

Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?

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Introduction

- Economists have generally viewed ex ante and ex post policies as substitutes for correcting externalities
- ① **Ex-Ante:** affect an activity before the externality is generated
- ② **Ex-Post:** regulate the externality only after it has been generated and harm has occurred

- Ex ante and ex post policies are very frequently used jointly

- Hospital located next to a noisy, dusty cement-manufacturing plant
 - inefficiencies are minimized by zoning ordinances (Ex-ante)
 - exposing the externality generator to nuisance liability (Ex-post)
- New drugs
 - test before the drugs are licensed by the federal Food and Drug Adm. (Ex-ante)
 - exposing the drug manufacturer to strict product liability (Ex-post)

- Criticism:

- ① In the case of ex ante regulation, the typical criticism is that the central regulator has imperfect information on accident costs and damages.
 - ② Suit may not always be brought against injurers and that uncertainty regarding the legal standard leads to over or underprotection.
- This paper first identifies a set of inefficiencies associated with ex post liability. These inefficiencies are due to a potential injurer's being uncertain about whether a court will hold him liable in the event of an accident and suit.
 - Authors do not assume risk aversion!
 - Demonstrate how ex ante regulation, if used jointly with tort liability, can correct some of those inefficiencies.

- Important Result:
 - When tort liability rules are in place, it is inefficient to set ax ante regulatory standards at the socially optimal level.
 - The only instances when the ex ante regulatory standard should be set at the social optimum are when there is a zero probability of a judgment against a rational injurer under ex post liability

- Risk-neutral firm (Engages in a risky activity)
- The firm can reduce the dangers associated with this activity by taking precaution (Costly)
- x level of precaution
- $C(x)$ cost of taking precaution $C'(x) > 0$ and convex
- $P(x, \varepsilon)$ accidents occurs with prob. $P(\cdot)$
- ε RV, represents the view of the court, $\varepsilon \sim q_\varepsilon$ (density function)
- $D(x, \varepsilon)$ size or the damage of accident
- $A(x)$ expectation of $P(x, \varepsilon)D(x, \varepsilon)$ over ε , $A'(x) < 0$
- View of the court is revealed after a court has heard evidence about x and the extent of damage
- $E[\varepsilon] = 0$
- $C(x) + A(x)$ is strictly convex

- 1 Find socially optimal amount of precaution, x^* [the expected social costs of accidents are minimized]
- 2 Find $\bar{x}(\varepsilon)$ court's interpretation of social optimum
- 3 Find \tilde{x} firm's precaution level (minimize expected private costs to the firm)
- 4 Comparison between x^* and \tilde{x}

- **First,**

$$\min_x E[C(x) + P(x, \varepsilon)D(x, \varepsilon)] = \min[C(x) + A(x)]$$

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$$C'(x) = -A'(x)$$

- The legal standard is an ex post parameter reveal by the court after the accident,

$$\min_x [C(x) + P(x, \varepsilon)D(x, \varepsilon)]$$

-

$$C'(x) + \frac{dP(x, \varepsilon)D(x, \varepsilon)}{dx} = 0$$

- Under a negligence rule, the injurer is found liable for all damages iff his level of precaution was less than the legal standard of precaution.



$$TC(x) = E[C(x) + L(x, \varepsilon) \times P(x, \varepsilon) \times D(x, \varepsilon)]$$

- Negligence:

$$L(x, \varepsilon) = \begin{cases} 1 & \text{if } x < \bar{x}(\varepsilon), \\ 0 & \text{otherwise} \end{cases}$$

- Ideally $x^* = \tilde{x}$

- **The firm does not know the view of the court, ε , when it chooses \tilde{x}**
- $q(x)$ the injurer's subjective probability distribution around the legal standard
- $q(x)$ is a continuous probability density with support $(-\infty, \infty)$
- $R(x) = \int_x^{\infty} q(x) dx$: the probability that the injurer's level of precaution x will end up being below the legal standard
- $E[P(x, \varepsilon)D(x, \varepsilon)] = A(x)$ the injurer will pay damages
- New Assumption: $C(x) + A(x)R(x)$ is strictly convex

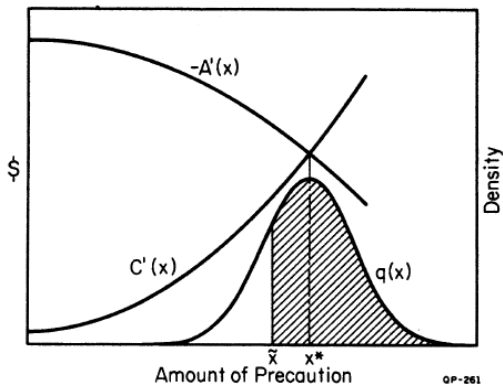


FIGURE 1. THE SOCIAL PROBLEM WITH
EVIDENTIARY UNCERTAINTY FOR THE INJURER

- When there is uncertainty, the injurer's objective function

$$\begin{aligned} TC(x) &= E[C(x) + R(x) \times P(x, \varepsilon) \times D(x, \varepsilon)] \\ &= C(x) + A(x)R(x) \end{aligned}$$



$$\min_x TC(x)$$



$$TC'(\tilde{x}) = C'(\tilde{x}) + A'(\tilde{x})R(\tilde{x}) - A(\tilde{x})q(\tilde{x})$$

- $A'(\tilde{x})R(\tilde{x})$: Injury effect (negative) [It represents a saving to the injurer from the application of greater precaution]
 - $A(\tilde{x})q(\tilde{x})$: Liability Effect (negative) [savings from providing slightly higher precaution in that the probability of being held liable is reduced]
- Both terms indicate that the marginal liability cost decline in precaution.

- If $TC'(x^*) < 0$ then $x^* < \tilde{x}$
- If $TC'(x^*) > 0$ then $x^* > \tilde{x}$

① Using

$$C'(x) = -A'(x)$$

② then,

$$TC'(x^*) = C'(x^*)[1 - R(x^*)] - A(x^*)q(x^*)$$

- ③ Since $C'(x) \geq 0$ by assumption and $R(x^*) \leq 1$ then $C'(x^*)[1 - R(x^*)] > 0$
- ④ Since $A(x^*)$ and $q(x^*)$ are greater than zero by definition then $A(x^*)q(x^*) < 0$
- ⑤ The sign of equation is indeterminate and the relationship between \tilde{x} and x^* cannot be discovered without knowing the magnitude of the various terms.

- Two cases:
 - ① there is a great deal of uncertainty with regard to the legal standard
 - ① e.g. Genetic engineering
 - ② and there is little uncertainty with regard to the standard.
 - ① e.g. Automobile accident
- Two distributions, with continuous density functions f and g , belong to the same class if there exists an $\alpha > 0$ and β such that

$$f(x) = \alpha g(\alpha x + \beta)$$

- Consider the class of distributions differing only in location and scale
- ① that contains $q(x)$, and
- ② whose members have identical means, x^*

$$q_\alpha(x) = \alpha q[\alpha x + (1 - \alpha)x^*]$$

- as α increases the probability mass becomes more concentrated at the mean
- as α decreases the spread of q_α increases
- **The greater the uncertainty in the legal standard, the more likely it is that a potential injurer will take less than the socially optimal amount of precaution** (the opposite is also true) *{See Proposition 1 and 2}*

- Let the safety regulation specify that precaution must be at least s .
- How does information about the safety regulation influence the firm's perception about the (uncertain) legal standard of care?
- The firm's probability distribution on the legal standard is truncated at s
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$$\underline{q}(x) = q(x/x \geq s)$$

$$\underline{R}(x) = \frac{R(x)}{R(s)}$$



$$\min_x \underline{TC}(x) = C(x) + A(x)\underline{R}(x)$$



$$TC'(\hat{x}) = R(s)C'(\hat{x}) + A'(\hat{x})R(\hat{x}) - A(\hat{x})q(\hat{x})$$

- How the injurer's choice of x changes with a change of the ex ante safety regulation s ; that is, what is the sign of $\frac{d\hat{x}}{ds}$?
- Total Differentiation of the F.O.C



$$(20) \quad \frac{d\hat{x}}{ds} = \frac{q(s)C'(\hat{x})}{R(s)C''(\hat{x}) + A''(\hat{x})R(\hat{x}) - 2A'(\hat{x})q(\hat{x}) - A(\hat{x})q'(\hat{x})}$$

- Proposition 4. Intuition:
 - The higher the level of the ex ante regulatory standard, the higher the legal standard is likely to be, at least in the eyes of the injurer. Thus, the ex ante regulation can correct cases of underprecaution resulting from exposure to liability alone, but it can also exacerbate overprecaution
- From Proposition 1-3 we know that: Injurers, when faced with only a negligence rule, may choose suboptimal precaution when
 - uncertainty about the legal standard is sufficiently large;
 - the marginal cost of precaution at x^* is large; or
 - the distribution about the legal standard is sufficiently biased to the left of x^*
- It follows that when any of these conditions holds, injurers can be induced to increase their level of precaution by establishing a minimum safety regulation, s
- the next question is what level of the ex ante regulation, s^* , will induce firms to choose $\hat{x}(s) = x^*$?

- Substitute x^* into

$TC'(\hat{x}) = R(s)C'(\hat{x}) + A'(\hat{x})R(\hat{x}) - A(\hat{x})q(\hat{x})$ and solve for s^*



$$C'(x^*)[R(s^*) - R(x^*)] - A(x^*)q(x^*) = 0$$

- *PROPOSITION 5*: The optimum level of an ex ante safety regulation, s^* , given that a negligence rule exists, will be less than the socially optimal level of precaution, x^* , provided $q(x^*) > 0$. If $q(x^*) = 0$, then $s^* = x^*$ is optimal.
 - The optimal ex ante regulatory constraint should be set below the socially optimal level of care unless there is no uncertainty concerning the legal standard of care.

- A comparison of the administrative costs of the tort liability system and of the ex ante system should be made.
- Uncertainty surrounding the legal standard could be further broken down into its different components
- The possibility of bankruptcy could be introduced.
- Uncertainty regarding the ex ante regulation could be introduced into the model.