A Note on Optimal Law Enforcement under Asymmetric Information

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Abstract

We show that the probability of apprehension and punishment is usually reduced in a framework with asymmetric information, leading to more offenses being committed. A positive correlation between crime and asymmetry of information in the enforcement process is established. Some suggestions concerning the efficiency of private versus public enforcement are drawn.

Keywords: fine, probability of detection, asymmetry of information

JEL Classification: K4

1. Introduction

Asymmetry of information between the government and a public enforcer as well as its impact on the cost structure of enforcement has not been discussed in the literature. Most models of law enforcement, since Becker (1968), assume symmetric information between government and enforcers. That corresponds to an ideal public law enforcement context as described by Landes and Posner (1975).

Realistically, public enforcement is not decided by a single actor, but by different agents, in particular, public enforcers and a government. An enforcement agency is more likely to have a comparative advantage in enforcement (detection and investigation) than the government. Through its operating activities, the agency obtains private information; information that is not available to the government (the principal). This information asymmetry poses a serious problem of implementing an optimal enforcement policy (within the public enforcement model).

The existence of asymmetry of information between enforcers and the government causes the usual problem of regulating any bureaucracy: it could be that some resources are taken out of enforcement activities to be spent in other activities that generate more utility to enforcers (promoting their careers or selecting enforcement areas they want to target for other reasons than social well-being); it could be that enforcers appropriate part of the (public) enforcement budget for private reasons.[1]

The nature of the internal organization of the enforcement bureaucracy is not discussed in this note. We take the view of a centralized bureaucracy which corresponds to the situation in many European countries.[2] There are however countries where enforcement agencies, in particular the police, is financed at some regional level, organized in a decentralized fashion, where local agencies might indirectly compete against each other.[3] Such competition effects may in turn reveal information and mitigate the problem we discuss in this note.

Following the regulation literature (Laffont and Tirole, 1993), we focus on the problem created by asymmetric information about the enforcer's (agent's) costs related to enforcement expenditure. The enforcement cost depends on several factors related to the nature of the crime and known by the enforcer (the agent), but only imperfectly observed by the principal (assumed to be a benevolent government). Therefore, a low cost enforcer may conceal its information by imitating a high cost enforcer, and must then be given an economic compensation—*information rent*—to be induced to reveal its true costs. The problem to be analyzed is the design of optimal incentives that may be offered to the enforcer (agency of enforcement) in order to secure participation with adequate compensation.

We show that the probability of apprehension and punishment is usually reduced in a framework with asymmetric information, leading to more offenses being committed. A positive correlation between crime and asymmetry of information in the enforcement process is established.

The optimal sanction is different than the usual solution, that is, the harm caused by the offense inflated by the probability of apprehension and punishment (the so-called *multiplier principle*). Furthermore, the difference between the optimal sanction and the *multiplier principle* increases with the opportunity cost of public fund raising.

We also show that asymmetric information is irrelevant within the usual Polinsky and Shavell's framework. The *information rent* is essentially a transfer from the government to the public enforcer. In the usual utilitarian context, the optimal policy is neutral to such redistribution. Asymmetry of information does not affect law enforcement as long as public fund raising is costless. The consideration of costly public fund raising allows us to establish the positive correlation between asymmetry of information between government and enforcers and the crime rate.

Having shown that the probability of apprehension is lower than in the model of ideal public enforcement (where there is no asymmetry of information), we make a contribution to the controversy over public versus private enforcement. Polinsky (1980) has shown that private enforcement was problematic in many circumstances because the probability of apprehension chosen by a private enforcer is lower than the optimal one. However, the optimal probability of apprehension is the one set by an ideal public enforcer, not by the public enforcer we model in this note. Consequently, both a private enforcer and a public enforcer choose a less than optimal probability even though for different reasons, the first because of profit maximization and the second because of asymmetry of information. In some cases, the difference between the ideal and the actual probability will be higher under private rather than public enforcement, in other cases the opposite will happen.[4]

In Section 2, we present the model. Remarks on the debate over private versus public enforcement are addressed in Section 3. Section 4 concludes the paper. The proofs of propositions are in appendix.

2. The model

We introduce a general function for global costs, $C(x, p)$, where x is an intrinsic cost parameter, and p is the probability of detection and conviction. The cost parameter is determined by the agency's technology and its private knowledge. The support $x \in [\underline{x}, \bar{x}]$, the distribution $G(x)$, and the density function $g(x)$ are common knowledge. The type $\underline{x}$ enforcer is the most and the type $\bar{x}$ enforcer is the least cost effective. We make the following conventional assumptions:

(a) Monotonicity: $\partial C(x, p)/\partial x > 0$.
(b) Single Crossing Property: $\partial^2 C(x, p)/\partial x \partial p > 0$.
(c) Convexity: $\partial^2 C(x, p)/\partial p^2 > 0$.
(d) $\partial^3 C(x, p)/\partial x \partial p^2 \geq 0$.
(e) $\partial^3 C(x, p)/\partial x^2 \partial p \geq 0$.
(f) Monotone Hazard Rate: $d[G(x)/g(x)]/dx \geq 0$.

The assumptions (d)–(f) are the conventional ones in the regulation literature (Laffont and Tirole, 1993). They guarantee the existence of a solution to our problem, thus they are sufficient conditions for deriving Proposition 2 later in the paper. Assumption (d) will ensure that the regulator's problem is concave, assumption (f) is the classical increasing hazard rate property which with assumption (e) ensures there is no bunching in the regulator's problem.[5]

In the optimal law enforcement literature, social welfare generally equals the sum of individuals' expected utilities minus the harm caused by offenses minus expenditure on law enforcement:[6]

$$W = \int_{p(x)s}^{B} (b - h) \, dF(b) - C(x, p(x)) - \lambda t$$

where s is sanction, b is benefit from committing an offense distributed across the population according to $F(b)$ for $b \in [0, B]$, h is the magnitude of the harm caused by each offense, λ is the opportunity cost of public funds, and t is the budget transfer from citizens to the government. The monetary sanction is assumed to be costless to impose as conventional in the law enforcement literature. Note that an individual decides to commit an offense if and only if $b \geq p(x)s$.[7]

Notice that λt reflects the welfare loss incurred by a transfer t from taxpayers to the enforcement agency. The social effect of this transfer is negative due to the use of distortionary taxation on income, capital and consumption to finance it. The parameter λ reflects the distortion and is called the shadow cost of public funds.[8]

The principal maximizes $W(p, s)$ in the probability p and severity s subject to the individual rationality constraint (agency's participation constraint), to the incentive compatibility constraint (agency reveals its own type), and the sanction s is upper bounded by the offender's total wealth $S(0 \leq s \leq S)$.

Proposition 1.   *Under symmetric information, the optimal enforcement policy is given by*
$s^* = S$ *and*

$$p^*(x)S = h - [(1 + \lambda)\partial C(x, p^*)/\partial p]/[Sf(p^*S)]$$

The interpretation of the optimal policy is standard: the marginal benefit from deterrence (in terms of avoided harm) equals the social marginal cost adjusted to deterring crime (adjusted because of being deflated by $Sf(\cdot)$) plus the expected sanction. As a consequence $p^*(x)S < h$, that is, at the optimum there is underdeterrence in the sense that the expected punishment borne by the offender is less than the harm borne by the victim.

Proposition 2.   *Under asymmetric information, the optimal enforcement policy is given by $s^* = S$ and*

$$\tilde{p}(x)S = h - [(1 + \lambda)\partial C(x, \tilde{p})/\partial p + \Delta]/[Sf(\tilde{p}S)]$$

where

$$\Delta = \lambda \frac{G(x)}{g(x)} \frac{\partial^2 C}{\partial x \partial p(x)}(x, \tilde{p}(x))$$

By comparing this solution with the solution to the symmetric information problem, we see that asymmetry of information generates a new term Δ-the marginal information cost for all types $x \geq \underline{x}$. The interpretation of the optimal policy is: the marginal benefit from deterrence (in terms of avoided harm) equals the social marginal cost plus the marginal cost of rent-seeking (both adjusted to deterring crime) plus the expected sanction.

For $\lambda = 0$, asymmetry of information does not affect the optimal policy and does not diminish deterrence ($p^* = \tilde{p}$). In the usual Polinsky and Shavell's model, raising public funds is costless. Consequently, asymmetry of information between the government and public enforcers is not an interesting issue. It does not affect the optimal policy; it only has a distribution role by increasing the share of enforcers at the expense of the government's share of criminal surplus. For a utilitarian government the optimal policy is neutral to such redistribution.

For $\lambda > 0$, there is more underdeterrence with asymmetry of information. We have already shown that because enforcement is costly, at the optimum, there is underdeterrence, that is, the expected sanction is less than the harm borne by victims. The degree of underdeterrence augments with asymmetry of information because enforcement is more costly in such context (given that an *information rent* must be paid).

Consequently, under asymmetry of information, the Becker result is reinforced. As the sanction increases, the degree of underdeterrence becomes less important. In the limit case, when the severity of punishment approaches infinity and the probability of punishment approaches zero, the fact that there is asymmetry of information is not very meaningful.

3.   Remarks on the debate over private vs. public enforcement

This paper is directly related to the literature that discusses the advantages of using private enforcement, in particular Polinsky (1980) and Shavell (1993). Polinsky (1980) shows that

in many situations the probability of apprehension chosen by a private enforcement enforcer is less than optimal. Moreover, in the context of a non-competitive environment, it could be unfeasible for the government to delegate optimal enforcement. The rationale for this striking result is that a private enforcer manipulates apprehension and detection to increase profits without seeking very high levels of compliance. Complete deterrence would mean zero profits for the enforcer.[9]

A private enforcement agency chooses the probability of apprehension and punishment whereas a public enforcement agency simply complies with the probability set by the government. However we propose in this note that a public enforcer manipulates the cost of complying with the probability set by the government in order to increase the *information rent.*

In a world where raising public funds is costless (as in Polinsky and Shavell's setup), we have shown that asymmetry of information between the government and enforcers does not affect the optimal policy. Consequently, we point out that public enforcement is preferred to private enforcement since, as Polinsky (1980) has shown, the private enforcer might choose a less than optimal probability even when the government offers a large reward whereas the public enforcer always complies with the optimal probability (given the incentive generated by the *information rent*).

A different result is obtained when raising public funds is costly. Both private and public enforcement lead to a probability of apprehension and punishment different from the optimal one. Which of the two is more efficient depends on the determinants of the probability of apprehension in both models. In our model of public enforcement, the determinant is the cost of raising public funds to finance the *information rent.* In Polinsky's model of private enforcement, the determinants are the private reward and the market structure.[10] Thus, it could be that private enforcement could be superior to public enforcement, namely when raising public funds is very costly.

4. Conclusion

This paper has extended the theory of optimal law enforcement to the case of asymmetry of information between the government and the public enforcement agency. We have shown that such asymmetry of information affects negatively the probability of apprehension and punishment (and hence positively the proportion of offenses committed) as long as public fund raising remains costly. It is the conjunction of asymmetry of information and socially costly public funds that causes distortions on the allocation of public enforcement effort thus reinforcing the implementation of the maximal fine.

Appendix: Proofs of propositions

Define:

$$U(x) = t(x) - C(x, p(x)) \quad \forall x \in \Omega$$
$$U(\hat{x}, x) = t(\hat{x}) - C(x, p(\hat{x})) \quad \forall \hat{x} \in \Omega$$

where $U(\hat{x}, x)$ is the rent of type x when $\hat{x}$ is reported, and $U(x) = U(x, x)$ when the enforcer reports truthfully. Recall that social welfare is:

$$W = \int_{p(x)s}^{B} (b - h) \, dF(b) - C(x, p(x)) - \lambda t(x)$$

Since $t(x) = C(x, p(x)) + U(x)$:

$$W = \int_{p(x)s}^{B} (b - h) \, dF(b) - (1 + \lambda)C(x, p(x)) - \lambda U(x)$$

where the first term refers to surplus of offenses, the second term to social cost of enforcement, and the third term to the cost of rent left to the agency.

Symmetric information

Since transfers are costly ($\lambda > 0$), under symmetric information $t(x)$ will be set such that the participation constraint will be binding for all types at the optimum. As a consequence, we can write $t(x) = C(x, p(x))$ for all $x \in \Omega = [\underline{x}, \bar{x}]$.[11] Under symmetric information, the enforcer does not obtain a rent since $U(x) = 0$; there is no social cost of information rent.

The principal's problem is then to maximize in p and s:

$$W = \int_{ps}^{B} (b - h) \, dF(b) - (1 + \lambda)C(x, p)$$

subject to the constraint that the sanction s is upper bounded by the offender's total wealth $S : 0 \le s \le S$.

The optimal probability $p^*(x)$ is found by pointwise differentiation of the expected social welfare with respect to $p(x)$ and s such that $0 \le s \le S$. See Garoupa (1997a).

Asymmetric information

The revelation principle states that the government can restrict its attention to the class of mechanisms in response to which the enforcement agency reports its type truthfully. The government offers a self-selection mechanism, a menu of type-revealing contracts in $p(x)$ and $t(x)$ that the enforcer may choose among:

$$M = \langle x \in \Omega, p(x), t(x) \rangle$$

Now, the government problem is to maximize in p, t, and s:

$$EW = \int_{\underline{x}}^{\bar{x}} \left\{ \int_{p(x)s}^{B} (b - h) \, dF(b) - (1 + \lambda)C(x, p(x)) - \lambda U(x) \right\} dG(x)$$

subject to:

$$U(x) \geq U(\hat{x}, x) \quad \forall x, \hat{x} \in \Omega \quad (IC)$$
$$U(x) \geq 0 \quad \forall x \in \Omega \quad (IR)$$

and the maximal sanction constraint $0 \leq s \leq S$. We see that asymmetric information generates an additional constraint—an incentive constraint (IC).

We begin by characterizing the class of mechanisms that satisfies the incentive constraints in order to implement the allocation $\langle p(x), t(x) \rangle$ in a dominant strategy. Following Laffont and Tirole (1993), the contract $\langle p(x), t(x) \rangle_\Omega$ satisfies the incentive constraints if and only if:

(i) $U(x) = \int_x^{\bar{x}} \frac{\partial C}{\partial \epsilon}(\epsilon, p(\epsilon)) \, d\epsilon$.
(ii) $p'(x) \leq 0, \forall x \in \Omega$.

From Guesnerie and Laffont (1984), we know that under assumptions we have imposed a mechanism $\langle p(x), t(x) \rangle$ induces truthful behavior if and only if:

(ii) $p'(x) \leq 0, \forall x \in \Omega$.
(iii) $dt(x)/dx = \partial C(x, p(x))/\partial p \, dp(x)/dx$

If $p(x)$ is non decreasing, the solution is obtained as explained in Guesnerie and Laffont (1984) by piecing together decreasing pieces of $p(x)$. The expression (i) is obtained by integrating (iii) such that the lowest efficient agent obtains no rent.

Since $U(x) = t(x) - C(x, p(x))$, the transfer is:

$$t(x) = C(x, p(x)) + \int_x^{\bar{x}} \frac{\partial C}{\partial \epsilon}(\epsilon, p(\epsilon)) \, d\epsilon$$

where the first term is the covered cost and the second term is the *information rent.* We can insert the rent expression into the objective function of government, and obtain the following expected social welfare:

$$EW = \int_{\underline{x}}^{\bar{x}} \left\{ \int_{p(x)s}^{B} (b - h) \, dF(b) - (1 + \lambda)C(x, p(x)) - \lambda \int_x^{\bar{x}} \frac{\partial C}{\partial \epsilon}(\epsilon, p(\epsilon)) \, d\epsilon \right\} dG(x)$$

Integrating by parts the last term, the expected social welfare can be rewritten as:

$$EW = \int_{\underline{x}}^{\bar{x}} \left\{ \int_{p(x)s}^{B} (b - h) \, dF(b) - (1 + \lambda)C(x, p(x)) - \lambda \frac{G(x)}{g(x)} \frac{\partial C}{\partial x}(x, p(x)) \right\} dG(x)$$

The enforcement problem is now reduced to maximizing expected social welfare subject to the monotonicity constraint $p'(x) \leq 0$ and the maximal fine constraint. The optimal probability $\tilde{p}(x)$ is found by pointwise differentiation of the expected social welfare with respect to $p(x)$ and s such that $0 \leq s \leq S$.

It remains to show that the solution satisfies the monotonicity condition $p'(x) \leq 0$, $\forall x \in \Omega$. Define:

$$\Gamma = h - [(1 + \lambda)\partial C(x, \tilde{p})/\partial p + \Delta]/[Sf(\tilde{p}S)] - \tilde{p}(x)S$$

Hence $\tilde{p}'(x) = -\Gamma_x / \Gamma_p$ where Γ_p is negative from the second-order condition. The sign of $\tilde{p}'(x)$ is the sign of Γ_x which is negative due to usual assumptions:

$$\Gamma_x = -\left[(1 + \lambda)\frac{\partial^2 C}{\partial p \partial x} + \lambda\frac{d}{dx}\left(\frac{G(x)}{g(x)}\right)\frac{\partial^2 C}{\partial x \partial p} + \lambda\frac{G(x)}{g(x)}\frac{\partial^3 C}{\partial p \partial x^2}\right] \Big/ [Sf(\tilde{p}S)]$$

Acknowledgments

Notes

1. This is a concern at the European level and is at the heart of the Oisin Program, a program funded by the European Union. It stimulates cooperation between law enforcement personnel and other public servants. The objective is to familiarize enforcers with the legal systems and law enforcement practices in other member states, and create more open and flexible enforcement bureaucracies. The program comprises incentives, training and exchanges.
2. In most European Union countries, the different police and enforcement agencies are controlled and budgeted by a centralized Ministry for Interior, Home Secretary or Ministry, or Ministry for Public Order.
3. Most notably the United States and up to some level Germany and Spain in the European Union. In Britain, the new Minister of State for Crime Reduction and Policing has proposed several police reforms aiming at centralization without limiting too much the operational discretion of the local Chief Constables. Also, the Home Office has empowered the Inspectorate of Constabulary to control for possible problems generated by local operational discretion. At the European Union level, the decision to create the Task Force of European Police Chiefs is in our view part of the process towards a more centralized police bureaucracy in Europe.
4. The controversy over public versus private enforcement has a long tradition in the literature. Becker and Stigler (1974) have argued that private enforcement might be advantageous because public enforcement creates incentives to bribery which undermine deterrence. Landes and Posner (1975) have proposed that public enforcement may be superior to private enforcement in many contexts, precisely because public enforcers can more easily enforce the combination of high fines and low probabilities of detection which Becker (1968) showed to be optimal. The discussion between private and public enforcement has been followed up by Polinsky (1980), Friedman (1984), Shavell (1993), Garoupa (1997b) and Garoupa and Klerman (2002).
5. We refer the reader to Guesnerie and Laffont (1984) for a discussion of these assumptions.
6. See Polinsky and Shavell (2000). It is conventional in this literature to include all gains in social welfare. Some argue that the offender's gains should be excluded for moral reasons.
7. Thus, knowing the crime rate will always allow the government to know the probability of apprehension.
8. For the US, it is normally assumed that $0.2 < \lambda < 0.4$ and a reasonable mean estimate is $\lambda = 0.3$. For France, it has been proposed $\lambda = 0.5$. See Ballard, Shoven, and Whalley (1985), Laffont and Tirole (1986), and Hausman and Poterba (1987).
9. The results obtained by Polinsky (1980) rely on the assumptions of his work. Garoupa and Klerman (2002) have commented on them. By changing these assumptions, some of the original results must be reassessed, but the general conclusions hold.

10. Polinsky (1980) shows that enforcement in a monopolistic market is more problematic than in a competitive market.
11. We have assumed that the revenues from punishing individuals given by $\int_{p(x)s}^{\infty} p(x)\, s\, dF(b)$ are distributed lump-sum. The results we present here are robust to a different specification that explicitly includes the revenues from punishing offenders.

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