Variable Probabilities of Suit and Liability Rules

Sébastien Rouillon
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Université de Bordeaux 4
GRETHA
Avenue L. Duguit
33 608 Pessac cedex
+033 (0)5 56 84 25 85
rouillon@u-bordeaux4.fr

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Summary: This note provides an additional argument in favour of the use of a negligence rule in tort law. When the probability of suit varies among injurers and is not observable by the judge, the judge will fail to implement the socially optimal level of care using a strict liability rule (for this implies to set damages equal to harm multiplied by the inverse of the probability of suit). However, he can still implement it using a negligence rule, subject to the condition that he chooses the negligence standard properly (for if damages are set large enough, potential injurers will comply with the standard, regardless their probability of suit).

1. Introduction

The Law and Economics literature provides valuable insights about the choice of a strict liability rule vs. a negligence rule, under various technological and informational circumstances (for a review, see Kaplow and Shavell, 2002).

This note supplies an additional argument in favour of a negligence rule, assuming that the probability of suit varies among injurers and that this information is not observable to the judge. It also shows the determination of the optimal damages under strict liability and imperfect information about the probability of suit.

Although natural, this assumption has not been considered in the economic analysis of liability. Bebchuk and Kaplow (1993) use a similar assumption in a model of law enforcement, assuming that individuals are not equally easy to apprehend. In contradiction with Becker (1968), they show that the penalty should not be maximal, because otherwise it would be too dissuasive for individuals with a large probability of being caught. In Section 4, a similar result is obtained for the optimal damages under the rule of strict liability.

The familiar model of tort law is introduced in Section 2. We build on Schmitz (2000) and add the assumption of variable probabilities of suit among the population. In Section 3, we assume that both the injurers and the judge have perfect information. In particular, the judge can observe the probability of suit and rely on it to set the damages. This assumption being standard, Section 3 only restates, as a benchmark, known results (Kaplow and Shavell, 2002; Polinsky and Shavell, 1998). In Section 4, we consider the case where the judge is unable to observe the probability of suit after an accident has occurred and prove that only the negligence rule is optimal. Under a strict liability rule, we derive the optimal damages and compare with the results in Section 3. In Section 5, the case where both the judge and the injurers are unaware of the probability of suit is introduced.

2. The model

In the model, risk-neutral agents (injurers) exert hazardous activities. They can reduce the probability of accident by taking care. Following Schmitz (2000), we assume that if an injurer expends $c(x)$ in care, the resulting probability of accident will be $1 - x$, and we admit the assumptions: $c(0) = c'(0) = 0$, $c(x)$ is twice differentiable, strictly increasing and strictly convex, and $c'(x) \to \infty$ when $x \to 1$. When an injurer provokes an accident, a third party (a victim) suffers a harm h and brings the suit to the judge (goes to trial) with a probability q ([1]).

2.1. Distribution of information. The assumptions about the distribution of information among the injurers and the judge appear to be central.

Since we focus on the effects of the variability of q in the population, we will assume everywhere that the technology $c(x)$ and the harm h are known to everyone. From this, the injurers and the judge are able to calculate the level of care that best fits their objective.

Concerning the information about q, we postulate that it is common knowledge that q is distributed in the population of victims on the support $[a, b]$ according to the density $g(q)$ (we assume that $0 < a < b \leq 1$ and $g(q) > 0$, for all $q \in [a, b]$). For the rest, the following table summarizes the cases considered in Sections 3 to 5:

Information available to… : **Case of…:**	**…the injurers**	**…the judge**
…perfect information (§ 3)	Current value of q	Current value of q
…imperfect information of the judge (§ 4)	Current value of q	Distribution of q
…imperfect information of injurers (§ 5)	Distribution of q	Both cases

Table 1. Distribution of information

2.2. Social optimum. This part borrows much from Shavell (1984) and is thus only sketched. The social problem is to minimize the expected social cost of the risky activity:

$$c(x) + (1 - x)\,h. \qquad (1)$$

The solution to this problem is $x = x^*(h)$, where $x^*(h)$ is defined, for all $h \geq 0$, by:

$$c'(x^*(h)) = h. \quad (2)$$

It is immediate that $x^*(h)$ is differentiable and strictly increasing (since $x^{*\prime}(h) = 1/c''(x^*(h)) > 0$, for all h). In other words, optimal care is an increasing function of the harm done.

3. Perfect information

We postulate thereafter that the judge seeks to minimize (1), using the liability rules (strict or negligence). In this section, we assume that their probability q is known to the injurers when they choose x and is observable by the judge after an accident has occurred (implicitly, the judge is allowed to make damages depend on it).

3.1. Strict liability. Consider first the use of strict liability. The judge fixes damages, denoted f. The injurer is liable for f when an accident occurs. Therefore, his problem is to choose x to minimize his expected private cost:

([1]) We implicitly assume thereafter that all trials go to an end and implement the correct decision. Therefore, q is also the probability that the injurers pay for damages when they ought to (the liability rule being given).

$$c(x) + (1 - x)\, q\, f. \qquad (3)$$

The solution to this problem is $x = x^*(q\, f)$.

From this, the judge implements the social optimal level of care if (Polinsky and Shavell, 1998):

$$q\, f = h \Leftrightarrow f = h/q. \qquad (4)$$

In other words, the injurers should face, when they choose x, the true cost h of their activity. At the time a suit is brought to the judge, damages should thus be multiplied by the inverse of the probability of suit ($1/q$).

3.2. Fault-based liability. Consider now the use of the negligence rule. The judge defines a damage f and a legal standard s. The injurer is liable for f when an accident occurs if he is found negligent (i.e., if $x < s$). Therefore, his problem is to choose x to minimize his expected private cost:

$$c(x) + (1 - x)\, q\, f, \text{ if } x < s, \text{ and } c(x), \text{ otherwise.} \qquad (5)$$

It is immediate to show that the judge implements the social optimal level of care if he chooses $f \geq h/q$ and $s = x^*(h)$ (Polinsky and Shavell, 1998). Indeed, if the injurer is liable for damages ($x < s$), his private cost (3) is minimized when $x = x^*(q\, f) \geq x^*(h) = s$. Otherwise, he chooses $x = s$ (doing more is costly and useless). And $x = s$ minimizes (5) since $c(s) < c(x^*(q\, f)) + (1 - x^*(q\, f))\, q\, f < \mathrm{Inf}\{c(x) + (1 - x)\, q\, f\,;\, x < s\}$.

4. Imperfect information of the judge

Here, we assume that the injurers know their q when they choose x, but that the judge can not observe it after an accident has occurred (or, equivalently, that he is not allowed to differentiate damages with respect to it). However, he is aware that the distribution of q in the population follows the density $g(q)$.

4.1. Strict liability. Consider the use of strict liability under this new assumption. Since the judge cannot observe q, he is bound to charge a uniform liability to the injurers, irrespective of their probability of suit. His problem is therefore to choose f to minimize:

$$\int_a^b [c(x^*(q\, f)) + (1 - x^*(q\, f))\, h]\, g(q)\, \mathrm{d}q, \qquad (6)$$

knowing that an injurer of type q facing a liability f cares $x^*(q\, f)$.

The first-order condition for this problem is (2):

$$\int_a^b (q\, f - h)\, x^{*\prime}(q\, f)\, g(q)\, \mathrm{d}q = 0. \qquad (7)$$

Since $x^{*\prime}(h) > 0$, this implies that the optimal damages, denoted f^*, satisfy:

$$a\, f^* < h < b\, f^* \Leftrightarrow h/b < f^* < h/a.$$

Hence, f^* is bounded below (resp., above) by the damages necessary to induce an injurer of type b (resp., of type a) to choose the socially optimal level of care $x^*(h)$.

From this, there exists a type $q^0 = h/f^* \in]a, b[$, such that all types $q < q^0$ will undertake too little care and all types $q > q^0$ will undertake too much care. As an immediate consequence, strict liability fails to implement the social optimum level of care.

(2) We assume everywhere that the second-order condition holds. It is immediate to verify that it is true when $c(x)$ is (locally) quadratic.

More can be said about f^* if we assume that the cost of care $c(x)$ is (locally) quadratic. Indeed, if $c(x) = C\,x^2/2$ (with $C > 0$), we get, for all h:

$$x^*(h) = h/C \text{ and } x^{*\prime}(h) = 1/C.$$

Then, eliminating the term $x^{*\prime}(q\,f) = 1/C$ in (6) and rearranging, we get:

$$f^* = m\,h/(m^2 + \sigma^2), \qquad (8)$$

where $m = \int_a^b q\;g(q)\;\mathrm{d}q$ and $\sigma^2 = \int_a^b (q - m)^2\;g(q)\;\mathrm{d}q$ are respectively the mean and the variance of q in the population of victims.

Equation (8) shows that the economic principle of Section 3.1, namely that injurers should always face the true cost of their activity at the moment they choose how much care to take, is not the correct one here. Indeed, when q varies among the victims and is not observable by the judge, it would a priori imply to set $f = h/m$ (since then $m\,f = h$ and the judge asks the injurers, on average, for the payment of the true cost of their activity). From (8), we see that this rule is obtained as a limit case, when $\sigma^2 \to 0$. Otherwise, smaller damages should be asked (Equation (8) implies that $f^* < h/m$).

4.2. Fault-based liability. Consider now the use of fault-based liability when q varies among the population and is not observable by the judge. Using the results obtained in Section 3.2, it is immediate to show that the judge can still implement the social optimum level of care.

Indeed, assume that he chooses $f \geq h/a$ and $s = x^*(h)$. For all q, we have $f \geq h/a \geq h/q$. From our results in 3.2, all injurers choose to follow the standard $s = x^*(h)$, which is the socially optimal level of care.

5. Imperfect information of the injurers

The results above rely on the assumption that the injurers know their probability of suit at the moment they choose how much to expend in care. However, in reality, q is partly exterior to the injurers (it depends on the incentives to go to trial of the victims, on the probability of an erroneous decision by the judge, etc.) Therefore, our assumption will not necessary be correct in all cases.

This drives us to consider the case where the injurer is unaware of his actual q and chooses x knowing its distribution only. Under this assumption, he seeks to minimize over x his expected private cost:

$$\int_a^b [c(x) + (1 - x)\,q\,f]\;g(q)\;\mathrm{d}q = c(x) + (1 - x)\,m\,f. \qquad (9)$$

The solution to his problem is $x^*(m\,f)$.

As a consequence, under a strict liability rule, the judge can implement the socially optimal level of care if ([3]):

$$m\,f = h \Leftrightarrow f = h/m. \qquad (10)$$

In other words, there is no need that the judge observes the probability of suit when the injurers do not. When the injurers only anticipate the average probability of suit m, uniform damages are sufficient and should be set such that parties internalize the true cost of their activity, given their common belief. A corollary is that it would be socially costly to provide the injurers with finer information about their actual q.

Comparing with Section 4 (if $c(x)$ is locally quadratic), our results also imply that injurers should be less severely ‘penalized’ when they own and use information to avoid their

([3]) Of course, the results of Section 4.2 apply and the first-best is also possible using a negligence rule.

liability than when they do not. Indeed, according to equations (8) and (10) respectively, the injurers should pay f^* when they know q, h/m when they do not, and we have $f^* < h/m$.

6. References

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