

THE JUDGMENT PROOF PROBLEM

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abstract. The effects of the possibility that parties would be unable to pay fully for harm done are considered in a theoretical model of the occurrence of accidents, the liability system, and the insurance market. The issues of primary concern are the inadequacy of parties' incentives to reduce risk, their diminished motive to purchase liability insurance, and the possible advantages and disadvantages of regulation of insurance markets.

The Judgment Proof Problem

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I. Introduction

Parties who cause harm to others may sometimes turn out to be "judgment proof," that is, unable to pay fully the amount for which they have been found legally liable.¹ This possibility is an important and realistic one. Certainly individuals may readily be imagined to cause personal injury or property damage resulting in judgments that exceed their assets plus any liability insurance coverage; and the same is true of firms.²

To understand the nature of this problem, a theoretical model of the occurrence of accidents is studied here. Using the model and assuming that potential injurers' assets are less than the harm they might cause, questions about the effects of liability on their behavior and on their purchase of liability insurance are considered.³ The conclusions reached may be summarized as follows.

(a) Liability does not furnish adequate incentives to alleviate risk. (See Propositions 1 and 2.) An injurer will treat liability that exceeds his assets as imposing an effective financial penalty only equal to his assets; an injurer with assets of \$30,000, for example, will treat an accident resulting in liability of \$100,000 identically with an accident resulting in liability of only \$30,000. Hence, injurers' expected penalties may be less than the expected losses for which they are liable. This has two implications.

First, injurers may engage in risky activities to a socially excessive extent.⁴ (An electric utility company may decide to build a nuclear power plant that could cause losses in the billions of dollars just because its expected financial penalty is limited by its assets of only a hundred million dollars.) Second, injurers may have too little incentive to take care to reduce risks given their level of activity. (The utility may invest too little in safety given that it builds the nuclear facility.) This problem, however, is less pronounced under the negligence rule than under strict liability, owing to the sharpness of incentives under the former rule;⁵ namely, taking proper care allows injurers to escape liability entirely under the negligence rule, whereas it merely lowers the likelihood of liability under strict liability.

(b) The motive to purchase liability insurance is diminished. (See Remark 2 and Proposition 2.) Because their assets are less than the harm they might cause, part of the premium injurers would pay for liability insurance would be to cover losses that they would not otherwise have to bear. If the injurer with assets of \$30,000 bought full liability coverage of \$100,000, seven-tenths of his premium would pay for the \$70,000 amount of liability that he would not bear if he did not own liability insurance. It follows that injurers may rationally decide against buying liability insurance, or at least may buy less coverage than the harm they might cause.⁶

(c) To the extent that liability insurance is purchased,
the problem of excessive engagement in risky activities is
mitigated; but the problem of inadequate levels of care
could be exacerbated if insurers' ability to monitor care is
imperfect. (See Proposition 2.) The purchase of liability
insurance by injurers will result in their bearing more of
the expected losses that their engaging in an activity would
create, making it less likely that they will choose to
engage in an activity when they ought not. (If the utility
were to buy full coverage against losses, then in principle
it would not build the nuclear facility unless that were
appropriate.) On the other hand, whether injurers' incen-
tives to take care would be altered for the better or the
worse by their purchase of liability coverage depends on the
ability of insurers to link premiums or the conditions under
which they will honor claims to injurers' precautions.
Where insurers can establish this connection fairly easily
(where, for instance, installation of safety devices could
be verified at low cost), they will tend to do so, and
injurers will therefore be induced to act in a way that
properly reduces risk. But where insurers find it too
difficult to make the connection (especially where what is
of concern is injurers' behavior rather than their acquisi-
tion of some physical entity), injurers' incentives will be
dulled by their ownership of coverage, and risks may be
higher than otherwise. (If insurers cannot tell how well
the utility trains the operators of its nuclear facility,

then the utility's motive to do this will be reduced by its ownership of liability insurance.)

After these points are developed in the model, a brief concluding section will discuss informally the use of various social policies to remedy the judgment proof problem.⁷

II. Analysis of the Model

The model is concerned primarily with injurers, parties who might cause accident losses for victims, but who can lower the probability of this by taking care.⁸ (Victims cannot affect the probability of accident losses, so they play no role in the analysis.) Let

x = level of care of injurers; $x \geq 0$;

$p(x)$ = probability of an accident; $0 < p(x) < 1$;
 $p'(x) < 0$; $p''(x) > 0$;

ℓ = magnitude of losses if an accident occurs; $\ell > 0$;

y = initial assets of injurers; $0 \leq y \leq \ell$; and

$U(\cdot)$ = von Neumann-Morgenstern utility function of wealth of injurers, who are either risk neutral or risk averse.

It is assumed that the variable care is non-monetary but has a monetary equivalent cost of x ;⁹ hence, if injurers exercise care of x , their utility will be $U(y-x)$ other things equal.

It is also assumed that if losses occur, they will be of fixed magnitude. In addition, it is assumed (without loss of generality) that if injurers are risk neutral, the utility of wealth y equals y ; and that if injurers are risk averse, $U(0) = 0$, $U'(y) > 0$, and $U''(y) < 0$.

Define x^* as the level of care that minimizes

$$(1) \quad x + p(x)\ell,$$

so that x^* satisfies

$$(2) \quad 1 + p'(x)\ell = 0.$$

Call x^* the efficient level of care.

Before proceeding, it is of interest to state what a benevolent dictator would do to solve the accident problem. The dictator would choose the level of injurers' care and levels of wealth contingent on accident involvement for injurers and victims so that no alternative choice would raise the expected utility of both injurers and victims. It is easy to show the following about this first-best Pareto efficient solution to the problem.¹⁰

Remark 1. The first-best Pareto efficient solution to the accident problem is such that (a) risk averse parties are left with the same level of wealth regardless of whether an accident actually occurs; and (b) the level of care is the efficient level x^* , that which minimizes expected accident losses plus the cost of care.

notes. (i) The explanation for the Remark is that the dictator can fully insure risk averse parties and thus that it is Pareto efficient for him simply to minimize expected accident losses plus the cost of care.

(ii) Suppose that the model were extended to allow injurers to choose whether to engage in their activity, that the benefit they obtain from it is b , and that if they do not engage in it they enjoy no benefit but cause no accidents. Then the first-best solution would be such that injurers would engage in their activity if and only if $b > p(x^*)\ell$.

A. Injurers' behavior under liability rules in the absence of liability insurance

Let us now consider injurers' behavior under the two major forms of liability: strict liability, under which injurers are liable for ℓ whenever they cause an accident; and the negligence rule, under which they are liable for accident losses only if their level of care was less than the level of due care, which is assumed to be x^* . If an injurer is liable under a liability rule, his actual payment is of course limited to his wealth y .¹¹ For this reason, an injurer's behavior will depend on his wealth; hence let

$x_s(y)$ = care taken by injurers under strict liability if their wealth is y ;

$x_n(y)$ = care taken by injurers under the negligence rule if their wealth is y .

We have

Proposition 1. (a) Under strict liability, injurers will take no care if their assets are sufficiently low; they will then take a positive and increasing level of care as a function of their assets. (b) Under the negligence rule, injurers will act negligently -- and thus will take the level of care they do under strict liability -- if their assets are sufficiently small; they will then act non-negligently, taking the efficient level of care. Moreover, they will begin to take the efficient level of care when their assets are less than the losses they might cause, and when under strict liability their level of care would be lower.

notes. (i) The Proposition is illustrated in Figure 1. The reason that $x_n(y) = x^*$ when $x_s(y)$ is lower is, as explained in the Introduction, that the incentive to take care is sharper under the negligence rule, for injurers will avoid liability entirely by choosing x^* rather than only reducing its probability. It should also be observed that although as drawn, $x_s(\ell)$ equals x^* , this is the case only if injurers are risk neutral; if they are risk averse, $x_s(\ell)$ would presumably exceed x^* .

(ii) If the model were extended to allow injurers to choose whether to engage in their activity, then under strict liability injurers might engage in their activity when they ought not if their assets are less than ℓ .¹² As noted earlier, however, this is true under the negligence rule even if their assets are not less than ℓ , for under that rule injurers do not pay for the losses they cause if they take due care.

Proof. (a) Under strict liability, an injurer's expected utility will be

$$(3) \quad EU^S(x, y) = (1 - p(x))U(y - x) + p(x)U(-x).$$

The partial derivative of (3) with respect to x is

$$(4) \quad EU_x^S(x, y) = -p'(x)[U(y - x) - U(-x)] \\ - [(1 - p(x))U'(y - x) + p(x)U'(-x)].$$

Since $EU_x^S(0, 0) = -U'(0) < 0$, it follows that for all y sufficiently small, $x_s(y) = 0$. Otherwise, $x_s(y)$ is determined by the first-order condition $EU_x^S(x, y) = 0$; and as the partial derivative of $EU_x^S(x, y)$ with respect to y is $-p'(x)U'(y -$

Exercise of Care Under The Liability Rules in the absence of liability insurance

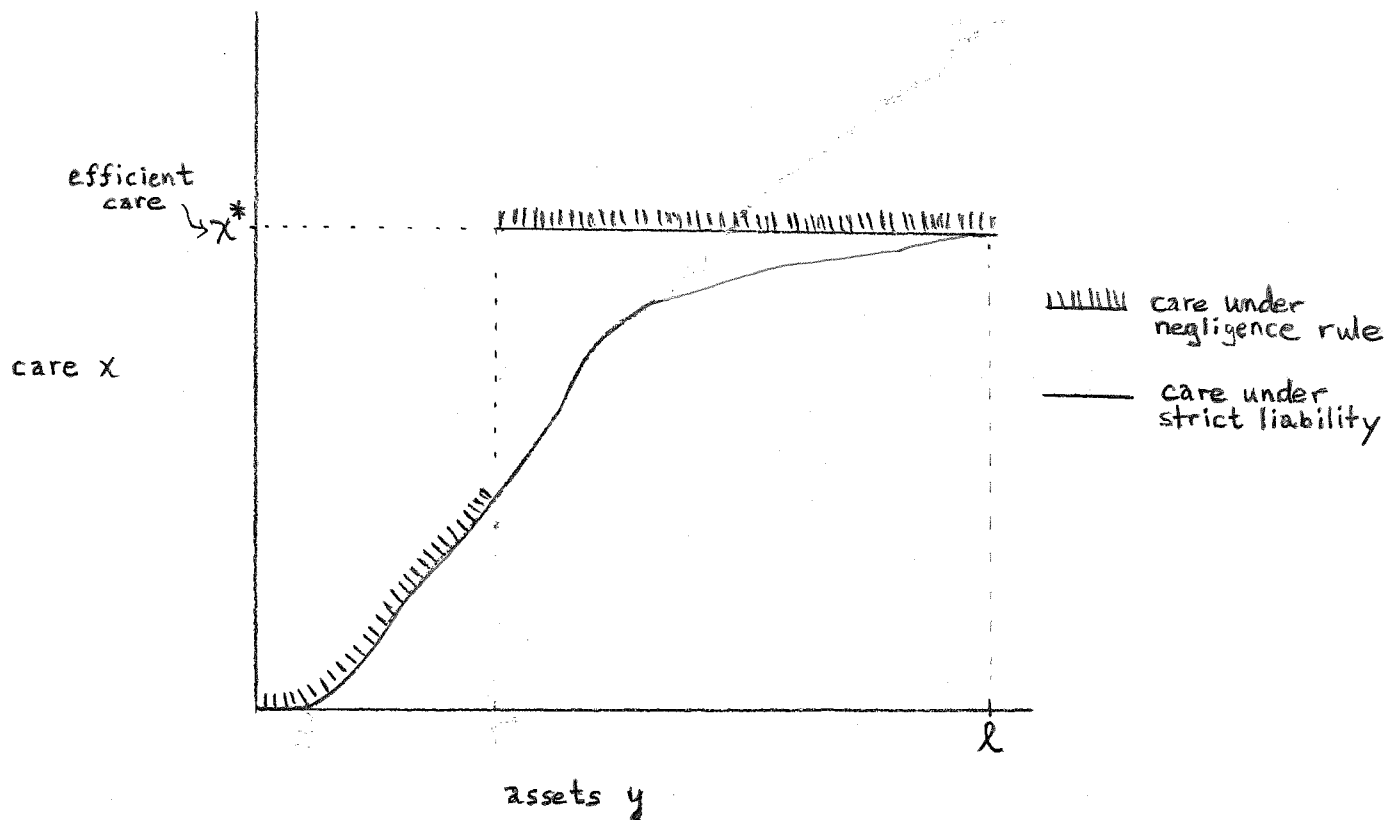


Figure 1

$x) - (1 - p(x))U'(y - x)$ and is positive, $x_s(y)$ increases with y .¹³

(b) An injurer's expected utility under the negligence rule will be

$$(5) \quad EU^n(x, y) = \begin{cases} EU^S(x, y) & \text{if } x < x^* \\ U(y - x) & \text{otherwise;} \end{cases}$$

thus, if x is not less than x^* , x^* will be chosen. The claims now follow from a series of steps:

(i) If $x_n(y) < x^*$, then $x_n(y) = x_s(y)$: From (5), we know that $x_n(y)$ maximizes EU^S over $x < x^*$. We also know that $EU^S(x_n(y), y) > U(y - x^*)$; and since $U(y - x^*) > EU^S(x, y)$ for $x \geq x^*$, we conclude that $x_n(y)$ in fact maximizes EU^S over all x , so that it must equal $x_s(y)$.

(ii) If y is sufficiently low, then $x_n(y) < x^*$: If $y < x^*$, then choosing $x = 0$ would be superior to choosing x^* . Hence, certainly for such y , $x_n(y) < x^*$.

(iii) If $x_n(y_1) = x^*$ and $y_2 > y_1$, then $x_n(y_2) = x^*$: If $x_s(y) \geq x^*$ anywhere in $[y_1, y_2]$, then since by (a) x_s is increasing in y , $x_s(y_2) \geq x^*$. This, however, implies that $x_n(y_2) = x^*$; for if not, $x_n(y_2) < x^*$, in which case by (i), $x_n(y_2) = x_s(y_2)$; but as $x_s(y_2) \geq x^*$, this means $x_n(y_2) \geq x^*$, which is a contradiction. Hence, suppose that $x_s(y) < x^*$ throughout $[y_1, y_2]$ and consider any y in that interval. Now by the envelope theorem the derivative of $EU^S(x_s(y), y)$ with respect to y equals the partial derivative of EU^S with respect to y , or $(1 - p(x_s(y))U'(y - x_s(y)))$; but this is less than $U'(y - x^*)$ since $x_s(y) < x^*$. Hence $U(y - x^*)$

grows faster with y than $EU^S(x_S(y), y)$ in the interval. This fact and the fact that $U(y_1 - x^*) > EU(x_S(y_1), y_1)$ imply that the same inequality holds at y_2 , which implies the required result.

(iv) The set of y such that $x_n(y) = x^*$ strictly includes that where $x_S(y) \geq x^*$: If $x_S(y) \geq x^*$, then $x_n(y) = x^*$; for otherwise, $x_n(y) < x^*$, but from (i), this means that $x_n(y) = x_S(y)$, contradicting the assumption that $x_S(y) \geq x^*$. Hence, we have shown that the first set weakly includes the second. Now let y_0 be the least y such that $x_S(y) = x^*$,¹⁴ and observe that $U(y_0 - x^*) > (1 - p(x^*))U(y_0 - x^*) + p(x^*)U(-x^*) = EU^S(x^*, y_0)$. Hence, by continuity, $U(y - x^*) > EU^S(x(y), y)$ in a neighborhood to the left of y_0 ; it follows that in this neighborhood $x_n(y) = x^*$ whereas $x_S(y) < x^*$.

(v) $x_n(y)$ first equals x^* for $y < \ell$: By Jensen's inequality,¹⁵ $(1 - p(x_S(\ell))U(\ell - x_S(\ell)) + p(x_S(\ell))U(-x_S(\ell))) < U(\ell - x_S(\ell) - p(x_S(\ell))\ell)$. But the latter is less than or equal to $U(\ell - x^* - p(x^*)\ell)$, which is less than $U(\ell - x^*)$. Hence, at ℓ , choosing x^* and being non-negligent is strictly preferred to choosing $x_S(\ell)$ and being subject to liability. Thus, by continuity, the assertion follows.

B. Injurers' behavior under liability rules given the availability of liability insurance¹⁷

Assume now that liability insurance is sold at an actuarially fair rate and that the policy purchased by injurers maximizes their expected utility, where

q = level of coverage; and

π = premium for coverage.

In order to analyze the expected utility-maximizing policy, it is convenient first to consider the decision to purchase insurance of a party who faces a fixed probability $0 < p < 1$ of liability for losses ℓ that would exceed his assets. If this party purchases coverage q and losses do not occur, his wealth will be $y - \pi$; and if losses do occur, his wealth will be $\max(0, y - \pi + q - \ell)$. In addition, $\pi = pq$, as the premium is fair, and therefore the maximum q the party can purchase is y/p . Hence, the party's insurance purchase problem is

$$(6) \quad \max_{0 \leq q \leq y/p} (1 - p)U(y - pq) + pU(\max(0, y - pq + q - \ell)),$$

the solution to which is as follows.

Remark 2. Suppose that the probability of a party's being liable for losses is fixed. Then (a) assuming that the party is risk averse, there is a critical level of his assets below which he will not purchase any insurance coverage and above which he will purchase full coverage. (b) If, however, the party is risk neutral, he will not purchase any insurance coverage regardless of his level of assets.

notes. (i) What is to be proved in (a) is that there is a y' where $p\ell < y' < \ell$, such that $q = 0$ for y in $[0, y')$ and $q = \ell$ for $y \geq y'$. The explanation is, as mentioned in the Introduction, that to buy coverage is to pay for losses that one would otherwise not bear, and since this factor is more important the smaller one's assets, at some sufficiently low

level of assets, one will no longer wish to buy coverage despite aversion to risk. If, however, one wishes to buy positive coverage, it must then be optimal to buy full coverage, since there is always a marginal advantage to increasing coverage if it is not full.^{17a}

(ii) What is to be proved in (b) is that if $y < \ell$, then $q = 0$ is strictly preferred. This is true because a risk neutral party, not being averse to risk, will clearly not wish to pay for any losses which he would not otherwise bear.¹⁸

Proof. (a) If a risk averse party chooses $q > 0$, then it must be that $y - pq + q - \ell > 0$ -- his net wealth if he causes losses is positive -- for otherwise the coverage will not have done him any good. Hence, if $q > 0$, the party's expected utility will be

$$(7) (1 - p)U(y - pq) + pU(y - pq + q - \ell).$$

Therefore (since $q = y/p$ is obviously not optimal), q will be determined by the first order condition

$$(8) (1 - p)(-p)U'(y - pq) + p(1 - p)U'(y - pq + q - \ell) = 0.$$

This implies that $U'(y - pq) = U'(y - pq + q - \ell)$, which in turn means that $q = \ell$ (since $U'' < 0$), so that the party's utility will be $U(y - p\ell)$.

On the other hand, if $q = 0$, the party's utility will be $(1 - p)U(y)$.

Hence, the party will not buy coverage when

$$(9) (1 - p)U(y) > U(y - p\ell);$$

otherwise he will buy full coverage. Now at $y = p\ell$, (9)

holds strictly, for $(1 - p)U(p\ell) > U(p\ell - p\ell) = 0$. And at $y = \ell$, the inequality in (9) is reversed, for $(1 - p)U(\ell) = (1 - p)U(\ell) + pU(0) < U(\ell - p\ell)$ since U is strictly concave. Also, clearly, $(1 - p)U'(y) < U'(y - p\ell)$. It therefore follows that the claimed y' exists.

(b) If a risk neutral party does not buy coverage and $y < \ell$, his expected wealth will be $(1 - p)y$. If he does buy coverage, his expected wealth will be, from (6), $(1 - p)(y - pq) + p\max(0, y - pq + q - \ell)$. Thus, if $q > 0$ and the second term is zero, expected wealth will equal $(1 - p)(y - pq) < (1 - p)y$, so the party will be worse off; and similarly, if the second term is positive, expected wealth will be $y - p\ell < (1 - p)y$ (since $y < \ell$), so the party will be worse off. This completes the proof.

Let us now return to our model, where injurers can affect the probability of losses, and let us assume initially that liability is strict. An injurer's expected utility will therefore be

$$(10) \quad EU^S(x, q, \pi) = (1 - p(x))U(y - \pi - x) \\ + p(x)U(\max(0, y - \pi + q - \ell) - x).$$

There are two situations to consider regarding insurers. In the first, insurers can observe x and link the premium charged to it. In this situation, the premium will be $p(x)q$ and the injurer's problem will thus be to maximize $EU^S(x, q, p(x)q)$ over x and q . In the other situation, insurers cannot observe x and link the premium to it. Here the injurer's

problem will be to maximize $EU^S(x, q, \pi)$ over q subject to the constraint that EU^S is maximized over x alone (as the injurer will choose x knowing that that will not affect his premium) and also to the constraint $\pi = p(x)q$.¹⁹ (In both situations $\pi \leq y$ is an additional constraint but it will be assumed not to be binding.)

Under the negligence rule, the formal statement of the injurer's problem in the two situations is the same, with EU^n (the expression for which we omit) replacing EU^S .

We have

Proposition 2. Suppose that liability is strict. Then

(a) if insurers can observe levels of care, risk averse injurers will buy no coverage if their assets are less than a critical level; otherwise they will buy full coverage and take efficient care. (b) If insurers cannot observe levels of care, risk averse injurers will again buy no coverage if their assets are less than a critical level, where this level will be higher than in (a); otherwise, they will purchase positive, but less than complete coverage and generally not take efficient care. (c) In either situation, risk neutral injurers will not buy coverage.

(d) Under the negligence rule (risk averse or risk neutral) injurers will not buy coverage.

notes. (i) The claim in (a) is that there is a y' , where $p(x^*)\ell + x^* < y' < \ell$ such that $q = 0$ and $x = x_S(y)$ for $y < y'$; and $q = \ell$ and $x = x^*$ for $y \geq y'$. The explanation for the existence of the critical level y' is that given for

Remark 2(a). Also, because if an injurer purchases coverage, it will be full and the premium will depend on x and equal $p(x)\ell$, the injurer will choose x to minimize $x + p(x)\ell$; thus he will choose x^* .

(ii) The claim in (b) is there is a y'' , where $y' < y'' < \ell$, such that $q = 0$ and $x = x_S(y)$ for $y < y''$; and $q > 0$ and x is generally unequal to x^* (where q and x depend on y) for $y \geq y''$. The reason that y'' exists is essentially that given for Remark 2(a). If injurers purchase positive coverage, their levels of care would be expected to be less than efficient because their incentives to avoid losses will be reduced. Injurers will not, however, purchase full coverage; for were they to do this, they would not be exposed to risk, not have any incentive to take care, and therefore have to pay a high premium. Finally, y'' will exceed y' because insurance, being incomplete, will be less valuable to own in the present situation.

Figure 2 illustrates (a) and (b) in the typical case.

(iii) The claim in (c) is that $q = 0$ is strictly preferred for $y < \ell$. This is true for the reason given for Remark 2(b).

(iv) The claim in (d) is that $q = 0$ is strictly preferred. This is true because only if an injurer chooses $x < x^*$ would he possibly wish to buy insurance coverage; for otherwise he will not be liable if he causes a loss. Now if $x < x^*$ and an injurer buys coverage, it must be high enough to leave him with positive assets if he causes a loss (else the

Exercise of Care and Purchase of Liability Insurance Under Strict Liability

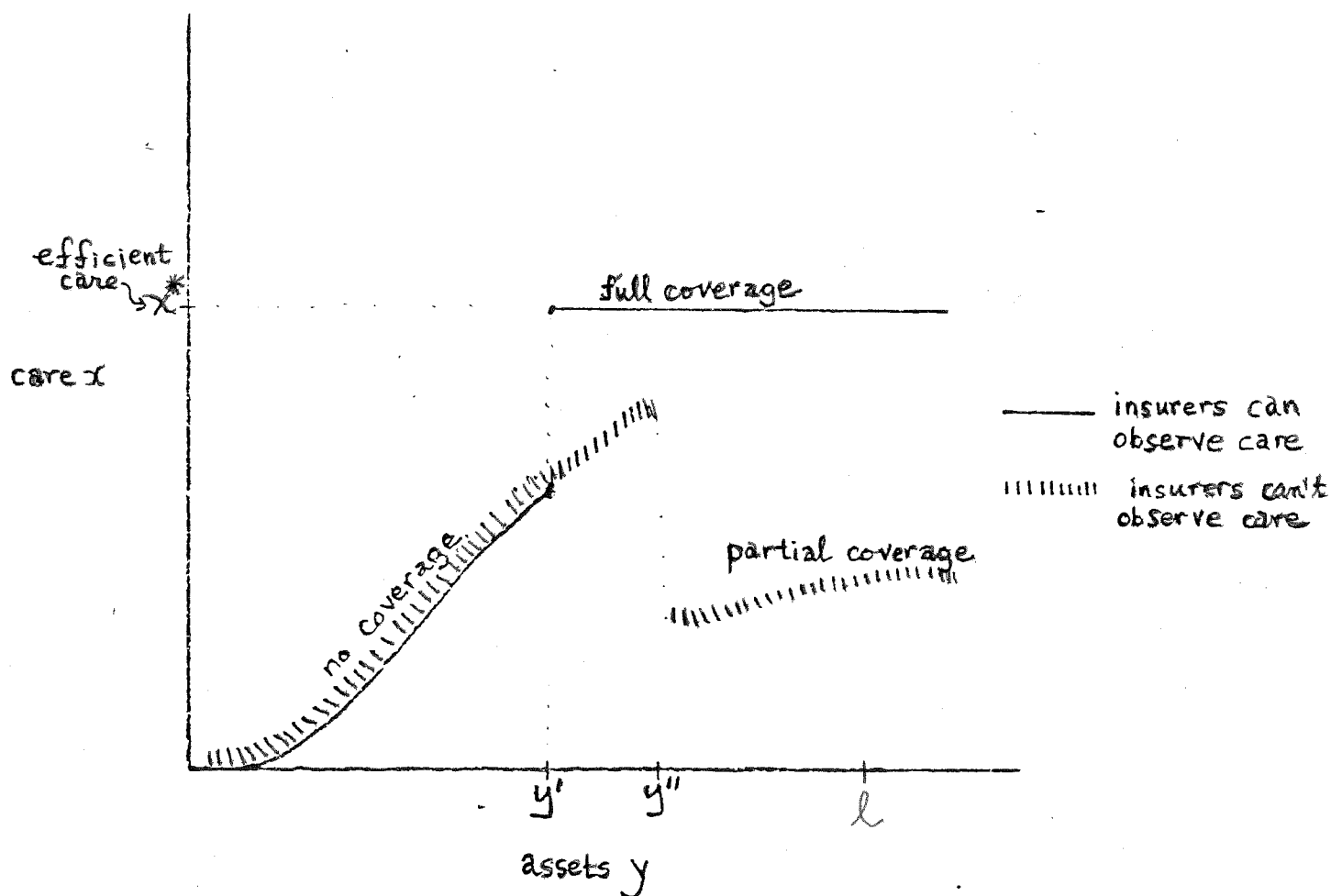


Figure 2

coverage is of no value). But this turns out to imply that the premium plus expected liability directly borne equals $p\ell$; and this implies that the injurer would have been better off choosing x^* and escaping liability. Hence, injurers will not wish to buy coverage (and will behave as described in Proposition 1).

(v) If the model were extended to allow injurers to choose whether to engage in their activity, then under strict liability, injurers would engage in it exactly when they ought if insurers can observe their levels of care and they buy full coverage. Otherwise, as noted after Proposition 1, they will engage in their activity too often.

(vi) If the model were extended to allow for uncertainty over the negligence determination, then risk averse injurers might buy liability insurance under the negligence rule.

Proof.(a) By the argument in the proof of Remark 2(a), we know that if an injurer chooses $q > 0$, then he will in fact choose $q = \ell$ (for given any x , the argument may be applied). And because when $q = \ell$, an injurer's utility will be $U(y - x - p(x)\ell)$, he will choose x to minimize $x + p(x)\ell$; but this is x^* . Hence, if $q > 0$, then $q = \ell$, $x = x^*$, and the injurer's utility will be $U(y - x^* - p(x^*)\ell)$.

If an injurer chooses $q = 0$, then he will select x to maximize $(1 - p(x))U(y - x) + p(x)U(-x)$, so he will choose $x_s(y)$. Thus, he will buy no coverage when

$$(11) \quad (1 - p(x_s(y)))U(y - x_s(y)) + p(x_s(y))U(-x_s(y)) > U(y - x^* - p(x^*)\ell);$$

otherwise he will buy full coverage. By the envelope theorem, the derivative with respect to y of the left-hand side of (11) is $(1-p(x_s(y)))U'(y-x_s(y))$ and that of the right-hand side is $U'(y-x^*-p(x^*)\ell)$; and the latter is greater than the former whenever the two sides of (11) are equal, since then $x_s(y) < x^* + p(x^*)\ell$.²⁰ From this it follows (we omit details) that if it becomes optimal to buy insurance for some y' , it must remain optimal to do so. Hence, as (11) holds at $y = p(x^*)\ell + x^*$ and is reversed at $y=\ell$,²¹ the claimed y' exists.

(b) This is clear from note (ii).

(c) Suppose that a risk neutral injurer were to buy positive coverage. Then by the proof of Remark 2(b), the injurer would be worse off than if he did not buy coverage and chose the same x . Hence, certainly, the injurer would be worse off than if he did not purchase coverage and chose x optimally.

(d) Suppose that an injurer strictly prefers to buy $q > 0$. Then $x < x^*$ must be true (for if $x \geq x^*$, the injurer bears no risk under the negligence rule). Also, as observed before, if $q > 0$, for the insurance to benefit the injurer, $y - \pi + q - \ell > 0$ must hold. Using this fact, $\pi = p(x)q$, and concavity of U , we have that the injurer's expected utility must be

$$(12) \quad (1-p(x))U(y-x-p(x)q)+p(x)U(y-x-p(x)q+q-\ell) \\ \leq U(y-x-p(x)\ell).$$

But the latter is less than $U(y-x^*-p(x^*)\ell)$, which is less than $U(y-x^*)$. Thus the injurer must be worse off than if he chose x^* and did not purchase insurance coverage.

C. Requirements to purchase liability insurance and prohibitions against its purchase

From the above results we can determine the effect of the policy of making purchase of full liability insurance coverage mandatory and of the policy of prohibiting its purchase.

Proposition 3. Suppose that injurers are required to purchase full liability insurance coverage. Then (a) if insurers can observe their levels of care, injurers will be led to take efficient care, whereas they might not have done so otherwise. But (b) if insurers cannot observe their levels of care, injurers will take no care, whereas they would usually have taken positive care otherwise.

notes. (i) It is of course assumed here that injurers' assets are sufficient to pay the premium for full coverage.

(ii) The claim of (a) is clear: Since injurers must purchase full coverage and their premiums will depend on x , they will choose x^* ; whereas if otherwise they would not have purchased coverage, they might not have chosen x^* under the negligence rule and, generally, would not have done so under strict liability.

(iii) With regard to the claim of (b), observe that since injurers are fully covered and their premiums will not depend on x , they will choose $x = 0$; whereas otherwise they would have purchased no coverage or only partial coverage, so that $x > 0$ would have been expected (unless y were extremely low).

(iv) Suppose that the model were extended to allow injurers to choose whether to engage in their activity. Then requiring injurers to purchase full coverage if they engage in their activity would mean that under strict liability, they would engage in it if and only if that were socially worthwhile (given their possibly suboptimal level of care).

Proof.(a) If liability is strict and injurers must purchase full coverage, then as in the proof to Proposition 2(a), they will choose x^* . But if injurers are either risk averse and $y < y'$ of Proposition 2, or if they are risk neutral, they would not have purchased liability coverage and would have taken $x_g(y)$, which is generally unequal to x^* .

If the negligence rule determines liability and injurers must purchase full coverage, then their wealth will be constant and equal to $y - [x + p(x)l]$ if $x < x^*$ (as their premium will be $p(x)l$) and to $y - x$ if $x \geq x^*$ (as their premium will be 0). Thus, injurers will be best off choosing x^* . In the absence of the requirement to purchase coverage, on the other hand, by Proposition 2, if y were sufficiently low, injurers would have chosen $x_g(y)$.

(b) This is clear from note (iii) above.

Proposition 4. Suppose that injurers are prohibited from purchasing liability insurance. Then (a) if insurers could have observed their levels of care and injurers had wished to purchase coverage, they would have taken efficient care;

whereas under the prohibition they generally will not take efficient care. But (b) if insurers could not have observed their levels of care and injurers had wished to purchase coverage, they would have taken different (and presumably lower) levels of care than they will under the prohibition. notes. (i) The explanation and proof of this is immediate from a comparison of Propositions 1 and 2, for if injurers are prohibited from purchasing liability insurance, they will behave as described in Proposition 1.

(ii) If the model were extended to allow injurers to choose whether to engage in their activity, then the effect of a prohibition against purchase of liability insurance could only be to lead risk averse injurers not to engage in their activity. This might or might not be socially beneficial, as injurers might or might not have made the socially appropriate choice whether to engage in their activity in the absence of a prohibition against liability insurance.

III. Concluding Remarks on Social Policy

In closing let us comment briefly on the use of social policy to alleviate the three problems created by injurers' lack of assets, that is, the tendency of injurers to engage excessively in risky activities and to fail to exercise adequate care when so doing; the bearing of risk by injurers due to their propensity not to purchase liability insurance; and the possibility that victims would not be completely compensated for their losses.

(a) The problem of injurers' excessive engagement in risky activities and the dulling of their incentives to take care. This problem may be meliorated in a variety of ways.²² Consider first a requirement to purchase liability insurance.²³ (See Proposition 3.) This will have essentially the effect that the voluntary purchase of liability insurance was noted to have in the Introduction.²⁴ Specifically, because injurers who engage in risky activities will have to pay premiums equal to the expected losses that they would impose on victims,²⁵ injurers will be led to make socially correct decisions whether to engage in activities.²⁶ Injurers will also be induced to take the appropriate level of care if insurers can assess their level of care and link terms of insurance policies to it. But if insurers cannot do this, a requirement to purchase liability insurance may have a perverse effect on injurers' exercise of care, and injurers might take less care than if they did not have to buy coverage and were exposed at least to the risk of losing their assets.²⁷

Consider next an opposite possibility: prohibiting purchase of liability insurance.²⁸ (See Proposition 4.) This would tend to discourage injurers from engaging in risky activities where they would otherwise voluntarily have purchased liability coverage. Hence, this effect could be beneficial, helping to cure the problem of excessive engagement in activities; but it could also turn out to have a disadvantageous chilling influence on behavior.²⁹ Similarly,

prohibiting purchase of liability insurance would be expected to increase the level of care exercised by injurers who would otherwise have insured; and one can imagine that this increase in the level of care might either be desirable or too great.

Another policy to consider is a requirement that injurers have some minimum level of assets to be allowed to engage in an activity.³⁰ While by definition this requirement will eliminate problems due to injurers' having assets less than the minimum level, it is indiscriminating in whom it excludes from engaging in an activity. In particular, it excludes those injurers who would be able and willing to pay for the expected losses that engaging in an activity would cause even though they might be unable to pay for the actual losses they could cause.³¹

An additional policy of interest is the direct regulation of safety. This will help in an immediate way to solve the problem of dilution of injurers' incentives, assuming that they would have to take called-for steps to reduce risk as a precondition for engaging in an activity. But the value of safety regulation is of course limited by the regulatory authority's ability to devise appropriate regulation. Moreover, safety regulation does not solve the problem that injurers have too great an incentive to engage in a risky activity; for it does not impose on injurers the expected losses caused by an activity (injurers need merely adhere to regulations).

A final policy to consider is resort to criminal liability. Clearly, parties who would who not take good care (or who would engage in a risky activity when they ought not) if only their assets were at stake might be induced to act otherwise for fear of criminal sanctions, notably imprisonment. The fact that criminal sanctions are socially costly to impose, however, diminishes their utility.

(b) The problem of risk-bearing by injurers. The tendency of potentially judgment proof injurers not to purchase liability insurance means that they are exposed to risk, which is a problem to the extent that they are risk averse. Of the policies we discussed, the only one that addresses this problem is a requirement that injurers purchase liability insurance coverage.³²

(c) The problem of inadequate compensation of victims. This problem will in principle automatically be solved where victims are well-informed purchasers of insurance. For in that situation, victims would be expected to obtain insurance policies protecting them against the possibility that injurers would be unable to compensate them fully for their losses.³³

But where victims do not voluntarily purchase such insurance coverage, two types of social policy may be employed to guarantee that they will nevertheless have adequate coverage.³⁴ First, victims may simply be made to obtain coverage³⁵ or a publicly-financed insurance fund may be established.³⁶ Second, injurers may be required to purchase a minimum level of liability insurance or to have a minimum

level of assets. In assessing the appeal of these latter policies, it is necessary to take into account their effects on injurers' behavior, which, as discussed above, may or may not be desirable. For example, if the use of a requirement to purchase liability insurance coverage adversely affected injurers' incentives to take care, then a requirement that victims purchase greater coverage might be the best way to assure them adequate compensation.

Footnotes

* Professor of Law and Economics, Harvard University. This is a revision of a 1983 version with the same title. I wish to thank L. Bebachuk and R. Mrofka for comments and the National Science Foundation (grant no. SES-8014208) for financial support.

1. The term judgment proof is sometimes meant to apply only where an injuring party has no assets whatever and is thus unable to pay any of the losses for which he is liable. But here, as stated, the term is interpreted more generally and is meant to apply whenever a party is unable to pay some portion of the losses for which he is liable.

2. Fires at nightclubs or hotels could well create losses greater than the worth of their owners; the harm caused by mass consumption of spoiled foods or by drugs with adverse side effects could exhaust the holdings of even large enterprises, and similarly with losses resulting from explosions, oil spills, or the release of toxic agents or radioactive substances.

3. A number of writers have considered these or closely related questions from an economic perspective; see notes 5 and 6 below. The analysis here adds to theirs in that it studies formally the judgment proof problem in a more general

model that (a) takes into joint account liability and liability insurance, and (b) draws distinctions between problems concerning injurers' engagement in activities and those concerning their exercise of care when so doing. In addition, (c) solutions to the judgment proof problem are discussed.

4. Of course, injurers may engage in activities to an excessive extent even in the absence of the judgment proof problem if the form of liability is the negligence rule (rather than strict liability); for under that rule injurers do not have to pay for the losses that their activity causes if they act with due care. See Shavell [1980]. But this tendency will be worsened by the judgment proof problem.

5. This particular point has been analyzed in Summers [1983] (which had not been published when I wrote the previous version of this paper) in a model in which injurers are risk neutral and liability insurance is not sold.

6. This point was first emphasized to my knowledge by Calabresi [1970] at 58. It was studied formally in Keeton and Kwerel [1984] and in Huberman, Mayers, and Smith [1983] in models assuming a fixed risk of liability; it is studied here in a model where the risk of liability is affected by injurers' exercise of care.

7. However, two of these policies (requirements to purchase liability insurance, and prohibitions against its purchase) are also studied formally using the model.

8. It will be easy to see how the conclusions we will reach would be altered if the model were extended to allow

injurers to choose not only their level of care but also whether to engage in their activity; we will comment on this below.

9. The assumption that x is non-monetary is largely an analytical convenience; see note 11 below.

10. Formally, the problem may of course be put as maximizing the expected utility of injurers subject to the constraint that victims' expected utility is held constant and to a resource constraint. See Shavell [1982], which proves the Remark for virtually the same model as is studied here.

11. Note that were care monetary, an injurer's payment would be limited to $y - x$, for the injurer's expenditures on care itself would lower his available wealth (a point that is overlooked in Summers [1983]). Care is assumed to be non-monetary here to avoid considering the effect of care on available wealth; although the effect is not important, considering it would introduce complications into the analysis. (The 1983 version of this paper assumed that care is monetary and dealt with the complications.)

12. An injurer's expected liability will be $p(x)y < p(x)\ell$ if he engages in the activity (where $x = x_s(y)$). Hence, if, for instance, the injurer is risk neutral, he will decide to engage in the activity whenever $b > x + p(x)y$ rather than only when $b > x + p(x)\ell$.

13. Differentiating $EU_x^S(x(y), y) = 0$ with respect to y and solving for $x'(y)$, we obtain $x'(y) = -EU_{xy}^S(x, y)/EU_{xx}^S(x, y)$. The denominator is negative (the second-order regularity

condition for a maximum), so that the sign of $x'(y)$ is that of $EU_{xy}^S(x, y)$.

14. If no such y exists, then $x_S(y)$ is always less than x^* , so that the claim is clearly true given that the set of y where $x_n(y) = x^*$ is non-empty, a fact we shall show in the next step of the proof.

15. See DeGroot [1970] at 97.

16. This result is proved in Keeton and Kwerel [1984] at 155-156 and 174-175.

17. For an analysis of liability and insurance in the absence of the judgment proof problem, see Shavell [1982].

17a. However, in a model with a variable level of loss, this would not generally be true; in such a model, it might well be optimal to be purchase positive but less than full coverage.

18. Note, by contrast, that if a risk neutral party's assets exceed ℓ -- so that he would have to bear ℓ if he did not insure -- the party would merely be indifferent between buying coverage and not.

19. See Shavell [1979] for details.

20. By Jensen's inequality, the left-hand side of (11) is less than $U((1-p(x_S(y)))y - x_S(y))$. Hence if the two sides of (11) are equal, then $(1-p(x_S(y)))y - x_S(y) > y - x^* - p(x^*)\ell$, which implies that $x_S(y) < x^* + p(x^*)\ell$.

21. At $y=\ell$, the left-hand side of (11) is, by Jensen's inequality, less than $U(\ell - x_S(\ell) - p(x_S(\ell))\ell)$, which is clearly less than or equal to $U(\ell - x^* - p(x^*)\ell)$.

22. The imperfect nature of each of the social policies we are about to review suggests that a combined approach would be best; but discussion of this issue is beyond our scope. Another issue that will not be discussed here is the administrative costs associated with use of the different policies.

23. Requirements to purchase liability insurance are common. For instance, purchase of liability insurance is compulsory for owners of automobiles in most states (see, for example, N.Y. Veh. & Traf. Law §312; Cal. Veh. Code §16020); and purchase of worker's compensation insurance must be made by employers according to many states' statutes (see, for example, N.J. Stat. Ann. 34:15-71).

24. But as the reader will recall, injurers' lack of assets reduces their motive to purchase liability insurance voluntarily.

25. More exactly, injurers would have to pay such premiums under strict liability; under the negligence rule, their premiums would be lower.

26. Think again of the electric utility company. If it is made to buy liability coverage, it will decide to build a nuclear-powered facility instead of a coal-powered facility if and only if the savings in production costs exceed the increase in expected accident losses as reflected in higher liability insurance premiums. Or think of the decision of a parent whether to allow a teenaged child to drive. If the parent would have to purchase additional liability coverage

if the child drives, the parent might, beneficially, choose to defer the time when the child begins driving if the child's immediate reasons for doing so are not strong. Such arguments have led some to suggest the desirability of a requirement to purchase liability insurance; see for instance Williamson, Olson, and Ralston [1967] at 247-249, Vickrey [1968] at 485, and Keeton and Kwerel [1984] at 161.

27. Suppose the electric utility has net worth of \$200 million and is required to purchase a \$1 billion liability insurance policy for its nuclear-powered facility. (Let us say that \$1 billion approximates the harm that a serious accident could cause.) Thus, being well insured, the utility might decide not to bear the expense of, for instance, more frequent safety inspections or (as noted earlier) better training of its workers where this would not affect its premium or its coverage in the event of a claim. But if the utility is not required to carry the \$1 billion liability coverage, perhaps it would choose not to purchase any coverage or only a small amount. (Indeed, if the utility were risk neutral, it definitely would decide against obtaining coverage; see Proposition 4.) In this case, then, its \$200 million would be at risk, and it might therefore choose to invest desirably in the additional inspections and training of workers.

28. As a general proposition, insurance contracts that indemnify conduct in contravention of public policy are void in the United States, 44 C.J.S. Insurance §241(a). However,

policies are held to be as against public policy only in cases of egregious misconduct, particularly where criminality, intentional torts, or statutory absolute liability is involved. Isenhardt v. General Casualty Company of America, 377 P.2d 26 (Or. 19620) (illegal insurance contract where insured sought indemnification for liability arising from assault and battery). Globus v. Law Research Service, Inc., 418 F.2d 1276 (2d Cir. 1969) (insurance contract is void in the case of the absolute liability of an underwriter for a violation of the Securities Act).

29. Consider a situation where most parties' assets are very low compared to the harm they might do and where it would be best for most parties not to engage in the activity. Here prohibiting purchase of liability coverage might be desirable. In other types of situation, however, the suspicion is that it would reduce engagement in activities too much. (Perhaps too few teenagers would drive if liability insurance for them was disallowed.)

30. This type of policy is not usual; modern state statutes typically do not require a minimum initial level of capital to incorporate. For example, in Delaware the incorporators have the discretion to specify in the certificate of incorporation the amount of authorized shares and par value, if any, and are not bound by a minimum capitalization requirement. See General Corp. Law of Delaware §102(a)(4). Some statutes that formerly required a nominal level of paid in capital (ranging from \$200 - \$1000) have been amended to

delete the minimum capitalization requirement. See, for example, Ky. Rev. Stat. §271A.270 eliminated \$1000 minimum capitalization requirement in Ky. Rev. Stat. §271.095.

31. Suppose that engaging in an activity, say operation of a chemical plant, could cause losses ranging up to several million dollars, but that expected losses would be in the neighborhood of only \$100,000, as the probability of an accident is low. Parties therefore ought to be able to engage in the activity whenever they would be willing to pay about \$100,000 to do so. To insist that parties have assets of a much higher amount, such as \$2 million, would exclude from the activity some parties that would have been willing to pay \$100,000 (and that might have been induced to take tolerably good care despite having assets considerably less than \$2 million).

32. Calabresi [1970] at 59 points out that such a requirement is desirable for precisely the presently discussed reason, as do Keeton and Kwerel [1984] at 161.

33. Thus drivers might voluntarily purchase policies providing coverage against losses caused by other uninsured drivers (so-called uninsured motorists).

34. A reason that victims might not purchase insurance coverage when it would be in their interests to do so -- and thus why social policy may be called for -- is that they do not appreciate the value of insurance (perhaps because they do not understand the magnitude of the risk they face, perhaps because of some psychological quirk).

35. The most common form of compulsory victims' insurance is uninsured motorist coverage; see, for example, Mass. Ann. Laws ch. 175 §113L; N.Y. Ins. Law §167(2-a); N.J. Stat. Ann. §17:28-1.1.

36. Public unsatisfied judgment funds are used in compulsory third party liability insurance jurisdictions for victims injured in automobile accidents. See, for example, N.J. Stat. Ann. §39:6-61 (third party automobile liability insurers contribute to the fund); N.Y. Ins. Law §5201. The public fund acts as a gap-filler to ensure full compensation when the injury is caused by an underinsured party, a hit and run driver that escapes detection, or a judgment proof out of state resident that is not required to carry liability insurance. Also, the Federal Government has recently established insurance funds to cover certain types of losses (due, for example, to miners' black lung disease).

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