play a role: they raise the equilibrium bribe and therefore increase the compliance threshold (8). In the optimum, the government increases i to the point where bribes are maximal ($b = \sigma f$).

The corrupted loss function is then expressed in terms of the number of officers p only:

$$W_c(p) = \int_{\sigma p f}^{\infty} (x - h)g(x)dx - \lambda p w_c^*(p; \bar{v}). \tag{12}$$

[14] For simplicity, we assume that $i^* = \sigma f$.

2.2.3 When is the corrupt regime optimal?

The government can move from one regime to the other by modifying the incentive pay i. The final outcome is determined by maximizing both W_{nc} and W_c in equations (6) and (12), and then choosing whichever is larger. When choosing which regime to adopt, the government essentially trades off lower agency costs (lower wages) in a corrupt regime, with the revenue that is collected when the regime is clean. Depending on the parameters of the model, either regime could prevail.[15]

It is worth pointing out that σ plays an important role in the selection of the optimal regime. When σ is small, officers collect in fines more than they cost in incentive pay, so it could not be optimal to let these profitable workers collect bribes. When σ is large, fines collected can barely cover the expense of keeping officers honest. It may be better to let them collect bribes.[16]

Aside from the profitability of officers, the government also finds that bribes are less desirable because they limit deterrence: for any given p, there are more criminals in a corrupt regime than in a clean one. Still, when society is highly tolerant of corruption (σ is high), bribe amounts are high, and that provides a relatively large deterrence. Hence, a society characterized by high σ could be better off adopting an enforcement system based on bribes.

Finally, the government finds that a regime based on bribes is desirable in that having more criminals effectively reduces officers's wage, since $w_c^*(p;\bar{v}) \leq w^*(p;\bar{v})$.

Whichever regime is chosen, officers benefit from their corruptibility, since they are able to supplement their wage with rents in the shape of bonuses or bribes.

[15] Notice that in the optimum we have $i = b = \sigma f$. Therefore, $v_c^E = w_c + \sigma f.[1 - G(p\sigma f.)]$ and $v_{nc}^E = w_{nc} + \sigma f.[1 - G(pf.)]$. A fast inspection reveals that the probability of apprehending a criminal is higher in the corrupted regime, $1 - G(p\sigma f) \geq 1 - G(pf)$. In equilibrium, the base wage that makes the officer indifferent between accepting the job or not must be lower in such a regime, i.e., $w_c^*(p;\bar{v}) \leq w^*(p;\bar{v})$ for a given value of p.

[16] Governments often exert great effort to keep highly profitable enforcement agencies (such as tax administrations and customs) as honest as possible, even amid the widespread corruption of other forces (i.e., police forces and anti-crime units).

2.3 Self Reporting

We now introduce self reporting in both regimes $j = nc, c$. Following KS, we assume that an individual who committed an unlawful act may admit it before the inspection has taken place. As a reward for the admission, the judiciary imposes a reduced or discounted fine r, which is less than the fine f. By self reporting and paying r, the individual avoids paying either the fine f or a bribe b. However, we diverge from the original Kaplow and Shavell model by assuming that those who self reported do not necessarily avoid enforcement audits, because officers cannot easily distinguish them from the general, non-self reporting population. By doing this, we abstract from the 'enforcement reduction' aspect of self reporting highlighted in their paper.

In general, the reduced fine follows a different judicial path than the full fine. A citizen who is reported to the judiciary by a law enforcer has the right to defend himself in a court of law, so demonstrating his culpability is time consuming and expensive. The same cannot be said when a person reports his unlawful act: by confessing, he gives up the right to proclaim his innocence. As a consequence, the bureaucratic procedure needed to process the reduced fine is more efficient and less expensive. This point, already highlighted by KS, adds to the appeal of self reporting. However, we prefer to abstract from it and show that the public finance benefits we highlight in this paper do not depend on the superior bureaucratic efficiency of self reporting.

2.3.1 Clean Regime

Suppose that $i \geq i^{nc}$, so that the regime is clean and there is no possibility of bribing officers. Then, an individual who commits an unlawful act can either accept the chance of being caught and pay a fine f, or report himself and pay the reduced fine r - whichever is more convenient (less expensive) in expectation to him. An individual with private gain x may commit the act if his private benefit from the act exceeds the cost:

$$x \geq \min[r, pf] \equiv \hat{x}_{nc}^{sr},$$

where r is now part of the set of policy instruments available to the government. To get the optimal level of r, consider first the case $r > pf$. Because self reporting is more expensive than the expected full sanction, criminals do not report their act. In this case, self reporting is possible, but no one employs it.

Now suppose $r \leq pf$. All unlawful acts are reported by miscreants who pay only reduced fines to the government. Since $\hat{x}_{nc}^{sr} = r$, the total number of crimes committed is $1 - G(r)$. The welfare achieved is

$$W_{nc}^{sr}(r, p, w, i) = \int_{r}^{\infty} (x - h)g(x)dx - \lambda \left\{ pv_{nc}^{sr,E} - r[1 - G(r)] \right\}, \tag{13}$$

where $v_{nc}^{sr,E}$ is the average payout given to officers (wages and incentives). This welfare can be achieved subject to the usual constraints on officers that dictates that their expected utility from their earnings $E(u(v))$ under the self reporting regime cannot fall below the reservation utility $u(\bar{v})$.

Proposition 2 explains the optimal self reporting policy.

Proposition 2 *When self reporting is adopted and corruption is not allowed:*

(i) $r = pf$ *(the reduced fine is equal to the expected full fine when bribing is not possible);*

(ii) $i \geq \sigma f$ *(the no-collusion condition (1) is implemented)*

(iii) $v_{nc}^{sr,E} = \overline{v}$ *(officers' base wage is equal to their reservation wage).*

Proof. *see the Appendix.* ■

With this proposition, we can replace r with pf, and $v_{nc}^{sr,E}$ with $\overline{v}$. The welfare function to be maximized becomes

$$W_{nc}^{sr}(p) = \int_{pf}^{\infty} (x - h)g(x)dx - \lambda p \left\{ \overline{v} - f[1 - G(pf)] \right\}. \tag{14}$$

The first term indicates the welfare loss due to crime; the second term represents the wage bill $\overline{v}$ paid to officers; the third term is the revenues from self reporting.

The critical difference between a self reporting regime and one that does not rely on it is that in the latter officers must be compensated for bearing the risk of uncertain wages. By introducing self reporting, officers receive only their base wage, they do not observe wage uncertainty, and therefore they do not need to be compensated for it. In section 2.4 we prove that this is a welfare-enhancing difference.

Even though inspectors never uncover unreported miscreants, the presence of officers does provide a credible threat against those criminals who fail to self report: such criminals could get caught and subjected to pay the full fine f. This mechanism resembles the 'threat' found in the enforcement of parking regulations. Cities allow drivers to park in certain areas only if they pay a certain reduced fine at the curb by feeding a meter. People feed the meter in the off chance that a parking inspector passes by and fines those who did not.

2.3.2 Corrupt Regime

Suppose the regime is corrupt. The choice now facing a guilty individual is between self reporting r_c and paying the bribe b with probability p, where b is still defined by (7). The threshold level of gain needed to choose between committing and not committing the act is

$$\hat{x}_c^{sr} = \min[pb, r_c].$$

so that in order for self reporting to be used, $r_c \leq b$ and the welfare achieved is

$$W_c^{sr}(r_c, p, w, i) = \int_{r_c}^{\infty} (x-h)g(x)dx - \lambda \left\{ pv_c^{sr,E} - r_c[1-G(r_c)] \right\}, \tag{15}$$

where in this case, $r_c[1-G(r_c)]$ is income earned from self reporting fines. We now establish the optimal corrupt policy under self reporting:

Proposition 3 *When the regime is corrupted and self reporting is adopted:*

(i) $r_c = pb$

(ii) $b \to \sigma f$

(iii) $v_c^{sr,E} = \overline{v}$

Proof. see the Appendix. ■

With this proposition, the objective function reduces to a function of p only:

$$W_c^{sr}(p) = \int_{\sigma pf}^{\infty} (x-h)g(x)dx - \lambda p\left\{\bar{v} - \sigma f[1 - G(\sigma pf)]\right\} \tag{16}$$

Again, the first term is the social loss due to criminality, and the term in parenthesis is the wage paid net of revenues from self reporting. Note that, in essence, the revenues from self reporting are in fact the bribes that are now diverted from the hands of corrupted officials into the state's coffers. This bribe diversion has no direct enforcement effect, but it has a significant revenue effect. It also has no direct effect on the corruptibility of officials, who would take bribes if in the position to do so.

2.4 Comparative Statics

We are now able to compare the different regimes with and without self reporting, and demonstrate the main result of the paper: that self reporting in a clean regime is the best enforcement policy. To reach that conclusion, we show in the next two lemmas that self reporting is more efficient in both clean and corrupt regimes. We start by evaluating self reporting in a clean regime.

Lemma 4 *Self reporting improves welfare under a clean regime.*

Proof. It is sufficient to show that for any $\tilde{p}$ that is chosen under a policy without self reporting, a self reporting policy $\tilde{r} = \tilde{p}f$ yields greater social welfare. Denoting the welfare without self reporting by $W_{nc}(\tilde{p})$ and the welfare with self reporting policy $\tilde{r}$ by $W_{nc}^{sr}(\tilde{p})$, the

increase in welfare under self reporting is

$$W_{nc}^{sr}(\tilde{p}) - W_{nc}(\tilde{p}) = \lambda p \left\{ (w^*(\tilde{p}; \bar{v}) + \sigma f[1 - G(\tilde{p}f)] - \overline{v} \right\} > 0$$

To see this point formally, let us consider the no self reporting regime. Note that since $E(v) = v_{nc}^E = w^*(\tilde{p}; \bar{v}) + \sigma f\left[1 - G(\tilde{p}f)\right]$, $E\left[u(v)\right] = u(\overline{v})$ and $u'' < 0$, Jensen's inequality tells us that $u\left[E(v)\right] = u(v_{nc}^E) > u(\overline{v})$. But we know that in the self reporting regime $u(v_{nc}^{sr,E}) = u(\overline{v})$, and so $u(v_{nc}^E) > u(v_{nc}^{sr,E})$. It follows that $v_{nc}^E > v_{nc}^{sr,E}$; substituting we have that $w^*(\tilde{p}; \bar{v}) + \sigma f\left[1 - G(\tilde{p}f)\right] > \overline{v}$. ■

The improvement is not necessarily caused by a reduction of crime rates. Indeed, the optimal policy under self reporting may or may not reduce the number of criminals with respect to the optimal policy under no self reporting. Nonetheless, for any given level of deterrence, self reporting allows the government to save in enforcement expenditures. This improvement is made from the incentives that are no longer paid out to officers. Since trasgressors report their harmful acts directly, they do not need to be inspected, and so officers do not receive any bonuses. The introduction of self reporting effectively accomplishes two goals: it induces officers to report thrutfully and it fully insures officers against income risk.

Next, consider the corrupted regime with and without self reporting.

Lemma 5 *Self reporting improves welfare under a corrupt regime.*

Proof. For any $\tilde{p}$ that is chosen under a policy without self reporting, the government can introduce self reporting by choosing $\tilde{r}_c = \sigma \tilde{p} f$. The gain in welfare is given by the difference between (12) and (15):

$$W_c^{sr}(\tilde{p}) - W_c(\tilde{p}) = \lambda \tilde{p} \left\{ w_c^*(\tilde{p}; \bar{v}) + \sigma f[1 - G(\sigma \tilde{p} f)] - \overline{v} \right\} > 0$$

To see this point formally, let us consider the no self reporting regime. Note that since $E(v) = v_c^E = w_c^*(\tilde{p}; \bar{v}) + \sigma f\left[1 - G(\sigma \tilde{p} f)\right]$, $E\left[u(w)\right] = u(\overline{w})$ and $u'' < 0$, Jensen's inequality tells us that $u\left[E(v)\right] = u(v_c^E) > u(\overline{v})$. But we know that in the self reporting regime $u(v_c^{sr,E}) = u(\overline{v})$, and so $u(v_c^E) > u(v_c^{sr,E})$. It follows that $v_c^E > v_c^{sr,E}$; substituting we have that $w_c^*(\tilde{p}; \bar{v}) + \sigma f\left[1 - G(\sigma \tilde{p} f)\right] > \overline{v}$. ■

Moving to a regime of self-reporting allows the government to add an income stream: bribes from officers that now find their way into the hands of the government. The principle established for the clean regime then translates also to the corrupt regime: officers cannot earn rents under self reporting.

The two lemmas show that self reporting improves welfare both under a clean and a corrupt regime. We now establish the third result: once self reporting is introduced, the clean regime always dominates.

Proposition 6 *When self reporting is introduced, for any policy that induces corruption, there exists another policy under a clean regime that is strictly preferable.*

Proof. Consider a regime of corruption with self reporting, where the number of officers is $\tilde{p}$ and the reduced fine is $\tilde{r}_c = \sigma \tilde{p} f$. We now show that the government would be strictly better off if it eliminates corruption (by choosing $i \geq i^{nc}$), reduces the workforce from $\tilde{p}$ to $\bar{p} = \sigma \tilde{p}$, and keeps the self reporting fine at $\tilde{r}_c$. The change in welfare is then

$$W_{nc}^{sr}(\bar{p}) - W_c^{sr}(\tilde{p}) = \lambda \tilde{p}(1 - \sigma)\overline{v} > 0$$

■

The fact that corruption is never optimal should not come as a surprise: the main reason for allowing corruption when there is no self reporting is that the government would forgo the expense of paying bonuses to its officials; but under self-reporting, bonuses are never paid, and in either regime officers earn their outside wage $\overline{v}$ only. With the main benefit of corruption gone, what is left is the negative aspect of corruption, namely, that it reduces

deterrence. But the level of deterrence under a corrupt regime can be achieved with lesser expense (fewer officers) under a clean one.

3 Discussion and Limits to the Theory

3.1 Risk neutral officers

So far we have assumed that officers are risk averse. In this section we consider risk-neutral officers that are constrained by some sort of 'limited liability' so that their base pay cannot fall below $\overline{v}$. A consequence of this is that their expected wages exceed $\overline{v}$. Under the clean regime with no self reporting , the objective function to be minimized is then reduced to,

$$W_{nc}(p) = \int_{pf}^{\infty} (x-h)g(x)dx - \lambda p \left\{\overline{v} + f(\sigma - 1)[1 - G(pf)]\right\}.$$

The corrupted regime without self reporting has the following loss function:

$$W_c(p) = \int_{\sigma pf}^{\infty} (x-h)g(x)dx - \lambda p\overline{v}.$$

Under the clean regime with self reporting, the welfare function to be maximized becomes

$$W_{nc}^{sr}(p) = \int_{pf}^{\infty} (x-h)g(x)dx - \lambda p \left\{\overline{v} - f[1 - G(pf)]\right\}.$$

When the regime is corrupted and self reporting is adopted:

$$W_{c}^{sr}(p) = \int_{\sigma pf}^{\infty} (x-h)g(x)dx - \lambda p \left\{\overline{v} - \sigma f[1 - G(\sigma pf)]\right\}$$

Comparing the different regimes with and without self reporting it is easy to note that the main result of our paper still holds: self reporting in a clean regime is the best enforcement policy. This is because it separates innocent citizens from offenders without the *direct*

intervention of the police force, and therefore deprives them of their bonuses[17].

3.2 Weakening of enforcement effort

The first limitation of self reporting in law enforcement is that it may create moral hazard problems of its own among the officers. In our model, the probability of detecting a criminal act does not depend on the officers' effort. In reality, the intensity of effort exerted is likely to change the chance that an unlawful act is uncovered. If all criminal acts were self reported, law enforcers would see no benefit in working hard, and this would reduce the probability of detection for everyone. How this weakening in enforcement impacts the overall equilibrium and the implementation of self reporting depends on how effort is modeled.

While this limitation may be substantial in some settings, it may not be as important in instances where either officer exertion is unimportant or it is easily monitored by the enforcement agency. Effort may be unimportant when the officer must perform many tasks, and only one of them is to check whether an individual has committed a certain crime. For example, customs officials at a port of entry perform a series of tasks on a random selection of incoming containers, such as ensuring that contents match the documentation. In the process, they may determine whether other regulations have been violated without making significant extra effort: whether all import duties have been paid, whether illegal substances or restricted materials are found. In other instances, where effort matters, the government can monitor effort. For example, many tasks can be standardized and reduced to checklists or forms that must be completed by the officers. Many instances of tax evasion are captured in this way, since officers must first of all check that forms sent from different sources match the income report.

[17] When revenue from the fines is collected in an inefficient manner (due to litigation or other court induced expenses), regimes without self reporting can often be corrupted. Self reporting dominates these corrupted regimes, even when the reduced fines themselves are inefficiently collected. A more detailed treatment of the case with linear utility is available from the authors.

3.3 Framing of innocent civilians

If officers receive a bonus every time they discover a criminal, they are more likely to abuse their position and frame the innocent to gain bonuses. In a normal setting without self reporting, the government *either* prevents corruption, *or* prevents framing, but not both at the same time (see Polinsky and Shavell, 2001). Under self reporting, however, all criminals self report so that officers are always matched with innocent civilians. Since all crimes reported by the police are likely to be instances of framing, a government that can commit to investigate all officer-produced cases can stem framing at virtually no cost.

Complications may arise whenever the government cannot make such a commitment. For instance, suppose that the government needs to hire investigators in charge of detecting framing before framing happens (and, for simplicity, assume that such investigators are incorruptible). In that case, the probability of an instance of framing being detected depends on the number of such investigators and on the number of other framing cases. The framing-deterring Bayesian outcome is likely to require a positive number of investigators and a more complex choice of self reporting policies.

While a full analysis of framing under self reporting is beyond the scope of this paper, we suspect that self reporting may in fact incentivize the government to perform monitoring of framing. In equilibrium, all criminals self report, and officers receive incentive payments only from those innocent civilians they were able to frame. Investigators are, therefore, very efficient in detecting framing. Absent self reporting, framing cases will be mixed with legitimate cases, and agents in charge of monitoring officers are much less efficient in uncovering abuses.[18]

[18] An alternative way to avoid framing would be to offer efficiency wages to officers. The threat of detection of extortion or framing and the subsequent loss of the high income could deter officers from abuse of power. We leave for future research the analysis of such a model of law enforcement based on efficiency wages.

3.4 Adverse selection of officers

A second aspect worth considering is adverse selection among officers. Officers may have different degrees of ability in performing their job: some may have a higher probability of uncovering offenders than others. Clearly, self reporting eliminates these differences, since the chance of encountering an unreported violation is zero for both 'good' and 'bad' officials. This may be a problem for the enforcement agency if selection is important in other aspects of its activities. For example, the agency may want to observe individual ability so that it can promote good workers to higher ranks. In that case self reporting is still worth it if the agency has other means to measure ability.

3.5 Failure to self report

In practice, offenders often fail to self report even when such an option is available. We can think of three reasons for this. First, it may be that individuals have heterogeneous probabilities of detection or levels of risk aversion (Innes 2000)[19]. Second, a person may have more to hide than the crime itself: self reporting on one crime may lead investigators to audit more thoroughly other aspects of a person's life, the cost of which is not 'priced in' the self reporting fine. Thus, a driver may prefer to 'hit and run' a bystander rather than stop to help if he is carrying a stash of drugs with him, for which he is guaranteed a harsh punishment. Third, individuals may face some uncertainty when self reporting due to the complexity of the law. He cannot be sure that, after self reported for one crime, he won't be held accountable for another act which he did not think was illegal.

Whenever these circumstances arise in a way that creates additional heterogeneity in citizens' preferences, some individuals do not self report. The implication is that in a clean regime the government cannot avoid paying incentives to some of its officers. This reduces the effect of self reporting against corruption. While proposition 5 may therefore be violated, we can show that self reporting remains the optimal policy under either clean or corrupt regime:

[19] It is also possible that individuals actively engage in avoidance (Malik 1990, Innes 2001); however, unless individuals have different cost functions of avoidance, there is no reason for agents to avoid self reporting.

this is because in either regime, the government can reduce the number of officers taking bribes or bonuses. Moreover, the introduction of self reporting still allows some governments (but not all) to fully eliminate corruption[20].

3.6 Dynamic transitions

Our model is an equilibrium model: we do not show how people learn the equilibrium bribes or the probabilities of detection. But dynamics are important when the government is moving from one policy to another. For instance, people may take some time to believe that corruption has been reduced. Initially, they may not want to pay a 'high' reduced fine $r = pf$ if they think that they can pay a cheaper bribe instead - even when that option is no longer available.

The transition from corrupt to clean policies can be expensive, because it requires the payment of incentives to officials and may involve a self reporting fine that is not initially binding. Anyway, these transition costs may hardly outweigh the future advantages of self reporting.

4 Conclusions

We analyze the role of self reporting as an anti-corruption instrument in the practice of law enforcement when the enforcers are corruptible. Enforcement agencies which suffer from widespread corruption within the ranks are fairly common in many countries of the world, one reason being that cleansing can be painful and expensive. Our paper suggests that when reform aimed to eliminate corruption is implemented in conjunction with self reporting, some of the costs of reform can be eliminated. This is due to the self reporting propriety of cutting enforcement costs by eliminating rents to officers and variations in their wages.

[20] Notes available from the authors upon request.

5 Appendix

5.1 Proof of Proposition 2

In what follows, we prove the three statements in Proposition 1, i.e. when the regime is clean and self reporting is allowed: (i) $r = pf$, (ii) $i \geq \sigma pf$ and (iii) $v_{nc}^{sr,E} = \overline{v}$.

(i) Suppose $r < pf$. Then, all criminals self report, and the government could slightly decrease p without changing the number of crimes. Neither the integral nor the last term in (13) would change. The second term would decrease if $v_{nc}^{sr,E}$ is nonincreasing in p. Since all offenders self report, there are no incentives paid and $v_c^{sr,E} = \overline{v}$ which is independent of p. Thus, welfare would increase. Since $r < pf$ is not optimal, it must be that $r \geq pf$. If $r > pf$ self reporting is not binding, and therefore the welfare function to be maximized is equivalent to (6). That is, self reporting is not adopted. When $r = pf$ self reporting is used by criminals and the welfare function is given by (13).

(ii) Suppose $i < \sigma f$. An offender who does not pay the reduced fine $r = pf$ expects to be apprehended with probability p. In that case, the officer will accept the bribe b as defined by (7). It follows that the violator's expected cost when not reporting himself equals $p\left[(1-\mu)i + \mu\sigma f\right] \leq p\left(\sigma f\right) < pf = r$. In this case, the regime is corrupt. Therefore it must be that $i \geq \sigma f$.

(iii) When offenders self report, officers only inspect innocent citizens, and therefore they earn no incentive pay: the only salary paid is the base wage. To maximize equation (13), the government sets base wage as low as possible, to $\overline{v}$.

5.2 Proof of Proposition 3

In what follows, we show that when the regime is corrupted and self reporting is allowed: (i) $r_c = pb$, (ii) $b \to \sigma f$ and (iii) $v_c^{sr,E} = \overline{v}$.

(i) Suppose $r_c < pb$. Then, all criminals self report, and the government could slightly decrease p without changing the number of crimes, which remain at $\hat{x} = r_c$. Neither the integral nor the last term in (15) would change. The second term would decrease if $v_c^{sr,E}$ is non-increasing in p. Since all offenders self report, there are no bribes and therefore the expected wage does not depend

on p, i.e., $v_c^{sr,E} = w_c$. Thus, reducing p increases welfare, which means that $r < pf$ is not optimal. Hence, it must be that $r \geq pf$. When $r > pb$, no offender self reports, so self reporting is not adopted and welfare function (12) applies. It follows that self report binds when $r = pb$ and social welfare is given by (15). We can then rewrite (15) as:

$$W_c^{sr}(r_c, p, w, i) = \int_{pb}^{\infty} (x - h)g(x)dx - \lambda \{pw_c - pb[1 - G(pb)]\} \tag{17}$$

(ii) To show that $b \longrightarrow \sigma f$, we need to show that the government wants to set $i \longrightarrow \sigma f$. Suppose that $i < \sigma f$, so that $b = (1-\mu)i + \mu\sigma f < \sigma f$. Now consider a raise in i to $\tilde{i}$, such that equilibrium bribe is $\tilde{b} > b$, and a corresponding decrease of p to $\tilde{p}$ such that $\tilde{p}\tilde{b} = pb$. Then, the integral in equation (17) does not change, whereas the second term decreases. Since reducing p increases welfare, i cannot be optimal. On the other hand, if $b \geq \sigma f$ (and, as a consequence, $i \geq \sigma f$,) the regime is a clean regime. Thus, $b \longrightarrow \sigma f$ and $i \longrightarrow \sigma f$.

(iii) So far, all criminal acts are reported to the government directly, so officers do not earn any bribes. Wages w_c enter the welfare function (17) negatively, so in order to maximize welfare, the base wage needs to be as low as the reservation wage $\overline{v}$.

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