

# Precautionary Incentives for Privately Informed Victims\*

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## Abstract

When one victim's precautions against crime have spillover benefits to other victims, individuals do not take the socially optimal amount of precaution. I explore the use of criminal sanctions as a mechanism to correct this: criminals are punished based on the level of precaution taken by the victim. The problem is compounded when victims have private information about their costs of precaution. I find that, when a sanctioning scheme is used to induce different levels of precaution from high-cost and low-cost victims, a sanction less than the maximum may be used to punish crimes against either type of victim. I also consider the extent to which such a mechanism is consistent with current legal doctrine.

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# 1 Introduction

Crime imposes a number of costs on society. The state expends effort to protect the citizenry and to apprehend and prosecute criminals. Potential victims<sup>1</sup> of crime exercise costly precautionary measures, and some of these individuals suffer the actual harm of crime. Minimization of the total social cost of crime will certainly require some precautionary effort from victims, and it may benefit society as a whole to give victims additional incentive to take precautions. In this paper I explore the use of criminal sanctions as a mechanism to induce precautions from victims: criminals are punished based on the level of precaution taken by the victim. I consider the theoretical attractiveness of such a mechanism as well as the practical applicability. Certain elements of U.S. criminal law are consistent with this kind of differential sanctioning.

The state would like to induce more precautionary effort from victims when precautions have spillover effects among victims. The precaution of one victim may help other victims by taking a criminal's time or effort, as when a thief saws through iron bars to get at valuables, or by lowering the overall return to crime (Shavell, 1991). That is, the total amount of precaution taken by all potential victims may discourage a potential criminal from even attempting a particular crime. Individuals are likely to disregard the benefit to others of their own precautions, and thus take too little precaution from a social perspective.

Different victims may incur different costs in taking a given precaution. Consider a neighborhood with a high rate of auto theft. A reasonable precaution to take would be not parking one's car in that neighborhood. However, this action is much more costly for someone who lives in that neighborhood than for one who lives elsewhere.

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<sup>1</sup>Throughout the paper I shall use "victim" and "potential victim," as well as "criminal" and "potential criminal," interchangeably.

When victims have different costs of precaution, a criminal sanctioning scheme may associate a higher sanction with one type of victim.

Holding victims partially responsible for crimes committed against them is in the same spirit as the rule of comparative negligence in tort law, wherein both injurer and victim are held responsible according to the care each has exercised.<sup>2</sup> Cooter and Ulen (1986) and Rubinfeld (1987) find that, in many cases, comparative negligence is the most efficient rule. In the setting of criminal law, Hylton (1996) examines optimal enforcement when victim precaution is taken into account. The victim does not consider the state's enforcement costs or the litigation costs of an apprehended offender and thus takes insufficient precaution. The optimal penalty is then lower than it would be when victim precaution is not taken into account. The lower penalty gives the victim incentive to exercise more precaution. Shavell (1991) models various spillover effects of victim precaution that give rise to distortions in victims' incentives. He mentions some ways of correcting such distortions, such as a state subsidy for precautionary measures like alarms or other theft-deterrent devices.

Ben-Shahar and Harel (1995) propose basing the sanction against an apprehended criminal on the precaution that the victim actually took.<sup>3</sup> A criminal is punished less severely if the victim did not take the state-mandated precaution. A victim would then want to take the socially optimal precaution, because otherwise he or she will be a more attractive target to criminals. In Ben-Shahar and Harel's model, victims' costs of precaution, as well as the actual precautions taken by an individual victim, are observable to both the state and the criminal.

This paper explores the use of criminal sanctions as an incentive mechanism for

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<sup>2</sup>The model presented here is specific to crime in two respects: the social welfare function gives no weight to the benefit of a crime to the criminal, and the punishment bears no relation to the harm caused to the victim. The possibility of using a similar model to analyze torts is discussed in Section 6.

<sup>3</sup>Ben-Shahar and Harel (1996) more generally consider the ramifications of basing criminal punishments on the behavior of the victim as well as that of the perpetrator.

victims in a setting of incomplete information. Victims have either a high or low cost of taking precaution. The amount of precaution taken by a victim is observable, but the cost is not. An individual's precaution protects that individual, but also contributes to the aggregate level of precaution, which protects all victims. Individuals do not take the socially optimal level of precaution because they disregard the spillover benefit of their precautions.

I assume that there is an exogenous maximum sanction: there is a bound on the punishment that the state may inflict on a convicted criminal. But this maximum sanction will not always be used. It may be optimal for the state to induce different levels of precaution from high- and low-cost victims using two different sanctions. This paper thus provides an explanation for why the state would use a less-than-maximum sanction *on the equilibrium path*—the lower sanction is actually used, not simply presented as a threat. Crimes against a victim for whom precautions are very costly may be punished more severely than crimes against a victim for whom precautions are less costly. However, it may be optimal to punish crimes against a lower-cost victim more severely; then, a victim who takes *more* precaution is protected by a *lower* sanction. This counterintuitive case is of particular interest. I describe the circumstances that lead to each of these scenarios and the accompanying intuition.

I set up the model in Section 2 and solve for private and social optima in Section 3. I solve for the possible sanctioning schemes in Section 4; in Section 5, I discuss the practical applicability of such schemes. I conclude and consider extensions in Section 6.

## 2 The model

An individual's precautions have the direct effect of reducing his or her own expected harm from crime, but the same precautions have indirect effects on other potential

victims. For example, if many motorists install alarms in their cars, auto theft becomes less attractive to a potential thief. An individual's installation of an alarm directly benefits the individual as well as contributing to the overall presence of car alarms. However, individuals do not take the public benefit into account when choosing their level of precaution. Although there are private benefits of precaution, if all potential victims were to decide collectively how much each should take, the socially mandated precaution level would, in general, be different from the private.

In this model, precaution can be thought of as anything that makes it more difficult, or less desirable, for a criminal to commit a crime. The precautions may increase either the probability of apprehension or the effort required of the criminal, or decrease the benefit of a successful crime. In any case, the precautions must be observable, to the criminal as well as the courts, in order for a precaution-based sanctioning scheme to work.<sup>4</sup> Some examples of observable precautions are the use of conspicuous locks or alarms, avoiding situations in which crime is more likely, and marking property to make it more difficult to sell.<sup>5</sup>

The spillover effects of precautions can be thought of as lowering the overall return to criminal activity. The aggregate precaution might influence one's decision of whether to embark on a career of crime, or the decision of whether to attempt a crime at any particular time or in any particular place. Alternatively, if there is a high level of aggregate precaution, a criminal is likely to encounter precautionary measures when attempting a crime; faced with enough resistance, the criminal might give up and go home. In any event, the aggregate precaution protects an individual

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<sup>4</sup>With unobservable precautions, courts cannot base sanctions on precaution levels and criminals cannot choose victims based on the expected sanction for that particular victim. Victims will have private incentive to take precautions, and criminals will take the expected precaution (and the expected sanction) into account when deciding whether to commit a crime. If there is a distortion of victims' incentives away from the social optimum, the kind of sanctioning mechanism proposed in this paper cannot correct it.

<sup>5</sup>I am grateful to a referee for pointing out the latter example.

victim by reducing the probability that a criminal will even attempt a crime against that individual.<sup>6</sup>

I consider two types of victims, those with a high cost of precaution ( $c_H$ ) and those with a low cost of precaution ( $c_L$ ), where  $c_H > c_L$ . Although the precautions are observable, the costs are not. These may be thought of as opportunity costs. A potential victim may exercise precaution by avoiding areas in which there is a high crime rate. One who lives or works in such an area has more incentive to be there, or more difficulty avoiding it, than others do. More generally, one victim may simply have to sacrifice more than another in order to exercise the same level of precaution.

There are  $m$  high-cost and  $n$  low-cost victims, where  $m > 1$ ,  $n > 1$ ;  $m$  and  $n$  are observable to all. I use  $i$  to index high-cost victims and  $j$  to index low-cost victims. A high-cost victim  $i$  invests in precaution level  $x_i$  ( $x_i \geq 0$ ) at a cost of  $c_H x_i$ , and similarly for a low-cost victim  $j$ . If caught committing a crime, a criminal faces sanction  $s$ . I do not explicitly consider whether the sanction is monetary or non-monetary, but I do consider it to be costlessly imposed. I do not take into account the benefit of the crime to the criminal.<sup>7</sup> The sanction is bounded above by  $\bar{s}$ . If there is no bound on the sanction, the result follows Becker (1968): all crime can be deterred, and victims' incentives don't cause any problems. Here, however, when there is an exogenous

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<sup>6</sup>This same kind of spillover is discussed in Shavell (1991).

<sup>7</sup>Ben-Shahar and Harel (1995) consider the benefit to the criminal as a distortion of precautionary incentives: from a social standpoint, victims tend to overinvest in precautions because they do not take into account the benefit to the criminal of committing a crime. In this paper I offer a different reason for distortion of victims' incentives. Disregarding the benefit to the criminal might be particularly appealing in the case of violent crimes where no property is transferred. For crimes such as theft, if property rights are held to be inviolable, then a transfer of property should not be thought of as a social benefit, no matter how efficient the transfer seems from a purely economic perspective. We would exclude the criminal benefit from the social welfare function if we believe that the violation of individual rights costs so much that the benefit to the criminal could not possibly outweigh it. Posner (1985) argues that the function of criminal law is to prevent people from circumventing the market, i.e. a system of voluntary exchange. If the law is meant to force criminals to use the market, the benefit of crime to the criminal has no bearing upon the law itself. I am grateful to a referee for pointing out the latter reference.

maximum sanction, it will not always be used.

Let  $y = \sum_{k=1}^{m+n} x_k$  be the aggregate level of precaution. The victim suffers harm  $h$  with probability  $p(x_i, y, s)$ , where

$$(A_1) \quad p_x < 0, \quad p_{xx} > 0$$

$$(A_2) \quad p_y < 0, \quad p_{yy} > 0$$

$$(A_3) \quad p_s < 0, \quad p_{ss} > 0$$

$$(A_4) \quad p_{xs} > 0$$

$$(A_5) \quad p(x, y, 0) = 1 \quad \forall x, y$$

$$(A_6) \quad p_x(0, y, s) = -\infty \quad \forall y, \forall s > 0$$

$$(A_7) \quad p_y > \max \left\{ -\frac{c_L}{h} \left( \frac{m+1}{m+n} \right), -\frac{c_H}{h} \left( \frac{n+1}{m+n} \right) \right\}$$

$A_1$  through  $A_3$  say that the probability of harm decreases with one's own precaution, the aggregate level of precaution, and the severity of the sanction against the offender. There are diminishing marginal returns to each of these factors.  $A_4$  says that increasing the sanction decreases the marginal return to individual precaution; this guarantees that a victim will respond to a decrease in the sanction by taking more precaution.  $A_5$  says that, with a sanction of zero, a crime will be committed with certainty; there is no precaution a victim can take that will outweigh the total lack of punishment.<sup>8</sup>  $A_6$  says that a victim would rather take some precaution than no precaution, unless the sanction is zero.  $A_7$  essentially says that  $h$  is not too high relative to the victims' costs. If  $h$  is very high, the best the state can do is to apply

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<sup>8</sup>It may be that a victim can take so much precaution as to preclude the possibility of crime, no matter what the sanction. If such behavior were possible and desirable to a victim, the sanctioning scheme proposed here would not have the intended effect. It would not be possible to induce a victim to take additional precaution if the victim already takes so much precaution as to be totally insulated from crime.  $A_5$  assumes that there are enough potential criminals to commit crimes against all potential victims when the sanction is zero. In other words, when there is no punishment, anyone with the slightest inclination to commit a crime does so, and all potential crimes are at least attempted. Although the victim's precaution may make it more difficult for the criminal to commit the crime, in the absence of any sanction, the criminal is willing to endure such difficulty.

the maximum sanction in all cases and let victims take their privately optimal precaution. This guarantees that at least one of the sanctioning schemes in the following section is feasible.<sup>9</sup>

Victims are risk neutral: they minimize the sum of precautionary costs and expected harm from crime. The risk preference of criminals does not need to be specified. The behavior of the criminal is modeled only through the probability of harm to the victim.

If the state applies the maximum sanction in all cases, regardless of the precaution taken by the victim, the high-cost type's expected cost is

$$c_H x_i + hp(x_i, y, \bar{s}), \quad (1)$$

the low-cost type's expected cost is

$$c_L x_j + hp(x_j, y, \bar{s}), \quad (2)$$

and the expected social cost is

$$\sum_{i=1}^m \{c_H x_i + hp(x_i, y, \bar{s})\} + \sum_{j=m+1}^{m+n} \{c_L x_j^t + hp(x_j, y, \bar{s})\}. \quad (3)$$

The order of the game is the following:

**Stage 1:** The state announces  $(x_L, s_L)$  and  $(x_H, s_H)$ .

**Stage 2:** Victims choose precaution level.

**Stage 3:** Criminals observe victims' precaution levels and choose victims.

**Stage 4:** Apprehended criminals receive the appropriate sanction.

The analysis that follows focuses on Stages 1 and 2. The behavior and punishment

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<sup>9</sup>The necessity of the precise condition is detailed in the proof of Proposition 3, available from the author.



of criminals (Stages 3 and 4) are modeled through the probability of harm to victims.<sup>10</sup> In the following sections, proofs not given are available from the author.

### 3 Private and social optima

If the state applies the maximum sanction indiscriminately, victims choose their precautions to minimize their private costs:

$$p_x(x_i, y, \bar{s}) = -\frac{c_H}{h} \quad (4)$$

for  $i \in \{1, \dots, m\}$ , and

$$p_x(x_j, y, \bar{s}) = -\frac{c_L}{h} \quad (5)$$

for  $j \in \{m+1, \dots, m+n\}$ . Let  $\hat{x}_H$  and  $\hat{x}_L$  be the privately optimal precautions given that all crimes are punished with the maximum sanction  $\bar{s}$ , and let  $\hat{y} = m\hat{x}_H + n\hat{x}_L$ .

The socially optimal levels of precaution,  $x_H^*$  and  $x_L^*$ , are those that a social planner with the power to choose each victim's precaution would impose in order to maximize total welfare. Social welfare is maximized when the total cost to potential victims—the cost of precaution plus the expected harm from crime—is minimized.

**Proposition 1** *When all crimes are punished with the maximum sanction,  $\bar{s}$ , the socially optimal precautions,  $x_H^*$  and  $x_L^*$ , satisfy*

$$p_x(x_H^*, y^*, \bar{s}) = -\frac{c_H}{h} - [mp_y(x_H^*, y^*, \bar{s}) + np_y(x_L^*, y^*, \bar{s})] \quad (6)$$

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<sup>10</sup>We might imagine that there is a certain amount of randomness in a criminals' choice of victim. Even if the expected benefit to the criminal of committing a crime against one type of victim is higher than for the other type of victim, there will still be crimes committed against both types of victim. This can be justified by a cost to the criminal of finding a suitable victim.

and

$$p_x(x_L^*, y^*, \bar{s}) = -\frac{c_L}{h} - [mp_y(x_H^*, y^*, \bar{s}) + np_y(x_L^*, y^*, \bar{s})], \quad (7)$$

where  $y^* = mx_H^* + nx_L^*$ .

**Proof.** Total social cost is

$$\sum_{i=1}^m [c_H x_i + hp(x_i, y, s_H)] + \sum_{j=m+1}^{m+n} [c_L x_j + hp(x_j, y, s_L)]. \quad (8)$$

Minimization of social cost with respect to  $x_i$  and  $x_j$  gives

$$c_H + hp_x(x_i, y, \bar{s}) + mhp_y(x_i, y, \bar{s}) + nhp_y(x_j, y, \bar{s}) = 0 \quad (9)$$

and

$$c_L + hp_x(x_j, y, \bar{s}) + nhp_y(x_j, y, \bar{s}) + mhp_y(x_i, y, \bar{s}) = 0, \quad (10)$$

using symmetry of victims of each type. The socially optimal sanction is  $\bar{s}$ , since the sanction is costless but precautions are costly. Rearranging (9) and (10) yields (6) and (7). ■

In the absence of a corrective mechanism, both types of victim take too little precaution:

**Corollary 1** *When all crimes are punished with the maximum sanction, the privately optimal precaution is less than the socially optimal for both the high-cost type and the low-cost type:*

$$\hat{x}_H < x_H^* \quad (11)$$

$$\hat{x}_L < x_L^*. \quad (12)$$

**Proof.** Since  $p_y$  is always negative,  $p_x(x_H^*, y^*, \bar{s}) > p_x(\hat{x}_H, \hat{y}, \bar{s})$ . Given diminishing

marginal returns to precaution ( $p_{xx} > 0$ ), this implies  $\hat{x}_H < x_H^*$ . By similar reasoning,  $\hat{x}_L < x_L^*$ . ■

Since victims do not take into account the effect of their precautions on the aggregate precaution level, there is underinvestment in precaution.<sup>11</sup>

## 4 Sanctioning schemes

### 4.1 Perfect information

In this setting, “perfect information” means that victims’ costs as well as their precautions are observable. If this is the case, the sanction can be based on the victim’s cost of precaution, not only on the amount of precaution taken. A simple scheme will correct victims’ underinvestment in precaution: No sanction is imposed unless the victim has taken the socially optimal precaution given his cost. If the victim has not taken the socially optimal amount of precaution, the criminal faces no sanction. Thus, a criminal has more incentive to target a victim who takes anything but the socially optimal precaution. Victims, then, will take the socially optimal precaution since they face a greater probability of crime if they do not.<sup>12</sup>

### 4.2 Asymmetric information

I return now to the assumption that individual victims are the only ones who know their own cost of precaution. An apprehended criminal faces one of two sanctions,  $s_H$  or  $s_L$ , depending on whether the victim took precautions appropriate to a high-

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<sup>11</sup>This is a common type of result in the mechanism design literature: in the presence of an externality, agents’ privately optimal behavior diverges from the socially optimal behavior.

<sup>12</sup>Ben-Shahar and Harel (1995) suggest this kind of sanctioning scheme. In their model, victims all have the same cost of precaution, and only the maximum sanction is used in equilibrium.

or low-cost victim.<sup>13</sup> The social planner's problem is to choose a set of sanctions (for crimes against high- and low-cost victims) and the corresponding precaution levels to minimize total social cost,  $\sum_{i=1}^m [c_H x_i + hp(x_i, y, s_H)] + \sum_{j=m+1}^{m+n} [c_L x_j + hp(x_j, y, s_L)]$ . The planner observes all parameters of the model, including  $m$  and  $n$ , but not the actual cost of any given victim. A sanctioning scheme is defined by  $\{s_L, s_H, x_L, x_H\}$ . The planner is constrained by the maximum sanction:  $s_i \leq \bar{s}$  and  $s_j \leq \bar{s}$ . I consider only mechanisms that satisfy the incentive compatibility constraints:  $IC_H : c_H x_i + hp(x_i, y, s_H) \leq c_H x_j + hp(x_j, y, s_L)$  and  $IC_L : c_L x_j + hp(x_j, y, s_L) \leq c_L x_i + hp(x_i, y, s_H)$  for all  $i \in \{1, \dots, m\}$  and  $j \in \{m+1, \dots, m+n\}$ . That is, no high-cost victim would be better off by taking the low-cost precaution, and vice versa. By the revelation principle, this is without loss of generality.<sup>14</sup>

I refer to a sanctioning scheme in which both types of victim take the same precaution, and criminals receive the same sanction for crimes against each type of victim, as a “pooling” scheme. A sanctioning scheme in which the two types take different precautions and criminals are punished more severely for crimes against one of the two types is a “separating” scheme.<sup>15</sup>

There are two feasible separating schemes,  $S_1$  and  $S_2$ , and one feasible pooling scheme,  $P$ . In both of the separating schemes, the low-cost victim takes more precaution than the high-cost victim. In each separating scheme, crimes against one type of victim are punished with the maximum sanction, and crimes against the other type are punished with a lower sanction, giving one type extra incentive to take additional precaution. The desirability of implementing such schemes and their consistency with current legal doctrines are discussed in Section 5.

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<sup>13</sup>For completeness, there would also be a sanction of zero if the victim has taken neither of the appropriate precautions.  $A_5$  guarantees that this will not be imposed in equilibrium.

<sup>14</sup>See, for example, Fudenberg and Tirole (1991), Chapter 7. Note that there are no individual rationality constraints because not participating is not an option.

<sup>15</sup>The terms *pooling* and *separating* are used in signalling games with somewhat different connotations. I use them here in the interest of brevity.

Scheme  $P$  is  $\left\{s_L^{(p)}, s_H^{(p)}, x_L^{(p)}, x_H^{(p)}\right\}$ , where  $x_H^{(p)} = x_L^{(p)} = x^{(p)}$  and  $s_H^{(p)} = s_L^{(p)} = \bar{s}$ . Scheme  $S_1$  is  $\left\{s_L^{(1)}, s_H^{(1)}, x_L^{(1)}, x_H^{(1)}\right\}$ , where  $x_L^{(1)} > x_H^{(1)}$ ,  $s_L^{(1)} = \bar{s}$ , and  $s_H^{(1)} < \bar{s}$ . Scheme  $S_2$  is  $\left\{s_L^{(2)}, s_H^{(2)}, x_L^{(2)}, x_H^{(2)}\right\}$ , where  $x_L^{(2)} > x_H^{(2)}$ ,  $s_L^{(2)} < \bar{s}$ , and  $s_H^{(2)} = \bar{s}$ . Complete characterizations of  $P$ ,  $S_1$ , and  $S_2$  can be found in Section 7. In all three sanctioning schemes, if any victim takes any precaution other than that prescribed by the planner, the sanction is zero.

The welfare-maximizing sanctioning scheme will always be one of these three. The planner can always implement the pooling scheme and at least one of the two separating schemes. Which scheme the social planner would prefer to implement depends upon which gives a greater social welfare (lower social cost). This is discussed at the end of this section.

**Proposition 2** *One of  $P$ ,  $S_1$ , and  $S_2$  minimizes social cost; no other implementable set of sanctions and precautions implies a social cost lower than that obtained under these three schemes.*

**Proposition 3** *The sanctioning schemes  $P$  and  $S_2$  are always implementable.  $S_1$  is implementable if  $c_H$  is not too high relative to  $c_L$ .*

As we would expect, the low-cost victim exercises at least as much precaution as the high-cost victim under all three schemes.

**Corollary 2** *In every sanctioning scheme, the precaution exercised by the high-cost victim is less than or equal to that exercised by the low-cost victim.*

**Proof.** Adding  $IC_H$  and  $IC_L$ , and using symmetry of victims ( $x_i = x_H \forall i$ ,  $x_j = x_L \forall j$ ), we have  $x_H \leq x_L$ . ■

No scheme requires either type to take the first-best precaution ( $x_H^*$  or  $x_L^*$ ); i.e., neither type of victim takes as much precaution as would be dictated by a social

planner with the power to mandate all victims' behavior.<sup>16</sup>

**Corollary 3** *It is not generally optimal to induce the first-best precaution from either type of victim.*

In the two separating schemes, crimes against one type of victim are punished as harshly as possible, while crimes against the other type are not. This use of the sanction is the means by which high- and low-cost types are induced to take more precaution (i.e., more precaution than they would take if they only had private incentives to do so). Since the low-cost victim always takes more precaution than the high-cost victim, it may seem intuitive that crimes against the low-cost victim should be punished with the higher sanction. However, this is not necessarily the case.

**Corollary 4** *If a separating scheme is socially optimal, crimes against one type of victim are punished with a sanction less than the maximum. In  $S_1$ , the less-than-maximum sanction is used for crimes against the high-cost type; in  $S_2$ , the less-than-maximum sanction is used for crimes against the low-cost type.*

If the state punishes the criminal based on the victim's precaution level, it might seem most reasonable to associate the greater sanction with the greater precaution—to “reward” more cautious victims. However, it is possible that the best course of action is just the opposite: it may be socially beneficial to impose a *greater* sanction on crimes against *less* cautious victims. It is not possible to specify analytically the

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<sup>16</sup>In a typical mechanism design problem (see, for example, Fudenberg and Tirole (1991), Chapter 7), the principal induces one type of agent to act in a first-best manner, while the other type or types are allowed to diverge from the first-best as an information rent. This does not happen here because of the interaction between the precautions of the two types of victim. In  $S_1$  and  $S_2$ , the expressions characterizing the low-cost victim's precaution include the high-cost victim's precaution. The high-cost precaution is not first-best, and this draws the low-cost precaution away from first-best also. It may be possible to induce the first-best precaution from one type, but doing so would require distorting the other type's precaution so much that social welfare would suffer on the whole.

conditions under which each sanctioning scheme is socially optimal.<sup>17</sup> The intuition for the use of the maximum vs. the less-than-maximum sanction is as follows:

When an individual takes more precaution, there is a private benefit and a social benefit. The social benefit of additional precaution—the contribution to aggregate precaution, which helps to protect all victims—is the same whether it is taken by a high- or low-cost victim. Both types of victim have private incentives to take less precaution than is socially optimal, and so both types are being given incentive to take more precaution. The sanction is being used to provide this incentive and to induce the two types to reveal themselves truthfully. Lowering the sanction against one type of victim has the cost of offering less of a direct deterrent to criminals, but it has the benefit of getting that type of victim to exercise more socially beneficial precaution. The state faces two questions: should it lower the sanction against one type of victim, or should it simply use the maximum sanction in all cases? And if a lower sanction will be used for one type of victim, should it be for the low-cost or the high-cost victim?

If  $c_H$  and  $c_L$  are very close together (if there is not much difference between the two types of victim), there is not much to be gained by using a sanction less than the maximum. There is no significant benefit to giving one type of victim extra incentive to take precaution; the loss of the direct deterrent effect of the high sanction outweighs this benefit. The optimal scheme in this case is  $P$ : both types of victim take the same precaution, and all crimes are punished with the maximum sanction.

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<sup>17</sup>No reasonable set of assumptions on  $p$ , the probability of harm to a potential victim, allows for such specification. The complementary slackness conditions involve the difference between  $p(x_H, y, s_H)$  and  $p(x_L, y, s_L)$ . Whether this difference is convex is indeterminate, given that each term is convex in all its arguments (and that one term is positive and the other negative). To determine the convexity of the difference, we would need to assume something like the following:  $p$  is convex over the range of  $x_H$  but concave over the range of  $x_L$ . That  $p$  is concave for large values of  $x$  (i.e., that the return to precaution is increasing for high levels of precaution) is not intuitively appealing. It would be particularly unappealing to assume that  $p$  is necessarily convex over the range of the high-cost type's precaution but concave over the range of the low-cost type's precaution.

If  $c_H$  and  $c_L$  are not sufficiently close together,  $P$  is not optimal; the state will choose one of the separating schemes. If there is not a drastic difference between the two costs,  $S_1$  and  $S_2$  are both implementable. Which scheme is better depends on the difference in cost and the difference in the additional precaution that would be induced from each type of victim if the sanction were lowered.<sup>18</sup> Consider the following scenario: (1) if an individual takes very little precaution, additional precaution has a relatively large impact on the probability of harm (i.e., precaution is relatively productive); and (2) if the sanction is very low, increasing the sanction has a relatively large impact on the probability of harm. Then, when the sanction is low, a change in the sanction will induce a relatively large change in the precaution taken by the victim. Now, it is always the case that the high-cost type takes less precaution than the low-cost type. So, in this scenario, because the productivity of precaution is greater at lower levels of precaution, when the sanction is low, the high-cost victim tends to be *more* responsive to changes in the sanction than the low-cost victim. However, the greater cost of precaution itself tends to make the high-cost victim *less* responsive to changes in the sanction. Weighing these two effects against each other determines which sanctioning scheme is optimal. The optimal scheme is  $S_1$  (the greater sanction is associated with greater precaution) if both of the following are true: (1) lowering the sanction for crimes against high-cost victims induces more additional precaution than lowering the sanction for crimes against low-cost victims; and (2) the additional cost incurred by the high-cost victims does not outweigh this additional benefit. Otherwise, the optimal scheme is  $S_2$ .

If  $c_H$  is very high relative to  $c_L$ ,  $S_1$  is not implementable. If a separating scheme is used, it must be  $S_2$ . Here the low-cost victim is protected by the lower sanction and is thus given relatively greater incentive to take precaution. Although the low-cost type tends to take more precaution than the high-cost type anyway, the lower cost is

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<sup>18</sup>The reasoning here is similar to that found in Hylton (1996) and Polinsky and Rubinfeld (1988).



so much lower that it is better to use the lower sanction to induce the low-cost type to take even more precaution. The use of the lower sanction *increases* the disparity in the contributions of the high- and low-cost types to aggregate precaution. Such a disparity is socially beneficial because of the disparity in the costs of precaution.

Even though the planner would like to encourage more precaution from all victims, it is not necessarily the case that taking more precaution is rewarded with a higher sanction. The *lower* sanction may be used to punish crimes against the low-cost victim, who takes *more* precaution than the high-cost victim.<sup>19</sup>

## 5 The case for differential sanctions

It may seem that basing a criminal sanction on the amount of precaution taken by the victim would be a radical change in accepted legal doctrine, and would perhaps be morally objectionable. However, the law may be viewed as a means to create efficiency: the most effective laws are those that serve to minimize the total costs of crime, including precautionary and enforcement costs as well as the actual harm from crime. In many cases, a potential victim's precautions are more cost-effective than the state's enforcement efforts. Or, as this paper has explored, a victim's private incentive to take precaution may diverge from the socially optimal precaution. Giving victims more incentive to take precautions can make society as a whole better off. We might view differential sanctioning as rewarding a victim who has taken appropriate precautions rather than as punishing a victim who has not.

Harel (1994) argues that “to disregard the victim's conduct in determining the

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<sup>19</sup>It may seem that the low-cost victim would then prefer to take the lower precaution prescribed for the high-cost victim, and thus be protected by the higher sanction. The low-cost victim would incur a lower cost by taking less precaution, but the difference in cost is not as great as it is for the high-cost victim, and the low-cost victim would lose some of the direct benefits of the precautions. The higher sanction does not make up for this loss.

sanctions of criminals... is both inefficient and unfair.”<sup>20</sup> Ben-Shahar and Harel (1995) take a similar stance. A doctrine of comparative fault in criminal law is analogous to comparative negligence in tort law. A tortfeasor may not be held liable for the full extent of the damages of an act if the victim did not exercise due precaution. This gives potential victims more incentive to take precautions. Cooter and Ulen (1986) and Rubinfeld (1987) have argued for the efficiency of comparative negligence. Harel (1994) goes on to argue that there is evidence of the principle of comparative fault in criminal law. He cites the doctrine of provocation as an example:

One way to reduce a homicide charge from murder to voluntary manslaughter is to show that the intentional killing occurred in the heat of passion as a result of provocation.<sup>21</sup>

A victim who has provoked an attacker is seen as contributing to the harm caused; the attacker is then punished less severely. Generally, according to the U.S. Federal Sentencing Guidelines, sentence should be reduced whenever “the victim’s wrongful conduct contributed significantly” to the commission of the offense.<sup>22</sup>

Harel also explains a puzzling aspect of the punishment of property crimes through comparative fault. Robbery, which typically involves theft combined with assault or battery, receives a harsher punishment than the sum of independent acts of theft and assault or battery. The explanation for this is that, in simple theft, the victim generally has not taken any special precautions to protect his or her property, whereas in the case of robbery, property has forcibly been taken from a victim who gave it up only under the threat of physical harm.<sup>23</sup> Similarly, if a victim was physically restrained during the commission of an offense—i.e., if the victim resisted to the

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<sup>20</sup>Harel (1994), p. 1183.

<sup>21</sup>Harel (1994), p. 1212.

<sup>22</sup>United States Federal Sentencing Guidelines, §5K2.10.

<sup>23</sup>Harel (1994), p. 1224.

degree that the criminal had to restrain the victim in order to carry out the crime—sentence should be increased.<sup>24</sup>

In all of these cases, *greater* precaution is associated with a *greater* sanction. This accords with the intuitive notion that greater precaution should be rewarded. However, as this paper has shown, it may be better to punish crimes against more cautious victims less severely. This gives the victims who typically take more precaution—those with a lower cost of precaution—extra incentive to take precaution, thus contributing more to aggregate precaution. One example where the harsher punishment is associated with the lower precaution is the sentencing guideline for vulnerable victims: one who commits a crime against a victim who is particularly vulnerable (because of physical weakness, mental incapacity, etc.) is subject to a greater punishment.<sup>25</sup> A vulnerable victim has a larger cost of precaution and will therefore be less inclined to take precaution than a non-vulnerable victim; *less* precaution is associated with a *greater* sanction. Another example of such sanctioning is the punishment of criminal attempt. Ben-Shahar and Harel (1996) point out that greater precautions lower the probability that an attempted crime will be successful; therefore, punishing attempted crimes less severely than successful crimes equates greater precaution with lower punishment.<sup>26</sup>

The latter two examples might seem to be unusual, or at least counterintuitive; if victim precaution is considered in sentencing, it might seem most sensible, and fair, to impose a more severe sentence if the victim took more precaution. But this practice may be misguided. This paper has made a theoretical argument for the efficiency of various sanctioning schemes. The case in which the efficient scheme calls for a lower

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<sup>24</sup>United States Federal Sentencing Guidelines, §3A1.3. The adjustment to the sentence is not applied when the offense specifically incorporates the use of physical restraint.

<sup>25</sup>United States Federal Sentencing Guidelines, §3A1.1. I am grateful to a referee for pointing out this example.

<sup>26</sup>I am grateful to a referee for pointing out this example.

sanction to be associated with greater precaution may be of practical significance, or it may simply be a theoretical curiosity. This question, as well as the importance of differing costs of precaution in general, could perhaps be explored empirically.

## 6 Conclusion

If there are precautionary spillovers among potential victims, each victim has incentive to take a socially inefficient level of precaution. This problem can be remedied to some degree by making criminal sanctions contingent upon the precaution taken by the victim. If victims have different costs of precaution, and this cost is unobservable, a sanctioning scheme can induce different levels of precaution from high- and low-cost victims, bringing victims' precautionary levels closer to the social optimum.

The need to induce precaution from victims is one reason why the state may use a sanction lower than the maximum in equilibrium. I have found that it may be better to use the greater sanction to punish crimes against either high- or low-cost victims, depending on the difference in cost and the difference in the magnitude of the impact of a change in the sanction on the change in precaution taken. This is contrary to the intuitively appealing notion that greater sanctions should always be used to punish crimes against particularly cautious victims. Certain criminal law doctrines are consistent with the use of greater sanctions for crimes against victims who have taken greater precaution. Such practices may be misguided. However, the intent is not: the state can use criminal sanctions to create better incentives for private precaution. Indiscriminate enforcement effort is not the only crime-fighting tool at the state's disposal.

Possible extensions to this model include analysis of civil liability<sup>27</sup> and the inclu-

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<sup>27</sup>If there is a positive externality between potential tortfeasors and potential victims, the appropriate level of precaution from each party is higher than without the externality. Perhaps the victim's

sion of the state's precautionary effort.<sup>28</sup>

## 7 Appendix

The pooling scheme,  $P$ , is characterized by the following:

$$s_L = s_H = \bar{s} \quad (13)$$

$$x_L = x_H = x \quad (14)$$

$$p_x(x, y, \bar{s}) = -\frac{c_H + c_L}{2h} - \frac{(n + m)p_y(x, y, \bar{s})}{2}. \quad (15)$$

The first separating scheme,  $S_1$ , is characterized by the following:

$$s_L = \bar{s} \quad (16)$$

$$p_x(x_H, y, s_H) = \frac{c_H - mc_L}{(m - 1)h} + \frac{(n + m)p_y(x_L, y, s_L)}{m - 1} \quad (17)$$

$$p_x(x_L, y, s_L) = -\frac{c_L}{h} - \frac{np_y(x_L, y, s_L) + mp_y(x_H, y, s_H)}{m + 1} \quad (18)$$

$$p(x_L, y, s_L) - p(x_H, y, s_H) = \frac{c_L(x_H - x_L)}{h}. \quad (19)$$

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carelessness (e.g., driving too fast) magnifies the potential damage of the tortfeasor's carelessness (e.g., driving while intoxicated). It may not be possible to induce the appropriate precautions from both parties by simply assessing a share of the actual damages from each. Analogously to the criminal model here, one of the involved parties would be assessed a higher share of the damages for taking suboptimal precautions. However, this would give the other party less incentive to take precautions. It may therefore be necessary to hold injurer and victim responsible for shares of the damages that add up to more than the actual damages. This is a new reason for decoupling liability (allowing the plaintiff's award to differ from the defendant's payment). Polinsky and Che (1991) show that decoupling liability can give the defendant adequate incentive to take care while reducing the plaintiff's incentive to sue, thus lowering expected litigation costs.

<sup>28</sup>If the sanction can depend on the victims' precaution, the state's expenditure may depend on it also. Offering more protection to appropriately cautious potential victims and more strenuous enforcement to actual victims may bring the social cost of crime closer to first-best.

The second separating scheme,  $S_2$ , is characterized by the following:

$$s_H = \bar{s} \quad (20)$$

$$p_x(x_H, y, s_H) = -\frac{c_H}{h} - \frac{mp_y(x_H, y, s_H) + np_y(x_L, y, s_L)}{n+1} \quad (21)$$

$$p_x(x_L, y, s_L) = \frac{c_L - nc_H}{(n-1)h} + \frac{(m+n)p_y(x_H, y, s_H)}{n-1}. \quad (22)$$

$$p(x_H, y, s_H) - p(x_L, y, s_L) = \frac{c_H(x_L - x_H)}{h}. \quad (23)$$

Let  $\lambda_i$  and  $\lambda_j$  be the respective Lagrange multipliers for  $IC_H$  and  $IC_L$ , and let  $\mu_i$  and  $\mu_j$  be the respective Lagrange multipliers for  $C_H$  and  $C_L$ . The Lagrangian for the optimization problem is

$$\begin{aligned} L = & -\sum_{i=1}^m \{c_H x_i + hp(x_i, y, s_i)\} - \sum_{j=m+1}^{m+n} \{c_L x_j + hp(x_j, y, s_j)\} \\ & -\lambda_i \{c_H(x_i - x_j) + h[p(x_i, y, s_i) - p(x_j, y, s_j)]\} \\ & -\lambda_j \{c_L(x_j - x_i) + h[p(x_j, y, s_j) - p(x_i, y, s_i)]\} \\ & -\mu_i [s_i - \bar{s}] - \mu_j [s_j - \bar{s}] \end{aligned} \quad (24)$$

where  $x_i, x_j, s_i, s_j, \lambda_i, \lambda_j, \mu_i, \mu_j \geq 0 \forall i, j$ . It is straightforward to find the necessary conditions for solutions to this problem, which lead immediately to Propositions 2 and 3 and Corollary 3. Full details of the solution are available from the author.

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