

# Legalize, Tax, and Deter: Optimal Enforcement Policies for Corruptible Officials\*

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First draft: September 2012

This draft: August 16, 2015

## Abstract

There is a heated debate on the merits of legalizing certain illegal, harmful and corrupting activities (such as trade in illicit drugs), but little theoretical insights on the consequences for optimal enforcement policies and corruption. We propose a model where the government hires law enforcers to report those who engage in a harmful activity. Offenders are allowed to respond by offering bribes to the law enforcers in exchange for their silence. When standard anti-corruption policies are costly to implement, we show that an alternative tax-and-legalize policy can yield significant benefits, especially in countries with weak institutions and for activities that are not too harmful. However, a tax-and-legalize scheme eliminates the distortions stemming from the threat of corruption by increasing the equilibrium number of harmful activities, which might explain why it is not as widespread a policy as the theory suggests.

**JEL Classification:** D73, K42, O10, H21

**Keywords:** legalization, permits, law enforcement, corruption, incentives, self reporting, leniency program, collusion.

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\*We are grateful to Dilip Mookherjee, Antonio Nicolò, Maitreesh Ghatak, two anonymous referees, Kevin Lang, Michael Manove and seminar participants at Boston University, University of Padua, Asset 2007 Conference, for their useful comments. Any remaining errors are ours. Alberto gratefully acknowledge financial support from the University of Padua (research grant CPDA071899).

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*“We have to see [legalization] as a strategy to weaken and break the economic system that allows cartels to make huge profits, which in turn increases their power and capacity to corrupt”*

*-Former president of Mexico Vincente Fox (2010)<sup>1</sup>*

## 1 Introduction

The corruptibility of law enforcers remains a significant concern in many developing and advanced economies, especially for those fighting certain illegal and harmful activities such as trading in illegal drugs, prostitution, gambling, poaching, or polluting. As the quote above suggests, many have proposed that a policy that legalizes the illegal activity and subjects it to a tax would at once address the dual problem of limiting the spread of the illegal activity and corruption.<sup>2</sup> While there is some anecdotal evidence in support of this view,<sup>3</sup> it is not obvious that a tax-and-legalize scheme can maintain deterrence and reduce corruption at the same time. To limit the spread of the illegal activity, a high pigouvian tax must be set. This would encourage the creation of black markets, and traders in the black market could sustain tax avoidance by paying bribes to corruptible tax officers. Unless legalization changes the incentives to bribe, it should offer no additional anti-corruption benefits.

In this paper, we develop a model of enforcement that allows for corruption and use it to demonstrate that, as part of an optimal compensation scheme, legalization plays an important anti-corruption role. In our model, individuals generate a social harm when engaging in an illegal activity that provides them with a private gain. A welfare maximizing government hires officers to monitor the population and fine miscreants, and can decide whether to allow bribe exchanges or ensure that officers never accept bribes. This is achieved by offering appropriate incentives paid whenever the enforcement agent apprehends an offender. We model the enforcement problem in such a way that, depending on a country’s tolerance for

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<sup>1</sup><http://www.bbc.co.uk/news/world-latin-america-10921975>. Accessed June 15, 2014.

<sup>2</sup>In addition to Vincente Fox, proponents of legalization include past presidents of Brazil, Mexico and Colombia Fernando Enrique Cardoso, Ernesto Zedillo, and Cesar Gaviria.

<sup>3</sup>For instance, Hong Kong legalized off-track betting in the seventies; this eliminated an important source of bribes for the police force, and police corruption was eliminated shortly after (Klitgaard [1988]).

corruption, bribing affects deterrence.

In our baseline model, officers are shielded by limited liability, and consequently the threat of corruption can impose significant welfare costs. Corruption is costly because the government faces the conflicting objectives of providing incentives to the officers and extracting surplus from them, a trade-off that has already been highlighted in existing theoretical research of moral hazard (e.g., Eswaran and Kotwal [1985], Mookherjee [1997], Banerjee, Gertler and Ghatak [2002], and Besley, Burchardi and Ghatak [2012]). As in these models, limited liability prevents the government from extracting the officer’s surplus and, for low enough outside option and wealth, it generates rents for the officers. In addition, our model offers a novel twist: the distortion caused by limited liability induces over enforcement, wherein the government optimal response to corruption is to *increase* the number of officers. Over enforcement allows the government to reduce the probability of paying out an incentive to the officers by reducing the overall crime rate and the likelihood that a fine will be assessed. This result can explain the anecdotal evidence of over-enforcement in situations where corruption is a threat and prohibition is adopted.<sup>4</sup>

Given this model of prohibition, we analyze the effect of a tax-and-legalize policy. Individuals can freely engage in the harmful activity, then pay a tax to the government. Enforcement shifts away from monitoring harmful activities to monitoring the payment of the tax. In equilibrium, the tax is paid by all miscreants, officers’ incentives are high but, since there is no tax evasion, they do not earn any incentive pay. Provision of high-powered incentives in the out of equilibrium case where the offender does not pay the tax effectively serves as a deterrent. Given that the incentives are no longer a concern on the equilibrium path, the tradeoff between incentives and extraction vanishes. Without the tradeoff, the government is able to leave officers with no rent, and distortions from corruption are eliminated. Ultimately, the government achieves “benchmark” outcomes—what would obtain if officers were incorruptible.

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<sup>4</sup>See for example the significant presence of police checkpoints in highways of many developing countries (Olken and Barron [2009]).

The economic intuition for this result is the following. Legalization provides miscreants with the ability to make a choice (i.e., whether to pay the tax) prior to an audit. On the equilibrium path (where the miscreant chooses to pay the tax), this effectively improves the bargaining position of the miscreant relative to the enforcer, and reduces the latter’s ability to gain rents from bribes. Importantly, it is the ability of the officer to obtain illegal bribes that determines her own bargaining position vis a vis the government; by eliminating illegal bribes, the government thus eliminates the payment of legal incentives.<sup>5</sup>

Our result begs the question of why legalization is not more widespread in the real world. The model offers two possible explanations. First, legalization is strictly welfare improving only for activities that are not too harmful and in countries with weak institutions, where the officers’ wealth and market wages are low. Second, under legalization, more individuals engage in the socially harmful activity. While this undesirable feature of legalization has been noted elsewhere in the economic literature,<sup>6</sup> we provide a novel explanation for its occurrence: legalization eliminates the distortion caused by corruption, and with it the over enforcement problem observed under prohibition. In a political economy context, legalization could be *controversial*: while society is better off with higher levels of the harmful act and lower enforcement expenditures, voters would reject legalization if the social benefit is not sufficiently spread across the voting population.

The theory presented here is empirically relevant, particularly (but not only) for the regulation of illicit drugs.<sup>7</sup> More broadly, the scheme we present here extends beyond legal-

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<sup>5</sup>The mechanism discussed here is modeled as a contract in Burlando and Motta (2015).

<sup>6</sup>An empirical literature ties legalization to increases in the use of the legalized drug (Saffer, and Chaloupka [1999], DiNardo and Lemieux [2001], and Anderson, Hansen and Rees [2013]). One reason often given is that of a demand shift, due in part by the psychological effect of making an illegal activity legal (what Miron and Zwiebel [1995] refer to the “respect for the law” effect.) Our model keeps the demand function constant. In addition, in our model legalization does not lead to higher revenues to the government, so we are not introducing a revenue concern that weakens enforcement.

<sup>7</sup>Many poor countries have already legalized narcotics that are illegal elsewhere. For instance, *chat*, a narcotic plant, is freely traded, taxed, and consumed in Ethiopia, Yemen and Somalia. It remains illegal elsewhere. Bolivia has legalized the sale and consumption of coca *leaves*, and against the wishes of many western countries, Uruguay has created a legal market for marijuana in 2013. The recreational consumption and trade of cannabis has been legalized in many Western countries and, recently, both Colorado, Oregon, Washington State in the United States.

ization, and fits into a general class of contracts where the costs of corruption are reduced by empowering individuals to bypass officials (Motta [2012], and Burlando and Motta [2015]). Such schemes are becoming increasingly prevalent in many developing countries beset by bureaucratic corruption.<sup>8</sup>

The rest of the paper is organized as follows: after a discussion of the current theoretical literature, section 2 sets up the model; section 3 discusses the model of optimal enforcement without corruption; section 4 introduces corruption under prohibition; and section 5 explains the tax and legalize scheme. Section 6 provides concluding remarks and possible extensions.

**Relation to the literature** Our model is inspired by a well established literature in development that explores the optimal compensation scheme for corruptible law enforcers, including Besley and McClaren (1993), Mookherjee and Png (1995), Bardhan (1997), Acemoglu and Verdier (2000), Mishra (2002), Bose (2004), and Baç and Bag (2006). This literature is tightly focused on a limited set of wage and incentive instruments, where the option of legalizing the illegal activity is ruled out by assumption. In our paper, we expand the policy instruments beyond compensation, to include legalization. Legalization functions as a communication protocol between the population and the government, in which the latter engages with miscreants *before* the police inspection takes place. In this regard, our approach is similar to the enforcement literature on *self reporting*,<sup>9</sup> although our paper is the first to

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<sup>8</sup>In 2005, India introduced a Freedom of Information Act (the RTIA), which allows citizens to inquire about any governmental activity—including the status of a person’s own permit applications. Peisakhin (2012) and Peisakhin and Pinto (2010) showed in randomized trials that RTIA requests provide an alternative way to petition for a permit, which ultimately reduces bribe payments. Private companies in developing countries also use such schemes to get around their own corruptible employees. In India, the *tatkal* system was introduced by the Bharat Sanchar Nigam phone company to provide people with an alternative to paying bribes for quick phone line installations. The same *tatkal* system was later adopted by the railways as a way for customers to avoid long waiting lists or paying bribes to intermediaries for a quick ticket.

<sup>9</sup>In the self reporting literature, the harmful activity remains illegal, but the government allows miscreants to pay a reduced fine if they self report prior to auditing. Malik [1993], Kaplow and Shavell [1994], Innes [1999, 2000, 2001], Motta and Polo [2003], and Buccirossi and Spagnolo [2005] study self reporting in a context where officers are not corruptible. See Polinsky and Shavell (2000) for a more general discussion on the law enforcement theory in the economic literature. Polinsky and Shavell (2001) Rose-Ackerman (1994), Hindriks, Keen, and Muthoo (1999), Livernois and McKenna (1999) consider the problem of enforcement with corruptible officials in a beckerian setting (Becker [1968] and Becker and Stigler [1974]) without exploring the role of legalization.

demonstrate that such schemes play an important anti-corruption role.<sup>10</sup>

Our paper is also related to the more general development literature of optimal incentive contracts under moral hazard where limited liability generates distortions. Aside from the study of corruptible bureaucracies, this literature includes tenancy contracts (Banerjee, Gertler and Ghatak [2002]), and credit markets (Besley, Burchardi and Ghatak [2012]). In these papers the authors show that certain policies (such as improvements in property rights) can relax the limited liability constraint *without* improving efficiency, and, depending on the context, may or may not make the borrowers/tenants better off. In our model legalization achieves a similar objective but it is always (weakly) welfare improving, and it unambiguously makes the officers worse off. This difference with the prior literature might be due to the fact that the kind of mechanism we propose relies on the presence of an intermediary. Allowing the offender to by-pass the officer by paying a tax reduces the inefficiencies associated with a middle-man (such as the officer) whose rents distort government decisions.

## 2 The model

### 2.1 Structure

There is a measure 1 of risk-neutral citizens who cause a harm to society of  $h > 0$  by committing an act that provides a private gain of  $x$ . The gain is distributed with a continuous density function  $g(\cdot)$ , which is everywhere strictly positive over the support  $[0, \infty)$ . We assume a continuous cumulative distribution function  $G(\cdot)$  and, for simplicity, a constant hazard rate function  $\frac{g(x)}{1-G(x)} = \lambda$ .<sup>11</sup> Absent enforcement problems, a welfare maximizing government would allow only those citizens whose private benefit is  $x \geq h$  to carry out the act. However, the act is not directly observable, and the government must engage in

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<sup>10</sup>An exception is Andrianova and Melissas (2008). They study legalization and corruption in a context where both penalties and enforcement are abolished under legalization. Their model is useful in some contexts, such as the choice of liberalizing trade to reduce corruption among import inspectors, but it cannot explain the role of legalization in contexts where harm control remains important.

<sup>11</sup>All results in the paper are generalizable to a nondecreasing hazard rate function. We also assume that the act does not affect any other decision the agent may make, such as the decisions to work for a wage; that is, we rule out the possibility that crime crowds out legal work.

costly monitoring and enforcement. To this purpose, the government employs a measure  $p$  of officers who are responsible for monitoring the population. Enforcement works as follows. Each officer is randomly matched with a citizen, and the officer immediately learns whether the citizen has carried out the sanctioned activity (but not the size of the private gain  $x$ ).<sup>12</sup> The officer's information is hard and verifiable in a court of law. The officer can report the violation to the judiciary system, which levies a fine  $f$  to the offender. The maximum level of sanction is  $\bar{f}$ , which may be interpreted as an individual's wealth.

### 2.1.1 Corruption

A corruptible officer will consider accepting a bribe  $b$  from the citizen in exchange for her silence. The size of the bribe is reached through a bargaining process. We assume that, while miscreants are willing to pay any bribe that is less than the fine, i.e.  $b \leq f$ , the bribe cannot be as large as the fine:

**Assumption (corruption tolerance):** the maximum agreeable bribe cannot be larger than a fraction  $\sigma \in (0, 1)$  of the fine.

In our model, the assumption introduces a limit to deterrence in corrupt regimes in a straightforward way. It corresponds to the reality of many bribery situations, where the bribe giver settles for a bribe that is much smaller than the full sanction. There are several ways to motivate this condition. At its simplest, the assumption states that the larger the bribe payment demanded by an officer, the greater is the chance of detection (as in Emerson, [2006]). Bribes that are too large become either detectable to the press and scandalous to society, while a relatively small side payment would be either undetected or acceptable. Thus, our  $\sigma$  measures society's tolerance for corruption. Societies that are intolerant (low  $\sigma$ ) find bribery unacceptable, and only small exchanges (that can perhaps be confused as acts of kindness rather than corruption) are possible. On the other hand, countries that are tolerant (high  $\sigma$ ) have societies where gift exchanges (which can mask bribery) are common or consider bribe

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<sup>12</sup>Relaxing the assumption on the observability of  $x$  would not change our results. See section 6.

payments as a way of life.<sup>13</sup> In either case, a collusive agreement where bribes are too high would be uncovered by the public as blatant corruption, the officer would lose the ill-gotten wealth, and the offender would be made to pay the full fine  $f$ .<sup>14</sup>

As an anti-corruption measure, the government can offer bonuses or incentives  $i$  that are paid when an officer reports an offender. Because acceptance of the bribe implies foregoing the incentive, the officer will consider only bribes that have the following characteristic:  $i \leq b < \sigma f$ . The agreement on the bribe is reached through a bargaining process, with weights to the officer of  $\mu \in (0, 1)$ . The equilibrium bribe is given by the following expression:

$$b(i, f) = \min \{ (1 - \mu)i + \mu f, \sigma f \}, \quad (1)$$

that is, the bribe level is fully characterized by the incentive and the fine. Note that, regardless of how the bargaining power is distributed between the two parties, corruption is eliminated whenever the incentive level  $i$  meets or exceeds the following no-collusion condition:

$$i \geq \sigma f \equiv i^{nc}. \quad (\text{IC})$$

When  $i < i^{nc}$ , a bribe will be agreed upon, violations are not reported, and the government neither pays incentives, nor receives any income from the fine. The regime is thus *corrupt*. When  $i \geq i^{nc}$ , no bribes are exchanged, and therefore all violations are reported, all fines are levied, and all incentives are paid. The regime is thus *not corrupt*, or clean. We denote

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<sup>13</sup>The prevalence of gifts exchange traditions allows individuals to mask corruption (Klitgaard, 1988), and some societies may just be more accepting when someone offers bribes to public officials (Lambsdorff, 2007).

<sup>14</sup>There are other possible ways to explain our assumption. Even if miscreants' ability to pay is greater or equal to the fine  $f$ , they might be unable to transfer more than a fraction  $\sigma f$  of this wealth in bribes. This could come from the fact that the fraction  $(1 - \sigma)f$  is held in assets that are not easily transferrable, or whose ownership is hard to verify at the time of the bribe transfer, such as boats, landholdings, or residential units located in another location or country. While a corrupt officer might be unable to take possession of these assets, a government can reasonably be expected to find, confiscate, and sell these items. Second, the assumption is consistent with a model where part of the punishment is non-monetary in nature, wherein only a fraction  $\sigma$  of the punishment is extracted in monetary form and the rest administered via revenue-neutral imprisonment. Finally, the assumption would arise in a model where bribe exchanges suffer transaction costs, similar to those existing in the literature of corruption (Tirole, 1992).



these two equilibrium regimes by the subscript  $j$ , where  $j \in \{nc, c\}$ .<sup>15</sup>

### 2.1.2 Enforcement costs

Officers are risk neutral with reservation utility  $v$ , where  $v$  is strictly positive and finite. The base wage  $w_j$  and incentive  $i_j$  offered in regime  $j$  must satisfy the following participation constraint:

$$w_j + \Pr(\text{audit success})_j \max[b_j(i, f), i_j] \geq v \quad (\text{PC})$$

where  $\max[b_j(i, f), i_j]$  represents the gains obtained from either the incentive or the bribe.

**Assumption (limited liability):** The government faces a limited liability constraint.<sup>16</sup> In particular, each officer has a limited amount of wealth  $\tilde{w}$ , so that the minimum base wage is  $-\tilde{w}$ .<sup>17,18</sup> For simplicity, we assume that  $\tilde{w} = 0$ ; this simplifies the exposition considerably and relaxing this assumption does not change our main results. In our model the relevant constraint is:

$$w_j \geq -\tilde{w} \equiv 0. \quad (\text{LL})$$

### 2.1.3 The government and social welfare

We conclude the model setup by introducing a benevolent, welfare maximizing government whose contribution of enforcement expenditures  $B$  on the larger total government budget consist of wage payments net of revenues from fines. We assume that the government carries a budget deficit, which is covered through distortionary taxation from the citizenship. The deficit is exogenous and assumed to be large. We assume that every dollar transferred from the offenders to the government can help reduce this deficit and, with it, the taxes that the government needs to raise and the associated distortion. The same applies to transfers to

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<sup>15</sup>Our model is robust to alternative modeling assumptions, as discussed in section 8.2.

<sup>16</sup>Limited liability is one way to generate rents for the officer as well as the inefficiency associated with corruption; see Burlando and Motta (2012) for an alternative modeling strategy that relies on risk aversion and that generates very similar insights.

<sup>17</sup>Implicitly, a second limited liability assumption states that  $w + \max[b, i] \geq -\tilde{w}$ . In equilibrium, there will never be a case where bribes or incentives are negative, so the condition is never binding.

<sup>18</sup>In the context of many developing countries bureaucrats and law enforcement officers are generally very poorly paid, often go unpaid, and sometime receive *negative* wages (see Besley and McClaren [1993])—enforcement officers essentially pay superiors for the right to enforce (and collect bribes).

and from the officers. A net enforcement budget  $B$  costs society  $(1 + d)B$ , where  $d > 0$  measures the size of the dead weight loss.<sup>19</sup>

The *enforcement regime* is characterized by the selection of four policies: the number of inspectors,  $p$ ; the base wage,  $w$ ; the incentive pay,  $i$ ; and the fine to miscreants,  $f$ . Enforcement regime  $j$  generates an expected sanction  $\hat{x}_j$ , which is also a handy measure of effective enforcement and social harm. Social welfare is thus

$$W_j(\hat{x}_j; i_j, f_j, w_j, p_j) = \int_{\hat{x}_j}^{\infty} (x - h)g(x)dx - dB_j(\hat{x}_j; i_j, f_j, w_j, p_j), \quad (2)$$

where the first term indicates the sum of private gains and social losses associated with the production of the harmful good, and the second term denotes the deadweight loss from taxation associated with enforcement budget. We assume that all transfers such as taxes, incentive payments and wages for law enforcement officers occur without cost, and that there is no social cost of corruption *per se*. In addition, since crime behavior does not crowd out work, fines are distortionary only insofar they change the propensity to commit a crime. That is, the only distortion in the model is caused by the deadweight losses from taxes.<sup>20</sup>

**Further assumptions and timing of the model** The timing of the model is as follows. First, the government announces the full set of policies. Agents observe these policies and decide whether to engage in the harmful act. Then, officers randomly pick agents for monitoring, discover whether there was harm, and either assess the fine or agree on the bribe.

For convenience, we make three additional assumptions on the parameter space:

**Assumptions:** (A1):  $\bar{f} > \frac{h}{1+d} - \frac{d(1-\sigma)}{\lambda(1+d)} > 0$ ; (A2):  $\bar{f} > v/\sigma$ ; (A3):  $h > \frac{1}{\lambda}$

The assumptions guarantee interior solutions,  $p \in (0, 1)$ . They essentially state that the

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<sup>19</sup>This is a critical distinction between our approach of corruptible enforcement and the canonical approaches of enforcement in Kaplow and Shavell (1994) or Polinsky and Shavell (2001), where the government budget does not include the revenues from fines collected and the effect of distortionary taxation. From this perspective, our framework is similar in nature to setups more commonly found in the literature of corruption, such as in Besley and McClaren (1993) and Laffont and Tirole (1993).

<sup>20</sup>Our results would not change if we were to relax this assumption and assume that revenues from fines are distortionary in the same way a tax is. See section 6, and the full extension of the model on the authors' websites.

maximum fines and the social harm  $h$  are sufficiently large, relative to parameters. Our main results extend to the case where corner solutions are considered.

### 3 Benchmark: Optimal enforcement without corruption

We start with an economy where enforcement agents cannot collude and are always honest. It follows directly that incentives need not be offered (i.e., the optimal incentive scheme is  $i^* = 0$ ). Moreover, given that officers never accept bribes, a citizen that commits the illegal act faces an expected sanction  $\hat{x} = pf$ . The total quantity of crime is  $1 - G(pf)$ , which is also the probability of a successful audit. In total, the government expects to receive  $pf[1 - G(pf)]$  in revenues from fines. With this characterization, the welfare function is:

$$W_{honest}(p, w, i, f) = \int_{pf}^{\infty} (x - h)g(x)dx - d\{pw - pf[1 - G(pf)]\}. \quad (3)$$

subject to the participation and limited liability constraints (PC) and (LL). Since wages are costly, efficiency requires wage rates to be at the lowest level possible:  $w^* = v$ . It is also readily observable from the welfare equation (3) that the optimal enforcement policy requires maximal fines  $f = \bar{f}$ . If fines are not maximal, the government can increase welfare by increasing the fines and reducing the amount of officers such that the enforcement level  $\hat{x}_{honest} = pf$  remains the same. The first and last term in equation (3) are a function of the enforcement level, and remain unchanged. However, the term in the middle is the wage bill, which is thus reduced. We lastly characterize the optimal size of the enforcement force,  $p^*$ , and the optimal enforcement level  $\hat{x}_{honest}^* = p^*\bar{f}$ . Differentiate (3) with respect to  $p$  using  $f = \bar{f}$  and set it to zero,

$$d\{v - \bar{f}[1 - G(p^*\bar{f})]\} = [h - p^*\bar{f}(1 + d)]g(p^*\bar{f})\bar{f}. \quad (4)$$

The left side is the net deadweight loss arising from the cost of hiring one more officer: the officer receives a wage  $v$  and brings in revenue from fines  $\bar{f}$  with probability  $1 - G(p^*\bar{f})$ . The

right side is the net social gain from the marginal officer deterring an amount of harmful activity equal to  $\bar{f}g(p^*\bar{f})$ . Each avoided act reduces social harm by  $h$  but also fails to generate a private gain of the deterred individual,  $x = p^*\bar{f}$ , as well as a revenue of  $\bar{f}$  with probability  $p^*$  from the expected fine. Note that  $p_h^* > 0$  and  $p_v^* < 0$ : actions that have larger negative spillovers receive more enforcement, while enforcement decreases with the agency cost  $v$ .<sup>21</sup>

## 4 Optimal Enforcement in the presence of corruption

We next consider the case where corruption is possible. Suppose that incentives are sufficiently high so that officers do not accept bribes. A miscreant pays the fine  $f_{nc}$  with probability  $p_{nc}$ ; the expected sanction is thus  $\hat{x}_{nc} = p_{nc}f_{nc}$ . The total quantity of crime is thus  $1 - G(\hat{x}_{nc}) = 1 - G(p_{nc}f_{nc})$ . In total, the government can expect to receive revenues from fines equal to  $p_{nc}f_{nc}[1 - G(p_{nc}f_{nc})]$ . In addition, it can expect to pay both the base wage bill  $p_{nc}w_{nc}$  and the incentive pay  $i_{nc}$  for each fine that is levied. When, on the other hand, incentives are low, officers and miscreants agree on a bribe  $b_c(i, f)$ . The potential miscreant faces an expected sanction of  $\hat{x}_c = p_c b_c(i, f)$ , which determines a crime level  $1 - G(\hat{x}_c) = 1 - G(p_c b_c(i, f))$ . Since enforcement functions through bribe exchanges, the government neither expects to pay out incentives nor receive fine income. Denoting by  $\mathbb{1}_{j=nc}$  whether the regime is clean, the welfare function in regime  $j$  is given by

$$W_j(p_j, w_j, i_j, f_j) = \int_{\hat{x}_j}^{\infty} (x - h)g(x)dx - dp_j\{w_j - \mathbb{1}_{j=nc}(f_j - i_j)[1 - G(p_j f_j)]\}. \quad (5)$$

The government maximizes this welfare function subject to the limited liability constraint (LL) and to the participation constraint (PC) which can be further specified as follows:

$$w_j + [1 - G(\hat{x}_j)]\max[b_j, i_j] \geq v, \quad j \in \{c, nc\} \quad (\text{PC}_j)$$

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<sup>21</sup>Assumptions A1-A2 guarantee that there are no corner solutions. In addition, for any given set of parameter values, the left hand side of equation (4) is strictly decreasing in  $p$  while the right hand side is strictly increasing in  $p$ ; the solution exists and is unique.

Note that, regardless of the regime, at least one or both participation and limited liability constraints must bind in equilibrium. (When they do not, the base wage  $w$  can be reduced without affecting the enforcement level, and welfare increases.) Which constraint will bind depends on the parameters of the model.

## 4.1 Optimal policy in the clean regime

Optimal fines and incentives depend on the regime. Suppose that  $i \geq i^{nc}$  and  $j = nc$ . Then:

**Remark 1** *The optimal policy in the clean regime includes  $i = i^{nc}$  and  $f = \bar{f}$ .*

We describe the general argument for this remark here, leaving the full proof to be part of the optimal policy in Proposition 1. Incentives are generally costly to the government whenever  $(PC_{nc})$  is slack, and revenue-neutral otherwise. Given that increasing the incentive above  $i^{nc}$  does not serve any purpose in terms of promoting honesty, setting  $i = i^{nc}$  is always an optimal response. A similar argument holds for the fine  $f$ . For any fine amount that is not maximal, proposition 1 shows that the government can achieve the same enforcement  $\hat{x} = pf$  by increasing  $f$  and reducing  $p$ , such that enforcement costs are (weakly) lower. Hence, setting the maximal fine  $f = \bar{f}$  is also optimal.

We are now left with characterizing the optimal interior  $\hat{x}_{nc}$  in the clean regime. For the sake of exposition, define two threshold values  $\bar{z} \equiv \sigma \bar{f} \left[ 1 - G \left( \frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)} \right) \right]$  and  $\tilde{z} \equiv \sigma \bar{f} \left[ 1 - G \left( \frac{h}{1+d} + \frac{d(1-\sigma)}{\lambda(1+d)} \right) \right]$ . The following proposition characterizes the optimal policy.

**Proposition 1** *The optimal interior enforcement policy with high-powered incentives includes fines and incentives as defined in Remark 1 and enforcement  $\hat{x}_{nc}$  as follows:*

$$\hat{x}_{nc} = \begin{cases} \hat{x}_{honest}^* & v > \tilde{z} \\ G^{-1}\left(1 - \frac{v}{\sigma \bar{f}}\right) > \hat{x}_{honest}^* & \tilde{z} \leq v \leq \bar{z} \\ \frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)} > \hat{x}_{honest}^* & v < \tilde{z} \end{cases} \quad (6)$$

**Proof.** See appendix. ■

The proposition states that, due to the threat of corruption, there is a wedge between the optimal enforcement,  $\hat{x}_{nc}$ , and the benchmark one,  $x_{honest}^*$ . The intuition for this result is familiar to readers of the contracting literature. The tradeoff the government faces with corruption is either to provide incentives or to extract surplus from the officer; this tradeoff is socially costly whenever the limited liability constraint (LL) binds. This will occur if the outside option for officers,  $v$ , is sufficiently low, and equation (6) shows the parameter space when this occurs.

In the first part of equation (6), benchmark enforcement is achieved when  $v > \tilde{z}$ . Limited liability is not binding, and the officer's expected wage equals the outside option  $v$ . Since corruption does not lead to rents, the enforcement level is first-best (and so is welfare).

In the second and third case of equation (6), the outside option  $v$  is low, officers benefit from limited liability protection such that (LL) binds, wages  $w$  are zero, and officers receive only an incentive pay. It is thus possible that enforcement agents earn positive rents. Since this binding constraint is not present in the benchmark problem, optimal enforcement diverges from benchmark levels, and it turns out that the direction is such that there is *too much enforcement*. The intuition is the following. Suppose that  $v \leq \tilde{z}$  and, contrary to (6), the government chooses the first best level of enforcement  $\hat{x}_{honest}^*$ . Without limited liability, the wage  $w$  such that  $(PC_{nc})$  binds would be negative; since wages cannot be less than zero,  $w = 0$  and officers earn rents from the expected incentive pay. Consider next a slight increase in  $p$ , such that (LL) continues to bind. These additional officers lower the crime rate and generate new revenues from fines. However, the decrease in the crime rate reduces the rate at which the existing force apprehends miscreants, which dampens revenue from existing officers but also the probability that an incentive pay will be awarded to them. As long as  $(PC_{nc})$  is not binding, a reduction in the expected incentive pay must not be balanced by an increase in the base wage  $w$ . Thus, the change in policy leads to a reduction in economic

rents to the officer and a reduction in social harm.<sup>22</sup> When  $\bar{z} \leq v \leq \tilde{z}$  (second case), the possible rents accruing to officers are relatively small, and the deviation just described is beneficial. The the optimal choice for the government is to hire as many officers as needed to reduce those rents to zero. When  $v < \bar{z}$  (third case), eliminating all rents would require hiring a large number of officers. Revenue losses from reducing the crime rate are sufficiently high that it becomes optimal to limit over enforcement and pay out rents—( $PC_{nc}$ ) becomes slack.

## 4.2 Regime choice

Having established the optimal enforcement policy under a clean regime, the next proposition states that this policy is better than one based on corruption.

**Proposition 2** *The optimal regime choice is always clean. The optimal policy is as determined by Proposition 1.*

**Proof.** We prove this proposition by showing that any (optimal) policy with collusion achieves a lower welfare level than a (not necessarily optimal) clean policy. Consider an optimal corrupt regime  $W_c^*$  with optimal policies  $\tilde{p}, \tilde{f}, \tilde{i}, \tilde{w}$ . Note that the achieved enforcement level is  $\hat{x}_c = \tilde{p}b_c(\tilde{i}, \tilde{f}) \leq \sigma\tilde{p}\tilde{f}$ , where the inequality is a consequence of the corruption tolerance assumption. In addition, the expected wage is  $\tilde{w} + [(1 - G(\hat{x}_c))]b_c(\tilde{i}, \tilde{f})$ . Set the clean regime to have the following policies:  $f = \tilde{f}, i = \sigma\tilde{f}, p = \tilde{p}b_c(\tilde{i}, \tilde{f})/\tilde{f}$ , and  $w = \tilde{w}$ . The enforcement level is unchanged:  $\hat{x}_{nc} = \hat{x}_c$ . This policy gives a weakly higher expected wage to officers compared to the corrupt regime, since the expected wage is  $\tilde{w} + [1 - G(\hat{x}_c)]\sigma\tilde{f} \geq \tilde{w} + [(1 - G(\hat{x}_c))]b_c(\tilde{i}, \tilde{f})$ . Thus, the clean policy meets participation and limited liability constraints. The gain in welfare from choosing this alternative policy is given by the difference between the constructed

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<sup>22</sup>It is important to highlight the ultimate role of distortionary taxation in our over-enforcement result. Since taxes are distortionary (i.e.,  $d > 0$ ), higher government expenditures reduce welfare. Thus, the government limits rents to officers and trades off social harm from the illegal activity with higher government revenues (through fines).

$W_{nc}$  and  $W_c^*$ :

$$W_{nc}(p, \tilde{w}, i, \tilde{f}) - W_c^*(\tilde{p}, \tilde{w}, \tilde{i}, \tilde{f}) = dp\tilde{f}(1 - \sigma)[1 - G(\hat{x}_c)] + d\tilde{w}[\tilde{p} - p].$$

Both terms are positive, since  $[\tilde{p} - p] = \tilde{p}[1 - \frac{b_c(\tilde{i}, \tilde{f})}{\tilde{f}}] \geq \tilde{p}[1 - \frac{\sigma\tilde{f}}{\tilde{f}}] > 0$ . ■

The fact that a corrupt regime is never optimal may seem inconsistent with real-world observations. Fortunately, our model can be readily extended to include that possibility (see section 6) without affecting our results.<sup>23</sup> In this version of the model, the fact that corruption is not optimal is a consequence of two factors. First, more officers are needed to achieve a particular enforcement level when corruption is allowed, because deterrence from corrupt officers is lower when they accept bribes.<sup>24</sup> Second, the revenues from fines  $\tilde{f}$  (which are foregone under corruption) exceed the incentive component paid to the officer,  $i$ . Thus, the wage bill per officer net of fine revenues is lower in the clean regime.

## 5 Tax and Legalize

We now introduce the tax-and-legalize mechanism. The government makes the harmful activity legal, but requires the payment of a reduced fine or tax  $r$ . It now employs a police force to monitor the payment of the tax and assess fines  $f$  as the punishment for tax evasion.

The timing of the model is modified as follows: the government chooses an enforcement policy  $f, p, w, r$ . Individuals then simultaneously choose whether to commit the harmful act and, if so, whether to pay the tax  $r$ . Audits follow as usual, except that the officer now must only determine whether an act has been committed without the tax payment. If there was tax avoidance, the officer can assess the fine  $f$  or accept a bribe  $b$ .

In a legalized regime, an individual who commits a harmful act can either pay the tax  $r$ , or avoid the tax and risk being caught—whichever is more convenient (less expensive) in expectation to him. The punishment  $f_j$  is equal to  $f$  in the clean regime ( $j = nc$ ) or the

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<sup>23</sup>For our main result to hold we just require that the *threat* of collusion is costly to the government.

<sup>24</sup>For a given number of police officers  $p$ ,  $\hat{x}_c = \sigma p \tilde{f} < \hat{x}_{nc} = p \tilde{f}$



bribe  $b$  in the corrupt regime ( $j = c$ ). An individual with private gain  $x$  may commit the act if his private benefit from the act exceeds the cost:

$$x_j \geq \min[r, pf_j] \equiv \hat{x}_j^l,$$

where  $r$  is now part of the set of policy instruments available to the government.

To get the optimal level of  $r$ , consider first the case  $r > pf_j$ . Because the tax is more expensive than the expected full sanction, perpetrators avoid the tax. In this case, the tax is ineffective, and no one employs it. Now suppose  $r \leq pf_j$ . Clearly, everyone pays the tax. Since  $\hat{x}_j^l = r$ , the total number of crimes committed is  $1 - G(r)$ . Given that, officers never find a tax evader, they never earn bribes or incentives, and their only source of income (and only source of enforcement cost) is the base wage  $w$ . Thus, the welfare achieved is

$$W_i^j(r, p, w, i, f) = \int_r^\infty (x - h)g(x)dx - d\{pw - r[1 - G(r)]\}, \quad (7)$$

subject to the usual constraints (PC) and (LL).

Proposition 3 explains the optimal tax-and-legalize policy.

**Proposition 3** *When the tax-and-legalize policy is adopted, all perpetrators pay the tax and:*

- (i)  $i \geq \sigma f$  (officers are always honest);
- (ii)  $r = pf$  (the tax is equal to the expected punishment);
- (iii)  $w = v$  (officers' base wage is equal to their reservation wage).

*In addition, (PC) is always binding and (LL) is never binding.*

**Proof.** see the Appendix. ■

In equilibrium, incentives are sufficiently high to ensure that officers are honest, but are never paid out because every perpetrator chooses to pay the tax. Because incentives are not paid on the equilibrium path, (LL) is never binding. Without limited liability protection, officers are unable to earn rents: (PC) binds.

Even though officers never uncover evaders, the presence of officers and the incentives they could receive do have a role: they act as a credible threat against tax evasion, and guarantee the officers' honesty when offered bribes. This mechanism resembles the 'threat' found in modern income tax systems, or the enforcement of parking regulations: cities allow drivers to park in certain areas only if they feed a parking meter. People comply in the off chance that a parking inspector passes by assessing fines for noncompliers.

## 5.1 Social welfare under legalization

Under legalization, welfare is a function of fines and enforcement costs,

$$W_l(pf) = \int_{pf}^{\infty} (x - h)g(x)dx - d\{pv - pf[1 - G(pf)]\}. \quad (8)$$

It is readily observed that this is the same welfare function achieved when officers are honest,  $W_{honest}(pf)$ . This implies that fines are maximal at  $\bar{f}$  and the optimal size of the office corp is the same under the tax-and-legalize regime as in the benchmark case, that is, dictated by the first order conditions (4). We highlight this in the following remark:

**Remark 2** *The tax-and-legalize regime achieves the benchmark policy and welfare:  $\hat{x}_l^* = \hat{x}_{honest}^*$  and  $W_l^* = W_{honest}^*$ . It is the preferred policy when the outside option is intermediate or low,  $v \leq \tilde{z}$ .*

Having determined that the tax-and-legalize regime achieves the same welfare as the benchmark regime, we can use equation (6) in proposition (1) to readily compare a regime cum legalization with a clean regime without it. Legalization does not improve welfare if  $v$  is sufficiently high such that (LL) is slack (i.e., for  $v > \tilde{z}$ ). At lower levels of outside option ( $v \leq \tilde{z}$ ), welfare in the clean regime is limited by the additional (LL) constraint, which is absent in the tax-and-legalize regime. Legalization thus offers strictly higher welfare.

## 5.2 Comparative statics

Equation (6) also offers a number of interesting comparative statics. It can be readily observed that the relevant threshold,  $\tilde{z}$ , decreases with  $h$ , while it increases with  $\sigma$  and  $\bar{f}$ . Thus, legalization is more beneficial for activities that are not too harmful and in countries with high tolerance for corruption and maximum allowable fine. The intuition behind this result is simple:  $\bar{f}$ ,  $\sigma$  and  $h$  affect both the size of the officer's incentive and likelihood of receiving it. An increase in  $\bar{f}$  increases the size of the bribe, forcing the government to raise the officers' incentive. The same applies to an increase in  $\sigma$ . However, an increase in  $\sigma$  has the additional effect of increasing  $\tilde{z}$  by lowering the optimal enforcement level under prohibition, which in turn makes it more likely that an illegal activity occurs and the corresponding incentive is paid out to the officer. A decrease in  $h$  behaves similarly: it increases  $\tilde{z}$  by lowering the optimal enforcement level, such that legalization is more likely to be useful.<sup>25</sup>

A natural question is whether poor countries have more to gain from legalization than rich ones. There are several parameters in our model that might reflect the relative development of a country. It is plausible to assume that more developed countries have higher market wages  $v$ , higher maximal fines  $\bar{f}$ , lower institutional tolerance for corruption  $\sigma$ , but also a higher return from the illegal activity  $x$  and a higher external cost  $h$ . Suppose that a country's set of parameters scales up at the same rate,  $\{\beta v, \beta \bar{f}, \beta x, \beta h, \frac{\sigma}{\beta}\}$  where  $\beta > 1$  is a measure of economic and social development. A comparison using (6) reveals that higher  $\beta$  is associated with lower  $\tilde{z}$  and a lower likelihood of adopting a tax-and-legalize scheme.<sup>26</sup>

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<sup>25</sup>Note that an increase in the officers' wealth  $\tilde{w}$  would also increase  $\tilde{z}$ , as it would unambiguously relax the limited liability constraint. Here we refrain from analyzing this comparative static formally because it would complicate the analysis considerably.

<sup>26</sup>One could argue that  $\sigma$  does not necessarily vary with a country's wealth, or that  $h$  and  $x$  are not necessarily higher in richer countries. All our results, including the decrease in the likelihood of legalization with development, continue to hold even if the scaling were not to affect  $\sigma$  or  $h$  and  $x$ . Details available upon request. We are grateful to an anonymous referee for suggesting this helpful exercise.

### 5.3 Enforcement and social harm under legalization

A concern with legalization is that it may increase the amount of harmful activity. When comparing the optimal amount of enforcement under legalization relative to  $\hat{x}_{nc}$ , we find that, in most areas where one expects to find legalization, more harm indeed must be allowed:

**Remark 3** *Legalization lowers enforcement and increases social harm.*

The statement is a direct consequence of proposition 1 and remark 2. Legalization is optimal when the outside option is low,  $v \leq \tilde{z}$ . However, it is precisely in this region where  $\hat{x}_{honest}^* = \hat{x}_l^* < \hat{x}_{nc}$ . This is a striking result: whenever it is socially beneficial to switch from a clean regime with prohibition to a tax-and-legalize regime, the amount of harm allowed increases. This is driven by the fact that, when  $v \leq \tilde{z}$ , the optimal response in the absence of legalization is to increase enforcement, and that over-enforcement is corrected once legalization is introduced.

It is important to stress that the decrease in enforcement brought by legalization is due to the changes to the incentive costs faced by the government, and it has nothing to do with either changes in consumer taste or to introduction of a revenue concern for the government brought by legalization. In our model, legalization does not change the demand for the illegal good, and the government always faces a revenue concern—even under prohibition.<sup>27</sup>

## 6 Concluding Remarks and Extensions

In this paper, we studied the role of legalization in the context of corrupted law enforcement. In our model, corruption dilutes deterrence, and effective anti-corruption policies increase enforcement costs. We find that tax and legalize can be useful in reducing enforcement costs; it changes the incentives of the miscreant and eliminates rents from corruption.

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<sup>27</sup>There is significant empirical evidence that legalization (or, conversely, prohibition) of an illegal activity changes the demand for a good. See footnote 6. In our model, we could easily introduce this feature by having a measure of infinitely risk averse citizens. Legalization would immediately result in a demand-side response, with higher demand for the harmful good at all levels of enforcement. Notes available upon request.

**Political economy of legalization** Our results raise an important question: Why is legalization not more widespread? A consequence of our model is that legalization will generally increase harm, and this increase is *optimal* for society. It is not hard to see that this aspect might be problematic from the point of view of implementation. In a world where utility is not perfectly transferable, the benefits from legalization may not be spread across the population. Legalization could easily spiral into a controversial and politically unpalatable choice. More concretely, consider the following plausible example. Suppose that  $v \leq \tilde{z}$ , that the government chooses enforcement to maximize social welfare and that social harm is caused by a small share of the population but affects everyone. Suppose that legalization is subjected to a referendum. In this case, voters would approve legalization only if the reduction in their tax rate outweighs the net utility loss due to a decrease in enforcement. If the tax system is organized in such a way that changes in tax rates would affect only a minority of the population, the median voter would reject legalization and prohibition would continue to be the only policy.<sup>28</sup>

**Legalization as repugnant policy** Another limitation of our analysis is that nothing prevents the social planner to legalize hideous crimes like murder. The reason is that, for a sufficiently large social harm  $h$ , welfare under legalization is equivalent to welfare under criminalization. This “knife-edge” result is easily resolved in a number of ways. Most obviously, to the extent that consumers find legalization to be undesirable (or perhaps even repugnant), its implementation may introduce a small (psychic) welfare cost. Such a cost will not affect the planner’s decision to implement legalization in most cases where  $v < \tilde{z}$ , but will ensure criminalization whenever  $v > \tilde{z}$ .

**Optimality of corruption** Our model does not capture those situations where the optimal regime is corrupt and bribes are exchanged in equilibrium. Our model generalizes to those cases, albeit at the cost of complicating the analysis. Consider for instance the situation

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<sup>28</sup>Of course, depending on the distribution of taxes and harm, there may exist a political economy equilibrium with legalization such that taxes are  $r^{pe} > r^l$  and the median voter prefers legalization. We leave the development of such a model to future research.

where the enforcement process is subject to some inefficiency, possibly driven by red tape in the judicial system. We can model red tape by assuming that only a fraction  $\alpha < 1$  of revenues from fines are accounted for and can be utilized. Depending on the relative size of  $\alpha$ , we show in a companion working paper that corrupted enforcement can be optimal.

When this is the case, we find that legalization can “clean up” corruption. Most directly, it can be used to reduce or eliminate red tape (as first discussed in Kaplow and Shavell, 1994), because the bureaucratic procedure needed to process a tax in a legalized setting is less complex than the one needed to assess culpability under prohibition. For instance, if legalization fully eliminates red tape, it achieves the benchmark welfare level  $W_{honest}^*$ , and so (by proposition 2) it also eliminates corrupted enforcement.

As we show in a companion paper, legalization can be useful even if red tape remains a problem. Consider the case where only a fraction  $\alpha$  of the tax is accounted for, such that legalization offers no revenue advantages over prohibition. Because legalization eliminates distortions from corruption, we show that there is a parameter space such that  $W_{nc}^* < W_c^* < W_l^*$ . In other words, absent legalization the distortions from corruption are such that the corrupt regime is preferred, but with legalization enforcement becomes clean.

**Observable benefit** Finally, in our model we have assumed that the officer observes whether the harmful act has taken place, but the private benefit  $x$  remains unobservable. Our model extends naturally to cases where officers are able to observe and seize the profits from the harmful act, such that both bribes and incentives are contingent on the type  $x$ . In those cases, the optimal legalization scheme would also be contingent on  $x$ .<sup>29</sup>

## References

- [1] Acemoglu, Daron and Verdier, Thierry. 2000. “The Choice between Market Failures and Corruption,” *American Economic Review*, 90(1), 194-211.
- [2] Anderson, Benjamin Hansen, and Mark D. Daniel Rees. 2013. Medical Marijuana Laws, Traffic Fatalities, and Alcohol Consumption. *Journal of Law and Economics*, 56, 333-369
- [3] Andrianova, Svetlana and Nicolas Melissas. 2008. “Corruption, Extortion, and the Boundaries of the Law,” *Journal of Law, Economics, and Organization*, 25(2), 442-471

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<sup>29</sup>Notes available upon request.

- [4] Baç, Mehmet and Bag, Parimal Kanti. 2006. "Beneficial Collusion in Corruption Control: The Case of Nonmonetary Penalties", *Journal of Development Economics*, 81(2), 478-499
- [5] Banerjee, Abhijit V., Paul J. Gertler, and Maitreesh Ghatak. 2002. "Empowerment and Efficiency: Tenancy Reform in West Bengal" *Journal of Political Economy*, 110(2), 239-280
- [6] Bardhan, Pranab. 1997. "Corruption and Development: A Review of Issues," *Journal of Economic Literature*, 35(3) pp. 1320-1346
- [7] Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." *Journal of Political Economy*, 76, 169-217
- [8] Besley, Timothy, Konrad B. Burchardi, and Maitreesh Ghatak. 2012. "Incentives and the De Soto Effect", *The Quarterly Journal of Economics*, 127 (1), 237-282.
- [9] Besley, Timothy and John McClaren. 1993. "Taxes and Bribery: the Role of Wage Incentives," *The Economic Journal*, v.103, 119-141
- [10] Bose, Gautam. 2004. "Bureaucratic delays and bribe-taking." *Journal of Economic Behavior and Organization*, 54, 313-320
- [11] Buccirosi, Paolo and Giancarlo Spagnolo. 2006. "Leniency Policies and Illegal Transactions," *Journal of Public Economics*, 90(6), 1281-97.
- [12] Burlando, Alfredo and Alberto Motta. 2012. "Can Self Reporting Reduce Corruption in Law Enforcement?" Working Paper.
- [13] ——. 2015. "Corruption and the Organization of the firm". *American Economic Journal: Microeconomics*, 7(3) 54-84.
- [14] DiNardo, John and Thomas Lemieux. 2001. "Alcohol, Marijuana, and American Youth: The Unintended Consequences of Government Regulation." *Journal of Health Economics*, 20, 991-1010.
- [15] Emerson, Patrick M., 2006. "Corruption, competition and democracy," *Journal of Development Economics*, 81(1), 193-212.
- [16] Hindriks, Jean, and Keen, Michael and Muthoo, Abhinay. 1999. "Corruption, extortion and evasion," *Journal of Public Economics*, 74(3), 395-430.
- [17] Innes, Robert. 1999. "Remediation and self-reporting in optimal law enforcement," *Journal of Public Economics*, 72(3), 379-393.
- [18] Innes, Robert. 2000. "Self Reporting and Optimal Law Enforcement When Violators have Heterogeneous Probabilities of Apprehension," *Journal of Legal Studies*, 29, 287-300
- [19] Innes, Robert. 2001. "Violator Avoidance Activities and Self-Reporting in Optimal Law Enforcement." *Journal of Law, Economics, and Organization*, 17(1), 239-56.
- [20] Kaplow, Luo, and Steven Shavell. 1994. "Optimal Law Enforcement with Self Reporting of Behavior," *Journal of Political Economy*, 102(3), 583-606.
- [21] Laffont, Jean-Jacques and Jean Tirole. 1993. "A Theory of Incentives in Procurement and Delegation" Cambridge, MA: MIT Press.
- [22] Lambsdorff, Johann Graf. 2007. *The Institutional Economics of Corruption and Reform*, New York: Cambridge University Press.
- [23] Livernois, John and Chris J. McKenna. 1999. "Truth or consequences: enforcing pollution standards." *Journal of Public Economics* 71, 415-440
- [24] Malik, Arun S. 1993. "Self Reporting and the Design of Policies for Regulating Stochastic Pollution," *Journal of Environmental Economics and Management*, 24, 241-257.
- [25] Miron, Jeffrey and Jeffrey Zweibel. 1995. The economic case against drug prohibition. *The Journal of Economic Perspectives* , 9(4), 175-192

- [26] Mishra, Ajit., 2002. “Hierarchies, incentives and collusion in a model of enforcement”. *Journal of Economic Behavior and Organization*, 47, 165-178
- [27] Mookherjee, Dilip. 1997. “Informational rents and property rights in land”. In: Roemer, J. (Ed.), *Property Relations, Incentives, and Welfare*. Macmillan, London.
- [28] Mookherjee, Dilip and I.P.L. Png. 1995. “Corruptible Law Enforcers: How Should They Be Compensated?” *The Economic Journal*, 105 (428), 145-159
- [29] Motta, Alberto. 2012. “Collusion and Selective Supervision”. Working paper.
- [30] Motta, Massimo, and Michele Polo. 2003. “Leniency Programs and Cartel Prosecution,” *International Journal of Industrial Organization*, 21(3), 347-379
- [31] Olken, Benjamin A. and Patrick Barron. 2009. “The Simple Economics of Police Extortion: Evidence from Trucking in Aceh,” *Journal of Political Economy*, 117(3), 417-452
- [32] Peisakhin, Leonid. 2012. “Transparency and Corruption: Evidence from India.” *Journal of Law and Economics*, 55(1), 129-149.
- [33] Peisakhin, Leonid, and Paul Pinto. 2010. “Is Transparency an Effective Anti-corruption Strategy? Evidence from a Field Experiment in India.” *Regulation and Governance*, 4, 261- 80.
- [34] Polinsky, Mitchell and Steven Shavell. 2000. “The Economic Theory of Public Enforcement of Law.” *Journal of Economic Literature*, 38(1), 45-76.
- [35] Polinsky, Mitchell and Steven Shavell. 2001. “Corruption and Optimal Law Enforcement.” *Journal of Public Economics* 81, 1-24.
- [36] Proto, Eugenio. 2007. “Land and the transition from a Dual to a Modern Econom”. *Journal of Development Economics*, 83 (2007) 88-108.
- [37] Rose-Ackerman, Susan. 1994. “Reducing Bribery in the Public Sector,” in *Corruption and democracy: Political institutions, processes and corruption in transition states in East-Central Europe and in the former Soviet Union*. Ed: Duc V. Trang. Budapest: Institute for Constitutional and Legislative Policy.
- [38] Saffer, Henry and Frank Chaloupka. 1999. “The Demand for Illicit Drugs.” *Economic Inquiry* 37, 401-411.
- [39] Tirole, Jean. 1992. “Collusion and the theory of organizations,” in J. J. Laffont, ed., *Advances in Economic Theory: Sixth World Congress*, Vol. II, Cambridge University Press, Cambridge.

## 7 Appendix

### 7.1 Proof of proposition 1

We derive the optimal policy under prohibition here and subsequently compare optimal enforcement against the benchmark in the following subsection. The proofs demonstrate that the optimal set includes a maximal  $f$  and  $i = i^{nc}$ . See notes available from the authors for a proof with a characterization of all optimal policies (including those where  $f < \bar{f}$ , and  $i > i^{nc}$ ).

**Part a.** Consider first the case where (LL) is slack. Then, (PC<sub>nc</sub>) binds and, from (PC<sub>nc</sub>), we get that the optimal wage is  $w_{nc} = v - i[1 - G(pf)]$ . Replacing this in the welfare function (5), we get that

$$W_{nc}(p, f) = \int_{pf}^{\infty} (x - h)g(x)dx - dp\{v - f[1 - G(pf)]\}. \quad (9)$$

Note first that welfare does not depend on  $i$ , and any  $i \geq \sigma f$  satisfies (IC). In addition, the welfare is equivalent to (3), the benchmark case without the possibility of corruption. The optimal policy



thus follows the benchmark case, which means that  $f = \bar{f}$  and the optimal interior solution  $p_{nc}$  is determined by the first order condition in the benchmark, honest case, equation (4). It follows that  $\hat{x}_{nc} = \hat{x}_{honest}$  and  $W_{nc}^* = W_{honest}^*$ .

We next determine the optimal  $i^*$ . As long as  $v > i^*[1 - G(p_{nc}\bar{f})]$ , (LL) is slack. Thus, any  $i^* \in [\sigma\bar{f}, \frac{v}{1-G(p_{nc}\bar{f})}]$  ensures that (LL) does not bind. In particular,  $i^* = \sigma\bar{f}$  is always a solution.

Next, we show the parameter space where this solution is feasible. The largest value of  $v$  such that (LL) binds is  $v = i^*[1 - G(p_{nc}\bar{f})]$ ; substituting this in (4) and considering that the hazard rate  $\frac{[1-G(p_{nc}\bar{f})]}{g(p_{nc}\bar{f})} = \frac{1}{\lambda}$ , we get

$$h - (1 + d)p_{nc}\bar{f} = \frac{di^*}{\bar{f}\lambda} - \frac{d}{\lambda}. \quad (10)$$

Solving for  $p_{nc}\bar{f}$  we get  $p_{nc}\bar{f} = \frac{h}{1+d} - \frac{d(i^* - \bar{f})}{\bar{f}\lambda(1+d)}$ . Substituting  $p_{nc}\bar{f}$  and  $i^* = \sigma\bar{f}$  into the participation constraint, we find that this solution is feasible for  $v > \tilde{z} \equiv \sigma\bar{f} \left[ 1 - G\left(\frac{h}{1+d} + \frac{d(1-\sigma)}{\lambda(1+d)}\right) \right]$ .

It remains to be demonstrated that, in the parameter space where the solution is feasible, it is also optimal. This follows immediately from the fact that when  $v > \tilde{z}$ , the government achieves benchmark welfare, and the benchmark welfare is strictly better than any clean regime welfare where (LL) binds. Thus, it is never optimal to set  $i > \sigma\bar{f}$  in such a way that (LL) binds.<sup>30</sup>

**Part c.** Next consider the case where (LL) binds and (PC<sub>nc</sub>) does not. Substituting  $w_{nc} = 0$  in the welfare function (5), we get an equation that is decreasing in  $i$ . Thus,  $i$  should be reduced until (IC) binds:  $i^{nc} = \sigma f$ . The welfare function takes the form

$$W_{nc}(p, f) = \int_{pf}^{\infty} (x - h)g(x)dx - dpf(\sigma - 1)[1 - G(pf)]. \quad (11)$$

This function does not separately identify  $p$  from  $f$ : rather, it identifies  $\hat{x}_{nc}$ , and then any combination  $p$  and  $f$  such that  $pf = \hat{x}_{nc}$  is equally acceptable. Here, we focus on  $f = \bar{f}$ . Setting the derivative of  $W_{nc}$  with respect to  $p$  equal to zero we get

$$[h - (1 + d\sigma - d)p_{nc}\bar{f}]g(p_{nc}\bar{f}) = d(1 - \sigma)[1 - G(p_{nc}\bar{f})]. \quad (12)$$

Dividing both sides by  $g(p_{nc}\bar{f})$  and substituting  $\frac{1-G(p_{nc}\bar{f})}{g(p_{nc}\bar{f})} = \frac{1}{\lambda}$ , and then solving for  $p_{nc}$ , we obtain that  $p_{nc}\bar{f} = \hat{x}_{nc} = \frac{h}{1+d\sigma-d} - \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}$ . An interior solution for  $p$  is guaranteed by assumption A1 and by  $h > \frac{\sigma}{\lambda}$ , which is again satisfied when A1 is satisfied. Thus,  $f = \bar{f}$  is feasible and guarantees an interior solution.

Finally, this solution applies whenever (PC<sub>nc</sub>) is slack; that means that it is feasible in the space  $v < \tilde{z} \equiv \sigma\bar{f} \left[ 1 - G\left(\frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}\right) \right]$ .

**Part b.** Next consider the case where (PC<sub>nc</sub>) and (LL) bind at the same time. Substituting  $w_{nc} = 0$  and the binding (PC<sub>nc</sub>) in the welfare function (5), we get an equation that is decreasing in  $i$ . Thus,  $i^{nc} = \sigma f$ , the welfare function takes the form (11), and the optimal enforcement policy  $p_{nc}$  and  $f_{nc}$  solves  $v = \sigma f_{nc}[1 - G(p_{nc}f_{nc})]$ . Rearranging, we get the optimal interior enforcement

<sup>30</sup> Assumptions A1-A2 ensure no corner solutions.  $p_{nc} > 0$  is guaranteed if  $v < \bar{f}(h\lambda + 1)/d$  (always satisfied by assumption A2) and by assumption A1, which implies that  $h > d(1 - \sigma)/\lambda$ .  $p_{nc} < 1$  is guaranteed by  $v > \bar{f}g(\bar{f}) (h - \bar{f}[1 + d] + 1/\lambda) = \lambda[h - (1 + d)\bar{f} + 1/\lambda]\bar{f}[1 - G(\bar{f})]$ , which is always satisfied because the threshold is smaller than  $\tilde{z}$  and by assumption A1.

solution  $\hat{x}_{nc} = G^{-1}(1 - \frac{v}{\sigma f_{nc}})$ . Plugging this into (11), we get that the equilibrium welfare is

$$W_{nc}(p_{nc}, f_{nc}) = \int_{\hat{x}_{nc}}^{\infty} (x - h)g(x)dx + dp_{nc}(1 - \sigma)\frac{v}{\sigma}. \quad (13)$$

We next show that, if  $\bar{z} \leq v \leq \tilde{z}$ ,  $f_{nc} = \bar{f}$ . Suppose  $f < \bar{f}$ , but  $p$  is chosen such that  $v = \sigma f[1 - G(pf)]$ . Then, we could increase  $f$  to  $f' > f$  and reduce  $p$  to  $p' < p$  such that  $f'p' = pf$ . Note that  $v < \sigma f'[1 - G(p'f')]$ ,  $(PC_{nc})$  is now slack, and the welfare achieved is determined by equation (11). Comparing this welfare function with equation (13), the two are identical:

$$\begin{aligned} W_{nc}(p, f) - W'_{nc}(p', f') &= p(1 - \sigma)\frac{v}{\sigma} - p'f'(1 - \sigma)[1 - G(p'f')] \\ &= (1 - \sigma)\{pf[1 - G(pf)] - p'f'[1 - G(p'f')]\} = 0. \end{aligned}$$

However, unlike  $W_{nc}(p, f)$ ,  $W_{nc}(p', f')$  is generally not evaluated at its optimal expected sanction. The optimal expected sanction  $\hat{x}_{nc} = p'f'$  is  $\frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}$  (see Part c. of this proof). The only time when  $pf = p'f'$  and the two welfare functions are equal is when  $v = \sigma f \left[1 - G\left(\frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}\right)\right] < \bar{z}$ . But here we are considering the case where  $v \geq \bar{z}$ . So it must be that the welfare is higher with  $f'$ . This contradicts the assertion that  $f$  was optimal.<sup>31</sup>

We conclude by noting that this solution is feasible for the space  $\bar{z} \leq v \leq \tilde{z}$ . It can be verified that at the boundary  $v = \bar{z}$ , the solution is  $p_{nc}\bar{f} = \hat{x}_{nc} = \frac{h}{1+d\sigma-d} + \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}$ , which is the same solution found in Part c. Also, at the boundary  $v = \tilde{z}$ , the solution is  $p_{nc}\bar{f} = \frac{h}{1+d} - \frac{d(i^* - \bar{f})}{f\lambda}$ , which is the solution for Part a. Outside of this interval, the solution in Part b. is dominated by the solutions in Part c. and Part a. Thus, the solution in Part b. applies to the space  $\bar{z} \leq v \leq \tilde{z}$ , and  $W_{nc}^*$  is continuous in  $v$ .

### 7.1.1 Proof of over-enforcement

The claim is that, when (LL) and  $(PC_{nc})$  both bind (alternatively, for  $\bar{z} \leq v \leq \tilde{z}$ ), there is over-enforcement in the clean regime relative to the benchmark. Note that the optimal enforcement level in case (b) solves  $\sigma\bar{f}[1 - G(p_{nc}\bar{f})] = v$ . Substituting this into (4) yields  $p\bar{f} = \frac{h}{1+d} + \frac{1-\sigma}{\lambda}$ , which is optimal in the benchmark regime (i.e.,  $p\bar{f} = p^*\bar{f}$ ) only when  $v = \tilde{z}$ . To complete the proof, then, we need to show that as  $v$  declines below  $\tilde{z}$ , enforcement increases more in the clean regime case than in the benchmark case. Using the implicit function theorem on  $\hat{x}$  under the two regimes:

$$\frac{\partial p_{nc}}{\partial v} = \frac{-1}{fg(pf)} \frac{1}{\sigma f}$$

and

$$\frac{\partial p^*}{\partial v} = \frac{-1}{fg(pf)} \frac{d}{f(1+d) + \frac{dv}{1-G(pf)}}.$$

For the latter derivative, we used  $\frac{v}{fg(pf)} = \frac{v}{\lambda f[1-G(pf)]}$ , whose derivative with respect to  $p$  is  $\frac{v}{1-G(pf)}$ . We thus need to prove that the former derivative is smaller than the latter in the region  $\bar{z} \leq v \leq \tilde{z}$ . This is so provided that  $\sigma f < f(1+d)/d + \frac{v}{1-G(pf)}$ ; rearranging, we have the condition  $v > (\sigma - \frac{1+d}{d})f[1 - G(pf)]$ , which is always met because the right hand side is negative.

<sup>31</sup> An interior solution requires  $v > \sigma\bar{f}[1 - G(\bar{f})]$ , which is satisfied by  $v > \bar{z}$  and by assumption A1, and  $v < \sigma\bar{f}$  (assumption A2).

**Case c** The claim is that, when  $(PC_{nc})$  is slack (alternatively, for  $v < \underline{z}$ ), there is over enforcement relative to the benchmark if  $h > \frac{1}{\lambda}$ . To prove it, note that the highest  $\hat{x}_{honest}^*$  possible occurs when  $v = 0$ . Denote by  $\hat{x}_{honest}^{*0}$  the enforcement for  $v = 0$ . Substituting  $v = 0$  in equation 4, we get that  $\hat{x}_{honest}^{*0} = \frac{h+d/\lambda}{1+d}$ . On the other hand, enforcement under the threat of collusion is (see case c. in the proof of proposition 1)  $\hat{x}_{nc} = \frac{h}{1+d\sigma-d} - \frac{d(1-\sigma)}{\lambda(1+d\sigma-d)}$ . It can be readily be observed that  $\hat{x}_{nc} > \hat{x}_{honest}^{*0}$  whenever  $h > \frac{1}{\lambda}$ . This holds by assumption A3 (a qualitatively similar version of this proposition holds when relaxing assumption A3).

## 7.2 Proof of Proposition 3

(i) Suppose that incentives are low, such that the regime is corrupt. We have shown in the main text that the optimal a tax-and-legalize scheme must satisfy  $r_c \leq pb$  in a corrupt regime. The government could provide high-powered incentives  $i \geq i^{nc}$ , keep the wage at  $w$  and the tax at  $r_c$ , and reduce the workforce from  $p$  to  $p' = r_c/f$ . Revenues and enforcement levels would not change; however, the wage bill would be smaller so the self reporting welfare function (7) would increase by  $W_l^{nc}(r_c) - W_l^c(r_c) = (p - p')w = (\frac{r_c}{b} - \frac{r_c}{f})w > 0$ . Thus, legalization is always implemented in a clean regime (i.e.,  $i \geq \sigma f$ ).

(ii) Suppose  $r < pf$ . Then, all criminals self report, and the government could slightly decrease  $p$  without changing the number of crimes. Neither the integral nor the last term in the self reporting welfare function (7) would change. The second term in (7) would decrease, because there are fewer wages to pay. Thus, welfare would increase. Since  $r < pf$  is not optimal, it must be that  $r \geq pf$ . If  $r > pf$ , no one pays the tax. Thus, it must be that the optimal  $r$  is  $pf$ .

(iii) When offenders self report by paying the tax, officers never audit anyone who has committed the sanctioned act and failed to self report. They never earn any incentive pay, and the only salary paid is the base wage. Constraint PC then reduces to  $w \geq v$ . To maximize equation (7), the government reduces the base wage to the point where the constraint binds, to  $v$ .

## 8 Online Appendix: extensions

### 8.1 Red tape

With red tape, a fraction  $\alpha < 1$  of revenues from fines are accounted for and can be utilized. Each fine  $f$  thus generates a social benefit (in terms of deadweight losses avoided) of  $\alpha f$  and a social loss of  $(1 - \alpha)f$  from resources wasted. Relative to the welfare function in the clean regime without red tape  $W_{nc}$ , welfare under red tape is:

$$W_{nc}^{red\ tape}(p, w, i, f) = \int_{\hat{x}_j}^{\infty} (x - h)g(x)dx - dp\{w - (\alpha f - i)[1 - G(pf)]\} - (1 - \alpha)pf[1 - G(pf)] \quad (14)$$

or alternatively

$$W_{nc}^{red\ tape}(p, w, i, f) = W_{nc}(p, w, i, f) - \{(1 - \alpha)(1 + d)\}pf[1 - G(pf)]. \quad (15)$$

With  $\alpha$  low enough and under certain parameters, bureaucratic red tape causes a large enough welfare loss that the government is better off enforcing through (efficient) bribes. In particular, when the outside option is low enough such that  $(PC_{nc})$  binds,  $W_c^* > W_{nc}^{*red\ tape}$ .<sup>32</sup>

<sup>32</sup>An older version of the paper develops the model with bureaucratic red tape; available from the authors upon request.

We next prove that, when legalization is not subject to red tape, it eliminates corruption. The proof is straightforward: by remark 2,  $W_l^* = W_{honest}^* \geq W_{nc}^*$ . By proposition 1,  $W_{nc}^* > W_c^*$ . Thus, legalization always dominates corruption.

Finally, we show that legalization with red tape can shift an enforcement regime from corrupt to clean. Suppose that each fine  $r$  brings  $\alpha r$  in revenue. Consider parameter values such that  $W_{nc}^{*red\ tape} < W_c^*$  but  $W_{honest}^{*red\ tape} > W_c^*$ . Then it is immediately clear that under prohibition the regime will be corrupt. Since  $W_l^{*red\ tape} = W_{honest}^{*red\ tape}$ , the legalized regime is preferred. Since legalized regimes are always honest, legalization cleans up corruption.

## 8.2 Type-contingent punishment

The main results of our paper are robust to a number of alternative modeling choices. For instance, we assume that the officer observes whether the harmful act has taken place, but the realized value of  $x$  remains unobservable (or is not hard information). Suppose instead that officers are able to observe and seize the profits from the harmful act. It is thus possible to generate a set of fines and legalized taxes that are contingent on the type of agent. Thus, the possible punishment from being apprehended is  $f + x$ . In addition and for simplicity, assume that bribes are not capped to  $\sigma f$ , so that the equilibrium bribe (equation 1) is

$$b(i, f) = (1 - \mu)i + \mu(f + x).$$

An effective incentive scheme would therefore require  $i$  contingent on  $x$ —specifically, the agent would have to receive  $i = f + x$  to maintain honest. The participation constraint ( $PC_{nc}$ ) is

$$w + E(i) = w + \int_{\hat{x}}^{\infty} (f + x)g(x)dx \geq v$$

where  $\hat{x} = \frac{p}{1-p}f$ . While this setup complicates significantly the analysis, the qualitative results in proposition 1 remain unchanged; namely, for  $v$  low enough, the limited liability constraint will be binding, and enforcement will be distorted away from the benchmark case.

Once again, legalization addresses this problem. Consider the type-contingent tax

$$r_x = p(f + x)$$

with an associated set of type-specific fines for tax evasion  $f_{x,x'}$

$$f_{x,x'} = \max[0, x - x']$$

levied on type  $x$  individuals who reported being type  $x'$ . Then, it is possible to construct an appropriate incentive schedule such that officers will never accept bribes, miscreants will always truthfully report their type and pay the associated tax, and no incentives are ever paid out. Legalization would thus eliminate corruption.