E C O N O M I C S B U L L E T I N

Fairness and self-reporting in optimal law enforcement

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Abstract

This paper shows that fairness concerns are a stand-alone driver of self-reporting as part of optimal law enforcement. If society cares about individuals who are wrongly acquitted or are wrongly convicted, self-reporting is advantageous. This continues to hold as we allow for fairness concerns regarding the sanction applied to convicted offenders. We furthermore show that the addition of the traditional enforcement costs argument unambiguously lowers the self-reporting sanction in comparison to the case in which only fairness aspects are considered.

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1 Introduction

Individuals who committed criminal acts sometimes report their own violations to authorities. These offenders who self-report are frequently sanctioned less than others. Several efficiency reasons for the widespread use of this practice have been advanced in the literature. Kaplow and Shavell (1994a) analyze this feature of real-life law enforcement and find that it creates savings in enforcement costs as self-reporting individuals do not need to be detected and investigated. Further, self-reporting can reduce risk-bearing costs as the probabilistic sanction can be exchanged for a certain sanction. Innes (1999, 2000, 2001) complements these advantages. Innes (1999) highlights that self-reporters will take remediation efforts, which can be beneficial in the case of environmental harm, for instance. Innes (2000) considers offenders who differ in their apprehension probability. As enforcement effort and sanctions prove as quite crude instruments if the enforcement authority cannot observe the offender type, self-reporting can fine-tune enforcement by avoiding overdeterrence of easily apprehended individuals without affecting deterrence of the remaining individuals. Finally, Innes (2001) shows that self-reporting leads to savings in avoidance costs.[1]

We show that fairness considerations are a stand-alone driver of self-reporting as part of optimal law enforcement. Thus, the conception of welfare applied here allows for fairness concerns since they affect individual well-being, as is argued by Kaplow and Shavell (2002:293), for instance. We capture fairness by error costs.[2] Courts often suffer from imperfect information. For instance, evidence may prove incomplete or be subject to misinterpretation. Legal errors are one consequence and can materialize by leaving the guilty unpunished or convicting the innocent.[3] Most individuals will conceive of it as alarmingly unfair if a detected offender walks free due to legal error, leave alone the incarceration of an innocent.

Our finding, holding enforcement effort constant, is that law enforcement optimally employs self-reporting because social costs are reduced by fewer errors. In the minimization of social costs, the effect of lower self-reporting sanctions concerning violation incentives is initially too small to counter the effect based on error costs. Thus, some self-reporting of offenders is cost minimizing.

In the next section, we illustrate the workings of self-reporting in varied frameworks all characterized by heterogeneity of offenders regarding the total detection and conviction probability. Modeling offender heterogeneity is asked for since it entails the result of partial self-reporting, which is obviously more descriptive of reality than the outcome that all offenders either self-report or do not report. Besides fairness captured by error costs in our basic model, we also supply a model in which inequitable treatment of offenders causes costs. Another variation is the additional consideration of the traditional motive, enforcement cost savings, in order to

[1] Further work on self-reporting with little relation to this study is provided by Feess and Walzl (2005) who examine what effects result if there are two stages at which self-reporting can occur, before detection and after detection but before conviction. Besides, Feess and Walzl (2004) analyze effects if there is a team of two offenders, who may behave cooperatively or noncooperatively after the act, and Feess and Walzl (forthcoming) analyze the impact of offender heterogeneity on the optimal self-reporting scheme.

[2] Kaplow and Shavell (1994a) already touch upon errors and self-reporting. They find that savings in enforcement effort by virtue of self-reporting can turn out even higher than in a frame without errors because of the likely increase in enforcement effort necessary to counter the deterrence dilution due to legal error. Our model is also related to that by Kaplow and Shavell (1994b). They consider errors in the context of optimal law enforcement but model the imposition of sanctions as costly per se, whereas in our model (i) the imposition is costly if it is perceived as unfair and (ii) the failure to impose a sanction on offenders is costly too.

[3] References Polinsky and Shavell (1989) refer to estimate the probability of a legal error to be about one to eight.

determine whether both factors, fairness and enforcement cost savings, combine to even lower self-reporting sanctions. Concluding, we show that our result also holds in a framework in which the informational structure is changed in direction of that modeled by Innes (2000), that is, heterogeneity ex ante. Section 3 offers concluding comments.

2 The Model and Analysis

2.1 Assumptions

The model builds on Feess and Heesen (2002).[4] Risk-neutral individuals decide whether to commit an offense that generates benefit b and harm h. Benefits are private information and vary among potential offenders according to the density function $f[b]$ and the cumulative density function $F[b]$ on the support $[0, \infty)$. The policy maker minimizes total social costs to be defined more closely in the subsequent subsections. Her means to achieve this end include monetary sanction s, enforcement effort $p \in (0, 1)$, and the sanction for self-reporters r. The enforcement effort p may be interpreted as detection probability and causes costs $C(p)$. We assume that p and s are exogenously given for the sake of simplicity. We consider fairness concerns of society's constituents as policy maker's motive to incentivize self-reporting and capture them by error costs. Detected innocent individuals are wrongly convicted with probability $t \in (0, 1)$. Detected offenders' conviction probability, θq, depends on the likelihood of rightful conviction $q \in (0, 1]$, $q > t$, and the individual's type $\theta \in [0, 1]$.[5] We consider the specific course of events during the commission of the act as the factor that introduces heterogeneity, i.e., determines the type θ. For example, if the undertaking of the act runs smoothly from the criminal's perspective, it usually will be more difficult to detect and convict this individual than a criminal who failed to exercise the offense in the way desired. An obvious example is the case in which the offender knows that his offense has been witnessed, which would imply a θ close or equal to one and make the legal judgment less error prone. The type θ is private information received after the act and distributed according to $g[\theta]$, with cumulative density $G[\theta]$.[6] The expected sanction for an offender with $\theta = 1$ is qps. In consequence, to make self-reporting advantageous for a nonempty subset of offenders, $r < qps$ must hold. The type who is indifferent between reporting and not reporting is $\tilde{\theta} = r/[qps]$. Taking this into account before the act, individuals with $b \geq \tilde{b}$ find committing the act advantageous, with

$$\tilde{b} = qps \int_0^{\tilde{\theta}} \theta g[\theta] d\theta + r \int_{\tilde{\theta}}^1 g[\theta] d\theta - tps. \tag{1}$$

We assume that nonoffenders never decide to self-report, thus, we require $r \geq tps$.

The time sequence is as follows. On the first stage, the enforcement authority complements the exogenously given detection probability p and sanction magnitude s with the chosen self-reporting sanction r. Given that, the individual decides whether to commit the act knowing b, p, s, r, and the distribution of θ but not the actual θ. The commission of the criminal act

[4] Models in Feess and Walzl (2005, forthcoming) likewise build on this structure.

[5] Combining type and conviction probability multiplicatively eases the analysis, see, e.g., Innes (2000). Besides, note that, whereas probabilities t and q are exogenous in this setting, they can be endogenized by a decision variable k, being effort directed at enhancing accuracy as in Kaplow and Shavell (1994b), without changing the result.

[6] The enforcement authority cannot observe the information gathered by the offender, e.g., whether he became aware of the bystander.

produces the signal as the undertaking takes its specific course. After the act, offenders decide whether to self-report or not, given the information on θ. Finally, the enforcement authority acts as chosen on the first stage.

2.2 Analysis

We will discuss the result of our basic framework at first, and then proceed to enrich this framework in two directions. In the basic model, we allow for error costs as direct costs in the objective function of the policy maker. In our first enrichment, we include concerns for equitable treatment of offenders, whether they be self-reporting or not. Second, we consider that total enforcement costs can be affected by providing self-reporting incentives. Before concluding, we supply a variant of the basic model in which the type is revealed before the act is committed.

2.2.1 Basic Model

Society dislikes errors not only because they dilute deterrence but also because of fairness considerations. Social costs reflect this in the form of direct error costs besides harm and enforcement expenditures.[7] Specifically, we build in a multiple of the expected sanction imposed on innocent individuals and of the expected sanction that offenders escape from. Social costs[8] SC^B consist of the harm and error potential created by offenders, the error potential due to nonoffenders, and enforcement costs.

$$SC^B = (1 - F[\tilde{b}]) \left[h + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta) g[\theta] d\theta \right] + F[\tilde{b}]tps\sigma + C(p) \qquad (2)$$

For the time being, we exclude what has already been proven as the advantage of self-reporting, being the reduction in enforcement costs.[9] That is why enforcement costs $C(p)$ are not reduced if a subset of offenders self-report. Note that it lowers social welfare if offenders escape from detection, which is in the spirit of Polinsky and Shavell (2000).[10] The derivative of social costs in the basic model with respect to r is

$$\begin{aligned} SC_r^B =& (1 - F[\tilde{b}]) s\sigma g[\tilde{\theta}] \frac{\partial \tilde{\theta}}{\partial r} (1 - pq\tilde{\theta}) \\ & - f[\tilde{b}] \frac{\partial \tilde{b}}{\partial r} \left[h + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta) g[\theta] d\theta - tps\sigma \right]. \end{aligned} \qquad (3)$$

For the borderline values $\tilde{b}$ and $\tilde{\theta}$, it holds respectively that $\frac{\partial \tilde{b}}{\partial r} = \int_{\tilde{\theta}}^1 g[\theta] d\theta > 0$ and $\frac{\partial \tilde{\theta}}{\partial r} = 1/[qps] > 0$. The first term of the first-order derivative depicts that less offenders self-report in consequence of a marginal increase in the sanction for self-reporters, which causes error costs to rise. The second term reflects the effect of a marginal increase in r on deterrence. The change in r increases borderline benefit $\tilde{b}$ and thereby induces more individuals to refrain from

[7] This is likewise done in Lando (2003) and Demougin and Fluet (2005), for instance, who deal with standards of proof, and in Chu et al. (2000) who deal with repeat offenders.

[8] The objective function does not account for offenders benefits, which is, for one, appropriate for some acts, and, for another, without consequence qualitatively (Feess and Heesen 2002).

[9] This reduction explains the result of Feess and Heesen (2002), for instance.

[10] This aspect is, however, not critical for our results.

the act. Consequently, harm and error costs of offenders can be avoided whereas error costs for incremental innocent individuals are incurred.[11]

Proposition 1 *Suppose (a) ex post asymmetric information, (b) constant enforcement effort, and that (c) society cares about type I and type II errors as well as escapes from apprehension, then some self-reporting lowers social costs.*

Proof. We prove by contradiction. Suppose self-reporting is not cost minimizing. Then, $r = qps$. However, setting $r = qps$ in (3) gives after inserting $\frac{\partial \tilde{b}}{\partial r}$ and $\frac{\partial \tilde{\theta}}{\partial r}$

$$SC_r^B(r = qps) = \frac{1-pq}{pq}\sigma \left(1 - F[ps(q\int_0^1 \theta g[\theta]d\theta - t)]\right) g[1] > 0. \tag{4}$$

This indicates that lowering r somewhat, that is, introducing self-reporting incentives, decreases social costs. ■

We find that the reduction of error costs is sufficient to make some self-reporting optimal. The reason is that lowering r marginally beneath qps will affect deterrence very little, while social costs are significantly lowered by the saving in error costs. That is, the increase in social costs due to the increase in violation incentives is continuous, whereas the reduction owing to error costs is discrete.

2.2.2 Equitable Treatment of Offenders

Fairness considerations may apply to the sanctioning of convicted offenders as well. Kaplow and Shavell (1994a) point out that self-reporting implies no enforcement cost savings if the enforcement method is monitoring.[12] In that case, two offenders, one of which self-reports whereas the other does not, both cause the same harm to society as they do not affect enforcement costs differently. In consequence, society may perceive it as unfair if they are treated differently.[13] The introduction of a self-reporting scheme introduces a discrepancy in the expected sanction for individuals that self-report and those that do not. If this is perceived as unfair, we need to reflect it in social costs. We include a function $v[\Delta]$ defined on $\Delta = qps - r \in [0, qps]$, that represents a dislike for inequitable treatment of offenders, $v[0] = 0$ and $v' > 0$.[14]

The social cost function that allows for this concern reads

$$\begin{aligned} SC^E =& (1 - F[\tilde{b}]) \left[h + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta) g[\theta] d\theta + (1 - G[\tilde{\theta}]) v[\Delta] \right] \\ &+ F[\tilde{b}]tps\sigma + C(p), \end{aligned} \tag{5}$$

[11] Note that without the incorporation of error considerations, i.e., $\sigma = 0$, the derivative is equal to $\left[-h\frac{\partial \tilde{b}}{\partial r} f[\tilde{b}]\right]$ and therefore provides incentives to increase r until $r = qps$ holds.

[12] The example provided by Kaplow and Shavell (1994a: 602) is that of police stationed at the roadside whose presence cannot be downscaled without affecting deterrence.

[13] The idea of costs due to a sanction differential is based on Polinsky and Shavell (2000). They introduce a fairness ideal with respect to sanctioning. Deviations in sanctioning are socially costly and occur in the form of offenders that escape detection and via offenders who are detected but convicted with a sanction that deviates from the fairness ideal.

[14] Note that capturing Δ in this way biases against self-reporting. An alternative assumption is that society includes the type information, for instance, by choosing $\hat{\Delta} = psq\int_0^1 \theta g[\theta]d\theta - r \leq \Delta$ for every r and given q, p, and s.

and yields the following first-order derivative for the self-reporting sanction;

$$SC_r^E = (1 - F[\tilde{b}]) \left[g[\tilde{\theta}] \frac{\partial \tilde{\theta}}{\partial r} [s\sigma(1 - pq\tilde{\theta}) - v[\Delta]] - (1 - G[\tilde{\theta}])v'[\Delta] \right]$$
$$- f[\tilde{b}] \frac{\partial \tilde{b}}{\partial r} \left[h + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta)g[\theta]d\theta + (1 - G[\tilde{\theta}])v[\Delta] - tps\sigma \right]. \quad (6)$$

We observe three consequences of the additional term. First, fairness costs lower the effect that higher r deters some individuals from self-reporting and thereby creates expected error costs since these individuals no longer cause fairness costs. Second, increasing the self-reporting sanction is beneficial since it decreases fairness costs $v[\Delta]$ that occur due to offenders who self-report. Finally, increasing r increases $\tilde{\theta}$ which is even more desirable if some offenders self report.

Corollary 1 *Suppose (a) ex post asymmetric information, (b) constant enforcement effort, and that society cares about (c) type I and type II errors and escapes from apprehension, as well as (d) equitable treatment of offenders, then some self-reporting lowers social costs.*

Hence, the additional fairness consideration does not affect the desirability of self-reporting in principle because the marginal costs of lowering r due to function $v[\Delta]$ bear no weight initially. The weight attached to marginal costs $v'[\Delta]$, $(1 - G[\tilde{\theta}])$, and the total magnitude of the term $v[\Delta]$ is zero at our margin, that is, at $r = qps$. Consequently, the first-order derivative (6 is positive at $r = qps$ and thereby indicates the cost advantages of introducing self-reporting incentives.

2.2.3 Fairness and Enforcement Costs

In this subsection, we inquire how fairness concerns interact with the reduction in enforcement effort motive.[15] In the analysis so far, we did not consider that self-reporting can reduce the number of individuals to whom enforcement effort is directed. However, as alluded to above, enforcement can take different forms and the expenses of some forms can be drastically reduced if some individuals self-report, whereas for others, such as monitoring, it might make little or no difference. To reflect this possible impact on enforcement costs in social costs, we implement a weight $\gamma \in [0, 1]$ attached to the set of self-reporters. Consequently, social costs SC^{FE} are

$$SC^{FE} = (1 - F[\tilde{b}]) \left[h + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta)g[\theta]d\theta \right]$$
$$+ F[\tilde{b}]tps\sigma + C(p) \left[1 - \gamma(1 - F[\tilde{b}])(1 - G[\tilde{\theta}]) \right]. \quad (7)$$

This social cost term is equal to the basic model for $\gamma = 0$. The new feature in comparison to the social objective function of the basic model is that enforcement costs with respect to offenders who self-report, $(1 - F[\tilde{b}])(1 - G[\tilde{\theta}])$, arise only in the amount of $(1 - \gamma)$.[16] We obtain

[15] Keep in mind that Feess and Heesen (2002) show that self-reporting is advantageous in the model applied here considering only the enforcement cost advantage.

[16] For instance, a $\gamma = 1$ can be a consequence of the fact that potential leads of these individuals no longer need to be investigated.

the following derivative with respect to r;

$$SC_r^{FE} = (1 - F[\tilde{b}])\frac{\partial \tilde{\theta}}{\partial r} g[\tilde{\theta}] \left\{ \gamma C(p) + \sigma s(1 - pq\tilde{\theta}) \right\} - f[\tilde{b}]\frac{\partial \tilde{b}}{\partial r} \left\{ h - \gamma C(p)(1 - G[\tilde{\theta}]) + G[\tilde{\theta}](1-p)s\sigma + ps\sigma \int_0^{\tilde{\theta}} (1 - q\theta) g[\theta] d\theta - tps\sigma \right\}. \tag{8}$$

The addition of enforcement cost savings, for one, makes it less desirable to deter individuals from self-reporting by increasing $\tilde{\theta}$ through r, and, for another, lowers the detrimental effects of higher violation incentives because the self-reporters set do not cause full enforcement costs. Since the consideration of fairness alone already yielded some self-reporting, we find that the following result holds.

Proposition 2 *Suppose (a) ex post asymmetric information, and (b) that society cares about type I and type II errors as well as escapes from apprehension, then allowing for enforcement cost savings in a framework with fairness concerns unambiguously argues for lowering the self-reporting sanction.*

Proof. The introduction of effects via enforcement costs can be captured by increasing γ somewhat from zero. Hence, we inquire after the sign of $\frac{dr}{d\gamma} = -\frac{SC_{r\gamma}}{SC_{rr}}$. Since a minimum demands $SC_{rr} > 0$, a decrease of r in γ requires $SC_{r\sigma} > 0$. The finding for the cross partial derivative, after due simplification, is in fact

$$SC_{r\gamma}^{FE} = C(p) \left\{ (1 - F[\tilde{b}]) g[\tilde{\theta}] \frac{\partial \tilde{\theta}}{\partial r} + (1 - G[\tilde{\theta}]) f[\tilde{b}] \frac{\partial \tilde{b}}{\partial r} \right\} > 0. \tag{9}$$

■

Consequently, in line with intuition, fairness combines with enforcement effort savings to argue for an even lower self-reporting sanction.

2.2.4 Extension: The Case of Ex Ante Heterogeneity

Assume that individuals do not get a private signal ex post but ex ante. This can be reasoned by referring to different offender experience, for instance.[17] Hence, varying offender experience causes different total detection and conviction probabilities which are foreseeable for individuals before they act. In this case, individuals decide before the offense whether they will self-report or not, given that they offend. The self-reporting sanction (the individualized expected sanction) defines the critical benefit level for individuals who self-report (do not report) as offender. For individuals who prefer to self-report, the critical benefit level is $b^* = r - tps$, while nonreporters require $\hat{b} = ps[\theta q - t]$. The time sequence in this setting is: (1) authority asserts r, (2) individual observes θ and decides whether self-reporting provides the lower expected sanction, (3) individual learns private information b and makes decision regarding the act, and (4) some individuals, offenders, and nonoffenders will be detected and some of these will be convicted according to policy variables from stage 1. The cut-off level for the type θ is still $\tilde{\theta} = r/qps$.

[17] Experienced criminals might be able to even plant misleading evidence, whereas inexperienced offenders cannot avoid leaving traces.

Social costs are given by

$$SC^{Ante} = \int_0^{\tilde{\theta}} \int_{\hat{b}}^{\infty} (h + p(1-q\theta)\sigma s + (1-p)\sigma s) f[b] db g[\theta] d\theta$$
$$+ h(1-G[\tilde{\theta}])(1-F[b^*]) + tps\sigma \left\{ (1-G[\tilde{\theta}])F[b^*] + G[\tilde{\theta}]F[\hat{b}] \right\} + C(p). \qquad (10)$$

Respective components of costs are: (i) harm and error potential of non-reporters who use cut-off level $\hat{b}$, (ii) harm of self-reporters who use cut-off level b^*, (iii) the expected error costs with respect to individuals who do not commit the offense, and (iv) enforcement costs.

This objective function has the following derivative with respect to r;

$$SC_r^{Ante} = \{tps\sigma(F[ps(q\tilde{\theta} - t)] - F[b^*]) - (1 - F[b^*])h + (1 - F[ps(q\tilde{\theta} - t)])[h + s\sigma(1 - pq\tilde{\theta})]\}$$
$$* g[\tilde{\theta}] \frac{\partial \tilde{\theta}}{\partial r} - f[b^*] \frac{\partial b^*}{\partial r} (1 - G[\tilde{\theta}]) [h - tps\sigma] . \qquad (11)$$

An increase in the sanction for self-reporters increases $\tilde{\theta}$. Consequently, more individuals take $\hat{b}$ as the relevant cut-off benefit level and create expected error costs. Furthermore, the borderline benefit b^*, relevant for self-reporters, increases, which lowers social costs by the harm corrected for the error potential of innocent individuals. We obtain the confirmation of our general finding in this framework as well.

Corollary 2 *Suppose (a) ex ante asymmetric information, (b) constant enforcement effort, and that (c) society cares about type I and type II errors as well as escapes from apprehension, then some self-reporting lowers social costs.*

We refer to (11), in which inserting $r = qps$ leaves only

$$SC_r^{Ante}(r = qps) = \frac{(1-pq)}{pq} \sigma (1 - F[\hat{b}]) g[1] > 0, \qquad (12)$$

so that introducing self-reporting incentives is again desirable.

3 Conclusion

A commonly observed feature of law enforcement is that offenders who report their acts to enforcement authorities are 'rewarded' by a reduction in the sanction. The widespread use in several jurisdictions suggests this practice to be advantageous. In the literature starting with Kaplow and Shavell (1994a), several advantages of observed lower sanctions for self-reporters have been established. We show that fairness is another factor that argues in favor of self-reporting in models with ex ante or ex post heterogeneity of offenders. What is more, self-reporting is optimal due to fairness even if there is no other advantage. The result continues to hold if differences in expected sanctions applied to convicted offenders who self-report and those who do not go to society's detriment. If we consider effects of enforcement effort besides fairness, we can confirm the intuition that the combination of motives yields an unambiguously lower self-reporting fine than fairness alone.

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