Self reporting reduces corruption in law enforcement

Motta, Alberto and Burlando, Alfredo

Boston University

10 January 2007

Self Reporting reduces corruption in law enforcement

Alfredo Burlando
Boston University
E-mail: burlando@bu.edu

and

Alberto Motta
Universita' di Padova
E-mail: motta@bu.edu

Version: June 23, 2007

We consider a model of law enforcement where homogenous, risk neutral, and corruptible inspectors are responsible for monitoring citizens who may have committed criminal acts. A welfare maximizing, budget constrained government can implement appropriate wage policies to prevent collusion, but we find that governments characterized by high administrative costs in administrating fines, or by a low ability to spot and prosecute corruption, may prefer to let corruption happen. By allowing citizens to avoid all monitoring by reporting their own violations first, the government is able to increase welfare by hiring fewer inspector, and in some instances by shifting from a regime of corruption to a regime where there is none. Moreover, self reporting fully eliminates any deadweight losses that arise from the incentive schemes when inspectors are risk averse. In order for self-reporting to have these effects, it is necessary that the government maintains also an optimal incentive scheme for its inspectors.

1. INTRODUCTION

Fines, monitoring, incentives, efficiency wages have all been tools described in the literature on corruption as effective in preventing the exchange of bribes between a bureaucrat — often an inspector tasked with enforcing the law — and a citizen. To this list, our paper adds a new tool: allowing the citizen to avoid all monitoring by reporting his own violations directly to the principal (the government).

More precisely, this paper will make four points using a modified model of law enforcement a la Kaplow and Shavell (1994). Our model features a welfare maximizing government in charge of enforcing the law by means of a number of inspectors who monitor the population and can be bribed by them. With this setup, the first point we make is that collusion of law enforcement is entirely and costlessly preventable by a wage policy to the police force that includes contingency payments based on the reports made by the inspectors to the government. The second point is that even in those instances in which the government can always and costlessly prevent collusion, there are cases in which it will rationally choose not to. We will show that when inspectors are corrupted, there is no need for the government to pay high wages, and in some cases (which depend on the characteristics of the principal-government) the reduction in enforcement costs more than compensates allowing for bribe exchanges. Thirdly, we show that introducing self reporting of violations into law enforcement is an effective tool in law enforcement and has two major effects: it reduces enforcement costs in a ‘clean’ regime (where incentives are strong enough to prevent corruption), a point made elsewhere by Kaplow and Shavell; and it allows some governments to shift from a corrupted regime to a clean one. Finally, we extend the basic model to risk averse inspectors. We find that in those cases, the government’s wage scheme cannot avoid paying rents to some of its own inspectors in the case in which there is no self reporting. However, these rents disappear completely when self reporting is allowed. This result comes from the fact that self reporting eliminates any uncertainty faced by the inspector, and therefore the government can avoid paying risk premia. A similar result can be considered for heterogenous inspectors.

Our approach straddles two literatures, on corruption and self reporting in the context of law enforcement. Since our objective is primarily to show some new properties of self-reporting, we will use a model from the literature on self reporting, and modify it by introducing elements from the literature of corruption. The latter has mostly considered the question of how corruptible law enforcers should be compensated, and they take the form of moral hazard problems where the principal is generally trying to maximize a welfare function that does not (generally) depend on the welfare of either the agent/citizen or the inspector. For example, Mookherjee and Png (1995) consider a government interested in controlling pollution, and use both sanctions and reward as means of controlling pollution. Basu et al. (1992) analyze some conditions for the control of corruption when law enforcers take into account the fact that they may, in turn, be caught for taking bribes. Marjit and Shi (1998) extend Basu et al. (1992) and show that when enforcers’ effort affects the probability of detection, deterrence may become so diluted that crimes cannot be controlled any longer. Bowels and Garoupa (1997) discuss bribery control through sanctions. Garoupa and Jellal (2002) extend Bowles and Garoupa (1997) by considering the effect of asymmetric information on corruption; they argue that asymmetric information between criminals and law enforcers may reduce corruption by altering the bargain power in the collusion process. Mookherjee (1997) consider bribery and extortion in the context of tax evasion allowing the possibility to use both sanctions and reward. Hindricks, Keen and Muthoo (1999) also analyze bribery and extortion, considering commissions and penalties as methods of control. Acemoglu and Verdier (2000) analyze a general equilibrium setting in which preventing all corruption is too costly and second best intervention may involve a certain fraction of bureaucrats accepting bribes: they propose the payment of efficiency wages to prevent bribe taking. Hasker and Okten (2005) study the impact of intermediaries on corruption and show that traditional methods of fighting corruption, i.e. penalty and rotation, may not be appropriate when interaction between clients, public official and intermediary agents are considered. Kulger et all (2005) analyze competition between differentiated criminal organizations which also engage in local corruption to avoid punishment; under certain condition they show that increasing policing and sanctions can increase the level of criminality.

On the other hand, the literature on law enforcement and self reporting has considered the moral hazard problem between the government and the criminal while treating the inspector as a monitoring technology that is costly to implement but not subject to incentive constraints. In this scenario, self-reporting has many positive characteristics. Kaplow and Shavell (1994) conclude that self-reporting offers two advantages over schemes without self-reporting: enforcement resources are saved and risk is reduced because criminals who report their behavior bear certain sanctions, rather than uncertain ones. In a later paper, Kaplow (1995) addresses the issue of law complexity: greater complexity allows better control of behavior. but more complex rules are more costly for both individuals and court to understand. Given this setting, he examines the relationship between rules complexity, welfare and self-reporting of behavior. Innes

(1999a) studies self-reporting enforcement regimes when the possibility of remediation is allowed and note that self-reporting firms always engage in efficient remediation and therefore less enforcement effort is required. Innes (1999b) considers, again, a model in which a violator can undertake remediation in order to reduce the harm caused. The paper stresses the importance of self-policing claiming that self-policing increases efficiency in two ways: remediation is achieved with certainty and the enforcement effort cost is often reduced. From a slightly different perspective, Franzoni (1999) develops a model of law enforcement in which the prosecutor can negotiate over penalties; the settlement stage introduces the possibility that maximal sanctions may not be optimal. He shows that the negotiation stage reduces the incentives for the prosecutor to investigate and increase the rate of noncompliance. Livernois and McKennna (1999), extend the standard model of enforcement to include a self-reporting and enforcement power. They find that under certain conditions, higher compliance rates are achieved with lower fines for noncompliance. Innes (2000) studies the benefit of self-reporting when criminals have heterogeneous probabilities of apprehension. He shows that efficiency can often be increased by inducing violators with high risk of apprehension to self-report. In the context of tax evasion and revenue maximization, Franzoni (2000) shows that amnesties (a type of self-reporting) are superior to individual deals since they allow the agency to reduce tax differential and to extract from taxpayers their defence costs. Fukuyama et all (2000) study self-reporting systems in the setting of environmental compliance. Innes (2001) studies self-reporting when violators can perform "avoidance" activities, which reduce their risk of apprehension. Once these activities are implemented in the model, self-reporting enforcement regimes are even more beneficial with respect to what was found by prior literature. Feess and Heesen (2002) consider optimal law enforcement whit self-reporting of behavior. They allow violators to receive a private signals about their individual probabilities of apprehension after the crime is committed. They conclude that self-reporting increases social welfare. Motta and Polo (2003) study competition policy against collusion when leniency programs are introduced, which reduces fines to firms that leak information to the Antitrust Authority. They show that leniency programs have the double effect of reducing enforcement cost and encouraging collusion, by decreasing the expected cost for violators. They conclude that the first effect dominates the second one, therefore leniency programs are beneficial, especially when the Antitrust Authority has limited resources. Feess and Walzl (2004) analyze the role self-reporting schemes when criminals are organized in teams. If the violators engage in cooperative behavior in the self-reporting stage, it is optimal to impose less than the maximum fine if both individuals self-report. The same result applied for imperfect self-reporting technologies, i.e. technologies such that the conviction of one agent does not necessarily imply the conviction of the other. In the spirit of their previous paper, Feess and Walzl (2005) analyze law enforcement where self-reporting individuals obtain reduced sanctions: moreover, they distinguish between two stages: the first self-reporting stage before the case is investigated and the second one when the criminal is detected. They show that fine reductions should be adopted in both stages. Friesen (2006) shows that self-auditing is beneficial because it allows for both self-reporting and self-policing; he concludes that self-auditing is more likely to be beneficial when the violators' damages are large. Buccirossi and Spagnolo (2006) study the effects of leniency programs on sequential, bilateral and illegal transactions. They find that leniency programs may end up encouraging occasional sequential illegal transactions. Feess and Walzl (2006) consider a model of optimal law enforcement with self-reporting where after violating the law individuals get a private update of their probability of apprehension. They conclude that under appropriate condition the optimal fine reduction is decreasing in the heterogeneity of the criminals. Stafford (2007) uses data on U.S. hazardous waste enforcement and disclosures: their results suggest that facilities that self-police may be able to strategically disclose in order to decrease future enforcement.

In nesting the tools used by the corruption literature into a self-reporting setting, we are preceded by Polinski and Shavell (2001), who introduce a detailed model of corruption in the Kaplow and Shavell framework: for example, their crooked inspectors could not just accept bribes from guilty criminals, but also frame and blackmail innocent citizens. They adopt costly incentives and fines to discourage their bureaucrats from adopting some deviant behavior, and demonstrate that fighting corruption is a costly enterprise. Our strategy differs from theirs in that we consider a simplified setting, where inspectors are agents, and where the cost associated with enforcement and collusion is the wage bill. When the wage policy is fully endogenized, we are able to design a welfare function that incorporates the utilities of inspectors and agents alike. Furthermore, we include self-reporting as an additional tool for the government.

2. THE BASELINE MODEL

There is a number of risk-neutral individuals or citizens of measure 1, who can choose between performing an illegal act or not. When performing the illegal act, they earn a certain private benefit b, but they impose a cost to society of h. Here, we assume that some potential criminals would benefit more than others from the illegal act; in particular, we assume that the benefit b is distributed with a cdf $F(b)$ with support $[0,\infty)$. On the other hand, for convenience we assume that the cost of the act does not change with the criminal.

The government can monitor the population in search of criminals. To do so, it hires p inspectors and pays them a wage of w. Each inspector is then paired with a randomly chosen citizen, and if that citizen turns out to have committed a crime, she is denounced and made to pay a fine s. We assume that limited liability applies, and no individual can be charged more than an amount[1] $\overline{s} > h$. We assume that inspectors are risk neutral, maximize their private profits, and have a reservation wage equal to c^*, which corresponds to what they could earn if working outside of the police force.

Given p and s, an individual will commit a crime only when the benefit exceeds the expected fine:

$$b > ps$$

and thus the total mass of citizens who commit a crime is $1 - F(ps)$.

The cost of enforcing the law consists on the wage bill paid to the inspector force, pw, minus the revenues coming from the fines that are paid by those who were caught infringing the law, which amount to a fraction $p(1-F(ps))$ of law-breakers. The government has an administrative cost $\alpha \in [0,1]$ in processing each fine s that it receives, such that net revenues from fines are $\alpha p(1-F(ps))s$. The parameter α can be thought of administrative efficiency and how developed is the judicial system. We also make an important assumption about the financing costs of law enforcement. Following Laffont and Tirole (1991), we assume that the government raises the funds needed to pay inspectors through inefficient taxation, such that enforcement costs the taxpayers

$$(1+\lambda)\left[pw - \alpha p(1-F(ps))s\right]$$

[1] As in Kaplow and Shavell (1994) we specify this assumption to rule out the corner solution where the optimal probability of apprehension equals one. The relaxation of this assumption doesn't affect our results.

where $\lambda \geq 0$ is a paramenter that describes how efficient the government is in raising taxes. When $\lambda = 0$, resources are costlessly shifted from taxpayers to the police force and there is no welfare loss in that operation; when $\lambda > 0$, there is a welfare loss equivalent to $\lambda \left[pw - \alpha p(1 - F(ps))s\right]$. As it will become clear, the assumption that λ is positive is an essential component of our model for two reasons. First, enforcement would be costless otherwise, and the government would always want to achieve a first best level of criminality.

Taking all these elements in consideration, the government maximizes a welfare function that is the sum of the utilities of citizens and inspectors, and is reduced to the following expression:

$$\max_{p,s,w} W(p, s, w) = \int_{ps}^{\infty} (b - h)f(b)db - \lambda p \left[w - \alpha s(1 - F(ps))\right] \tag{1}$$

This function is subject to participation and incentives constraints, the nature of which changes depending on the assumptions made. We then begin by considering the simplest case of no collusion, and obtain two baseline results: an equilibrium crime and welfare when there is no self reporting of crimes, and when criminals are allowed to turn themselves in; the remaining sections will introduce collusion between criminals and inspectors.

2.1. Law enforcement without self-reporting

2.1.1. No collusion

In this baseline case with no moral hazard there are no incentive constraints on the welfare function, and the optimal levels of p and s are obtained by maximizing (1). In our setting, the optimal fine is the maximum fine possible, $\bar{s}$. Suppose the fine is not maximal and set to some $s^* < \bar{s}$. Then, the government could raise s a little bit and at the same time lower p in such a way that ps does not change at all. The integral portion of the welfare function does not change, nor do the revenues from collecting the fine; but by lowering p, the government reduces the cost of enforcement λpw. Note that this argument applies to all the variants that are considered in this paper, and therefore we will always write the fine as $\bar{s}$. Secondly, because there is no moral hazard, the government can set the wage equal to the inspector outside option c^*. p is determined by maximizing the function

$$\max_{p} W_{nc}(p) = \int_{p\bar{s}}^{\infty} (b - h)f(b)db - \lambda p \left[c^* - \alpha \bar{s}(1 - F(p\bar{s}))\right] \tag{2}$$

using Leibniz rule, we obtain that the first order conditions for p have the form

$$\frac{dW_{nc}}{dp} = \bar{s}(h - p\bar{s})f(p\bar{s}) - \lambda \left[c^* - \alpha \bar{s}(1 - F(p\bar{s})) + \alpha p\bar{s}f(p\bar{s})\bar{s}\right] \tag{3}$$

If c^* is sufficiently large, this expression may be negative: this implies the possibility for p^*_{nc} to be equal to zero. Moreover $p^*_{nc} = 1$ is also possible: note that we shall rule out this result since it implies that the cost of enforcement,c^*, is actually lower than the revenues obtained by the convicted criminals. This case is note particularly interesting for the purpose of our analysis because it entails that law enforcement produces any welfare loss. The interior solution is determined by

$$p^*_{nc}\bar{s} = \frac{1}{(1 + \lambda\alpha)} \left[h - \frac{\lambda c^*}{[\bar{s}f(p^*_{nc}\bar{s})]} + \frac{\alpha\lambda(1 - F(p^*_{nc}\bar{s}))}{f(p^*_{nc}\bar{s})}\right] \tag{4}$$

Note that the socially optimal level of $p^*_{nc}\bar{s}$ when the costs to society can be fully privatized is h: welfare is increased when crimes are accomplished by those whose private benefit exceeds h. With costly enforcement, $p\bar{s} < h$ and crime exceeds the socially optimal level.

2.1.2. Collusion

We now consider the possibility that the criminal can bribe inspectors in case the inspectors discovers her. The inspector makes a take-it-or-leave-it offer m to the agent for not disclosing his identity to the judiciary. If the criminal refuses the offer, the inspector will report her, and she will pay the full fine $\bar{s}$. If she accepts the offer, then a bribe is exchanged and no report is made. We make the standard assumption made by Laffonte and Tirole (1991) that the side contract between the two agents is self-enforcing; however, we also attach a probability $l(m)$ that somehow the side deal is detected by the judiciary system. When the bribe is detected, the inspector is fired and loses both bribe and wage w, while the criminal is prosecuted and made to pay an amount up to his limited liability s. The function $l(m)$ is increasing in m: the higher the bribe, the higher the likelyhood that the collusion is uncovered. We further assume that l is exogenously given. This is in line with some of the literature on collusion[2], where inspectors are caught in the fact by chance or by colleagues who leak the information to the judiciary system. In this context, the function $l(m)$ is an indicator of how transparent the law enforcement system is: for any given m', $\tilde{l}(m') > l(m')$ indicates that the second country lacks transparency or ability to prosecute petty corruption. To keep the model simple we assume that $l(m)$ is a step function:

$$l(m) = \begin{cases} 1 & if \quad m > \sigma\bar{s} \\ 0 & if \quad m \leq \sigma\bar{s} \end{cases}$$

This assumption keeps the model manageable without affecting the implications. It is also a parsimonius description of how easy it is to detect collusion: the case where σ is small or zero corresponds to societies where bribes are not an acceptable alternative to paying fines; a high σ instead corresponds to potentially more corrupt societies, where even outrageous instances of bribery go either undetected or unprosecuted. The other advantage of this formulation of the probability of detection is that it implies a simple equilibrium bribe. For the deal to take place, the bribe must be high enough such that inspector accepts it ($m \geq 0$) but low enough to go undetected ($m \leq \sigma\bar{s}$). the exchanged bribe is

$$m = \frac{1}{2}\sigma\bar{s}$$

Note that for simplicity it is assumed that the two parties have equal weights in the Nash bargain, this assumption doesn't affect any our results[3].

We show that the government has two possible ways to respond to the possibility of collusion. It could maintain a 'clean' regime by paying an incentive wage which provides a premium to those inspectors that report a criminal. Alternatively, It could maintain a 'corrupted' regime by paying below-market level wages to inspector with the implicit

[2] See for example Besley and McClaren (1993) and Mookherjee and Png (1995)

[3] Basu et al. (1992) analyze some conditions for the control of corruption when law enforcers take into account the fact that they may, in turn, be caught for taking bribes. Marjit and Shi (1998) extend Basu et al. (1992) and show that when enforcers' effort affects the probability of detection, deterrence may become so diluted that crimes can be controlled any longer. Nevertheless our results would not be affected by introductioning this extension.

understanding that any difference in wages will be made up by collecting bribes. We analyze them in turn.

Clean regime The government could set up a two tiered payment system for its inspectors. It pays a fixed wage w to all inspectors, and an additional incentive v to the fraction of its inspectors who report a criminal. In order for the inspector to weakly prefer reporting the criminal (as opposed to accepting the bribe), the government must pay an incentive equal to $\sigma\bar{s}$ in case inspector discovers an illegal act. At the same time, the government must ensure that the expected reward to the inspector is at least as large as its reservation wage c^*. Thus, the government can avoid collusion by ensuring that the following constraints hold:

$$IC : w + (1-a)v \geq w + (1-a)\sigma\bar{s} \tag{5}$$

$$PC : w + (1-a)v \geq c^* \tag{6}$$

where $1-a$ is the probability of discovering an illegal act. In order to maximize the utility function (NUMBER), these two contraints must bind with equality, in which case $v = \sigma\bar{s}$ and $w = c^* - (1-a)v$. With this system of incentives, inspectors always report the criminals, who then still face an expected fine of $p\bar{s}$; thus, $a = F(p\bar{s})$. Successful crime detection yields revenues equivalent to $\alpha p(1-F(p\bar{s}))\bar{s}$, and therefore the overall government's expected cost associated with hiring the inspectors and preventing them from being corrupted is given by $\lambda p[w + \bar{s}(1-F(p\bar{s}))(\sigma+\alpha)]$ and the welfare function becomes

$$W_i(p_i) = \max_p \int_{p\bar{s}}^{\infty} (b-h)f(b)db - \lambda p\left[c^* - \alpha(1-F(p\bar{s}))\bar{s}\right] \tag{7}$$

which is exactly the same as in the case without moral hazard (1): $W_i(p) = W_{np}(p)$ so that $p_i = p_{nc}$. Note that in this version of the model, corruption has no cost to society, unlike what was found by Polinski and Shavell (2001) in a setting very similar to ours: indeed, since the seminal paper by Becker and Stigler (1974),in which they show that corruption among law enforcers may dilute deterrence and consequently reduce the extent to which laws and sanctions can effectively control criminality, the literature on crime has started to analyze the issue of corruption among law enforcers, mostly considering corruption as a negative phenomenon to be challenged. The reason for our surprising result is that when enforcement costs are fully endogenized, the government can manipulate wages in such a way that in expectation inspectors always get their reservation utility, and therefore obtain the level of criminality that would have prevailed without moral hazard. Deadweight losses can be incorporated into this framework in a number of ways. For instance, we could specify the utility of the inspectors to be Leontief, in which case the base wage must always be $w = c^*$ and bonuses cannot be discounted from the base pay. While the deadweight loss is most apparent (and the analysis simplest) in the case of inifite risk aversion, the argument carries over for inspectors who are risk averse, as it will become clear in the first of our extensions. Another possible reason for the inability of incentives to fully eliminate collusion may arise from heterogeneity among inspectors. This case will also be analyzed in the section that follows.

Corrupted regime Even with risk-neutral and homogeneous inspectors, a government may in fact choose to allow corruption to flourish. The manipulation of wages allows the government to adopt another alternative wage policy that allows for collusion but saves on monitoring costs. To see how this argument works in the model, suppose that wages are $w_c < c^*$, the outside option of the inspectors, and that no contingency payments are given out. Under normal circumstances we would expect that the government is unable to hire anyone for the job. However, because inspectors have the possibility to supplement their income with bribes, they would be willing to work for the lower wage as long as their expected earning (wages + bribes) is greater or equal to the outside option. The expected earnings derived from extracting bribes are equal to the bribe amount, m, times the probability that the inspector encounters a criminal, $1 - F(pm)$. Thus, the participation constraint (6) under a corrupt regime is now changed to be

$$CPC : w_c \geq c^* - m(1 - F(m)) \tag{8}$$

and, as before, this constraint will be binding: there is a welfare loss associated with providing inspectors with excess salaries. Note that inspectors will take bribes not only when incentive wages are not offered, but also when they are offered but they are too low, that is, when (5) does not bind: $v < m$. Suppose then that $v > 0$ is offered but the IC is violated. The joint payoff from having a side deal between inspectors and criminals is $\sigma\bar{s} - v$, and the equilibrium bribe paid out will be

$$m = \begin{cases} \frac{1}{2}(v + \sigma\bar{s}) & if \quad v < \sigma\bar{s} \\ 0 & if \quad v \geq \sigma\bar{s} \end{cases} \tag{9}$$

where for simplicity it is assumed that the two parties have equal weights in the Nash bargain (it will become evident that there are no changes to any formulas if we relax this assumption to a more general case). The higher the incentive v, the higher the bribe that is exchanged; at the same time, the higher the bribe, the lower the criminality[4]. Thus, a government that chooses to allow criminality to flourish is still able to affect the number of crimes by using its wage policy to affect the bribe levels. It is then as if the government is choosing the bribe itself to meet its goals:

$$\max_{p,v} W_c(p, m, v) = \int_{pm}^{\infty} (b - h) f(b) db - \lambda p \left[c^* - m(1 - F(pm))\right] \tag{10a}$$

$$st : CIC_1 : m = \frac{1}{2}(v + \sigma\bar{s}) \tag{10b}$$

$$: CIC_2 : m \leq \sigma\bar{s} \tag{10c}$$

the choice variable v enters into the maximization only once, in CIC_1, and it is the tool used by the government to change the equilibrium bribe. We now show that v should always be chosen such that CIC_2 binds. Suppose that CIC_2 does not bind, and a level $\tilde{p}, \tilde{m} < \sigma\bar{s}$ is selected. Then, the government could increase m and reduce p such that $mp = \tilde{m}\tilde{p}$. The integral portion of the welfare function is unchanged, and so is the function $F(pm)$; however, the government has now saved $\lambda(\tilde{p} - p) c^*$ and is therefore strictly better off. The welfare achieved by the country is then

$$W_c(p) = \int_{p\sigma\bar{s}}^{\infty} (b - h) f(b) db - \lambda p c^* + \lambda p \sigma\bar{s}(1 - F(\sigma p \bar{s})) \tag{11}$$

[4] The fact that higher incentive incrases the level of bribe has been already highlighted in other articles: see for example Mookherjee and Png (1995), Mooherjee's (1997), Hindricks, Keen and Muthoo (1999).

The equilibrium level of crime can be shown to be

$$p_c\sigma\bar{s} = \frac{1}{1+\lambda}\left[h - \frac{\lambda}{\sigma\bar{s}f(p_c\sigma\bar{s})}w_c\right] = \frac{1}{1+\lambda}\left[h - \frac{\lambda c^*}{\sigma\bar{s}f(p_c\sigma\bar{s})} + \frac{\lambda(1-F(p_c\sigma\bar{s}))}{f(p_c\sigma\bar{s})}\right] \quad (12)$$

The formula is somewhat similar to (4); and in fact the two are identical when $\alpha = 1$: in that case, $p_{nc} = \sigma p_c$. However, for a more general case it is not possible to say whether there is more or less crime under corruption than under a clean regime, a feature that is common to other model that use a similar setup as ours.

So far, we have demonstrated that a government that faces collusion can choose to operate in two different regimes; we now take on the issue of which regime is ultimately selected.

In summary we have the following proposition,

PROPOSITION 1. *The optimal wage policy offered by a law enforcement agency when agents are corruptible can be one of the following:(a) when incentives are paid, there is no side payments between criminals and law enforcers, and outcomes mirror the 'first best' case without moral hazard, (b) when a capitulation wage is offered, law enforcers are paid below-market wages, but are allowed to supplement their income with bribes. In general, there will be more criminality under this regime than under a 'clean' regime.*

2.1.3. Optimal regime choice

In this section we compare the two wage regimes that we have identified. Note that the government will select between a corrupt or a clean regime by independently maximizing (7) and (11) and comparing the two levels of welfare. It is evident that the government will not automatically choose a clean regime over a corrupted one: the choice depends critically on the levels of the parameters in the model, particularly α and σ. Figure 1 and 2 show how (7) and (11) evaluated at their respective optimal as these two parameters of interest vary. (7) is strictly increasing in α, and (11) is strictly increasing in σ. A simple proof is proposed for σ, the same applied also for α : consider any given level of p_c^*, then if σ is increased it is always possible to lower p_c^* such that the product σp_c^* is unchanged, and so the level of criminality is unchanged, but the cost of law enforcement is reduced. Therefore, the welfare function (11) evaluated at its optimal must be strictly increasing in σ.

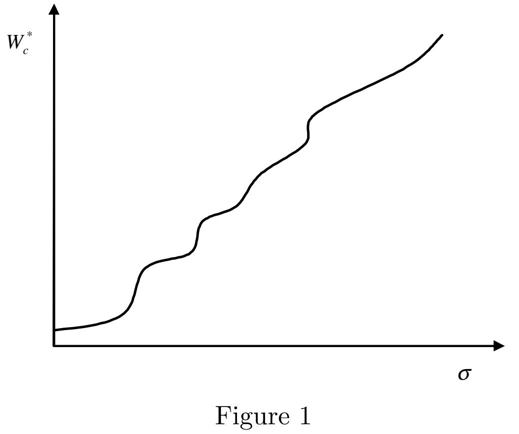


Figure 1

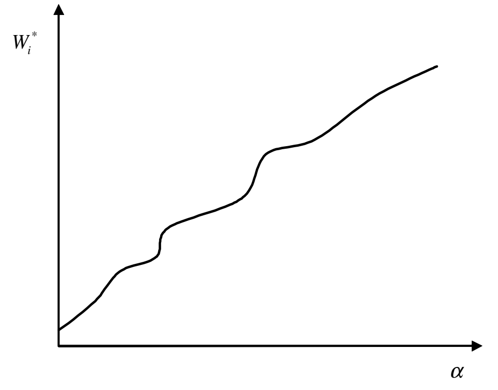


Figure 2

In order to compare the two wage regimes we consider two decision loci representing values of α and σ for which the government would be indifferent between any of the two regimes. We do so by comparing (7) and (11): the corrupted regime, i.e. capitulation wages, and the clean regime, i.e. efficiency wages, yield the same level of welfare if and only if,

$$\alpha = \frac{\int_{p_c\sigma\bar{s}}^{\infty}(b-h)f(b)db - \int_{p_i\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_c c + \lambda p_i c + \lambda p_c \sigma \bar{s}(1-F(\sigma p_c \bar{s}))}{\lambda p_i(1-F(p_i\bar{s}))\bar{s}} \tag{13}$$

It is easy to establish that (13) is increasing in σ. Indeed, the welfare function (11) evaluated at its optimal is strictly increasing in σ, while (7) is unaffected by any change in σ. Therefore, by differentiating (13) we obtain that α must be an increasing function of σ. This function is illustrated as the curve in Figure 3. The corrupted regime always dominates the clean regime at the bottom of the box: moreover when $\alpha = \sigma = 1$, (7) and (11) evaluated at their respective optimal yields the same level of welfare. On the other hand, when $\sigma = 1$ efficiency wages always dominate capitulation wages for any value of α.

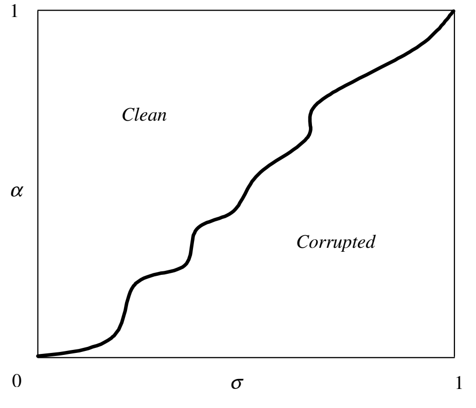


Figure 3

We see that for countries facing low levels of α it is often better to allow for collusion, because the side deals between inspectors and criminals is more efficient than formal punishment through the judiciary system. Similarly, a country with low levels of σ is more likely to remain clean, because the regime is so transparent (or the level of morals so high) that any form of bribing is discovered and denounced right away. The graph paints a reasonable picture in which countries with inefficient or ineffectual bureocracies (low α) tend to be corrupt, and countries with transparent systems and little potential corruption (low σ - we are thinking Nordic countries, for example) do not have a corrupt regime. Comparing (7) and (11), the corrupted regime dominates the clean one if and only if

$$\frac{\int_{p_c\sigma\bar{s}}^{\infty}(b-h)f(b)db - \int_{p_i\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_c c^* + \lambda p_i c^* + \lambda p_c \sigma\bar{s}(1-F(\sigma p_c\bar{s}))}{\lambda p_i(1-F(p_i\bar{s}))\bar{s}} - \alpha \leq 0 \tag{14}$$

We can now summerize our results,

PROPOSITION 2. *Countries characterized by inefficient bureaucracies, i.e. sufficiently low α, and inefficient transparency, i.e. sufficiently high σ, such that (14) holds, shall choose to let corruption flourish, even though they could choose a clean regime.*

2.2. Law enforcement with self reporting

Self reporting commands a flourishing literature in the economics of law enforcement, beginning with Kaplow and Shavell (1994). The main point coming from this literature is that self-reporting allows the government to cut law enforcement costs in a manner of ways. KS, in a set up very similar to ours, showed that when self reporting is allowed, all criminals prefer to pay a reduced fine and turn themselves in rather than waiting to get caught by the police, which leads to fewer inspectors needed. There is a sense, prevalent in the media, that allowing for discounts based on self reporting or even amnesties are a form of corruption by itself, as they correspond to the criminal officially 'bribing' her way out of her harsh and deserved punishment. Yet, we show that self reporting is a good tool *against* corruption, when that is defined to be a side agreement between criminals and the police force.

2.2.1. No collusion

We start by considering the case without collusion, which is similar to the original Kaplow and Shavell. Suppose that the government allows the citizens to turn themselves in if they commit the crime and pay a reduced fine r. KS show that, in that situation, the government would set the reduced fine to be the certainty equivalent of the full fine, $r = p\bar{s}$, and that when it does so, every citizen that commits a crime pays the reduced fine. As a consequence, the government needs to hire enough policemen to control only the honest people who did not commit the crime. The welfare function becomes,

$$\max_p W_{nc}^{sr}(p) = \int_{p\bar{s}}^{\infty}(b-h)f(b)db - \lambda p\left[F(p\bar{s})c^* - \alpha\bar{s}(1-F(p\bar{s}))\right] \tag{15}$$

where again $\alpha p\bar{s}(1-F(p\bar{s}))$ are the revenues from the reduced fine (and not, as before, from the full fines). Note that we are maintaining the assumption that there is a leakage in revenues, even though it may be reasonable to assume that, since self-reporting involves an admission of fault, the government does not have to spend as much money demonstrating culpability in a court of law. We choose to maintain this leakage because we demonstrate that the benefits from self reporting go beyond a streamlined bureocratic process, which adds above and beyond what we will show in this section.

Compare (15) with (1): the only modification to the maximization comes from having $pF(p\bar{s})c^*$ as opposed to pc^*. Any p that is desired without self reporting can be achieved with self reporting with fewer inspectors. We will often refer to this social welfare function (15), and to the arguments p that maximize it, as the first-best outcomes under self reporting.

$$p^{sr}_{nc}\bar{s} = \frac{1}{(1+\lambda\alpha)}\left[h - \frac{\lambda c^* F(p^{sr}_{nc}\bar{s})}{[\bar{s}f(p^{sr}_{nc}\bar{s})]} + \frac{\alpha\lambda(1-F(p^{sr}_{nc}\bar{s})}{f(p^{sr}_{nc}\bar{s})}\right] \tag{16}$$

the solution indicates that $p_{nc} < p^{sr}_{nc}$; crime and enforcement costs are lower when self reporting is allowed. It is then a preferred policy.

We now compare the two possible regimes–clean and corrupt–when the government allows self-reporting of crimes; we will then proceed to compare how the presence of self-reporting may affect the type of regime the government chooses.

In summary,

PROPOSITION 3. *When self-reporting is introduced: (a) all violators report having commit the harmful act, (b) the optimal probability p^{sr}_{nc} is given by equation (16).*

2.2.2. Collusion

Clean regime Again, in this regime we allow a schedule of payments to policemen that vary depending on whether they reported a criminal. The use of incentive wages guarantees that no police officer is ever corrupted, and therefore guarantees that all criminals who are caught face charges equal to $\bar{s}$. Because of that, the reduced fine that applies is now equal to $r = p\bar{s}$, or the fine that was used in the first-best (no collusion) scenario. It is straightforward to show that the welfare function to be maximized is

$$\max_p W^{sr}_i(p) = \int_{p\bar{s}}^{\infty}(b-h)f(b)db - \lambda p\left[F(p\bar{s})c^* - \alpha\bar{s}(1-F(p\bar{s}))\right] \tag{17}$$

Note that this is the same as equation (3), and therefore it achieves the highest welfare possible: $p^{sr}_i = p^{sr}_{nc}$ .Why? First, it is clear that the number of crimes remained at their first best: committing a crime is not cheap because of high reduced fines, and because when those reduced fines are not paid out, it is not possible to bribe officials and pay a bribe. Secondly, since all criminals report, inspectors need to monitor a small population, thus reducing the number of policemen. Finally, while incentive wages guarantee that policemen are not going to take bribes, self reporting ensures that no incentive payments are actually given. Since all criminals voluntarily report their crime and pay the fee to the government, no criminals are actually discovered by policemen. In order to meet the IC constraint, inspectors need to receive a base wage $w = c^*$.

Given our results, we have the following proposition.

PROPOSITION 4. *Given any enforcement scheme under a clean regime without self reporting, there exists a scheme with self reporting that is welfare improving, i.e. behavior is the same but enforcement costs are lower.*

Note that this comparison understates the advantage of the optimal self-reporting scheme over the optimal scheme without self-reporting, because generally the two optimal probabilities of detection, p^{sl}_{nc} and p_{nc}differ.

Corrupted regime We show in the appendix that capitulation wages are not compatible with self-reporting. Intuitively, this results may be explained in the following fashion: since under self-reporting all violators report having commit the harmful act, it follows that the government can no longer set wages below inspectors' outside option.

In summary we have the following proposition.

Proposition 5. *A government that allows for self reporting but does not pay high enough incentives to satisfy (5) will always choose a reduced fine that is too expensive. The welfare reached is then equal to (11).*

2.2.3. Optimal regime choice

A choice must be done by a government facing corruption among its inspectors: either it chooses corruption to continue and pay capitulation wages, or it must introduce incentive wages, self reporting, and clean out corruption. Any other choice is not optimal. In this section we compare the two wage regimes that we have identified. As before, the government will select between a corrupt or a clean regime by independently maximizing (17) and (11) and comparing the two levels of welfare.

In order to compare the two wage regimes we consider two decision loci representing values of α and σ for which the government would be indifferent between any of the two regimes. We do so by comparing (17)) and (11): the corrupted regime, i.e. capitulation wages, and the self-reporting clean regime, i.e. efficiency wages plus self-reporting, yield the same level of welfare if and only if,

$$\alpha = \frac{\int_{p_c\sigma\bar{s}}^{\infty}(b-h)f(b)db - \int_{p_i^{sr}\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_c c^* + \lambda p_i^{sr} c^* F(p_i^{sr}\bar{s}) + \lambda p_c \sigma \bar{s}(1 - F(\sigma p_c \bar{s}))}{\lambda p_i^{sr}(1 - F(p_i^{sr}\bar{s}))\bar{s}} \tag{18}$$

It is easy to establish that (18) is again increasing in σ, like in the previous case when self-reporting was not allowed. In order to compare this result with the previous one, define α_s as the value of α such that (18) holds: on the other hand we denominate α_{ns} the value of α such that (13) holds. Comparing (18) with (13) we conclude that given any enforcement scheme under a clean regime without self reporting, there exists a scheme with self reporting, which implies $\alpha_s \leq \alpha_{ns}$. Suppose that self-reporting is not allowed, then for any given value of σ, countries characterized by a low level of efficiency $\alpha \in [0, \alpha_{ns}]$ shall choose to let corruption flourish by adopting capitulation wages. When self-reporting is introduced, the fraction of countries with a level of efficiency $\alpha \in [\alpha_s, \alpha_{ns}]$ shall instead choose to clean the system from corruption.

By differentiating (18) we obtain that α_s must be an increasing function of σ. This function is illustrated as the lower curve in Figure 4. The corrupted regime always dominates the clean regime at the bottom of the box: differently form the previous case, when $\alpha = \sigma = 1$, the clean regime always dominates the corrupted one. Moreover, when $\sigma = 1$ the clean regime always dominate capitulation wages for any value of α. We can therefore plot the graph for a given distribution function $F(.)$,

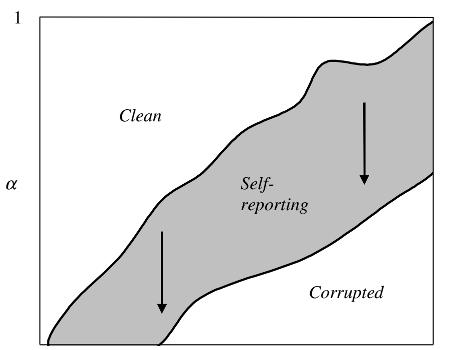


Figure 4

The grey zone in Figure 4 represents the decision loci that was previously dominated by capitulation wages and that is now dominated by the clean regime.

In summary we obtained the following results,

PROPOSITION 6. *When police officers are corruptible and self reporting of crimes is allowed: (a) capitulation wages cannot be offered (b) having incentive wages allows the government to the first best level of criminality and first best social welfare (c) a fraction of countries with a level of efficiency* $\alpha \in [\alpha_s, \alpha_{ns}]$ *shall now choose to clean the system from corruption, whereas without self-reporting the would have preferred to adopt capitulation wages, by accepting corruption to widespread.*

3. EXTENSIONS

3.1. Risk Aversion

In our discussion, we have used as examples a risk neutral, homogeneous inspector, and showed that in that case, there are no costs associated with avoiding collusion. But costs from avoiding collusion arise immediately if we consider a more general setting where inspectors are risk averse, or where they are heterogeneous. Because the implications are similar, we study here only the case of risk aversion. To make the analysis even simpler, suppose that all inspectors are infinitely risk averse (Leontief utility function)[5]. In that case, the incentive and compatibility constraints are now as follows:

$$IC_{RA} : w + (1-a)v \geq w + (1-a)\sigma\bar{s}$$

$$PC_{RA} : w \geq c^*$$

Thus, the incentive remains as before, $v = \sigma\bar{s}$, but the government cannot lower the base wage. Under this system, those officials who do not catch any criminals obtain a utility of c^*, whereas those who catch a criminal obtain $c^* + \sigma\bar{s}$. All in all, the additional cost of maintaining an incentive scheme is $p\sigma\bar{s}(1 - F(p\bar{s}))$, and the welfare function is

$$W_i^{RA}(p_i^{RA}) = \max_p \int_{p\bar{s}}^{\infty} (b-h)f(b)db - \lambda p \left[c^* - \alpha(1-\sigma)(1-F(p\bar{s}))\bar{s}\right]$$

Comparing W_i^{RA} with W_i, we have that

$$W_i^{RA}(p) - W_i(p) = \lambda p\sigma\bar{s}(1 - F(p\bar{s}))$$

which is what we define as the cost of collusion.

Now, suppose that self reporting is allowed, and set to be $r = p_{nc}^{sr}\bar{s}$, that is, the level that would be chosen if there was a clean regime and the inspectors are all risk neutral. Also, let inspectors earn a base wage w and an incentive wage $\sigma\bar{s}$ that is contingent on catching a criminal. In this case, the following will happen: all guilty citizens will self report their crime; no incentives will ever be paid out; and therefore $w = c^*$. The welfare achieved is then exactly equivalent to (17), and the cost of collusion is entirely eliminated.

The reason for this result is straightforward: under corruption, inspectors receive an uncertain income that depends on whether they report criminals. When these inspectors are risk averse, they must be paid a wasteful risk premium over the certainty equivalent

[5] Using infinite risk aversion simplifies the formulas, but we can show the same results for less extreme cases.

c^*, and this premium is socially wasteful. Self reporting is a way to eliminate uncertainty in the payoff function of the inspector, since now controls are done only on honest people.

This last property of self reporting would also work if we consider heterogeneous inspectors: for example, when a small number of inspectors turn out to be very good at capturing criminals, they earn rents under anti-corruption schemes. These rents will be eliminated by self reporting.

3.2. Heterogeneity in morals

Apart form risk aversion, in this section we consider also heterogeneous inspectors. They are of two types: θ are dishonest and $1-\theta$ are honest. Similarly to Beslay and McLaren (1993), dishonesty is defined as an immutable characteristic of preferences - an honest person regards his integrity as priceless and thus will not take a bribe, while a dishonest person will maximise his expected income. While dishonesty is immutable it is possible, therefore, to make a dishonest person behave honestly by making it in his or her interest to do so. For the sake of semplicity we will assume dishonest inspectors to be risk neutral: relaxing this assumption wouldn't change any of our results.

Our previous discussion remains unchanged with respect to capitulation wages and incentive wages: note that capitulation wages are applicable only to dishonest inspectors, it follows that if $p_c \geq \theta$ then the government is not able to hire enough inspectors as it would be optimal under the corrupted regime. In this case the government can only assume $p_c = \theta$ inspectors. It follows that, under capitulation wages, welfare is strictly increasing in θ when the condition, $p_c \geq \theta$, is binding. The welfare function can be written as follow,

$$\begin{aligned} W_c^H(p) &= \int_{\theta\sigma\bar{s}}^{\infty}(b-h)f(b)db - \lambda\theta c^* + \lambda\theta\sigma\bar{s}(1-F(\sigma\theta\bar{s})) \\ s.t.\ \ p_c &\geq \theta \end{aligned}$$

Graphically this can be illustred for a generic distribution function,

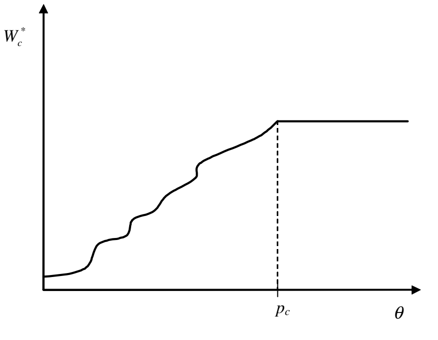


Figure 7

More interestingly when heterogeneity is introduced an additional wage policy can be considered: reservation (or market) wages. By doing so the government can hire both honest and dishonest inspector, under the implicit understanding that the dishonest ones will accept the bribe. The welfare function takes the following form,

$$\max_p W_{nc}(p) = \int_{p\bar{s}\sigma\theta + p\bar{s}(1-\theta)}^{\infty}(b-h)f(b)db - \lambda p\left[c^* - \alpha\bar{s}(1-\theta)(1-F(p\bar{s}\sigma\theta + p\bar{s}(1-\theta)))\right] \tag{19}$$

It is easy to establish that (19) is strictly decreasing in θ and strictly increasing in α and σ. Figure 5 and 6 show how (19) evaluated at its optimal as these two parameters of interest vary.

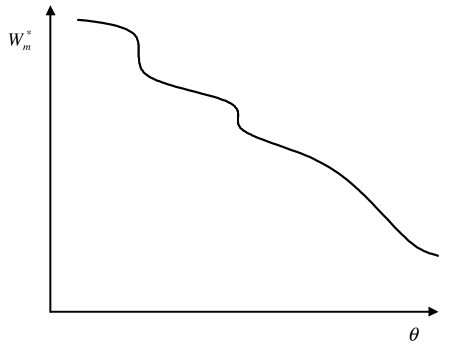


Figure 5

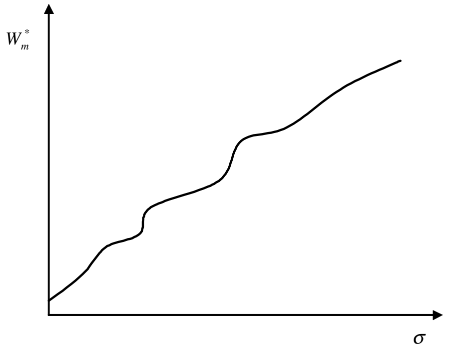


Figure 6

In order to compare incentive wage regimes with market wages we consider two decision loci representing values of σ and θ for which the government would be indifferent between any of the two regimes. We do so by comparing (17) and (19):

$$\begin{aligned} \int_{p_i\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_i\left[c^* - \alpha(1-\sigma)(1-F(p_i\bar{s}))\bar{s}\right] \\ -\int_{p_m\bar{s}\sigma\theta+p_m\bar{s}(1-\theta)}^{\infty}(b-h)f(b)db - \lambda p_m\left[c^* - \alpha(1-\theta)(1-F(p_m\bar{s}\sigma\theta+p_m\bar{s}(1-\theta)))\bar{s}\right] &= 0 \end{aligned}$$

By differentiating this equation we obtain that θ must be an increasing function of σ. This function is illustrated as the curve IM in Figure 8. Consider the choice between market and capitulation wages by comparing (11) and (19). In this instance, we obtain

$$\begin{aligned} \int_{p_c\sigma\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_c c^* + \lambda p_c\sigma\bar{s}(1-F(\sigma p_c\bar{s})) \\ -\int_{p_m\bar{s}\sigma\theta+p_m\bar{s}(1-\theta)}^{\infty}(b-h)f(b)db - \lambda p_m\left[c^* - \alpha(1-\theta)(1-F(p_m\bar{s}\sigma\theta+p_m\bar{s}(1-\theta)))\bar{s}\right] &= 0 \end{aligned}$$

without any futher specification of our model, it is not possible to show whether θ is an increasing or decreasing function of σ. This is represented as the generic line CM in Fig. 8 . When $\sigma = \theta = 1$, capitulation wages always weakly dominates market wages. Moreover, when $\sigma = 0$ the market regime always dominate capitulation wages for any value of θ.

Finally, in order to confront capitulation wages and efficiency wages we compare (7) and (11): the corrupted regime, i.e. capitulation wages, and the clean regime, i.e. efficiency wages, yield the same level of welfare if and only if,

$$\begin{aligned} \int_{p_i\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_i\left[c^* - \alpha(1-\sigma)(1-F(p_i\bar{s}))\bar{s}\right] \\ -\int_{p\sigma\bar{s}}^{\infty}(b-h)f(b)db - \lambda p_c c^* + \lambda p_c\sigma\bar{s}(1-F(\sigma p_c\bar{s})) &= 0 \end{aligned} \tag{20}$$

By differentiating (20) it is easy to establish that θ is a decreasing function of σ. It is illustrated as the curve IC in Fig. 8. With these schedules in place, we can characterise the parameter values in which each of the wage strategies is optimal. They are labelled as MW, EW and CW, standing for market, efficiency and capitulation wages, respectively. To describe our results we shall plot the three decision loci for various parameter values.

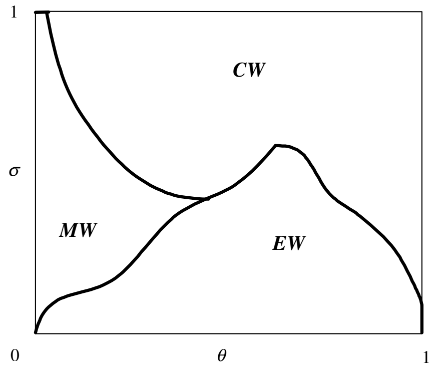
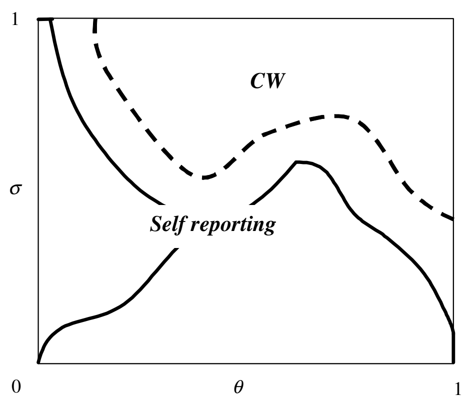


Figure 8

It is easy to show that also in this case, self-reporting dominates both market wages and efficiency wages. By comparing capitulation wages and self-reporting regime we add to the graph an extra dotted line,



This results is coherent with the rest of our analysis: by allowing citizens to avoid all monitoring by reporting their own violations first, the government is able to increase welfare by hiring fewer inspector, and in some instances by shifting from a regime of corruption to a regime where there is none. Most papers on amnesties have taken the view that the latter can be justified only from the point of view of myopic governments looking for short-term gains in exchange for larger longer term losses, including diluted deterrence and reduced effectiveness of laws and sanctions. Our results is actually the opposite. Adopting self-reporting, i.e. moderate amnesties, as a way to reduce collusion, the government is actually competing with its own inspector in the attempt to induce the agents to self-report. Note that more standard instruments against corruption entail competing against criminals by incetivizing the inspectors to refuse bribery. In the context of our model amnesties are preferable to standard anti corruption-policies, particularly in countries with lower levels of judicial development and lower morals.

4. CONCLUSION

Our paper indicates some properties of self reporting of crimes in law enforcement that have not been considered in the past. Self reporting reduced corruption in law enforcement by providing an outside option to criminals, who can choose to come clean directly with the govenrment instead of through the police force. Self reporting is strictly beneficial for governments who already have in place an effective incentive schemes to prevent collusion by reducing enforcement costs. These savings come from two sources. The first source, already identified in the literature, is that the number of controls needed to maintain a certain level of crime is now reduced. The second comes from the elimination of any rents that in some cases must be paid to some inspectors: these rents come from either risk aversion, or from heterogeneity of inspectors.

Self reporting also benefits some governments which, in the absence of this tool, would have rather let corruption prevail. By adding self reporting many more governments would be able to switch from corrupt regimes to clean ones. To domonstrate this, we have considered a range of countries with institutional weaknesses along two directions: the first is that the government is unable or unwilling to either find or prosecute gross instances of bribe taking; the second may be that inefficient judicial systems makes prosecuting criminals too expensive, and the government may prefer to let 'informal punishment' as a form of a bribe to take place. In our model, self reporting does not solve either of these problems; however, it makes them less relevant, and in many cases it tips the government to clean up corruption.

5. APPENDIX

Proposition 5. If the government chooses an incorrect mix of reduced fines and incentive payments, she may not be able to achive the welfare level in (15). In fact, self reporting will not achieve a clean regime unless it is coupled by incentive wages.

To see why, suppose $v = 0$. The government now must choose a policy w_c^{sr} that satisties contraint (8) and a reduced fine r. At this point, the criminal can choose to either pay the reduced fine or to bribe an official in the event of being caught; it will choose the bribe m if $pm \leq r$. Now, suppose for a moment that the criminal chooses not to pay the reduced bribe and is caught by the inspector. The criminal now can either pay a bribe or the full fine $\bar{s}$, and therefore the equilibrium bribe amount (9) applies. In our example, we have set $v = 0$, and thus $m = \frac{1}{2}\sigma\bar{s}$. Note that this equilibrium bribe does not depend at all on the reduced fine, and thus the government cannot offer a reduced fine that is greater than $\frac{1}{2}\sigma\bar{s}$.

We now analyze the optimal response of the government, who must choose what reduced fine to set. She has two alternatives: set it low enough that it binds (and avoids collusion) or high enough that it does not bind and lets collusion happen.

case 1 Suppose $r \leq pm = \frac{1}{2}p\sigma\bar{s}$, and all criminals prefer the reduced fine than the bribe. Then, the government obtains revenues of $\alpha r(1 - F(r))$ and must maximize the function

$$\begin{aligned} \tilde{W}_c(p, r) &= \int_r^\infty (b - h)f(b)db - \lambda pc^* + \lambda r(1 - F(r)) \\ st &: \quad r \leq \frac{1}{2}p\sigma\bar{s} \end{aligned}$$

The constraint must bind with equality: if not, p can be lowered without affecting r, and since fewer inspectors are hired, income increases. This reduces to

$$\tilde{W}_c(p) = \int_{\frac{1}{2}p\sigma\bar{s}}^{\infty} (b-h)f(b)db - \lambda pc^* + \lambda\alpha \left[\frac{1}{2}p\sigma\bar{s}(1-F(\frac{1}{2}p\sigma\bar{s}))\right] \tag{21}$$

case 2 Now suppose that $r > pm = \frac{1}{2}p\sigma\bar{s}$, and all criminals prefer paying the bribe. The government can adjust wages downward and still hire inspectors, but it will not derive any revenues from the fines since all inspectors are accepting bribes equal to $\frac{1}{2}p\sigma\bar{s}$. In this scenario, the welfare function to be maximized is simply

$$\bar{W}_c(p) = \int_{\frac{1}{2}p\sigma\bar{s}}^{\infty} (b-h)f(b)db - \lambda pc^* + \lambda \left[\frac{1}{2}p\sigma\bar{s}(1-F(\frac{1}{2}p\sigma\bar{s}))\right] \tag{22}$$

Compare (21) with (22): for any possible p, $\bar{W}_c(p) - \tilde{W}_c(p) = (1-\alpha)\lambda\left[\frac{1}{2}p\sigma\bar{s}(1-F(\frac{1}{2}p\sigma\bar{s}))\right] > 0$. Thus, when the government chooses to violate (5), she will always choose a regime in which self reporting constraints are not binding.

REFERENCES

[1] Acemoglu, A, Verdier, 2000,*The choice between corruption and market failue*, American Economic Review.

[2] Becker, G.S. and G.J. Stigler, 1974, *Law Enforcement, Malfeasance, and Compensation of Enforcers*, Journal of Legal Studies 3: 1-18.

[3] Besley, T., and MacLaren, J., 1993, *Taxes and bribery: the role of wage incentives*, Economic Journal 103 (1993), pp. 119–141.

[4] Bowles, R. and N. Garoupa, 1997, *Casual Police Corruption and the Economics of Crime*, International Review of Law and Economics 17: 75-87.

[5] Buccirossi P., Spagnolo, G., 2000, *Counterproductive Leniency Programs Against Corruption*, Econometric Society World Congress 2000 Contributed Papers 1311, Econometric Society.

[6] Feess, E., and Walzl,M., 2005, *Quid-Pro-Quo or Winner-Takes-It-All? An Analysis of Corporate Leniency Programs and Lessons to Learn for EU and US Policies*, Research Memoranda 039, Maastricht : METEOR, Maastricht Research School of Economics of Technology and Organization

[7] ____."Heterogeneity and Optimal Self-Reporting." Journal of Institutional and Theoretical Economics-Zeitschrift Fur Die Gesamte Staatswissenschaft, 2006, 162(2), pp. 277-90.

[8] ____. "Optimal Self-Reporting Schemes with Multiple Stages and Option Values." International Tax and Public Finance, 2005, 12(3), pp. 265-79.

[9] ____. "Self-Reporting in Optimal Law Enforcement When There Are Criminal Teams." Economica, 2004, 71(283), pp. 333-48.

[10] Feess, E. and Heesen, E. "Self-Reporting and Ex Post Asymmetric Information." Journal of Economics-Zeitschrift Fur Nationalokonomie, 2002, 77(2), pp. 141-53.

[11] Franzoni, L. A. "Amnesties, Settlements and Optimal Tax Enforcement." Economica, 2000, 67(266), pp. 153-76.

[12] Friesen, L. "The Social Welfare Implications of Industry Self-Auditing." Journal of Environmental Economics and Management, 2006, 51(3), pp. 280-94.

[13] Fukuyama, K.; Kilgour, D. M. and Hipel, K. W. "Self-Reporting Systems for Environmental Compliance." Journal of Water Resources Planning and Management-Asce, 2000, 126(1), pp. 3-12.

[14] Garoupa, N., and Jellal, M., 2002, *Information, corruption and optimal law enforcement*, CEPR Discussion Paper Series No. 3560.

[15] Hasker K., Okten C., Intermediaries and Corruption, 2005, working paper.

[16] Hindriks, J., M. Keen and A. Muthoo (1999), *Corruption, Extortion and Evasion*, Journal of Public Economics 74: 395-430.

[17] Innes, R. "Self-Policing and Optimal Law Enforcement When Violator Remediation Is Valuable." Journal of Political Economy, 1999b, 107(6), pp. 1305-25.

[18] ____. "Self-Reporting in Optimal Law Enforcement When Violators Have Heterogeneous Probabilities of Apprehension." Journal of Legal Studies, 2000, 29(1), pp. 287-300.

[19] ____. "Violator Avoidance Activities and Self-Reporting in Optimal Law Enforcement." Journal of Law Economics & Organization, 2001, 17(1), pp. 239-56.

[20] Livernois, J. and McKennna, C. J. "Truth or Consequences - Enforcing Pollution Standards with Self-Reporting." Journal of Public Economics, 1999, 71(3), pp. 415-40.

[21] Kaplow, L. "A Model of the Optimal Complexity of Legal Rules." Journal of Law Economics & Organization, 1995, 11(1), pp. 150-63.

[22] Kaplow, L. and S. Shavell, 1994, *Optimal Law Enforcement with Self-Reporting of Behavior*, Journal of Political Economy 102: 583-606.

[23] Kugler M., Verdier T. and Zenou Y., 2005, *Organized crime, corruption and punishment*, Journal of Public Economics 89: 1639-1663

[24] Motta, M. and Polo, M. "Leniency Programs and Cartel Prosecution." International Journal of Industrial Organization, 2003, 21(3), pp. 347-79.

[25] Marjit, S. and Shi, H., 1998. *On controlling crime with corrupt officials*, Journal of Economic Behavior & Organization, Elsevier, vol. 34(1), pages 163-172, January

[26] Mookherjee, D., Png, I., 1995, *Corruptible law enforcers: how should they be compensated?*, Economic Journal 105: 145-59.

[27] Mookherjee, D.,1997, *Incentive reforms in developing country bureaucracies: lesson from tax administration*, paper prepared for the Annual World Bank Conference on Development Economics

[28] Polinsky, A.M. and Shavell, S., 2001, *Corruption and Optimal Law Enforcement*, Journal of Public Economics 81: 1-24.

[29] Polinsky, A.M. and Shavell, S., 2000, *The Economic Theory of Public Enforcement of Law*, Journal of Economic Literature 38: 45-76.

[30] Stafford, S. L. "Should You Turn Yourself In? The Consequences of Environmental Self-Policing." Journal of Policy Analysis and Management, 2007, 26(2), pp. 305-26.

6. (NOT CITED)

REFERENCES

[1] Abdala, M., Nicolas, M., and Steeve, M., 2006. *Gangs and Crime Deterrence*, Journal of Law, Economics and Organization, Oxford University Press, vol. 22(2), pages 315-339,

[2] Bac, M., Bag, K.,P., 2000, *Law enforcement costs and legal presumptions*, working paper.

[3] Bar-Ilan, A. and Sacerdote, B. "The Response of Criminals and Noncriminals to Fines." Journal of Law & Economics, 2004, 47(1), pp. 1-17.

[4] Bardhan, P., 1997. *Corruption and development: a review of issues*, Journal of Economic Literature 35 (3), 1320-1347.

[5] Basu, K., Bhattacharya, S. and Mishra, A., 1992. *Notes on bribery and the control of corruption*, Journal of Public Economics, Elsevier, vol. 48(3), pages 349-359, August.

[6] Boyer, M.; Lewis, T. R. and Liu, W. L. "Setting Standards for Credible Compliance and Law Enforcement." Canadian Journal of Economics-Revue Canadienne D Economique, 2000, 33(2), pp. 319-40.

[7] Chang, Juin-jen, Lai, Ching-chong and Yang, C. C., 2000, *Casual police corruption and the economics of crime:: Further results*, International Review of Law and Economics, Elsevier, vol. 20(1), pages 35-51, March.

[8] Chris W., S., and Alexander S. P. , 2004, Big Field, *Small Potatoes: An Empirical Assessment of EPA's Self- Audit Policy*, Public Economics 0403007, EconWPA.

[9] DasGupta, A. and Mookherjee, D. "Tax Amnesties as Asset-Laundering Devices." Journal of Law Economics & Organization, 1996, 12(2), pp. 408-31.

[10] Fender, J., 1999, *A general equilibrium model of crime and punishment*, Journal of Economic Behavior & Organization, Elsevier, vol. 39(4), pages 437-453, July

[11] _____. "Negotiated Enforcement and Credible Deterrence." Economic Journal, 1999, 109(458), pp. 509-35.

[12] Garmon, C. "A Note on Negligence and Collusion-Proof Liability." International Review of Law and Economics, 2005, 25(2), pp. 256-63.

[13] Garoupa, N., 2000, *The Economics of Organized Crime and Optimal Law Enforcement*, Economic Inquiry, Oxford University Press, vol. 38(2), pages 278-88, April.

[14] Garoupa, N. "Optimal Law Enforcement and Imperfect Information When Wealth Varies among Individuals." Economica, 1998, 65(260), pp. 479-90.

[15] Garoupa, N. and Stephen, F. H. "Optimal Law Enforcement with Legal Aid." Economica, 2004, 71(283), pp. 493-500.

[16] Gawande, K. and Bohara, A. K. "Agency Problems in Law Enforcement: Theory and Application to the U.S. Coast Guard." Management Science, 2005, 51(11), pp. 1593-609.

[17] Giannakas, K. and Kaplan, J. A. "Policy Design and Conservation Compliance on Highly Erodible Lands." Land Economics, 2005, 81(1), pp. 20-33.

[18] Guriev S., 2003, *Red tape and corruption*, Journal of Development Economics

[19] Harford, J. D. "Initial and Continuing Compliance and the Trade-Off between Monitoring and Control Cost." Journal of Environmental Economics and Management, 2000, 40(2), pp. 151-63.

[20] Hentschel, E. and Randall, A. "An Integrated Strategy to Reduce Monitoring and Enforcement Costs." Environmental & Resource Economics, 2000, 15(1), pp. 57-74.

[21] Heyes, A. "A Theory of Filtered Enforcement." Journal of Environmental Economics and Management, 2002, 43(1), pp. 34-46.

[22] ____. "Implementing Environmental Regulation: Enforcement and Compliance." Journal of Regulatory Economics, 2000, 17(2), pp. 107-29.

[23] Innes, R. "Fines, Appeals and Liability in Public Enforcement with Stochastic Damage and Asymmetric Information." Economica, 2004, 71(283), pp. 391-416.

[24] ____. "Remediation and Self-Reporting in Optimal Law Enforcement." Journal of Public Economics, 1999a, 72(3), pp. 379-93.

[25] Lando, H. "Does Wrongful Conviction Lower Deterrence?" Journal of Legal Studies, 2006, 35(2), pp. 327-37.

[26] Langpap, C. "Pollution Abatement with Limited Enforcement Power and Citizen Suits." Journal of Regulatory Economics, 2007, 31(1), pp. 57-81.

[27] Levinson, D. J. "Collective Sanctions." Stanford Law Review, 2003, 56(2), pp. 345-428.

[28] Levitt, S. D. "Incentive Compatibility Constraints as an Explanation for the Use of Prison Sentences Instead of Fines." International Review of Law and Economics, 1997, 17(2), pp. 179-92.

[29] Levitt, S. D. and Snyder, C. M. "Is No News Bad News? Information Transmission and the Role of "Early Warning" in the Principal-Agent Model." Rand Journal of Economics, 1997, 28(4), pp. 641-61.

[30] Katz, E. and Rosenberg, J. "Reward Offered, No Questions Asked: An Analysis of Rewarded Theft." Economica, 2004, 71(283), pp. 501-06.

[31] Kessler, D., P., and Levitt, S. D., 1999. *Using Sentence Enhancements to Distinguish between Deterrence and Incapacitation*, Journal of Law & Economics, University of Chicago Press, vol. 42(1), pages 343-63, April.

[32] Kirchhoff, S. "Green Business and Blue Angels - a Model of Voluntary Overcompliance with Asymmetric Information." Environmental & Resource Economics, 2000, 15(4), pp. 403-20.

[33] Macho-Stadler, I. and Perez-Castrillo, D. "Optimal Enforcement Policy and Firms' Emissions and Compliance with Environmental Taxes." Journal of Environmental Economics and Management, 2006, 51(1), pp. 110-31.

[34] Marcel, B., Tracy R., L., and Wei L., L., 2000, *Setting standards for credible compliance and law enforcement*, Canadian Journal of Economics, Canadian Economics Association, vol. 33(2), pages 319-340, May

[35] Montero, J. P. "Multipollutant Markets." Rand Journal of Economics, 2001, 32(4), pp. 762-74.

[36] ____. "Prices Versus Quantities with Incomplete Enforcement." Journal of Public Economics, 2002, 85(3), pp. 435-54.

[37] Mookherjee, D. and I.P.L. Png, 1992, *Monitoring vis-à-vis Investigation in Enforcement of Law*, American Economic Review 82: 556-565.

[38] Mookherjee, D., Png, I, 1994, *Marginal Deterrence in Enforcement of Law*, Journal of Political Economy 102: 1039-1066.

[39] Motchenkova,E., 2004, *Effects of leniency programs on cartel stability*, Discussion Paper 20, Tilburg University, Tilburg Law and Economic Center

[40] Motchenkova,E., and Laan, R, 2005, *Strictness of leniency programs and cartels of asymmetric firms*, Discussion Paper 74, Tilburg University, Center for Economic Researc

[41] Shleifer, A., Vishny, R., 1993, *Corruption*, Quarterly Journal of Economics 110, 681-712.

[42] Tirole, J., 1986. *Collusion and the theory of organizations.* In: Laffont, J.-J. (Ed.), Advances in Economic Theory. Sixth World Congress. Cambridge University Press, Cambridge, NewYork, vol.2,pp. 151-206.

[43] Pfaff, A. and Sanchirico, C. W. "Big Field, Small Potatoes: An Empirical Assessment of Epa's Self-Audit Policy." Journal of Policy Analysis and Management, 2004, 23(3), pp. 415-32.

[44] ____."Environmental Self-Auditing: Setting the Proper Incentives for Discovery and Correction of Environmental Harm." Journal of Law Economics & Organization, 2000, 16(1), pp. 189-208.

[45] Polinsky, A. M. "Optimal Fines and Auditing When Wealth Is Costly to Observe." International Review of Law and Economics, 2006, 26(3), pp. 323-35.

[46] Polinsky, A.M. and Shavell, S., 1979, *The Optimal Tradeoff between the Probability and Magnitude of Fines*, American Economic Review, American Economic Association, vol. 69(5), pages 880-91, December.

[47] Rose-Ackerman, S. 1999, *Corruption and Government: Causes, Consequences, and Reform*, Cambridge University Press, Cambridge.

[48] Sanchirico, C. W. "Detection Avoidance." New York University Law Review, 2006, 81(4), pp. 1331-99.

[49] Sandmo, A. "Efficient Environmental Policy with Imperfect Compliance." Environmental & Resource Economics, 2002, 23(1), pp. 85-103.

[50] Sah, Raaj K, 1991, *Social Osmosis and Patterns of Crime*, Journal of Political Economy, University of Chicago Press, vol. 99(6), pages 1272-95, December

[51] Shavell, S., 1987, *The Optimal Use of Nonmonetary Sanctions as a Deterrent*, American Economic Review, American Economic Association, vol. 77(4), pages 584-92, September

[52] Shavell, S., 1991, *Specific versus General Enforcement of Law*, Journal of Political Economy 99: 1088-1108.

[53] Shimshack, J. P. and Ward, M. B. "Regulator Reputation, Enforcement, and Environmental Compliance." Journal of Environmental Economics and Management, 2005, 50(3), pp. 519-40.

[54] Steven Shavell, 2003, *Economic Analysis of Public Law Enforcement and Criminal Law*, NBER Working Papers 9698, National Bureau of Economic Research, Inc.

[55] Spagnolo, G., 2004, *Divide et Impera: Optimal Leniency Programmes*, CEPR Discussion Papers 4840, C.E.P.R. Discussion Papers

[56] Spagnolo, G., Buccirossi P., 2005, *Leniency Policies and Illegal Transactions* Journal of Public Economics 90: 1281-1297.

[57] ____. "State Adoption of Environmental Audit Initiatives." Contemporary Economic Policy, 2006, 24(1), pp. 172-87.

[58] Stranlund, J. K. and Chavez, C. A. "Effective Enforcement of a Transferable Emissions Permit System with a Self-Reporting Requirement." Journal of Regulatory Economics, 2000, 18(2), pp. 113-31.

[59] Stranlund, J. K.; Chavez, C. A. and Field, B. C. "Enforcing Emissions Trading Programs: Theory, Practice, and Performance." Policy Studies Journal, 2002, 30(3), pp. 343-61.

[60] Stranlund, J. K.; Costello, C. and Chavez, C. A. "Enforcing Emissions Trading When Emissions Permits Are Bankable." Journal of Regulatory Economics, 2005, 28(2), pp. 181-204.

[61] Sutter, D. "Legitimacy and Military Intervention in a Democracy - Civilian Government as a Public Good." American Journal of Economics and Sociology, 1999, 58(1), pp. 129-43.