A note on the optimality of strict liability

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Abstract

I show that, contrary to what is widely accepted, in situations of unilateral care a rule of strict liability is not optimal. The difference between my results and previous ones follows from my consideration of the victim's rational behavior.

1. Introduction

It is well known that the tort system is in turmoil; the unfortunate purpose of this paper is to add a bit of theoretical confusion to the actual chaos. It is widely accepted that, in situations of unilateral care, a rule of strict liability leads an injurer to engage in an optimal level of activity and precaution. [1] I claim below that this optimality follows directly from ignoring the victim's rational behavior.

In earlier work, the victim's level of activity has been assumed away by considering it to be fixed; yet, no reason whatsoever has ever been given to support the plausibility of this assumption. Shavell (1980), for example, discussing the interaction between drivers (injurers) and pedestrians (victims), simply invites the reader to 'imagine the behavior of pedestrians to be fixed'. [2] I show below in a simple model that, when this unrealistic assumption is relaxed and the victim's rational behavior is considered, the widely accepted optimality of strict liability breaks down.

2. The model

Consider a framework in which the (representative) injurer's utility function (U) depends solely on the injurer's level of activity (s); that is, $U = U(s)$, such that $U_s > 0$ and $U_{ss} < 0$. The cost of engaging in activity s is given by $C = C(s)$, such that $C_s > 0$ and $C_{ss} > 0$. When engaging in his activity, the injurer may exercise precaution at a cost P, which depends on the injurer's level of precaution (x); that is, $P = P(x)$, such that $P_x > 0$ and $P_{xx} > 0$. The (representative) victim's utility function (V) depends solely on the victim's level of activity (t); that is, $V = V(t)$, such that $V_t > 0$

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[1] See, for example, Shavell (1980, 1987) and Landes and Posner (1987).
[2] Shavell (1980, p. 2).

and $V_{tt} < 0$. The cost of engaging in activity t is given by $D = D(t)$, such that $D_t > 0$ and $D_{tt} > 0$. Since the situation to be analyzed is one of unilateral care (that is, a situation in which only the injurer's level of precaution determines the probability of an accident), then the victim does not exercise precaution.

The possibility of an accident creates an expected accident loss (l) or, simply, an expected loss. This expected loss should be thought of as the product between the certain loss of an accident (L), which depends on the level of activity of the injurer and the victim, and the probability that an accident occurs (p), which depends on the injurer's level of precaution; that is, $l(s, t, x) = p(x)L(s, t)$, such that $l_s > 0$, $l_t > 0$, $l_x < 0$, $l_{ss} > 0$, $l_{tt} > 0$, $l_{xx} > 0$, $l_{st} > 0$, $l_{sx} < 0$ and $l_{tx} < 0$. It is here that the departure from the previous literature begins.

The last assumptions not only imply that the expected loss is increasing in the injurer's level of activity ($l_s > 0$) and decreasing in the injurer's level of precaution ($l_x < 0$); *they also imply that the expected loss is increasing in the victim's level of activity* ($l_t > 0$). Consider Shavell's (1980, 1987) example of accidents involving drivers and pedestrians. [3] His model correctly reflects the fact that the more drivers drive and the less precaution they take, the higher the expected loss. And yet, *should it not also reflect the fact that the more pedestrians walk, the higher the expected loss?*

Consider the problem of maximizing the welfare of society (W), defined as the joint utility of the injurer and the victim, net of the cost of the activities, the cost of precaution and the expected loss. That is

$$\max_{s,t,x} W = U(s) + V(t) - C(s) - D(t) - P(x) - l(s, t, x) \,. \tag{1}$$

The first-order conditions for this problem are given by

$$U_s(s^*) = C_s(s^*) + l_s(s^*, t^*, x^*) \,, \tag{2}$$

$$V_t(t^*) = D_t(t^*) + l_t(s^*, t^*, x^*) \,, \tag{3}$$

$$P_x(x^*) = -l_x(s^*, t^*, x^*) \,. \tag{4}$$

Expression (2) shows that the injurer should choose his level of activity by balancing its marginal benefit (U_s) against its marginal cost (C_s) and the marginal expected loss generated by his activity (l_s). Expression (3) shows the same for the victim. Finally, expression (4) shows that the injurer should choose his level of precaution by balancing the marginal cost of precaution (P_x) against the marginal reduction in the expected loss ($-l_x$). Thus, the socially-optimal values of the injurer's level of activity (s^*), the victim's level of activity (t^*) and the injurer's level of precaution (x^*) solve simultaneously from the system (2)–(4).

Consider now a framework in which the injurer and the victim each solve their own problem subject to a rule of strict liability. Consider first the victim's problem, which is the part of the analysis that has been ignored in earlier work. The victim's behavior is established in the following proposition:

Proposition 1. *If a situation of unilateral care is governed by a rule of strict liability, then the victim engages in a higher-than-socially-optimal level of activity.*

Proof. The victim privately chooses his level of activity in order to maximize his net utility,

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[3] Note, however, that this not a good example. It is troublesome to accept that a clear situation of bilateral care is *assumed* to be one of unilateral care.

which is independent of the expected loss; for, under strict liability, the injurer bears the loss of any accident. Thus, the victim's problem is:

$$\max_{t} \{V(t) - D(t)\},$$ (5)

for which the first-order condition is

$$V_t(t^0) = D_t(t^0).$$ (6)

Let t^0 be the level of activity that solves from (6). It follows directly from comparing (6) and (3) that $t^0 > t^*$. □

Expression (6) shows that the victim chooses his level of activity by balancing the marginal benefit (V_t) and the marginal cost (D_t) of his activity, thus ignoring the marginal increase in the expected loss (l_t). In other words, since the victim is compensated for any accident loss, then he ignores such a cost. Hence, *the victim engages in an excessive level of activity*. This point has been surprisingly ignored in the previous literature.

Earlier analyses assumed an inexplicable asymmetry between the victim and the injurer; the latter (but not the former) was assumed to maximize his net utility by choosing the variables under his control. Thus, the optimality of strict liability stemmed from the fact that the victim's level of activity, assumed to be fixed, was simply not considered. The model presented here, by explicitly considering the victim's rational behavior, overcomes this weakness of previous analyses.

Having shown that the victim engages in a level of activity that is higher than socially desirable, I turn now to show how the results previously derived in the literature change. A point that seems to be missed by both Shavell (1980, 1987) and Landes and Posner (1987) is established in the following proposition:

Proposition 2. If a situation of unilateral care is governed by a rule of strict liability, then the injurer's socially-optimal level of activity (s^*) and precaution (x^*) are no longer optimal.

Proof. Considering the victim's behavior established in Proposition 1, the problem of maximizing social welfare *given* the victim's decision becomes

$$\max_{s,x} \{U(s) + V(t^0) - C(s) - D(t^0) - P(x) - l(s, t^0, x)\},$$ (7)

for which the first-order conditions are

$$U_s(s^M) = C_s(s^M) + l_s(s^M, t^0, x^M),$$ (8)

$$P_x(x^M) = -l_x(s^M, t^0, x^M).$$ (9)

Let (s^M, x^M) be the solution of the system (8)–(9); that is, the injurer's level of activity and precaution that maximize social welfare, given the victim's higher-than-socially-optimal level of activity $(t^0 > t^*)$. Since, by assumption, $l_{st} > 0$ and $l_{xt} < 0$, it then follows that $l_s(s^M, t^0, x^M) \neq l_s(s^M, t^*, x^M)$ and $l_x(s^M, t^0, x^M) \neq l_x(s^M, t^*, x^M)$. Therefore, it follows directly from (8)–(9) that, generically, $s^M \neq s^*$ and $x^M \neq x^*$. □

Mathematically, Proposition 2 states that the values of s and x that solve from the system (8)–(9) are not the same as those that solve from the system (2)–(4). Intuitively, it says that an

increase in the victim's level of activity changes marginal expected losses, thus changing the injurer's level of activity and precaution that maximize social welfare. [4]

The injurer's private problem is to maximize his net utility, given the victim's higher-than-socially-optimal level of activity; that is

$$\max_{s,x} \{U(s) - C(s) - P(x) - l(s, t^0, x)\} \,, \tag{10}$$

for which the first-order conditions are

$$U_s(s^0) = C_s(s^0) + l_s(s^0, t^0, x^0) \,, \tag{11}$$

$$P_x(x^0) = -l_x(s^0, t^0, x^0) \,. \tag{12}$$

The solution of this system (s^0, x^0) yields the injurer's level of activity and precaution that maximize his net utility. Note that this solution is identical to the one that arises from the system (8)–(9) because, when maximizing with respect to s and x, expressions (7) and (10) yield the same first-order conditions. Thus, $(s^0, x^0) = (s^M, x^M)$.

I turn now to analyze the injurer's reaction as a response to the higher-than-socially-optimal level of activity in which the victim engages. Put differently, I turn to compare the injurer's socially-optimal level of activity and precaution (s^*, x^*) to the level of activity and precaution in which the injurer engages under a rule of strict liability (s^0, x^0). Such a comparison is established in the following proposition:

Proposition 3.   If a situation of unilateral care is governed by a rule of strict liability, then the optimal reaction of the injurer as a response to the victim's higher-than-socially-optimal level of activity is given by

$$\partial s / \partial t = [l_{sx} l_{xt} - (P_{xx} + l_{xx}) l_{st}] / H \,, \tag{13}$$

$$\partial x / \partial t = [(U_{ss} - C_{ss} - l_{ss}) l_{xt} + l_{st} l_{xs}] / H \,, \tag{14}$$

where

$$H \equiv -(U_{ss} - C_{ss} - l_{ss})(P_{xx} + l_{xx}) - (l_{sx})^2 > 0 \,. \tag{15}$$

Furthermore, if

$$l_{st} > l_{sx} l_{xt} / (P_{xx} + l_{xx}) \,, \tag{16}$$

$$l_{xt} > -l_{st} l_{xs} / (U_{ss} - C_{ss} - l_{ss}) \,, \tag{17}$$

then the optimal reaction of the injurer as a response to the victim's higher-than-socially-optimal level of activity is to reduce his level of activity and to increase his level of precaution.

Proof.   Expression (13) follows from the derivation of the system (11)–(12) with respect to s and t. Similarly, expression (14) follows from the derivation of the same system with respect to x and t. The fact that the determinant of the system (H) is positive follows from the fact that this

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[4] The strict concavity of W implies that social welfare is maximized *only* when $(s, t, x) = (s^*, t^*, x^*)$. Hence, social welfare is lower when $(s, t, x) = (s^M, t^0, x^M)$.

determinant is equal to the Hessian of the system (11)–(12). [5] Finally, it can be determined by simple inspection that the two conditions stated in expressions (16) and (17) are sufficient to unambiguously determine the signs of (13) and (14), respectively. □

Unfortunately, the injurer's response to the victim's excessive level of activity cannot be unambiguously determined. That is the case because first-order effects and second-order effects act in opposite directions. Yet, expressions (16) and (17) establish that, if first-order effects dominate second-order effects, then the optimal reaction of the injurer as a response to the victim's excessive level of activity is to decrease his level of activity and to increase his level of precaution.

3. Conclusions

I have shown that, contrary to what is widely accepted, in situations of unilateral care a rule of strict liability does not yield a socially-efficient outcome. The widely accepted optimality of strict liability followed from a framework in which the injurer behaved rationally but the victim did not. Or, put differently, from a framework in which the victim's level of activity was considered to be fixed; hence, his behavior was ignored. But never a good reason was given to justify this asymmetry. I have shown that, when this unrealistic asymmetry is relaxed, the optimality of strict liability in situations of unilateral care breaks down. This result is not only strong but also intuitively plausible. Since strict liability places the victim in a situation of indifference with respect to accident losses, then the victim ignores this cost when deciding the level of activity in which he will engage. Once the victim decides to engage in an excessive level of activity, the rest of the results follow.

References

Landes, W. and R. Posner, 1987, The economic structure of tort law (Harvard University Press).
Shavell, S., 1980, Strict liability versus negligence, Journal of Legal Studies 9, 1–25.
Shavell, S., 1987, Economic analysis of accident law (Harvard University Press).

[5] For (10) to be maximized, it has to be the case that $H > 0$.