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EX-ANTE AND EX-POST CORRUPTION

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Abstract

This paper studies the optimal compensation policy for a corruptible inspector, in charged with monitoring evasion from a taxpayer. Namely, I discuss how the optimal compensation policy varies according to the timing of collusion, which is allowed to occur either before or after inspection takes place. This paper shows that increasing the bonus rate is a better policy than increasing the penalty rate when corruption occurs after inspection. The contrary is true when the collusive agreement is established before the inspection. Implications for privatization of law enforcement are analyzed.

1 Introduction

When it comes to tax collection, there is pervasive evidence of several forms of dishonesty and malpractice, not only limited to developing countries but also to much higher profile cases[1]. Collection of tax revenues typically implies several forms of illicit behavior: taxpayers may try to evade their legal liabilities, while tax inspectors may abuse their authority soliticing bribe or threatening the taxpayer to report a taxable income higher than the true one. The economic

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[1] Young et all (2001) analyse corruption in the contest of american IRS.

literature has already well documented that, whenever law enforcement is delegated, opportunities for collusion between taxpayer and inspector may arise: most of the articles, however, allow collusion to happen only *after* inspection has already occurred. The main object in this article is to incorporate the possibility for the collusive contract to be established *both* before and after the inspector has already exerted effort: in what follows, the first type of collusion is denoted as *ex-ante corruption* (or preemptive collusion) while the former as *ex-post corruption.* As long as timing of corruption is endogenously determined, the relation between compensation policies and corruption may be different with respect to standard economic wisdom. Conceptually, the main novelty is that inspector can avoid the monitoring effort by choosing to collude ex-ante: therefore she decides whether or not to accept a preemptive bribe taking into consideration the equilibrium level of effort she is going to exert if ex-ante collusion is not taking place. Ceteris paribus, higher levels of effort imply increased profitability of preemptive collusion, i.e. profitability of ex-ante corruption is increasing in the out-of-equilibrium optimal level of effort that the inspector would have exerted by monitoring. As a consequence of this result, any kind of compensation policies aimed to increase the inspector's monitoring effort may also increase the likelihood of ex-ante corruption: this is of course an undesired side effect which arises directly from allowing endogenous timing of corruption. The other side of the story concerns taxpayers: evaders benefits from preemptive collusion are due to lower levels of monitoring, as a consequence evasion is generally larger in case of ex-ante collusion. But taxpayer is also harmed by ex-ante collusion since it eliminates the monitoring lottery which may be favorable to him with some probability, i.e. due to imperfect monitor technology, inspector may not discover the concealed income even after inspection is carried out. Even if *ex-ante* and *ex-post* corruption have been already documented in detail[2], only few contributions combine the two types of corruption in one

[2] For example, serbian custom officials are known to accept bribe from travelers without checking their belongings: see "Investigation: Serbia Losing Customs Corruption Battle" by John Simpson (2005). William et all

model, studying their interaction. Among them Guriev's work (2003) analyzes the interactions between ex-post, ex-ante corruption and red tape: in his paper bureaucrat may extort bribes from the agent in exchange for reducing the amount of red tape (ex-ante corruption). Moreover the bureaucrat may take bribes to conceal the information produced through red tape: the former kind of corruption tends to reduce red tape while the later is increasing it. In any case, authors show that the equilibrium level of red tape is above the social optimum. Bac and Bag (2000) also analyses ex-ante corruption in relation to law enforcement costs and legal presumptions. Samuel (2009) independently worked on a framework very similar to the one presented here. He also obtained some of our results.

Apart from the ones cited above, several other articles study the optimal incentive policy for a corruptible law enforcers but none of them allow for timing of corruption to be endogenously determined. Becker and Stigler (1974) focus on controlling bribery and consider paying commission to enforcers. Mookherjee and Png (1995) consider bribery and the use of both sanctions and reward as means of control. Bowels and Garoupa (1997) discuss bribery control through sanctions. Hindricks, Keen and Muthoo (1999) analyze bribery and extortion in the contest of tax evasion, considering commissions and penalties as methods of control. Polinsky and Shavell (2000) also examine both bribery and extortion allowing for both penalties and reward to be used against corruption. Acconcia, D'Amato and Martina (2003) restrict their attention on tax evasion and analyze the interaction between evasion, corruption, monitoring and incentive schemes. 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 is considered. More important for the purpose of this article is Mooherjee's (1997) contribution: he considers bribery

in their survey of corruption in Eastern Europe discuss the problem of ex-ante as well as ex-post corruption. See also surveys by Tirole (1992) Bardhan (1997).

and extortion in the context of tax evasion allowing the possibility to use both sanctions and reward as means of control. The model presented here is the natural extension of Mooherjee's (1997) when *ex-ante* collusion is incorporated: in particular it addresses the problem of designing incentives mechanisms for public bureaucrats considering the effect of these incentive schemes on corruption, taxpayer compliance and tax revenue.

This paper also discuss the issue of privatization of law enforcement: it has been argued that when it comes to reform bureaucracies the side effects of incentive reforms may be so costly to neutralize the positive ones[3]. Given these concrete difficulties in designing effective incentives mechanisms for public bureaucrats, it has been questioned if there is any scope for the existence of a Civil Service in charged with monitoring evasion from taxpayers. In other words, given the growing disillusionment with government bureaucracies, it has been questioned whether should be more reasonable to reform or dismantle these bureaucracies. In favor of this last option, Becker and Stigler (1974) advocated privatizing law enforcement to motivate the inspector. More recently Dean Yang (2005) analyzed the effectiveness of the so called "hiring integrity" strategy: this approach encompass hiring private firms to monitor potentially corrupt activity[4]. Yang found that countries implementing such inspection programs experienced large increases in import duty collections, moreover hired integrity appears to have been cost-effective. Nonetheless it remains conceptually unclear whether or not privatization is the optimal policy to adopt. More specifically, arguments against privatization of law enforcement can be found in Mookherjee (1997) and Mookherjee and Png (1995) - in their setting privatization could be

[3] At the contrary, Mookherjee (1998) argues that governments truly committed to reform may succeed in reforming tax administration if they make use of instruments aimed at altering the institutional attributes of public bureaucracies.

[4] Dozens of developing countries have adopted this startegy to fight corruption in customs services. The approch consists in hiring private firms to conduct preshipment inspection of imports. Inspection firms' reputation plays a crucial role in guaranteeing honesty and reliability when competition among the private monitors generates incentives for integrity.

interpreted as a reward rate of 100%: in both articles, dismantling Civil Service need not be the optimal strategy. The most immediate draw-back is harassment of honest citizens and extortion. On the one hand, privatization gives inspector an incentive to resist the evasion of taxes; on the other hand it also gives them an incentive to over-state taxes. As long as privatization entails an increased stake for denouncing evaders, it also enhances their ability to extort by making credible the threat of over-reporting taxpayer's income. This paper shows that it exists another crucial aspect to be considered in adopting policy devices which entail increasing inspector reward rate. Indeed, a different and more subtile reason why privatization may not solve the problem of corruption lies in the timing of collusion itself: if the taxpayer can bribe the inspector before she actually inspects, further increase in reward rate may not affect the likelihood of corruption and, at the same time, it may produce counter effect in terms of both taxpayer compliance and tax revenue. Under certain conditions, therefore, the revenue authority may be interested in holding both "carrots" (bonuses) and "sticks" (penalties), as policy instruments: more precisely, under ex-ante corruption, increasing the bonus rate is never a better policy than increasing the penalty rate. Therefore in this case no privatization at all is warranted. Reversed results applied if ex-post corruption is considered.

Section 1.2 presents the model. Section 1.3 analyses social welfare. Section 1.3 introduces asymmetric information. Section 1.4 concludes.

2 The Model

The model entails a risk-neutral taxpayer (whom is referred to as “he”) with true income $y \in \mathbb{R}^{+}$. The income is distributed with a cumulative distribution function $G(.)$, which is common knowoledge. The taxpayer can conceal income by an amount e by self reporting an income equal to $y - e$ and paying a tax of $t(y - e)$; t is assumed to be constant. Under the law, evasion is subject to a fine f and the revenue authority employs an inspector (whom is referred to as "she") to monitor taxpayers and enforce the regulation. To obtain evidence of evasion with probability $p \in [0, 1]$, the inspector must exert effort $E(p)$ which is unobservable by the tax administration on a routine basis, unless special audits are arranged; $E(p)$ is assumed to be strictly increasing, convex, differentiable and $E(0) = 0$. In this section, I assume that the inspector observes the real taxpayer's income[5]. This setting may apply to those situations in which taxpayer cannot help signaling his own true income[6]. Nontheless, inspector must find hard evidence of evasion before denouncing the taxpayer. The timing of the game is as follows: before having actually exert the effort, $E(p)$, tax collector must decide whether to initiate a preemptive collusion with the taxpayer or whether to start investigating. In case tax collector decides to collude ex-ante, she will indicate the size of the bribe, b_a, that taxpayer must paid in exchange for not being monitored. The side contract is assumed to be enforceable. If taxpayer accepts the ex-ante agreement, information about the bribe and the taxpayer's true income leaks anyway to the regulator with an exogenous probability l; this may happen through an internal audit or external vigilance agency. The first regulator's policy consists of two instruments: penalty for bribe-taking g and penalty for bribe-giving c. These components are the 'sticks': penalty can be imposed on the tax collector in the form of a fine that has a constant pecuniary (present value) of c on the amount of underreport income[7]. Symmetrically, the tax payer is penalized at a fixed proportional rate, g.

If the taxpayer rejects the inspector's collusive offer, she proceeds to investigate him. With some probability p evidence of evasion is discovered. If inspector reports evasion, the taxpayer

[5] In Section 1.3 this assumption is relaxed and asymmetric information is introduced.

[6] For example, living expenses and consumption behaviors may be used by the inspector to infer the real taxpayer's income.

[7] The penalty may be thought as a transfer to an undesired location, a refusal of promotion in the future, or the extreme punishment of being fired.

must pay additional taxes of te and an additional penalty at a constant rate f on the amount of evasion[8]; that is, overall, taxpayer has to pay back a total of $(t + f)e$. At this stage, the inspector may ask for a bribe (ex-post corruption) for not reporting taxpayer's evasion[9]. Again with some exogenous probability l the bribery is discovered; same penalties apply as for the ex-ante collusion case. Apart from penalties, which represent the first policy instrument, the second regulator's policy corresponds to the 'carrot': the tax collector can retains a certain fraction, r, of the additional revenues generated. On top of these collection-based bonuses, the tax collector is paid a fixed salary W, where U is her outside option. Having this schedule in place, it is possible to analyze different compensation mechanisms. One extreme case entails no incentive pay at all ($c = r = 0$): that is, the compensation mechanism reduces to a form of fixed salary. This solution may be rare: usually, corrupt and inefficient behaviors are penalized along the lines of an implicit code of conduct. When this is the case, sticks represent the incentive. The use of promotions based on performance is also quite usual: collection-based bonuses indirectly have the same effect. Finally, the other extreme case is privatization of tax collection where all revenues are retained by tax collector ($r = 1$): in this case W is typically negative, representing a transfer from the tax collector to the government. This transfer could take the form of a permit for the right to collect taxes.

[8] We would obtain the same results if we were to consider a more complex setting where the tax collector has discretion regarding the level of evasion, d, that she reports to the regulator. In our simple linear model, it will be evident that either the tax collector will report the entire evasion ($d = e$) or nothing ($d = 0$).

[9] Having this assumption in place implies that extortion or overassessment are not allowed in the model: the result wouldn't change substantially if those issues were to be considered. To see this point, suppose that a taxpayer can file an appeal when the inspector reports $d > e$. The overall cost of appealing is A, which includes monetary and psychic costs. The probability of having a successful appeal is a: in this case, the taxpayer is refunded the excess taxes and fines paid $(t + f)(d - e)$ as well as some fraction, k, of the costs incurred in appealing the assessment. The tax collector is made to pay back her commissions plus an additional penalty for overassessment at a rate x, i.e. $(x + r)(t + f)(d - e)$. In the event of a unsuccessful appeal, the taxpayer receives no refund, while the tax collector is entitled to keep the entire commission, $r(t + f)d$. Having this schedule in place, the possibility of overassessment exercises no effect on monitoring or tax evasion incentives: indeed, extortion ends up representing a lump sum taxation. We address the reader to Mookherjee (1997) for a formal proof.

2.1 Ex-post corruption

To begin with, suppose that only ex-post corruption is possible. If inspection is successful, tax collector discovers evidence of taxpayer's evasion, e. In this case, the expected benefit to the taxpayer from not being denounced is

$$(t+f)e - l(t+g)e,$$

while the cost to the tax collector of not reporting the evasion equals the sum of expected penalties for bribery and forgone commissions,

$$lce + r(t+f)e.$$

Accordingly, the condition for corruption to occur is

$$(1-r)(t+f) > l(c+t+g), \tag{1}$$

which ensures that the collective gains to tax payer and tax collector are positive.

Notice that (1) never holds when tax collection is privatized, i.e. $r = 1$, while it is more likely to be satisfied when there is no incentive pay, i.e. $r = c = 0$. When condition (1) is satisfied, the supervisor determines the ex-post bribe by keeping in mind that the taxpayer will reject his collusive offer if the bribe that he demands is too large. Thus, the ex-post bribe b_p and the expected cost of giving a bribe $l(t+g)e$ must be less than the fine $(t+f)e$. That is, $(t+f)e - l(t+g)e > b_p$. However, the supervisor will not offer a bribe unless it is profitable to him. Thus, b_p minus the penalty for taking a bribe lce must be greater than $r(t+f)e$. That is, $b_p > lce + r(t+f)e$. For simplicity the supervisor is allowed to extract all the surplus from taxpayer, making him indifferent between paying the bribe or let the evasion to be disclosed[10]. In this case the ex-post bribe level would be,

$$b_p = e\left[t + f - l(t+g)\right]. \tag{2}$$

Suppose the regime is corrupt, i.e. (1) holds. Tax collector's expected payoff equals

$$W + pe\left[t + f - l(t+g+c)\right] - E(p) \tag{3}$$

and the taxpayer's expected payoff is given by

$$y - t(y-e) - pe\left(t+f\right). \tag{4}$$

In the second stage of the game the two will simultaneously select their respective strategies: the tax collector will select the inspection effort (p), while the taxpayer will decide the level of evasion (e). From now on (e_p, p_p) denotes the equilibrium values in the ex-post corrupt regime. The unique Nash equilibrium of this game depends on the parameter values. If the amount of evasion is "interior", equilibrium monitoring intensity and evasion solve,

$$p_p = \frac{t}{(t+f)}, \tag{5}$$

$$e_p = \frac{E'(p_p)}{(t+f) - l(c+t+g)}. \tag{6}$$

Notice that when (5) holds the taxpayer is actually indifferent between concealing all his income and not evading at all: therefore he randomizes accordingly. The equilibrium level of expected

[10]Our main results are not affected by this assumption regarding the bargain process.

evasion solves (6)[11]. In the corner solution taxpayer discloses nothing at all ($e_p = y$) and the equilibrium monitoring intensity p solves $E'(p_p) = y[(t+f) - l(c+t+g)]$. This implies self reporting an income equal to zero. For the sake of simplicity, in what follows I study only the case where taxpayers don't conceal all their income. Focusing on "interior" solution doesn't affect our main results; it simply allows us to rule out corner solutions which may complicate the exposition. The first result of the paper is encapsulated in the following proposition.

Proposition 1 *When the regime is ex-post corrupt, an increase in the penalty rate, c, reduces the likelihood of corruption but it also increases evasion. On the contrary, an increase in the bonus rate, r, reduces only the likelihood of corruption.*

Proof. From equation (5) and (6), it is easy to notice that a small increase in bonus rate, i.e. positive incentives, has no effect on the optimal level of tax evasion. On the contrary, increased use of penalties, i.e. negative incentive, increases tax evasion. Condition (1) implies that both types of incentives reduce the likelihood of corruption. QED. ■

This suggests that, under an ex-post corrupt regime, the "carrot" is more effective than the "stick". To see this point, consider the effect of a local increase in the penalty rate, c, for taking a bribe. The increase in the expected penalty reduces the inspector's incentive to monitor. In turn, this increases taxpayer incentive to evade. This is a well-known result that has already been analysed by Mookherjee and Png (1995) and Mookherjee (1997).

Before being able to extend our analysis to include ex-ante collusion, the behaviors of the tax payer and the inspector when bribery is not profitable must be analyzed. To this purpose, assume that the regulator's policy does not satisfy (1). It follows that bribery does not occur. In this case, the expected payoff for inspector is $W + p[r(t+f)e] - E(p)$ and $y - t(y-e) - p[(t+f)e]$ for taxpayer. From now on (e_c, p_c) denotes the equilibrium values in the clean regime. If the

[11] These mixed strategies could be easily "purified" by introducing heterogeneity among taxpayers.

amount of evasion is interior, the optimal level of effort by inspector, p_c, and the optimal level of evasion e_c are given by

$$p_c = \frac{t}{(t+f)}, \tag{7}$$

$$e_c = \frac{E'(p_c)}{r(t+f)}. \tag{8}$$

Otherwise, if evasion is maximal ($e_c = y$) the equilibrium monitoring intensity solves $E'(p_c) = yr(t+f)$. As before, for the sake of exposition I rule out corner solutions. A simple inspection revelas that the penalties for corruption have no effect, since bribery does not occur. An increase in the reward rate increases the inspector's incentive to monitor. By doing so it also reduces evasion.

2.2 Ex-ante corruption

In the following section only ex-ante collusion is allowed[12]. In this case, the timing of the game can be represented as follow,

- Tax collector decides whether to initiate an ex-ante collusion with the taxpayer or whether to start inspecting. If the tax collector decides to engage a preemptive agreement, she makes a take-it-or-leave-it offer to the taxpayer for not monitoring him. This contract is assumed enforceable.

- Taxpayer decides whether to accept ex-ante collusion or not.

- Taxpayers decides how much to evade.

[12] This is equivalent to assume that ex-post corruption is not profitable, i.e. condition (1) doesn't hold.

- If ex-ante collusion has not taken place, the inspector selects the monitoring effort, inspection is carried out and its results are delivered to the principal; fines eventually applies and payoffs are realized.

- If the ex-ante agreement has been established, inspection doesn't take place while the principal receives notification from inspector, which certifies that the taxpayer has not conceal any income. Bribery is discovered with exogenous probability, fines and penalties eventually apply and payoffs are realized.

In case the preemptive agreement between inspector and taxpayer fails to be established, the game's setting is identical to the one presented in the previous section, i.e. clean regime outputs apply. On the contrary, if the taxpayer decides to accept inspector's offer the structure of the game is different. In order to solve the model, the concept of subgame perfect Nash is adopted. That is, first the individual's optimal choice of evasion e is computed, contingent on him accepting the preemptive agreement. Next, the necessary and sufficient conditions for an ex-ante collusion are analyzed.

In the last stage of the game, taxpayer must decide how much to evade; in the ex-ante corrupt regime the expected payoff of the tax collector will be

$$W + b_a - lce$$

and the expected payoff of the taxpayer is given by

$$y - t(y - e) - b_a - l(t + g)e.$$

For a given level of the ex-ante bribe, which is exchanged in the first stage of the game, the equilibrium level of evasion is given by $e_a = y$ if the following condition holds,

$$\frac{\partial U}{\partial e} = t - l(t+g) \geq 0. \tag{9}$$

Otherwise the agent self-reports his true income and $e_a = 0$. Differently from equation (6), where only ex-post corruption was considered, it is evident that neither a small increase in positive incentives, r (a higher bonus rate) or c (a higher penalty for bribe taking) causes tax evasion to vary. On the other hand, penalty for bribe giving, g, has negative impact on evasion; if g is raised sufficiently, the outcome may be to switch the system to a corner equilibrium at which taxpayers disclose all his income. In this sense, the level of tax evasion is decreasing in penalty for bribe giving, g. The equilibrium strategies in the ex-ante corrupted regime are denoted by (e_a, p_a), which represent respectively the level of evasion and the effort devoted to monitoring, where $p_a = 0$.

In the first stage of the game, what determines whether there will be ex-ante corruption or not? The expected benefit to the taxpayer from not being inspected equals

$$t(e_a - e_c) - l\,(t+g)\,e_a + p_c[(t+f)e_c]. \tag{10}$$

Note that taxpayer's benefit depends on the out-of-equilibrium level of monitoring effort, p_c, which is exerted by inspector in case preemptive collusion is not taking place. Therefore p_c represents the optimal level of monitoring which solves equation (7). Up to this point, the only difference between ex-ante and ex-post benefit from corruption consists in the presence of two extra terms, p_c and $t(e_a - e_c)$; indeed, when the preemptive agreement is proposed to the taxpayer, he considers his probability of getting caught during the inspection, p_c, in case he refuses to pay the ex-ante bribe. Moreover he keeps in mind the difference in the equilibrium level of evasion between the two regimes, the clean one, e_c, and the ex-ante corrupt one, e_a. These elements were not present in the previous section where only ex-post corruption was allowed to be established: in that setting collusion happens only after monitor activity has already occurred and evidence of evasion has been collected.

The gain to the tax collector of colluding ex-ante equals the saved effort minus the sum of expected penalties for bribery and forgone commissions,

$$E(p_c) - lce_a - p_c[r(t+f)e_c]. \tag{11}$$

Confronting (3) with (11), it is easy to notice that two new elements enter in the former expression: first, the inspector's gain includes the effort that he avoids by not monitoring, $E(p_c)$. Secondly, the forgone commissions are obtained only with a certain probability, p_c, contingent on the collection of the hard evidences required to obtain legal persecution.

Again, the expected gains from corruption is captured entirely by inspector who holds all the bargain power, so that the equilibrium bribe level would be

$$b_a = t(e_a - e_c) - l\,(t+g)\,e_a + p_c[(t+f)e_c]. \tag{12}$$

Corruption occurs only if the collective gains to the pair are positive

$$p_c(1-r)(t+f)e_c + E(p_c) + t(e_a - e_c) \geq l\,(t+g+c)\,e_a. \tag{13}$$

The following proposition describes the impact of incentives on the likelihood of corruption.

Proposition 2 *When the regime is ex-ante corrupt and condition (1) doesn't hold, an increase in the penalty rate, c, reduces the likelihood of corruption. On the contrary, an increase in the* *bonus rate, r, doesn't affect the likelihood of corruption.*

Proof. By substituting (7), (8) and $e_a = y$ into (13) I obtain

$$E(p_c) - \frac{E'(p_c)}{(t+f)}t + ty \geq l\,(t+g+c)\,y \tag{14}$$

From this expression it is easy to notice that an increase in the value of r has no effect on the likelihood of corruption. On the contrary, increased use of penalties reduces the likelihood of corruption. QED. ■

This result contrasts sharply with the one obtained in the previous section; by introducing ex-ante collusion the down-side of increasing in the level of bonus rate is uncovered. This effect was not present in case taxpayer and inspector can only collude after monitor activity has already been carried out. On the other hand, I obtain more familiar results when considering increases in the values of c and l, which make inequality (14) less likely to hold and in this sense reduce the likelihood of corruption.

2.3 Ex-ante and ex-post corruption

In this section both ex-ante and ex-post corruption are considered, studying the interaction between these two forms of collusion. This is equivalent to assume that condition (1) holds, therefore ex-post corruption is preferred to the clean regime. In the first stage of the game, agents will decide whether to collude ex-ante or not: they take into consideration that in case they fail to establish a preemptive agreement they will collude ex-post after inspection has been carried out and contingent on hard evidences being discovered by inspector during his monitor activities. The expected benefit to the taxpayer from not being inspected equals

$$t(e_a - e_p) - l\,(t+g)\,e_a + p_p l\,(t+g)\,e_p. \tag{15}$$

Taxpayer's benefit depends on the out-of-equilibrium level of monitoring and evasion effort under the ex-post corrupt regime, i.e. p_p and e_p. When the preemptive agreement is proposed to the tax payer, he considers his probability of getting caught during the inspection, p_p, in case he refuses to pay the ex-ante bribe. A second aspect is related with the difference in the equilibrium level of evasion between the two regimes, the ex-post corrupt one, e_p, and the ex-ante corrupt one, e_a.

The gain to the tax collector of colluding ex-ante equals the saved effort minus the sum of expected penalties for bribery and forgone commissions,

$$E(p_p) - lce_a + p_p lce_p. \tag{16}$$

Confronting (3) with (16), two new elements are introduced: first, the inspector's gain includes the effort that he avoids by not monitoring, $E(p_p)$. Secondly, the ex-post penalty for bribe-taking are now avoided. The equilibrium bribe is,

$$b_a = t(e_a - e_p) - l\,(t+g)\,e_a + p_p l\,(t+g)\,e_p.$$

Ex-ante corruption occurs only if the collective gains to the pair are positive

$$E(p_p) + t(e_a - e_p) + p_p l\,(t+g+c)\,e_p \geq l\,(t+g+c)\,e_a \tag{17}$$

The following proposition remarks the impact of incentives on the likelihood of corruption.

Proposition 3 *When the regime is ex-ante corrupt and condition (1) holds, an increase in the penalty rate, c, reduces the likelihood of corruption. On the contrary, an increase in the bonus rate, r, doesn't affect the likelihood of corruption.*

Proof. By substituting (5) and (6) into the former expression I obtain,

$$E(p_p) + te_a \geq l\,(t+g+c)\,e_a + e_p\left[t\left(1 - \frac{l\,(t+g+c)}{(t+f)}\right)\right].$$

Defining T_a as tax inspector's gain under the ex-ante corrupt regime,

$$T_a = E(p_p) + te_a - l\,(t+g+c)\,e_a - e_p\left[t\left(1 - \frac{l\,(t+g+c)}{(t+f)}\right)\right].$$

Given that condition (1) must hold, derive the above equation with respect to c, to obtain

$$\frac{\partial T_a}{\partial c} = l\left(e_a - e_p\frac{t}{(t+f)}\right) + \frac{\partial e_p}{\partial c}\left|t\left(1 - \frac{l\,(t+g+c)}{(t+f)}\right)\right| \geq 0.$$

It follows that increases in c decrease the likelihood of ex-ante corruption. Note that r has no impact at all on the likelihood of corruption. QED ■

Again, the introduction of ex-ante collusion highlights a drawback of increasing the level of bonus rate: this result is consistent with the one obtained in the previous section where the alternative to ex-ante corruption was the clean regime. Standard results also apply for increases in the values of c and l , which make inequalities less likely to hold and in this sense reduce the likelihood of corruption.

2.4 Welfare

This section studies the welfare trade-off among corruption, evasion and enforcement. An utilitarian approach is adopted: this standpoint ignores all transfers, and, in particular, attaches no social cost to bribery *per se*. It also assumes that the regulator has no budget restrictions, so that any reward, r, and penalty for corruption, c, are feasible.

Proposition 4 *In both the clean and the ex-post corrupt regime, social welfare is not affected by incentives r and c. Moreover, any policy under a clean regime yields the same social welfare under a corrupt regime.*

Proof. See Appendix. ■

Somewhat surprisingly, increases in incentive components have effect neither on net revenues nor on welfare. Moreover, ex-post corruption doesn't affect social welfare. This result is clearly biased by the utilitarian approach adopted here. If policy maker's target is to jointly defeat ex-post corruption and evasion (i.e. the policy maker attaches a social cost to bribery and evasion *per se*), eliminating corruption is always optimal. This is reasonable if additional negative side-effects of evasion and bribery were to be considered. These may include distortion in productive decisions and a general deterioration of the central government's ability to control and regulate the economy.

When ex-ante corruption is considered, different policy implications arise.

Proposition 5 *When the regime is ex-ante corrupt, local increases in the penalty rate, c, provocates social welfare to increase. On the contrary, bonus rate, r, has no effect on welfare.*

Proof. See Appendix. ■

When the regime is ex-ante corrupt increasing the penalty rate is a better policy than increasing the bonus rate. Moreover, as long as the penalties can be freely varied, the optimal compensation policy entails increasing c at the maximum level.

Nonetheless, one issue is left to be clarified: is it optimal for our utilitarian regulator to eliminate ex-ante corruption? The answer to this question is not *a priori* clear[13]. Notice that if

[13] The fact that some countries may prefer to let corruption widespread, has been shown in several economic articles which consider second best policy involving a certain level of corruption. For example, Acemoglu and Verdier (2000) analyze the case in which preventing all corruption is too costly and second best intervention may

c is raised sufficiently, the outcome may be to switch the system from an ex-ante corrupt regime to a clean one (or alternatively to an ex-post corrupt regime). By comparing the social welfare in the different regimes, I have

$$SW^a - SW^p = SW^a - SW = (\lambda - 1)l(c + t + g)y - t(\lambda - 1)\left[y - \frac{E'(p_c)}{(t+f)}\right] + \lambda E(p_c).$$

Whether or not the ex-ante corrupt regime is preferred to the other ones depends crucially on taxpayer's income and inspector's effort $E(p_c)$. In order to address this issue more precisely, the effort function should be further specified; for the purposes of this paper, I prefer to maintain a generic effort function and leave a more detailed analysis to future extensions.

In the above discussion it was assumed that the regulator has no budget restrictions, i.e. any reward, r, and penalty for corruption, c, are feasible. On the contrary, suppose now that the regulator, due to some budget limitations, is bounded to choose values of r and c that satisfy (1), (13) and (17). Under these circumstances, corruption can no longer be eliminated. Moreover, when the regime is ex-post corrupt and the policy maker's target is to jointly reduce corruption and evasion, increasing the bonus rate is a better policy than increasing the penalty rate. Indeed, while an increase in the bonus rate will cause no effect on tax evasion, increases in penalties increase it. Otherwise, when the regime is ex-ante corrupt, increasing the penalty rate is a better policy than increasing the bonus rate. This is due to the fact that an increase in the bonus rate will cause no effect on the likelihood of corruption, while increases in penalties decrease it. In this case no privatization at all is warranted to fight corruption.

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involve a certain fraction of bureaucrats accepting bribes. Besley and McLaren (1993) identify conditions under which it may be optimal to allow corruption among tax collectors. Rose-Ackerman (1978) and Tirole (1986) are also examples of articles that do not assumes corruption to be *per se* a negative phenomenon.

3 Extension

3.1 Asymmetric information

In this section a slight modification of the previous model is considered: that is, the inspector can no longer observe the real taxpayer's income $y \in [0, \overline{y}]$ where, $\overline{y} \in \mathbb{R}^{+}$. All the other assumptions remains unchanged. Notice that the analysis of ex-post corruption is identical to the one presented in the previous section. On the contrary, ex-ante corruption is affected by the introduction of asymmetric information: this is due to the fact that the inspector ignores which type of taxpayer she is going to be dealing with during the ex-ante agreement.

Suppose that condition (1) holds: in this case ex-post corruption is preferred to the clean regime. A taxpayer characterized by a level of income $\widehat{y}$ will accept to pay the ex-ante bribe if the following condition holds,

$$\begin{aligned}
&\widehat{y} - t(\widehat{y} - e_a) - b_a - l(t+g)e_a \geq \\
&\widehat{y} - t(\widehat{y} - e_p) - p_p e_p \left[t + f - l(t+g)\right] - p_p e_p l(t+g)
\end{aligned}$$

where the RHS (LHS) indicates the taxpayer utility under the ex-post corrupt regime (ex-ante corrupt regime). By substituting $e_a = \widehat{y}$ the above expression can be rewritten in the following fashion,

$$b_a \leq \widehat{y}\left[t - l(t+g)\right] - te_p + p_p e_p \left(t + f\right) \tag{18}$$

Recall from equation (9) that the condition for evasion to occur is

$$\frac{\partial U}{\partial e}=t-l(t+g)\geq 0.$$

By selecting the bribe $b_a=\widehat{y}\left[t-l(t+g)\right]-te_p+p_pe_p\left(t+f\right)$, the inspector is effectively inducing taxpayers characterized by an income $y\in[\widehat{y},\infty)$ to accept preemptive collusion. The other taxpayers, i.e. $y\in[0,\widehat{y})$ shall refuse to pay the ex-ante bribe. Recall that y is distributed with a cumulative distribution function $G(.)$ and density function $g(y)$, which are common knowledge. The equilibrium bribe b_a^* is determined by maximizing inspector's utility function,

$$\begin{aligned}U_i=&\int_{\widehat{y}}^{\overline{y}}(W+b_a-lcy)g(y)dy\\&+\int_{e_p}^{\widehat{y}}\left\{W+p_pe_p\left[t+f-l(t+g+c)\right]-E(p_p)\right\}g(y)dy.\end{aligned}$$

where $\widehat{y}=\frac{b_a+te_p-p_pe_p(t+f)}{t-l(t+g)}$. To determine b_a^* differentiate this expression with respect to b_a, to obtain

$$\begin{aligned}\frac{\partial U_i}{\partial b_a}=&G(\overline{y})-G(\widehat{y})-\frac{1}{t-l(t+g)}(W+b_a-lc\widehat{y})g(\widehat{y})\\&+\frac{1}{t-l(t+g)}\left\{W+p_pe_p\left[t+f-l(t+g+c)\right]-E(p_p)\right\}g(\widehat{y}).\end{aligned}$$

The optimal bribe solves

$$G(\overline{y}) - G(\widehat{y}(b_a^*)) - \frac{1}{t - l(t+g)}(W + b_a^* - lc\widehat{y}(b_a^*))g(\widehat{y}(b_a^*)) +$$
$$\frac{1}{t - l(t+g)} \{W + p_p e_p [t + f - l(t+g+c)] - E(p_p)\} g(\widehat{y}(b_a^*)) = 0.$$

If condition (1) doesn't hold, the alternative to ex-ante corruption is the clean regime. In this case a taxpayer characterized by a level of income $\widehat{y}$ will accept to pay the ex-ante bribe if the following condition holds, $b_a \leq \widehat{y}[t - l(t+g)] - te_c + p_c e_c (t + f)$. The equilibrium bribe b_a^* is determined by maximizing inspector's utility function,

$$U_i = \int_{\widehat{y}}^{\overline{y}} (W + b_a - lc\widehat{y})g(y)dy + \int_{e_c}^{\widehat{y}} \{W + p_c[r(t+f)e_c] - E(p_c)\} g(y)dy$$

where $\widehat{y} = \frac{b_a + te_c - p_c e_c(t+f)}{t - l(t+g)} = \frac{b_a}{t - l(t+g)}$. To determine b_a^* differentiate this expression with respect to b_a, to obtain

$$\begin{aligned}\frac{\partial U_i}{\partial b_a} &= G(\overline{y}) - G(\widehat{y}) - \frac{1}{t - l(t+g)}(W + b_a - lc\widehat{y})g(\widehat{y}) \\ &\quad + \frac{1}{t - l(t+g)} \{W + p_c[r(t+f)e_c] - E(p_c)\} g(\widehat{y}).\end{aligned}$$

The optimal bribe solves

$$G(\overline{y}) - G(\widehat{y}(b_a^*)) - \frac{1}{t - l(t+g)}(W + b_a^* - lc\widehat{y}(b_a^*))g(\widehat{y}(b_a^*)) +$$
$$\frac{1}{t - l(t+g)}\left\{W + p_c E'(p_c) - E(p_c)\right\} g(\widehat{y}(b_a^*)) = 0.$$

The next proposition studies the effect of incentives on the likelihood of corruption.

Proposition 6 *Under asymmetric information, an increase in the penalty rate, c, reduces the likelihood of ex-ante corruption. On the contrary, an increase in the bonus rate, r, doesn't affect the likelihood of ex-ante corruption.*

Note that in order to prove that r does not affect the likelihood of corruption, it is sufficient to check that neither the inspector's payoff nor the equilibrium bribe depends on r, regardless of the selected regime. On the other hand, an increase in the penalty rate, c, reduces the inspector's payoff when the regime is ex-ante corrupt: therefore, as long as any penalty for corruption is feasible, it exists a value of c such that ex-ante corruption is no longer profitable. In this sense, an increase in c decreases the likelihood of ex-ante corruption. QED

This proposition ensures that the main argument of this paper still holds even under asymmetric information.

4 Conclusion

The contribution of this paper is to study the design of incentives mechanisms for corruptible inspectors, considering the effect of these incentive schemes on corruption, taxpayer compliance and tax revenue. Incorporating the possibility for the collusive contract to be established *both* before and after inspection, this paper offers new policy perspectives concerning the effect of incentives on corruption. The results show that increasing the bonus rate is never a better policy than increasing the penalty rate when corruption occurs before inspection. The contrary is true when the collusive agreement is established after the inspection. Implications for privatization of law enforcement are analyzed.

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5 Appendix

5.1 Proof of Proposition 1.4

Consider an ex-post corrupt regime, i.e. $(1-r)(t+f) > l(c+t+g)$. The expected government's net revenues equals the difference between expected tax revenues and the tax collectors's wage

$$NR_p = t(y - e_p) - W + p_p l(c + t + g)e_p.$$

The social welfare is calculated aggregating the (shadow) value of net government revenues and tax collector and taxpayer's utility. Given these assumptions, social welfare equals

$$SW_p = y + (\lambda - 1)(ty - W) - (\lambda - 1)\{t - p_p l(c + t + g)\}e_p - E(p_p), \tag{19}$$

where $\lambda > 1$ denotes the shadow value of net government revenues. To maximize welfare and revenues, tax collector's salary is set at the smallest possible value (that is, $W = E(p_p) + U$). Inserting this into the social welfare equation and substituting (5) and (6), yields reduced-form expressions for social welfare,

$$SW_p = y + (\lambda - 1)(ty - U) - (\lambda - 1)t\frac{E'\left(\frac{t}{(t+f)}\right)}{(t+f)} - \lambda E\left(\frac{t}{(t+f)}\right).$$

Consider now a clean regime, i.e. $(1-r')(t+f) \leq l(c'+t+g)$. In this case incentives are sufficient to keep the inspector from being bribed. The expected government's net revenues equals the difference between expected tax revenues and the tax collectors's wage

$$NR = t(y - e_c) - W + p_c[(1 - r')(t + f)e_c].$$

The social welfare is calculated aggregating the (shadow) value of net government revenues and tax collector and taxpayer's utility. Social welfare equals

$$SW = y + (\lambda - 1)(ty - W) - (\lambda - 1)\{t - p_c(1 - r')(t + f)\}e_c - E(p_c),$$

where $\lambda > 1$ denotes the shadow value of net government revenues. To maximize welfare and revenues, tax collector's salary is set at the smallest possible value (that is, $W = E(p_c) + U$). Inserting this into the social welfare equation and substituting (7) and (8), yields reduced-form expressions for social welfare,

$$SW = y + (\lambda - 1)(ty - U) - (\lambda - 1)t\frac{E'\left(\frac{t}{(t+f)}\right)}{(t + f)} - \lambda E\left(\frac{t}{(t + f)}\right).$$

Hence, $SW_p = SW$ for any value of r, c, r' and c'. QED.

5.2 Proof of Proposition 1.5

The expected government's net revenues equals

$$NR^a = t(y - e_a) - W + l(c + t + g)e_a.$$

By substituting $e_a = y$, the expected value of the government's net revenues is

$$NR^a = l(c + t + g)y - W \tag{20}$$

while social welfare is given by

$$SW^a = y \ + (\lambda - 1)l(c + t + g)y - (\lambda - 1)W. \tag{21}$$

To maximize welfare and revenues, tax collector's salary is set at the smallest possible value (that is, $W = U$). Inserting this into equations (20) and (21), yields reduced-form expressions for revenues and welfare

$$SW^a = y \; + (\lambda - 1)l(c + t + g)y - (\lambda - 1)U.$$

A fast inspection reveals that local increases in incentive component c provocates social welfare to increase. Bonus rate has no effect on welfare. QED.