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Two Advantages of the Negligence Rule Over Strict Liability when the Parties are Risk Averse

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Abstract: When parties are risk-averse and therefore take out insurance, the efficiency of a tort rule depends on how well the insurance contracts govern incentives, risk allocation and transaction costs under the rule. This article presents two overlooked or discarded advantages of the rule of negligence over strict liability, which appear when insurance contracts are incomplete due to ex-ante transaction or ex-post verification costs. One advantage arises because of a legal impediment under strict liability: insurers cannot exempt coverage for all acts of simple negligence. Instead, the insurer must, at a cost, precisely specify each act for which coverage is excluded. Such specification can be prohibitively costly when there are many acts and many contingencies. These transaction costs, or the inefficient risk allocation associated with a deductible, are avoided under the negligence rule, where under idealized conditions the injurer can simply take due care and need not take out insurance. The other advantage of the negligence rule is that it provides incentives for the victim to bring forward information about the injurer's acts. The victim has little incentive to convey such information under strict liability, whereas the victim's insurer may elicit it, e. g. by not covering the victim's loss fully.

Keywords: the negligence rule, strict liability, insurance, unilateral care

1 Introduction

When parties to accidents are insured, the ability of insurance contracts to effectively govern incentives, risk allocation and transaction costs becomes salient in the comparison of liability rules. This article discusses two related advantages that the negligence rule may hold over the rule of strict liability when the incompleteness of insurance contracts is taken into account, i. e. when there may be a significant transaction cost in specifying acts ex-ante or when it may be difficult to

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verify acts ex-post. These advantages are not mentioned or have been discarded in the standard account, as quoted below.

The first advantage is that the negligence rule may economize on transaction costs that arise because the liability insurer must specify in exact terms those acts that preclude insurance coverage. For instance, the liability insurer cannot under strict liability condition coverage on the injurer acting in a manner that under the negligence rule would be considered due care; such preclusion is too unspecific to be valid under insurance contract law. In fact, insurers often tell of the difficulties of specifying terms that are specific and precise enough for the courts to accept them. Under this legal restriction insurers may choose to incur the transaction costs of specifying acts precisely or they may partially forego such regulation and instead provide incentives for injurers by other means such as through deductibles. Under either choice, there will be a loss of efficiency, which may be avoided under the negligence rule, since under that rule there is no need for the liability insurer to condition coverage on due care (as due care precludes liability). In fact, the transaction costs as well as the inefficient risk allocation may be avoided altogether under the negligence rule under idealized conditions, since the injurer need not take out insurance but can avoid liability by taking due care. Therefore, under idealized conditions the negligence rule may dominate strict liability for unilateral accidents when the parties are risk averse.

The second advantage concerns the costs for the insurer of obtaining information about the acts performed by the injurer. In his seminal comparison of negligence and strict liability, Shavell pointed to a reason for disregarding this factor. He wrote (Shavell 1982:131):

> Suppose, for example, that it would be very expensive to determine injurers' prevention activity. Then liability insurers would not do so, and therefore, as explained, the policies they sell would involve incomplete coverage. Consequently, as stated in Proposition 4, under strict liability risk averse injurers would be left bearing a risk, which is socially undesirable. On the other hand, according to Proposition 5, under the negligence rule the socially undesirable bearing of risk would be avoided, for the injurers would act in a non-negligent way. Yet it should not be concluded from this that the negligence rule would be superior to strict liability, for the application of the negligence rule requires the courts to ascertain injurers' prevention activity- an undertaking that was assumed in the first place to have been sufficiently costly to make it less than worthwhile for liability insurers.

Yet, the costs of verifying the acts taken by the injurer may not be identical under the two rules when the victim observes the injurer's behavior. It may be hard for the insurer to obtain information about acts performed by the injurer when the rule is strict liability for then the victim may not have an incentive to report those acts. This incentive is generally present under the rule of negligence, as the victim's compensation depends on the injurer's negligence when the victim's insurance contains a deductible. Consider, for instance, the accident of a dog

biting a person. Under strict liability there is no incentive for the victim to present the details of how the accident occurred, such as whether the dog was held in a leash, since the victim's right to compensation is unaffected by these circumstances. Yet, the liability insurer might wish to obtain this information if there is a clause in the insurance contract that excludes coverage if the dog was unleashed. Insurers explain that they sometimes investigate breaches of insurance conditions themselves through assessors or other experts, but that it is not uncommon for them to receive significant information from victims when the rule of negligence applies, for then the victim typically has a strong incentive to incriminate the injurer. For example, in the context of construction contracts, house-owners sometimes take photos of the progress of construction, and such information is more likely to come forward when the house-owners benefit from presenting it. Naturally, one can imagine various ways in which the liability insurer might seek to induce the victim to come forward with her information,[1] but as will be discussed below this meets with both practical and legal impediments.

It should be emphasized that while the present article directs attention to two advantages of the negligence rule over strict liability that have not been addressed in the literature, many other factors of course enter into the the overall comparison. For example, the negligence rule suffers from the disadvantage that its vague standard is often interpreted differently by the parties, which can lead to costly litigation, and the negligence rule can also perform badly when the injurers' acts are unverifiable. On the other hand, strict liability entails many claims for compensation, which may be costly to administer, also for the insurers. These important points are well-known and are therefore not included in the present analysis.

The remainder of the article first briefly reviews the literature and then formally analyzes the two points just made. Finally, the article discusses some objections that can be raised against the analysis, summarizes its main findings, and points out possibilities for future research.

2 The literature

The literature on the relative advantages of negligence and strict liability is large. One of its main insights is that the comparison hinges on whether the injurer's or the victim's unverifiable acts and activity levels are the most important (see e. g. Shavell 1987). Schäfer and Müller-Langer (2009) present an overview of the many factors that enter into the comparison. Among these, they mention the informational advantage of the negligence rule, which they think has been relatively neglected:

1 For convenience, the injurer is referred to as male and the victim as female.

> All in all it can be said that the negligence rule has the advantage of generating more valuable information for third parties than the strict liability rule. This is an advantage which has been overlooked in much of the literature.

The present article considers the insurer as such a third party.

As exceptions to their statement that the literature has overlooked the information advantage of the negligence rule, Schaefer and Mueller-Langer mention Feess and Wohlschlegel (2006).

Demougin and Fluet (1999) build on the analysis of Newman and Wright (1992) by extending the latter's model to include the notion that the negligence rule but not the rule of strict liability provides information to an employer about an employee's act. The information provided by the court that the employee has acted negligently is valuable to the employer if the latter wishes to induce the employee to take proper care. It is assumed that the employer cannot in the same way as the court call in witnesses and induce them to tell the truth under oath.

Fees et al. emphasize that the due care standard created by the court under the negligence rule may benefit injurers generally when they are unaware of the correct level of care.

The general point that the negligence rule yields more information than strict liability is made also in a paper by Sher (2006) in the context of medical malpractice. We return to his claims below.

The difficulty and costs of drafting insurance terms are addressed in the literature on contract incompleteness. For instance, Battigalli and Maggi (2002) assume that there is a cost to writing both contingencies and acts. These costs lead to rigidity (acts that are insufficiently contingent on the circumstances) and discretion (acts that are not specified at all but left for the agent to decide). Their theory can explain that insurers leave many acts to the discretion of the insured as it is too costly to specify all acts in the insurance contract.

Similarly, Dye (1985) models the notion that there is a cost to specifying future contingencies, while Shavell considers a cost per clause written into a contract (Shavell 2006).

Al-Najjar et al. (2006), whose example is co-insurance, model the complexity of the world which any finite contract cannot capture fully.

3 A model of tort law that includes a cost of describing acts in the insurance contract

We now consider the advantage of not having to describe the act ex-ante under the negligence rule, and to isolate this effect we consider a model in which the act

can be verified at no cost ex-post. It is assumed that only the injurer acts while the victim is passive, and that the sequence of interaction is as follows:

Stage 1: The court or a lawmaker decides whether to adopt a rule of negligence or of strict liability, applying the criterion of Kaldor-Hicks efficiency. The choice of the negligence rule is termed n while the choice of strict liability is termed s.

Stage 2: The injurer X and the victim V choose whether or not to take out insurance, offered by a liability insurer, I_x and a first-party insurer, I_v, to the respective parties. Both insurers are risk neutral. What drives the demand for insurance is risk aversion. The injurer's and the victim's utility functions are U and V, respectively, both increasing and concave. The insurer's insurance contract may contain a deductible, d, and/or a clause stipulating coverage conditional on the injurer not taking an improper act. T is the transaction cost of conditioning coverage in this manner. Note that the liability insurer cannot condition coverage and cannot condition the deductible on a vague standard. The insurer cannot write: 'the deductible is d when it can be shown that the injurer acted negligently'. The act must be specified with precision, which is assumed to involve the cost T. When the insurer conditions coverage on the act $\delta = 1$, otherwise $\delta = 0$. X's insurance premium is π, while $V's$ is π_v. If one of these is zero, this reflects that no insurance is taken out. The deductible implies that whatever liability arises, X's liability insurer, I_x, pays the liability minus d. The insurance contracts are offered in a competitive market, and so are priced according to a zero-profit condition.

Stage 3: The injurer chooses the act $x \in (0, 1)$ at a cost c(x), $x \in (0, 1)$. The act $x = 1$ is due care while $x = 0$ is negligence, since by assumption $p(1)h + c(1) < p(0)h + c(0)$.

Stage 4: An accident of harm h occurs with probability $p(x)$. If an accident occurs, the act committed by the injurer becomes common knowledge, which means that the court will also be informed of it at no cost.

Stage 5: The victim's insurer presents a claim for damages against the injurer according to the tort rule.

Stage 6: Pay-offs are realized by all the parties in a settlement that perfectly anticipates what would happen in court. The court is assumed to set damages correctly given its information.

We are interested in the sub-game perfect equilibrium of this game, i. e. we are seeking the rule that induces the more efficient outcome in the Kaldor-Hicks

sense. Under uncertainty, we define Kaldor-Hicks in terms of the summation of the injurer's, the victim's and the insurers' certainty equivalents.

Two insights simplify the analysis: One is that we need not consider the possibility that the parties do not take out insurance. The victim will always wish to be insured due to risk aversion, and we can imagine that the liability insurer might mimic the outcome that occurs if the injurer self-insures, by setting the deductible equal to total liability h. If this is the value-maximizing outcome, this is what competition will force the insurer to do, and so we need not consider the choice on the part of the injurer of whether to be insured or not. The other insight is that we can compare the two rules in terms of how well they implement $x = 1$. If it is not optimal to do so, the liability insurer can implement $x = 0$ equally well under either rule by simply covering the injurer's full loss unconditionally. If one rule then implements $x = 1$ better than the other, the one weakly dominates the other, as it will always do as well and will do better when it is optimal to implement $x = 1$. As we will only be interested in this form of weak domination of one rule over the rule, we do not have to explicitly consider the possibility that it may not be optimal to implement $x = 1$.

An equilibrium that implements $x = 1$ is a vector $((n \text{ or } s), d^*, \delta^*, \pi^*, \pi_v^*)$.

For this case of costly ex-ante contracting but cost-less ex-post resolution, the following proposition applies under the other assumptions of the model:

Proposition 1. *Under unilateral care and risk aversion, the negligence rule is more efficient than the rule of strict liability when:*

(1) *there is a cost for the liability insurer of describing the act that precludes coverage*
(2) *the injurer's act is common knowledge ex post*
(3) *under strict liability, the liability insurer cannot condition coverage on a vague standard of negligence,*

Proof. Formally, we show that the equilibrium is $(n^*, d^* = h, \delta^* = 0, \pi^* = 0, \pi_v^* = p_1 h)$, i. e. the negligence rule is the most efficient and under it the injurer is not covered by insurance ($d = h$), corresponding to the case where the injurer does not take out insurance but simply takes due care.[2] All risk falls on the victim who will insure (without any moral hazard, since the victim does not act). That this is an equilibrium can be seen by solving the game backwards: When the injurer has taken due care and this is common knowledge, the victim will not raise a claim (since a claim will be defeated in court). This implies of course that the injurer will not pay damages. The expected utility for the injurer is then $U(-c(1))$. If, on

2 Recall that we assume that the injurer always takes out insurance but may not be covered at all, if this is optimal.

the other hand, the injurer had acted negligently, this would have been common knowledge and so the victim would have raised a claim for compensation equal to h. In that case, the injurers expected utility would amount to $p(0)U(-h-c(0))+(1-p(0))U(-c(0))$. To see that $U(-c(1)) < p(0)U(-h-c(0))+(1-p(0))U(-c(0))$, when, as assumed, $p(0)h+c(0) > p(1)h+c(1)$, note first that the average loss of the lottery in which the loss is $h+c(0)$ with probability $p(0)$ and $c(0)$ with probability $1-p(0)$ is greater than $c(1)$, when $p(0)h + c(0) > p(1)h + c(1)$. And second, that the lottery naturally has a greater variance than the certain outcome when $x = 1$, namely the loss of $c(1)$. Hence, the injurer will choose $x = 1$ and then bear no risk. All risk will be born by the victim's risk neutral insurer, such that the first-best will be realized under the negligence rule. Under strict liability, by contrast, either the cost T will be incurred or the injurer will bear part of the risk through a deductible. Note that both instruments will not be used as there is no reason to let the injurer bear part of the risk when the insurer conditions coverage on the act $x = 1$ and the act is perfectly verifiable ex-post. The deductible d under strict liability is calculated from the incentive compatibility constraint: $p(1)U(-d-p(1)h)+(1-p(1))U(-p(1)h) \geq p(0)U(-d-p(1)h) + (1-p(0))U(-p(1)h)$. We denote the lowest value that fulfills this equation by d_S^*.

The outcome where $x = 1$ is implemented under strict liability is hence either $(d^* = d_S^*, \pi^* = p(1)h, \delta^* = 0, \pi_V^* = 0)$, or $(d^* = 0, \delta^* = 1, \pi^* = p(1)h, \pi_V^* = 0)$. Both of these outcomes are second-best, since either the insurer bears the risk of incurring the loss d_S^*, or a transaction cost T is incurred. Hence, the first best cannot be achieved under strict liability. When only a second-best outcome is realized under strict liability, the sum of the certainty equivalents is higher under the negligence rule. That the first best yields a higher sum of certainty equivalents than the second best can be seen from the formulation where the first-best contract is found as that which maximizes one actor's expected utility given a constant expected utility for the other actor(s). The difference between the first- and the second-best then amounts to one more constraint put on this maximization problem. With one more constraint, the sum of certainty equivalents will be smaller. ■

Note that the proposition reflects the advantage that standards may have over rules when it is costly to specify acts ex-ante but the violation of standards is clear ex-post (e. g. Kaplow 1992).

4 A model of the information advantage of the negligence rule

We now consider the advantage that the negligence rule may hold in better inducing the victim to come forward with information about the injurer's act. The idea

is that under the negligence rule but not under the rule of strict liability, it is in the interest of the victim's insurer to obtain this information when the injurer has acted negligently, since the insurer can then seek redress (with the injurer or, as practical reality, directly with the injurers' insurer). To highlight this effect, we assume that only the victim observes the act taken by the injurer, and that the victim's insurer can elicit the information by applying a deductible. When the victim pays a deductible, she becomes interested in proving the injurer's negligence, since she recovers the deductible from the injurer when she can do so. Under the assumption that the information can be elicited under the negligence rule and that it will not be elicited under strict liability (due to the lack of incentives on the part of the victim's insurer), it is apparent that the negligence rule may outperform strict liability in the model above, as without information about the injurer's act it is clearly not possible to induce the first best. By contrast, if communicating the injurer's act costs t, the victim will communicate it under the negligence rule when $t < d_v$, where d_v is the deductible that the victim must pay. This cost of communication will only be incurred outside equilibrium, i. e. when the injurer has chosen $x = 0$, and therefore, when $t < d_v$, the first best can be induced under the negligence rule within the model analyzed above. Since this is straightforward, we shall analyze the information advantage within a model that is more realistic and that throws into question the alleged advantage of the negligence rule. We shall assume that the injurer will wish to be covered by his insurance under either rule because there is a possibility that the injurer (or the injurer's employees) may lapse in the execution of due care. We inquire whether the negligence rule still outperforms the strict liability rule in this setting, when only the victim observes the injurer's act.

Thus, we distinguish the act which X chooses, which we denote $x \in (0,1)$, and the act that actually materializes $y \in (0,1)$, where $y = 0$ is the negligent act while $y = 1$ is due care. One can think of x as the level of attention devoted to a task and of y as the actual performance which may deviate from the chosen level of attention due to a momentary lapse. Of course, it is the actual performance which affects the probability of an accident, i. e. the likelihood of an accident is $p(y)$. The probability of a lapse is ϵ, such that although the injurer chooses the act $x = 1$, the act that ensues is $y = 0$ with probability ϵ and $y = 1$ with probability $1 - \epsilon$. We assume for simplicity that if $x = 0$, then $y = 0$ with certainty. Hence, whereas above, the probability of an accident was $p(x)$ it is now given by the equations $p_\epsilon(0) = p(0)$ and $p_\epsilon(1) = \epsilon p(0) + (1 - \epsilon)p(1)$.[3] To make this example interesting we must assume that the court cannot observe whether $y = 0$ was due

3 The model of the section above was a special case of the present model, with $\epsilon = 0$.

to a lapse or due to $x = 0$; the victim, the insurer and the court can only observe the actual act y.

Before analyzing the consequences of the victim's insurer's different incentives to elicit information about the injurer's act under the two rules, we consider the setting in which the information is common knowledge, and in which contracting is without cost. We show that $x = 1$ can then be implemented equally well under either rule, from which it will follow that the negligence rule will perform better when it can elicit information at low cost.

Proposition 2. *Under unilateral care, the rules of strict liability and negligence are equally efficient when:*
(1) *there is no cost of contracting*
(2) *the injurer may lapse*
(3) *the injurer exhibits constant absolute risk aversion*
(4) *the act carried out (y) is common knowledge*

Proof. Note first that the liability insurer will cover fully, i. e. not apply a deductible, when the observed act is $y = 1$, for then it must be the case that $x = 1$ (since if $x = 0$ then $y = 0$). When, on the other hand, $y = 0$, i. e. the bad act is observed, it may not be optimal to exclude coverage completely, as the correct act may have been chosen by the injurer. We hence do not consider δ but assume that the deductible may vary from 0 to h.

We now show that the incentive compatibility constraint for the injurer, which ensures that the injurer chooses $x = 1$, will be identical under the two liability rules, except for a constant reflecting that the insurance premium will be higher under strict liability than under the negligence rule. Denoting the deductible under the negligence rule by d_n, the incentive constraint is derived as follows under this rule:

If the injurer chooses $x = 1$, his act will be $y = 0$ with probability ϵ and $y = 1$ with probability $1 - \epsilon$. This means that if the act is $x = 1$, the insurer's expected utility is:

$$\begin{aligned}\epsilon(p(0)U(-d_n - \pi_n - c(1)) + (1 - p(0))(U(-\pi_n - c(1))) \\ + (1 - \epsilon)p(1)U(-\pi_n - c(1))\end{aligned} \tag{1}$$

whereas if $x = 0$, then $y = 0$, and the expected utility is $p(0)U(-d_n - \pi_n - c(0)) + (1 - p(0))(U(-\pi_n - c(0)))$. For the incentive compatibility constraint to be fulfilled the above expression for the expected utility when $x = 1$ must exceed this latter expression of the expected utility when $x = 0$. The deductible, d_n^*, can hence be calculated from the equation:

$$\begin{aligned}&\epsilon(p(0)U(-d_n^* - \pi_n - c(1)) + (1-p(0))(U(-\pi_n - c(1)))\\&\qquad + (1-\epsilon)p(1)U(-\pi_n - c(1))\\&= p(0)U(-d_n^* - \pi_n - c(0)) + (1-p(0))(U(-\pi_n - c(0)))\end{aligned} \tag{2}$$

We know from the above analysis that there exists a solution when $\epsilon = 0$, from which we can conclude that when ϵ is small, $x = 1$ can be implemented.[4] Under strict liability, the deductible is termed d_s, and will be applied when $y = 0$. The expected utility from $x = 1$ is hence:

$$\begin{aligned}&\epsilon(p(0)U(-d_s - \pi_s - c(1)) + (1-p(0))U(-\pi_s - c(1))\\&\qquad + (1-\epsilon)U(-\pi_s - c(1))\end{aligned} \tag{3}$$

If under strict liability, $x = 0$, the actual act will be $y = 0$, and so the insurer will apply the deduction when the accident happens. This means that the injurer's expected utility becomes: $p(0)U(-d_s - \pi_s - c(0)) + (1-p(0))(U(-\pi_s - c(0)))$. The incentive compatibility constraint is fulfilled when the expected utility above for $x = 1$ exceeds the latter expression for the expected utility when $x = 0$.

Note that the incentive compatibility constraints are exactly the same under the two rules when $d_n = d_s$, except for the expressions π_s and π_n. Naturally, $\pi_s > \pi_n$, so the injurer's wealth is simply lower under strict liability than under the rule of negligence. However, the incentive compatibility constraint will be unaffected by the wealth level when the injurer's utility function exhibits constant absolute risk aversion. For then any two lotteries will be ranked in the same manner, regardless of the injurer's wealth.

When the incentive compatibility constraint of the injurer is the same under the two rules, he will be exposed to the same level of risk when $x = 1$ is implemented. The diminution of his certainty equivalent due to his exposure to risk will then be the same under both rules. All other risk will be carried by risk neutral parties. Hence, the sum of the certainty equivalents will then also be identical under the two rules. ■

We now consider the case where y is private information on the part of the victim, and where the victim cannot be induced to reveal it to the liability insurer under strict liability. Thus, we add the following to the second stage of the game described above:

4 When it cannot be implemented, the two rules will both allow the inefficient act and will do equally badly.

Stage 2': The victim's insurance contract may contain a deductible, d_v, that the victim will recover when she can show that the injurer acted with negligence. Communication costs t, as mentioned, and is in the form of hard information, i. e. verifiable signals that can be used by the insurer against the injurer in court. Under strict liability, $d_v = 0$ as the victim's insurer does not gain from the victim's information (this is further discussed below).

Stage 4 of the game we modify as follows:

Stage 4': An accident of harm h occurs with probability $p(x)$. If an accident occurs, only the victim observes the acts taken by the injurer.

In other respects, the two models are the same.

We now show that if t is sufficiently small, the negligence rule is more efficient than strict liability. Under the negligence rule the victim's insurer can induce the victim to communicate her information about the injurer's act through a deductible equal to t. Such deductible ensures the incentive to communicate, for when communication costs t and the deductible equal to t can be recovered from the injurer when the injurer has acted negligently, it will be optimal for the victim to report the injurer's negligence. The deductible introduces some risk for the victim and a communication cost when the injurer has acted negligently, but the risk and the communication cost is small when t is small. On the other hand, if the injurer's act will not be communicated by the victim, as will be the case under strict liability, it will be harder for the injurer's insurer to induce the injurer to take care. The insurer will have to employ a deductible and it cannot be contingent on the injurer's act but must apply whenever an accident occurs. Such a non-contingent deductible imposes unnecessary risk on the injurer. When t is sufficiently small, the dead-weight loss due to this risk is higher than the dead-weight loss due to the victim's deductible t. Hence,

Proposition 3. *Under unilateral care, the negligence rule is more efficient than strict liability, when:*

(1) *the injurer may lapse with probability ϵ.*
(2) *only the victim observes the injurer's act y (that may be due to a lapse)*
(3) *the victim can report the nature of the injurer's act at a cost of t*
(4) *t is sufficiently small*

Proof. As noted above, it suffices to show that the negligence rule can implement the outcome where the injurer chooses $x = 1$ more efficiently than the rule of strict liability.

Under the negligence rule, when the deductible $d_v = t$ (or slightly higher), the victim will have an incentive to communicate the injurer's act. However, this deductible comes with the cost that the victim must bear the risk of the loss d_v when an accident occurs, which it does in equilibrium with probability $\epsilon p(0) + (1-\epsilon)p(1)$, given that $x = 1$. When the injurer has acted negligently, which occurs with probability $\epsilon p(0)$, the victim communicates at a cost of $t = d_v$ and recovers d_v. Hence, with probability $\epsilon p(0)+(1-\epsilon)p(1)$, the victim suffers a loss of d_v. The fact that the victim bears this risk lowers the sum of certainty equivalents (although of course the victim's insurer gains from not paying out the full loss to the victim; it is only the inefficiency of the risk allocation that counts negatively in the sum of certainty equivalents.[5]

The injurer must also bear risk under the negligence rule, for if he bears no loss when an accident occurs and he is found to have acted negligently, he will have no incentive to take due care. However, he only bears risk when both of these conditions are fulfilled, i. e. the deductible will only have to be paid with probability $\epsilon p(0)$. This implies that when $x = 1$ the injurer's expected utility equals:

$$\begin{aligned}&\epsilon(p(0)U(-d_n - \pi_n - c(1)) + (1-p(0))(U(-\pi_n - c(1)))\\&+ (1-\epsilon)(p(1)U(-\pi_n - c(1)) + (1-p(1))U(-\pi_n - c(1)))\end{aligned} \tag{4}$$

When $x = 0$, the expected utility is:

$$p(0)U(-d_s - \pi_s - c(0)) + (1-p(0))U(-\pi_s - c(0)) \tag{5}$$

Hence, d_n is given by

$$\begin{aligned}&\epsilon(p(0)U(-d_n - \pi_n - c(1)) + (1-p(0))(U(-\pi_n - c(1)))\\&+ (1-\epsilon)(p(1)U(-\pi_n - c(1)) + (1-p(1))U(-\pi_n - c(1)))\\&= p(0)U(-d_n - \pi_s - c(0)) + (1-p(0))U(-\pi_s - c(0))\end{aligned} \tag{6}$$

Note that under constant absolute risk aversion this simplifies to

$$\begin{aligned}&\epsilon(p(0)U(-d_n - c(1)) + (1-p(0))(U(-c(1)))\\&+ (1-\epsilon)(p(1)U(-c(1)) + (1-p(1))U(-c(1)))\\&= p(0)U(-d_n - c(0)) + (1-p(0))U(-c(0))\end{aligned} \tag{7}$$

5 We assume that the insurer's settle without cost; if we assume there is a cost of settlement this cost would also be incurred under strict liability leading to a well known comparison between the two rules.

since under constant absolute risk aversion, comparison between lotteries is unaffected by initial wealth.

Under strict liability, in order to implement $x = 1$ under strict liability, the deductible must be set at the same level whenever an accident occurs and not only when an accident occurs and $y = 0$, as is optimal (because when $y = 1$, the correct act $x = 1$ must have been chosen). A deductible is hence applied even when $y = 1$ (and an accident occurs), which implies a loss of efficiency. When the deductible in applied whenever there is an accident, i. e. with probability $p(1)$, its size is given by a comparison between the expected utility of the injurer when $x = 1$ and $x = 0$. When $x = 1$, the expected utility is:

$$\begin{aligned}&\epsilon(p(0)U(-d_s - \pi_s - c(1)) + (1 - p(0))(U(-\pi_s - c(1)))\\ &+ (1 - \epsilon)(p(1)U(-d_s - \pi_s - c(1)) + (1 - p(1))U(-\pi_s - c(1)))\end{aligned} \tag{8}$$

When $x = 0$, the expected utility is:

$$p(0)U(-d_s - \pi_s - c(0)) + (1 - p(0))U(-\pi_s - c(0)) \tag{9}$$

Hence, d_s is given by

$$\begin{aligned}&\epsilon(p(0)U(-d_s - \pi_s - c(1)) + (1 - p(0))(U(-\pi_s - c(1)))\\ &+ (1 - \epsilon)(p(1))U(-d_s - \pi_s - c(1)) + (1 - p(1))U(-\pi_s - c(1)))\\ &= p(0)U(-d_s - \pi_s - c(0)) + (1 - p(0))U(-\pi_s - c(0))\end{aligned} \tag{10}$$

Under constant absolute risk aversion, this simplifies to:

$$\begin{aligned}&\epsilon(p(0)U(-d_s - c(1)) + (1 - p(0))(U(-c(1)))\\ &+ (1 - \epsilon)(p(1))U(-d_s - c(1)) + (1 - p(1))U(-c(1)))\\ &= p(0)U(-d_s - c(0)) + (1 - p(0))U(-c(0))\end{aligned} \tag{11}$$

Comparing (7) and (11) we see that the only difference in the incentive compatibility constraint is that the deductible is applied more often under strict liability than under the negligence rule when the injurer chooses $x = 1$. This means that choosing $x = 1$ is less attractive under strict liability and that the deductible must therefore be higher to ensure that the incentive compatibility constraint is fulfilled. When, hence, the deductible is both higher and more often used under strict liability than under the negligence rule, the risk borne by the injurer must also be higher. This is a natural consequence of less information being available to the insurer under strict liability (Holmstrom 1979). This efficiency loss must

be weighed against the efficiency loss experienced by the victim under the negligence rule, which served to induce the victim to report the injurer's negligence. It follows that if t is sufficiently small, the efficiency loss will be lower under the negligence rule than under strict liability. ■

The difference between the two rules in so far as the effectiveness of the deductible is concerned arises because the deductible is applied under strict liability despite the injurer having taken care, when an accident nevertheless occurs. This means that the dead-weight loss is greater when there is a greater risk that an accident occurs despite $x = 1$. It is hence a countervailing effect to the well-established result that strict liability may be more efficient than the negligence rule when this risk is large because it is then important that the injurer internalizes the cost of the activity.

It may be noted that the advantage applies also in a multi-period setting where the liability insurer may apply experience-rating of the insurance premium. Over time, the premium will more correctly reflect actual behavior when this behavior becomes known to the insurer. Under strict liability, $X's$ premium may be raised over time although X has chosen $x = 1$, if there happen to be many accidents. Hence, X is exposed to more risk under strict liability than under negligence, even in a multi-period setting.

We now turn to comments that may be levied against the model.

5 Comments

5.1 Can the insurer elicit the victim's information?

It may be taken for granted that it is easier to induce the victim to report her information concerning y under the negligence rule than under the rule of strict liability, but this may not be as clear as it seems at first sight. First, I_x may conceivably pay V to come forward with information about X's negligence, and may then in anticipation of this information condition on it in the contract with X. Why would we expect I_v to be able to induce V to report her information but not expect that I_x would be able to do the same? However, it may be difficult for the liability insurer to know when there is reason to ask V for information. Moreover, the right to solicit witness testimony by paying for it is limited by law for obvious reasons[6] Second, if it is difficult for I_x to obtain information about X's act but

6 for instance, while a witness is entitled to an attendance fee and travel expenses under 28 U.S.C. §1821 for testifying at a trial, hearing, or deposition, some jurisdictions view it as improper

easier for I_V, why do the two not contract for the information? I_X could somehow buy the information from I_V. The liability insurer could conceivably ask the first-party insurer to provide information on the injurer's act as part of a settlement deal under strict liability.[7] However, there are in fact limits to such information exchange. They require the explicit consent of the victim at least within the EU where this follows from GDPR-regulation laid down in an EU-directive.[8]

5.2 Can the insurer stipulate that coverage is contingent on the injurer acting with due care?

Under strict liability, the insurer may conceivably wish to condition coverage on the injurer acting with due care (or following public rules of safety) when the injurer is not likely to lapse and it is possible for the insurer to verify whether the injurer acted with due care. This might seem attractive for the insurer when it is hard to contract explicitly about the many acts that an injurer may undertake, and when it is clear in retrospect when the injurer acted negligently. However, third party insurers are restricted in their ability to limit coverage in case of simple negligence or through other vague clauses. For example, the Danish Insurance Contract Law states the restriction as follows in §20[9]:

> It cannot be validly agreed that the company shall be exempt from liability, if the insured event has been caused by a negligence, which cannot be designated as gross.

More generally, it is the rule at least in Denmark that any acts that preclude coverage must be stated in clear, unambiguous terms, such the the insured knows that the contract requires of him. I would tentatively suggest two explanations for this mandatory rule. The insured may be ill-informed about the meaning of vague terms such as negligence, and may not understand that the insurer is likely to be in a strong bargaining position, in part due to superior information, when claims must be sorted out under such terms.

It should be added, however, that courts may allow insurers to condition coverage on precise commands laid down in public regulations (at least according

to compensate a fact witness for time and expenses incurred by the witness in the preparation of his or her testimony.

7 I am grateful for this suggestion by the editor.

8 Interestingly, however, one insurer told me that such consent is, in his experience, not rarely sought.

9 http://www.aida.org.uk/pdf/Danish20Insurance20Contract20Act20-20English.pdf

to Danish precedent); what matters is that the insured can easily discern exactly what is required of him.

6 Summary and suggestions for future research

This article addresses two advantages of the negligence rule over the rule of strict liability when insurance contracts are incomplete.

One is that the negligence rule may, as a standard, economize on insurance contracting costs. Under strict liability, it is costly for the liability insurer to condition coverage on specific acts, if there are many of them or if they are hard to specify with the precision required of insurance contract law. The insurer may instead apply a deductible, which imposes a risk on the injurer, and/or accept a lower degree of care on the part of the injurer. These difficulties are avoided under the negligence rule where under idealized conditions, the injurer may simply take due care and not take out insurance. Hence, for the general reason that standards can do better than rules, the negligence rule can do better than strict liability when insurance contract law prohibits the insurer from conditioning on a vague standard.

As for the other advantage, the negligence rule provides an incentive for the victim's insurer of eliciting the victim's information about the injurer's act. The victim's insurer's incentive to do so is likely to be absent under strict liability and there are reasons to expect it to be difficult for the liability insurer to provide such an incentive for the victim's insurer. When more information is produced under the negligence rule, it can be easier for the liability insurer to control the injurer's acts without imposing risk on him. We demonstrated that the victim's insurer can induce the victim to furnish information about the injurer's act by applying a deductible. This deductible need not be higher than the cost of communication, and so if this cost is low, the distortion in risk allocation will be insignificant. On the other hand, the inability of the liability insurer to verify the injurer's act induces an inefficiency in the liability insurance, which increases with the risk that an accident occurs despite the injurer taking proper precautions. This modifies the well-known finding that strict liability tends to be superior to the negligence rule when the injurer's act is inherently dangerous (since strict liability restricts the activity level).

Two lines of further inquiry are suggested by the present analysis. First, it may be that the point that the negligence rule produces more information than strict liability can be broadened to include information that does not reside with the victim. The information may reside elsewhere, e. g. with witnesses, and can be gathered by other actors including the injurer, the insurers' assessors, and the

police (when public regulation has been violated). According to Sher (2006), the advantage of the negligence rule arises also for such information: He writes:

> The negligence rule .. motivates the parties to any potential damages claim to invest in searching for and assessing the information they require in order to file the claim, and conversely, to defend themselves against it... Has the doctor acted optimally, including staying appropriately and professionally up-to-date? Has the HMO acted optimally, for example, by purchasing the appropriate medical gear?

These questions would be irrelevant under a rule of strict liability, he claims, and he concludes that since more information that is useful for the prevention of accidents is produced under the negligence this rule can be more efficient. However, one might object to Sher's analysis that it diagnoses the problem incorrectly in a one-period model and that it may be false in a multi-period setting. As for the one-period model the advantage claimed by Sher of the negligence rule relates to the first advantage of the present model, namely the difficulty for the liability insurer of conditioning on specific acts. If the insurer were able to condition on the relevant acts, he would have an incentive to raise a claim ex-post and to accumulate evidence against the injurer. If the information does not reside with the victim, one would think that the insurer will be in just as good a position as the victim to accumulate such evidence. In a one-period model, when the liability insurer cannot condition coverage on specific acts, he will tend to cover less than fully and in this manner provide some incentive for the injurer. While this economizes on information, it implies some extent of inefficiency; the trade-off is the one analysed above. As for the multi-period model, the injurer's insurance premium is likely to reflect the actual risk of accidents in the long run, and the injurer will therefore have an incentive to accumulate information about the reasons behind the accidents, and which procedures of action should be changed. Since one must assume that the insurer will maintain profitability in the long-run, the costs and the benefits of information all accrue to the injurer, who should in theory therefore have an incentive to optimally gather information. Hence, one can raise objections to Sher's analysis both in a one-period and in a multi-period context. Yet, it would seem that this attempt at rebutting Sher's analysis is based on a set of assumptions that may not be fulfilled in reality. One can think of more complex models where Sher's claims hold true. Imagine e. g. that management of a hospital is wary of its reputation, and therefore does not wish for its decisions to be scrutinized after an accident. Management may for this reason prefer not to accumulate information even though on balance the information is worth its cost in terms of the avoidance of future accidents. If the hospital is insured, management may prefer to pay a higher insurance premium if this means that it can avoid the risk of being found to have acted improperly, and the liability insurer

may be content with receiving the higher premium. If, however, victims of personal injury are not fully covered, they might be much better off in a system that forces clarity concerning reasons behind accidents. In such a model, the question of course arises whether the tort system is a suitable system for such inquiry; it may be that regulators should be in charge of accumulating the information. On the other hand, it may be that such investigations should (in some cases) be conducted within the legal system where where people testify under oath and can be sanctioned for false testimony. These questions may be worth addressing further within the law and economics paradigm.

As a second avenue of future research, the present analysis has pointed to the consequences of insurers being unable to condition coverage through vaguely worded clauses. Yet, insurers have been allowed by courts to refer to public regulation in its insurance conditions, when it is easy for the insurer to understand what such regulation implies. Hence, regulation and insurance interact, and it would be interesting to know more about the extent to which this enables insurers to regulate the acts of the insured.

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